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MINISTRY OF AGRICULTURE AND IRRIGATION

IRRIGATION IMPROVEMENT PROJECT

(IDA Credit No. 3412 – YEM)

Main Technical Assistance Package for IIP

WORKING PAPER 15

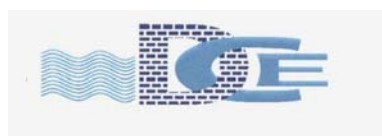
Progress Report MIS-GIS

June 2003

 **ARCADIS** EUROCONSULT

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YEMENI ENGINEERING GROUP

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ABBREVIATIONS AND ACRONYMS

ID	Irrigation Department (Tuban)
MIS	Management Information System
PAD	Project Appraisal Document
PIM	Participatory Irrigation Management Staff (PIM Specialist, PIM Trainer, PIM Extensionists)
PIU	Project Implementation Unit
PMU	Project Management Unit
SMM	Spate Management Model
SMU	Scheme Management Unit
TDA	Tihama Development Authority of MAI (Zabid)
ToR	Terms of Reference
WM	Water Management Staff (Water Management Specialist(s))
WUA	Water User Association
WUG	Water User Group
YR	Yemeni Rials

WORKING PAPERS

- **WP 1 – Water Management in Wadi Tuban & Wadi Zabid**
Alan Clark
- **WP 2 – Concept Paper Management Information Systems**
Thomas R. E. Chidley
- **WP 3 – Training Report No.1 – Orientation Workshops**
Olaf Verheijen
- **WP-4 – Procedure Manual on Participatory Irrigation Management**
Olaf Verheijen
- **WP 5 – Concept Paper for Flood Warning System**
John Windebank
- **WP 6 – Hydrological Analysis**
David T. Plinston
- **WP 7 – Community Awareness Campaigns**
Darryl Kuhnle
- **WP 8 – Gates Assessment – Interim Report**
David A. R. Wood
- **WP 9 – Initial Roads Study**
Abbas A. Abu Taleb
- **WP 10 – Training Report 2**
Olaf Verheijen
- **WP 11 – Training Report 3**
Olaf Verheijen
- **WP 12 – Issue Paper on PIM**
Wicher Boissevain/Olaf Verheijen
- **WP 13 – Irrigation Management (First Mission Report)**
Wicher Boissevain
- **WP 14 – Hydrological Analysis-Interim Report 2**
David Plinston/Abdul-Aziz Abdullah Ahmed Al-Ariki
- **WP 15 – Progress Report MIS-GIS**
Reint-Jan de Blois/Mohammed Ahmed Abdulrahim Hodish/Abdulrahman Mujahed

1 SUMMARY

This report follows up on Working Paper 2: Concept Paper Management Information Systems (MIS) that lays out a strategy for the implementation of a MIS as part of component A (PIM) of the IIP project.

Following the first mission of the International MIS Specialist, the National MIS Specialist has focused his efforts on the design of the MIS, in close collaboration with its future users and with Project- and PIU Staff involved in gathering first line data on developed paper forms and in populating (data entry) the MIS.

The report summarizes the achievements made so far and proposes improvements in the design and implementation (use) by all staff, including a rough estimate of the time planning.

Besides reporting on the development status of the MIS as a whole, the report focuses mainly on the PIM component of the MIS with WUG/WUA formation progressing steadily in both project areas. In particular, the current PIM database design was reviewed against the background of the latest WUG/WUA activities as well as the data entry procedures and collaboration between PIM- and WM-staff in the development and uses of the database to facilitate these activities. The relevant points mentioned in the following documents (dated early June) have been incorporated in this report:

- Second 'Debriefing Report Irrigation Management Specialist (Boissevain)'
- 'Field Visit Report Wadi Tuban', Olaf Verheijen
- 'Internal Memo WUA Performance Monitoring', Wicher Boissevain
- 'Performance Assessment of Water User's Associations and Data', Olaf Verheijen

These and other related documents have been included in a separate binder for future reference by the National MIS/GIS Specialists and other project staff.

In comparison with the MIS design, data entry requires much more staff input. Moreover, PMU/PIUs (or their successors) will have to recruit highly experienced IT personnel unless current staff (seconded from TDA and ID) is trained in operating and maintaining the MIS¹. Since the ToR does not go into great detail, the PMU/PIUs should decide which components should be designed, who will be responsible for data entry, and who will finance the required activities.

