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USAID FAMILY FARMING PROGRAM

TAJKISTAN

NEEDS-BASED BUDGETING FOR IRRIGATION SYSTEM MANAGEMENT IN TAJKISTAN

MAY 2014

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NEEDS-BASED BUDGETING FOR IRRIGATION SYSTEM MANAGEMENT IN TAJIKISTAN

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ACRONYMS

ALRI	Agency for Land Reclamation and Irrigation
FAO	Food and Agriculture Organization of the UN
FFP	Family Farming Program
GDP	Gross Domestic Product
GoT	Government of Tajikistan
ISF	Irrigation Service Fee
MEWR	Ministry of Energy and Water Resources
MLRWR	Ministry of Land Reclamation and Water Resources
OF	On-farm
TJS	Tajik Somani
USAID	United States Agency for International Development
WB	World Bank
WUA	Water User Association
WUAF	Water User Association Federation

NEEDS-BASED BUDGETING FOR IRRIGATION SYSTEM MANAGEMENT

EXECUTIVE SUMMARY

The water sector in Tajikistan is currently in transition to a new system of management based on principles of integrated water resource management (IWRM). Prominent among these principles are (a) management on the basis of hydrologic units, (b) clear accountability for management decisions, (c) user participation in decision-making, and (d) devolution of responsibility to the lowest feasible level.

At the top of the management pyramid, water resource management and policy formulation have been separated from service delivery functions by creating two separate organizations and water resource management mandated to be carried out on the basis of river basins and sub-basins. At the base of the pyramid, tertiary-level (“on-farm”) water management is being shifted to newly-established water user associations (WUAs) organized on the basis of canal command boundaries. Between these two levels, management is still being practiced by management organizations based on administrative boundaries which bear no relationship to hydrologic boundaries or canal service areas. This results in unresponsive and inefficient management, lack of accountability for management decision-making, and an inability to plan and budget in an integrated way. This study attempts to lay groundwork for a shift to system-based needs-based budgeting and management.

To plan and budget irrigation management effectively, it is necessary to reorganize management responsibilities to correspond to canal commands, and to develop and apply a number of new tools. Needed tools include the following.

- Detailed GIS-based irrigation system maps
- Geo-referenced inventories of all canal and drain reaches and important system facilities
- Inventories of the working O&M equipment available to each management organization
- System-specific maintenance schedules for all canal and drain reaches and important water control structures
- A spreadsheet or accounting system-based template for creating canal system-based budgets
- A regularly-updated schedule of unit costs related to system maintenance

All system management organizations require a reliable source of funding to plan and operate effectively. A reasonable way to provide such support the management activities of newly-established WUAs and

WUA Federations (WUAF) is to allocate collections from the current ISF among the active managing organizations, including ALRI, the WUAs, and, ultimately, WUAFs.

WUAFs are just now being established in some regions of the country. To assume canal management responsibilities, they must develop technical capacity, experience, and a reliable source of funding. In the interim before these elements are in place, however, WUAFs can play a very useful role in developing the budgeting tools listed above, along with the water measurement capabilities necessary for effective contracting between ALRI Districts and WUAs.

The Tax Department currently taxes the operation of non-profit ALRI Districts at a rate of 18%. When interest charges are added to this amount, tax payments become the largest single expenditure category for many Khatlan Districts, exceeding, for example, expenditures on critically-important canal and drain cleaning, operations which are currently dismally underfunded. This tax has the effect of starving irrigation management organizations of badly-needed O&M funds and should be reconsidered.

ALRI Districts currently accumulate huge debts to the national electricity provider for the costs of operating cascaded pumping systems. These costs, which benefiting farmers are generally unable to pay, are rightly considered as the responsibility of the nation as a whole, and not as that of an arbitrarily-selected group of (gravity-irrigating) farmers. Any subsidies devoted to cascade pumping costs should be paid directly from the State budget.

Most Tajik irrigation systems are badly deteriorated and the equipment required to maintain them is antiquated. Experience with selective rehabilitation at the on-farm level in Khatlan has been positive, and should serve as a model for further rehabilitation work at both on-farm and main system levels. There is an urgent need also for canal and drain cleaning equipment which should be considered in donor assistance programs.

BACKGROUND

Tajikistan entered a modern era of independence in 1991, with more than 700,000 hectares of agricultural land under productive irrigation. Some three-quarters of that land was served by expensive high-lift pumping to lands high above gravity command. Operations and maintenance of these systems was well funded from the State budget and energy was available to operate pumps. Water was measured and records kept. In the centrally-planned Soviet economy, economic viability of farms and systems was not an issue, and support to the irrigation systems was not dependent on their productivity or on the extent of cost recovery.

Following the end of the Soviet era, these conditions changed radically. Funding for O&M dropped precipitously, from US\$ 88/hectare in 1990 to US\$ 14/hectare just three years later, and rapid deterioration of system assets commenced. By 2014, by one recent estimate, there were only around 515,000 hectares irrigated, of which just one-third was served by lift irrigation¹. Moreover many of the remaining systems are in extremely poor condition and deterioration continues.

At the same time, agriculture remains very important to the national economy and to the well-being of rural people. In 2010, agriculture provided about 19% of the GDP and employed most of the economically active rural population, most of whom were women².

**Objective of Water Sector Reforms in Tajikistan
(draft Water Sector Reform Strategy)**

“an efficiently planned, developed and managed water sector based on sound policies, joint analysis and management of groundwater and surface water quantity and quality, [that] balances the different sectors that use water, using the basin as the management area, aiming to obtain the best economic benefit for the Republic of Tajikistan, in a fair and equitable manner without compromising the ecological integrity and while duly respecting water needs of downstream countries”

To address this twin crisis of water governance and water management, the Government of Tajikistan (GoT), together with its development partners, has embarked on a program of strategic reform of the water sector. This program extends from the top of the sector, the water resource level, to the very bottom where irrigation water enters the soil in farmers’ fields to support growing crops. Its stated objective is shown in the box above.

Insofar as it applies to irrigation system management, the principles and aims articulated in the draft Water Sector Reform Strategy include the following.

- Water resources are managed in an integrated manner

¹ Burt, C. 2014. Improving irrigation-related electrical energy efficiency in Tajikistan. Washington DC: World Bank.

² FAO. 2011. Crop and Food Security Assessment Mission Report: Tajikistan 2011. Rome: FAO.

- Water management areas are changed from territorial and administrative boundaries to geo-hydrological ones
- Policy and strategic guidance functions and service delivery functions are separated
- Water governance institutions are transparent, accountable, and participatory
- Water management institutions are performance-based and effective

The purpose of the present report is to lay the groundwork for a needs-based budgeting process for canal managers. Given the transformation which is underway in the water sector in Tajikistan, any proposal for reforms to the current budgeting system must take into account the principles articulated above. Proposed changes must also recognize and build on the practices currently employed in preparing irrigation system budgets, and the constraints faced in preparing operating budgets, so that a transition to a new set of practices can be mapped out. Such a transition process will also involve changes in higher-level policies and practices that currently constrain effective system O&M and needs-based budgeting.

The organizational context for future irrigation service delivery includes Water User Associations (WUAs) providing retail water delivery services to farmers at the so-called “on-farm” (OF) level, and either Federations of WUAs (WUAFs) or District Offices of the newly-established Agency for Land Reclamation and Irrigation (ALRI) operating the main canals serving groups of individual WUAs. It is the operation and maintenance (O&M) of these main canals that is the subject of this study.

