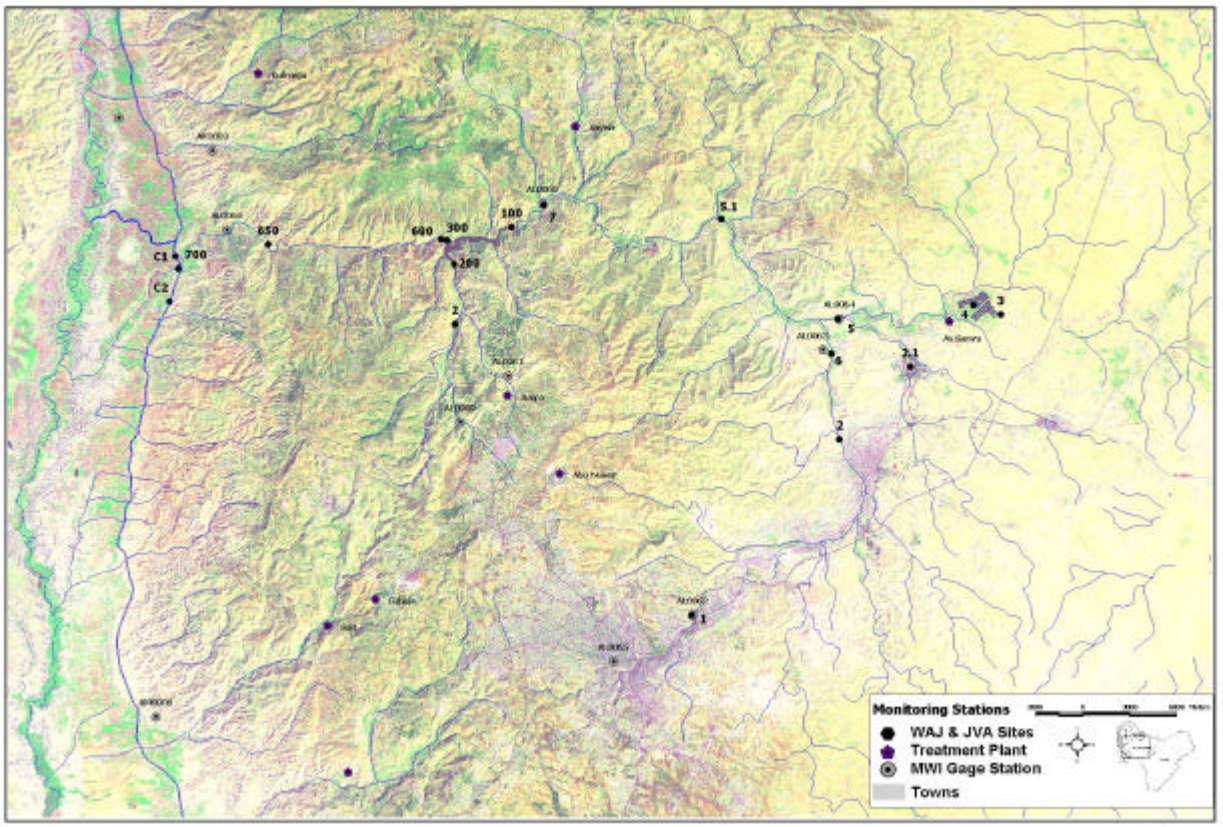
MINISTRY OF WATER AND IRRIGATION

Water Resource Policy Support



Gaging stations and water quality sampling sites in the Amman-Zarqa and adjacent basins

MONITORING & INFORMATION MANAGEMENT PERTAINING TO WATER REUSE IN JORDAN

WATER REUSE COMPONENT

November, 2000

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Executive Summary

This working paper is designed to guide future efforts in The Ministry of Water and Irrigation (MWI) toward water reuse monitoring and information management. These efforts should be focused on increasing efficiency and standardizing methods in which water quality information flows into Ministry and through the various directorates involved in water reuse monitoring. The structure of the document is a compilation of tools and documents that will aid the Ministry in its efforts. As the topics that need to be addressed range from National water quality standards to specific database parameter specification, a working Model is presented to organize high priority activities and outline tangible indicators to monitor progress on these activities.

Working within the Model's framework, advancements have been made toward specific goals. This includes interviews with MWI and identified collaborative organizations, standardizing database structure and parameters for water quality entry, and developing formalized inter-institutional and MWI information flows.

There is a large amount of monitoring data relevant to water reuse being collected in Jordan and a well-developed monitoring infrastructure is in place. Thus, actions have been focus on establishing flows of water quality data into the Ministry on a regular basis and not on the physical structures and mechanisms to collect data.

Some activities to develop an effective monitoring system in MWI may require a long term commitment by Ministry staff and will have longer time frames for completion. However, many activities can be addressed immediately and advancements have been made towards the completion of these activities in the previous month. Actions to date are clearly outlined in this document and supporting data and documents are provided to proceed.

It is strongly recommended that the Ministry continue with water quality data migration to the MWI Oracle database. The next steps in this process are to clarify current parameter coding for identified parameters and formalize information transfer between collaborative organizations. This may require the short term inputs of a consultant specialized in Chemistry and database formatting.

If this document and the working Model are utilized they will facilitate a structured and monitored process to enhance the Ministry's ability to monitor water quality of surface waters pertinent to the reuse of water in Jordan.

I. Introduction

1.Objective

This document's main objective is to present a potential Monitoring and Information Management framework to enhance the Ministry of Water and Irrigation's ability to efficiently gather, access and utilize data specific to water reuse in the Amman-Zarqa and Middle Jordan Valley basins.[1]

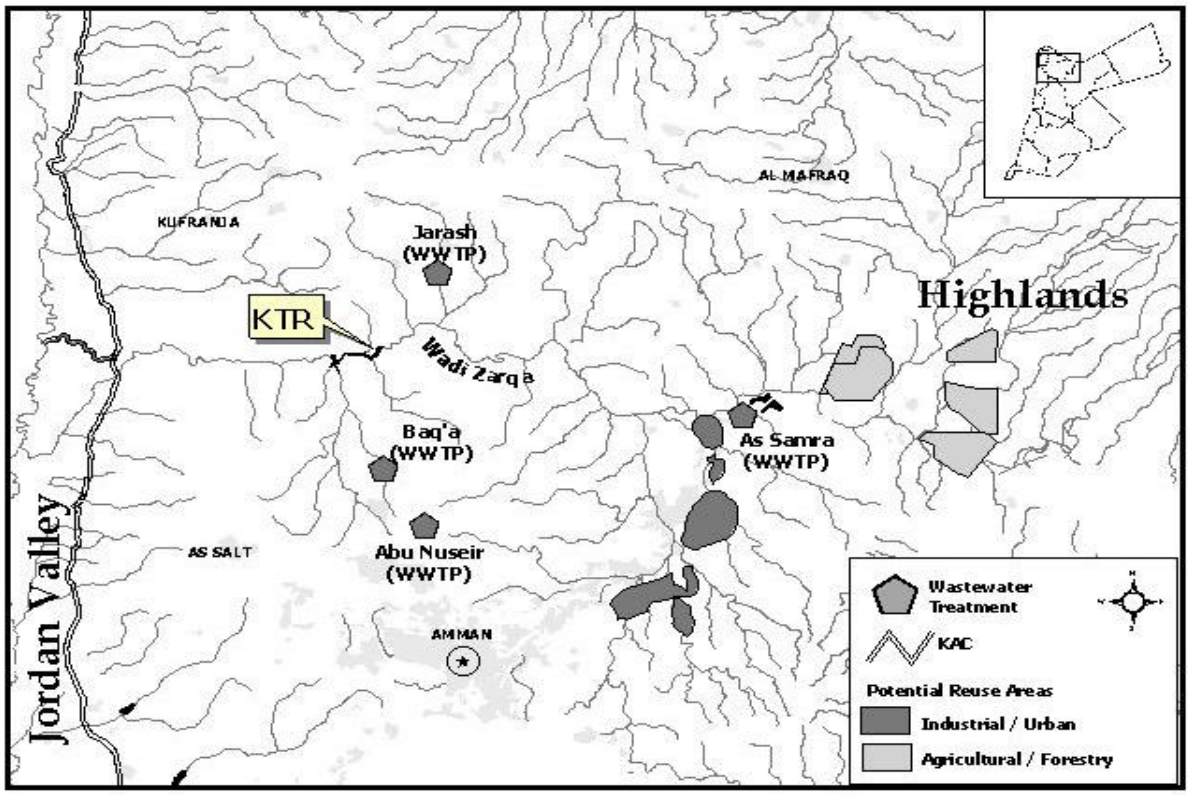

Figure 1*:* Area of Focus for Water Reuse Component in Water Resource Policy Support Project.

2. Methodology

The methodology used for the production of the working paper was characterized by its participatory nature, the acquiring of primary data and the use of available secondary data.

Its main components included[2]:

- Identification of main monitoring "collaborative organizations" and key informants (end users) with MWI and ARD[3]
- Individual Key informant interviews to assess current monitoring practices

[1] See Appendix A: Scope of Work
[2] See Appendix B: Working Notes
[3] Collaborative organizations are organizations that collect and analyze water quality data and have the potential to provide this data to MWI.

- Joint information exchange meetings with key informants to current monitoring challenges
- Collection of existing institutional organograms of the MWI and collaborative organizations to compare, contrast and socialize
- Analysis of existing information flow networks between MWI and "collaborative organizations" to identify limitations
- Analysis of existing MWI and "collaborative organizations" database structures to identify existing formats
- Analysis of key water quality parameters in current use by MWI and collaborative organizations to identify existing available monitoring parameters
- Validation meetings with MWI, ARD and collaborative organizations in order to discuss and guide the potential framework construction.

2.1 Methodological Strengths

- Tangible advancements towards over all working model objective
- Indicator based advancements to chart progress
- Collection of primary data in terms of end users and their needs
- Socialization of institutional structures

2.2 Methodological limitations

- Limited time frame of analysis
- Raising of expectations among key informants
- Limited access to key personnel

3. Definitions

Management Information System (MIS)

Information management is commonly looked at from a "systems" perspective. The MIS includes collecting, storing, retrieving and socializing data that is used or designed by one or more managers in the performance of their duties. A MIS often uses computers as tools for storing retrieving and analyzing data to create useful information for project purposes.

The following items are necessary for effective information management.

- Efficient collection of pertinent information.
- Standards for data transfer between institutions or within institutions.
- Infrastructure for data transfer.
- Established channels of information flow.

Utilization of Management Information Systems

- Every person needs information to perform his/her duty
- Different jobs requite different levels of information
- Basis for monitoring and evaluation system
- Assessment of information needed at different project cycle stages

Monitoring

Monitoring can be divided into two components. The first component is the identification of the parameters and indicators that will be monitored throughout the project's implementation. An indicator is a yardstick to measure change and it is developed once project objectives and activities are identified. The second is the physical network of protocols, formats, collection mechanisms, monitoring stations, data transfer and data storage. These components deal mainly with the infrastructure needed to effectively monitor key indicators and the flow of information through the various structures in the network. This can include hardware such as monitoring stations and computers and software such as Oracle and Access. Thus, the physical infrastructure is designed to facilitate the flow, at specified time intervals, of monitoring information to decision-makers

II. Working Model[4]

Central to this working paper was the development of a *Working Model or Program Planning Matrix (PPM).*[5] The model is intended to organize efforts and monitor advancements towards specific activities. The Model outlines specific activities that need to take place to reach a main goal. In some cases advancements were made on activities and are highlighted in the Model. Other activities may take more time to advance on but clear indicators are presented to act as a checklist for advancements. The format of the Model is by no means static and new activities and indicators can be added. In addition, the PPM can be applied to other planning situations where there are complex planning issues.

The Model's main goal is to support monitoring activities specific to water reuse in the Amman-Zarqa and middle Jordan valley basins. Its main strategy is to organize and facilitate a dynamic process to reach the goal.

