

Jordan Valley Authority Cost/Tariff Model

User's Manual

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CHAPTER ONE

BACKGROUND

In August 1997, FORWARD started detailed work on the development of an electronic spreadsheet model to assist the Jordan Valley Authority (JVA) in its future financial planning for irrigation water services in the Jordan Valley and wholesale water service to the Water Authority of Jordan (WAJ). In August 1998, a draft version of the model was provided to JVA for review. After revision of the model and a training/transfer period, a final version of the model was provided to JVA for use in September 1998.

The JVA model is a single workbook composed of worksheets assigned to logical planning, engineering, and financial components. Data links exist between worksheets and components within the model.

The model has standard cost accounts and model parameters for each cost center and the tables for each center have a similar structure and format to allow for grouping of individual worksheets for common editing (adding rows, changing labels or formulas) of all selected sheets at one time. This has facilitated development of the model.

The last worksheet is a schematic diagram outlining the conceptual structure of the JVA model.

1.1 Model Goals, Capabilities, and Limitations

The primary goal in developing the model was to give JVA the ability to examine a wide array of potential future outcomes, given underlying changes in key system parameters, and to see the effect of such changes upon projected annual costs and needed revenue recovery. As well as its planning purposes, the model is to be used in annual budgeting and tariff setting.

The model meets these goals and should provide the Authority with a flexible and powerful tool for short- and long-term planning. The JVA model is not a detailed systems operations model nor is it a detailed accounting program suitable for monthly cash flow management. Its focus is on an annual basis for costing purposes and on a seasonal basis for water demand, supply, and revenue calculations, and at a level of detail suitable for forecasting major expenses and revenues.

A glossary of commonly-used terms is provided in Annex A. It would be best to review the glossary prior to reading the technical chapters that follow.

1.2 Modeling Software and System Requirements

The model was developed using Microsoft Excel 7.0 3-D electronic spreadsheet software. This modern software allowed the model to be developed in easy-to-understand logical planning and financial modules assigned to individual worksheets

(pages) of a workbook. Because of similarities in cost-accounting structures, this 3-D layering of similarly-designed pages facilitated model creation and editing, as well as the addition or deletion of new cost centers as the need arises over time. Most importantly, the use of the electronic spreadsheet tool greatly facilitates the performance of what-if analyses that are critical in evaluating future courses of action.

Since the current version of the model is several megabytes in size, software (such as pkzip and pkunzip) that facilitates zipping and unzipping of large files is recommended for easier file transfer.

Minimum hardware system requirements for operation of the model are a PC with at least 150 MHz Pentium processor, 32 Mb RAM with 256K cache, 2-4 Mb video RAM, 2.0 Mb or greater hard disk, 10X or higher CD-ROM, and a 3.5" diskette drive. A color desk-jet printer to allow for the printing of informative colorized tables and graphs from the model is also recommended.

CHAPTER TWO

JORDAN VALLEY AUTHORITY MODEL

2.1 Overview

At its simplest level, the JVA model contains four major analytical components or processes that represent either a single worksheet or groups of worksheets:

- **Financial/Model Parameters Component**

Contains the model's summary financial information in tabular and graphical form as well as global model parameters that, when changed, can have widespread effects upon the model's calculations and results.

- **Planning Component**

Contains the various underlying factors and calculations affecting system growth, water demand, water supply availability, and how water supplies are allocated in either surplus or deficit conditions.

- **Revenue Component**

Contains the calculations that generate system subscriber revenue on a seasonal basis and according to water quality, fees, as well as adjustments to revenue.

- **Cost Component**

Contains the various cost centers of the Authority, the local parameters that uniquely affect their expenses, the calculation of costs, and various aggregations of cost centers used for tariff considerations.

The underlying details are somewhat more complicated with a larger number of sub-components addressing various planning, engineering or financial issues and data flowing from one portion of the model to another.

While input parameters affecting the calculations are present throughout, the model essentially begins with irrigated areas and theoretical cropping requirements to obtain projected water demands. Projected water demands are compared to available water supplies at the stage office level, and decisions are made on how to ration supplies during shortages or how to allocate or draw upon various supplies during surplus conditions. These decisions are used as key inputs to determine the expenses of various cost centers. The model also allows JVA to feed information related to each cost center and allocate the common expenses to cost centers. These cost data are then aggregated for financial analyses.

MODEL COMPONENTS AND WORKSHEETS

Financial/Model Parameter Component

JVA-IS	JVA Income Statement and Global Parameters
ND-IS	North Directorate Income Statement
MD-IS	Middle Directorate Income Statement
SD-IS	South Directorate Income Statement
SG-IS	Southern Ghors Income Statement

Planning Component

DemAnn	Annual Demand
DemSum	Summer Demand
DemWin	Winter Demand
BalAnn	Annual Balance
BalSum	Summer Balance
BalWin	Winter Balance

Revenue Component

RevAnn	Annual Revenue
RevSum	Summer Revenue
RevWin	Winter Revenue

Cost Component

ExpAmman	Cost/Expense of Supplies to Amman
ExpSummary	Total JVA Expenses
Cost Summary	JVA Cost Breakdown (with and without Capital Costs)
ND-Total	North Directorate Water Expenses
MD-Total	Middle Directorate Water Expenses
SD-Total	South Directorate Water Expenses
SG-Total	Southern Ghors Water Expenses
ND-Sources	North Directorate Water Expenses – Sources
MD-Sources	Middle Directorate Water Expenses – Sources
SD-Sources	South Directorate Water Expenses – Sources
SG-Sources	Southern Ghors Water Expenses – Sources
ND-Secondary	North Directorate Water Expenses – Secondary
MD-Secondary	Middle Directorate Water Expenses – Secondary
SD-Secondary	South Directorate Water Expenses – Secondary
SG-Secondary	Southern Ghors Water Expenses – Secondary
ND-KAC	North Directorate Water Expenses – KAC
MD-KAC	Middle Directorate Water Expenses – KAC
SD-KAC	South Directorate Water Expenses – KAC
ND-Pumps	North Directorate Water Expenses – Pumping
MD-Pumps	Middle Directorate Water Expenses – Pumping
SD-Pumps	South Directorate Water Expenses – Pumping
SG-Pumps	Southern Ghors Water Expenses – Pumping
Yarmuk	Water Expenses – Yarmuk/Adasiya/Unity
N.Conveyor	Water Expenses – North Conveyor
Mukheiba	Water Expenses – Mukheiba
Wadi Arab	Water Expenses – Wadi Arab Reservoir
Taibeh	Water Expenses – Taibeh
Ziglab	Water Expenses – Ziglab

Abu Ziad	Water Expenses – Abu Ziad
Jurum	Water Expenses – Jurum
Wadi Yabis	Water Expenses – Wadi Yabis
Kufrinja	Water Expenses – Kufrinja
Wadi Rajib	Water Expenses – Wadi Rajib
Deir Alla	Water Expenses – Deir Alla
KTR	Water Expenses – King Talal Reservoir
Karamah	Water Expenses – Karamah
Shuieb	Water Expenses – Shuieb Reservoir
Kafraïn-Hisban	Water Expenses – Kafrien / Hisban
Hasa, etc.	Water Expenses – Wadi Hasa, Fifa, Khnezeira, and Ain Maghara
Mujib	Water Expenses – Mujib Dam
WadiAraba	Water Expenses – Wadi Araba
Others	
1995Data	1995 Budget Allocation Data
1996Data	1996 Budget Allocation Data
1997Data	1997 Budget Allocation Data
ND-Base	North Directorate – Base Costs
MD-Base	Middle Directorate – Base Costs
SD-Base	South Directorate – Base Costs
SG-Base	Southern Ghors – Base Costs
CentDir	Water Expenses – Central Directorate
WkShpDir	Water Expenses – Workshop Directorate
Dams-Arab	Water Expenses – Wadi Arab Reservoir Share from Dams Directorate
Dams-KTR	Water Expenses – King Talal Reservoir Share from Dams Directorate
Dams-Karamah	Water Expenses – Karamah Reservoir Share from Dams Directorate
Dams-Kufrein	Water Expenses – Kufrien Reservoir Share from Dams Directorate
Pumping	Pumping Electrical Expenses by Stage Office & Directorate
Perform	Water Expenses Performance Indicators
All Chart	Chart – Allocation of JVA 1997 O&M Expenses to Directorates

Expected system income is generated from irrigation water usage data multiplied by the applicable tariffs which may reflect seasonal, water quality, or usage-level features. Fee income is calculated and then adjusted for billing collections. This expected income is then compared with expenses, resulting in the net income of the system. Then management decisions can change variables underlying income or expenses to see the affect on desired performance goals.

2.2 Financial Summary and Global Model Parameter Component

This component contains summary and/or input data. It includes a single Income Statement worksheet for each of the four directorates, North, Middle, South, and Southern Ghors Directorates, and a summary Income Statement for the JVA system: **(ND-IS, MD-IS, SD-IS, SG-IS, and JVA-IS)**.

This component contains the summary financial performance of the Authority (income statements), various performance measures, and global parameters that affect large

portions of the model when changed by the user. For the most part, this component contains the main drivers of the model (global parameters) as well as the results (income statement and performance measures). These beginning and ending pieces are packaged together to allow the model operator to perform what-if scenarios on the parameters and quickly see the overall results of the changes.

The following is a description of the JVA Income Statement worksheet (**JVA-IS**). The worksheets for each directorate have the same structure. The description below applies to them with regard to Table 1 only.

Table 1: Income Statement

The first table in **JVA-IS** relates the net income of the Authority and represents the highest level of information in the model. Any significant change to the parameters alters the financial data in this table. Much of the data in this table is obtained from worksheets in other components that summarize the income statements of directorates. The income statement for each directorate is calculated in the revenue and cost components and passed to the net income table for presentation and subsequent calculation of the Authority's net income.

The model calculates two different levels of net income:

- Net income after operating expenses; and
- Net income after operating and debt service expenses.

These two performance levels are also provided in percentages. This last item (percent of revenue recovery goals) is most useful in specifying alternative tariff schedules and ascertaining the change in revenue's impact on the targeted revenue recovery goal.

Below the net income table are various informative graphs on JVA performance that will assist the model operator and decision-makers in interpreting the model's results.

Tables 2a – c: Global Model Parameters

These tables, below the graphs, identify the various global parameters. They include user-specified data on common costs such as costs for electricity and fuel, inflation rates, per dunum on-farm efficiency rates, and tariff levels. Changes in these variables will affect multiple underlying worksheets and have a more noticeable affect upon the Authority's financial performance.