As a result of these considerations, the present study undertook to examine the context in which systems are currently managed in Tajikistan, the practices employed by both ALRI offices and WUAs, and the constraints encountered. This examination included a three-day field visit to Khatlan Region, where four ALRI District offices were visited and meetings held with chairpersons and officers of several dozen WUAs.

The report is organized into three major sections. The first section describes the financial and institutional context in which irrigation management takes place, with a particular focus on Khatlan Region. The second section discusses the budgeting process and suggests preconditions for introducing a needs-based budgeting process, development of the tools needed to facilitate budgeting, and next steps to be taken. The final section presents a summary and conclusions.

SYSTEM MANAGEMENT CONTEXT

PHYSICAL SYSTEM

During the Soviet era, an extensive system of canal and pump-based irrigation was developed. Figure 1 illustrates the extent and density of the networks developed.

At the collapse of the Soviet Union, the irrigated area in the country was said to comprise about 750,000 hectares, some three-quarters of which was irrigated with water lifted from rivers or canals. Some of these lifts comprised cascades of two or more stages, which raised water one hundred meters or more above the level of the source. Needless to say, operating these cascades of pumps was and remains extremely

expensive, though that was of little concern under the planned and administratively-directed economy prevailing at the time.

Today as much as one-third of the command of 25 years ago is no longer in service, and pump-irrigated area has shrunk to perhaps one-third of the total. The high cost of operating the lift stations, however, remains a major portion of the cost of irrigation system O&M. Until 2000, the Ministry of Land Reclamation and Water Resources (MLRWR) bore all of these costs. After that year, the costs of operating the smaller pumping stations located “on farm” were shifted to farmers, and later to WUAs, while the larger stations and cascades were the responsibility of District offices of MLRWR, or more recently, District offices of the Agency for Land Reform and Irrigation (ALRI). The inability of the District offices to pay the electricity bills for these pumps has resulted in their incurring huge debts to *Electricity Tajikistan*, the national energy provider.

In parts of the country, the Khatlan Region for example, a sizeable share of the land irrigated was reclaimed from swamps and wetlands by constructing artificial drainage systems. The continuing productive use of these lands requires that drains be cleaned frequently, also an expensive activity which Districts generally have not been able to afford.

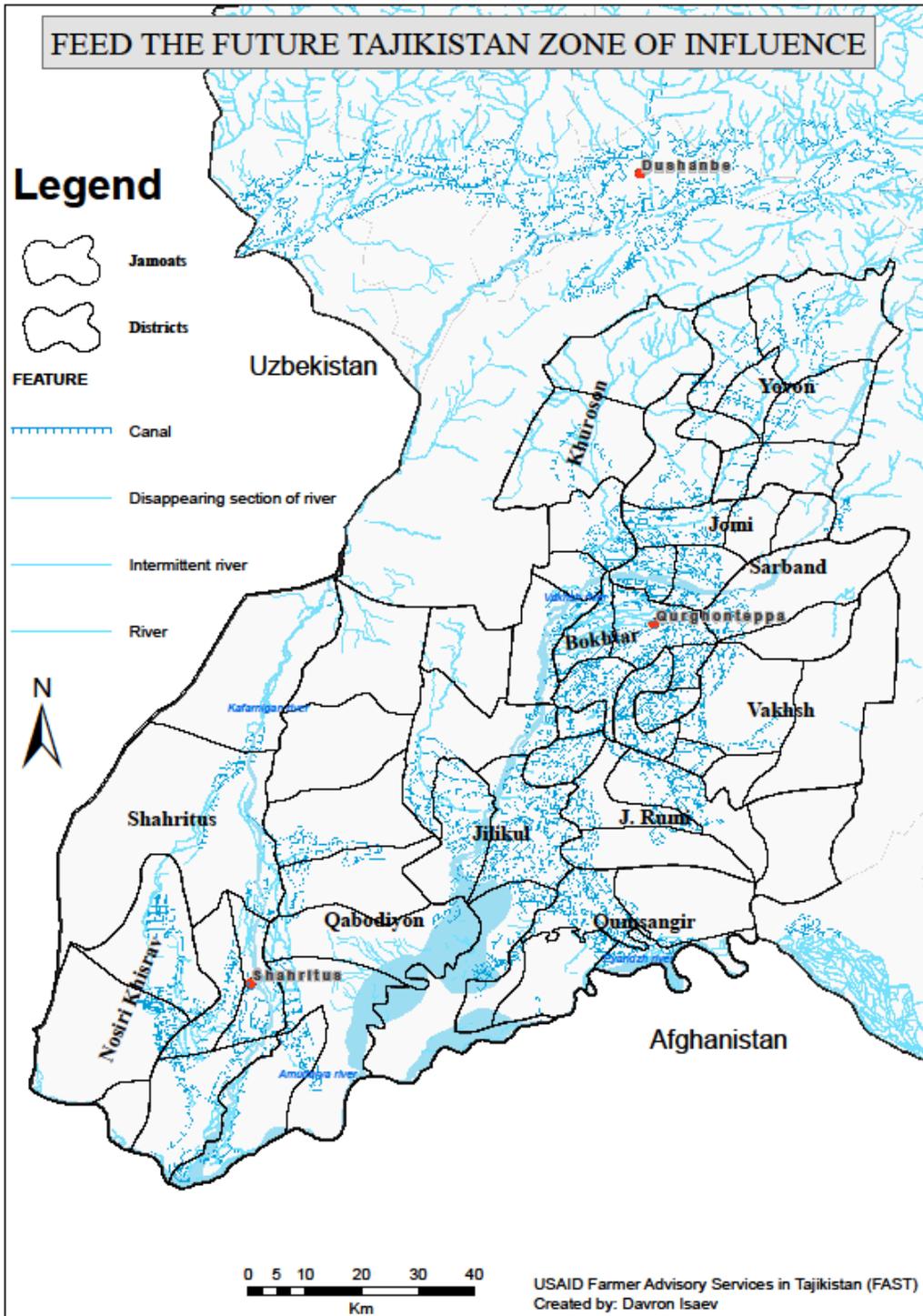
Other parts of irrigation and drainage systems have deteriorated as well. For example, although staff gages, called hydroposts, are widely present in systems, they are seldom calibrated or read. As a result, modern management practices, which require regular volumetric measurements, cannot be applied. Likewise, inventories of system facilities are outdated or non-existent, limiting the use of modern budgeting and asset management practices. Many gates and other water control structures are damaged or missing from both on-farm systems and larger canals, which allows only crude water control practices to be applied.

ORGANIZATIONAL SET-UP

Government Decree 12, dated November 19, 2013, abolished the Ministry of Land Reclamation and Water Resources and divided its functions between two newly established governmental bodies – the Ministry of Energy and Water Resources (MEWR) and ALRI. Functions for reclamation and irrigation and drainage were transferred to the newly established ALRI, while policy-making functions were lodged in the MEWR.

The main objective of the reform was to separate preparation of policies and guidelines from the functions of providing irrigation and drainage services by operating and maintaining irrigation and drainage systems. Subsequently, Basin Organizations are to be created for four major water basins in the country, and management entities are to be reorganized on the basis of hydrologic boundaries. This reform process is planned to continue over the coming 5 to 10 years.