The following are specific characteristics inherent in the Model. It is a tool:

- to outline current situations with MWI and collaborative organizations;
- that will facilitate the organization of thoughts; and,
- that will help its participants formulate action plans.

Activities and Desired Results Developed in the Model

The following are the tentative activities and projected results the Model seeks to promote.

- *Develop and set water quality standards for the use of recycled water resources.*

[4] See Appendix C: Working Model Framework
[5] For the purpose of this document PPM and Working Model are considered analogous.

This result will take place at the National level with the input of various monitoring institutions in Jordan. This is an essential step in achieving a viable monitoring system, as it will act as the "ruler" to which key monitoring parameters will be measured.

Some potential activities to reach the above mentioned goal are to identify organizations utilizing water quality standards and develop a water quality standard steering committee.[6] As water quality standards are updated regulations for the enforcement of these standards must be revised accordingly.

- *Develop and set standardized protocols for database entry in the MWI for water quality data.*

As potential water quality data will come from a variety of collaborative organizations it is essential to develop standardized protocols and parameters in MWI that will facilitate efficient and accurate updates to the system.

To assure data quality and efficient up-dates a review existing entry and protocol standards must take place. The current structure must then be compared to International analytical methods and the current parameter coding in MWI and then socialized with MWI staff for adoption. If a revised method is acceptable then data entry formats based on international analytical methods and updated parameter coding must be developed. The final step will be to input standardized water quality data into the MWI database.

- *Formalized Institutional information flow networks*

Within MWI various directorates will have specific needs to monitor water quality and may require access to all of the data or sub-sets of data depending on their needs. Most importantly MWI staff must know what data is available to them and have the proper hardware, software and training to access the data that they will then process into information.

Potential steps to formalize information flow in MWI include, an assessment of current MWI information flow, installation of software and hardware for data retrieval and identification of end-users of water quality data.

- *Formalized inter-institutional information flow network*

Water quality data is collected by organizations under the umbrella of MWI and in some cases by hired contractors. Currently this data is socialized through informal channels in formats that do not facilitate easy updates to the MWI central database.

Potential steps to formalize information flow between MWI and collaborative organizations include, assessing the inter-institutional flow networks, installing

[6] According to WAJ Central Laboratories, Amman a steering committee is in place and making efforts to revise water quality standards.

hardware and software for data entry, developing strategies for data compatibility with MWI database and developing lines of information transfer between organizations.

III. Accomplishments to Date

The methodology employed yielded the following tangible working model results:

- **List of collaborative organizations**

Six organizations have been identified as playing a role in monitoring surface water for the Zarqa and middle Jordan valley drainage basins: the Ministry of Water and Irrigation (MWI); the Water Authority of Jordan (WAJ); the Jordan Valley Authority (JVA); the Royal Scientific Society (RSS); the Ministry of Health (MOH) and, the Ministry of Agriculture (MOA). All of these organizations directly or indirectly monitor the quality of surface waters or wastewater treatment plants in the area of focus for this study.

- **Individual organization water quality standards**

Collaborative organizations were contacted that could potentially provide water quality data to MWI and a list of key quality parameters was compiled for organizations that could potently provide data. Appendix D contains lists of parameters organized by collaborative organization. MWI has assigned codes to a list of approximately 700 parameters to facilitate entry into its database. It should be noted here that for the MWI database the units are tied to the specific parameter. This is an import aspect to consider when transferring data into the MWI database as the selection of the proper code not only determines the element but the units of measure as well. As this list is extensive it is included on a disk that accompanies this report. (Parametercode_unit.xls)

- **List of MWI and collaborative organization personnel involved in database entry**

Appendix E contains a list of key personnel involved in the compilation and storage of key water quality data in their respective organizations and associated contact information.

- **International Standards and Methods for Water Quality Data**

To standardize Parameters and Methods the book, “Standard Methods: For the Examination of Water and Waste Water” 19th Edition 1995, edited by, Eaton A., Clesceri L., and Greenberg A., was utilized. This book provides uniform methods of analysis for all elements related to water and wastewater testing. After review of the various organizations that monitor water in Jordan, it was discovered that this text is used consistently across organizations. In fact, this book is consistent with international standards for water and wastewater testing. Appendix F contains copyright information for the book and a table of contents.

- **Print out of current MWI database structure for analytical methods**

As advances were made to transfer historical RSS water quality data into the MWI database, inconsistencies were discovered with the analytical method codes used for each parameter. This is a required field in the MWI database as it defines clearly the methods used to analyze parameters. The correct analytical method associated with each parameter adds value to the data. Appendix G contains an example of some inconstancies identified with current methods. The inconstancies can be overcome by adding new unique codes to the database, which clearly cite the analytical method. However, before adding new codes it is essential to review the existing codes to avoid the duplication of coding.

- **Document that records inconsistencies and sets forth new analytical methods**

In preparation for RSS data migration Ramzi Sabella and Andrew Alspach have prepared a document that outlines current MWI Analytical Methods and compares the methods used by RSS current information in the database. In addition, if an exact match to current methods is not achieved then it is recommended that a new MWI code should be established. Appendix H contains this document.

- **Document that records importance of parameter coding for data transfer**

Ramzi Sabella (Water reuse Engineer-ARD) and Andrew Alspach have clarified parameter coding for data migration to MWI database for historic RSS monitoring station data. The need to match MWI parameter coding with new data sources is essential for accurate data migration. As mentioned earlier in this document, the MWI parameter code includes both units of measure and a specific element thus, new parameter codes must be developed if the element and the unit of measure do not match existing codes. See Appendix I for documentation.

- **List of MWI and collaborative organizations staff contacted**

Appendix J holds a list of contacted personnel in MWI and collaborative organizations during the period of October 9th to November 16th, 2000.

- **Meetings with identified staff**

A list of questions was developed for informal interviews with key informants. This was intended to guide the discussion but information often deviated from the list of questions as new information came available. Appendix K contains notes from the key informant interviews in questionnaire and summary form.

- **Sample data entry forms**

A sample data entry form was developed to standardize data entry formats for the MWI database. Appendix L contains a screen shot of the sample form designed in Excel. There are two key pieces of information that are needed from organizations outside of MWI for compatibility with the MWI database. 1) Identification of MWI parameter code that matches both the units and the element to be entered into MWI database. 2) Identification of the Analytical Method used to analyze each parameter.

- **Current Organogram diagrams**

Organograms where collected from MWI and collaborative organizations to depict the current working structure of organizations (Appendix M). The organograms are intended to provide a base on which to outline the flow of information between specific departments in various organizations and give an overview of the structure.

- **Tentative flow diagram of data transfer**

After contacting collaborative organizations and assessing structures and data flow, a tentative flow diagram was developed. Appendix N contains the proposed diagram and is intended to assist MWI in targeting specific organizations for water quality data.

IV. Future Steps

- The Ministry of Health collects extensive water quality data for potable water monitoring in Jordan. A monthly summary of this information in document form is provided to MWI to assist in decision making and monitoring. In addition, water quality data from wastewater treatment plants is monitored by the MOH but surface water stations are not included in their monitoring scheme. The interaction between the MOH and MWI should be examined closer. As a raw water quality data source the MOH may not be as useful as other organizations. However, as a monitoring partner MOH interaction is invaluable.

- Due to time restraints the Ministry of Agriculture was not contacted. MOA was identified as playing a role in the monitoring of water quality. Future steps should be taken to contact them and access the potential for their collaboration with MWI.

- The potential for connecting WAJ labs to the MWI database on a Wide Area Network WAN should be explored for increased data sharing. This will become more feasible after the full deployment of the Laboratory Information Management System (LIMS) that will be based on a Oracle database.

V. Challenges

Willingness in Ministry to proceed with monitor plans and continue with migration of water quality data to MWI database.

A genuine acceptance in MWI of opening up the database to end-users is necessary to take advantage of the data store within it.

Socialization of available data with MWI staff so they are informed about the content and quality of the database.

VI. Conclusions[7]

The more the MWI database is used the more accurate it will become. End users of the data are highly qualified in their fields and if unusual trends or anomalies are discovered in the data they will be researched. This should not be perceived as negative in the Ministry as problems occur in all databases.

The Ministry of Health acts as a separate monitoring structure and their monthly assessments should be compared to MWI outputs.

Existing monitoring data sources are sufficient for monitoring of surface waters related to the wastewater component.

MWI should standardize data entry for water quality data.

RSS should be approached to modify it data entry format. If needed, formal letters should be developed for approval.

Trained personnel should migrate data to Oracle from WAJ sources.

Short-Term inputs from consultant with chemistry background and knowledge of databases should be hired to standardize MWI coding based on specific RSS and WAJ data parameters and methods. (Appendix O contains a preliminary scope of work for the this input)

[7] Appendix P contains a final presentation with conclusions presented to MWI, USAID and ARD staff.

APPENDIX A

SCOPE OF WORK FOR ANDREW ALSPACH

Scope of Work–Jordan Water Resource Policy Support Project
Short Term Technical Assistance– Database-Information Management

Background

This project is to support the implementation of Jordan's water policies, and one of its main components is wastewater reuse planning.

The consultant's assignment will be to assist in implementing the workplan for the wastewater reuse component of the project, and will be particularly focused on developing and enhancing the information management system relating to water reuse, and in supporting the assessment of the monitoring system relevant to water reuse in the Amman-Zarqa basin.

The existing monitoring and information management systems associated with water reuse in the Amman-Zarqa basin are relatively extensive. Presently data and information are gathered and analyzed on the water quality and quantity in the effluent from wastewater treatment plants, flows in the wadis, water in the reservoir, conveyance to the Jordan Valley, and the application and drainage of water within the Jordan Valley. The facilities are managed and information maintained by a number of different Government agencies and institutions.

Although some deficiencies have been noted in monitoring, the primary constraints to a comprehensive and integrated monitoring and information management system appear to be associated with the management and sharing of the information.

The basic strategy for strengthening the monitoring and information management is to focus on strengthening the information management, although also taking into account the need to make the monitoring comprehensive, reliable and cost effective. This consultant's role is to focus on the information management related to water reuse, specifically within the Ministry. However, he will also coordinate with the other specialists considering monitoring to integrate these activities into the information management system.

The consultant will also support the Ministry of Water and Irrigation in web page development, including training Ministry personnel in web page development, and maintenance.

Scope of Work

The intent of this Consultant's input is to complete the work detailed under activity 4.7 (Monitoring and Information Management), which is focused on enhancing the Ministry's capability to gather, access and utilize the data and information relevant to monitoring water reuse in the Amman-Zarqa basin.

- Review existing documentation on information management within the Ministry.
- In coordination with Ministry personnel and other team members, determine the primary information requirements for monitoring water reuse, and identify the constraints and limitations of the existing system.
- Working with the Ministry, enhance the database and the information management system to include the data and information generated by JVA, WAJ and RSS.
- Develop strategies to facilitate the real-time transferring and sharing of information between the above agencies.
- Working with the Ministry and other team members, assess the comprehensiveness and completeness of the existing monitoring systems and identify specific needs for further improvement.
- Develop strategies for enhancing the accuracy and timely distribution of monitoring data, and wider distribution of findings.

This work is to be integrated with the other activities under this component, and with the relevant activities of the Groundwater component.

Outputs

Completed transfer of existing data (RSS) onto the Ministry Oracle database.

Practical implementation plan for information management for monitoring water reuse in the Amman-Zarqa basin.

Roles and Responsibilities

The consultant will report to the ARD Home Office Project Management team at ARD headquarters concerning all US-based arrangements and activities (contractual issues, international travel, travel advance, payment for services).

In Jordan, the consultant will report to ARD's Chief of Party on all logistical issues, and work directly with the Water Reuse Planning Component leader on all technical issues.

Level of Effort

The in-country activities of the consultant will be for 30 working days.

