

Ministère de l'agriculture, des ressources hydrauliques  
et de la pêche (DGGREE)  
Office national de l'assainissement



الديوان الوطني للتطهير  
OFFICE NATIONAL DE L'ASSAINISSEMENT

# METHODOLOGICAL GUIDE

## TECHNICAL ASSISTANCE MISSION FOR TREATED WASTEWATER REUSE OPERATIONS IN TUNISIA

DIAGNOSIS AND PLANNING  
BY AN INTEGRATED PARTICIPATORY APPROACH

In memory of Hachmi KENNOU



## TECHNICAL ASSISTANCE MISSION FOR TREATED WASTEWATER REUSE OPERATIONS IN TUNISIA

### Abstract

This guide is the result of a technical assistance mission for Treated Wastewater Reuse (TWR) operations in the field of agriculture in Tunisia. The mission was carried out by the **Mediterranean Water Institute (IME)** in 2019 and 2020, following a joint request submitted by the Ministry of Agriculture's General Directorate of Rural Engineering, Water and the Environment (DGGREE) and the National Office of Sanitation (ONAS). To carry out this mission, IME solicited its members, Société du Canal de Provence (SCP) and Société des Eaux de Marseille (SEM) and was funded by the Rhône-Mediterranean and Corsica Water Agency, the South Region (Provence-Alpes-Côte d'Azur), in the framework of decentralized cooperation, and the French Development Agency (AFD).

The objective of the mission was to prepare the implementation of **integrated pilot areas for the reuse of treated wastewater** in Tunisian agriculture, from the raw wastewater inlet of the treatment plant to the marketing of agricultural products. This includes any complementary treatments such as the gauging and operation of the hydraulic network, irrigation techniques at the plot level, agricultural productions and cultivation systems, governance...

The mission focused on two specific sites: the historical irrigated perimeter of Zaouïet (Governorate of Sousse) and the new irrigated perimeter of Dkhila (Governorate of Mahdia).

To achieve this, an integrated participatory approach methodology was developed, based on the expertise mobilized by the IME, enriched and adapted via exchanges with local partners, and deployed on two specific sites.

This guide aims to capitalize on the implemented **methodology** to be able to reproduce the technical assistance approach to the perimeters irrigated by treated wastewater, "**TWR systems**".

The aim is to answer the following questions:

- What are the issues to be considered in order to initiate or improve the operation of TWR systems?
- How to aggregate all actions required to initiate an operation or complete an optimization project?
- How to ensure a good collective functioning between the multiple stakeholders?

## TECHNICAL ASSISTANCE MISSION FOR TREATED WASTEWATER REUSE OPERATIONS IN TUNISIA

💧 This methodology consists of four steps:



The cross-cutting principles underlying the methodology are:

- **An integrated approach:** although pre-defined themes are analysed, teamwork in the form of brainstorming, group field expertise and interdisciplinary dialogue led to the realization of an integrated multi-thematic analysis, which considers the TWR system as a single entity.
- **An in-depth institutional approach** in order to fully understand and propose how to overcome the interplay of actors, which turns out to be one of the main difficulties encountered by TWR systems.
- **A participatory approach** with the beneficiaries and users of the irrigated perimeter: the farmers themselves, including their production practices, their management of health risks and their economic constraints.

The guide describes the general principles of the approach and proposes specific illustration boxes based on the Tunisian context.

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#### ACRONYMS AND ABRÉVIATIONS

RMCWA	Rhône-Mediterranean and Corsica Water Agency	TW	Treated Wastewater
AWUA	Agricultural Water Users Association	SWOT	Strengths, Weaknesses, Opportunities and Threats
AFD	French Development Agency	ADG	Agricultural Development Group
NEA	National Environment Agency	IWRM	Integrated Water Resources Management
AWUA	Agricultural Water Users Association	IME	Mediterranean Water Institute
CITET	Tunis International Centre for Environmental Technologies	MAWRF	Ministry of Agriculture, Water Resources and Fisheries
RCAD	Regional Commissariat for Agricultural Development	SM	Suspended Matter
BOD5	5-day Biological Oxygen Demand	ONAS	National Office of Sanitation
COD	Chemical Oxygen Demand	IPP	Irrigated Public Perimeter
DGGREE	General Directorate of Rural Engineering and Water Exploitation	TWR	Treated Wastewater Reuse
ESIA	Environmental and Social Impact Assessment	MASS	Mutual Agricultural Service Society
RW	Raw wastewater	PS	Pumping Station
		WTP	Wastewater Treatment Plant

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## TECHNICAL ASSISTANCE MISSION FOR TREATED WASTEWATER REUSE OPERATIONS IN TUNISIA

## INTRODUCTION

## GUIDE DEVELOPMENT

## Reminder of the approach

The project of technical assistance to the Tunisian agricultural TWR operations emanates from a joint **request** from the Ministry of Agriculture (DGGREE) and the National Office of Sanitation (ONAS), and is carried out by the Mediterranean Water Institute (IME); a Marseille-based NGO.

Regarding the **implementation** of this mission, the IME solicited its members, Société du Canal de Provence (SCP) and Société des Eaux de Marseille (SEM). Concerning **funding**, the Rhône-Mediterranean and Corsica Water Agency, the South Region (Provence-Alpes-Côte d'Azur), in the framework of decentralized cooperation, and the AFD, solicited by the DGGREE, completed the share of self-financing brought by the IME.

The project, conducted in consultation with both sanitation and agriculture players, which is a specificity, aims to bring about usable results to improve the Tunisian agricultural TWR sector as a whole.

The objective of the mission was to prepare the implementation of **integrated pilot areas for the reuse of treated wastewater** in Tunisian agriculture, from the raw wastewater inlet of the treatment plant to the marketing of agricultural products. This includes any complementary treatments such as the gauging and operation of the hydraulic network, irrigation techniques at the plot level, agricultural productions and cultivation systems, governance...

Four irrigated perimeters, called 'pilot sites', were studied:

- In 2019-2020: Zaouïet, Sousse (250 ha, created in 1987) and Dkhila, Mahdia (50 ha, created in 2020)
- In 2021: Chebba and Beni Hassen (50 ha each, planned)

The developed methodology is compiled in this guide, which should be applicable to the optimization of an existing operation as well as the setting up of a new project.

## OBJECTIVES AND PURPOSES OF THE GUIDE

In an effort to strengthen the capacities of all partners in this approach, the request to capitalize thereon and to present the results was clearly expressed.

This guide aims to present a methodology, originally built on a **classic approach** of agricultural TWR projects, adapted to the context and specific challenges of Tunisia.

The **innovative adaptations** that were made to this approach resulted from the work meetings held with the Tunisian authorities and project stakeholders, on the one hand, and from the site visits conducted, on the other.

## ADOPTED APPROACH

### 💧 TWR, a complex system

Treated wastewater reuse is a practice that mobilizes multiple themes.

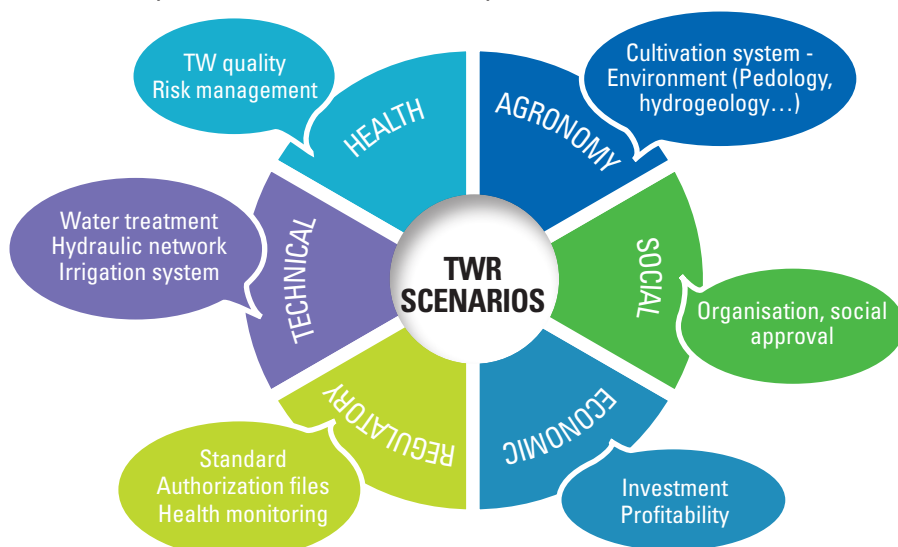


Figure 1 : TWR  
multi-thematic approach

Support for the creation of a new irrigated perimeter or the optimization of an existing one requires the mobilization of a composite team, bringing together complementary expertise and associating international and local consultants. It is thus a classic work, based on the experts' skills, which can be set up.

### 💧 The organizational issue

However, in the context of a global rethinking of the treated wastewater reuse strategy in Tunisia, the pilot projects addressed by the IME are considered an opportunity to experiment with **new approaches** whose sole objective is the sustainability of irrigated perimeters.

Our vision for these pilot projects was not limited to proposing yet another set of recommendations, but aimed to **create favourable conditions** for their implementation, by mobilizing the energies of local stakeholders around a single dynamic.

Indeed, following the work conducted on the two sites, we highlighted three **major observations**:

1. the different themes cannot be approached separately, they interact in many ways,
2. the social and institutional dimension links these themes, it is transversal,
3. and finally, it is necessary to establish or reinstate a calm and constructive multi-stakeholder dialogue on the two pilot areas.

We have highlighted **latent conflicts** between institutional actors, particularly on the oldest Zaouïet IP in Sousse:

- the different actors are blaming each other for the dysfunctions of the perimeter,
- the lack of transparency between institutional actors and farmers leads to mistrust,
- the lack of appropriate regulation and coordination mechanisms does not facilitate any progress.

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This cannot be done without dialogue, respect and trust between all actors. Therefore, after a few months of shared study and observation between the IME team and the Tunisian partners, it was decided to reorient the methodology by relying on **two main pillars**:

- An in-depth **institutional approach** to fully understand the difficulties faced by TWR IPs and to suggest solutions,
- An **integrated participatory approach** that involves the beneficiaries and users of the irrigated perimeter: the farmers themselves, with their production practices and management of health risks and economic constraints. This enables to conduct a shared diagnosis and implement an action plan.