Figure 1. Irrigation canal density in Southwestern Tajikistan



Note: Double click map to open high resolution version.

ALRI

In accordance with Government Decree 125, dated February 27, 2014, ALRI was established as a national management body responsible for implementing state policy on land reclamation and irrigation management. The main functions of ALRI are the following.

- Development and submitting for approval to the Government of Tajikistan draft laws, strategic papers, and programs in the irrigation and ameliorative sector
- Coordination and implementation of state policy in the field of land reclamation
- Development and realization of long-term and short-term state programs on land reclamation development, rural and pasture water supply, and anti-flood activities
- Development of differentiated tariffs for services in water supply taking into account the market cost of charges and operation of water management facilities
- Assistance in providing state support for operation of irrigation pump stations
- Establishing differentiated tariffs for water supply services, taking into account the market cost of inputs for maintenance and operation of irrigation facilities
- Facilitating provision of government support for maintenance and operation of irrigation pumping facilities
- Establishing a coordinating unit on joint operation and management of irrigation facilities together with the Water Users' Associations

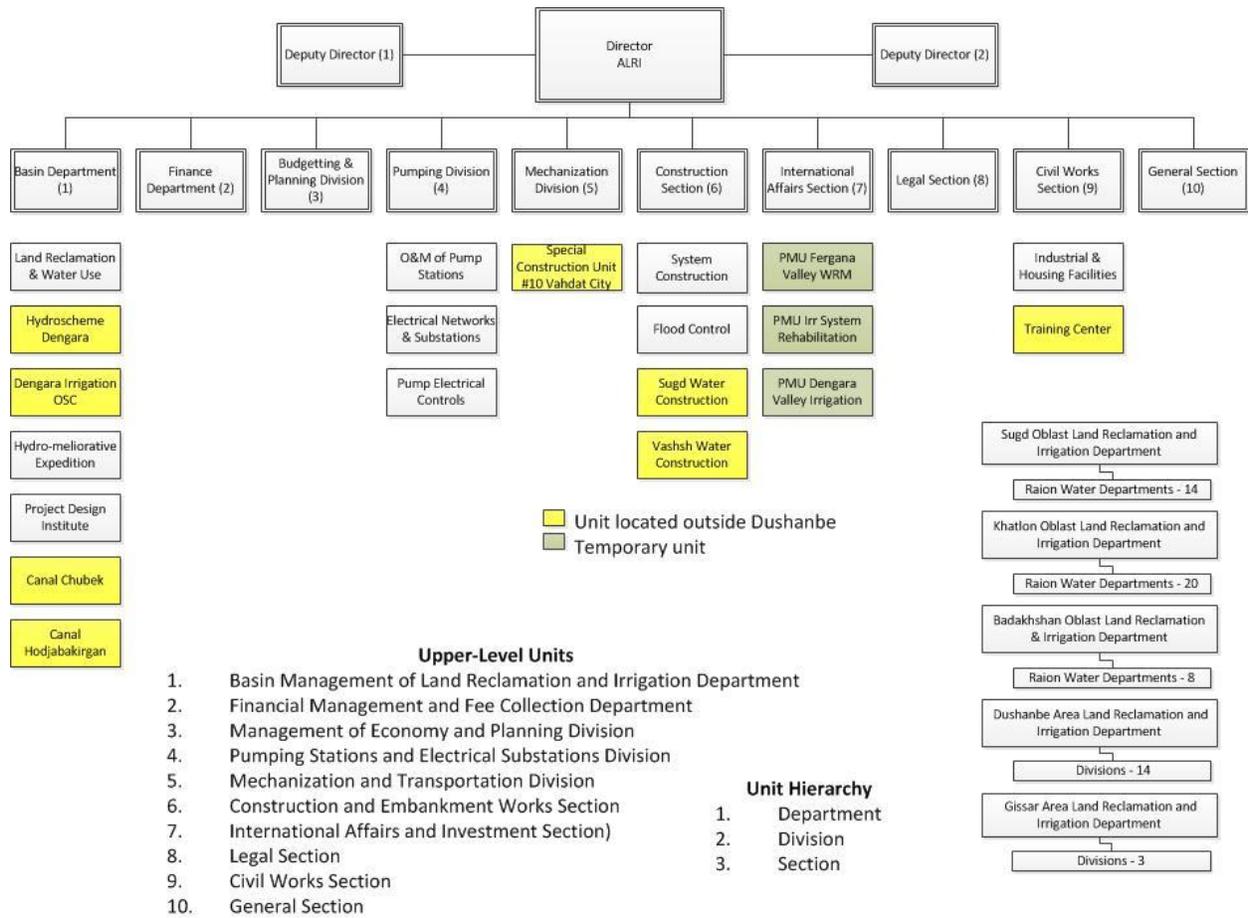
An unofficial organizational chart of the new ALRI, prepared by the authors, is shown in Figure 2. At this writing, operating regulations for ALRI have not yet been approved and issued by the Government.

The ALRI will play a key role in future irrigation service delivery; however before it can be effective in that role, its field units must be reorganized so that their areas of management responsibility correspond to canal commands. At present, ALRI Districts operate on the basis of boundaries which coincide with the Regional (Oblast) boundaries of the civil administration, managing only the portions of canals and command areas within these boundaries. This creates two severe problems.

First, canals cut across District boundaries, making unified planning, budgeting, and management of these canals extremely difficult. Coordination mechanisms exist, but they are cumbersome and often ineffective. The 70 km long Vakhsh Canal in Khatlan, for example, cuts across four different Districts (Sarband, Vakhsh, Rumi, and Qumsangir) along its course. Moreover the command areas served by the canal lap over into still other Districts. Thus a request for water by a farmers' group in Jilikul would go to the ALRI District Office in Jilikul, and then be passed upwards to the Khatlan Regional Office before being relayed to the Rumi District which is actually controlling the water flow. A single ALRI office controlling the entire canal, from Sarband to the tail, could operate far more effectively, efficiently, and responsively.

Secondly, a District may be responsible for portions of a number of different canals which might pass through its area. Budgets for these canals are combined and there are no cost centers which would allow separate accounting for the costs and revenues associated with each canal. This severely limits accountability for performance and the information available to managers in making decisions.

Figure 2. Unofficial organizational chart of the ALRI



WUAS

The other key organization in the new management set-up is the WUA. Some 106 WUAs are reported to have been established in Khatlan Region in recent years, using a variety of approaches and schemes (Table 1). These WUAs cover a service area of about 150,000 hectares. The most recent program working to establish WUAs in the region is the USAID-funded FFP. The 54 WUAs established over the past two years by this program have an average coverage of just under 3,000 hectares each³.

Table 1. WUAs in Khatlan Region

District	WUAs (#)	Serviced land (ha)	Contracts with farmers (#)
Jillikul	5	13,780	1,169
Panj	8	11,598	4,930
Farkhor	9	18,883	3,940
M.A. Khamadani	11	13,693	2,234
Vakhsh	8	11,493	888
Bokhtar	6	11,782	822
A.Jomi	10	13,545	926
Yovon	8	21,769	1,634
Kabodiyon	11	9,194	887
N.Khusrav	3	5,978	530
J.Rumi	9	11,099	2,503
Shahritus	10	3,921	55
Kulob	1	1,995	213
Muminabad	1	159	102
Vose	6	1,000	136
Total	106	149,889	20,969

The FFP is currently in the process of forming 5 federations (WUAFs) linking 37 of the WUAs it has established into hydrologically-based groupings. These WUAF will serve an average of 16,558 hectares each. These Federations are organized on a canal system basis, which make them well-adapted to assuming future canal management responsibilities, and they are sufficiently large to achieve some operating economies of scale. The exact functions of these federations and how they are to be funded has yet to be established. Some suggested roles for these WUAFs are discussed later in this report.