The historical data for these parameters, shown for the first few years, can be used as an initial starting basis for the user-specified projected values. Projected changes from historical values or trends for future years can then be made based upon known effects of planned projects, new negotiated prices, information received from other ministries or agencies, desired policy targets, or best professional guesses of staff.

The model has been structured to allow for multiple usage-block levels, four different water quality tariffs, and for summer and winter seasonal tariffs schedules even though the Authority does not currently have this number of variable tariffs.

For each water quality and for each season, there is a table provided in the model for the operator to define the desired tariff schedule. On the left-hand side of these tariff schedules tables are two columns for the user-specified definition of the usage blocks. Up to six different usage blocks are allowed in the model. By inputting the upper range of the desired block, the model will automatically calculate the starting range of the next block. In the highest defined block, this usage block should be closed off with a large number, such as 999999, to avoid problems in the if statements used in the subsequent revenue calculations. If the cell is left blank or text is entered, a logical error will arise in the model. This should assist the model operator in identifying groupings of common consumption patterns that would help define the usage blocks for tariff-setting purposes.

Once the desired usage blocks are defined, the model operator can then specify the projected tariffs to meet the desired revenue recovery or policy goals.

2.3 Planning Component

The planning component of the model includes water demand and water balance worksheets: Summer, Winter, and Annual Demand (**DemSum**, **DemWin**, and **DemAnn**); and Summer, Winter, and Annual Water Balance (**BalSum**, **BalWin**, and **BalAnn**). This component:

- Projects the change or growth in demand for JVA water according to the change in the irrigated areas, cropping patterns, and cropping requirements;
- Inventories the quantities of available water supply, compares projected water needs against available supplies, and allows for the rationing of demands (given water shortages) or the allocation of supplies (given water surplus);
- Defines the quantity of water use that can actually be met; and
- Defines the quantity of water billed.

The planning component provides important data to other portions of the model. The allocation of supplies from various sources is later used to determine pumping costs, and water use is then used in revenue and fee calculations.

Water Demand and Supply Centers

Essential to the overall planning functions of the model is the definition of water demand and supply centers for evaluating water needs and the system's ability to supply those needs. The demand centers represented by the farm units were aggregated into development areas and the development areas were aggregated into ten stage offices and the Southern Ghors Directorate. The Deir Alla transfer point for the Amman water

supply and upcoming JVA sales for non-irrigation purposes in the Southern Ghors were also considered as a demand center. The stage offices and water sources were distributed among the four geographic directorates. The following is a list of supply sources and demand centers:

Supply Sources	Demand Centers
North Directorate	
Yarmouk River/Adassiyya/Unity Dam System	Stage 1
North Converyor	Stage 2
Mukheiba Wells	Stage 7
Wadi Arab Reservoir	
Wadi Taibeh (Waqgas)	
Wadi Sharhabeel (Ziglab)	
Wadi Abu Ziad	
Wadi Jurum	
Wadi Yabis	
Middle Directorate	
Wadi Kufranja	Stage 3
Wadi Rajib	Stage 4
King Talal Reservoir	Stage 5 and Stage 8
South Directorate	
Karamah Reservoir	Stage 6
Shuieb Reservoir	Stage 9
Kafrein/Hisban System	Stage 10
Southern Ghors Directorate	
Wadi Hasa, Fifa, Khnezeira, and Ain Maghara System	
Mujib	
Wadi Arab	

The flow charts in Figures 1 to 3 show the possible links between supply sources and stage offices for the North, Middle, and South Directorates. They also show the diversions from the King Abdullah Canal (KAC). The diversion to the stage offices is made either by gravity or by pumping.

Water Demand Worksheets

The demand module consists of three worksheets: Summer Demand, Winter Demand, and total Annual Demand. The **DemSum** and **DemWin** (and their summary **DemAnn**) worksheets provide various tables used in the calculation of the future level of water demand and quantity of water billed. Summary data are provided at the top of the worksheets followed by a series of tables (logical steps) to adjust the forecasts for various purposes.

The following is a discussion of how water demand is calculated and adjusted for the summer demand sheet. The winter demand sheet has the same structure.