¹ This is to re-emphasize what was already noted in the Concept Paper MIS.

2 TOR REQUIREMENTS MIS

The ToR in the contract envisages a MIS that contains the following basic features:

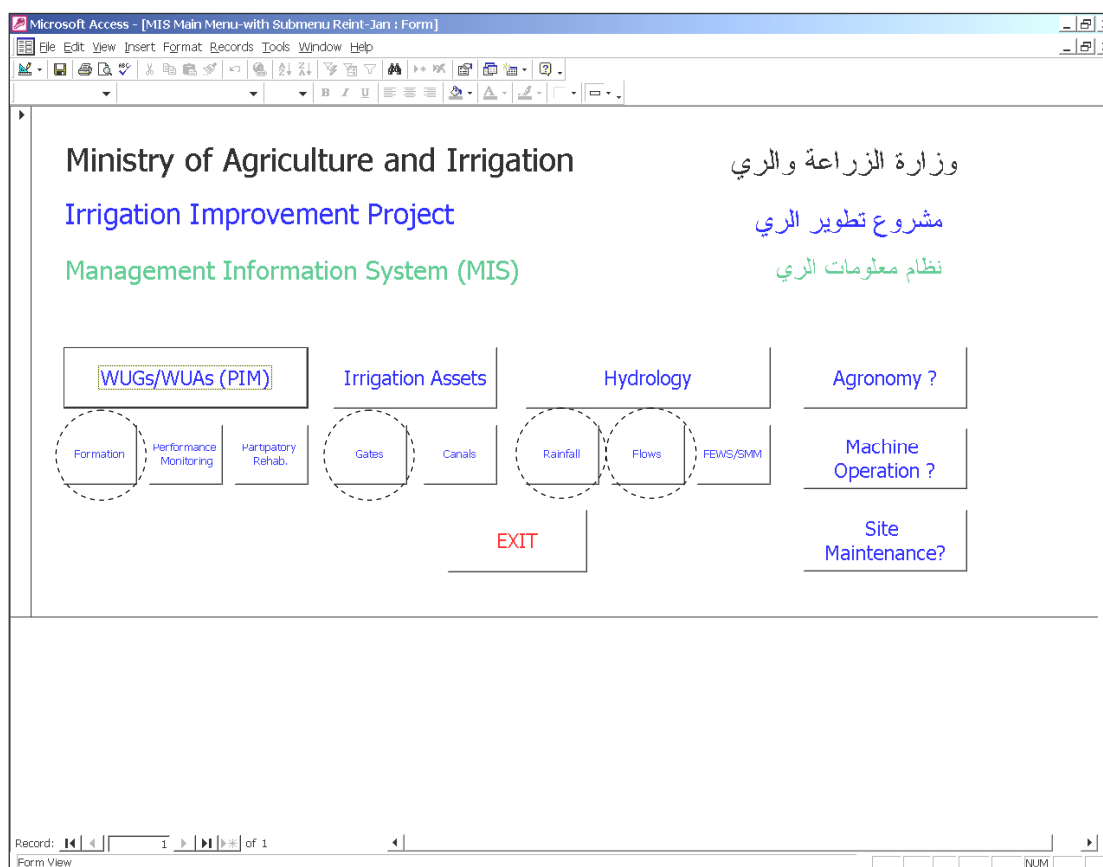
- Medium for storing all **basic information pertaining to the irrigation system** infrastructure: service area, irrigation infrastructure, organization and equipment
- **Generation information needs of different levels of management** for successful operation of the irrigation system: forms/systems for tracking of day-to-day activities related to irrigation O&M (including financial and administrative aspects).
- Reports related to monitoring irrigation operation, maintenance and control of facilities and equipment, water charge billing and collection support services, and overall operating and financial performance
- **Identifying the users of the information and reports**, and specifies the frequency of such reports base on the need for the information
- Providing information required by the Irrigation Department or the Tihama Development Authority for **monitoring the performance of the WUAs**

According to the ToR, the MIS will be developed for the Scheme Management Unit (SMU) and the WUAs. The MIS should therefore meet their (future) information requirements for reporting on (internal) management of systems operations, as well as those of the Irrigation Department, Tihama Development Authority (TDA) and Social Department in their supervisory role in overseeing system operations and monitoring WUA performance in spate irrigation areas. An overview of the paper forms, including a few samples, used by 1) the Project Implementation Unit (PIU) -in Tuban- and 2) the TDA -in Zabid- is included in Appendix A. These forms reflect the need of the PIU's (PMU) and TDA and have been taken into consideration in designing the MIS.