APPENDIX B

WORKING NOTES

OCTOBER 7TH TO NOVEMBER 16TH

Notes
Andrew Alspach (GIS/Data Management Specialist)
Click Date to Jump Directly to Activities (Use arrow, "upper left" to get back to dates)

October 9th 10th 11th 12th 13th (Output Week 1)14th 15th 16th 17th 18th 19th (Output Week 2)20th 21st 22nd 23rd 24th 25th (Output Week 3) 26th 27th 28th 29th 30th 31st

November 1st 2nd 3rd (Output Week 4) 4th 5th 6th 7th 8th 9th 10th 11th(Output Week 5) 12th 13th 14th 15th 16th

October 9th

- Talk to Peter, Suzan and Edward to develop work plan.
- Set-up computer, establish connection to Oracle database.
- Help Suzan, Rana, Raba'a and Mahamoud Shloul with Web-page development (finished section on links)

October 10th

- Work on EMWIS Web-page Development with Ministry. (Finished sections on training and events)
- Speak with Edward about Monitoring and Information Management.

Peter and I spoke with Mohamed Monsour about monitoring on Edward's suggestion. (Edward not avalable)

Brief interview with Mohamed Monsour
Highlights:
JVA WAJ, MWI need to have the same regulations and formats for information to insure compatibility and access.

Peter brought up:
A water quality report is prepared every month and given to the secretary general. The target audience is farmers but it does not get distributed to them. Mohamed was unaware of this report.

Mohamed suggested the development of a special Unit devoted to monitoring and analysis, as current staff does not have to time to devote to this activity.

October 11th

- Talk with Steve Gratton about his work on soils and provide assistance if needed.

(Steve is developing his recommendations on key indicators to insure crop development)

- Develop work plan specific to Monitoring and Information Management. Peter gave me a table of contents outline to work from and I expanded on that. (TOCworkingpaper.doc)
- Speak with Ibtisam about protocols for uploading data into Oracle database and obtain write privileges. (She will send me an Excel file with current database coding…Need to speak with Iman Jabel about the process of getting Excel files formatted for entry into Oracle.)

October 12th

- Elicit feedback from Edward on tentative Monitoring and Information Management work plan. (Still need to talk with Edward)
- Format RSS data and upload into Oracle database.(This will not happen until Ibtisam Returns week of the 22nd)
- Collect existing documents on Information Management in Ministry. (Suzan gave me flow diagrams for MWI and I have WAJ organizational structure still need JVA)
- Finalize draft EMWIS Web Page. (Worked with Suzan …we will try to get it done by Sunday. Still needs more work than can be done by today, Thursday.)

October 13th

- Research JVA, WAJ, MWI, and RSS inter-institutional relationships and current data sharing activities. (Prepared list of questions to Guide interviews with key personnel in WAJ, JVA and MWI)
- Upload RSS data into Oracle database. (Must wait for Ibtisam's return)
- Revise Monitoring and Information Management work plan.

Outputs first week

- Draft EMWIS web page (Deadline is moved to Sunday! We have made a lot of progress)
- Tentative Monitoring and Information Management work plan
- Compilation of documents pertaining to Information Management in MWI (Have flow diagrams of institutional structure in MWI, JVA, WAJ)

WEEK Two

October 15th

- Worked on EMWIS webpage.
- Set up interviews with key informants from MWI and WAJ.

October16th

Dr. Hani set up interviews with Yasser Nasal (MWI) and Mohamed Siama (JVA) Zackaria ????? (MWI)

(CLICK to see interview form)

October 17th

Met with Yousef Hassen (CLICK to See Interview Form)

- Attended GTZ Meeting presented to the Ministry that covered the modeling effort for the (Electronic Master Planning Tool).

Highlights:
Nadia Gandour (WAJ) expressed her frustration at not having access to this tool set and data in general.

GTZ proposed a standard data entry form to be used across organizations for Oracle entries. (Why this standard form is just now being developed is major question mark for me.)

GTZ informed me that ideally one person would be in charge of running the modules and staff would feed Questions or Scenarios to this person for analysis.

My assessment is that the tools are complicated in design and users were not identified or involved in the development. Thus, the hands-on user base is small. If the user base is expanded and tools are adapted to specific need they will be better utilized.

The common theme of unreliable data came up which puts model results into question.

October 18th

- Organized Monitoring, Information Management information to date. Need to set up meeting with Suzan Taha, Nadia Gandour and Edward.

- Developed map sample for representing Excel spread sheet data in custom designed maps that the project could identify. (Worked with Ramzy)

October 19th

- Visited Royal Scientific Society (RSS) and spoke with M.Y. Saidam Ph.D (environmental eng.) RSS provides MWI, JVA and WAJ with specific water quality data based on the request of the previously mentioned organizations. Essentially they act as a private contractor. Of interest to the monitoring and information management task is that RSS is open to changing the format of final data products that are provided to MWI. If MWI can specify a format that is more compatible with data entry standards in the ministry this could simplify the migration of data to the Oracle database.

- Compiled Organizational Flow diagram for MWI ,JVA and WAJ.

Outputs Second Week

- Completed Informal Interviews with 4 Key Informants.
- Assessed GTZ and RSS interaction with MWI.
- Compiled MWI, GTZ, WAJ organizational flow diagram. (View diagram) The original was created in Visio Professional and should be printed from that program. MWI uses this program.
- MWI WebPage was presented at EMWIS conference at Marriott (View Sample Page)

Problems:
We need to make contact with Edward.

Week 3
October 22nd

- Worked on Oracle----RSS data transformation. (see MWI parameter coding)

- Short interview with Suzan Taha. She was in a hurry and said she would talk to me more after I speak with Edward. She said that the only data deficit that she can identify is the need for water quality data in the Oracle database. She said that she was open to giving access to data to key personnel in JVA and WAJ but that this was ultimately Edward's decision. We looked at some sample Excel maps.

October 23rd

- Designed and implemented a one hour training for Raba'a, Hejan and Rima for Microsoft FrontPage. The session was designed to give them the skills to assist Mahamoud Schloul in updating the WebPage. Basic skills were stressed in editing pages (graphics and text), updating and checking links and the virtual connection between various pages.

- Identified areas of focus to concentrate specifically on during this trip. (View areas of Focus)

October 24th

- Worked on Monitoring and Information Management working paper.

- Designed excel map layers related to water quality monitoring.

October 25th

Assigned Oracle water quality parameter codes to RSS data. (*View Data*)
Need to confirm correct codes with database managers and water engineers.

- Short meeting with Suzan more web page advancements needed.

Outputs Third Week

- Training of three Ministry staff in Microsoft Front Page web page software
- Developed Sample mapping data for end users in the Ministry (Excel)
- Advanced on RSS data migration

Week 4
October 29th

Met with Edward …..Highlights:

We used my areas of focus to guide discussion. (View agenda) These were intended as items to get discussion rolling.

The first two points dealt with migration of data into the MWI database. Specifically we focussed on standardized protocols and formats for the RSS water quality data. Edward mentioned that international assistance is not needed for simple matters such as format specification. I agreed with him that this could be done in the Ministry but that this situation is an indicator of how difficult it is to get new data sources into Oracle. Also, this is a good example of data migration from an organization outside of the WAJ, JVA, MWI circle. In the case of RSS they may be open in providing data in a format that is easily transferred to Oracle.

Point three dealt with end user needs and tools for extracting data from the database. We tried to focus on end user needs in MWI but Edward pointed out that he could only speak of his situation. This may warrant an MWI end user meeting in the future. According to Edward there are two tools developed for "Reporting" which is actually extraction tools for the database. Fixed reporting forms are in the process of being developed and should be ready soon. Dynamic reporting forms have been developed and are currently being tested by Iman Jaber (MWI). The fixed forms will allow for fix queries to be made on "normally" requested data. The Dynamic forms allow a user to formulate his/her own query. These tool gets the data out of the Oracle database and can be saved in a text format that can be read by excel. Note that this is a raw data table. Analyses in Excel or other like programs can then be performed.

Point four was relatively open ended and targeted at end user needs. We had a brief discussion about this but ran out of time. This is the same for identifying users in WAJ and JVA.

Need to follow up on EU Project in Environmental Monitoring, JVA labs, and MOH

Developed tentative Wastewater data entry form. (View Form)

Reviewed Italian EMWIS Web Site and gave comments to Mahamoud Shloul. Comments include:

- Develop frame and Non-frame version of site. Home Page should be non-frame w/ links to frame version.

- Italian site had a lot of info on history of EMWIS. I suggest that this is unnecessary and should be developed on the Main EMWIS site and linked to instead of duplicating efforts.

- MWI should concentrate on WAJ and JVA inputs to complete the content of our web page. Ours is similar to the Italian page put simplified.

- Italian site had Online forms. MWI should decide if they would like to use these. If so they should be a lot shorter than the Italian site, which is 7 pages and complex. MWI would also have to develop a database for entry of this data and identify personnel for data entry. My assessment is that this is more work than the benefit would justify.

- The Italian site had a "Hotspot" map of Italy that was used as a way to return to the home page…. this is a nice idea that MWI could use on their page.

- Raba'a and Rima should concentrate on JVA and WAJ inputs and page developments. (They have researched potential water related links and contacted them for content. This should be added to the Useful links page)

October 30th

Meeting with Ministry of Health
Hussain M. Al Khandak (Head of Env. Monitoring Division)

Highlights:
Potable Water
18 Labs around the country and each lab has a self-contained monitoring system. 3 types of reports are produced, weekly, monthly and yearly. These are all based on the same parameters that WAJ uses for monitoring. They are distributed to selected MWI personnel. Dr. Hazim

Wastewater
Site selection for wastewater treatment plants and testing of plants using WAJ parameters and standards. No monitoring at stations on the Zarqa river.

General
Summaries of data are generated based on Administrative Governorates. This means that comparisons of data can be represented in Maps using the governorates as "containers".

Spoke with Tom and Peter and clarified objectives of water reuse monitoring.

Initial thoughts:
The objective of the monitoring system is, "that a sufficient water quality monitoring system is in place, or will be in place, to insure that the health of the population will not be negatively affected by an increase in water reuse." Thus, a multi-layered monitoring system must be in place that will utilize multiple institutions and Ministries. These can be viewed as layers of defense against poor quality water. Each layer of monitoring will have different temporal and indicator resolutions. The key to a successful monitoring system will be useful indicators at each level and the channels of communication between organizations. Key water quality indicators must be monitored on a realistic timetable in accordance with the needs of each organization.

- Ibtisam's computer crashed so she was unable to review the standardized form for RSS data entry. We did talk about the query tools that she built for the Oracle data base. (See talk with Edward for more info)

October 31st

- Field Visit As Samara KTR region
- Spoke with Farmers about their use of monitoring data.

November 1st

- Interview with Zackaria Tahaweneh at WAJ LABS

Highlights:
We talked about the general interactions of WAJ labs with RSS, JVA and the Ministry. The lab produces monthly reports of water quality data which are distributed to Key Ministry staff. They have a close working relationship with the MOH and data sharing takes place. To date, no formal mechanisms are in place for sharing of raw data.

The labs are in the process of moving to a new building and updating their Laboratory Information Management System (LIMS) Tom has be interacting with them to facilitate staffing and training of personnel to move to the new system. They are anxious to move over to the new system, which is based on an Oracle database. When this system gets up and running there is potential for seamless data transfer to MWI's database if it is design with the same stucture.

- Talked with Tom about previous work on Laboratory Information Management System (LIMS)

November 2nd

- Worked with Ibtisam on representing data in Excel Maps.
- Compiled information to date and continued work on working paper
- Worked on RSS coding

November 3rd

Compiled information to date and continued work on working paper

Outputs Fourth Week (Oct 29 – Nov 3)

- Provided feedback and suggestions for EMWIS web page
- Incorporated Zarqa river field visit, information interviews with Edward Qunqar, Peter McCornick and Tom Cusack, in conceptualization of monitoring and Information Management working paper.
- Advanced on research to migrate RSS data to Oracle database.