ALRI-WUA RELATIONSHIP

Most WUAs interviewed strongly preferred a relationship with ALRI District offices based on measured quantities of water delivered to WUA boundaries. Water volumes would be measured jointly and ISF billings would be based on these measured volumes of water. This type of a contractual arrangement creates a transparent and accountable relationship between the two parties, reducing levels of mistrust and potential conflict.

A prerequisite for a useful contractual relationship between an ALRI District and a WUA is calibrated measurement device at each point where water enters the WUA service area, a regular system of joint reading of measurement devices, and a schedule of deliveries that becomes a part of the contract between the two parties.

³ Some of these new WUAs appear in the list of 106 obtained from ALRI, but others do not, indicating that the total may presently be somewhat higher than 106. However note that not all of these WUAs are active.

FUNDING IRRIGATION O&M

REVENUE

Irrigation system O&M is currently funded through a combination of national government funding; local government funding; user fees; public and private debt; and, because of extensive maintenance deferral, mining of past capital investments. With the advent of functioning WUAs, there are now three primary organizations involved in managing irrigation water from the source to the farm. Storage reservoirs with hydroelectric generation installed are managed by *Electricity Tajikistan*, which controls water releases and funds operation and maintenance. Below the reservoir, ALRI manages the larger canals and delivers water to WUAs. Below this level, WUAs assume control and deliver water to individual farms. Where there are no WUAs, ALRI manages water all the way to the individual farm. Each of these three entities is funded by its own revenue streams.

Electricity Tajikistan

Electricity Tajikistan is a government-owned corporation and is funded by fees paid by its customers and periodic injections of state capital.

ALRI

ALRI's budget derives from three separate sources. These are the national-level State budget, the local government ("Hokumat" or "Raion") budget, and a user fee or irrigation service fee (ISF) imposed by the government, which is currently set at 1.5 diram per cubic meter of water delivered. The District ALRI offices manage these funds in three separate budgets, all using different formats. Moreover, budget formats also differ from one District to the next. Obtaining a comprehensive overview of the money available for an individual District for system O&M is thus difficult. Further complicating the picture is the fact that, traditionally, farmers could pay their ISF either in cash or in kind. This resulted in payments being made in the form of agricultural products like wheat or potatoes, or other commodities such as diesel fuel. This practice appears to be diminishing, at least in Khatlan Region, as Districts become increasingly reluctant to accept payment in kind. Rumi District, for example, abandoned the practice almost entirely in 2013.

As seen in Table 2, in the three Districts providing budgetary information, the ISF provides four-fifths of the operating budget for the District, with the State budget funding putting up only 8% of income. Local budget funding is slightly greater than income from the State budget, but is earmarked exclusively for drain cleaning. This probably has to do with the fact that, while cleaning main drains provides benefits for agriculture, it also is instrumental in providing urban drainage for population centers. The table indicates that, except in Jomi District, almost all of the ISF payments come in the form of cash. All districts need to move in this direction if system operations are to be managed efficiently and professionally.

Table 2. Income sources and types for four Khatlan Districts

District	Income						
	Source				Payment		
	ISF	State Budget	Local Budget	Total	Cash	In-Kind	Total
Jomi					47%	53%	100%
Vakhsh	79%	11%	10%	100%	97%	3%	100%
J. Rumi	78%	5%	16%	99%	100%	0%	100%
Qumsanghir	84%	9%	7%	100%	100%	0%	100%
Average	80%	8%	11%	100%	86%	14%	100%

The total budgeted amounts for O&M in the three districts reporting this information is shown in Table 3. Note that the areas shown are design areas and may overestimate the actual area currently irrigated.

Table 3. ALRI District revenue per hectare, 2013

District	Revenue (TJS)	Service Area (ha)	Revenue/Unit Area (TJS/ha)
Jomi	not available		
Vakhsh	1,672,982	22,902	73
J. Rumi	5,683,221	24,667	230
Qumsanghir	2,496,204	25,694	97
Total	9,852,407	73,263	134

In addition to supporting system O&M, the collection of ISF by the ALRI District offices also serves as a taxation tool for local governments. The tax code imposes an 18% tax on the amount of all contracts written by the District offices for service to WUAs or directly to farmers. The District adds this tax to the fee levied on water users (1.5 dirams/m³) and so the actual ISF charged to farmers is 1.77 dirams/m³. The receipts from these taxes are passed to the Hokumat where they constitute a source of funds for local government. In fact Hokumats works closely with the Districts in collecting fees, strongly encouraging WUA officers to collect fees from farmers and turn them over to the Districts, which pass the portion comprising the tax on to the Hokumats.

This system of taxation has a couple of other noteworthy dimensions. First, the 18% tax is imposed on contracted revenue and not on revenue actually collected. Thus when the District writes contracts with WUAs for irrigation service for a year, it is immediately liable for payment of the 18% tax. Farmers tend to make ISF payments throughout the season, particularly at its end, and collection rates are seldom 100%, leaving the District liable for time delays and uncollected amounts. In addition, an interest rate of 0.08%/day is charged on unpaid taxes. With daily compounding, this amounts to an annual interest rate of about 35%. Unpaid balances of taxes and interest is itself subject to interest payments going forward, and

so the debts that Districts have relative to the Tax Department and the Hokumats mount swiftly. This results in a situation where most Districts have tax debts that are virtually unpayable. It is of concern that the young WUAs which have been enlisted as collection agents for the ISF, may fall into this debt trap as well⁴.

Taxation of government agencies which deliver irrigation water is a very unusual practice. Most other nations recognize the public character of these agencies and do not attempt to tax them. Moreover the practice of passing the resulting debt burdens on to WUAs will have a very pernicious and destructive impact on the WUAs themselves. In general, farmers are much more willing to pay fees that are clearly used locally to provide and improve the irrigation services they receive. This is the very nature of a “service fee”. By co-opting this process to generate tax revenue for local governments, the connection between the “service” and the “fee” is undermined. Moreover, by using WUAs as tax collectors, their credibility as service providers to water users is weakened and their legitimacy and sustainability threatened.

WUAs

WUAs generate operating income from the payment of membership fees by farmers. Table 4 shows the average membership fees paid by farmers in 37 Khatlan WUAs in 2013. Per hectare fees are assessed on the area of dekan farm land, i.e. kitchen gardens and presidential decree land is excluded, which comprises about 80% of the total. This exclusion stems from the fact that kitchen garden land was excluded from fee payment during Soviet times and applying the fee to them was felt to be politically infeasible. This means that about 20% of the irrigated land served by the WUAs does not generate fee income to support WUA operations. Most of these WUAs are only one to three years old and so there is not much history to their financial operations. In general, however, those WUAs in existence for 2 or more years have tended to vote to increase the per hectare fees they assess on themselves as they gain experience with budgeting and operations and confidence in WUA management.