3 MIS DEVELOPMENT

3.1 MIS COMPONENTS

The MIS will be implemented using MS Access 2000 and will include a single user-friendly interface which will allow users to link up with one of the components. A ‘screendump’ of what this interface might look like is shown in the figure below (source: Hodish).



The sequence of the components (from left to right) indicates the development stage, with the dotted lines showing the subcomponents for which the MIS design has been practically been completed and data entry is ongoing.

1. Basic information and the maintenance requirements for all the gates along the higher level canals in Tuban and Zabid wadi's is stored in the 'Gates' component and could be included (as is shown) under 'Irrigation Assets'. Basic information pertaining to the wadi's (cross sections, profiles) and irrigation canals² can be stored under irrigation assets as well. Up to now, only limited data has been collected on the irrigation canals. Since this data is most relevant to the water user associations, close collaboration with the Water Management Specialists is required to collect and enter the data in an efficient manner.
2. Information pertaining to the formation of WUGs/WUAs is stored in the 'PIM' component. Key institutional, financial, technical indicators for WUA performance monitoring still need

² The availability of this data should be checked with the Water Management Specialist(s) in Tuban/Zabid

to be defined and incorporated in the database. For this purpose, an internal memo has been drafted by Wicher Boissevain which gives an overview of key project progress indicators based on: 1) milestones listed in the Project Appraisal Document (PAD), 2) indicators taken into consideration by the Social Department, and 3) internal project progress monitoring requirements. See paragraph 4.3 for further details.

3. Hydrological data will be included in a 'Hydrology' component. The TA Hydrologists have completed the design and the component will be incorporated in the MIS as a whole following the entry of missing (still expected) data.

The PMU/PIUs have repeatedly indicated their interest in an MIS component for tracking the application and O&M of major equipment assets. Hardcopies of previously collected forms (see overview Appendix A) in Tuban are archived by the National MIS Specialist. During a field visit to Zabid, the PIU Director in Zabid re-emphasised their interest to have the existing system incorporated in the MIS (Access environment) as a whole. A digital copy of the existing system will be sent to Sana'a office. The 'Concept Paper MIS' indicates that the feasibility of incorporating this into a MIS will be investigated (page 2-9) but 'that the PMU have already instituted such a system' (page 3-15) and that there is no need to replace it.

3.2 DATA EXCHANGE SANA'A AND PROJECT OFFICES

With developing data requirements, the MIS components require continuous development as well, parallel to the data entry in the project offices. The 'master-replica' option in Access meets these demands and allows for parallel data entry (in the replica-file) and design (in the master-file). Positive experience with this option in the design and population of the 'gates' database, this option will be used for the PIM database as well, with two separate files for Tuban and Zabid limiting the size of the files that are sent back and forth by email to the Sana'a office.

A second advantage of having data entry staff and other users working with the 'replica' is that it is of 'read-only' file type, hereby building in an additional security and preventing (unintentional) changes to its design. If necessary, additional security can be provided by distinguishing 'administrators' and 'general users' using the 'User Group Accounts/Permissions' option in Access (see Tools-Security).

3.3 BI-LINGUAL DATA ENTRY

Most of the MIS components have been designed for bilingual data entry and storage. For each database, designers and users jointly decided which fields should allow for bilingual data entry. Limiting the use of English 'fields' to the most crucial data will contribute significantly to the reduction of data entry time.

3.4 ENCODING

To facilitate efficient data collection and a logical setup of the database, a coding system was developed by project- staff, assisted by the National MIS Specialist, to label the gate and WUG/WUA records in the respective components. Where possible/practical, existing coding systems were used. The codes serve as indexes for the database records and give direct insight in the location of the irrigation structure in question. To further clarify the layout of the irrigation

schemes, sketches of scheme canals have been made and documented and schematics are being developed by the Water Management Specialist (in Tuban) for each command area.

- For each of the following MIS components details on the status of development and data entry are provided in the next chapters: PIM Component
- Gates (Sub)component (of component 'Irrigation Assets')
- Hydrology Component

4 PIM COMPONENT

Parallel to the formation of WUGs and WUAs, two identical PIM databases were designed to collect data on the farmers, field plots, canals and formed WUGs within the Tuban and Zabid project areas. Data entry is being carried out by PIU staff at the respective project offices.