November 5th

Meetings with Edward to further discuss migration of RSS data and clarify points.

Highlights;
We need to assign new Ids to monitoring stations.
Need to clarify Analytical Methods
Need to clarify parameter coding

Meeting with Dr. Nawal Sunna' (WAJ Labs)
Highlights:

She gave us samples of monthly reports and annual reports and help us to clarify the analysis performed at WAJ central Labs. With a map of monitoring stations in the region we clarified which stations that WAJ used for sampling. She also was very helpful in clarifying technical questions about specific water quality parameters.

November 6th

- Helped Nisarine to design access database to enter farmer survey data for targeted study along the Zarqa river.
- Began reformatting of working paper to make it more action oriented and not a long narrative of information.

November 7th

- Worked with Ramzi to refine key parameter, "Analytical Methods" and Parameter coding

November 8th

- Worked with Ramzi to refine key parameter, "Analytical Methods" Parameter coding
- Assisted Lana with ArcView questions

November 9th

- Conceptualized PPM model
- Compiled data to date

- Worked with Ramzi on parameter coding

November 10th
- Developed PPM logical framework
- Worked on working paper

November 11th
- Developed PPM logical framework
- Worked on working paper

(Outputs Week 5)
- Draft PPM logical framework
- Draft working paper
- Document of revised Analytical Methods

November 12th
- Finalized parameter coding with Ibtisam
- Worked on working paper

November 13th
- Met with Edward to get feedback on PPM logical framework

Highlights:
No objections but the meeting was short and we did not have time to look at the planning matrix in great detail.

November 14th
- Worked on Presentation for USAID and Ministry staff.
- Compiled Appendixes for working paper and continued writing

November 15th
- Presented work to USAID and Ministry staff.
- Worked on final report

November 16th
- Incorporated feed back from ARD staff and into working paper
- Compiled final report
- Presented work to USAID and Ministry staff.

APPENDIX C
WORKING MODEL FRAMEWORK

PROGRAM PLANNING MATRIX (PPM)	**TITLE : MONITORING AND INFORMATION MANAGEMENT FOR WATER RESOURCE POLICY SUPPORT PROJECT**		
NARRATIVE SUMMARY OF OBJECTIVES / ACTIVITIES	**OBJECTIVELY VERIFIABLE INDICATORS (OVI)**	**MEANS / SOURCES OF VERIFICATION (MOV)**	**IMPORTANT ASSUMPTION (IA)**
OVERALL GOAL To assure public health in areas specifically affected by water reuse in Jordan.	**INDICATORS MEASURING** *GOAL ACHIEVEMENT* An efficient monitoring and evaluation network of water quality within the Ministry of Water and Irrigation (MWI)	- MWI Database - Inter-institutional information flow mechanisms in place - Institutional information mechanisms in place - Enforced water quality standards - Periodic public dissemination of information	**FOR LONG-TERM ACHIEVEMENT** - The political and economic situation remains favorable. - MWI will benefit from the increase in efficiency
PROJECT PURPOSE To support monitoring activities specific to water reuse in the Amman-Zarqa and middle Jordan valley basins.	**INDICATORS MEASURING PURPOSE ACHIEVEMENT** - Organizational capacity improved	- MWI Database - Inter-institutional information flow mechanisms in place - Institutional information mechanisms in place - Enforced water quality standards - Periodic public dissemination of information	**FOR GOAL ACHIEVEMENT** - Adoption by MWI of measures to increase efficiency
PROGRAMME RESULTS/OUTPUTS	**INDICATORS THAT MEASURE RESULT ACHIEVEMENTS**	**PURPOSE OF ACHIEVEMENT**	**IMPORTANT ASSUMPTIONS**
1- Develop and set water quality standards for the use of recycled water resources. 2- Develop and set standardized protocols for database entry in the MWI. 3. Formalized Institutional information flow networks 4. Formalized inter-institutional information flow network	1.1. National standards for recycled water reuse in health and agriculture in place. 2.1. Specific database entry formats based on international water quality standards in place for data entry 3.1. Transparent data entry and retrieval mechanisms utilized by Ministry personnel 4.1 Periodic updates to MWI database by “Collaborative Organizations” and accessible by all	-National Standard documents, regulations and Laws -MWI Database based on international standards -Trained data entry specialists and efficient end user retrieval of information -Current water quality data in MWI database -“Collaborative organizations” access to data	-Same as above -“Collaborative organizations” willing to participate in data transfer

ACTIVITIES/INPUTS	INDICATORS	DOCUMENTATION	ASSUMPTIONS
1- *Develop and set water quality standards for the use of recycled water resources.*			
1.1 Identify organizations utilizing water quality standards - Consult with Ministry personnel and ARD team members to identify organizations - Contact identified organizations and obtain water quality standard information	**-* List of stakeholders ("collaborative organizations")** **-* Individual organization water quality standards**	**ARD and MWI documents**	**-Same as above** **-ARD and MWI work closely, collaboratively and productively**
1.2 Develop water quality standard steering committee - Identify key water quality policy makers - Bring together heads of water quality divisions to achieve purpose and consensus - Develop and set up productive and continuous process of information exchange	-List of key water policy makers - Meeting minutes, Letter of Agreement -Agreed upon working agenda		**National efforts to develop and ratify water quality standards**
1.3 Develop water quality standards - Compile existing national water standards for the use of blended water use for agriculture and health - Outline ambiguities in the standards - Revised and adopted existing standards based on findings	-List of current water standards for the use of recycled water for agricultural and health -Outline of identified ambiguities in National standards - Adoption of adapted water standards		
1.4 Develop regulations for the enforcement of water quality standards - Assist in the elaboration of new laws (creation and amending) and public policy in the area of water management	- New laws and public policies that enforce adapted water standards		
2- Develop and set standardized protocols for database entry in the MWI			
2.1 Review existing entry and protocol standards - Identify MWI and "collaborative organization" personnel involved in the database entry process - Assess current protocols and information current flow networks	**-* List of MWI and "collaborative organization" personnel involved in database entry** **-* Tentative outline of current protocols and information flow charts**		**MWI's willingness to adopt international analytical methods**
2.2 Compare existing analytical methods to International analytical methods and socialize amendments for adoption - Compile current MWI analytical methods - Compile international analytical methods - Identify inconsistencies in the methods and standardize methods accordingly - Develop socialization and adoption Strategy	**-* Print out of current database structure for analytical methods** **-* "International Standards and Methods for water Quality Data"** **-* Document that records inconsistencies and sets forth new analytical methods** -MWI adoption of new analytical methods		
2.3 Develop data entry formats based on specific Parameter coding & international analytical methods - Identify end users (at the MWI) and water quality information specialists at "collaborative organizations" - Identify key water quality parameters - Based on the 2.2 develop upgraded data entry forms	**-* List of MWI and "collaborative organizations" staff** **-* Meetings with identified staff** **-* Document that records importance of parameter coding for data transfer** -Tentative list of key water quality parameters **-* Sample data entry forms**		
2.4 Input standardized water quality data into MWI database - Identify trainees - Develop and implement training for qualified MWI personnel in data entry - Monitor data entry quality	**-* Tentative list of MWI key personnel to be trained** -List of trainers -Training methodology document -List of key personnel charged with quality assessment		

ACTIVITIES/INPUTS	INDICATORS	DOCUMENTATION	ASSUMPTIONS
3-Formalized Institutional information flow networks **3.1 Assessment of current MWI information flow** - Identify end users of water quality information in MWI - Identify current flow of information in MWI - Identify current use of water quality information - Outline retrieval of information process and procedures	**-** Tentative list of end user in MWI - MWI information flow chart **-* List of key water quality parameters** -Software developed for information retrieval		
3.2 **Install software and hardware for data Retrieval (infrastructure)** - Assess current hardware and software in MWI - Upgrade hardware and software accordingly - Identify trainees - Develop and implement data retrieval training package - Monitor and evaluate training utilization	-Assessment document of existing equipment and software in MWI -Number of software and hardware upgrades -List of trainers -Training methodology document -List of key personnel charged with quality assessment		
3.3 Identify end users of water quality data (political) - Disseminate water quality information available to end users - Identify type of data to be accessed to users	-Implemented information workshops -List of specific data available to users		
4 Formalized inter-institutional information flow network			
4.1 **Assess the inter-institutional flow networks** - Identify "collaborative organizations" - Identify current information flow network - Identify specific water quality data available in "collaborative organizations" - Document current format of water quality data	**- * List of "collaborative organizations"** **- * Current organogram diagrams** **-* List of key water quality parameters from each "collaborative organizations."** **-* Sample documents of water quality data formats in "collaborative organization".**		
4.2 **Install hardware and software for data entry (infrastructure)** - Assess current hardware and software in MWI - Upgrade hardware and software accordingly - Identify trainees - Develop and implement data retrieval training package - Monitor and evaluate training Utilization	-Assessment document of existing equipment and software in MWI -Number of software and hardware upgrades -List of trainees -List of trainers -Training methodology document		
4.3 Develop strategy for data compatibility with MWI database - Socialize MWI standards - Assess current multi-institutional standards - Identify discrepancies - Develop compatible format - Standardize transfer protocol	-Socialization agenda developed and in place **- * Print out of current database structure and standards from all organizations**		
4.4 Develop lines of information transfer between organizations - Establish lines of data transfer - Ensure transparency for data access	**-* List discrepancies between formats** -Standardized format developed and in place -Standardized forms for data transfer in place **-* Tentative flow diagram of data transfer** -Access to data by all identified "collaborative institutions"		

