TECHNICAL AND INSTITUTIONAL SUPPORT FOR WATER MANAGEMENT IN ALBANIAN IRRIGATION

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ABSTRACT

Since 2001, Société du Canal de Provence (SCP) has been asked by the French Ministry of Foreign Affairs to provide support in certain specialised fields to a vast program undertaken by the World Bank in Albania to rehabilitate the irrigation networks in collaboration with the Project Management Unit (PMU) of the Albanian Ministry of Agriculture and Food. The support contributed by this work concerns the aspects requiring the intervention of engineers and operators in the irrigation sector. SCP has adopted an approach jointly with Albanian partners and with the oldest Water Users' Association (WUA) in Provence, the Canal St Julien. The pilot command areas chosen for this project are located about 50 kms to the south of Tirana, in the area of Peqin Kavaje and Lushnije. These command areas are managed by 26 WUAs and 2 federations of WUAs (FWUAs). They represent a total irrigated area of 20,000 ha. Topographical data of the Peqin Kavaje main canal were then used to model the canal with SIC[7] software in order to simulate operation of canal in both steady and unsteady flow conditions so that the hydraulic constraints on operation of the facilities could be assessed.

The work undertaken relates to the following main aspects:

- Survey and monitoring of network hydraulic operation and delivery of irrigation water;

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[7] SIC: Simulation Irrigation Canals: computer model developed by the Montpellier CEMAGREF (France)

- Institutional and technical support to the WUAs and FWUAs;
- Training of the farmers and the members of WUAs;
- Technical visits in France.

As a result, the work highlighted the current malfunctions on the canal and led to proposals for solutions:
- On the physical level, concerning the rehabilitation program, in particular, the construction of control facilities of duckbill weir type;
- On the organizational and functional levels, a list of actions and the means to be implemented for ensuring the water service at long term.

This type of intervention is particularly remarkable insofar as it allows organisations with competences and complementary cultures to take part in a project of cooperation in which the institutional and human components have an essential role.

INTRODUCTION

Since the 90's Albania has made considerable efforts to reorganize the agricultural sector. Irrigation has now been completely reorganized through a simultaneous program of infrastructure rehabilitation and management transfer. Some 200 WUAs, each covering about 500 hectares, have been established and have been in operation since then. The WUAs usually manage the secondary canals, while groups of farmers operate the tertiary canals. For operation and maintenance of the main canals, the Albanian authorities decided to establish a FWUA.

The Albanian government sought the assistance of France due to the expertise developed by the French Regional Development Companies in the control of water conveyors and distributors and the long experience of France in the field of participative management of irrigation. In this context, the French Ministry of Foreign Affairs (MAE) included Albania in its programme of technical assistance and signed a four-year service contract with a partnership formed between the SCP and the Saint-Julien Canal WUA.

One of the pilot project carried out by French experts is the Federation of Peqin-Kavaje. This Federation was judged to be representative of the problems encountered by Albanian Federations in institutional and operational management. The purpose is to improve the water management capacities within the pilot project WUAs and the Federation. Specifically, the aim of the Federation is to improve its performance in terms of water distribution to WUAs by introducing and testing new management methods combined with suitable monitoring techniques.

A detailed inspection with an Albanian project team was made, from the intake in the Shkumbinit River to the downstream part of the Peqin Kavaje main canal, during the 2000-2001 closure period. This partly consisted of a topographical survey, in order to update the longitudinal profile of the canal, the position of the structures, and an overall survey of the condition of the canal and all its structures (bridges, footbridges, aqueducts, cross regulators, offtakings, etc). Following this analysis, physical modifications has been proposed in order to adapt the Peqin-Kavaje main canal capacities to the water requirements. The feasibility of implementing a water roster along the secondary canals and its consequences for the operation of the main canal was examined.

These are all contained in detailed and exhaustive Canal de Provence internal report. The paper shall only present highlights of the whole study. In the first section the pilot project and some of its hydraulic features are presented. The second section deals with our proposals for the modernization of water supply and their consequences in term of main canal modifications. The last section describes the capacity building program which has been organized by the team of the project.