FIGURE 1

**SCHEMATIC OF JORDAN VALLEY SUPPLY SOURCES AND STAGE OFFICES
NORTH DIRECTORATE**

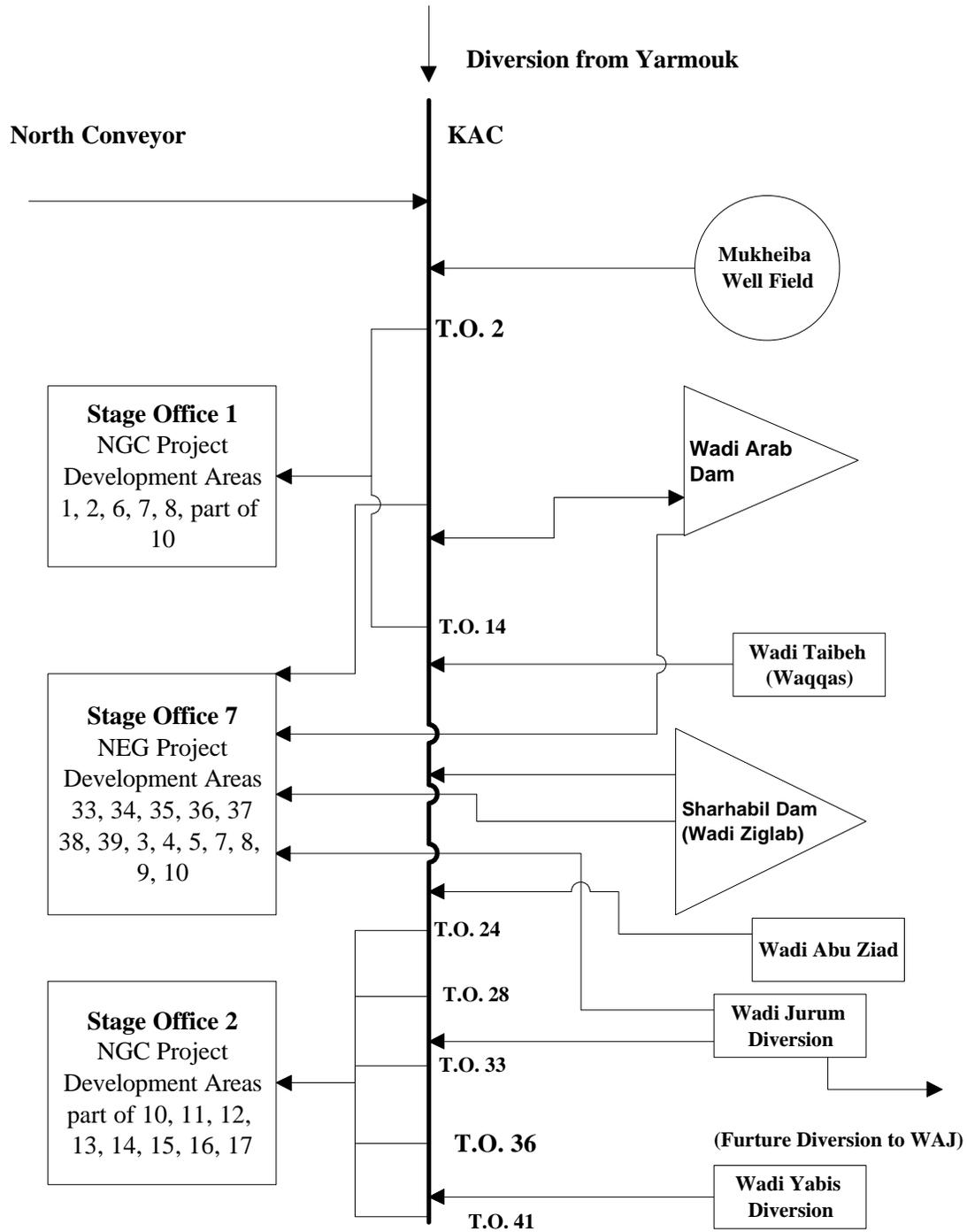


FIGURE 2

**SCHEMATIC OF JORDAN VALLEY SUPPLY SOURCES AND STAGE OFFICES
MIDDLE DIRECTORATE**

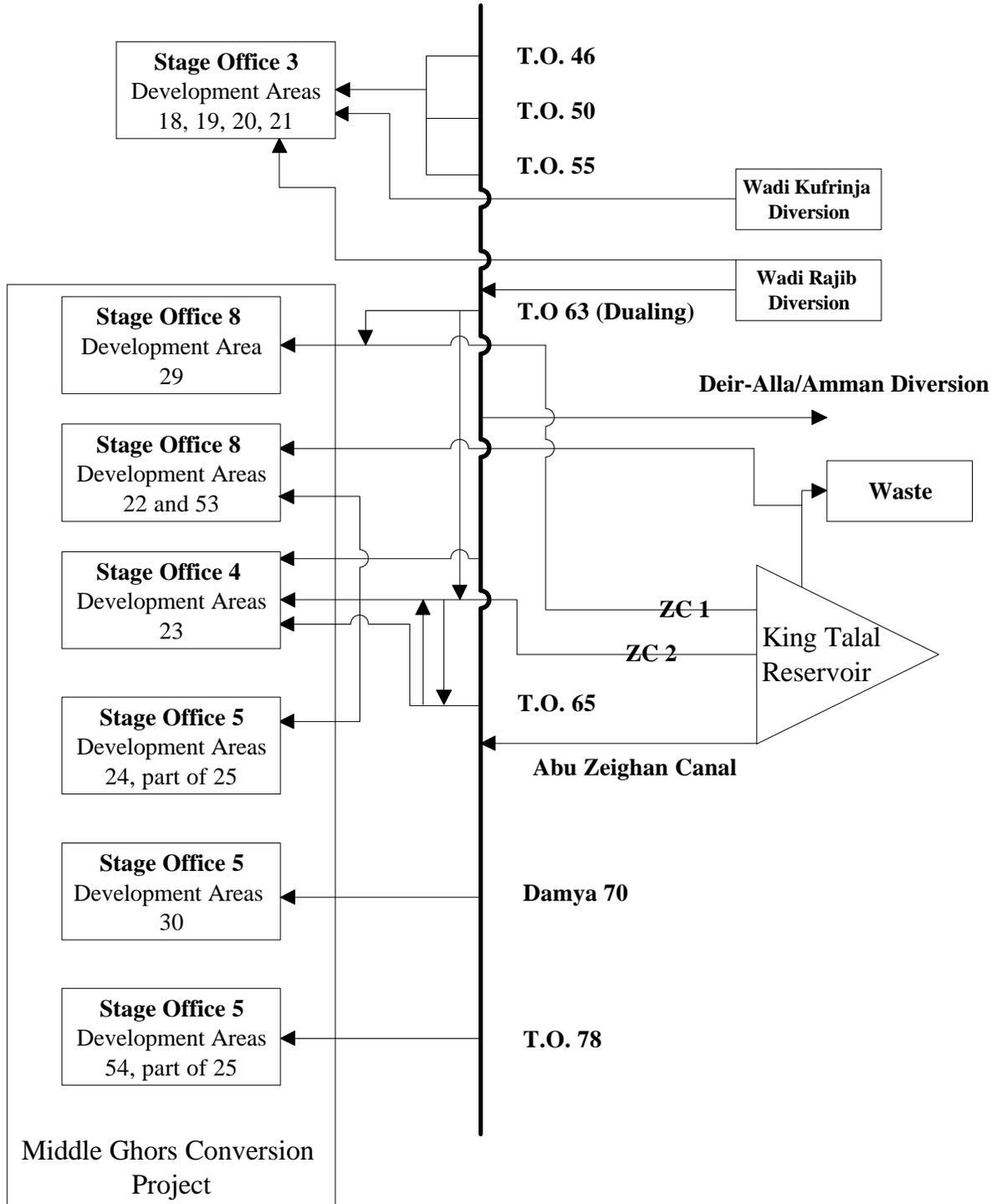


FIGURE 3

**SCHEMATIC OF JORDAN VALLEY DEMAND AND SUPPLY OFFICES
SOUTH DIRECTORATE**

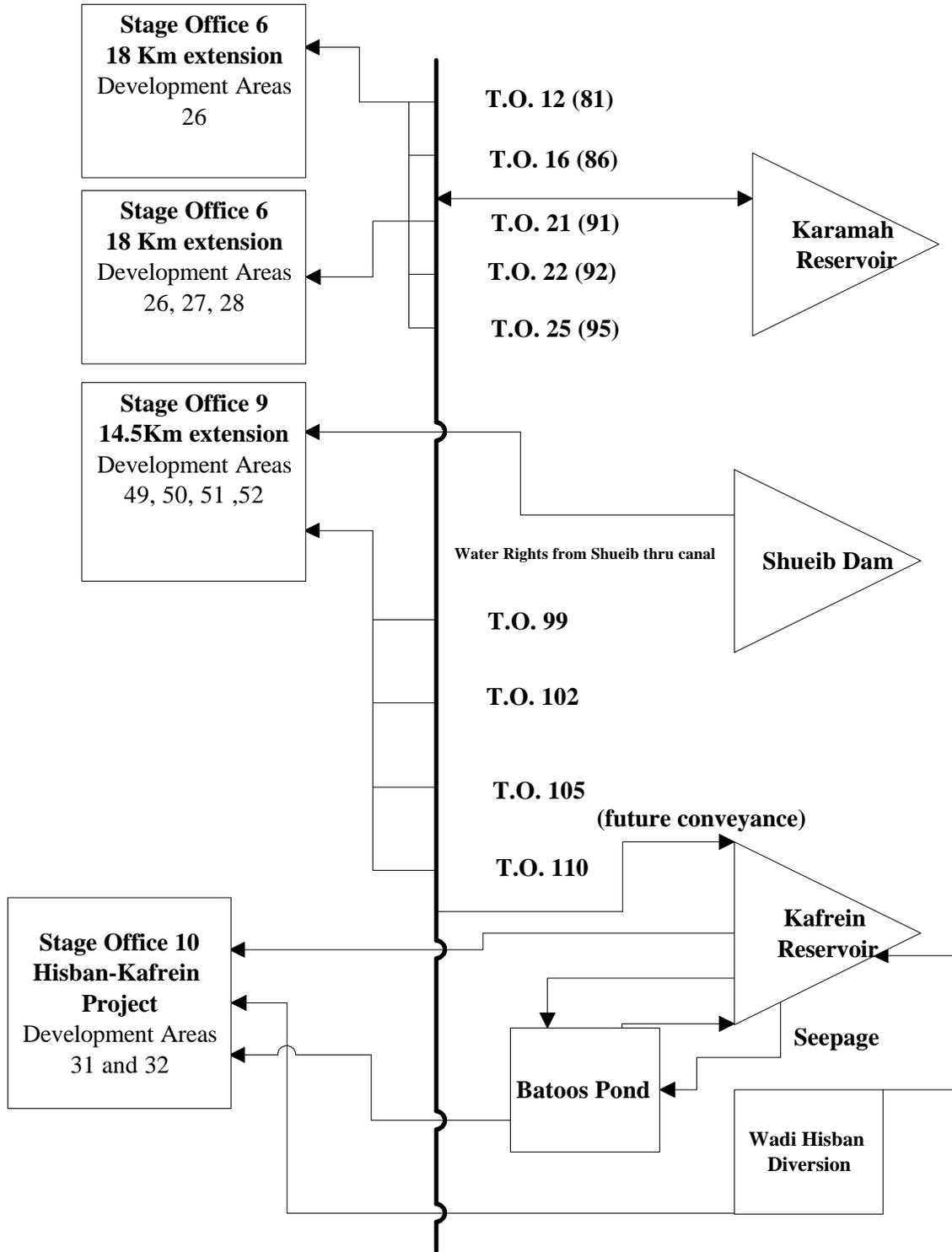


Table 1: Water Demand by Directorate and Stage Office

This table shows the summary of the demand for each stage in each directorate. These summary data are obtained from the tables below in this sheet

Table 1a has the same structure. However, it shows summary data of Water Demand by Directorate and Crop Type. Five crop types were adopted in the model: citrus, bananas, other trees, and fodder.

Table 2: Assumed Leaching Rates by Crop Type

The next table shows the assumed leaching (m³/dunum) rates for all stage offices by crop type. For example the annual leaching requirement for citrus is taken as 15% of the annual total demand. 25% of that annual leaching requirement is in summer, while 75% is in the winter. As we go down in this table the water quality get worse, thus, the leaching requirement increases. The user is able to change the default assumptions by entering the required values.

Tables 3a – k: Irrigated Area, Application Rates, and Water Demand

In these tables, the user can specify the amount of irrigated area for each crop type in dunums for each stage office in every directorate. The user can also input the application rates for each crop in cubic meter per dunum, and the model will calculate the water demand for each crop. These values are summed up and summarized in the demand summary table (Table 1) and passed over to the water balance sheets.

Irrigated Area. This uses recent historical estimates of irrigated area to forecast the future areas. The forecast should be done according to the change in irrigated areas, and model operator then specifies projected future areas.

Water Application Rates. These data are the estimated requirements of water per dunum for different crop families and seasons. All numbers are extracted from studies prepared by JVA staff and external consultants.

Water Demand by Crop Type. These data indicate the total water demand for each crop by season, and are calculated using the irrigated areas for each crop type multiplied by the water application rate for the same crop and season:

$$\text{Water Demand by Crop Type} = \text{Irrigated Area} * \text{Water Application Rates}$$

Water Balance Worksheets

The water balance module consists of three worksheets: Summer Balance, Winter Balance, and total Annual Balance. The **BalSum** and **BalWin** (and their summary **BalAnn**) worksheets maintain a balanced account of the water in the different parts of the JVA irrigation system for different operational possibilities entered by the user. The

water balance module also determines the amount of water produced by each supply cost center for the calculation of unit costs. The module is not intended as a water operation model. It does not reflect the discrete monthly or daily time step needed for more accurate operational purposes.

The water balance module makes a fairly detailed account of the water balance in the JVA and allows the user to change some supply quantities. It adjusts the water balance accordingly. The time frame for the model is from year 1995 to 2002. The year 1997 was considered to be the present. Year 1995 and 1996 were considered to be the past. Years 1998 to 2002 are the future forecast years.

The model considers seasonal variation by computing the summer and winter balances separately. The summer season starts 1 April and ends 30 September each year. The winter season starts 1 October and lasts until 31 March. The cycle of seasonal operations is assumed to begin at the start of the summer season, 1 April, and to last until the end of the summer season, 30 September.

The following is a description for the summer water balance sheet. The description also applies to the winter water balance sheet.

Table 1: System Water Demand and Supply Balance

This first table at the beginning of the sheet represents a summary of the water demand and supply balance. The first part of this table, Water Demands, summarizes the desired level of water demand in millions of cubic meters (MCM) for all demand centers for the years 1995 to 2002. It is linked to the associated demand worksheets (**DemSum** and **DemWin**) discussed above. This part of the table is important for the water balance and is used in the subsequent tables. The user is not supposed to change the figures directly in the Water Demands portion of this table.

The second part of this table, Available Supplies, shows the supplies available to the JVA system. The user is able to input the available supplies for the years 1995, 1996, and 1997. For the future years, the cells contain formulae that average the past few years or reflects a carryover balance of reservoir storage, gains, and losses.

Carryover storage was considered for three different reservoirs: Wadi Arab, King Talal, and Karamah Reservoirs. All water in the other reservoirs is considered to be exhausted seasonally, and any unused volume in the season will be lost. The following is a description of how the carryover storage was modeled for the three reservoirs: Wadi Arab, King Talal, and Karamah Reservoirs.

Wadi Arab Reservoir. An initial storage amount was obtained from JVA records for the summer of 1995. In addition, the pump back from the KAC and the water shed runoff into the reservoir was assumed to be readily available for use in that season. Thus, the total available supplies for Wadi Arab Reservoir is the carryover storage plus any pump back in that season and watershed runoff. For the winter of 1995 and any other subsequent season the following formula is used:

$$S(i) = C(i-1) + F(i) + P(i)$$

Where:

S(i)	The available supplies in season (i)
C(i-1)	The carryover storage from season (i-1)
F(i)	Watershed runoff from floods and baseflow
P(i)	Pump back to the reservoir from KAC in season (i)

The previous season carryover was calculated according to the following equation:

$$C(i-1) = S(i-1) + P(i-1) - R_{kac}(i-1) - R_7(i-1)$$

Where:

S(i-1)	The available supplies in season (i-1)
P(i-1)	Pump back from KAC to the reservoir
R _{kac} (i-1)	Release from reservoir to KAC at season (i-1)
R ₇ (i-1)	Release from the reservoir to stage 7 at season (i-1)

The user need not change the available supplies for this reservoir.