Parameters & MWI Coding (NEW indicates new code must be created)			Standard Method & MWI Coding (NEW indicates new code must be created)			Existing MWI Codes			
Item	**Code**	**Description**	**Standard Method**	**MWI Code**	**Comments**				
pH	403	pH - Lab	std. meth.19.4500- H, B	55					
EC	95	Conductivity (umhos/cm @ 25C)	std. meth.19.2510-B	55	To be checked				
TDS	70300	Residue - Total Filtrable (dried at 180 C)	std. meth.19.2540-C	NEW					
TSS	NEW	Total Suspended Solids dried @ 103 -105 C	std. meth.19.2540-D	NEW					
BOD5	310	BOD - 5 day (20 Deg, C)	std. meth.19.5210-B	NEW					
BOD5f	NEW	BOD - 5 day (20 Deg, C)-filtered	-	NEW	For waste stabilization ponds only				
COD	340	COD - 0.25N K2CR2O7	std. meth.19.5220-B,4a	NEW					
TFSS	NEW	Total, Fixed, Solids in Solid and Semisolid Samples	std. meth.19,2540 G	37	New code for parameter because RSS reports in mg/l.	70299	Solids - Suspended Residue on Evaporation at 180 C	Water	MG/L
						70322	Solids - Volatile % of Total Solids	Water	%
						70324	Solids - Volatile Suspended in Mixed Liquor	Water	MG/L
						85207	Solids - Volatile % in Sediment	Sediment	%
						47004	Solids - Total Dissolved (Electric Conductivity)	Water	MG/L
						93	Solids, floating	Water	MG/L
TVSS	NEW	Total, Volatile, Solids in Solid and Semisolid Samples	std. meth.19,2540 G	37	New code for parameter because RSS reports in mg/l.	Same as TFSS			
CL	NEW	Chloride ; Cl/ Potentiometric Method	std. meth.19.4500-Cl, D	NEW					
MBAS	38260	MBAS (methylene blue active subts.) (detergents)	std. meth.19.5540 -C	28					
NO3	NEW	Nitrate: NO_3 / Ion Chromatography	std. meth.19.4500 NO_3, C	NEW					
B	1022	Boron / Inductively Coupled Plasma (ICP)Method	std. meth.19.4500-B,D	NEW					
TP	665	Phosphorus - Total as P	std. meth.19.4500-P, C	NEW					
SO4	945	Sulfate - Total as SO4	std. meth.19.4500-SO4,B	NEW					
TCC	NEW	TCC / Multiple Tubes	std. meth.19.9221- B	NEW					
TFCC	31615	Coliform, Fecal, MPN,EC MED,44.5C (tube 31614)	std. meth.19.9221- E	NEW	Check with RSS which method				
	31621	Coliform, Fecal, A-1 Mod, 44.5C, 24H	?						
Nematod	NEW	Nematodes / Sedimentation Methods	Schwartz brod	NEW					
Al	NEW	Aluminum / Metals by Atomic Absorption	std. meth.19.3110	1	New code for parameter because RSS reports in mg/l.	1105	Aluminum - Total	Water	UG/L
						1106	Aluminum - Dissolved	Water	UG/L
						1108	Aluminum	Sediment-D	MG/KG
As	NEW	Arsenic / CHG- Atomic Absorption	std. meth.3114- C	2	New code for parameter because RSS reports in mg/l.	1000	Arsenic - Dissolved	Water	UG/L
						1002	Arsenic - Total	Water	UG/L
						1003	Arsenic	Sediment-D	MG/KG
Cd	NEW	Cadmium / Metals by Atomic Absorption	std. meth.19.3110	1	New code for parameter because RSS reports in mg/l.	1025	Cadmium - Dissolved	Water	UG/L
						1027	Cadmium - Total	Water	UG/L
						1028	Cadmium	Sediment-D	MG/KG
Cr	NEW	Chromuim / Metals by Atomic Absorption	std. meth.19.3110	1	New code for parameter because RSS reports in mg/l.	1029	Chromium	Sediment-D	MG/KG
						1030	Chromium - Dissolved	Water	UG/L
						1034	Chromium - Total	Water	UG/L
						1032	Chromium , hexavalent	Water	UG/L
						1220	Chromium , hexavalent Dissolved	Water	UG/L
Hg	NEW	Mercury / Metals by Atomic Absorption	std. meth.19.3110	1	New code for parameter because RSS reports in mg/l.	71890	Mercury - Dissolved	Water	UG/L
						71900	Mercury - Total	Water	UG/L
						71920	Mercury	Sediment-W	MG/KG
						71921	Mercury	Sediment-D	MG/KG
Pb	NEW	Lead / Metals by Atomic Absorption	std. meth.19.3110	1	New code for parameter because RSS reports in mg/l.	1049	Lead - Dissolved	Water	UG/L
						1051	Lead - Total	Water	UG/L
						1052	Lead	Sediment-D	MG/KG
Cu	NEW	Copper / Metals by Atomic Absorption	std. meth.19.3110	1	New code for parameter because RSS reports in mg/l.	1040	Copper - Dissolved	Water	UG/L
						1042	Copper - Total	Water	UG/L
						1043	Copper	Sediment-D	MG/KG
DO	299	Dissolved Oxygen (by probe) (MG/L)	std. meth.19.4500-O, G	NEW					
NH4-N	71845	Nitrogen, Ammonia - Total as NH4	std. meth.19.4500 NH_3 -?	NEW	Must be checked				
NO3-N	71850	Nitrogen, Nitrate - Total as NO3	std. meth.19.4500 NO_3, C	NEW	To be confirmed				
T-Kj-N	625	Nitrogen, Kjeldahl - Total	std. meth.19.4500 Norg B	9					
H2S	71875	Hydrogen sulfide	std. meth.19. 4500- S, D	NEW					
Chl (a)	NEW	Chlorophyll / Fluorometric	std. meth.19.10200H.3	NEW					

APPENDIX D

PARAMETERS ORGANIZED BY COLLABORATIVE ORGANIZATION

JVA Parameters

Parameters	Units
pH	SU
EC	µs/cm
TDS	mg/l
TSS	mg/l
BOD5	mg/l
COD	mg/l
Cl	mg/l
MBAS	mg/l
TN	mg/l
TP	mg/l
SO4	mg/l
TCC	MPN/100ml
TFCC	MPN/100ml
Nematodes	Egg/l
Chl (a)	µg/l
Al	mg/l
As	mg/l
Cd	mg/l
Cr	mg/l
Hg	mg/l
Pb	mg/l
Cu	mg/l
Ca	mg/l
Mg	mg/l
Na	mg/l
Mn	mg/l
Zn	mg/l
HCO3	mg/l
DO	mg/l
PO4-P	mg/l
NH4-N	mg/l
NO3-N	mg/l
K	mg/l
Fe	mg/l
THBC	CFU/ml
Org-N	mg/l
TP (f)	mg/l
T-Kj-N	mg/l
NO2-N	mg/L
H2S/15	mg/L
H2S/5	mg/L
H2S/b	mg/L
Transp	m
Temp	C
H2S/0	mg/L
Mo	mg/l
Al/B	mg/L

Note that Bracketed data is collected more frequently(usually on a monthly basis) than unbracketed data

Parameters	Units		Parameters	Units		Parameters
Al/M	mg/L		BOD5/S	mg/L		pH/M
Al/S	mg/L		BOD5/M	mg/L		pH/B
As/B	mg/L		BOD5/B	mg/L		PO4-P/S
As/M	mg/l		Alk./S	mg/L		PO4-P/M
As/S	mg/L		Alk./M	mg/L		PO4-P/B
Cd/M	mg/L		Alk./B	mg/L		Sb/S
Cd/S	mg/L		Silica/S	mg/L		Sb/M
Co/B	mg/L		Silica/M	mg/L		Sb/B
Co/M	mg/L		Silica/B	mg/L		Se/S
Co/S	mg/L		Eh/S	mV		Se/M
Cr/B	mg/L		Eh/M	mV		Se/B
Cr/M	mg/L		Eh/B	mV		T-N/S
Cr/S	mg/L		Cd/B	mg/L		T-N/M
Cu/B	mg/L		Ag/S	mg/L		T-N/B
Cu/M	mg/L		Ag/M	mg/L		T-P(f)/S
Cu/S	mg/L		Ag/B	mg/L		T-P(f)/M
Fe/B	mg/L		Chl (a)/S	ug/L		T-P(f)/B
Fe/M	mg/L		Chl (a)/M	ug/L		T-P/S
Fe/S	mg/L		Chl (a)/B	ug/L		T-P/M
Li/B	mg/L		Cl/S	mg/L		T-P/B
Li/M	mg/L		Cl/M	mg/L		T.Kj-N/S
Li/S	mg/L		Cl/B	mg/L		T.Kj-N/M
Mn/B	mg/L		DO/S	mg/L		T.Kj-N/B
Mn/M	mg/L		DO/M	mg/L		TDS/S
Mn/S	mg/L		DO/B	mg/L		TDS/M
Mo/B	mg/L		EC/S	uS/cm		TDS/B
Mo/M	mg/L		EC/M	uS/cm		Temp./S
Mo/S	mg/L		EC/B	uS/cm		Temp./M
Ni/B	mg/L		HCO3/S	mg/L		Temp./B
Ni/M	mg/L		HCO3/M	mg/L		TSS/S
Ni/S	mg/L		HCO3/B	mg/L		TSS/M
Pb/B	mg/L		Hg/S	mg/L		TSS/B
Pb/M	mg/L		Hg/M	mg/L		V/S
Pb/S	mg/L		Hg/B	mg/L		V/M
Sn/B	mg/L		NH4-N/S	mg/L		V/B
Sn/M	mg/L		NH4-N/M	mg/L		
Sn/S	mg/L		NH4-N/B	mg/L		
Zn/B	mg/L		NO2-N/S	mg/L		
Zn/M	mg/L		NO2-N/M	mg/L		
Zn/S	mg/L		NO2-N/B	mg/L		
B	mg/l		NO3-N/S	mg/L		
Br	mg/L		NO3-N/M	mg/L		
SAR			NO3-N/B	mg/L		
F	mg/l		Org.-N/S	mg/L		
CN	mg/l		Org.-N/M	mg/L		
Phenol	mg/l		Org.N/B	mg/L		
Algae Count	cell/mL		pH/S	SU		

RSS Parameters(Example Site7)

Parameters	Unit
pH	SU
EC	us/cm
TDS	mg/l
TSS	mg/l
BOD 5	mg/l
COD	mg/l
Cl	mg/l
MBAS	mg/l
NO3	mg/l
B	mg/l
TP	mg/l
SO4	mg/l
TCC	MPN/100ml
TFCC	MPN/100ml
Nematodes	Egg/l
Chl (a)	ug/l
Al	mg/l
As	mg/l
Cd	mg/l
Cr	mg/l
Hg	mg/l
Pb	mg/l
Cu	mg/l
DO	mg/l
NH4-N	mg/l
T-Kj-N	mg/l
NO3-N	mg/l

Paramaters WAJ (Example Baqa Treatment Plant)

ITEM	MONTH /unit
INF.AVG.FLOW	M3/D
MAX.INF FLOW	M3/H
MIN.INF FLOW	M3/H
EFF .AVG.FLOW	M3/D
TDS -INF	Mg/L
TDS -EFF	Mg/L
TDS RED	%
TSS-INF	Mg/L
TSS-EFF	Mg/L
TSS REDUCTION	%
BOD "5"-INF	Mg/L
BOD "5"-EFF	Mg/L
BOD.REDUCTION	%
BOD 5"F"-EFF	mg/l
COD-INF	Mg/L
COD-EFF	Mg/L
COD.REDUCTION	
SLG TR O .F P	M3/MONTH
SLG P .T.THICK	M3/MONTH
T.REMOVED GRIT	M3/MONTH
TSM REMOVED	M3/MONT

Parameters WAJ (Example Site (4) Outlet Al -Samra)

Parameters	Unit
pH	SU
EC	µs/cm
TDS	mg/l
TSS	mg/l
BOD 5	mg/l
BOD 5 (f)	mg/l
COD	mg/l
TFSS	mg/l
TVSS	mg/l
Cl	mg/l
MBAS	mg/l
NO3	mg/l
SAR	
B	mg/l
TP	mg/l
SO4	mg/l
TCC	MPN/100ml
TFCC	MPN/100ml
Nematodes	Egg/l
Chl (a)	µg/l
Al	mg/l
As	mg/l
Cd	mg/l

Parameters	Unit
Cr	mg/l
Hg	mg/l
Pb	mg/l
Cu	mg/l
DO	mg/l
NH4-N	mg/l
NO3-N	mg/l
TP (f)	mg/l
T-Kj-N	mg/l
Temp	C

Note that WAJ Central Laboratories collects samples from treatment plants and analyzes them along with analysis that is conducted at each treatment plant. In addition, RSS is contracted by WAJ to collect from sites at Al -Samara treatment plant. The parameters listed here are collected on a monthly basis.

APPENDIX E

MWI & "COLLABORATIVE PERSONNEL" INVOLVED IN DATABASE ENTRY

MWI
Ibtisam Salah
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MOA (Nothing)

APPENDIX F

INTERNATIONAL STANDARDS & METHODS FOR WATER QUALITY DATA

Not available in electronic format. Reference:

American Public Health Association. 1995. Standard Methods for the Examination of Water & Wastewater. 1015 Fifteenth Street, NW, Washington, DC 2005.