### Methodological scheme

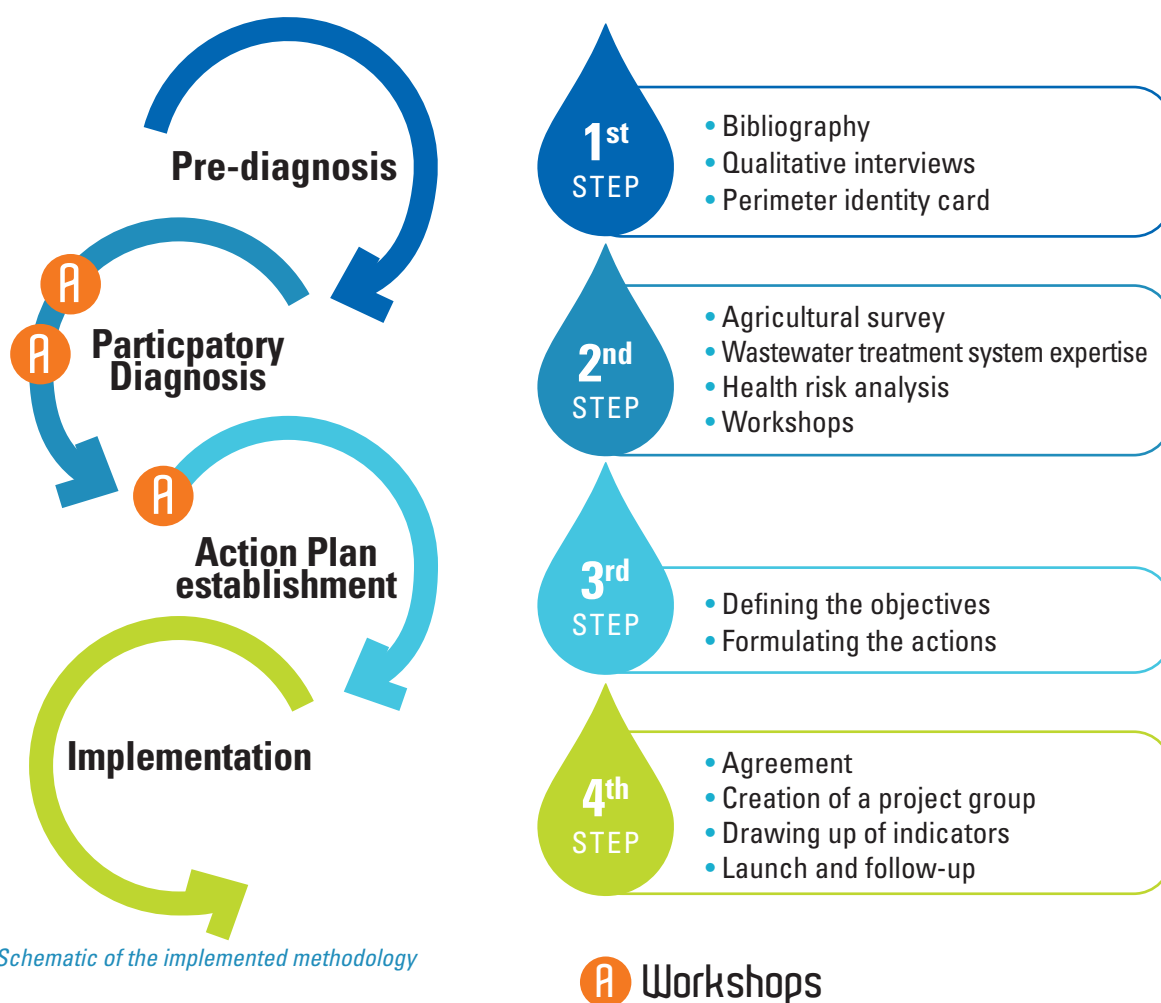


Figure 2 : Schematic of the implemented methodology

This feedback on the support of 'TWR systems' in all their complexity is what IME wishes to share through this methodological guide..





## STEP 1: PRE-DIAGNOSIS - CHARACTERIZING THE IRRIGATED PERIMETER AND ITS ISSUES

### OBJECTIVES

- Building a global understanding of a TWR system
  - Identifying direct and indirect actors of the TWR irrigated perimeter operation
  - Initiating the mobilization of actors
- The data collected during this pre-diagnosis phase allow us to make an inventory of the studied perimeters in order to identify the problems.*

### APPROACH AND TOOLS

- Individual meetings with identified institutions,
- Site visits,,
- Semi-structured interviews with farmers,
- Literature review

## 1.1 PREPARATORY PHASE OF THE APPROACH

During this step, the partners hold a kick-off meeting and discuss:

- The actors involved ;
- The preparation of a mission letter signed by national authorities
- The overall progress of the project and of the pre-diagnosis phase in particular

Local representatives of the Ministries of Agriculture, Health, and Environment, as well as farmers' representatives participate in the **launch** of the project. The Agricultural Water Users Association (AUEA) must also be present, when available.

## 1.2 INDIVIDUAL INTERVIEWS WITH STAKEHOLDERS

After the kick-off meeting, qualitative interviews with all stakeholders are organized in order to understand the TWR system situation and dynamics.

### 1.2.1 TYPOLOGY OF INSTITUTIONS

The institutions responsible for TWR are divided into three main groups:

1. Institutions in charge of producing TW
2. Institutions in charge of distributing it
3. Institutions in charge of controlling its quality and its risks to human health and the environment



Figure 3 : A TWR system typology of actors

## TECHNICAL ASSISTANCE MISSION FOR TREATED WASTEWATER REUSE OPERATIONS IN TUNISIA

A fourth group, more varied and less directly concerned, is also necessary. These include all economic chain links associated with the agricultural sectors, inputs and products.

### FOCUS: The main institutions involved in an agricultural TWR project in Tunisia:

#### 1. Institutions in charge of producing TW

ONAS is committed to delivering, with self-monitoring, at the outlet of its treatment plants, TW that comply with the standards (NT106.02 modified in 2018 and NT 106.03, 1989 version).

In addition to ONAS, there may be private TW-producing companies that can be used in agriculture. These institutions must be identified and integrated into the process.

#### 2. Institutions in charge of distributing TW

Le Ministère en charge de l'agriculture (MARHP) est co-responsable des stratégies nationales de REUT et de leur traduction puis de leur mise en œuvre aux plans régional et local, par le biais du CRDA, son organe régional décentralisé. Le GDA en tant que structure socioprofessionnelle conformée par les agriculteurs dans le but de gérer le périmètre irrigué à partir des EUT.

#### 3. Institutions in charge of controlling its quality and its risks to human health and the environment

- NEA carries out the control and monitoring of TW discharges into the natural environment. It provides feedback allowing MAWRF to decide on the granting of agricultural TWR authorization.
- The Ministry of Public Health and its regional offices are responsible for sanitary control.
- The Ministry of Local Affairs and the Environment is also responsible for controlling the quality of water discharged into the environment through the ANPE, which is a national agency in charge of environmental protection..
- The latter also oversees institutions for promotion, training and assistance in the field of environmental protection technologies such as CITET

#### 4. Other institutions involved met during the survey

- The Territorial Extension Unit, a RCAD component, which provides guidance and information to farmers through centrally programmed actions or specific programmes
- Agricultural cooperatives called Mutual Agricultural Service Companies (SMSA), which are mainly responsible for supplying farmers with inputs..
- The Oil Office, which receives olive oil from several oil mills in the region.
- The Olive Institute, which is an olive oil research and development organization.
- Some oil mills in order to determine their conditions of reception and transformation of olives coming from the TWR perimeters.
- Some farmers through field meetings and semi-structured interviews.

*Box 1 : Actors to mobilize in Tunisia.*

## 1.2.2 MAIN QUESTIONS CHECKLIST

An interview outline was developed.

It is above all **factual data** that is sought here, even though points of view and feelings are also important. The main elements of the diagnosis will be observed at the end of these interviews. These will be confirmed and established in Step 2, with an in-depth analysis based on the team's expertise. Its objective is to guide the exchange with the interviewees and to frame the discussion by focusing on 10 major themes that cover all TWR system characteristics and problems.

## TECHNICAL ASSISTANCE MISSION FOR TREATED WASTEWATER REUSE OPERATIONS IN TUNISIA

The objectives of the different parts of the questionnaire are presented below:



Figure 4 : Interview outline - Themes to be addressed and presentation of objectives

## TECHNICAL ASSISTANCE MISSION FOR TREATED WASTEWATER REUSE OPERATIONS IN TUNISIA

Following the interviews, the team of experts crosschecks and shares the data collected with the different organizations. This crosschecking ensures that the information shared by the different structures is consistent. If discrepancies are noted, further in-depth verification is undertaken:

- either by going back to the interlocutors to clarify certain elements and, if necessary, compare points of view,
- or by looking for written documents, reports, notes, etc., which would allow for arbitration against simple oral statements,
- or by recording disagreements.

### 1.3 ANALYSIS OF EXISTING LITERATURE

Several documents need to be analysed in order to make the necessary diagnosis of the study. The documents collected cover the following three main categories:

#### Resource : THE SANITATION SYSTEM

Technical characteristics of the RW network, the WTP, results of the treatment performances  
Connected industries and pollution risk  
Water quality analyses by different actors (Environment, Health)  
Incident management

#### Uses : IRRIGATION AND AGRICULTURAL NETWORK

Major irrigation network works  
Annual reports on the IP functioning over 5 years  
Statistical data on the main agricultural productions

#### The Environment : THE TWR SYSTEM IN ITS TERRITORY AND IN IWRM

Physical environment: climate, weather, geology, soil maps and soil analysis, surrounding natural areas...  
Aquatic environment: qualitative and quantitative characterization of surface water, exploitation rate of groundwater  
Human environment: land use, urbanization plans

Other documents are useful to identify:

- the state of research: research institutes and universities works...
- the reports of the meetings of regional TWR 'inter-stakeholder' consultation bodies, when available.



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### 1.4 IRRIGATED PERIMETER IDENTITY CARD

The collection and analysis of this information helps to design the ID card of the studied irrigated perimeter. Below is an example of an ID card developed in the framework of this project.