THE PILOT PROJECT

The irrigation scheme

The Peqin-Kavaje main canal (see figure 1) is a 42-kilometer long conveyance and supply structure. It is fed from an intake situated upstream of the Cengelaj barrage on the Shkumbinit River. 15 km downstream of the head structure, the canal separates into two branches: the Karina Gose branch and the Peqin-Kavaje branch.

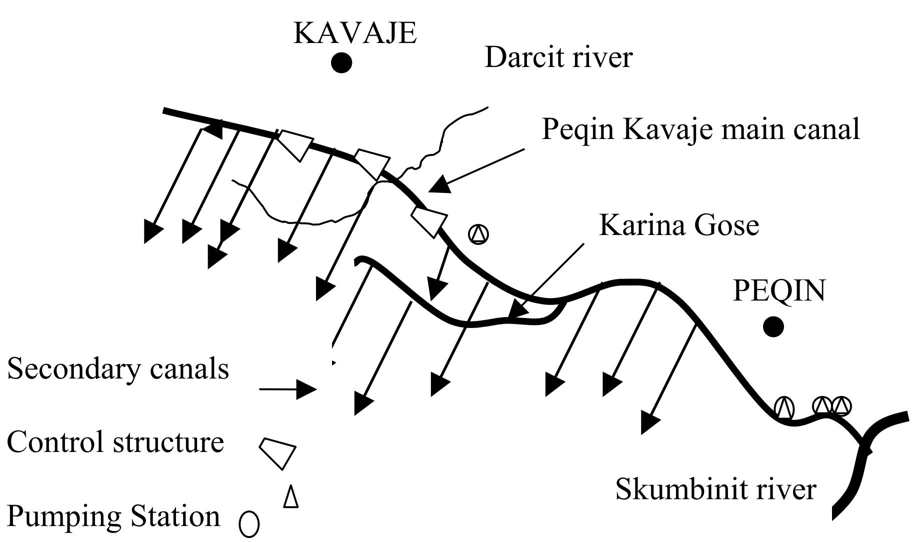

Figure 1. Pilot project irrigation scheme

The Peqin Kavaje federation was created in 1998 and consists of 12 WUAs: two WUAs located on the upstream part in Peqin district which use pumping stations, and ten WUAs located in Kavaje district which use a mixed system (gravity and pumping).

The Peqin-Kavaje main canal supplies 38 secondary canals on the left bank, a few direct irrigation offtakes and some pumping stations. The command area covers around 10,000 hectares. The pilot project has a drainage network which collects the surplus irrigation water and directs it towards Shkumbinit River or the sea. On the drainage network, some pumping takes place to supply some irrigation plots. The canal was designed in 1952 to convey a flow of 7 cumecs. In 1980, the capacity of the first 15 km of the canal was increased to 17 cumecs in order to supply the pumping stations. Due to urbanization, a canal bypass was built in 1998 for all the downstream part of the canal (around 8 km long).

Hydraulic analysis of the current condition of the Peqin-Kavaje main canal

The detailed inspection and the topographical surveys made it possible to model the Peqin-Kavaje main canal in order to assess the current hydraulic characteristics and the current water management. Using SIC simulation model, the analysis had the following objectives:

- To reproduce the waterline at maximum flow on hydraulic longitudinal profiles, in order to identify the current capacities of the main canal;
- To identify zones which limit the canal's capacity;
- To underline the hydraulic constraints for operation of the main canal;
- To check the actual water management methods;
- To link the hydraulic constraints of the main canal to current management methods.

With above tasks, the hydraulic characteristics of the main canal have been defined (maximum discharges, storage volumes, hydraulic delay, etc..). These enable the assessment of hydraulic constraints on operation of the main canal. Two methods were used to estimate the hydraulic delay needed to pass from one operating flow to a new flow on the canal:

- Steady flow computation using two waterlines (one set at the maximum flow and the other at 50% of the maximum flow) as presented in the table 1;
- Unsteady flow computation using the unsteady flow module of the SIC model.