King Talal Reservoir. The available supplies for KTR for the summer of 1995 were obtained from JVA records by obtaining the initial storage of the reservoir at that summer and adding it to the stream flow of the Zarqa River in the same summer. For the subsequent seasons the following equation is used:

$$S(i) = C(i-1) + F(i)$$

Where:

S(i)	The available supplies in season (i)
C(i-1)	The carryover storage from season (i-1)
F(i)	Watershed runoff from floods and base flow

$$C(i-1) = S(i-1) - R_{8zc1}(i-1) - R_{4zc2}(i-1) - R_{5zc2}(i-1) - R_{kac}(i-1)$$

Where:

C(i-1)	The carryover storage from season (i-1)
S(i-1)	The available supplies in season (i-1)
R _{8zc1} (i-1)	Release from the KTR to Stage 8 through ZC1
R _{4zc2} (i-1)	Release from the KTR to Stage 4 through ZC2
R _{5zc2} (i-1)	Release from the KTR to Stage 5 through ZC2
R _{kac} (i-1)	Release from the KTR to KAC through Abu Zeghan Canal

However, an upper constraint was put on the carryover storage. The volume of water cannot exceed the maximum storage of KTR, which is assumed to be 75 MCM. This constraint was programmed by the following conditional statement:

If $C(i-1) > 75$ MCM then 75, otherwise $C(i-1)$, which means whenever the carryover volume exceeds 75 MCM, the assumed maximum storage capacity of the reservoir, the carryover is modified to equal 75 MCM. If the carryover is less than the assumed maximum storage capacity of the reservoir, the carryover amount is not modified.

Karamah Reservoir. This reservoir, which is essentially an off stream storage dam, is also modeled to have carryover. The initial storage in the summer of 1995 was considered to be zero since the dam was under construction. The operation of Karamah Dam would include the releases from the KAC to store in the reservoir and the pump back from the reservoir to the KAC. The carryover storage from the previous season was considered in the current season by using the following equation:

$$S(i) = C(i-1) = R_{kac}(i-1) - P_{kac}(i-1)$$

Where:

$C(i-1)$	The carryover storage from season (i-1)
$R_{kac}(i-1)$	Release from KAC to store in Karamah at season (i-1)
$P_{kac}(i-1)$	Pump back from the reservoir to the KAC

It was assumed that the release from KAC to Karamah Reservoir was not considered readily available for use in the same season, and that filling the reservoir would occur at the end of the season and therefore would not be available at that season.

Table 2: Demands Met (Supplies Used)

This table has three parts:

- Summer System Demands shows a summary of the demand sheet exactly as in the first part of Table 1 of the water balance worksheet.
- Summer System Water Use shows a summary of the demands met (supplies used) at each of the demand centers. The values are taken from Table 4, Water Supply Allocations. The user is not required to change anything in the table.
- Percent Summer System Demands Met is equal to the ratio of the values shown in the second part to the values shown in the first part of Table 2.

Table 3: Percent Allocation of Stored Water Supplies

In this table, the user can change the percent allocation to the demand centers from the stored water supplies. The user may use this table as a control valve to increase or

decrease supplies to a particular demand center. For the years 1995 to 1997, these values are based on actual allocations. For future years, the users are able to change these values. The default value is suggested to be the average.

For example, the user has different options for allocating the water from the Wadi Arab Reservoir. It can be allocated to Stage 7 by inputting a percent value, or the user can direct some of the water to KAC, and the rest will remain in storage. The amount that remains in storage is calculated from what is left over after releases from Wadi Arab to Stage 7 and the KAC. It is not input by the user. The total utilization from a certain water supply is not necessarily 100%.

Table 4: Water Supply Allocations

This next table shows a fairly detailed account of the water supply allocations for each stage. The demand, obtained from the demand part of Table 1, is presented first. The supplies available for each stage are presented next. The KAC is considered as a supply source to a stage if that stage has access to the water in the canal. The supplies are then summed up as total available supply for each stage. For each stage, an available water surplus or deficit is calculated. Any unused surplus is then carried over to the next stage downstream of the canal as remaining KAC amounts.

For each stage, the user is able to specify the percentage of demand that is to be met from the available sources. The table goes through all the stages in the North and South KAC and presents the total unaccounted-for water at the end. This table is similar for the Southern Ghors Directorate.

Table 5: Water Volume Accounting

This next table shows the global volume balance for the North and South KAC and the different directorates. In this table the user can specify the amount of water to be allocated to the water rights. This table verifies the more detailed information presented in Table 4.

2.4 Revenue Components

The revenue components of the model can be separated into tariff revenues and other sources of income. They include the summer, winter, and annual revenue worksheets (**RevSum**, **RevWin**, and **RevAnn**).

The tariff revenues are calculated at the directorates level and are based upon detailed information on quantities consumed by usage block from different qualities of water in different seasons, revenue details, and adjustments for collections. The other sources of JVA's income are generally based upon trend information or percentages of other utility measures.

JVA receives various types of revenue and income although the large majority of receipts are from irrigation water sale revenue. The various types of revenue and income considered in the model include:

Water Revenue from Retail Subscribers. This is the primary source of income for JVA, collected monthly by JVA through the water bill, and is based on applying the seasonal tariff for water on the measured water consumption according to the quality of water and season of use. This revenue is calculated for all water subscribers, including those who pay and those who do not. We are forecasting this revenue according to the following:

$$\text{Water Consumption} * \text{Applied Water Tariff}$$

Water Revenue from WAJ. This is considered an important source of future income for JVA, to be collected from WAJ once the management contract takesplace, and is based upon a tariff to be negotiated with WAJ. This revenue is forecast according to the following:

$$\text{Water Consumption} * \text{Applied Water Tariff}$$

Stamps Fees. This is a fee paid by subscribers, suppliers, and other parties for all formal transactions with JVA. Based on a fixed fee for all subscriber classes, these fees are forecast according to the following:

$$\text{Current Stamps Fees} * \text{Inflation Rate}$$

University Fees. This is a fee paid by subscribers, suppliers, and other parties for some of the formal transaction with JVA, and is based on a fixed fee for all subscriber classes. These fees are forecast according to the following:

$$\text{Current University Fees} * \text{Inflation Rate}$$

Other Fees. This represents fees associated with violations of laws and other services. Forecasting of this income will be based on the trend of previous years:

$$\text{Current Other Fees} * \text{Inflation Rate}$$

Tender Income. This represents fees paid by suppliers to buy new tenders. Forecasting of this income will be based on the trend of previous years:

$$\text{Current Tender Income} * \text{Inflation Rate}$$

Rent of Agricultural Units. This represents fees paid by farmers renting agricultural units from JVA. Forecasting of this income will be based on the trend of the previous years:

$$\text{Current Rent of Agricultural Units} * \text{Inflation Rate}$$

Income from Electricity. Represents the income from electricity generation by JVA from Dams, and sold to the Electricity Company. Forecasting of this income will be based on the trend of the previous years:

$$\text{Current Income From Electricity} * \text{Inflation Rate}$$

Revenue Worksheets

Three worksheets make up the revenue portion of the model. **RevSum** and **RevWin** are for actual summer and winter revenues. **RevAnn** is the total annual revenue.

Table 1: Water Income

Water Revenue from Retail Subscribers. This is the actual revenue realized from the sale of water to JVA subscribers. The information in this table results from applying the tariff of each season according to the quality of water supplied for each block. It is shown on the **RevSum**, **RevWin**, and **RevAnn** worksheets, as it is the amount actually realized.

$$\text{Water Revenue (Season/Water Quality)} = \text{Water Billed} * \text{Applied Tariff.}$$

This is applicable for Summer/Winter and for all water qualities. This also applies to quantities sold to WAJ.

Other Income. This is the actual income realized from other fees at JVA for subscriber classes. The information in this table results from last year numbers adjusted for inflation rate and is only present on the **RevAnn** worksheet as it is calculated on an annual basis.

Tables 2a - k: Revenue Calculation Tables

The temporary working tables at the bottom of the **RevSum** and **RevWin** worksheets are used as to distribute information from the aggregated tariff user blocks to more detailed user blocks. While the current tariff structure reflects only a few groupings of usage blocks, the usage blocks on these worksheets will allow the JVA to monitor a more detailed pattern of water use. With this information, other possible groupings of usage blocks might be considered for tariff-setting purposes in the future.

2.5 Cost Component

The expenses for JVA water are divided among various cost centers which include Sources, Dams, Pumps, KAC, and Secondary Systems. The cost centers have been selected in coordination with JVA to identify the cost of water at the individual major sources, facilities, and transfer points.

Each cost center accumulates direct cost and cost allocated from the Cost Center Directorate, the Workshop Directorate, and the Central Directorate. For Wadi Arab,

Kafrain, Karamah, and KTR, there is an additional cost allocated from the Dams Directorate.

Each cost center considered in the model has a separate sheet with individual costing.

Cost Centers	
Sources	Facilities
Yarmouk River/Adassiyya/Unity Dam System	KAC – North Directorate
North Conveyer	KAC – Middle Directorate
Mukheiba Wells	KAC – South Directorate
Wadi Arab Reservoir	Secondary System – North Directorate
Wadi Taibeh (Waqqas)	Secondary System – Middle Directorate
Wadi Sharhabeel (Ziglab)	Secondary System – South Directorate
Wadi Abu Ziad	Secondary System – Southern Directorate
Wadi Jurum	Pumping - North Directorate
Wadi Yabis	Pumping – Middle Directorate
Wadi Kufranja	Pumping - South Directorate
Wadi Rajib	Pumping – Southern Directorate
King Talal Reservoir	
Karamah Reservoir	
Shuieb Reservoir	
Kafrain/Hisban System	
Wadi Hasa, Fifa, Khnezeira, and Ain Maghara System	
Mujib	
Wadi Arab	

The direct cost of supplying water for each directorate is accumulated from the cost centers within each directorate, which include: primary cost centers, secondary cost centers, KAC cost centers, and cost transferred from other directorates.

Unit Cost for Bulk Sale to WAJ

To calculate the cost per cubic meter for bulk sale to WAJ, the model considers the following cost assignments:

- The total cost of Yarmuk/Adisayya;
- The total cost of North Conveyer;
- The total cost of Wadi Arab;
- WAJ share from KAC cost, and the cost of additional work done on KAC to maintain the quality level required by WAJ;
- Kufranja lost revenue;
- Cost of difference in water quality; and

- Additional margin.