In addition, WUAs established under the FFP have received grants to support selective rehabilitation and improvements to on-farm channels and structures. However because these grants are one-off occurrences, they are not considered here as a part of WUAs operating budget.

Table 4. WUA membership fees in 37 Khatlan WUAs

WUAF Group	# of WUAs	Avg WUA Fee	
		TJS/ha	\$/ha
Shorabad	6	30.8	\$ 6.16
Qumsanghir	12	36.7	\$ 7.34
Jilikul	6	28.7	\$ 5.74
Qubodiyon	7	30.7	\$ 6.14
Yovon	6	28.3	\$ 5.66
Average	7	31.0	\$ 6.21

⁴ Recognizing this problem, the Government recently cancelled the debts of the ALRI Districts to *Electricity Tajikistan* and the Tax Department, as well as ISF debts owed by WUAs to Districts. However the rules and practices which led to the accumulating debts remain in place.

EXPENDITURES

ALRI

Average District expenditure patterns for three Khatlan Districts are shown in Table 5. As evident from the table, the largest single share of expenditure is for tax payments, which comprises nearly one-third of the average District budget. Even though the nominal tax rate is 18% of contract fees, with the effects of compounding interest charges, the actual impact on the District budget is nearly double that. Were these taxes not present, as is the case in most other countries, the budget for ditch cleaning, for example, could be more than doubled with no increase in irrigation fees.

Table 5. Expenditure patterns for 3 Khatlan ALRI Districts

District	Expenditures									
	Salary	Taxes	Spares	Other Depts	Ditch Cleaning	Elect	Equip	ALRI	Other Exp	Total
Jomi	not available									
Vakhsh	34%	17%	2%	5%	36%	4%	1%	1%	1%	101%
J. Rumi	19%	45%	7%	14%	8%	3%	0%	0%	4%	100%
Qumsanghir	33%	34%	0%	4%	23%	5%	0%	1%	0%	100%
Average	29%	32%	3%	8%	22%	4%	0%	1%	2%	100%

Rules call for the payment of 1% of ISF collections to the Regional ALRI office and 10% to the Central ALRI office. However, Districts seldom make these payments in full. Most Districts also owe large amounts to the Tax Department and to Electricity Tajikistan. Where Districts operate pumping stations, electricity charges are significant. Qumsangir District, for example, reports owing TJS 4.0 million in taxes and interest, and TJS 4.2 M in energy charges. These unpaid debts constitute, in effect, a major source of operating funds for the Districts.

WUAs

Average WUA expenditures for 2013 are shown in Table 6. Two cases are shown – one for WUAs without special maintenance grants and the other with those grants. As seen, for the normal situation, salaries and office expenses comprise the dominant expenditure category, at 87%. The amounts remaining for field operations, other than staff time, are quite limited. Where there are additional funds available for system improvements, those fixed costs are spread over a much larger total budget and hence constitute a much smaller and more reasonable share of total expenditures at 38%. This indicates the need for additional revenue to WUAs generally to provide money for fuel, equipment rental, casual labor, and repairs in addition to salaries and office expenses.

Table 6. Average expenditure shares of 37 Khatlan WUAs

WUA Expense Shares		
	With Grants	Without Grants
Salaries	38%	83%
Office expenses	2%	4%
Construction needs	0%	0%
Fuel	2%	4%
Equipment	0%	0%
Electricity	1%	2%
Contract labor	0%	0%
Travel expenses	1%	2%
Repairs	55%	1%
Amortization	0%	0%
Contingencies	1%	2%
	100%	100%

O&M NEEDS

It is difficult to assess the actual O&M funding requirements for the irrigation sector in Tajikistan. Needs vary widely by system, depending on water supply, the need for drainage, and especially, whether water is supplied by gravity or by pumping. Landell Mills, a contractor to EuropeAid, made rough estimates of Tajikistan O&M costs in 2012⁵. Their estimates are shown in Table 7.

Table 7. Estimated O&M costs for Tajik irrigation system O&M (diram/m³)

Cost Type	Gravity (d/m³)	Pumped (d/m³)	Weighted Average (d/m³)
Operations	0.33	3.95	1.80
Maintenance	1.00	1.92	1.32
Total O&M	1.33	5.87	3.12
<i>Current ISF</i>	<i>1.50</i>	<i>1.50</i>	<i>1.50</i>
Depreciation	2.40	4.80	3.30
Total (w/ dep.)	5.23	12.17	7.92

Source: Europeaid. 2012.

These estimates show that the current ISF of 1.5 diram/m³, excluding the tax liability currently faced by Districts, is generally adequate to support gravity irrigation but can provide only about one-quarter of the

⁵ Landell Mills, 2012. *Appendix B: implementation and investment plan for the irrigation and rural water supply sub-sector, Provision of technical assistance to the Tajik Ministry of Land Reclamation and Water Resources and the Water & Energy Council to further develop the national water sector strategy and an irrigation sub-sector and implementation and investment plan*. Brussels: Europeaid.

cost of supplying pumped irrigation water. If depreciation is considered, then the current ISF can cover just 29% of the cost of providing gravity irrigation and a minimal 12% of the cost of providing pumped water. However, it is probably most reasonable at this point to consider only the direct costs of irrigation service provision and to disregard the calculated depreciation costs for a number of reasons: (1) most Tajik irrigation systems are presently fully depreciated, (2) external assistance is the most likely source of any future rehabilitation funding, (3) it is highly unlikely that any money collected as a depreciation reserve would actually be set aside for this purpose, (4) the taxation system embedded in the ISF collection process and the lack of transparency in ALRI finances so distorts the financing system for irrigation services that incentive signals created by the imposition of depreciation charges would not be transmitted effectively to water users.

ALLOCATING ISF

The ISF was developed at a time when the MLRWR operated the entire water resource system from river to farm field. Today that picture has changed, with the expansion across the country of WUAs which are, increasingly, managing retail water delivery, and the emergence of WUAFs which could in future manage larger canal systems serving individual WUAs. At the same time, the duties of the District ALRI offices have diminished correspondingly. And while WUAs generally levy additional fees to hire staff for their WUAs, they lack operating funds for purchasing or renting equipment, fuel, transportation and outside services, like dredging.

Logic and fairness require that, given the current sharing of management responsibilities, ISF collections also be shared among the different managing organizations. Table 8 shows several alternative scenarios of fee sharing between the ALRI Districts and WUAs. ISF is calculated at 1.5 diram/m³, ignoring the 18% turnover tax imposed by the Tax Department, with an average water use of 7,308 m³/ha.

Table 8. WUA funding under alternative ISF sharing arrangements

Funding Option	WUA Fee + ISF Share		ISF to District		Total Water Fees	
	TJS/ha	\$/ha	TJS/ha	\$/ha	TJS/ha	\$/ha
Membership fee only	31.0	\$ 6.21	110.0	\$ 22.00	141.0	\$ 28.21
Membership fee + 20% ISF	53.0	\$10.61	88.0	\$ 17.60	141.0	\$ 28.21
Membership fee + 30% ISF	64.0	\$12.81	77.0	\$ 15.40	141.0	\$ 28.21
Membership fee + 40% ISF	75.0	\$15.01	66.0	\$ 13.20	141.0	\$ 28.21

Note that sharing 20% of the ISF with WUAs would increase their income by more than 70%, while sharing 30% of ISF would more than double WUA income. This would provide WUAs with coverage for field operating expenses in addition to the staff salary coverage which they generate directly through per hectare membership fees. Revenue sharing would also encourage WUAs to exert greater diligence in collecting ISF.