4.1 CANAL, FARMER, FIELD PLOT, WUG AND WUA ENCODING

The schematic layout of wadi Tuban is included in Appendix B to illustrate the coding system used for the primary³ and lower level canals (see text box below). The schematic illustrates that each offtake is coded with an abbreviation of the canal/obara name. Similarly, canal codes have been given to the lower level canals (secondary and/or tertiary (WUG-level) depending on the 'traditional' or 'modern' layout of the system) canals for each command area for which separate schematics have been prepared by the Water Management Specialists. To further illustrate the encoding, the schematic for the 'traditional' Bert-Salem command area has been enclosed in Appendix 2.

The following coding system has been used to label these canals:

- **Secondary Canals:** offtakes from the primary canals are numbered from up- to downstream with the letter p (i.e. p1...pn, n=number of offtakes)
- **Tertiary Canals:** tertiary canals are numbered from up- to downstream with a number (without a letter)
- **Farmer Codes:** Tertiary Canal Code, followed by Fn (n=farmer number)
- **Farmer Plots:** Tertiary Canal Code followed by Pn (n=plot number from up- to downstream)
- **WUG Code:** Since more than 1 tertiary canal can be part of one WUG, WUGs are numbered by the Secondary Canal Code followed by a (capital) letter. If for a particular reason (due to excessive size for example) farmers sharing a single tertiary canal are organized in two separate WUGs, the two WUG (capitals) letters are preceded by the Tertiary Canal number.

An analysis of collected data for wadi Tuban so far revealed some small inconsistencies in the encoding which were streamlined following discussions with project and PIU staff. It was agreed that the codes should be added to the schematics of the Water Management Specialist, hereby providing a single overview of the irrigation system (including codes) which can be used by all project staff, in particular PIM-staff (including Extensionists) and WM staff and PIU staff involved in data entry. In the long run, it will provide the PIU's, PMU and other organizations with updated (as farmer data is only subject to change) overviews of the irrigation schemes.

Following discussions with PIM-staff on the data collection and entry for wadi Zabid, the issue of shared ownership (more than one owner) and shared farming (more than one farmer) per plot was raised. It appears that Tuban staff are dealing with this issue by simply noting down the 'family name' of the farmer and/or owner instead of entering data on each farmer/owner (for example: sons of a deceased father). Since the reasoning of PIM-staff in Zabid seems justified, the Tuban database will be customised to meet these data entry and presentation requirements

³ Offtakes from the wadi, whether it be upstream from a weir or directly from the wadi (so-called obara)

within the coming days/weeks. The issue will also be discussed in Tuban before a decision is taken to implement these changes there as well.

4.2 WUG FORMATION AND MONITORING

Contrary to the Gates database (see chapter 5), two separate database files (for Tuban and Zabid) are being used for the PIM database. This database includes data on 1) farmers, 2) field (plot) data, 3) canals, 4) WUGs, and 5) WUAs. The text box below gives a summary of the data entry status as per June 2003.

Tuban

27 WUGs (of 142 formed so far-more will follow), 120 (of 500+) WUG Canals, 900 (of 5000+) farmers, 700 farmer plots (out of 5000+), 70 village names, 17 weir/obar names. To stimulate/support the use of the MIS in the WUG/WUA formation process, the data entry for the WUGs (formed so far) was completed in Sana'a .

Zabid

- **With the formation of WUGs just getting underway, only data on 1 WUG (of 7 formed so far) has been entered so far. Following the changes to the database (to account for more than one owner/farmer per field plot), data entry will proceed shortly (with data on 1 WUG -45+farmers-entered within two hours during the field visit) the data entry -with effort/willingness from the side of data entry staff- should be able to keep up with the formation of WUGs, hereby allowing PIM-staff to benefit from its advantages.**
- **With the digitising of the field plots well underway, a first attempt will be made to link the field/farmer/canal data to the GIS.**

With the data entry⁴ progressing slowly but gradually, PIM- and WM- staff in Tuban have (understandably) started using Excel-sheets to monitor the progress of the WUG/WUA-formation. As a result, data is being entered twice, once in the Excel sheets and once in the database. A quick comparison revealed inconsistencies between the two data sources. It is essential that a single source of data is used. To bridge the gap between the current situation (much data yet to be entered) and the needs of the PIM-, WM- and other project staff, the 'Summary Sheet on Formation of WUG's per Primary Canal System' (as used before in Excel) have been replicated in the Access database. An identical 'report' was designed to generate the same overviews based on the already entered data (on 27 user groups).