Identity Card of Zaouiet IP in Sousse			
CREATION : 1987		SURFACE IRRIGABLE : 205 initialement, + 52 ha en 2018	
LOCATION : Gouvernorat de Sousse - délégation de Zaouia Ksibet Thrayet			
WATER RESOURCES:	Initial	Current	Potential
	WTP Sousse South		WTP Sousse Hamdoun
CHARACTERISTICS OF THE CURRENT WTP (SOUSSE SOUTH): Leaching bed and activated sludge			
TERTIARY TREATMENT: No			
AVAILABLE TW FLOW RATE:	< 2018 (Sousse South in overload)	2018 – 2019... (Sousse South at nominal capacity)	Potential (Sousse South + Hamdoun)
	Regarding perimeter supply, the current quantity treated is 10,000 m3/d		
SUPPLY	In the upstream part of the discharge pipe, a diversion intake structure allows the TW to be diverted and directed to the irrigation pumping station via a reinforced concrete supply pipe, with a diameter of 800 and a length of 60m. This spigot was built during the creation of Zaouïet IP in Sousse		
PUMPING STATION	Management : RCAD Management : RCAD Flow rate, HMT: 70 L/s per pump, 45 m HMT		
STORAGE : 2500 m3 at the top of the network, highest point			
IRRIGATION NETWORKS: 17.7 km of pipes / 102 irrigation hydrants			
AGRICULTURAL PRODUCTIONS: Olive growing with intercalated forage crops (sorghum, bersim...)			
TW ANNUAL RECOVERY RATE: Not considered in 2019 due to pumping station breakdowns and the sudden deterioration of service quality.			
From 2014 to 2018: the WTP produces around 6% of the annual volumes, considering the daily treated volumes (30,000 m3/d) and the IP annual consumption (700,000 m3)			

Table 1 : Example of an IP identity card in Tunisia



## TECHNICAL ASSISTANCE MISSION FOR TREATED WASTEWATER REUSE OPERATIONS IN TUNISIA



Treated wastewater storage basin



Plot of olive trees interspersed with forage sorghum



Traditional gravity irrigation (robta)



TWR pumping station

## 1.5 PUTTING THE NATIONAL REGULATORY AND ORGANIZATIONAL FRAMEWORK INTO PERSPECTIVE

The situation of the local 'TWR system' studied is to be compared with the regulatory framework and the national set of factors. Three aspects can be distinguished:

- **The legal framework:** the texts in place, and in particular a triptych that is essential for TWR:
  - Required water quality
  - Authorized agricultural productions
  - Required health risk reduction measures
- **The institutional framework:** the actors, their roles and the coordination among themselves. In this framework, we normally find the division of the functions of production / distribution / control previously seen.
- **The procedural framework:** the steps to be followed for the implementation of a TWR perimeter and the monitoring of its proper functioning. These procedures (authorization file, reporting frequencies) are described in the regulations.



## TECHNICAL ASSISTANCE MISSION FOR TREATED WASTEWATER REUSE OPERATIONS IN TUNISIA

### FOCUS: The Tunisian example of TWR regulation

#### The system is based on four texts:

1. Decree No. 89-1047 of July 28, 1989, issued by the President of the Republic, which defines the conditions for TWR in agriculture: main principles of health protection, monitoring frequencies and concerned parameters
2. Standard NT 106.03 approved on May 28, 1990, which defines the water quality thresholds required for agricultural TWR
3. The Minister of Agriculture Decree of June 21, 1994, which defines the list of crops that can be irrigated with treated wastewater, excluding market garden crops
4. The Minister of Agriculture Decree of September 28, 1995, which approves the specifications on the special terms and conditions of agricultural TWR, and in particular the following requirements:
  - water quality (reference to the decree of July 28, 1989)
  - water storage and distribution
  - health measures: harvest time, sprinkling precautions, protective equipment
  - protection of groundwater and surface water resources

#### Box 2 : Main TWR regulatory texts in Tunisia

The following chart highlights the diversity of actors involved in the TWR Tunisian example, both at the national level (upper part) and local level (lower part). We distinguish in yellow, red and green the authorities linked to the Ministry of the Environment, Health, and Agriculture respectively. The functions of production, control and distribution are also represented.

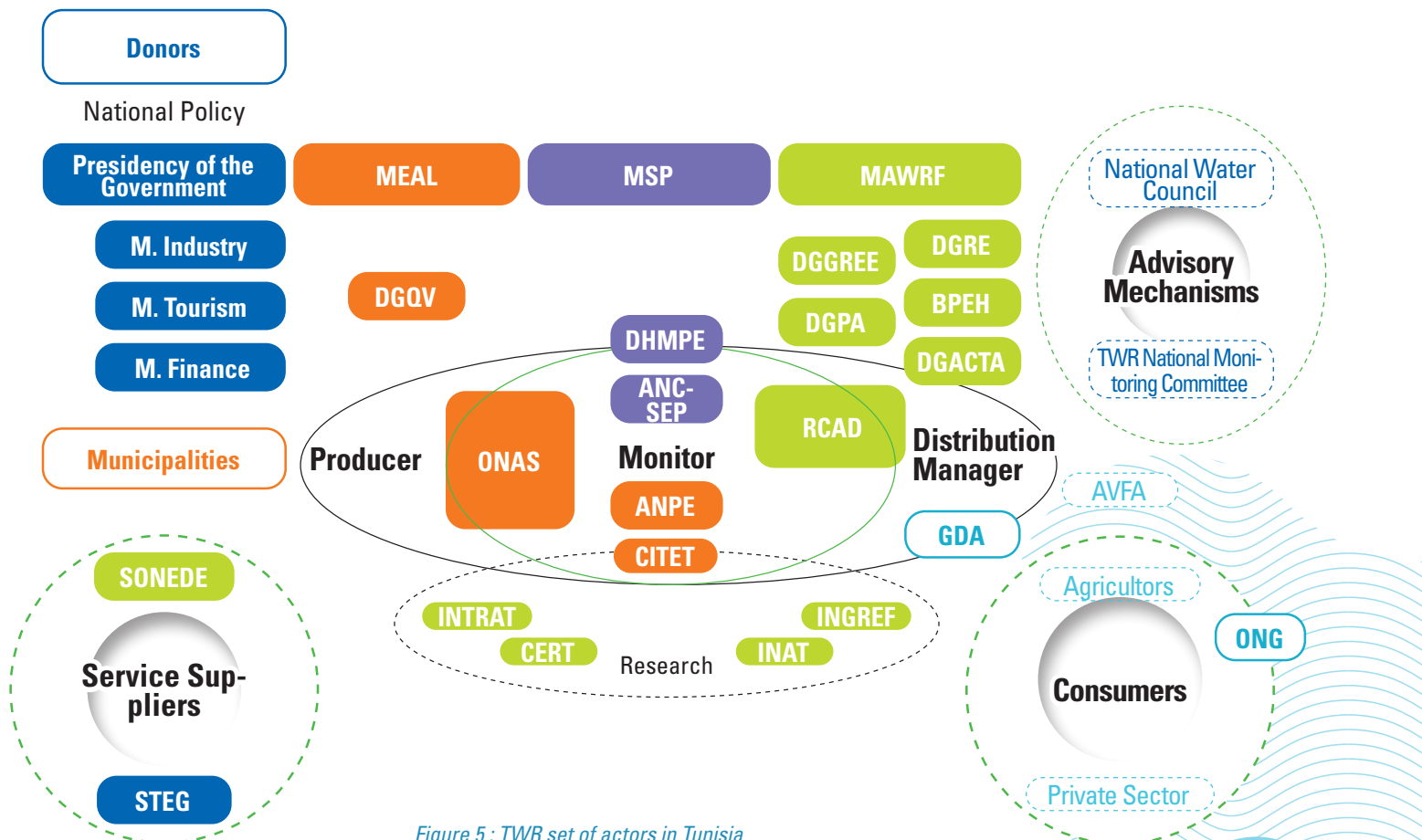


Figure 5 : TWR set of actors in Tunisia

## TECHNICAL ASSISTANCE MISSION FOR TREATED WASTEWATER REUSE OPERATIONS IN TUNISIA

## STEP 2 : DIAGNOSIS – ANALYSING THE FUNCTIONING OF THE PERIMETER AS A WHOLE

### OBJECTIVES

- Identifying, characterizing, and analysing the problems faced by IPs mobilizing treated wastewater
- Motivating stakeholders to adopt collective approaches to understand the situation through a shared diagnosis, and move towards the resolution of common issues

### APPROACH AND TOOLS

- Site visits
- Actors mapping
- Agricultural survey
- Multi-stakeholder participatory workshops
- Summary of collected and analysed data

## 2.1 SITE VISIT

During the pre-diagnosis step, initial contacts with the site will have taken place, in conjunction with the services of the Ministry of Agriculture and agricultural water users (ideally alongside the interview conducted with their association, AWUA).

A site visit is again essential to:

- Review the site and visualize all problems (hydraulic, agricultural, etc.) identified during pre-diagnosis
- Meet with users and their support actors to confirm the topics that will be specifically addressed during the survey phase and in the workshops,
- Continue the work of collecting appropriate documentation and data,,
- Make contacts to facilitate the mobilization of these people later on,
- Adapt the rest of the work, in particular the survey questionnaires for farmers and the interview guides for institutions or key actors.

## 2.2 AGRICULTURAL SURVEY

This part of the diagnostic work is fundamental. It is divided into four stages, the first two of which can be carried out simultaneously:

- Sample selection
- Developing the questionnaire
- Conducting the survey
- Results interpretation

## TECHNICAL ASSISTANCE MISSION FOR TREATED WASTEWATER REUSE OPERATIONS IN TUNISIA

### Sampling

In general, sampling is based on the following points:

- The objectives of the survey
- The means that can be deployed
- Prior knowledge of the perimeter and the people therein
- The number of farmers in the perimeter under study
- The choice of appropriate dates to conduct the surveys

However, it is common not to have accurate data allowing the establishment of this purposive sampling. Also, when prior knowledge of the perimeter is poor, it is advisable to proceed differently, for example by interviewing at least one farmer for each type of production previously identified during the first site visit, in order to cover the entire spectrum of existing productions.

### Structuring the survey questionnaire

The survey questionnaire generally benefits from being co-constructed with the stakeholders, including the Ministry responsible for TWR studies. This is not, however, a prerequisite.