OPTIONAL ROLES FOR WUAFS

Establishment of WUAFs is just getting underway, and a clear role for these emerging WUAFs is not yet apparent. Over the longer run, normal practice would be for the WUAFs to assume responsibility for operating and maintaining the larger canals which supply WUAs with water, as well as maintaining the larger collector drains serving agricultural areas. Performing this role would require the use of the whole-canal budgeting practices which were the original topic for this study.

However to play this role, WUAFs will need to develop a significant technical capacity, and will need a reliable source of funding to support canal and drain O&M. The most obvious source of funding for these tasks would be to reallocate a share of the existing ISF to WUAFs which assume canal operating responsibilities. This share would be additional to any share allocated previously for WUA operations. This reallocation is logical, given that management functions would be shifting from the ALRI District offices to WUAFs, reducing ALRI costs and shifting them to the WUAFs.

Until such time, however, as WUAFs do acquire an adequate source of funding and sufficient technical capacity to operate and maintain larger canals and drains, the ALRI Districts will need to continue to provide this service. The question then is what should the role of the WUAFs be in the meantime, and how can they be funded for this role?

It is proposed here that WUAFs become, initially, a source of technical expertise and training support for the WUAs which form the federations. This would require that each WUAF employ at least one qualified engineer familiar with irrigation system O&M, water measurement, hydropost calibration, and water budgeting. This engineer could then provide training and support to technicians employed by individual WUAs. In addition, an organizational development specialist could be added to the WUAF staff to provide on-going support to the member WUAs in management practices, budgeting, board and general assembly meeting procedures, negotiating service agreements, and so on. Given the expected on-going support for system management from external donors such as USAID and the World Bank (GAFSP), it seems reasonable for these projects to provide cost-sharing support for WUAF budgets during this interim capacity-development period. Matching funds could be provided by the WUAs themselves through a small surcharge on the membership fees charged to farmers.

PLANNING AND BUDGETING

PRECONDITIONS FOR NEEDS-BASED SYSTEM-LEVEL BUDGETING

HYDROLOGIC BOUNDARIES

Most WUAs are organized on the basis of hydrologic boundaries, as are the WUAFs currently being formed⁶. In addition, upper-level water resources management in the country is being reorganized along river basin boundaries. This leaves ALRI as the “middle man” that is still organized on the basis of administrative/territorial boundaries, a mismatch that needs to be corrected. There are overall goals for reorganizing ALRI along service area boundaries, but no specific plans or timetables as yet for doing this.

In addition to reorganizing ALRI Districts along service area boundaries, accounting systems needs to be reformed to create individual cost centers for each canal system where two or more canals are incorporated into a single District, so that costs and revenues can be tracked on a system-by-system basis. In any event, accounting systems need to be standardized so that the same categories are used in all Districts, and so funds from all three sources feeding into a District are shown in a single unified budget.

⁶ Some older WUAs were organized along territorial lines and need to be re-formed.

SUFFICIENT INCOME

Creating a practical operating budget is always a process of going back and forth between estimated needs and the estimated resources available to meet those needs. Creating a needs-based budget designed to keep a system operating in like-new condition is pointless if available resources supply only a small fraction of the estimated need. At the same time, simply continuing a budget level from one year to the next risks accepting a *status quo* based on insufficient resources, leading to continuing poor irrigation service and rapid system deterioration. A practical budgeting process involves an iterative process of (a) examining and making assumptions about several key operational parameters, (b) estimating budgetary needs to achieve a particular level of irrigation service and sustainability, (c) comparing these needs with available resources, (d) examining options for increasing resource levels, if necessary, and (e) adjusting budgets to match expected (adjusted) resource levels.

KEY OPERATING PARAMETERS

A number of key operating parameters help to establish O&M needs and, hence, the resources required for carrying out system O&M. These include the following.

WATER SUPPLY

The level of water supply, relative to crop needs, is a key parameter determining O&M needs. Where the raw supply is generous, say two or three times crop demand, management is simpler and maintenance less demanding. In essence managers can substitute water for more careful water control and maintenance. In Khatlan water is generally abundant, making the demands for economy of water use less stringent. In other parts of the country, though, particularly in the Syr Darya basin, this is less true, and more careful management and maintenance may be required. However this principle is complicated where there is poor sub-surface drainage, since excess water in the system may contribute to high water tables and waterlogging of fields. This is also the case in some areas of Khatlan.

SILTATION RATE

A second major factor is siltation rates. The speed with which canals and, especially drains, accumulate sediment depends on the soil type, canal lining (or not), precipitation patterns, and sediment loads carried by water flows. Soils in Khatlan are silty and are highly erosive leading to unstable canal banks and high levels of mobilized sediment in collected drain water. Most canals are unlined and gradients are low, resulting in low flow velocities and leading to settling out of transported sediment in canals and drains. These factors make sedimentation in canals and drains a major problem in the Khatlan area, and a major cost center for maintenance activities. In other areas, this may be a much smaller issue.

PUMPING

A third major factor is the extent of pumping and the party that bears responsibility for pumping costs. Where extensive pumping takes place, particularly in multi-stage cascades, operating costs will be very high relative to gravity command areas. This will result in extremely high budgeted costs in these systems, typically well beyond the ability of local farmers to pay.

In the past, the government paid for virtually all of the pumping costs. More recently the tendency has been to shift responsibility for these costs to field operating units – ALRI Districts or WUAs. However, since these units often cannot afford to pay these bills, the result is accumulating unpaid debts to *Electricity Tajikistan*. It also leads to attempts to force farmers who irrigate by gravity to subsidize those who use pumped water. In general, this is an unfair policy, as gravity irrigating farmers are no more responsible for the public policy decisions that lead to the creation of expensive pump irrigation than are

other citizens throughout the country. The decisions to construct these systems were national decisions, and the nation as a whole is responsible for providing any resulting operating subsidies that these decisions entail. A return to the policy where the central government covers the costs of cascade pumping would be wise.

REHABILITATION CYCLE

Finally the rehabilitation cycle should be taken into account. Any system requires periodic thorough rehabilitation and modernization, both to restore functionality and to adapt the system to current customer service demands⁷. A maintenance plan should recognize this cycle and may be designed to allow a certain amount of deterioration in non-critical facilities over time to minimize operating costs, recognizing that a thorough modernization is due at a particular point in time.

In any event, the costs of restoring or rehabilitating a system should be kept separate from operating expenses. Where system operators (Districts, WUAs, WUAFs) are expected to provide some on-going rehabilitation of deteriorated systems in the absence of a formal rehabilitation project, additional funding, possibly from donor sources, should be sought.

CONTRACT OR FORCE ACCOUNT MAINTENANCE

A fundamental decision faced by budget planners relates to the maintenance activities which are to be undertaken by the staff of the managing agency using agency equipment (force account), and activities which are to be contracted out to private sector entities. Activities related to system operations, such as receiving and filling water orders, opening and closing gates, and so on, are generally undertaken directly by agency staff. However maintenance activities can often be carried out more cheaply by outside contractors, when full life-cycle costs of providing the maintenance service are considered. Even though these outside contractors will necessarily include a certain level of profit in their charges, they have a fundamental advantage in that their equipment can be used for a variety of purposes and will be used throughout the year, rather than only during a short period of canal closure. This can reduce their costs significantly.