Following discussions with the PIM- and WM staff, the following procedure was agreed upon:

- **Until/if data entry catches up with the status of the WUG formation, summary sheets on the formation of WUGs will be 'pre-cooked' using stored totals in the database. Changes/additions will be noted on the hardcopies (which include a printing date⁵) and data will be modified by the PIU staff member who is currently entering the data.**
- **Once the data entry catches up with the actual status of the WUG formation, the newly designed 'report' will be printed and used.**

⁴ Arabic manuals are available for PIM data entry but should be updated to include the latest changes in the database (since data entry staff have been trained 'by-doing' in both project areas also for future use).

⁵ Since the printouts incorporate any additional records entered since the last printout (contrary to Excel files which often 'saved as' new files hereby increasing the risk of printing out incomplete/old files), data reliability is assured

This procedure will benefit the sustainability of the MIS in the short- and long-term. In the coming few weeks, communication between the PIM-, WM and data entry staff is essential to correct any mistakes or inconsistencies in the WUG data so that the users of the reports gain confidence in its effectiveness. Related to this, the Water Management Specialist (Tuban: Hobeshan, Zabid: Gamal) should streamline the schematics to include the WUG- and canal coding and the WUG entities (covering one/more ma'aqams) as they are entered in the database⁶. These up-to-date schematics also serve as a helpful visual aid for other project staff, particularly prior to the completion of alternative -properly scaled- GIS maps.

With the formation of WUGs/WUAs progressing steadily now in Tuban, the MIS Specialist(s) should monitor the data entry closely and where necessary, provide training in the use of the PIM database, hereby introducing changes/improvements where necessary. The text box below summarizes the modifications/additions to the existing PIM database.

Tuban

- **Each offtake has been encoded individually (with the previously defined 'command area code' followed by a code of the obar-previously these were all included in one 'command area code'). This small change in the coding system is consistent with the schematics made by the Water Management Specialists.**
- **Inconsistencies in the entered data were corrected in line with the adapted coding system, with a primary focus on the entry of data on the WUGs/WUAs.**
- **New data entry 'forms' and output 'reports'(Summary Sheets on WUG Formation) have been made to support the PIM activities related to the formation of WUGs/WUAs (see Appendix D).**

Zabid

- **The revised database for Tuban (including new forms) was also installed in Zabid. Changes to account for more than one owner/farmer per field plot should be completed within a week or two. In the mean time, data entry for the other WUGs will continue.**

In Tuban, data entry is carried out by a secretary who is expected to provide secretarial support to PIM, WM- and PIU-staff as well. Given the 10,000+ records on farmers/field plots still to be entered (and the existing gap with the WUG-formation status), additional staff input (possibly by Hayam who will be completing gates data entry) should be considered. Since ultimately the PIU's and PMU will be the main user of the MIS, the involvement of one/more of their staff members should be considered as well, depending on the (foreseen) future roles of PMU/PIUs and other organizations including TDA and Irrigation Department in Lahej.

In Zabid, the slow progress in data entry was discussed. Following a joint exercise (involving the secretary and the PIM Specialist and -Trainer) in which all field/farmer/owner/canal data was entered for one WUG, confidence has grown in the preferred option of data entry in Zabid (data entry in Sana'a as an alternative). A challenging but feasible data entry 'planning schedule' should be given⁷ and close monitoring should be carried out to confirm this.

⁶ For use by all project staff including ST-staff providing intermittent inputs (hereby having the most up-to-date information with an arms reach), until GIS maps (properly scaled) might provide more accurate alternatives.

⁷ Following changes to the database (to be implemented within a week or so) to account for data entry for more than one owner/farmer per field plot.

4.3 WUA FORMATION AND PERFORMANCE MONITORING

Since January 2003 over 140 WUGSs have been formed in Tuban and participatory design activities are being initiated parallel to the formation of Water User Associations. Initially the main focus has been placed on three command areas:

1. Al-Arais (modernized) system, upper location (Wadi Tuban)
2. Al-Bustan (modern system) and Bert Salem Complex (traditional system), lower location (Wadi Saghir)⁸
3. Faleg Eiadh (diversion weir with traditional canals), middle location (Wadi Kabir)