The survey questionnaire is structured as follows:

**Part A:** It consists of characterizing the agricultural exploitations, the hydraulic functioning of the perimeter and its relation with the institutions in charge of treated wastewater production, the main constraints of the farmers and their perception of TWR. This part is structured around the following chapters:

- Identification of the interviewee/farmer
- Characteristics of the agricultural exploitation and its access to production factors in particular, mainly land, water and labour
- Description of agricultural practices, particularly irrigation and farm economics
- The current or future functioning of the irrigated perimeter

**Part B:** It consists of collecting information to calculate the gross value added per hectare or per head in the case of livestock.

- Estimation of data to calculate gross product, intermediate consumption and gross value added for animal and crop production

Questionnaires are also an opportunity for investigators to raise awareness and remind people of the TWR regulations in place. This awareness-raising can be very useful, especially for perimeters that have not yet benefited from TW and where farmers' knowledge of the TWR specifications is poor or non-existent. The semi-structured interview allows important points to be addressed, such as vaccination or the wearing of protective equipment.

### Conducting the survey

The idea is to group as many interviews as possible, over a one-week period, by mobilizing interviewers who are well versed in the field of agriculture and who have a sufficient level of education to understand TWR. They should be trained beforehand.

When the agricultural territory is marked by significant fragmentation, or the presence of pluriactive or non-professional farmers, it is desirable to visit the site at a time when one is sure to find a maximum number of people on site, such as during paid vacations or the olive harvest period (as in the coastal zone in Tunisia). This last practical point is fundamental because in most of the perimeters studied, the farmers are double or even triple active and do not stay on site. The chances of meeting them outside of these periods are therefore low.

## TECHNICAL ASSISTANCE MISSION FOR TREATED WASTEWATER REUSE OPERATIONS IN TUNISIA

Responses to the surveys are registered in an Excel table to facilitate their analysis and interpretation. The data is entered by the interviewers. Inconsistencies are checked by both the expert who will interpret the data and the interviewer who conducted the interviews.

### Results interpretation

Quantified responses allow **the calculation of standard indicators** such as the average exploited area, the average age of farmers, and the proportion of exploited land rented or owned. Generally, the data do not allow for in-depth statistical analysis. Nevertheless, they provide orders of magnitude and patterns that can be used in the analysis.

**Qualitative data** are interpreted, especially for the establishment of projections that help reconstruct what the irrigated perimeter might look like in the future. For example, they can be used to give an indication about the evolution of land use or the number of livestock according to the producers' declared projects.

The analysis should preferably be done **in conjunction with the team of interviewers** who visited the site to clarify certain answers, qualify others, or correct figures that could distort the results because of problems with measurement units or data entry. It is therefore recommended to proceed with the analysis of the survey results soon after its completion.

Quantitative data of the technical-economic section are necessary to **calculate the gross value added of the plots located** within the irrigated perimeter in order to obtain an initial assessment of the farmers' financial situation.

It would have been necessary to conduct surveys on all farmers' plots, which was not possible. Also, technical-economic calculations do not go as far as determining the net value added and the income of farmers. However, for the purposes of our analysis, this first approach already allows us to identify the main constraints of the farms and to propose specific actions.

## 2.3 PARTICIPATORY DIAGNOSTIC WORKSHOPS

The objectives of the participatory diagnosis are:

- Identifying the **problems/constraints and expectations** of the various stakeholders in the field
- Preparing the stakeholders for a **constructive exchange**
- Motivating stakeholders to get **involved** in the rest of the process

Our approach consists in deploying participatory tools with **two distinct groups**:

- An 'institutional' group composed of different stakeholders other than farmers (for the case of Tunisia, we can mention ONAS, RCAD, ADG, the Ministry of Health, SMSA, etc.)
- A 'users' group composed of IP farmers

Indeed, the establishment of a multi-stakeholder dialogue platform requires a propaedeutic approach that does not start by putting heterogeneous actors with different visions and disparate or even opposing interests in the same setting. The two groups will meet during the next step of pooling and sharing the diagnosis.

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In our case, we are in a situation of **unequal power relationships** where the administration can rely on its legal prerogatives to subordinate the farmers or the irrigators' association.

The relationship of trust and co-construction must be prepared by **empowering and involving each actor/group of actors separately** to help them structure and clarify their vision of the TWR system, and to allow them to criticize themselves and discover the reasons of dysfunction.

In addition, this approach makes it possible to neutralize tensions and **create a pleasant climate of dialogue and empathy** favourable to the construction of solutions that are shared and supported by all actors.

### FOCUS: elements of the participatory diagnosis on the Tunisian irrigated perimeters of Zaouiet (Sousse) and Dkhila

On the Zaouiet (Sousse) and Dkhila pilot areas, we noticed that the suggestions were not so different from one group to the other. This observation made during the productions pooling of each group enabled to favour agreements over disagreements. This undeniably contributed to the establishment of a constructive climate for this pooling workshop.

#### Box 3 : Focus on the Tunisian examples of Zaouiet (Sousse) and Dkhila perimeters

To achieve these goals, we recommend a **3-step** approach:

#### 1. Historical analysis of the perimeter's governance

This first step clarifies the roles and responsibilities of each IP member and defines the main operating principles (information sharing, monitoring, consultation mechanisms).

The **SMAG** tool (Self-Modelling for Assessing Governance) seems relevant to this step. It is a participatory tool designed by Irstea G-EAU research centre in Montpellier (France) to:

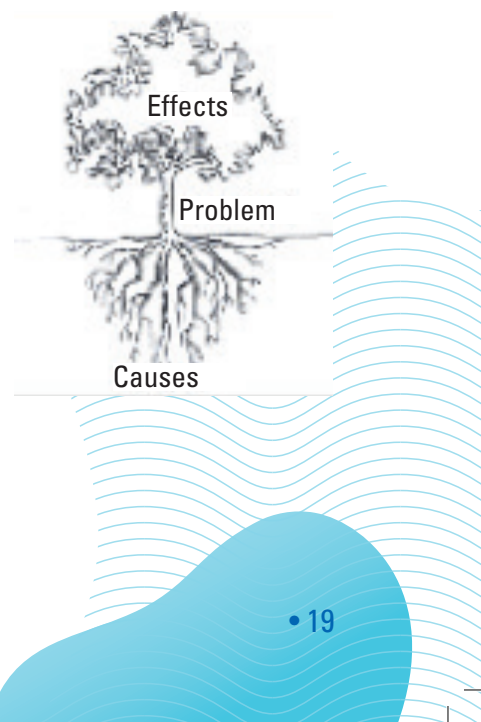
- Clarify **the key decisions** made and build a shared understanding of the reasons and impacts thereof;
- Share the **history of a project governance**;
- Analyse and make **recommendations** on what could or should be changed in the current and future governance of the project.

#### 2. Identification of constraints and expectations in separate groups

This step is the core of the participatory diagnosis. It aims to analyse current and future problems and to clarify participants' expectations and motivation.

The problem tree method facilitates the structuring of this step. Problem analysis is used to define the negative aspects of an existing situation and to determine the "cause-effect" relationship between identified problems. By identifying causes and sub-causes, it is possible, based on a complex problem, to define the main causes on which it is preferable to work.

The objective is to have farmers and institutional structures share an understanding of the irrigated perimeter, its problems and dynamics in order to identify and prioritize the issues of the area.





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### 3. Pooling the suggestions of each group

Finally, all those involved in an IP can meet to discuss the different points of view and perspectives in order to build a common vision of the perimeter situation.

This pooling consists of a cross-meeting between the groups of institutions and farmers-users, which takes place according to the following plan:

- 1. Introducing the participants
- 2. Reminding of the project objectives
- 3. Presenting the works of the different groups
- 4. Identifying the points of convergence and divergence
- 5. Agreeing on the priority issues to be addressed.

The mobilization of stakeholders is a key factor to the success of this participatory approach. It is important to properly communicate the project beforehand in order to invite as many people as possible to join the discussions.

During the workshops, it is the moderator's responsibility to facilitate everyone's participation by distributing the floor or modifying the size of groups so that everyone can participate in the discussions.



Figure 6 : Photo of a pooling workshop for the Dkhila perimeter (Tunisia)



## 2.4 WASTEWATER TREATMENT PLANT DIAGNOSIS AND FEASIBILITY

### 2.4.1 DATA COLLECTION

#### • Existing data

The first step consists in collecting (from the project owner or his operator) and analysing the existing data available.

#### DATA COLLECTION RELATES IN PARTICULAR TO :

- Type of treatment and origin of treated water (domestic, industrial),
- Plans of the wastewater treatment plant(s),
- Current effluent production and its intra- and interannual variability: daily volume, hourly flow rate, concentrations at inlet and outlet of treatment plant;
- Recurring difficulties and other impacts on wastewater treatment plants,
- Future evolution of flows and pollution to be treated, possibility of extension, etc.
- Quantity and quality of sludge generated by wastewater treatment plants
- Available plots of land and their urban planning and environmental constraints,
- Flood risks,
- Geotechnical characteristics of the sites concerned,
- Capacity of electrical installations and subscribed power,
- Operation of wastewater treatment plant
- Etc.

#### • Monitoring the performance of target stations

In the case of missing data and according to TWR regulatory and technical requirements, it is advisable to carry out a performance monitoring of the treatment plant: 24-hour balances at the inlet and outlet of the plant. Performance monitoring is an essential step in understanding or anticipating issues related to the quality of reused water.

#### • Additional data: site visits

A visit of each treatment plant involved in the project is carried out in the presence of the operator.

These visits enable:

- to improve knowledge about the existing wastewater treatment plant,,
- to verify specific points that may have been detected,
- to investigate the existing management practices,
- to apprehend all constraints and potentialities of the site,
- to find out about the exploitation difficulties
- etc.

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## 2.4.2 ANALYSIS AND INTERPRETATION

The performance of the wastewater treatment plant is determined based on the collected data. Likewise, the quality (MES, COD, bacteriology, etc...) and quantity (daily volume and hourly flow) available for the reuse of treated wastewater are also assessed.

## • Treated Wastewater characterization

The following summaries are drawn up as a result of the basic data collection:

SYNTHESIS OF THE WASTEWATER COLLECTION SYSTEM (WW)  
AND ITS OPERATION:

- Permanent and pseudo-permanent Parasitic Water levels (PW), groundwater upwelling, seawater intrusions;
- Type of connected industrial plants and their pretreatments, in particular slaughterhouses, healthcare institutions (with regard to prions-related risks), etc.