Cost Categories

Expenses at the cost centers are classified as variable and fixed expenses. Variable expenses include External Pumping Cost, Electricity for Pumping, and Generator Fuel. They vary proportionally with the quantity of water delivered (the cost per m³ is variable). Fixed expenses include Salaries, Rent, Temporary Labor, Social Security, Travel, Communications, Insurance, Civil Work Maintenance, Vehicles & Equipment Maintenance, Equipment - Spare Parts and Supplies, and others. They vary, but not in relation to the quantity of water. They are fixed for different flows.

All expenses are expressed in the model are annual. The data on expenses should always be updated. The user shall input all expenses even if not paid. The data presented in the model for years 1996 and 1997 are actual data from JVA records. Other years throughout the model's period are forecast as described below in the cost categories.

Figure 4 is a typical cost center sheet. The cost center name appears in Row 3. For simplicity, the actual names of the cost centers were used as the names of the worksheets in the Excel file. Row 4 presents the years (i.e., model's period) for which the expenses shall be input/forecast. The first column in the table presents all the cost categories as mentioned above. The following paragraphs explain all the cost categories and how are they forecast. The manual also explains the cost centers sheet by sheet.

Variable Expenses

External Pumping Cost. This item represents the water pumped from Lake Tiberias through the North Conveyor and is limited to that source. For the years 1996 and 1997 (historical record), the cost is calculated according to:

$$\text{Quantity of Water Received} * \text{Cost per cubic meter of water.}$$

For future forecasts, this cost is adjusted by the inflation rate.

Electricity for Pumping. This item is the expense for power used by the water facilities for pumping. Such expenses may be obtained directly from the Electricity Company bill. Electricity consumption expenses are based on power consumption (kWh/m³) and cost of electricity (JD/kWh):

$$\text{Power consumption per cubic meter of water (kWh/m}^3\text{)} * \text{Quantity of Water (m}^3\text{/yr)} * \text{Cost per kWh in JD.}$$

For future forecasts, this cost is adjusted by the inflation rate.

**FIGURE 4
TYPICAL COST CENTER SHEET**

	A	B	C	D	E	F	G	H	I	J
1	TABLE								Revised:	6-Dec
2	WATER EXPENSES (mill. JD)									
3	YARMOUK / ADASIYYA / UNITY - NORTH DIRECTORATE									
4	Item		1995	1996	1997	1998	1999	2000	2001	2002
5										
6	Operating Expenses									
7	Variable Operating Expenses									
8	External Pumping Cost		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
9	Electricity for Pumping Stations		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
10	Fuel		0.000	0.009	0.007	0.007	0.007	0.007	0.007	0.006
11	Total Variable Costs		0.000	0.009	0.007	0.007	0.007	0.007	0.007	0.006
12										
13	Fixed Cash Operating Expenses									
14	Salaries & Wages		0.000	0.078	0.061	0.060	0.063	0.057	0.058	0.053
15	Rent		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
16	Temporary Labor		0.000	0.011	0.010	0.010	0.010	0.009	0.009	0.008
17	Social Security - Unclassified		0.000	0.005	0.004	0.004	0.004	0.004	0.004	0.003
18	Travel		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
19	Communications		0.000	0.001	0.002	0.002	0.002	0.002	0.002	0.002
20	Insurance		0.000	0.002	0.001	0.001	0.001	0.001	0.001	0.001
21	Civil Work Maintenance		0.000	0.001	0.001	0.001	0.001	0.001	0.001	0.001
22	Vehicles & Equipment Maintenance		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
23	Equipment - Spare Parts & Supplies		0.000	0.014	0.010	0.011	0.011	0.010	0.010	0.009
24	Building - Utilities		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
25	Others		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
26	Total Fixed Cash Costs		0.000	0.112	0.090	0.089	0.093	0.085	0.085	0.078
27										
28	Total Operating Expenses		0.000	0.121	0.097	0.096	0.100	0.092	0.091	0.083
29										
30	Debt Service		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
31	Total Water Expenses (mill. JD)		0.000	0.121	0.097	0.096	0.100	0.092	0.091	0.083
32										
33										
34	Annual Flow Pumped (MCM)		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Generator Fuel. This item is the expense on fuel for generating power when there is no permanent electricity supply. Fuel consumption per cubic meter of water pumped is the basis for estimating this expense:

$$\text{Fuel used per cubic meter of water (liter/m}^3\text{)} * \text{cost of fuel per liter (JD/liter).}$$

Fixed Expenses

Salaries & Wages. For this item direct salaries and wages were allocated to each cost center. To assist JVA in forecasting and adjusting this item, the number of staff in each cost center and average cost per staff were used as a basis for calculation:

$$\text{Average cost per staff (calculated for each cost center)} * \text{Number of staff.}$$

For future forecasts, this cost is adjusted by the labor inflation rate.

Rent. This item represents rent for facilities used in each cost center and is adjusted by the inflation rate to forecast future costs.

Temporary Labor. For this item direct, temporary labor was allocated to each cost center. To assist JVA in forecasting and adjusting this item, the number of staff in each cost center and the average cost per staff were used as a basis for calculation:

Average cost per staff (calculated for each cost center).

For future forecasts, this cost is adjusted by the labor inflation rate.

Social Security – Unclassified. Social Security is calculated as a percentage of Salaries & Wages. This percentage might change in the future since the number of staff on social security is increasing and the number of staff on retirement plans is decreasing. The Social Security expense is calculated according to the following:

Average percentage of social security to salaries (calculated for each cost center)
* Number of staff.

Travel Expenses. This item represents the cost of staff travel related to a certain cost center. Current travel expenses adjusted for inflation are used to forecast future costs.

Communications Expenses. This item represents the cost of telephones and other communication facilities in each cost center. Current communications expenses adjusted for inflation are used to forecast future costs.

Insurance Expenses. This item represents the cost of insuring the facilities and equipment used in each cost center. Current insurance expenses adjusted for inflation are used to forecast future costs.

Equipment Spare Parts and Supplies. Spare parts and maintenance are the expenses incurred to maintain the cost center facilities. Forecasting spare parts and maintenance is based on the trends of previous years' expenses. Data that are available on existing projects may be used for forecasting expenses for future projects that are similar in nature. The forecast includes a variable for future change in expenses.

(Current/estimated spare parts and maintenance including labor cost) * Change in maintenance * Inflation rate.

Civil Work Maintenance. This item covers both labor and spare parts used in maintaining the facilities. Forecasting civil work maintenance is based on the current level of expenses adjusted for inflation.

Current civil work maintenance * Change in maintenance * Inflation rate.

Vehicles and Equipment Maintenance. This item represent the direct cost of maintaining vehicles and equipment except for spare parts. The forecasting for this item is based on the current value of vehicles and equipment maintenance adjusted for inflation.

Building Utilities. Expenses on utilities include fuel for central heating, oil and lubricants, water supply, electricity for lighting, and services. Forecasting expenses on utilities is based on previous trends adjusted for inflation.

Other Expenses. This includes any other expenses that are not part of the above cost components. Future forecasts are adjusted for inflation.

Debt Service

According to JVA decision, the debt service method has been used to account for the cost of old and new projects. This method requires that the interest expenses and principal yearly payments for each project be taken into account. Both interest and principal will be calculated for government loans, local loans, and international loans. Calculations will be made separately for each cost center and will be based on the value of loans, all interest rates applicable, and a payments schedule which may reflect a special grace period or interest-only provisions.

Interest. This includes interest on amounts borrowed and commitment interest on the amount reserved by the lender for the project but not used.

Principal. Principal payments include all payments made during the year toward the principal of the loan.

CHAPTER THREE MODEL USE AND MAINTENANCE

3.1 Use of the Model

Limitations of the Model

One obvious practical limitation of the model is its size. In trying to answer all possible questions, the model can easily get too big and cumbersome. It is not an operations model that advises on daily operations or water quality blending. It is not an engineering design model that will identify project plans, specifications, and costs. Nor is it a life-cycle investment model that can more specifically weigh the monetized benefits and costs of a project investment.

However, the cost/tariff model can provide aggregate information that may be useful in further evaluation of these issues. It can provide a forecast of major expense categories by cost center and annual cash flow of the Authority, information on the quantities and timing of supply needed, and with- and without project cash flow that may be useful for a longer-term project investment analysis.

Development of Standard Planning Scenarios

It will be useful for the model operator and JVA managers to have baseline or benchmark planning scenarios from which to evaluate the merit of alternative actions. Typically two scenarios are defined for benchmarking purposes: the **No Action** future, and the **Most Likely** future.

The **No Action** future scenario usually involves a set of planning and policy assumptions whereby external things in the world continue to change (such as population growth and inflation), but there is no significant action by the organization (no new projects and no tariff increases). The purpose of this scenario is to indicate the real or implied cost of inaction, such as water shortages and financial deficits, and to help motivate decision-makers to take timely and appropriate actions.

The **Most Likely** future scenario encompasses a set of planning and policy assumptions by the model operator and policy-makers on what they expect to happen in the future. This usually embodies continuance of recent trends, the implementation of planned projects, tariff changes to meet revenue targets, and other expected actions.

Variations on Most Likely Future

From these two benchmark scenarios, the model operator and policy-maker can examine alternative actions and other scenarios such as:

- What happens if the Authority grows faster or slower?
- What happens to system revenue if water use patterns change?

The model's predicted outcome under these planning and policy variations can then be compared to the no action and most likely scenarios to see how changes in the underlying assumptions might affect the viability of no action or anticipated actions.

3.2 Model Modifications

Annual Updating and Modifications

At the beginning of each new fiscal or calendar year, several annual updating changes will be required to keep the model current:

- The year just passed will now be a historical year instead of a forecast year. It will be important to keep the historical data as current and accurate as possible as it will be the source of useful trend information for future calculations and it will guide future planning assumptions.
- The projected data should be replaced with historical data as available, and the cells of this new historical column of data should be colored gray to signify its historical character.
- To maintain the length of the future-planning horizon, a new future year should be specified at the end of the planning period. This can be accomplished by selecting column of the previous last year, say year 2002, and copying it to the next blank column to the right, as the basis for the year 2003. Prior to copying the column, the operator should <Page Down> through the sheet to make sure that the copying of the new column of formulas does not over-write any needed information.

Planning, Policy, and Project Changes and Sequence of Modifications

The JVA model is not fully automatic. It requires the intervention of the model operator or policy-maker to make new decisions given changes in the underlying conditions. For instance, providing for increase in water demand growth without an increase in water supply may require the user to make new decisions about rationing available water supplies; or by allowing new water supplies to become available, the user may need to decide how much water to get from what source. In addition, any underlying changes that increase or decrease system costs may require a corresponding change in tariffs to reach desired revenue recovery goals.