As of June 7th 2003, the first two mentioned WUAs have been formed for which data has yet to be entered in the PIM database. An overview of the current and required changes/additions in relation to the WUA formation monitoring (and data entry) is enclosed in Appendix C. These proposed changes/additions are based on detailed analysis of the following (draft) reports (all dated early June 2003) of which hardcopies have been included in a separate binder of the National MIS Specialist):

1. Second 'Debriefing Report Irrigation Management Specialist (Boissevain)'
2. 'Field Visit Report Wadi Tuban', Olaf Verheijen
3. 'Internal Memo WUA Performance Monitoring', Wicher Boissevain
4. 'Performance Assessment of Water User's Associations and Data', Olaf Verheijen

Besides these 'internal' monitoring -WUA formation indicators-, there are also a number of WUA performance indicators which are generally more of an 'external' nature since particularly the Social Department will be involved in monitoring the functioning of the WUAs after they are established using the following indicators (see report number 1):

- Timely submittal of WUA Meeting minutes
- Submittal of financial audit statement
- Prolongation of corporate license under 'Law on Cooperative Associations and Societies (Law 39, 1998)

In Report 4, numerous other potential institutional, financial and technical performance indicators are listed. PIM/WM staff emphasized the effectiveness and ease in using key financial indicators such as the fee collection percentage to monitor WUA performance. Based on the gained experience in forming several WUAs, PIM/WM staff should decide on which indicators to use. Reports similar to the 'WUG Formation Summary Sheets' can be used to present this data, with the sole purpose of assisting PIM- and other project staff in monitoring progress.

⁸ Initially, two WUAs were planned for Al-Bustan and Bert Salem Complex

5 GATES COMPONENT

Considering the enormous effort required to make an inventory of the gates for (participatory neutral) contracting of 'priority works', the main focus was initially placed on assessment of the irrigation infrastructure resulting in the identification of 'priority' rehabilitation works. For this reason, the development of a database to facilitate this process was designed first. The 'gates' database aims to collect general data and maintenance requirements for the vertical and radial gates at all levels of the irrigation scheme. A detailed field assessment has been carried out using three forms⁹. The text box below gives a summary of the entered data so far.

Tuban

1100 gates entered, 400+ gates (Beizag command area) are currently being converted from existing Excel sheets (used prior to the design/implementation of the database), approximately 500 still need to be entered during the coming few weeks.

Zabid

144 (all) gates have been entered, a much small number (in comparison with Tuban) due to the more 'traditional' character of the irrigation scheme)

A delaying factor in the completion is the duplicate- and unmatched codes that have resulted from inconsistencies in data entry in separate (non-linked) Excel sheets¹⁰ for the Beizag (Tuban) area. Since (hand-drawn) schematics have not been bundled, plotted locations of the gates on the geo-referenced satellite photo's will be used (since the current ones show clouded skies) to correct these inconsistencies, if necessary combined with field verification.

5.1 ENCODING GATE RECORDS

The canal codes consist of canal code¹¹ followed by a 'L' or 'R' (for Left and Right side of the canal) in case the gates serves as an off-take and 'M' (for Middle) in case of a check structure in the canal. In cases of more than one gate per structure, a (sub)letter is added. Hardcopies of the hand-drawn sketch files should be archived in an orderly manner, preferably also as scanned digital files in the database.

The Gate_Locations show a few inconsistencies, particularly for the imported Beizag gate data. These will be corrected where possible using the sketches made by Adel Tadras. Remaining queries might require feedback from him. The finalization of this exercise will complete the data entry on the gates and maintenance requirements. A remaining task concerns the systematic storage of the photo files for each gate. Various photo directories from different hard drives have been collected (backups were made on CD) and a logical directory structure (Command Areas with possible subdirectories for Primary (main)/ Secondary/Tertiary files) should be prepared by Hayam to be carried out by Hayam with the help of/clarification by Fakh. Backups of all the

⁹ 1) Site Assessment of Vertical Sluice Gates for Canal Offtakes (general information/condition of components), 2) Form including data on required works ('Quantity of Works') for Secondary Gates, 3) Form including data on required works ('Quantity of Works') for Main Radial Gates along the Wadi's.

¹⁰ Separate sheets contain 'general information' and 'gate maintenance requirement' data.

¹¹ Primary/main canal: abbreviation of the canal, secondary canal x: P-x

photo's have been archived in the Sana'a office on CD's and on the computer of the MIS Specialist.