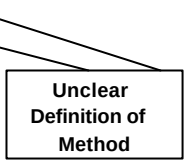
APPENDIX G
CURRENT MWI DATABASE STRUCTURE FOR ANALYTICAL METHODS

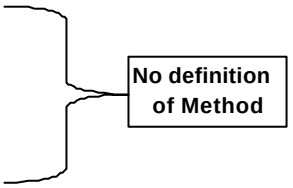
Code	Description	Instrument	Calibration_Range	Reference
30	Carmine method	2	0-1 ppm	std. meth.17.4500
31	Iodometric method	18		std. meth.17.4500
32	Polarographic method	20		Metrohm VA 69
33	Closed reflux method	21		std. meth.17.5220
34	Winkler method	22		std. meth.17.5210-B
35	TS, TSS, dried at 103-105 C	0		std. meth.17.2540-A
36	TDS, dried at 180 C	0		std.meth.17.2540-B
37	FS, VS, Ignition at 550 C	0		std. meth.17.2540-C
38	Setting Solids, gravimetric/volumetric	0		std. meth.17.2540-F
39	MPN/100 ml	30		std. meth.17.908-B,D
40	MPN/100 ml	30		std. meth.17.908-C,D
41	MPN/100 ml	30		std. meth.17.910-A
42	MPN/100 ml	40		
43	Pour plate	33		std. meth.17.915-A
44	MPN/100 ml,streak on plate	33		std. meth.17.907-A
45	Schwartzbord method	35		Wito, 1989 or Rachel Ayres et al., 1991
46	Spectrophotometric method	2		std. meth.17.1002-G
47	Direct count	36		std. meth.17.1002-F,D
48	Spread Plate Technique	38		
49	EDTA titrimetric method	39		std. meth.17.2340-C
50	EDTA titrimetric method	39		std. meth.17.3500-Ca-D
51	EDTA titrimetric method	39		std. meth.17.3500-Mg-E
52	Titration method	39		std. meth.17.2320-B
53	Ion selective electrode	0		
54	France emission photometric	0		
55	Electronic method	0		std. meth. 4500-H+ B
1	Atomic Absorption Method	1	0.0 - 3.0 ppm	std. meth.
2	Atomic Absorption/vapor hydride system	1	0.0 - 30 ppb	std. meth.
3	Nesslerization method	2	0.0 - 2.00 ppm	std. meth.
4	Ammonium molybdate method	2	0.0 - 2.00 ppm	std. meth.
5	Turbidimeter method/nephlo.	3	0.0 - 200 NTU	std. meth.
6	Atomic absorption/graphite furnace/low range	1	0.0 - 20 ppb	std. meth.
7	ICP method	4		std. meth.
8	Persulfate-ultraviolet oxidation	5	0 - 400 ppm	std. meth.17.5310-C(page 5-22)
9	Marco-Kjeldahl	6		std. meth.17.4500-NorgB(page4-144)
10	Threshhold odor No.	7	0 - 200 No.	std. meth.17.2150-B(page 2-18)
11	Partition Gravimetric Method	8	0 - 200 mg/l	std. meth.17.5520-B(page 5-43)
12	Halogenated Solvents, haloforms using static head space techniques (1985)	9	0.01 - 100 ppb	DOE standing comm. of Analysis,UK
13	Purge and Trap capillary column/gas chromatography/mass spectrometric method	10	0.5 - 10 ppb	std. meth.17.6210-D
14	EPA 608	11	0.5 - 20 ppb	EPA
15	Equilibrium with CO2	12		
16	Reduction by Zn	12		
17	Benzene synthesis line	12		
18	Electrolysis	13		
19	Lucas Cell	14		
20	Concentration by evaporation	15		
21	Standard method pH meter (Corning 115)	16	0-14	
22	Argentometric method	18		std. meth.17.4500-Cl
23	Turbidometric method	2	0-40 ppm	std. meth.17.4500-SO4
24	Brucine Method	2	0 - 2 ppm	std. meth.14 (page 425)
25	Screening Method	2	0-7 ppm	std. meth.17.4500-NO3
26	Stannous chloride method	2	0-2 ppm	std. meth.17.4500-P
27	Persulfate digestion method	2	0-2 ppm	std. meth.17.4500-PB
28	Anionic surfactants as MBAS	2	0-2 ppm	std. meth.17.5540-C
29	Kit Method	19	0-1 ppm	Hach Kit method
57	Standard method pH meter (Hanna 8519)	17	0-14	
56	Field Method	0		

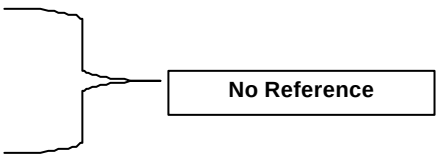
APPENDIX H
INCONSISTENCIES IN MWI ANALYTICAL METHOD CODES

Example of Current Analytical Methods In MWI DataBase

Code	Description	Reference
30	Carmine method	std. meth.17.4500
31	Iodometric method	std. meth.17.4500
32	Polarographic method	Metrohm VA 69
33	Closed reflux method	std. meth.17.5220
34	Winkler method	std. meth.17.5210-B
35	TS, TSS, dried at 103-105 C	std. meth.17.2540-A
36	TDS, dried at 180 C	std.meth.17.2540-B
37	FS, VS, Ignition at550 C	std. meth.17.2540-C
38	Setting Solids , gravimetric/volumetric	std. meth.17.2540-F
39	MPN/100 ml	std. meth.17.908-B,D
40	MPN/100 ml	std. meth.17.908-C,D
41	MPN/100 ml	std. meth.17.910-A
42	MPN/100 ml	
43	Pour plate	std. meth.17.915-A
44	MPN/100 ml,streak on plate	std. meth.17.907-A
45	Schwartzbord method	Wito, 1989 or Rachel Ayres et al., 1991
46	Spectrophotometric method	std. meth.17.1002-G
47	Direct count	std. meth.17.1002-F,D
48	Spread Plate Technique	
49	EDTA titrimetric method	std. meth.17.2340-C
50	EDTA titrimetric method	std. meth.17.3500-Ca-D
51	EDTA titrimetric method	std. meth.17.3500-Mg-E
52	Titration method	std. meth.17.2320-B
53	Ion selective electrode	
54	France emission photometric	
55	Electronic method	std. meth. 4500-H+,B
1	Atomic Absorption Method	std. meth.
2	Atomic Absorption/vapor hydride system	std. meth.
3	Nesslerization method	std. meth.
4	Ammonium molybdate method	std. meth.
5	Turbidimeter method/nephlo.	std. meth.
6	Atomic absorption/graphite furnace/low range	std. meth.
7	ICP method	std. meth.
8	Persulfate-ultraviolet oxidation	std. meth.17.5310-C(page 5-22)
9	Marco-Kjeldahl	std. meth.17.4500-NorgB(page 4-144)
10	Threshhold odor No.	std. meth.17.2150-B(page 2-18)
11	Partition Gravimetric Method	std. meth.17.5520-B(page 5-43)
12	Halogenated Solvents, haloforms using static head spac	DOE standing comm. of Analysis,UK
13	Purge and Trap capillary column/gas chromatography/	std. meth.17.6210-D
14	EPA 608	EPA
15	Equilibrium with CO 2	
16	Reduction by Zn	
17	Benzene synthesis line	
18	Electrolysis	
19	Lucas Cell	
20	Concentration by evaporation	
21	Standard method pH meter (Corning 115)	
22	Argentometric method	std. meth.17.4500-CL
23	Turbidometric method	std. meth.17.4500-SO 4







APPENDIX I

Not available in electronic version.

APPENDIX J

PERSONNEL FROM MWI & COLLABORATIVE ORGANIZATIONS CONTACTED

MWI
Edward Qunqar
E-mail: equnqar@mwi.gov.jo

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Zakaria Haj-Ali
E-mail: Zhajali@mwi.gov.jo

Yassar Nasal
E-mail: Ynasal@mwi.gov.jo

WAJ
Zakaria F.Tarawneh (Director of Labs & Quality Dept)
Phone: 5864361 /2

Dr.Nawal Sunna' (WAJ Labs) (Ph.D Environmental Engineering)
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Youssef Hassan
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RSS
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Phone: 5662080 – 5685397 – 5685396

APPENDIX K

MEETINGS WITH IDENTIFIED STAFF

Tentative list of questions to focus on Information Management and Monitoring, specific to the water re-use component.

Name: Mohamed Siame (MWI)
Bishar Shureideh (WAJ)
Yasser Nasal (MWI)

1) What is the main purpose of the surface water (& waste water) monitoring system?

(Main Objective)

Data for in-house (MWI) studies to monitor quality and quantity information. Universities also use the data but have to request it officially.

2) What is your interaction with JVA, WAJ, MWI, RRS, MOA, MOH?

(Inter-institutional structure)

Informal interaction and sharing of data. If you are on good terms with people there is free sharing of data. You must know about data sources and contact the people that have the data.
After data is submitted to be entered into the MWI oracle database it is very difficult to retrieve this data.
Problems:
Do not have hardware to retrieve the data (Computers)
Do not have permissions to the data.

3) In your position what are the key pieces of information that you need to make decisions?

The data that we need to do our jobs is collected but many times it is very inefficient to compile this information from the different sources.

3.a) How fast do you need this information updated?

(Indicators, Efficiency)

Depends on the data. In general quantity data (Surface water) is collected on a regular basis and in a timely manner. Quality data is many times dependent on situations such as pollution sources up stream and the time frames for collection are excelerated.

4) Can you identify information that you need but do not have access to?

After data is entered into MWI oracle database it is difficult to get back out. Entering new data sources into the database is very difficult. (bureaucratic)

4.a) Do you know if the raw data is collected?
(Information flow and access)

Yes

5) Is the current surface water monitoring system sufficient?
(Monitoring Infrastructure)

Yes, Surface water system is sufficient. Ground water system needs more work.

6) How should quality and quantity information be distributed to water users?

A monthly bulletin. Currently a monthly magazine (French project) is produced but it is not current MWI data.

6.a) What information should be distributed to water users?
(Indicators)

Current MWI analysis's. A steering comity that overseas analysis and checks for quality needs to be created. Current staff do not have time to devote to these activities.

7) What information should be shared at MWI, JVA, WAJ level?

All. Ideally there should be open sharing of information in an electronic format.

7.a) What information should remain within your organization and is your current access to information sufficient.

None. It should be shared but this is not realistic due to attitudes of some staff to keep the information to themselves.

Tentative list of questions to focus on Information Management and Monitoring, specific to the water re-use component.

Name: Yousef Hassen
Org: JVA

1) What is the main purpose of the surface water (& waste water) monitoring system?

(Main Objective)

To maintain and monitor quality and quantity water data for the KAC and surface waters …specifically flowing from KTR.

2) What is your interaction with JVA, WAJ, MWI, RRS, MOA, MOH?

(Inter-institutional structure)

There are various ways we interact but there is not a free flow of information between JVA and MWI.

3) In your position what are the key pieces of information that you need to make decisions?

We need to monitor in real-time all flows related to the KAC and some quality relater parameters.

3.a) How fast do you need this information updated?

(Indicators, Efficiency)

Real-time or at least daily.

4) Can you identify information that you need but do not have access to?

We have some equipment that we received after the termination of a previous project. Specifically an Ultra-sonic sensor for KTR to determine depth and 6 monitoring stations. We need funding to install, set-up and calibrate this equipment.

There are 5 stage offices that have Oracle databases set-up based on the MWI format. These offices have yet to be connected to a Wide Area Network (WAN).

4.a) Do you know if the raw data is collected?

(Information flow and access)

Yes most of the data is collected….but access can be a problem.

5) Is the current surface water monitoring system sufficient?
(Monitoring Infrastructure)

Yes, but improvements can be made to make it more efficient.

6) How should quality and quantity information be distributed to water users?

A daily bulletin that summarizes quality and quantity information is produces for those that monitor the various systems in JVA. (Does not get distributed outside JVA)

6.a) What information should be distributed to water users?
(Indicators)

Summaries of water quality a quantity.

7) What information should be shared at MWI, JVA, WAJ level?
As much as needed and politically acceptable.

7.a) What information should remain within your organization and is your current access to information sufficient.
(Information flow)

We are not against sharing any data and would like MWI and WAJ to be open to sharing as well.

Informal Interviews Narrative Format

Met with Edward Qunqar (MWI)
Highlights:

We used my areas of focus to guide discussion. These were intended as items to get discussion rolling.