In general when confronted with a change in the underlying model parameters, the user should first ask would this change affect water demands, water supplies, system costs, and/or system revenues? Think through the likely effects first, as this will likely be the best guide on what portions of the model need checking.

A good standard procedure for recalibrating the model after an underlying parameter is changed is:

- Check the factor most affected by the parameter and ask Did it change in the expected fashion. For instance, if the price per kWh of electricity increases 5%, did the predicted electricity costs for the subsequent year also increase in roughly the same amount? If not, check for formula errors or unexpected changes in other parameters affecting this variable. Then,
- Go to the water balance tables. Changes in factors affecting either water demand or supply will be reflected in a new water deficit or surplus situation. A change in either one of these conditions will require the user to make new decisions about demand rationing or supply allocation to rebalance demands that can be met with available supplies, or to decide from which source supplies are obtained. Then,
- Ask, would the parameter change affect the cost at one of the cost centers identified in the model? If so, has the cost of that activity changed in rough accordance with expectations? Finally,
- Ask, would the parameter change necessitate a change in the tariffs to maintain revenue recovery at the desired target goal? If so, a change in tariffs may be required to finish the recalibration of the model.

Cautions on Changes

A good understanding of electronic spreadsheets is one of the most important skills for the successful model operator. Unfortunately some of these skills cannot be effectively taught, but are only understood and learned after an error has occurred. For this reason, it is always prudent to have recent backup copies of the model. The model is easy to edit for the skilled user and large portions of the model are not write-protected. Because of this, several cautions are warranted:

- Are the worksheets grouped in such a way that the changes I am about to make to the one sheet I want to revise will unintentionally affect many sheets at once?
- Have I thought through the effect of deleting or adding a row? Is there any other information to the right (off the view of the screen) that will be lost if I delete a row? Will I be changing the standard table structure on one sheet instead of all similar sheets if I add a row)?
- Have I thought through the effect of deleting or adding a column? (There are not many good reasons to do this, if at all.)
- Does the formula I am about to copy contain a relative or absolute cell reference that is desired in the copied formula, or alternatively, does it need such a fixed reference?

- Before I save the file, do I want to Save As under an alternative file name to protect my original file?

3.3 Backup

The model requires update at least annually. Accordingly, a backup should be prepared for the new version of the model and labeled properly as per procedure. Backup should be done for all scenarios prepared by the model operator.

The operator should prepare new backup copy for any changes that occur during the year and for all new scenarios requested by management. Keep all backup copies properly documented so the model operator can retrieve the appropriate scenario and readily understand the parameter settings that define that scenario.

3.4 Printing

Printouts of the all worksheets of the model should be prepared annually for all scenarios, and more frequently as needed. These copies should be dated and labeled clearly to avoid any difficulties in utilizing the planning information, for example using the wrong scenario for certain decisions.

ANNEX A GLOSSARY

Absolute Cell Reference	Worksheet location of a cell or a range of cells containing values or data to use in a formula.
Adjustments to Revenue	Made on bills issued due to exemptions and expected metering errors.
Billing Collections	Amounts collected or expected to be collected from customers from current year billings.
Capital Cost	Cost of new projects, modifications, and additions to existing projects plus the cost of additional fixed assets for the year.
Cost	Amount spent or accrued for the year to cover capital expenditures or to produce water.
Customer Water Demand	Quantity of water that customers are willing to buy and consume at the current tariff.
Expense	Amount spent or accrued for the year to cover current year expenses and the cost of producing water used by customers.
Fee	Amount charged to cover services in addition to water production and delivery.
Fixed Operating Expenses	Expenses that are almost fixed for different flows of water, but vary from year to year, such as salaries and maintenance.
Global Parameter	Affects numerous items and multiple worksheets. Any change in this parameter will affect the results of the model.
Grouping (or selecting) Multiple Worksheets	Allows the user to adjust cost center items or formulas in several worksheets at the same time.
Income	Includes revenues from all types and subscriber classes and other fees and charges.
Local (or cost center) Parameter	Affects a single item or worksheet, such as average salaries or electricity for each cost center.
Links	Relation between two worksheets (or two models) where the data in one worksheet utilize information available in the other worksheet.

Net Income	Revenues from current year activities after deducting all expenses related to the current year.
Operating Expenses	Directly related to current year operations, such as electricity for pumping, fuel, and salaries.
Relative Cell Reference	Identifies a cell or a range of cells on a worksheet and tells Microsoft Excel where to look for values or data to use in a formula.
Revenue	Income accrued during the year from the sale of water to customers.
Supply Allocations	Allocation of available supplies to different stage offices and to different classes of customers.
Supply Availability	Quantity of water that is available or can be produced to meet demand.
Tariff	Rate specified for each block of usage used for pricing the quantity of water billed.
Total Demand	Quantity of water demanded by all users of the system; amount customers are willing to buy and consume at the current tariff.
Unaccounted-for Water	Percentage of water produced in the system that cannot be billed due to leakage, metering error, illegal connections, or other administrative reasons.
Variable Operating Expenses	Increase proportionally with the increase in the flow of water.
Water Pumped	Quantity of water produced from the source.
Water Use	Quantity of water used by water customers. Quantity of water pumped adjusted for leakage.
Workbook	File with many worksheets which organizes various kinds of related information.
Worksheet	Cells organized into columns and rows; a spreadsheet, always part of a workbook; the primary document used to store and work with data in Microsoft Excel.

**ANNEX B
SELECTED JVA TABLES**

**INCOME STATEMENT
JORDAN VALLEY AUTHORITY**

Item	1998	1999	2000	2001	2002
INCOME (million JD)					
Irrigation Water Revenue	0.000	0.000	0.000	0.000	0.000
Non-irrigation Water Revenue	0.000	0.000	0.000	0.000	0.000
Total Water Revenue	0.000	0.000	0.000	0.000	0.000
Less: Net Adjustments to Revenue	0.000	0.000	0.000	0.000	0.000
Un-collected Revenue	0.000	0.000	0.000	0.000	0.000
Net Water Revenue	0.000	0.000	0.000	0.000	0.000
Fee and Other Income	0.000	0.000	0.000	0.000	0.000
Total Water Income	0.000	0.000	0.000	0.000	0.000
EXPENSES (million JD)					
Operating Expenses					
Variable Operating Expenses					
External Pumping Cost	0.000	0.000	0.000	0.000	0.000
Electricity for Pumping	0.000	0.000	0.000	0.000	0.000
Generator Fuel	0.000	0.000	0.000	0.000	0.000
Total Variable Costs	0.000	0.000	0.000	0.000	0.000
Fixed Cash Operating Expenses					
Salaries & Wages	0.000	0.000	0.000	0.000	0.000
Rent	0.000	0.000	0.000	0.000	0.000
Temporary Labor	0.000	0.000	0.000	0.000	0.000
Social Security - Unclassified	0.000	0.000	0.000	0.000	0.000
Travel	0.000	0.000	0.000	0.000	0.000
Communications	0.000	0.000	0.000	0.000	0.000
Insurance	0.000	0.000	0.000	0.000	0.000
Civil Work Maintenance	0.000	0.000	0.000	0.000	0.000
Vehicles & Equipment Maintenance	0.000	0.000	0.000	0.000	0.000
Equipment - Spare Parts & Supplies	0.000	0.000	0.000	0.000	0.000
Building - Utilities	0.000	0.000	0.000	0.000	0.000
Others	0.000	0.000	0.000	0.000	0.000
Total Fixed Cash Costs	0.000	0.000	0.000	0.000	0.000
Total Operating Expenses	0.000	0.000	0.000	0.000	0.000
Debt Service	0.000	0.000	0.000	0.000	0.000
Total Water Expenses	0.000	0.000	0.000	0.000	0.000
NET INCOME (million JD)					
After Operating Expenses	0.000	0.000	0.000	0.000	0.000
After Operations & Debt Expenses	0.000	0.000	0.000	0.000	0.000
After Operating Expenses	0.0%	0.0%	0.0%	0.0%	0.0%
After Operations & Debt Expenses	0.0%	0.0%	0.0%	0.0%	0.0%

**GLOBAL MODEL PARAMETERS
JORDAN VALLEY AUTHORITY**

Item	1998	1999	2000	2001	2002
COMMON COSTS					
Electricity (JD/kWh)	[REDACTED]				
Fuel (JD/liter)					
INFLATION RATES					
Electricity/Fuels	[REDACTED]				
Salaries					
External Water					
General Other					
UNACCOUNTED-FOR (primary & secondary)					
KAC - North	[REDACTED]				
KAC - South					
BILLING COLLECTION RATES					
Irrigation	[REDACTED]				
WAJ - Amman					
S. Ghors Non-irrigation					
IMPROVED ON-FARM EFFICIENCIES (% savings from 1997 level)					
North Directorate	[REDACTED]				
Citrus					
Bananas					
Other Trees					
Vegetables					
Fodder					
Middle Directorate	[REDACTED]				
Citrus					
Bananas					
Other Trees					
Vegetables					
Fodder					
South Directorate	[REDACTED]				
Citrus					
Bananas					
Other Trees					
Vegetables					
Fodder					
S. Ghors Directorate	[REDACTED]				
Citrus					
Bananas					
Other Trees					
Vegetables					
Fodder					
Include Capital Cost? (1=yes; pick one and only one)					
None	[REDACTED]				
New					
New and Old					

**PROPOSED WATER TARIFF SCHEDULE - WINTER
JORDAN VALLEY AUTHORITY**

Item	1998	1999	2000	2001	2002
QUALITY 1 TARIFF (JD/m³)					
Usage Block Definition					
0	1,000				
1,001	2,000				
2,001	3,000				
3,001	999,999				
QUALITY 2 TARIFF (JD/m³)					
Usage Block Definition					
0	1,000				
1,001	2,000				
2,001	3,000				
3,001	999,999				
QUALITY 3 (JD/m³)					
Usage Block Definition					
0	1,000				
1,001	2,000				
2,001	3,000				
3,001	999,999				
QUALITY 4 TARIFF (JD/m³)					
Usage Block Definition					
0	1,000				
1,001	2,000				
2,001	3,000				
3,001	999,999				
DEIR ALLA TARIFF (JD/m³)					
Usage Block Definition					
0	999,999				
S. GHORS MUNICIPAL (JD/m³)					
Usage Block Definition					
0	999,999				
S. GHORS INDUSTRIAL (JD/m³)					
Usage Block Definition					
0	999,999				
S. GHORS TOURISM (JD/m³)					
Usage Block Definition					
0	999,999				