On the other hand, where equipment, such as an excavator, is provided free of charge or at a subsidized cost to a canal operator, and if depreciation is not factored in, maintenance by force account can be cost effective. Where resources from all domestic sources simply are not sufficient to provide adequate maintenance, then the provision of free or subsidized equipment, such as excavators for cleaning canals, may be a sound way of providing assistance to the sector which will have a continuing impact over the coming 10 to 20 years⁸. At any rate, the strategy to be used for activities such as canal and drain cleaning – force account versus contracting out – is an important consideration in preparing an O&M budget.

⁷ For example, when farmers shift from furrow or flood irrigation to drip irrigation, the requirements for service delivery can change radically, requiring modifications in system facilities.

⁸ The existence in the field of working Russian draglines dating from the 1950s speaks to the ability of local mechanics to keep equipment operating, even well past its normal lifetime.

BUDGETING

There are three basic categories in a needs-based budget – staff and office expenses, operational expenses, and maintenance expenses. The first category is shared across both operations and maintenance. A sample checklist for these expenses is shown in Annex 1.

STAFFING AND OVERHEAD

Staff levels will depend on the responsibilities mandated to the operating agency. Typically there are some management staff, such as a CEO, senior engineer, and an accountant that have overall responsibilities. In addition there will generally be staff whose responsibilities are focused on the field and may be either for operations, for maintenance, or both. The number of these staff will depend on the functions being performed, and the size and complexity of the system. The key operating parameters discussed above will be important here. In particular, the absence or presence of pumping stations and the extent to which major maintenance activities are contracted out will be critical. In preparing an operating budget for a new organization, it is useful to first develop a functional analysis of just what tasks will need to be done before moving to a consideration of the positions to be created.

Overhead expenses generally include office space, furnishings, equipment, utilities, and so on. These costs can be allocated separately to operations and maintenance if there is a compelling reason to do so, but this typically is not necessary.

OPERATIONS

Operational costs (costs of delivering water) generally comprise the easier part of the budget to develop. Functions involved include such activities as water measurement, gate operation, and interaction with clients (WUAs in this case). Typically the major cost centers are for personnel and field transportation. If pumping is involved, and if these costs are not paid directly by the government, then energy will be a major cost item as well, often the largest single operating expense.

MAINTENANCE

Budgeting maintenance activities involves more uncertainties and requires that a number of assumptions be made. Maintenance can be separated into routine and preventative maintenance, minor repairs, and major or emergency repairs. **Routine maintenance** includes such activities as gate painting and lubrication, canal bank weed cutting and brush clearance, pump maintenance, canal bank road grading, and care of buildings and other ancillary structures.

It also includes the task of canal and drain cleaning which, in areas where siltation is a problem as in much of Khatlan, is a major task. While the activities mentioned earlier are generally done on an annual basis, canal and drain cleaning may be done annually, or at intervals of two, three, or more years. A critical assumption to be made is the frequency of such cleaning – whether cleaning of a particular canal or drain is to be done every year, every second year, every five years or some other interval. This choice will have a major effect on the annual budget. Typically cleaning of different canals and drains will be staggered, so that something is being cleaned every year. This evens out both annual budgets and equipment use. Because of its powerful effect on annual budgets, establishing cleaning intervals is often a parameter that is used to harmonize maintenance needs with resource availability.

Minor repairs are required annually on some items someplace in the system. These could include repairing a broken control gate, replacing a missing staff gage (hydropost), or an engine overhaul on an excavator. Replacement of worn out tools or office equipment might also fall into this category. The exact

nature of the repairs which will be needed in a given year is generally not known, but an allowance must be set aside for this.

Major or emergency repairs is a “lumpy” cost that may or may not occur in a given year. Generally well-run organizations will set aside a reserve fund for such activities, which might include replacing a set of large control gates on a canal, say after 25 years of service, or repairing a breach in a canal embankment. Canal breach repair is of particular importance, since not only does it interrupt the water supply to the entire system, or a sizeable portion of it, but it can also threaten adjacent houses, businesses, roads and other infrastructure. It is often necessary for the canal operator to have at least some equipment of its own on hand to allow for a rapid response to such emergency situations.

An additional challenge in systems which are badly deteriorated is to distinguish routine repairs and maintenance from rehabilitation activities. While it would be desirable, in a perfect world, for irrigation system users to bear the full costs of rehabilitation and routine operations, this is often beyond their ability to pay. Hence external support, from the government or from external development partners, is often needed to carry out rehabilitation activities. The selective rehabilitation approach employed by the FFP appears to have worked well for this, and should be considered as a model for improvements at the main system level as well. With respect to budgeting, though, such needed actions could be identified in a separate budget section which would be contingent on receipt of additional resources.

TOOLS

The following tools are important precursors to a whole-canal needs-based budgeting process.

Software

A system operating agency, whether it is a WUAF or a canal-based unit of ALRI, would be expected to do its budgeting on a computer, either using a spreadsheet template or a dedicated budgeting and accounting software package. Even at the WUA level, basic management functions like budgeting and accounting should employ a software package of some sort. WUAs are being provided with computers during the organization process, and the use of paper budgeting and accounting systems simply isn't something that should be advocated and trained for today.

Budget development would be done by the operating unit staff, with oversight and approval falling to the Board, in the case of a WUAF, or to the next highest operating level in the case of an ALRI unit. WUAF budgets may also be subject to review by a regulating authority.

Maps

A reliable map of system layout and assets is an essential tool for effective maintenance planning and budgeting. The most effective way to create such maps is by using GIS-based mapping software, coupled with field-collected GPS data to document canal alignments and the location of structures. Such mapping requires some specialized training and software, but is not overly complicated and is done routinely today in many developing countries. This is a function that WUAFs, once formed, could perform in advance of their taking on full canal operating responsibilities.

Inventories

Coupled with the mapping exercise outlined above, an inventory of system assets, such as canals, gates, bridges, and regulators, is essential for planning and budgeting maintenance. Creating such an inventory in conjunction with the mapping is a relatively simple task, but a vital one.

The other important inventory required is of working equipment available to the operating agency, including heavy equipment such as excavators and back-hoes, vehicles, current meters, and so on.

Maintenance schedules

Needs-based budgeting is facilitated by a schedule of recurring maintenance needs of each type of structure and canal reach in the system inventory. This schedule will indicate how often, for example, mechanical cleaning of a particular drain needs to be undertaken. There may be generic guidelines for this, but these guidelines will need to be tailored to the conditions prevailing in each system in which it is applied.

Schedule of unit costs

An updated table of standard unit costs for such things as a cubic meter of concrete, or of cutting weeds along a linear meter of large canal facilitates budget preparation by avoiding the need to collect such information repeatedly. At the same time the schedule of unit costs needs to be adjusted regularly for inflation, using an index of some sort.

CONCLUSIONS AND RECOMMENDATIONS

CAPABLE MANAGEMENT AGENCY

CONCLUSION

There is currently no organization in Tajikistan able to practice whole-canal needs-based budgeting and apply it to canal management. However, reforms underway have the potential to create such organizations in two ways.