## SYNTHESIS OF THE WASTEWATER TREATMENT PLANT:

- General data: location, year, nominal capacities, discharge standards ;
- Type of treatment ;
- Wastewater treatment plant load rate and number of capacity overruns ;
- Quality of treated effluents, variation over the year and number of possible non-conformities;
- Quality, quantity and type of external inputs received (discharge and emptying materials, external greases, external sands, external sludge, road sweepers, network cleaning materials, etc.);
- Quality, quantity and destination of by-products (refuse, sands, greases, sludge, etc.) ;
- Technological and natural risks present ;
- Regulatory constraints (urban planning, etc.) ;
- Possible future projects ;
- Space available for new TWR facilities.

Water quality will be compared to the performance expected for the type of process in place (activated sludge, in this case) and to the regulatory requirements related to treated water reuse.

The diagnosis phase of the treated effluents quality is important because it allows the gauging of their complementary treatment in order to be reused. This is similar to the characterization of treated wastewater needs in terms of quantity and quality.

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### • Wastewater reuse constraints

This analysis mirrors the various constraints defined by the regulations in place (defined possible uses, distance constraints in relation to uses and available land, modalities of treated water use, regulation and storage, etc.).

It should be noted that, concerning the quality of TW intended for reuse in wastewater treatment plants receiving industrial effluents, it is important to be vigilant about :

- Salinity and its long-term accumulation, which can cause problems for soils and irrigated crops.
- The possible presence of heavy metals and micro-pollutants.
- Connected industries.

### • Relevance of additional treatment

The need for additional (or tertiary) treatment and its necessary minimum performance will be defined according to the regulatory constraints applicable to the project (water quality for reuse, etc.) and the quality of effluents treated by the treatment plant.

## 2.5 DIAGNOSIS OF THE HYDRAULIC IRRIGATION NETWORK

The objective of the hydraulic irrigation system diagnosis is to make a complete analysis of the infrastructure to check if it is able to ensure its service function by respecting the adequacy between the need and the resource. It is a question of identifying the potential failures of the network in terms of flow and pressure supply.

Generally, the **malfunctions** observed are related to :

- the pumping station
- the roughness of the pipes under pressure due to material deposits, which increases head losses and decreases their capacity flow;
- the poor maintenance of the venting equipment, which can lead to air accumulation in the network and consequently decrease the transport capacity of the pipes;
- the excessive simultaneous drafting at service points, which results in a drop in pressure throughout the system, exacerbated by the above problems
- the services located on high points for which the available pressure decreases;

The diagnosis includes:

- The **production line**, composed of the main works
- The **distribution network**,

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## 2.5.1 DIAGNOSIS OF THE PRODUCTION LINE

In order to carry out a diagnosis of the production line, it is necessary to make a **complete analysis of its composition** (WTP, supply pipe, connection structure, suction tank, valves, pumping station, discharge pipe, storage or regulation tank...).

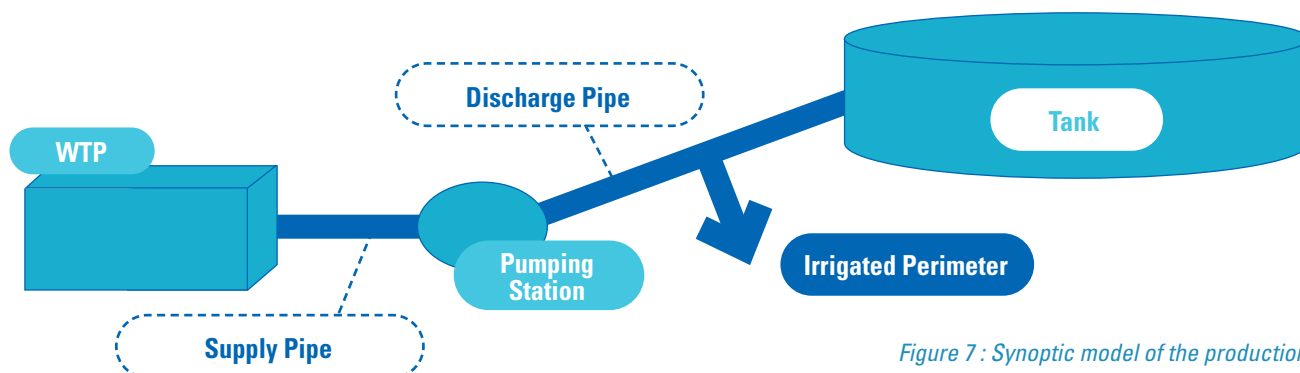


Figure 7 : Synoptic model of the production line

Once the perimeter is in place, an in-depth analysis of the **production line's operation** allows us to understand the failures and to identify where we need to act to improve/restore proper operation.

This analysis includes:

- A comparison between **theoretical operation** and **real operation**
- A specific diagnosis by means of equipment / structures
  - **Pumping station:** equipment diagnosis, tests and analysis of the operating curve
  - Diagnosis of the capacity of the **pipes** / head loss
  - Diagnosis of **protection and control structures** (standards, gauging, civil engineering)

The summary diagnosis of the pumping station includes:

- **Hydraulic tests:**
  - Flow measurement at station outlet,,
  - HMT measurement: pressure measurement at the upstream and downstream ends of the machine,
  - This allows to calculate the operating Q point (and H for the machine) and compare it with the theoretical operating point.
- **Electrical tests:**
  - Voltage measurement
  - Current measurement,
  - Cos Phi measurement (if pumps are supplied with 400 V)

When the perimeter is at the study stage, the design assumptions are reviewed and analysed.

## 2.5.2 DIAGNOSIS OF THE DISTRIBUTION NETWORK

The diagnosis of the distribution network includes the following analyses:

- **Architecture of the distribution network** and **service mode**
- **Network hydraulic operation**
  - Irrigation network **design**
  - **Perimeter hydraulic context** (location of hydrants, elevation profile of the study area)
  - **Network modelling**

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- **Irrigation network efficiency:** based on data from annual operating reports. The efficiency of the network is the ratio between the volumes distributed at the irrigation hydrants and the volumes pumped from the tank.
- **Irrigation at the plot level:** it allows to identify the irrigation practices adopted by the users and to give recommendations to avoid problems related to over-irrigation, especially hydromorphy.

Interviews with the infrastructure operators of the irrigated perimeter (irrigation workers, pump operators, etc.) also provide valuable information on the malfunctions encountered in terms of flow and pressure. Modelling provides additional information to understand the origin of these malfunctions and is therefore complementary to the necessary discussions with the network operators.

### Focus on network modelling

Hydraulic modelling helps:

- determine the failures of the hydraulic system and identify the actions required to rehabilitate and/or reinforce the infrastructures (e.g.: addition of a regulation tank to the production line, reinforcement of hydrants)
- determine the operating constraints and define the network operating rules that could identify the origin of the network malfunctions.

These problems are to be identified beforehand. Modelling will help understand their origin and eventually analyse the effects of potential solutions.

Irrigation network modelling is based on the simulation of two key parameters, the continuous flow rate and the Clement flow rate presented below:

- **Simulation of the continuous flow rate:** It is the flow that would have to be supplied to each hectare of the perimeter if it were to be supplied, without interruption, 24 hours a day.
- **Simulation of the Clement flow rate:** It corresponds to the abounding network operation (the probability allowing the calculation of the peak flow of an operating irrigation network) without any water tower that may have a random and independent use of irrigation hydrants. A hydraulic modelling of steady-state distribution networks can be realized using softwares such as IRMA, PORTEAU or even simply an Excel spreadsheet if the hydraulic network is not meshed (which is the case for most TWR irrigated perimeters). Modelling requires as input data the internal diameter of the pipes, at least their Z geometry and the elevation of the service points, the characteristic curves of the pumping station, the characteristic levels of the tank.

These models will allow to verify the size of the distribution network and the production line in relation to the estimated peak flow. It is preferable to calibrate the model on a pressure/flow measurement campaign.

Example of a result obtained when modelling the pressure at an irrigation network hydrant. The milky way is a graphical illustration allowing to represent the service of the network hydrants. The y-axis and x-axis show the excess pressure (m) and the pressure drop (m) respectively. The excess pressure is the difference between the pressure calculated by the model and the desired pressure to achieve. The pressure drop is the difference between the static pressure and the calculated pressure.

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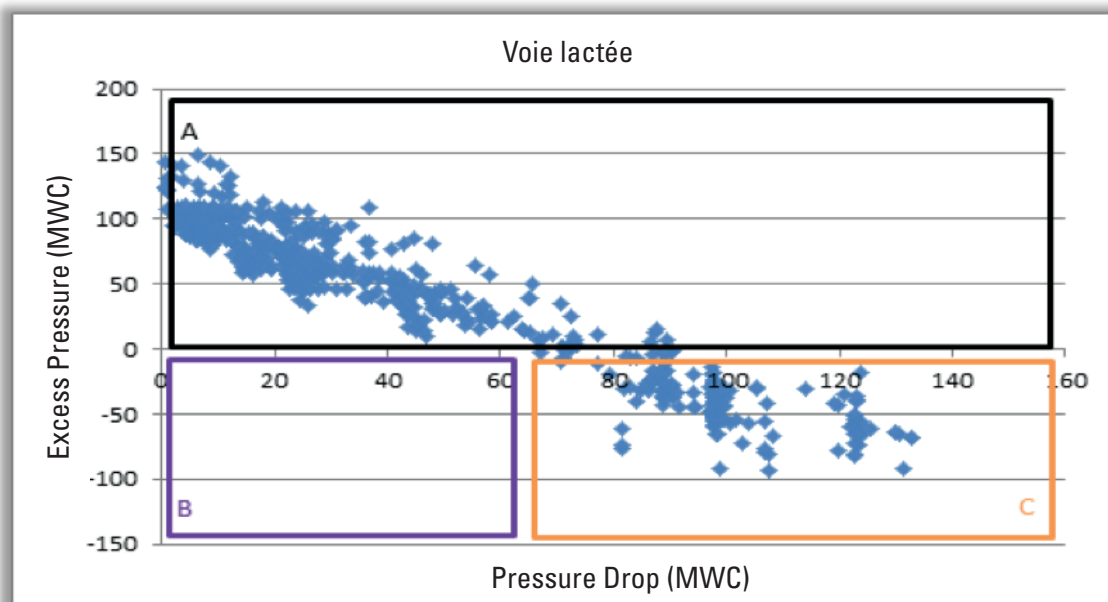


Figure 8 : The milky way of pressure drops and excess pressure at the hydrants

## 2.6 AGRICULTURAL DIAGNOSIS

### 2.6.1 CROP AND ANIMAL PRODUCTION SECTORS

The agricultural diagnosis is based on four major sources:

- The bibliographical analysis carried out before and during the project
- Participatory diagnostic workshops
- Agricultural surveys of farms
- Meetings with key actors in the agricultural sector

The main sectors in question are listed during step 1 of the pre-diagnosis, along with the main actors involved, which vary greatly according to sectors and countries.