Revised:

INCOME STATEMENT
JORDAN VALLEY AUTHORITY - NORTH DIRECTORATE (Applicable for all
Directorates)

Item	1998	1999	2000	2001	2002
INCOME (million JD)					
Subscriber Water Revenue	0.000	0.000	0.000	0.000	0.000
Less: Net Adjustments to Revenue	0.000	0.000	0.000	0.000	0.000
Un-collected Revenue	0.000	0.000	0.000	0.000	0.000
Net Water Revenue	0.000	0.000	0.000	0.000	0.000
Other Income					
Total Water Income	0.000	0.000	0.000	0.000	0.000
EXPENSES (million JD)					
Operating Expenses					
Variable Operating Expenses					
External Pumping Cost	0.000	0.000	0.000	0.000	0.000
Electricity for Pumping	0.000	0.000	0.000	0.000	0.000
Generator Fuel	0.000	0.000	0.000	0.000	0.000
Total Variable Costs	0.000	0.000	0.000	0.000	0.000
Fixed Cash Operating Expenses					
Salaries & Wages	0.000	0.000	0.000	0.000	0.000
Rent	0.000	0.000	0.000	0.000	0.000
Temporary Labor	0.000	0.000	0.000	0.000	0.000
Social Security - Unclassified	0.000	0.000	0.000	0.000	0.000
Travel	0.000	0.000	0.000	0.000	0.000
Communications	0.000	0.000	0.000	0.000	0.000
Insurance	0.000	0.000	0.000	0.000	0.000
Civil Work Maintenance	0.000	0.000	0.000	0.000	0.000
Vehicles & Equipment Maintenance	0.000	0.000	0.000	0.000	0.000
Equipment - Spare Parts & Supplies	0.000	0.000	0.000	0.000	0.000
Building - Utilities	0.000	0.000	0.000	0.000	0.000
Others	0.000	0.000	0.000	0.000	0.000
Total Fixed Cash Costs	0.000	0.000	0.000	0.000	0.000
Total Operating Expenses	0.000	0.000	0.000	0.000	0.000
Debt Service	0.000	0.000	0.000	0.000	0.000
Total Water Expenses	0.000	0.000	0.000	0.000	0.000
NET INCOME (million JD)					
After Operating Expenses	0.000	0.000	0.000	0.000	0.000
After Operations & Debt Expenses	0.000	0.000	0.000	0.000	0.000
After Operating Expenses	0.0%	0.0%	0.0%	0.0%	0.0%
After Operations & Debt Expenses	0.0%	0.0%	0.0%	0.0%	0.0%

WATER DEMAND BY DIRECTORATE AND STAGE OFFICE - WINTER (Same for Summer)
JORDAN VALLEY AUTHORITY

Item	1998	1999	2000	2001	2002	2003
North Directorate						
Stage Office #1	0.000	0.000	0.000	0.000	0.000	0.000
Stage Office #7	0.000	0.000	0.000	0.000	0.000	0.000
Stage Office #2	0.000	0.000	0.000	0.000	0.000	0.000
North Directorate Demand - Winter	0.000	0.000	0.000	0.000	0.000	0.000
Middle Directorate						
Stage Office #3	0.000	0.000	0.000	0.000	0.000	0.000
Stage Office #8	0.000	0.000	0.000	0.000	0.000	0.000
Stage Office #4	0.000	0.000	0.000	0.000	0.000	0.000
Stage Office #5	0.000	0.000	0.000	0.000	0.000	0.000
Middle Directorate Demand - Winter	0.000	0.000	0.000	0.000	0.000	0.000
South Directorate						
Stage Office #6	0.000	0.000	0.000	0.000	0.000	0.000
Stage Office #9	0.000	0.000	0.000	0.000	0.000	0.000
Stage Office #10	0.000	0.000	0.000	0.000	0.000	0.000
South Directorate Demand - Winter	0.000	0.000	0.000	0.000	0.000	0.000
S. Ghors Directorate - Winter	0.000	0.000	0.000	0.000	0.000	0.000
Total JVA Water Demand - Winter	0.000	0.000	0.000	0.000	0.000	0.000
Deir Alla Diversion - Winter	0.000	0.000	0.000	0.000	0.000	0.000
S. Ghors Municipal - Summer	-	-	-	-	-	-
S. Ghors Industrial - Winter	-	-	-	-	-	-
S. Ghors Tourism - Winter	-	-	-	-	-	-
Total JVA Water Demand & Deir Alla - Winter	0.000	0.000	0.000	0.000	0.000	0.000

**IRRIGATED AREA, APPLICATION RATES, AND WATER DEMAND - WINTER
STAGE OFFICE #1 - NORTH DIRECTORATE**

Item	1998	1999	2000	2001	2002	2003	
Irrigated Area (dunums)							
Citrus							
Bananas							
Other Trees							
Vegetables							
Fodder							
Total Planted Area - Winter	0	0	0	0	0	0	
Water Application Rates (m³/dunums)							
Citrus							0.0
Bananas							0.0
Other Trees							0.0
Vegetables							0.0
Fodder							0.0
Average Application Rate - Winter	0.0	0.0	0.0	0.0	0.0	0.0	
Water Demand by Crop Type (mcm)							
Citrus	0.000	0.000	0.000	0.000	0.000	0.000	
Bananas	0.000	0.000	0.000	0.000	0.000	0.000	
Other Trees	0.000	0.000	0.000	0.000	0.000	0.000	
Vegetables	0.000	0.000	0.000	0.000	0.000	0.000	
Fodder	0.000	0.000	0.000	0.000	0.000	0.000	
Stage Water Demand - Winter	0.000	0.000	0.000	0.000	0.000	0.000	

**WATER USE DISTRIBUTION PERCENTAGES BY BLOCK - WINTER
DETAILED SCHEDULE**

Usage Block	1998	1999	2000	2001	2002	2003
STAGE 1						
0	1,000					
1,001	2,000					
2,001	3,000					
3,001	4,000					
4,001	5,000					
5,001	6,000					
6,001	7,000					
7,001	8,000					
8,001	9,000					
9,001	10,000					
10,001	999,999					
Total Stage		0.0%	0.0%	0.0%	0.0%	0.0%

Revised:

SYSTEM WATER DEMAND AND SUPPLY BALANCE - WINTER (Same for Summer)

JORDAN VALLEY AUTHORITY

Item	1998	1999	2000	2001	2002
WATER DEMANDS (MCM)					
Stage 1					
Stage 7					
Stage 2					
Stage 3					
Stage 8					
Deir Alla Diversion					
Stage 4					
Stage 5					
Stage 6					
Stage 9					
Stage 10					
S. Ghors Irrigation					
S. Ghors Municipal					
S. Ghors Industrial					
S. Ghors Tourism					
<hr/>					
Total Winter System Demand					
AVAILABLE SUPPLIES (MCM)*					
Yarmuk/Adasiyya/Unity					
North Conveyor					
Mukeiba					
Wadi Arab Reservoir (watershed + carryover)					
Taibeh					
Ziglab					
Abu Ziad					
Jurum					
Yabis					
Kufranja					
Wadi Rajib					
King Talal Reservoir					
Karamah Reservoir					
Shueib Reservoir					
Kafrein/Hisban					
Hasa + Fifa + Khnezeira + Ain Maghara					
Mujib/Wala					
Wadi Araba					
<hr/>					
Total Winter System Supplies					

WINTER SURPLUS (DEFICIT) IN MCM

* Supplies adjusted downwards for average amount of spills, other water lost to the system, and water rights.

**PERCENT ALLOCATION OF SUPPLIES - WINTER
JORDAN VALLEY AUTHORITY**

Item	1998	1999	2000	2001	2002
Wadi Arab					
to Stage 7					
to KAC					
remains in storage					
Total Wadi Arab					
Ziglab					
to Stage 7					
remains in storage					
Total Ziglab					
Jurum					
to Stage 7					
to KAC					
remains in storage					
Total Jurum					
KTR					
to Stage 8					
to Stage 4					
to Stage 5					
to KAC					
remains in storage					
Total KTR					
Karamah					
to KAC					
remains in storage					
Total Karamah					
Shueib					
to Stage 9					
remains in storage					
Total Shueib					
Kafrein					
to Stage 10					
remains in storage					
Total Kafrein					
Mujeb					
to SG					
remains in storage					
Total Kafrein					

**WATER SUPPLY ALLOCATIONS - WINTER
JORDAN VALLEY AUTHORITY**

Item	1998	1999	2000	2001	2002
Initial Supplies to KAC					
Yarmuk/Adisayya/Unity					
North Conveyor					
Mukeiba					
(minus Wadi Arab pump-back)					
plus Wadi Arab release to KAC					
Total Initial KAC Available Supply					
Stage 1 - Winter					
Stage Demands					
Supplies Available					
Remaining KAC					
Total Available Supply					
Water Surplus/Deficit					
% of Stage Demand to be Met					
Stage Water Use					
Net Water Surplus/Deficit					
Stage 7 - Winter					
Stage Demands					
Supplies Available					
KAC to Stage 7					
Wadi Arab (not through KAC)					
Ziglab (not through KAC)					
Jurum (not through KAC)					
Total Available Supply					
Water Surplus/Deficit					
% of Stage Demand to be Met					
Stage Water Use					
Net Water Surplus/Deficit					
Stage 2 - Winter					
Stage Demands					
Supplies Available					
Remaining KAC					
Tiebeh					
Abu Ziad					
Jurum (to KAC)					
Yabis					
Total Available Supply					
Water Surplus/Deficit					
% of Stage Demand to be Met					
Stage Water Use					
Net Water Surplus/Deficit					

NORTH DIRECTORATE

Stage 3 - Winter

Stage Demands

Supplies Available

Remaining KAC

Total Available Supply

Water Surplus/Deficit

% of Stage Demand to be Met

Stage Water Use

Net Water Surplus/Deficit

Stage 8 - Winter

Stage Demands

Supplies Available

KAC to Middle Ghors (P63 & P65)

Kufranja (not through KAC)

Wadi Rajib

KTR (ZC1 not through KAC)

Total Available Supply

Water Surplus/Deficit

% of Stage Demand to be Met

Stage Water Use

Net Water Surplus/Deficit

Less KAC - Wasted

Less KAC - North Unaccounted-for water

Deir Alla Diversion - Winter

Amman Demand

Supplies Available

Remaining KAC

Total Available Supply

Water Surplus/Deficit

% of Stage Demand to be Met

Stage Water Use

Net Water Surplus/Deficit

Stage 4 - Winter

Stage Demands

Supplies Available

Remaining KAC water from earlier diversion

KTR (ZC2 not through KAC)