- Redrawing boundaries of ALRI Districts to correspond to canal commands, and developing and implementing in these districts a unified budgeting framework using canals as cost centers.
- Establishing WUAFs based on canal commands, giving them an adequate and reliable source of funding, and building their technical and managerial capacity.

Over the medium term, a combination of these approaches is likely to be necessary. ALRI would welcome donor assistance in this process.

RECOMMENDATION

Pursue both approaches now, with the aim of having selected canals under unified management within 2 to 4 years. Request donors with up-coming or on-going water sector projects to assist and support the process of realigning boundaries and responsibilities.

BUDGETING AND MANAGEMENT TOOLS

CONCLUSION

Before reliable needs-based budgeting can be undertaken, a number of tools need to be developed and applied. These include the following.

- GPS-based **maps** of canal system layouts and service areas.
- **Inventories** of system-based assets, including water control structures, canal reaches, bridges, syphons, and so on (linked with the digital system map).
- **Inventories** of working equipment available to the managing organization.
- A **schedule of required maintenance** for each major structure and each canal and drain reach in the system showing periodic maintenance needs, such as greasing and painting, and recurrence intervals for desilting canals and drains (every year, every 3 years, every 5 years, etc.). These schedules need to be tailored to each system.
- A spreadsheet or accounting package **template** for preparing a canal-based budget.
- A **list of unit costs** for maintenance inputs such as meter of canal cleaned, cubic yard of gravel delivered, replacement 50 centimeter gate, and so on.

RECOMMENDATION

Begin work now to develop these tools and to create the capabilities within ALRI and WUAFs to apply them to selected canal-based systems.

WUAF ROLE

CONCLUSION

Federations of WUAs are just now being organized and registered in Khatlan. The eventual role for these WUAFs will be to take on canal system management responsibilities from ALRI. To do this, they will require technical capacity, experience, and a reliable source of funding. While these requirements are being put into place, WUAFs can play a very useful interim role in supporting and strengthening the WUAs which formed them. That role could include calibrating hydroposts which measure water entering and leaving the system, developing the budgeting and management tools outlined above, and providing advice and training to member WUAs on both technical and organizational matters.

RECOMMENDATION

Provide interim financial support to WUAFs, possibly in the form of matching grants to farmers' own contributions through their WUAs) This will allow the WUAFs to hire a small initial set of staff and undertake the supporting activities outlined above.

ISF REALLOCATION

CONCLUSION

The ISF currently in place was intended to fund the operation and maintenance of the complete irrigation systems, from reservoir to farmers' field. These activities have traditionally carried out by what is now ALRI. Today this water delivery responsibility is, in many locations, shared by ALRI and WUAs. In the future, WUAFs are expected to take on an additional portion of this responsibility, by managing system

main canals. At the same time, WUAs currently have inadequate funding, and the new WUAFs have no reliable sources of income at all.

RECOMMENDATION

Develop and implement a set of rules for allocating the existing ISF among the different organizations (ALRI, WUA, WUAF) actively managing irrigation and drainage systems. Note that this allocation would only become effective once a particular organization actually assumed operational responsibilities.

TAXATION OF NON-PROFIT ORGANIZATIONS

CONCLUSION

Current taxation rules impose an 18% turnover tax on ALRI districts, much of which is passed along to farmers when it is added to the ISF payments they are required to make. The Tax Department also charges interest on unpaid balances at an equivalent annual rate of approximately 35%. This results in ALRI Districts incurring steadily mounting debts which have, in many cases, become virtually unpayable. It also reduces significantly the revenue available to the ALRI District for O&M in general, and for canal and drain cleaning in particular. In addition, it puts WUAs in the role of tax collector for the government, damaging their credibility in the eyes of farmers and reducing their effectiveness as irrigation managers.

RECOMMENDATION

Reconsider the policy of imposing the 18% turnover tax on not-for-profit service organizations such as ALRI and WUAs.

CASCADE ENERGY COSTS

CONCLUSION

In addition to incurring large debts for turnover taxes and interest, ALRI Districts also incur major debts for the electricity required to operate large pumped cascades supplying water to farmers who farm land high above gravity command. These energy charges cannot be supported by current ISF rates and are generally beyond the ability of recipient farmers to pay. Since these expensive cascade systems were created as a matter of national public policy, supporting their continued operation is the responsibility of society as a whole, and not of other irrigating farmers who had nothing to do with their establishment.

RECOMMENDATION

Return to the previous practice of paying for energy to operate high-lift cascade pumping systems from the State budget, rather than attempting to pass these costs on to ALRI Districts or to other groups of unconnected farmers.

MAINTENANCE BACKLOG

CONCLUSION

Underfunded maintenance, particularly canal and drain cleaning, has led to a huge maintenance backlog in many irrigation and drainage systems and significant system deterioration in water control facilities, despite the skill shown by ALRI districts in keeping ancient equipment operating. Remedying this deferred maintenance backlog, and even meeting the burden of routine canal cleaning, is simply beyond farmers' ability-to- pay in many regions. Selective system rehabilitation grants, as implemented by the

FFP for on-farm works in more than 50 Khatlan WUA areas, appear to have been very cost effective in helping to restore water control in these areas and provide a useful model for additional support.

RECOMMENDATION

Consider using donor-provided rehabilitation funds at the on-farm level to provide additional grants to WUAs for water control improvements and canal and drain cleaning. Consider using a similar selective rehabilitation mechanism at the main canal level to restore functionality at that level. Consider also providing equipment such as hydraulic excavators and backhoes to man canal operators and to WUAFs as a form of on-going subsidy to system operations for the coming decade.

ANNEX 1. O&M BUDGET CHECKLIST

1. Staff
 - a. Basic office-based staff (manager, engineer, technician, accountant)
 - b. Field staff (mirobs, maintenance workers, pump operators)
 - c. Staff benefits
2. Office Expenses
 - a. Rent
 - b. Utilities (electricity, internet connection, water, propane)
 - c. Office equipment (computer, copy machine, printer, A/C)
 - d. Office furnishings (desks, chairs, tables)
 - e. Supplies for office (paper, toner, calculators, other office supplies)
 - f. Transport (for office staff)
 - g. Travel (conferences, meetings)
 - h. Meals and entertainment (for visitors)
3. Office Services
 - a. Maintenance and repair (office building, furnishings, equipment)
 - b. Office cleaning (if outsourced)
 - c. Accounting (if outsourced)
 - d. Audits
 - e. Legal services
4. Governance
 - a. Board meetings (allowances, travel)
5. Operations
 - a. Energy (pumping)
 - b. Field transport (vehicles, motorcycles)
 - c. Fuel
6. Materials
 - a. Rock and gravel
 - b. Cement
 - c. Building stone
 - d. Consumables (paint, grease, oil)
 - e. Fabricated gates
 - f. Pre-cast structures
7. Equipment
 - a. Water measurement equipment (hydroposts, current meters, flumes, weirs)
 - b. Hand tools (shovels, cutting tools, wheel borrows, miscellaneous hand tools)
 - c. Small equipment (welding machines, cement mixers)
 - d. Vehicle and heavy equipment purchase and replacement
8. Maintenance
 - a. Brush clearance
 - b. Desilting
 - c. Pump repair and servicing

- d. Canal bank road grading
- e. Emergency repairs