In the context of agricultural development projects, commodity chain analyses can be used to reconstruct the flow of materials between upstream and downstream production, and thus to include not only the supply issues and difficulties, but also the marketing of products, a particularly key and sensitive subject for TWR projects. These two aspects enable to clarify the financial flows between links in the chain and the distribution of added value between actors, and thus to evaluate the overall economic performance of the entire production chain, from the upstream to the downstream of a given production.

The diagram below presents the typology of actors to be mobilized during this stage of work:



Figure 9 : Typology of actors to be mobilized for the study of agricultural sectors



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Farm surveys allow us to complete this vision at the level of the upstream and downstream interface. The first site visit allows us to identify the main sectors present in the field and to adapt the surveys and interviews accordingly.

### FOCUS: agricultural actors in milk and olive oil sectors in Tunisia

For example, for the perimeters studied in Tunisia, the key upstream-to-downstream and accompanying actors may be:

- RCADs concerned, heads of districts and heads of plant and animal production
- SMSA
- The Regional Office of Livestock
- The National Oil Office
- Peddlers
- Processors such as oil mills, dairy plants, etc.

**Nevertheless, these types of actors should be adapted according to the sectors involved and the issues at stake**

*Box 4: Actors of milk and olive oil sectors in Tunisia:*

## 2.6.2 KEY CHALLENGES, KEY OPPORTUNITIES

Key challenges and opportunities can vary greatly from one perimeter to another and may completely or partially overlap in some cases. It is therefore unwise to try to apply preconceived recipes, but rather to be particularly attentive to the solutions proposed by site operators and resulting from participatory workshops, interviews or surveys.

Consequently, the following points should be identified:

Theme	Method
<b>Degree of farm diversification</b>	Check the degree of diversification in order to assess the adaptability of a given farm: If the farm is highly diversified, adaptation will be more difficult as it is required to adjust its production.
<b>Access to inputs</b>	Check that access to inputs is regular, reliable and affordable
<b>Marketing</b>	Understand the positioning of the product's sales level (is the product sold in bulk, after initial processing, after packaging, etc.) to make sense of the value-added calculations.  Understand marketing channels and their sensitivity to TWR problems (quality control methods, verifications carried out, management of problems in case of trust crisis, etc.)
<b>Gross value added per hectare or per head</b>	These technical-economic indicators can predict farmers' income when GVA is low or even negative. This means that production costs are too high in relation to expected revenues with which the farmer cannot cope financially. He cannot afford to pay for his work or investments. Priority action levers must be studied to overcome this situation. Beware, the opposite is not true: it is not because GVA is high that the farmer is necessarily better off. The farmer may have extremely high structural costs that can affect the technical-economic results in terms of income despite having a relatively high GVA.

## TECHNICAL ASSISTANCE MISSION FOR TREATED WASTEWATER REUSE OPERATIONS IN TUNISIA

## 2.7 HEALTH AND ENVIRONMENTAL DIAGNOSIS

### 2.7.1 HEALTH INPUT DATA TO BE CONSIDERED

TWR health issues are dependent on a number of factors:

- **Water quality** in relation to the connected population health status and the nature of the industrial units connected to the sanitation system
- **Reuse regulations**, as well as monitoring and surveillance systems
- **Users' capacity** to master good practices
- The natural environment

Around these axes, the diagnostic phase of the TWR system health analysis will engage:

- The characterization of the health quality of TW and sludge, and the associated risks,
- The epidemiological situation of the agglomerations' populations connected to the sanitation network,
- The organization of the health surveillance system at the local and regional level,
- The possible interactions between these TW and the characteristics of current or projected agricultural practices,
- The possibilities offered by the natural environment to compensate for the risks,
- The current organization of these waters control and monitoring.
- The evaluation of future users' sensitivity in relation to risks following the interviews of the participatory approach and the social survey conducted.

The overall assessment of this analysis will allow an **understanding of all problems and issues** and will highlight the main constraints and challenges to be faced in order to optimize the operation of the TWR system.

### 2.7.2 REFLECTING UPON HEALTH RISK MANAGEMENT

Based on the results of the diagnosis, the "health" component of the action plan will be developed (Step 3) and can be implemented according to an adapted chronology in the short, medium and long term.

For example, the following elements could be integrated into the action plan:

#### On user health and safety:

- Capacity building (supervision, health education and awareness).
- The total coverage of wastewater handlers in terms of vaccination and means of protection.

#### On good prevention practices related to crops:

- Monitoring the quality of products (all chemical or biological contaminants) in the perimeters irrigated by treated wastewater, according to a risk assessment plan.

#### On monitoring and control:

- The acquisition of necessary equipment for control and monitoring,
- The agreement and distribution of monitoring roles between regional stakeholders (epidemiological monitoring, quality of TW and agricultural products)
- Regular monitoring of treated wastewater according to regional stakeholders' legal missions by means of a centralized registration system.

## TECHNICAL ASSISTANCE MISSION FOR TREATED WASTEWATER REUSE OPERATIONS IN TUNISIA

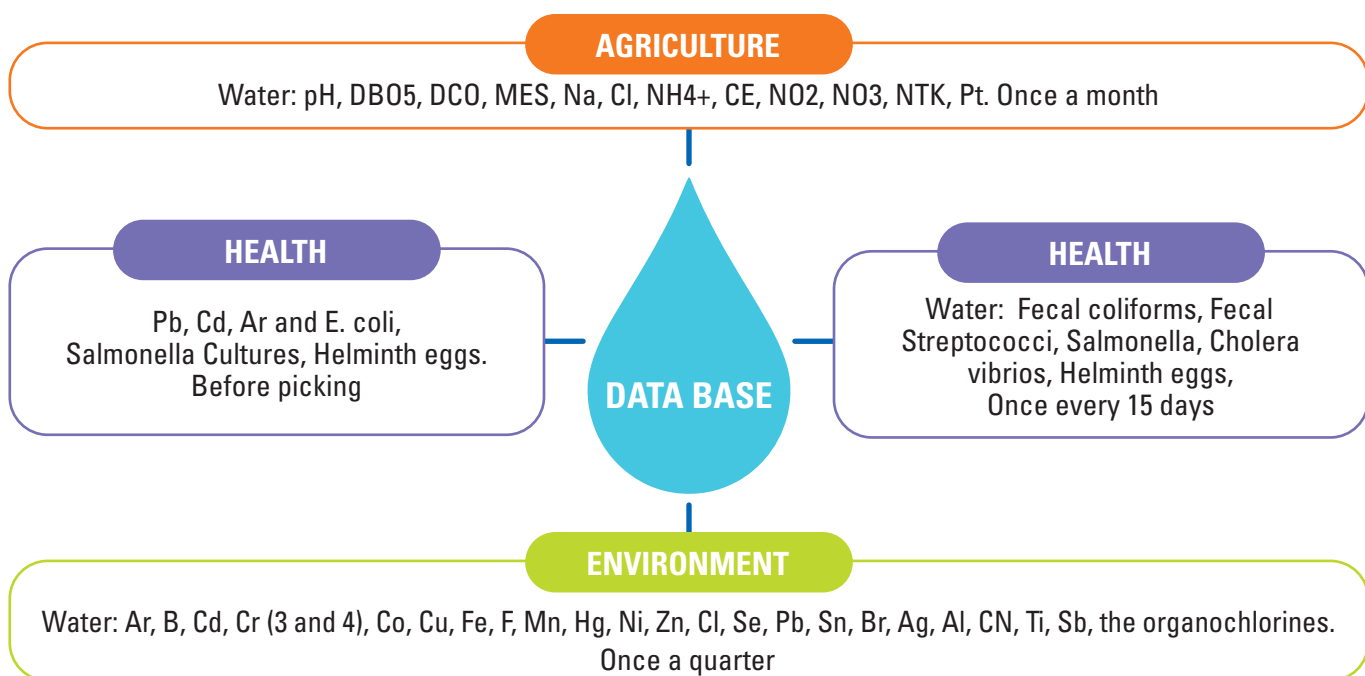


Figure 10 : Aggregating health data in a database

- An alert and anticipation system designed for early intervention when detecting water quality deterioration in WTP. It combines continuous measurements (e.g. turbidity sensor), and rapid microbiological analyses.
- A national well-structured local-to-central sentinel epidemiological surveillance system that takes care of waterborne diseases.
- Performance and impact indicators

The success of the risk management plan in terms of prevention and treatment will depend on the quality of systems and the skills of all teams involved at the local and regional levels.

### A TWR PROJECT SET IN ITS ENVIRONMENT

The deployment of a TWR irrigated perimeter directly modifies the regional hydrological balances of conventional waters:

- Surface waters by removing discharges, either in a continental area (river, dam, temporary stream...) or in a maritime environment (outfall or coastal discharge)
- Groundwater by possible infiltrations

These modifications can be of a quantitative order; decrease of a stream flow or rise of an aquifer, as well as of a qualitative order; suppression of a surface pollution or contamination of an aquifer.

There are also indirect changes, where the mobilization of TW resources substitutes a conventional resource extraction..

Environmental and Social Impact Assessments (ESIA), which are standardized methods at the local and international levels, identify the various impacts of a development project, and propose supporting and monitoring measures. TWR must be supported by such an approach. In 2017, the World Bank published an environmental and social framework that precisely describes what is expected from an ESIA.

## TECHNICAL ASSISTANCE MISSION FOR TREATED WASTEWATER REUSE OPERATIONS IN TUNISIA

## 2.8 SUMMARY OF THE DIAGNOSIS: STRENGTHS, WEAKNESSES, OPPORTUNITIES AND THREATS

Once all diagnostic data are collected via these different channels, the team, through brainstorming, sharing and discussion sessions, proceeds to the elaboration of a synthetic 'SWOT' (strengths, weaknesses, opportunities and threats) diagnosis to visualize the main issues.