1) Work with Edward, Ibtisam and Oracle database managers to design a format for water quality input in database. (RSS data)
2) Design Excel format to be presented to RSS so future data can be directly converted to Oracle.
3) Address end user needs in Ministry. Suggest tools for turning data into information. (Excel Maps)
4) Develop list of key indicators that Water Resources, Water Information Systems, Environmental Protection and Strategy and Policy directorates need to monitor on a month basis.

Identify key directorates in WAJ and JVA for data sharing.
The first two points dealt with migration of data into the MWI database. Specifically we focussed on standardized protocols and formats for the RSS water quality data. Edward mentioned that international assistance is not needed for simple matters such as format specification. I agreed with him that this could be done in the Ministry but that this situation is an indicator of how difficult it is to get new data sources into Oracle. Also, this is a good example of data migration from an organization outside of the WAJ, JVA, MWI circle. In the case of RSS they may be open in providing data in a format that is easily transferred to Oracle.

Point three dealt with end user needs and tools for extracting data from the database. We tried to focus on end user needs in MWI but Edward pointed out that he could only speak of his situation. This may warrant an MWI end user meeting in the future. According to Edward there are two tools developed for "Reporting" which are actually extraction tools for the database. *Fixed reporting* forms are in the process of being developed and should be ready soon. *Dynamic reporting* forms have been developed and are currently being tested by Iman Jaber (MWI). The fixed forms will allow for fix queries to be made on "normally" requested data. The Dynamic forms allow a user to formulate his/her own query. These tool gets the data out of the Oracle database and can be saved in a text format that can be read by excel. Note

that this is a raw data table. Analyses in Excel or other like programs can then be performed.

Point four was relatively open ended and targeted at end user needs. We had a brief discussion about this but ran out of time. This is the same for identifying users in WAJ and JVA.

M.Y. Saidam Ph.D (Environmental eng.) Royal Scientific Society (RSS)

RSS provides MWI, JVA and WAJ with specific water quality data based on the request of the previously mentioned organizations. Essentially they act as a private contractor. Of interest to the monitoring and information management task is that RSS is open to changing the format of final data products that are provided to MWI. If MWI can specify a format that is more compatible with data entry standards in the Ministry this could simplify the migration of data to the Oracle database.

Meeting with Ministry of Health
Hussain M. Al Khandak (Head of Env. Monitoring Division)

Highlights:
Potable Water
There are 18 Labs around the country and each lab has a self-contained monitoring system. 3 types of reports are produced, weekly, monthly and yearly. These are all based on the same parameters that WAJ uses for monitoring. They are distributed to selected MWI personnel. Dr. Hazim

Wastewater
Site selection for wastewater treatment plants and testing of plants using WAJ parameters and standards is performed by MOH. No monitoring stations on the Zarqa river are used for data collection..

General
Summaries of data are generated based on Administrative Governorates. This means that comparisons of data can be represented in Maps using the governorates as “containers”.

Interview with Zackaria Tahaweneh at WAJ LABS

Highlights:
We talked about the general interactions of WAJ labs with RSS, JVA and the Ministry. The lab produces monthly reports of water quality data which are distributed to Key Ministry staff. They have a close working relationship with

the MOH and data sharing takes place. To date, no formal mechanisms are in place for sharing of raw data.

The labs are in the process of moving to a new building and updating their Laboratory Information Management System (LIMS) Tom has be interacting with them to facilitate staffing and training of personnel to move to the new system. They are anxious to move over to the new system, which is based on an Oracle database. When this system gets up and running there is potential for seamless data transfer to MWI's database if it is design with the same stucture.

Meeting with Dr. Nawal Sunna' (WAJ Labs)
Highlights:

She gave us samples of monthly reports and annual reports and help us to clarify the analysis performed at WAJ central Labs. With a map of monitoring stations in the region we clarified which stations that WAJ used for sampling. She also was very helpful in clarifying technical questions about specific water quality parameters.

APPENDIX L

Sample Data Entry Form Excel

The form should be designed with MWI parameter and standard method coding built in. Figure 1 depicts the form design and Figure 2 shows the associated MWI coding per parameter. Note that units should be added to this design as the MWI code includes units and the element.

Figure 1

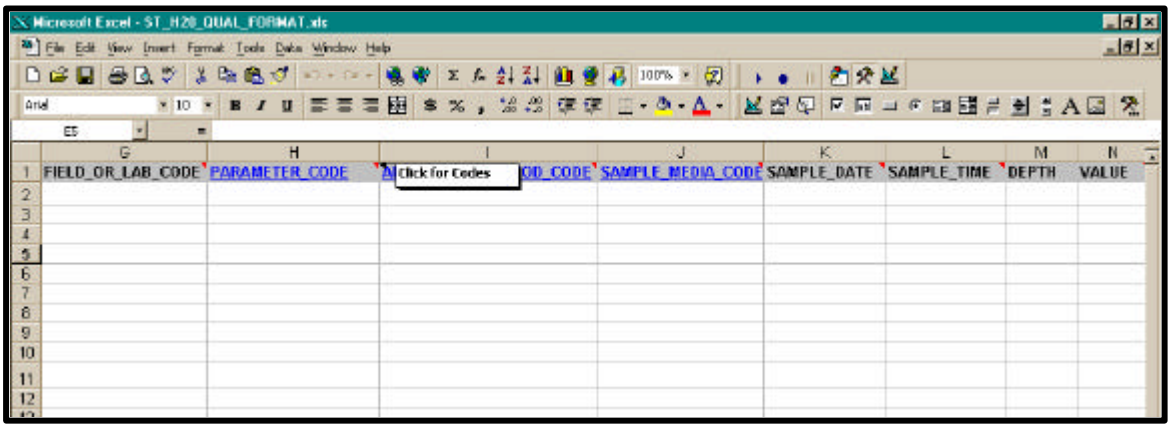
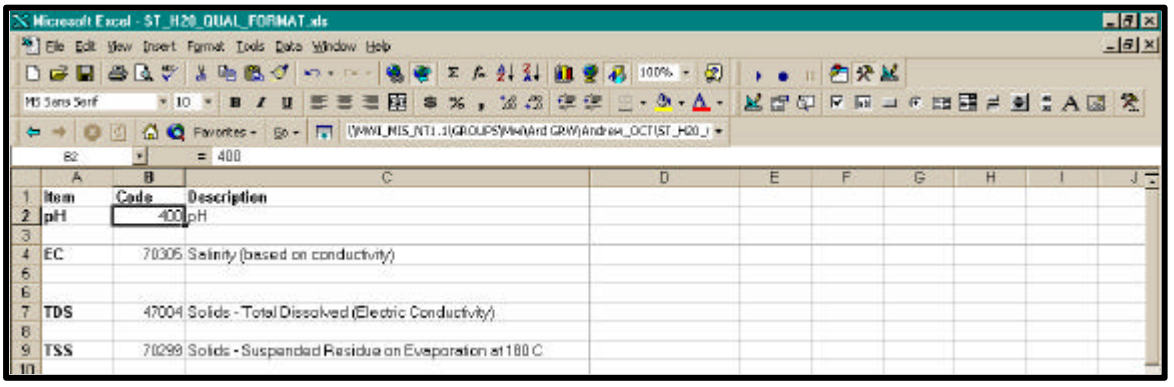