Table1: steady flow estimation of the hydraulic delays

Reach	Ups (m)	Dws (m)	Qmax (l/s)	Max vol (m^3)	Qmax/2 (l/s)	Max Vol/2[8] (m^3)	Delay[9] (mn)
1 & 2	45	3,600	6,400	51,390	3,200	31,600	100'
3	3,600	5,600	5,800	20,800	2,900	12,200	50'
4	5,600	12,480	4,600	61,700	2,300	38,300	170'
5	12,480	15,720	3,000	24,500	1,500	16,100	90'
6	15,720	27,750	2,600	76,600	1,300	44,300	410'
7	27,750	34,570	2,000	31,100	1,000	18,600	210'
8	34,570	38,040	1,600	19,100	800	11,000	170'
9	38,040	41,200	500	3,100	250	2,000	70'
10	41,200	42,380	300	900	150	500	44'
						Total	**22 hours**

MODERNIZATION OF OPERATION

Water distribution

The strategy to distribute the water along the secondary canals

The federation project objective requires that its performances in terms of water supply to WUAs are improved by introducing and testing new management approaches associated with adapted control techniques. The purpose of this section is to analyze the feasibility of setting up rotational distribution along the secondary canals and to determine the consequences for the operation of the main canal.

Rotational distribution along the secondary canals consists in creating a roster on which the flow is successively distributed to tertiary canals. When the tertiary unit (irrigated area supplies by tertiary canal) is too small, which is the case in the Peqin-Kavaje irrigation project (12 ha), the roster can be prepared so that it supply several adjoining tertiary canals (2 or 3) at the same time.
The advantages of this method of distribution, which is widely used, are:

- Each plot is irrigated using the entire flow from the tertiary canal. As a result there is no need to share the flow inside the tertiary unit. The system of water

[8] Max Vol/2 = storage volume in each reach corresponds to the water line obtained with 50% of the maximum flow

[9] Hydraulic delay = $\frac{MaxVol - MaxVol/2}{Q\max - Q\max/2}$

allocation to the tertiary canal is based on time and is easy to control and implement.
- The irrigation program can be prepared in advance. This simplifies the work of farmers and operators.

The water requirements

Using the CROPWAT software, the water needs of the crops have been estimated in accordance with the cropping pattern. The curve in figure 2 shows the continuous flow required along the main canal in order to satisfy the needs of crops. This flow is expressed in l/s/ha.

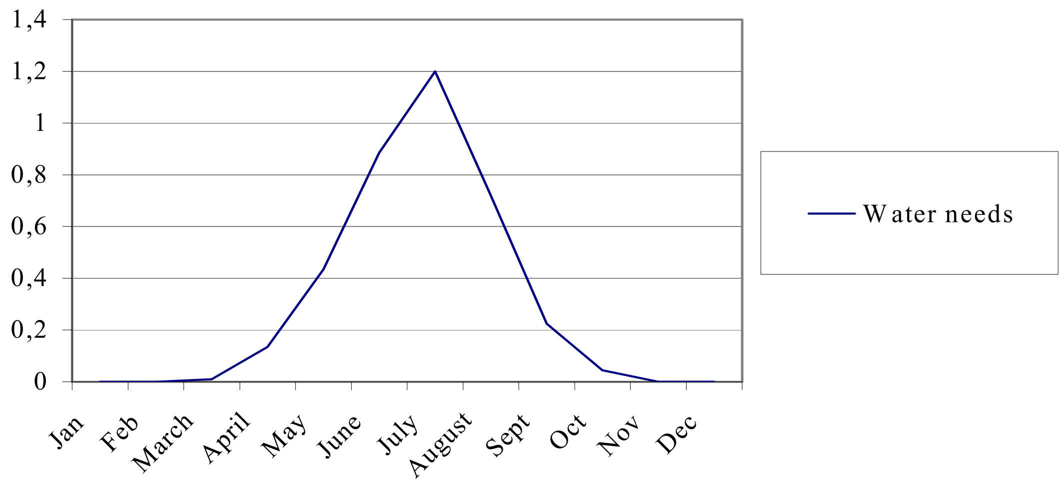

Figure 2. Water needs to supply the crops

The irrigation period can be broken down into three sub-periods:
- The peak period is between May 15 and September 15 when requirements are more than 0.6 l/s/ha.
- Two periods of two months, at the start and at the end of the irrigation season when the needs of crops are less than 0.6 l/s/ha.