Here is an example of a SWOT diagnosis:

FACTORS	FAVOURABLE	UNFAVOURABLE
INTERNAL	<p><b>STRENGTHS</b></p> <p><b>1. A solid identity</b></p> <ul style="list-style-type: none"> <li>• More than 30 years of experience</li> <li>• Farmers convinced of the importance of TWR</li> <li>• Strong demand of TW</li> <li>• ADG in place</li> </ul> <p><b>2. A water quality that is now satisfactory</b></p> <ul style="list-style-type: none"> <li>• Good water quality since 2019 with the transfer of TW surplus from Sousse South to Sousse Hamdoun</li> </ul> <p><b>3. An agricultural economy with many assets</b></p> <ul style="list-style-type: none"> <li>• Good agriculture-livestock integration</li> <li>• Supply and marketing structures in place (SMSA)</li> <li>• Technical and economic results that are more favourable than elsewhere due to the lower cost of water and fertilizers thanks to TWR</li> <li>• No marketing or discount problems in relation to the price of milk or oil produced by the TWR IP</li> <li>• Short sales channels for milk</li> <li>• The price of TW has already risen to 50 millimes /m<sup>3</sup>, surpassing the regulatory floor of 20 millimes</li> </ul> <p><b>4. Mobilized research centers</b></p> <ul style="list-style-type: none"> <li>• The Olive Institute works on TWR impacts on the quality of olive oil</li> </ul>	<p><b>WEAKNESSES</b></p> <p><b>1. A recent historical liability</b></p> <ul style="list-style-type: none"> <li>• 2010s liability of poor water quality</li> <li>• Water supply deficient in 2019 (pumping station failures)</li> </ul> <p><b>2. Unsatisfactory coordination and lack of trust</b></p> <ul style="list-style-type: none"> <li>• Lack of cooperation between actors</li> <li>• Lack of trust between actors (ONAS / RCAD / farmers)</li> <li>• Distrust of health analyses results</li> <li>• Distrust of TWR impact on the organoleptic and sanitary quality of products</li> </ul> <p><b>3. Insufficient health management</b></p> <ul style="list-style-type: none"> <li>• Lack of a water quality surveillance and monitoring plan in accordance with the requirements of the regulations in place</li> <li>• Lack of training for water users in relation to health risks</li> </ul> <p><b>4. Agricultural practices that are generally not very efficient</b></p> <ul style="list-style-type: none"> <li>• Land fragmentation</li> <li>• Disappearance of family labor</li> <li>• Archaic irrigation practices</li> <li>• Fragile (deficient?) economy of the dairy cattle breeding, which is the main production of the IP because of: <ul style="list-style-type: none"> <li>- High world price of concentrated products,</li> <li>- Non-remunerative milk price.</li> </ul> </li> <li>• Difficulties of SMSA collective organization to the detriment of breeders remuneration</li> <li>• Progressive sale of the livestock</li> <li>• Technical and economic results of the agriculture producing a low and insufficient margin to ensure a dignified life for a family</li> </ul>

Table 2 : Example of SWOT (Zaouiët TWR system, Sousse, Tunisia, 2020)

## TECHNICAL ASSISTANCE MISSION FOR TREATED WASTEWATER REUSE OPERATIONS IN TUNISIA

FACTORS	FAVOURABLE	UNFAVOURABLES
EXTERNAL	<p><b>OPPORTUNITES</b></p> <p><b>1. A collective mobilization of institutional actors</b></p> <ul style="list-style-type: none"> <li>National TWR dynamic (e.g. TWR 2050 national plan).</li> <li>ONAS strategy of commissioning TW tertiary treatments, especially here for Sousse South and Sousse Hamdoun (resulting from the standards tackled in the decree of March 26, 2018 on TW quality)</li> <li>Improving the monitoring system management of health and environmental impact</li> </ul> <p><b>2. New infrastructure and TW resources</b></p> <ul style="list-style-type: none"> <li>Possibilities of re-supply / IP networking following the commissioning of Sousse Hamdoun WTP</li> </ul> <p><b>3. Generalized paths of technical progress</b></p> <ul style="list-style-type: none"> <li>Introduction of new technologies for water treatment and irrigation, to meet health requirements and save water in the perimeter</li> </ul> <p><b>4. Potential markets for agricultural production</b></p> <ul style="list-style-type: none"> <li>OEP's willingness to develop cotton cultivation</li> <li>Opportunities to diversify crops, particularly towards arboriculture</li> <li>Tunisian fodder deficit, price of imported food supplements and a call for a local fodder production</li> </ul> <p><b>5. A sludge management model to be invented</b></p> <ul style="list-style-type: none"> <li>Green waste deposit for co-composting</li> <li>Sludge composting: a circular economy approach with an effective waste management and a creation of an agronomic product</li> </ul>	<p><b>THREATS</b></p> <p><b>1. A collective dynamic that is losing momentum</b></p> <ul style="list-style-type: none"> <li>Lack of political consideration for TWR</li> <li>Dissension and lack of communication between actors in the TWR sector</li> <li>ADG weakening, increase in individualism among farmers</li> <li>Decrease in social approval of TWR practices and its commercial impact on products sales</li> </ul> <p><b>2. Disabling means of agricultural production</b></p> <ul style="list-style-type: none"> <li>Continued urbanization and loss of land</li> <li>Disappearance of family labor</li> <li>Decrease in the number of cattle, due to the continued drop in milk prices and increase in production costs</li> </ul> <p><b>3. Insufficient public means</b></p> <ul style="list-style-type: none"> <li>ONAS coverage of operating costs (deterioration of water quality)</li> <li>Pumping station functioning</li> <li>ADG financing</li> </ul>

## STEP 3: ACTION PLAN - SUGGESTING SOLUTIONS FOR IMPROVEMENT

### OBJECTIVES

- Suggesting adapted solutions to respond to the shared diagnosis
- Putting the actors in a suitable position to suggest solutions that seem feasible to them in order to facilitate implementation

### APPROACH AND TOOLS

- Participatory planning workshops
- Action sheets

### 3.1 OBJECTIVE-BASED PLANNING

The planning logic adopted is **objective-based strategic planning**. It consists in breaking down the general objective - which is none other than the common vision constructed during the pooling workshop - into specific objectives. These specific objectives are translated into an **operational programme** comprising the actions necessary to achieve the targeted objectives, establish the corresponding development plans and define the essential support measures.

The actions developed within the framework of the operational plan (action plan) are quantified and scheduled in time and space with an estimate of the respective implementation costs. The plan specifies for each action:

- Its nature
- The timeframe for its implementation
- Its cost
- The main agency in charge of implementation and the contributing agencies
- The human and material resources required for its implementation
- The source of funding

A sheet is developed for each action in order to facilitate any funding requests or fundraising.



## TECHNICAL ASSISTANCE MISSION FOR TREATED WASTEWATER REUSE OPERATIONS IN TUNISIA

VISION: SUSTAINABILITY OF TW IRRIGATED PERIMETERS General objective and strategic objectives		
G.O: SETTING UP PERENNIAL PERIMETERS PÉRENNES	S.O 1: Ensure a quality water service in relation to service continuity and water quality	Ensure continuous water service
		Ensure proper wastewater standards
		Establish a monitoring system
	S.O 2: Ensure trust in the system	Share information on the quality of treated wastewater and agricultural products in the perimeter
		Develop technical-scientific references and promote the implementation of TWR
		Develop protection measures for farmers
	S.O 3: Ensure good governance of the perimeter	Determine the tasks, missions and responsibilities of each party
		Discuss TWR with stakeholders (local, national and international)
	S.O 4: Ensure the quality of production	Guarantee quality agricultural products
		Introduce new irrigation techniques
	S.O 5: Ensure the economic sustainability of the system	Ensure agricultural outlets
		Ensure the economic profitability of agricultural production
		Set a fair price for agricultural water
	S.O 6: Ensure the environmental sustainability of practices	Control the environmental impact
		Diversify the valorization channels of TW and sludge

Table 3 : Logical framework of the proposed action plan

## 3.2 PARTICIPATORY PLANNING WORKSHOPS

Participatory planning aims to involve the stakeholders of the irrigated perimeter in the developing of an action plan for their territory.

The challenge is threefold. It is about:

- Suggesting actions and measures that respond to the challenges of the territory,
- Discussing, evaluating and prioritizing the suggestions, and
- Designing a short, medium and long term action plan.

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To do this, we recommend the following steps, which are based on the Cooplan methodology<sup>1</sup>:

### 1. Validate the objectives of the action plan

First, it is important to agree with all participants on the perspectives of this plan. Ideally, the main problems identified during the diagnostic phase should be reformulated in the form of objectives for the territory.

### 2. Brainstorming on the potential actions enabling the achievement of these objectives

This is the most important step in the participatory planning process. It is about giving time and creating favourable conditions for all participants to make suggestions and share ideas. At this stage of the process, there is no pre-selection, all proposals are legitimate. It is a stage of freedom and creativity.

### 3. Detail the actions by identifying the necessary resources, the expected impacts and the scale of implementation

To assess the feasibility and relevance of an action, it is important to specify its needs and consequences. The participants will together estimate the resources needed to carry out each action (money, labor, land, knowledge, etc.) as well as its potential impacts (income, biodiversity, health security, image, etc.).

These lists of resources and impacts enabling the characterization of the actions can be proposed by the facilitators or discussed by the participants themselves as evaluation criteria.

### 4. Evaluate participants' commitment.

An action plan should not be an off-the-ground document. Its value depends heavily on its implementation and therefore on the actors' responsibility to carry it out in a given territory. At this stage of the process, it is important to evaluate the actors' level of commitment to the proposals made. A consensus scale can facilitate this evaluation. It consists in asking participants to give their position for each proposal (I support / I like / I am not interested / I need more information / I dislike).

### 5. Combine actions in time and space to build the action plan

A list of actions does not constitute an action plan. These actions must be organized in time and space. To do this, it is necessary to group the actions according to their scale of intervention (local/regional/national) and their perspective (short/medium/long term).

### 6. Analyse the action plan and discuss its feasibility and coherence

Discussions on the feasibility and coherence of the action plan are conducted with regard to the resources and impacts of the selected actions. The objective is not to have a figure-based debate with the participants but rather to highlight certain inconsistencies in their proposals.