Given the fairly large size of each photo (400-900 Kb), required to achieve sufficient resolution, embedding/linking these files in/to the database will require excessive storage space. Using hyperlinks has the disadvantage of being sensitive to the exact location (directory) of the photo files. Similarly, changes in the directory structure will corrupt the link. It is therefore suggested to only include the file name in the allocated field in the database.

6 HYDROLOGY COMPONENT

A third component of the MIS has been designed to store and present all available hydrological data, including rainfall series for measuring stations in both command areas as well as measured and calculated spate flows¹². The design of the MIS for the Hydrology Component was made by the International Hydrological Analyst during his first mission and further populated by the National Hydrological Analyst from thereon. Additional precipitation data for 2003 and any other new data will be included during the next mission of the International Hydrologist following the screening of the (new) data. The table below gives a general overview of the available data.

File Name/ Description	Content
Zabid.mdb	Flood Analysis Data/statistics derived from 18 years of individual floods recorded at Kohlah by TDA from 1982 –2001: Duration, Qbar, Qmax, Volume, Duration per flood event and/or daily figures
AddRain.mdb	Daily precipitation data for 24 gauging stations between 1993 and 2000 (check: Zabid area, which data is yet to be added?)
RainSummary.mdb	Summary of all the available (and yet to be received?) precipitation data for 25 gauging stations (check fields: DSY-n, DEY-n, DT-n, DCt-n, MSY-n, MEY-n, MT-n, ID-h)
AddRainNWRA.mdb	Additional daily precipitation data from NWRA and TDA between 1993-2001 for 14 gauging stations (check: for OTHER gauging stations ?)
AddRainTDA.mdb	Additional daily precipitation data from NWRA and TDA between 1993-2001?
Tuban Discharge Calculations	Three files for 200b, 2001 and 2002
Zabid Floods	Wadi Zabid - Kolah Hourly flood hydrograph (April 1996)
Total and Base Flows at selected measuring stations in Wadi's across the country	Yearly Total and (some) Base Flows for Wadi Zabid at Kolah , Wadi Rima at Mishrafah, Wadi Rasyan, Wadi Mawr -Shat Al Arg, Wadi Surdud - Faj AL Hussein, Wadi Tuban - Dukeim , Wadi Bana, Wadi Rabwa - Saba Weir, Wadi Ahwar - Fuad Weir, Wadi Mawza
Excel files ¹³	Rainfall, wind, temperature, humidity, sunshine radiation figures for locations/stations Lahej, Fiyush, Madram and Montrain used for evapotranspiration calculation purposes
Excel and Word files ¹⁴	Hydrometry and hydrology of Tuban and Zabid Wadi's as well as other Wadi's throughout the country

The location of the current and proposed meteorological stations has also been added as a theme in ArcView. In close collaboration with the end users, the Hydrologist(s) and MIS-GIS Specialist(s) should decide which general information and available precipitation data should be linked from the MIS to the GIS.

¹² Data collected from government organizations including NWRA and TDA.

¹³ The inclusion of this data in the MIS should be considered, in the mean time the files should be given clear names and stored in a logical directory structure.

¹⁴ See footnote 13.

7 GIS DEVELOPMENTS

7.1 DIGITISATION PROGRESS

7.1.1 FIELD AND FARMER PLOTS

For Zabid over 12000 ha (of project area=15000 ha) of farmer plots have been digitised. Parallel to the digitisation work, PIM staff have formed 7 WUGs¹⁵ in the project area. The boundaries of each WUG have been defined to coincide with the hydrological boundaries, with each 'mansub' (local name for 'ogma') or weir off-take supplying water (in most areas through traditional field-to-field application) to one WUG. PIM-staff have marked up (1:5000 and 1:2000) printouts of the satellite imagery with the actual plot boundaries for each WUG formed so far based on information collected by Extensionists in the field. Copies of these maps were obtained for the four Wadi Naseri WUGs to experiment with and propose procedures for the finalisation of the digitising work and the linkage between the (geographic) GIS and (descriptive) MIS data in Zabid (see section 7.2). Moreover, it will serve as learning experience for GIS and MIS-work in Tuban.

For Tuban, digitising work has yet to start. The schematic made by the National Water Management Specialist indicates a total project area at 11500 ha. This needs to be double checked with the requirements listed in the ToR.

7.1.2 WUG/WUA COMMAND AREAS

So far, over 140 WUGs and two WUAs have been established in the Tuban project area. The boundaries of these and future WUGs/WUAs should be digitised in separate layers as well. The creation of three layers (field plots, WUGs, WUAs) will allow the user to carry out detailed analyses, including for example an analysis of dual membership of farmers.