The night irrigation issue

According to the federation, farmers do not want to irrigate at night and therefore the gates supplying the secondary canals are normally closed during the night. The issue of night irrigation is crucial to canal management. This controls the possibility of organizing a rotation of the secondary canals, to transfer flow towards the downstream users which are largely underfed by current practices. This strategy to distribute the water has been analyzed through two alternatives:
- Continuous distribution (24 hours a day) along the secondary canals;

- Discontinuous distribution along the secondary canals, allowing farmers to irrigate their plots only during the day (12 hours a day).

For each alternative, the consequences on both physical modernization and operation of the main canal have been analyzed. The conclusions on the ability to fulfill the requirements have been given.

Modernization of the main canal

Alternative 1: Continuous distribution (24 hours a day)

The secondary canals remain always open and the tertiary canals are operated based on the water roster. The time between two successive operations of a same tertiary canal correspond to the duration of the water roster. During a same water roster, the duration of the operation of a tertiary canal correspond to the time needed to satisfy the water needs for the crops.

Unless incidents occur, the networks will operate smoothly: Operation will be limited to simultaneous opening and closing of tertiary offtakes and some adjustments at the head regulator on some secondary canals. This organization of distribution is suitable for upstream control. Considering the small number of changes that would be required during the irrigation season, it would be possible to keep the existing structures after rehabilitation (cross regulators). However, to increase the flexibility of the operation and to limit the human intervention along the main canal, the implementation of duckbill weirs or longitudinal weirs has been proposed. In addition no electrical power, level detectors and controllers are needed.

The installation of control structures such as weirs will allow substantial head to be maintained in the canal and limit the level fluctuations at the offtakes. This has three major advantages:

- Easier supply to head gates of the secondary canals (more head at low flow);
- More accurate control of flows delivered to the secondary canals (limited level fluctuations in the canal);
- Reduction of the hydraulic delays along the main canal.

However, it should be specified that the weir setting is governed by the following points:

- The length of the weir depend on the head required at the weir with maximum discharge;
- The elevation of the weir crest must ensure that the structure operates with free flow;
- The number of weirs to be installed depend on the canal slope and the number of head gates of secondary canals affected by the structure;

- The presence of weirs will increase the sedimentation upstream of the structures. The presence of a gate at the end of the weir will facilitate cleaning and draining, and allow the operator to proceed to flushing operations.

Concerning the modernization of the head gates of the secondary canals, the best technical solution will consists in installing baffle distributors at each turnout. These baffle distributors are used to both control and measure flows. However, this is expensive equipment and requires the installation of civil works.

The application of the simulation model has determined the required settings for fourteen (14) weir crests. Each crest elevation was set in order to:
- Ensure that the weirs operate in free flow conditions,
- Allow correct supply to the baffle distributors (operation with +/-10%).

The site of the weirs on the canal was determined based on the position of the secondary canals, and to avoid further heightening of the banks. With regard to the baffle distributors:
- The nominal discharges chosen correspond to the values obtained for the water roster;
- They were all set in order to adjust their nominal discharge to within +/-10%.

The tables 2 and 3 below give example to adjust theses hydraulic structures.

Table 2. Weir settings – example

Location (m)	**Flow max (cumecs)**	**Length (m)**	**weir elevation (m)**	**bottom elevation (m)**	**water level max (m)**	**Structure**
33531	2.000	15	22.53	20.8	22.68	Duckbill
40088	0.5	3.6	13.5	12.78	13.66	Long weir

Table 3. Baffle settings - example

Baffle distributor	**Nominal discharge (cumecs)**	**Nominal Head (m)**	**Maximun head (m)**	**Minimum head (m)**	**Head variation (m)**
X2 150	125	22.65	22.68	22.62	0.06
XX2 360 X2 120	475	13.54 13.54	13.66	13.50	0.05

Alternative 2: Discontinuous distribution (12 hours a day)

Discontinuous distribution allows farmers to irrigate their plots only during the day (12 hours a day). Therefore the duration of a tertiary canal operation cannot exceed 12 hours consecutively and the operators are obliged to open the gates of all the secondary canals in the morning and close the gates in the evening. This operation will have an impact on the management of the main canal.