## 3.3 DEVELOPMENT OF ACTION SHEETS

A summary of the action plan is then presented using objective-based action sheets (strategic/operational). It provides a quick overview of all information needed to understand the "why" of the action (problem, link with the project's logical framework), the "how" (scale, type of action, human, material and financial resources, etc.), the "who" (who is responsible, who is contributing, who is operating), the expected results and the action's priorities.

<sup>1</sup>

<sup>1</sup>. Participatory water management planning system developed by INRAE in 2004 and implemented in various international projects



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Below is an example of an action sheet.

JOINT	SHEET N° 1.1.	TITLE: Agreement between all actors
<b>STRATEGIC OBJECTIVE:</b> "Ensure good governance of the perimeter"	<b>OPERATIONAL OBJECTIVE:</b> "Determine the tasks, missions and responsibilities of each party"	
<b>SCALE :</b> Local : <input checked="" type="checkbox"/> Regional : <input checked="" type="checkbox"/> Central : <input type="checkbox"/>  <b>TYPOLGY :</b> Research : <input type="checkbox"/> Works : <input type="checkbox"/> Purchases : <input type="checkbox"/> Capacity building : <input type="checkbox"/> Coordination : <input checked="" type="checkbox"/> Regulation : <input type="checkbox"/>	<b>DESCRIPTION :</b> There are currently no bilateral and/or multilateral documents signed. We recommend the establishment of the following documents: <ul style="list-style-type: none"> <li>• Agreement between TW supplier and RCAD</li> <li>• Management contract and subscription contract between RCAD and ADG</li> <li>• Agreement with a water analysis laboratory</li> <li>• Agreement with the occupational physician to provide health care and vaccinations for farmers</li> <li>• ADG internal regulations</li> <li>• ADG standard water distribution contract with a manual of procedures</li> <li>• Contract between ADG and SMSA or other resellers of IP products</li> </ul> A charter and a common 5-year strategy for the whole perimeter must be clearly defined with all actors.	
<b>INITIAL PROBLEM :</b> <ul style="list-style-type: none"> <li>• Lack of cooperation-coordination between actors</li> <li>• Poorly defined roles and responsibilities</li> <li>• No arbitration process</li> </ul>	<b>EXPECTED RESULTS :</b> <ul style="list-style-type: none"> <li>• Standard contracts between parties</li> <li>• Negotiated and validated procedures</li> <li>• Enforceable technical and administrative obligations</li> </ul>	
<b>DEADLINE :</b> 12 mois	<b>RESOURCES :</b> <ul style="list-style-type: none"> <li>• Legal experts</li> <li>• Benchmark of existing documents on other perimeters</li> <li>• Focus group</li> <li>• Training sessions</li> <li>• Participatory workshops for multilateral documents</li> </ul>	
<b>AGENCY RESPONSIBLE FOR THE ACTION:</b> the project group, the delegate, the regional committee	<b>CONTRIBUTING AGENCIES :</b> All IP stakeholders	
<b>OPERATING AGENCY :</b> DGGREE ; A research office		
<b>REQUIREMENTS:</b> <ul style="list-style-type: none"> <li>• Authorization to use the IP from the Minister of Agriculture</li> <li>• Technical information on networks capacity</li> <li>• Willingness of all stakeholders</li> </ul>	<b>RISKS :</b> <ul style="list-style-type: none"> <li>• Difficult negotiation between parties</li> <li>• Administrative issues that may limit farmers' adherence</li> <li>• Lack of monitoring</li> </ul>	
<b>COST OF ACTION:</b> -	<b>FINANCING:</b> Donors, Public funds	
<b>ALTERNATIVE :</b> A de facto operation without an agreement may last for a while, but the alternative is not permanent.		
<b>IMPORTANCE :</b> ●●●●●	<b>URGENCY :</b> ●●●●○	

Tableau 4 : Exemple d'une fiche action complétée pour un périmètre de REUT en Tunisie

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STEP 4: IMPLEMENTATION - CARRYING  
OUT THE ACTION PLAN

## OBJECTIVES

- Moving from the «discussion» stage to concrete implementation
- Achieving jointly defined objectives

APPROACH  
AND TOOLS

- Agreements between actors
- Project group
- Follow-up and evaluation of actions

Once the diagnosis is made and the action plan established, we move to the next step, which is implementation.

This requires :

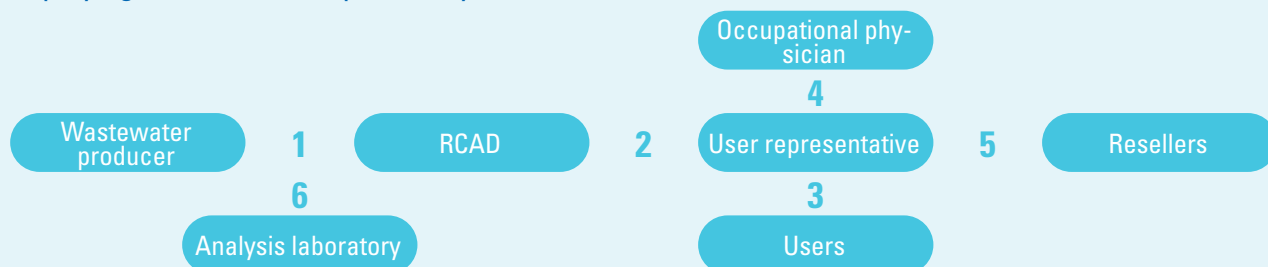
- **Clarifying “who” does “what”** at different levels: at the global level, it is done in the agreement stage; but at the operational level, it is clarified within the project group
- **Structuring and operating a project group:** it is a question of defining a decision-making head (a COPIL), a member in charge of facilitation and the organization of project sub-groups
- **Setting up an efficient reporting system** to ensure the follow-up of the actions implementation

## 4.1 AGREEMENT BETWEEN ACTORS

To ensure good governance of a TW IP, it is necessary to determine the tasks, missions and responsibilities of each party, including **financial counterparts**.

These commitments can be specified in a series of special bi-party or tri-party agreements that bind the actors together.

The diagram below is an example of an agreement system between different actors in Tunisia, displaying the role and responsibility of each of them.



1: Agreement between treated wastewater supplier and RCAD  
2: Management contract and subscription contract between RCAD and ADG  
3: ADG internal regulations and standard water distribution contract with a procedures manual

4: Agreement with the occupational physician to provide health monitoring and vaccinations for farmers  
5: Contract between ADG and SMSA or other resellers of UP products  
6: Agreement with a water analysis laboratory

Box 5 : Agreement between actors of a TWR system in Tunisia

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These contracts and agreements should be accompanied by a **multi-actor charter** that specifies the terms and conditions of perimeter management: responsibilities, operation, vision, principles, arbitration procedures, etc.

**Its purpose is to commit all stakeholders to a collective approach with common objectives for the perimeter.**

### 4.2 CREATING A PROJECT GROUP

The creation of a project group is one of the keys to a successful implementation and sustainability of the actions. Its purpose is to :

- Unite the actors around the same dynamic
- Facilitate coordination between actors and reinforce dialogue
- Get the actors back to their role of "acting"
- Create a framework to facilitate reporting.

The project group is a multi-actor steering body and true COPIL that is responsible for a concrete implementation of the action plan.

To do this, it must

- Take ownership of the action plan developed during Step 3 of the methodology
- Ensure the follow-up of the action plan implementation
- Identify and discuss the problems raised by the actors in order to set up new actions and keep the plan alive.

This group must have a certain autonomy in order to take charge of all aspects relating to the operation in a collaborative and decentralized manner: financial, technical, health, environmental aspects, etc.

It is composed of the various key actors of the TWR field, including political actors. The constitution of this group must be subject to specific negotiations and must comprise as many actors as possible, including civil society.

To make it operational and consistent with the projects, this group is then divided into subgroups responsible for specific topics. It is at the level of these subgroups that the autonomy to act must be the strongest. They are structured around the strategic objectives that were determined during the development of the action plan.

In the Tunisian case, these objectives are as follows:

- S.O 1: Ensure a quality water service in relation to service continuity and water quality
- S.O 2: Ensure trust in the system
- S.O 3: Ensure good governance of the perimeter
- S.O 4: Ensure the quality of production
- S.O 5 : Ensure the economic sustainability of the system
- S.O 6 : Ensure the environmental sustainability of practices

The actors are then involved in the sub-groups in order to implement their corresponding action sheets.



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## 4.3 ACTIONS IMPLEMENTATION AND FOLLOW-UP

The first task of these **strategic-objective-based subgroups** will be to **analyse** action sheets and **classify** them based on urgency and feasibility

The more urgent and feasible an action is, the faster it can be implemented.

They will then question the risks and how to prevent them. They will make commitments to achieve concrete results in the form of **indicators**, take actions and meet deadlines..

**Periodic meetings** are organized to verify compliance with the commitments made. In the event of non-compliance, they are organized to identify the causes in order to find solutions. When implementation problems are more significant than expected, they are reported to the project group presented above, which acts as a COPIL.

The critical points to achieve effective implementation are:

- A clear and shared definition of "who" does "what," at an operational level, based on what is already stipulated in the action sheets,
- Effective communication with the steering committee to inform it of any implementation difficulties encountered and to find solutions collectively,
- Periodic reporting, in addition to the communication of difficulties, in order to facilitate hindsight in the implementation, and to have a clear idea of the team's progress.

Progressively, when all sub-groups have analysed the action sheets as described above, they will be translated in terms of :

- Intervention **timeline** and,
- A **dashboard** for results monitoring through the definition of clear indicators

This dashboard will have to enrich the realized periodic reporting in the form of group facilitation rather than in the form of a report

Once these tools are in place, it will be easier to monitor the progress of the action plan implementation. The following table provides an example of indicators and outcomes enabling the monitoring of the project results.

Indicators	Résultat à atteindre court-terme	Résultat à atteindre moyen-terme
<b>Network efficiency</b>	50%	80%
<b>Mode of irrigation</b>	20% Drip Irrigation, 20% aspersion	50% Drip Irrigation, 50% aspersion
<b>Percentage of degraded soils</b>	10%	5%
<b>Intensification rate</b>	1,5	1,8
<b>Intervention time for curative maintenance</b>	5 days	2 days
<b>Water quality compliance</b>	80%	100%
<b>Percentage of sanitary measures compliance (vaccine, outfit...)</b>	80%	100%

Table 5 : Example of action plan progress indicators



La publication et la traduction en trois langues du Guide a été financée  
par l'Agence de l'Eau Rhône-Méditerranée-Corse



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