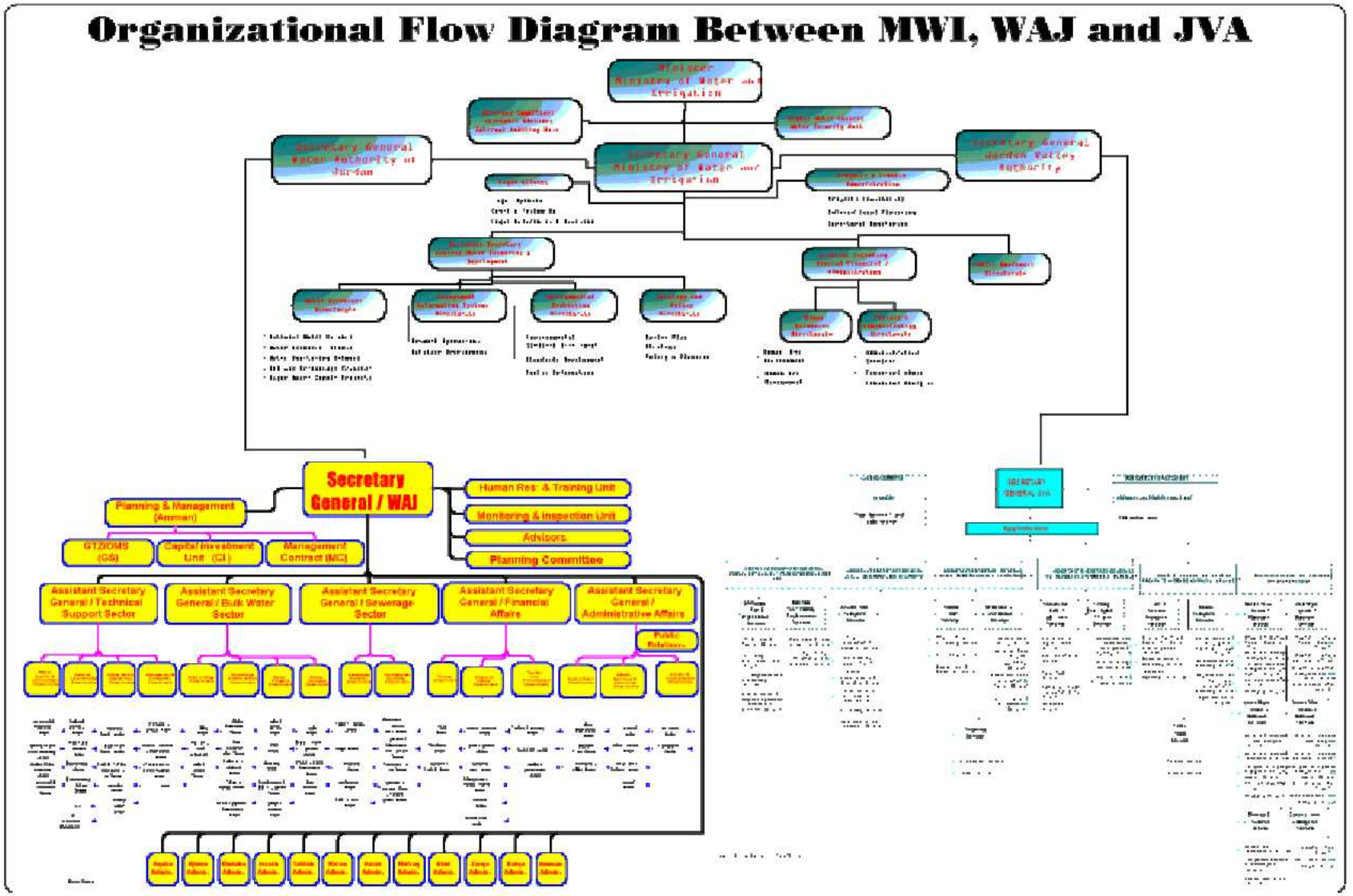
Figure 2



APPENDIX M

Current Organogram Diagrams

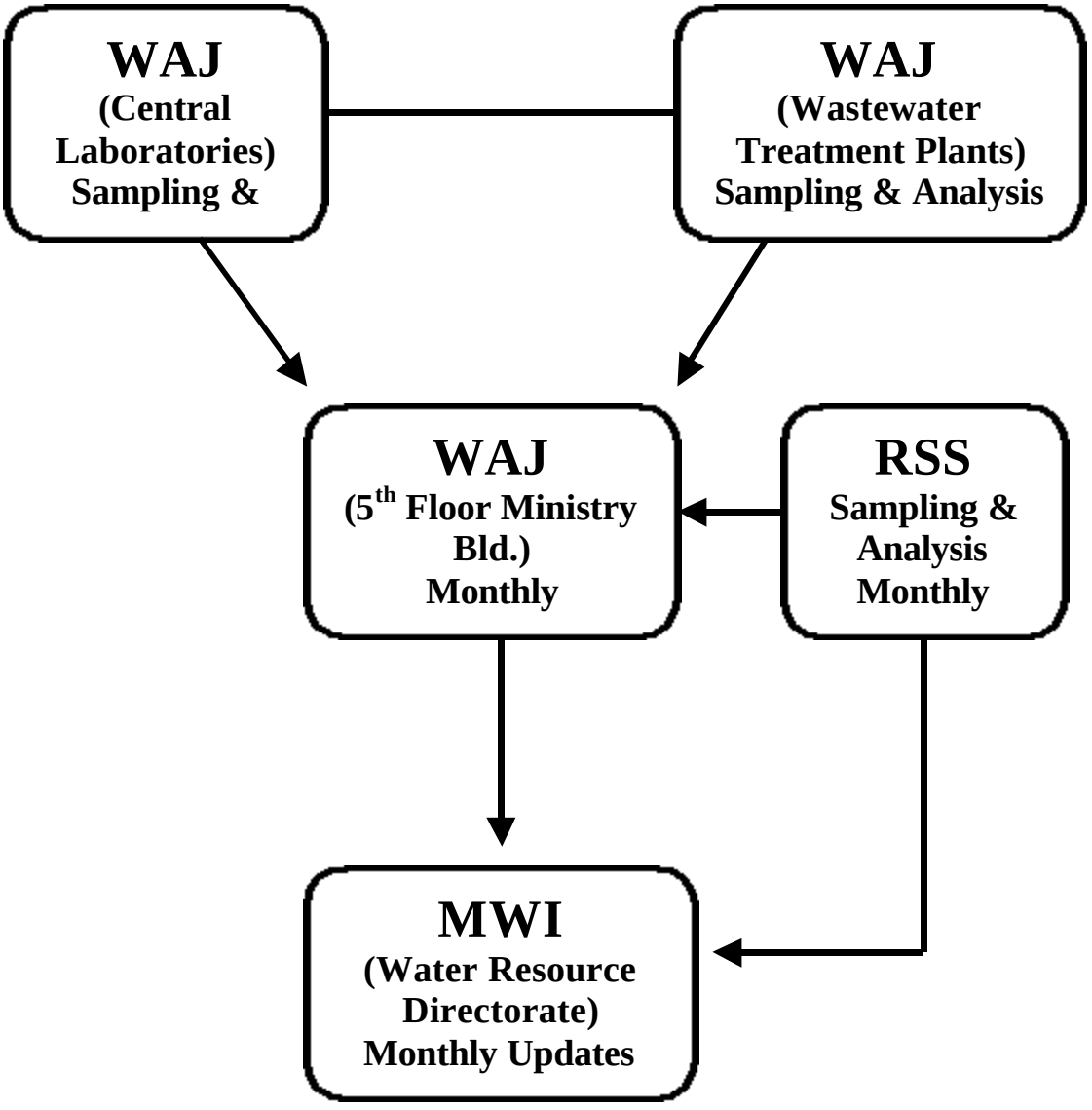
Organizational Flow Diagram Between MWI, WAJ and JVA



APPENDIX N

TENTATIVE FLOW DIAGRAM FOR DATA TRANSFER

Potential Monthly Water Quality Updates



APPENDIX O

SCOPE OF WORK

Scope of Work–Jordan Water Resource Policy Support Project
Short Term Technical Assistance– Chemist / Database Specialist

Background

This project is to support the implementation of Jordan's water policies, and one of its main components is wastewater reuse planning. Advancements have been made in identifying water quality data from collaborative organizations and the short term inputs from a specialist in chemistry and database structures are needed to continue these efforts.

The consultant's assignment will be to continue efforts to migrate water quality data to the Ministry's database. The ideal consultant will be familiar with water quality parameters for wastewater and Standard International Methods used to analyze this data. In addition he/she will have knowledge of Oracle database structures and coding.

Scope of Work

The Consultant will assess current water quality parameter and Standard Method coding in the MWI database. A comparison of this coding to identified data sources will be conducted and new codes will be created when needed.

The intent of this Consultant's input is to complete the work detailed under activity 4.7 (Monitoring and Information Management), which is focused on enhancing the Ministry's capability to gather, access and utilize the data and information relevant to water reuse.

The activity specifically requires the following:

- Review documentation and work to date by ARD/MWI staff pertaining to data migration.

- Update parameter codes based on Royal Scientific Society (RSS) and Jordanian Water Authority (WAJ) water quality parameters while reviewing MWI existing coding to insure there is no duplication of codes.

- Update Standard Method codes based on Royal Scientific Society (RSS) and Jordanian Water Authority (WAJ) water quality parameters while reviewing MWI existing coding to insure there is no duplication of codes.

- Revise standard entry forms for water quality data entry forms based on new codes.

- Work closely with RSS and WAJ to clarify procedures

This work is to be integrated with the other activities under this component, and with the relevant activities of the Groundwater component.

Outputs

- A table of new parameter codes to be added to MWI database.
- Justification document for new water quality parameter codes
- A table of new Standard Method codes to be added to MWI database.
- Justification document for new water quality Standard Method codes
- A standardized water quality data entry form compatible with Oracle database format and designed to facilitate the selection of coding by "clicking" on codes.

Roles and Responsibilities

The consultant will report to ARD's Chief of Party on all logistical issues, and work directly with the Water Reuse Planning Component leader on all technical issues.

Level of Effort

10 days will be allocated to complete the activities outlined in this scope of work

Schedule

As soon as possible

APPENDIX P

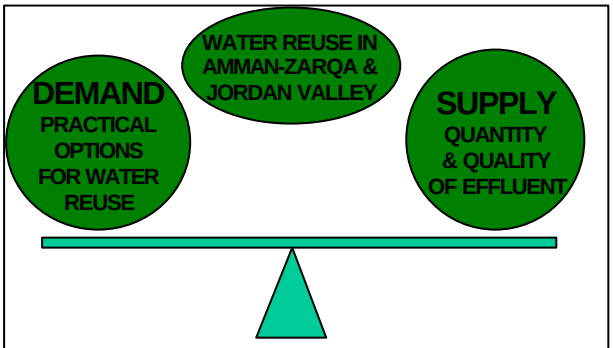
Final Presentation with Conclusions Presented to MWI, USAID and ARD Staff

WATER REUSE IN THE AMMAN-ZARQA BASIN

Ministry of Water & Irrigation
Hashemite Kingdom of Jordan

KEY ACTIVITIES

- Characterization (Quality & Quantity) of Effluent
- Water Reuse Options
- Storage, Conveyance & Blending
- Discharges to Sewers
- Monitoring & Information Management
- Laws, Standards & Regulations



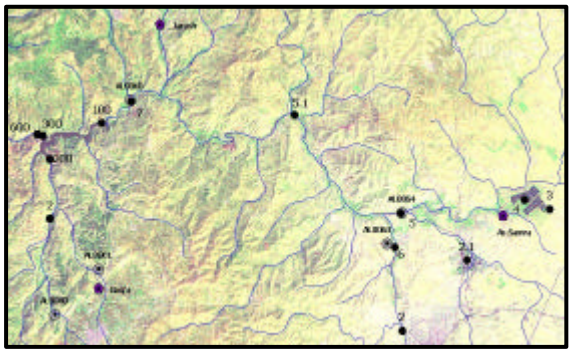
Water Management - Storage, Conveyance & Blending
Monitoring & Information Management
Laws, Standards & Regulations
Hazardous Discharges to Sewers

SUB-ACTIVITIES

- Characterize the Present Monitoring & Information Management System
- Make Practical Steps to Enhancing the Existing Information Management System
- Define Monitoring & Information Requirements for Managing Water Reuse in the Amman-Zarqa Basin
- Develop Strategy for Reaching Requirements

Summary Presentation- Monitoring and Information Management

Short-term Consultant: Andrew Alspach - ARD
Duration: 32 days



Activities

Monitoring and Information Working Paper specific to water reuse component

Working Model

Advancements on water quality data migration to MWI database

EMWIS Web-Page Development

Page Development with MWI staff

Training of three MWI staff in Web-Page updates and maintenance

Spatial representation of data with Excel

Worked with MWI staff to demonstrate Excel capabilities to map spreadsheet data

Monitoring and Information Working Paper specific to water reuse component

Objective:
To present a potential Monitoring and Information Management framework to enhance the Ministry of Water and Irrigation's (MWI) ability to efficiently gather, access and utilize data specific to water reuse in the Amman-Zarqa and Middle Jordan Valley basins.

Methodology

Identification of main monitoring "collaborative organizations" and key informants (end users) with MWI and ARD staff

Individual Key informant interviews to assess current monitoring practices

- Collection of existing institutional organograms of the MWI and "collaborative organizations" to compare, contrast and socialize
- Analysis of existing information flow networks between MWI and "collaborative organizations" to identify limitations and potential
- Validation meetings with MWI, ARD and "collaborative organizations" in order to discuss and guide the potential framework construction.

Model

The Model's main goal is to support monitoring activities specific to water reuse in the Amman-Zarqa and middle Jordan valley basins. Its main strategy is to organize and facilitate a dynamic process to reach the goal.

The following are specific characteristics inherent in the Model:

It is a tool to outline current situations with MWI and "collaborative organizations"

- It is a tool that will facilitate the organization of thoughts
- It is a tool that will help its participants formulate action plans

Major Advancements to Date

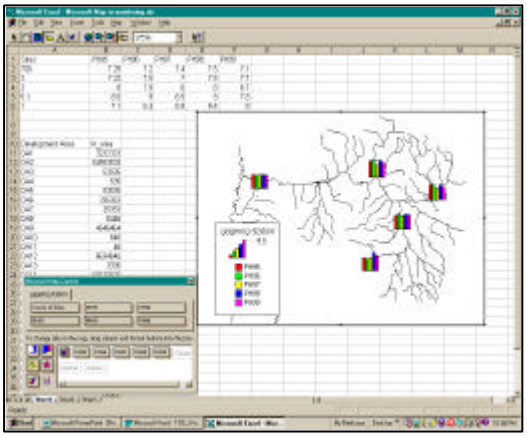
Compilation of individual organization's water quality Standards & Parameters

- Document that records inconsistencies and sets forth new analytical methods
- Document that records importance of parameter coding for data transfer
- Sample data entry forms
- Print out of current database structure and standards from all organizations
- Tentative flow diagram of data transfer

EMWIS Web-Page

EMWIS Web-Page

Excel Maps

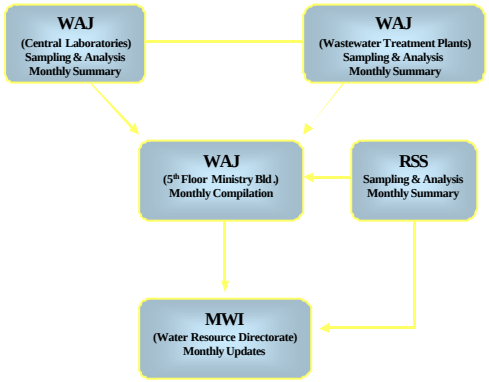


Conclusions & Recommendations

Existing monitoring data sources are sufficient for monitoring

- Short-Term inputs from consultant with chemistry background and knowledge of databases should be hired to standardize MWI coding based on specific RSS and WAJ data parameters and methods.
- Standardize data entry for water quality data
- Trained personnel should migrate data to Oracle from WAJ sources.

Conclusions & Recommendations



Conclusions & Recommendations

The framework Model developed during this period should be used as a tool to guide and monitor advancements.

- RSS should be approached to modify its data entry format.
- Formal procedures for monthly updates should be developed. Letters to RSS, WAJ trained personnel if needed.
- The Ministry of Health acts as a separate monitoring structure and their monthly assessments should be compared to MWI.
- Trained Web-Page staff should be given access to all files developed for the EMWIS page.