It appears clearly that implementing a water roster without night irrigation generates sharp variations in the flow regime on the main canal, and requires much greater transit discharges than with the previous alternative. For transit discharges, significant canal works would be required. In its current state, the Peqin-Kavaje main canal is unable to cope with the variations generated by this alternative. Additional works would consist in:

- Creating an intermediate reservoir in order to increase the storage capacity of the canal;
- Increasing the transit capacities on certain sections of the canals.

ORIENTATIONS OF THE MODERNIZATION

Based on our recommendations, the Albanians involved in the project decided to modernize the main canal following the strategy of the alternative 1. On this basis, an investment programme taking into account this strategy was prepared in close collaboration with the Albanian counterparts (PMU). Due to the significance of the work and the stakes that this work represented for future management of the main canals, the PMU was provided with technical support and consultancy services for the completion of this work. These services consisted of validating the detailed designs for the construction of the new control facilities realized by the Albanian partners, and defining with the PMU the list of priority works to be executed. In 2001, three duckbill weirs have been constructed. Their implementation in the field, which was financed by the World Bank, was completed under the supervision of Albanian consulting engineers. These facilities are now operational.

As the result of the project’s physical modernization, a local consultant has been trained on the job in Albania and in France. The local consultant is now capable of identifying designing and supervising all physical improvement in irrigation canals.

CAPACITY BUILDING

It is deemed that without having a new generation of properly trained irrigation managers a successful modernization of the irrigation schemes in Albania is clearly at risk. The aim of this component of the project was to help Albania in undertaking a training and capacity building program in the field of irrigation management and canal operation, drawing from up-to-date hydraulic and flow control expertise as well as practical experience from irrigation scheme managed by farmers. The capacity building has been achieved through professional training modules and technical visits, both in France and Albania and by creating partnerships between professional from both sides. This partnership materialized in February 2002 with signatories enjoining Saint Julien WUA and the Federation of Peqin Kavaje, in the presence of the Albanian Minister of Agriculture in an official protocol.

In this context, training activities have been developed to enable Albanian farmers to benefit from French experience. Saint-Julien WUA in France was chosen due to its age (the canal was dug in 1171), the dynamism of its managers and representatives, as well as its hydraulic and agronomic characteristics and its area, which is comparable with the areas of the Albanian projects. Although there are notable differences between the contexts of the two countries, the associations' representatives noted many similarities in the operating constraints and practices used on the irrigation networks. The discussions related mainly to:

- Techniques for collecting irrigation fees and their effectiveness;
- Tariffs applied;
- Allocation of the income collected;
- Representativeness of farmers and the organisation of elections;
- The constraints due to operation and maintenance of the networks;
- The organisation of the technical and administrative team in charge of the operation and management of the networks;
- Relations between farmers and WUAs;
- The role of the State and the local authorities in the management of WUAs;

These meetings between the managers of irrigation associations led to a sharing of experience and exchanges on precise problems encountered in daily management

CONCLUSION

A list of activities and the means to be implemented has been developed. These recommendations, which are intended for the federations and Associations and also to all the players involved in irrigation in Albania, will:

- On a 3 to 5-year time frame, guarantee a reliable supply of water to the plots requiring a dependable resource, control conveyor and distribution infrastructure operations, and ensure equitable sharing of water between and within the associations,
- On a 5 to 10-year time frame, enable them to cope with an increase in demand for irrigation water which will require that the efficiency of the networks is improved, the operation of the conveyor and distribution infrastructures are even better controlled, and be able to accept more members,
- On a 10 to 15-year time frame, ensure the lasting quality of the water service by satisfying all the users equitably.