Total Available Supply

Water Surplus/Deficit

% of Stage Demand to be Met

Stage Water Use

Net Water Surplus/Deficit

Stage 5 - Winter

Stage Demands	
Supplies Available	
Remaining KAC water from earlier diversion	
KAC to Stage 5	
KTR to KAC SOUTH	
KTR (ZC2 not through KAC)	
Total Available Supply	
<hr/>	
Water Surplus/Deficit	
<hr/>	
% of Stage Demand to be Met	
Stage Water Use	
<hr/>	
Net Water Surplus/Deficit	

MIDDLE
DIRECTORATE

SOUTH
DIRECTORATE

(Minus Karamah gravity flow from KAC)	
Plus Karamah pump Release to KAC	
Flushing release to river	

Stage 6 - Winter

Stage Demands	
Supplies Available	
Remaining KAC*	
Total Available Supply	
<hr/>	
Water Surplus/Deficit	
<hr/>	
% of Stage Demand to be Met	
Stage Water Use	
<hr/>	
Net Water Surplus/Deficit	

Stage 9 - Winter

Stage Demands	
Supplies Available	
Remaining KAC	
Shueib	
Total Available Supply	
<hr/>	
Water Surplus/Deficit	
<hr/>	
% of Stage Demand to be Met	
Stage Water Use	
<hr/>	
Net Water Surplus/Deficit	

Stage 10 - Winter

Stage Demands	
Supplies Available	
Remaining KAC (future only)	
Kafrein/Hisban (not through KAC)	
Total Available Supply	
<hr/>	
Water Surplus/Deficit	

% of Stage Demand to be Met 
Stage Water Use

Net Water Surplus/Deficit

KAC - South Special Pumps
KAC - South Wasted
Unaccounted-for Water - South KAC

Net Water Surplus/Deficit (KAC final discharge)

Southern Ghors Directorate - Winter

Stage Demands
Supplies Available
 Hasa + Fifa + Khnezeira + Ain Maghara
 Mujib
 Wadi Araba

Total Available Supply

Water Surplus/Deficit

% of Stage Irrigation Demand to be Met 

Irrigation Water Use
Municipal Water Use
Industrial Water Use
Tourism Water Use
Stage Water Use

Net Water Surplus/Deficit

WATER EXPENSES (mill. JD)
SOURCES - NORTH DIRECTORATE (Applicable for all Directorates)

Item	1998	1999	2000	2001	2002
Operating Expenses					
Variable Operating Expenses					
External Pumping Cost					
Electricity for Pumping					
Fuel					
Total Variable Costs					
Fixed Cash Operating Expenses					
Salaries & Wages					
Rent					
Temporary Labor					
Social Security - Unclassified					
Travel					
Communications					
Insurance					
Civil Work Maintenance					
Vehicles & Equipment Maintenance					
Equipment - Spare Parts & Supplies					
Building - Utilities					
Others					
Total Fixed Cash Costs					
Total Operating Expenses					
Debt Service					
Total Water Expenses (mill. JD)					
Annual Flow - Pumped (MCM)					
Annual Flow - Gravity (MCM)					
Annual Flow (MCM)					
Unit Cost (JD/m ³)					

WATER EXPENSES (mill. JD)
SECONDARY - NORTH DIRECTORATE (Applicable for all Directorates)

Item	1998	1999	2000	2001	2002
------	------	------	------	------	------

Operating Expenses

Variable Operating Expenses

- External Pumping Cost
- Electricity for Pumping
- Fuel

Total Variable Costs

Fixed Cash Operating Expenses

- Salaries & Wages
- Rent
- Temporary Labor
- Social Security - Unclassified
- Travel
- Communications
- Insurance
- Civil Work Maintenance
- Vehicles & Equipment Maintenance
- Equipment - Spare Parts & Supplies
- Building - Utilities
- Others

Total Fixed Cash Costs

Total Operating Expenses

Debt Service

Total Water Expenses (mill. JD)

- Annual Flow - Pumped (MCM)
- Annual Flow - Gravity (MCM)
- Annual Flow (MCM)
- Unit Cost (JD/m³)

**FACILITY FORECAST PARAMETERS AND MANAGEMENT EFFICIENCIES
SECONDARY - NORTH DIRECTORATE (Applicable for all Directorates)**

Item	2001	2002		
Variable Operating Costs				
External Water Sources				
Unit Cost (JD/m ³)				
Electricity				
Current Consumption (KWH/m ³)				
Project 1 Consumption (KWH/m ³)				
Project 2 Consumption (KWH/m ³)				
Project 3 Consumption (KWH/m ³)				
Fuel				
Quantity (Liter)				
Fixed Operating Costs				
Salaries & Wages				
Current Staff				
Project 1 Change in Number of Staff				
Project 2 Change in Number of Staff				
Project 3 Change in Number of Staff				
Management Changes in Staff				
Average Cost per Staff (JD)				
Temporary Labor				
Current Staff				
Management Changes in Staff				
Average Cost per Staff (JD)				
Social Security Payments				
% of SS to Salaries & Wages				
Project 1 Change in Maintenance				
Project 2 Change in Maintenance				
Project 3 Change in Maintenance				

WATER EXPENSES (mill. JD)
KAC - NORTH DIRECTORATE (Applicable for all Directorates)

Item	1998	1999	2000	2001	2002
Operating Expenses					
Variable Operating Expenses					
External Pumping Cost					
Electricity for Pumping					
Fuel					
Total Variable Costs					
Fixed Cash Operating Expenses					
Salaries & Wages					
Rent					
Temporary Labor					
Social Security - Unclassified					
Travel					
Communications					
Insurance					
Civil Work Maintenance					
Vehicles & Equipment Maintenance					
Equipment - Spare Parts & Supplies					
Building - Utilities					
Others					
Total Fixed Cash Costs					
Total Operating Expenses					
Debt Service					
Total Water Expenses (mill. JD)					
Annual Flow - Pumped (MCM)					
Annual Flow - Gravity (MCM)					
Annual Flow (MCM)					
Unit Cost (JD/m ³)					

WATER EXPENSES (mill. JD)
PUMPING - NORTH DIRECTORATE (Applicable for all Directorates)

Item	1998	1999	2000	2001	2002
Operating Expenses					
Variable Operating Expenses					
External Pumping Cost					
Electricity for Pumping					
Fuel					
Total Variable Costs					
Fixed Cash Operating Expenses					
Salaries & Wages					
Rent					
Temporary Labor					
Social Security - Unclassified					
Travel					
Communications					
Insurance					
Civil Work Maintenance					
Vehicles & Equipment Maintenance					
Equipment - Spare Parts & Supplies					
Building - Utilities					
Others					
Total Fixed Cash Costs					
Total Operating Expenses					
Debt Service					
Total Water Expenses (mill. JD)					
Annual Flow - Pumped (MCM)					
Annual Flow - Gravity (MCM)					
Annual Flow (MCM)					
Unit Cost (JD/m ³)					

WATER EXPENSES (mill. JD)
YARMOUK / ADASIYYA / UNITY - NORTH DIRECTORATE (Applicable to all Sources)

Item	1998	1999	2000	2001	2002
Operating Expenses					
Variable Operating Expenses					
External Pumping Cost					
Electricity for Pumping Stations					
Fuel					
Total Variable Costs					
Fixed Cash Operating Expenses					
Salaries & Wages					
Rent					
Temporary Labor					
Social Security - Unclassified					
Travel					
Communications					
Insurance					
Civil Work Maintenance					
Vehicles & Equipment Maintenance					
Equipment - Spare Parts & Supplies					
Building - Utilities					
Others					
Total Fixed Cash Costs					
Total Operating Expenses					
Debt Service					
Total Water Expenses (mill. JD)					
Annual Flow - Pumped (MCM)					
Annual Flow - Gravity (MCM)					
Annual Flow (MCM)					
Unit Cost (JD/m ³)					

WATER EXPENSES (mill. JD)
CENTRAL DIRECTORATE/WORKSHOP

Item	1998	1999	2000	2001	2002
Operating Expenses					
Variable Operating Expenses					
External Pumping Cost					
Electricity for Pumping					
Fuel					
Total Variable Costs					
Fixed Cash Operating Expenses					
Salaries & Wages					
Rent					
Temporary Labor					
Social Security - Unclassified					
Travel					
Communications					
Insurance					
Civil Work Maintenance					
Vehicles & Equipment Maintenance					
Equipment - Spare Parts & Supplies					
Building - Utilities					
Others					
Total Fixed Cash Costs					
Total Operating Expenses					
Debt Service					
Total Water Expenses (mill. JD)					
Annual Flow - Pumped (MCM)					
Annual Flow - Gravity (MCM)					
Annual Flow (MCM)					
Unit Cost (JD/m ³)					

WATER EXPENSES (mill. JD)
ALLOCATION PERCENTAGES OF
CENTRAL/WORKSHOP DIRECTORATES COSTS

Item	1998	1999	2000	2001	2002
Primary Sources					
North Directorate					
Secondary					
KAC					
Pumping					
Middle Directorate					
Secondary					
KAC					
Pumping					
South Directorate					
Secondary					
KAC					
Pumping					
Southern Ghors Directorate					
Secondary					
KAC					
Pumping					
Total JVA					

WATER EXPENSES (mill. JD)**ALLOCATION % OF CENTRAL/WORKSHOP DIRECTORATES COSTS TO PRIMARY SOURCES**

Item	1998	1999	2000	2001	2002
NORTH DIRECTORATE					
Yarmuk/Adasiyya/Unity					
North Conveyor					
Mukeiba					
Wadi Arab Reservoir (watershed + carryover)					
Taibeh					
Ziglab					
Abu Ziad					
Jurum					
Yabis					
TOTAL NORTH DIRECTORATE					
MIDDLE DIRECTORATE					
Kufranja					
Wadi Rajib					
Deir Alla					
King Talal Reservoir					
TOTAL MIDDLE DIRECTORATE					
SOUTH DIRECTORATE					
Karamah Reservoir					
Shueib Reservoir					
Kafrein/Hisban					
TOTAL SOUTH DIRECTORATE					
SOUTHERN GHORS DIRECTORATE					
Hasa + Fifa + Khnezeira + Ain Maghara					
Mujeb					
Wadi Araba					
TOTAL SOUTHERN GHORS DIRECTORATE					
TOTAL					