7.1.3 OTHER LAYERS

Besides the digitisation of the field plots, the following layers have been developed for the Zabid GIS as of June 2003:

- 36 canals (or portions)
- 5 main weirs/diversion structures
- 25 (secondary) diversion structures
- 20 roads
- current and proposed meteorological stations

The inclusions of the 144 (secondary) gates can be completed shortly since the coordinates are included in the (practically) finalised Gates database.

7.2 LINKAGE GIS-MIS

With the foreseen linkage between (selected) GIS imagery and MIS data, a constant (non auto-ID) must be defined to serve as a 'primary key' (a unique value) to link the geographic polygons

¹⁵ Three pilot areas: 1) Wadi Nasery (4 WUGs), 2) Gereb-Bira (one or two WUGs), and 3) Ebry-Garhazi (one or two WUGs)

(field plots, WUGs, WUAs) to farmer plot-, WUG- and WUA data. The (unique) field plot-, WUG- and WUA-codes will be used for this purpose. As a 'case study', the field plot digitising was finalised for the Mansub Al Shalabi WUG and the thematic attribute table was joined with the 'field' table (through the 'unique' field code). This linking-tool proved to be quite powerful as data from the 'farmer table' in Access, linked internally to the 'field' table, could be displayed on screen with the touch of a button. A sample printout of farmer names for each plot within the Mansub Al Shalabi WUG is enclosed in Appendix E.

Another advantage of this 'live link' is that any updates/additions in the Access database are automatically shown on the GIS maps.

It should be noted, however, that the process of designating the identical code (already entered in the MIS) to the polygon in ArcView is a simple but cumbersome exercise. The GIS Specialist should study possibilities of involving secretarial staff in this process, following on-the-job training. Preferably, this work should be completed in the respective offices in Tuban and Zabid, since the maps (showing actual field plot boundaries) and all encoding/data entry works is done there as well.

7.3 ISSUES RELATED TO ARCVIEW 3.2-8.2

Following startup problems with the license files, ArcView 8.2 is working properly now. Since it appears to run somewhat slower than ArcView 3.2 (refreshing the thousands of drawn polygons), the latter is currently used. Particularly in linking up with the MIS, ArcView 8.2 has the strong advantage of being able to link any Access database file directly to the attribute table of a given layer. Since there are clear disadvantages in working with two separate GIS files¹⁶ at the same time (requiring updating of files in both copies along the way), it is suggested to start using ArcView 3.2 from hereon. The GIS Specialists should jointly decide on this during the upcoming mission of the International Information Analyst.

7.4 FEEDBACK FROM THE PIU

Following a brief presentation on the GIS progress, the Zabid PIU Director explicitly requested the following:

- Names of digitised villages should be identified and included on future printouts of any maps. The GIS Specialist should consult PIM staff on this issue (planning: mid June if possible)
- Conflict resolution related to land ownership rights are dealt with by government staff from the responsible Directorate. It is unclear whether the location of the disputed land OR the whereabouts of the farmers home determines which Directorate will deal with the dispute. In any case, he would like the 3¹⁷ Directorates to be included as a separate layer as well.
- Road '10b', although not entirely shown on the acquired imagery so far, has not yet been digitised despite the fact that it is eligible for rehabilitation as part of the project.
- The PIU Director would like to receive an updated printout (1:50,000 scale) showing the latest GIS developments once every few weeks.

¹⁶ ArcView 3.2 for digitizing work and ArcView 8.2 for the GIS-MIS linkage.

¹⁷ Mention was also made of a 4th Directorate being established.

8 WORK PLAN 3RD QUARTER 2003

8.1 ACTION MIS

Gates Database

- ❑ Gates database: photo files for each gate should be stored in a logical directory tree (to be carried out by Hayam with the help of/clarification by Mr. Fakhri), with the name of each photo file included in the MIS. Similarly, (available) sketch files¹⁸ for each main/secondary canals could be scanned and included in the database (as originally planned).
- ❑ Consider separate database-file for Tuban and Zabid (similar to PIM-database).
- ❑ Consider adding a weir/obar code here as well since the primary canal (code) does not directly indicate which scheme it is part of.

PIM Database

- ❑ Check status of schematic development (and consistency with PIM database data-presented in WUG Formation Summary Sheets) by Water Management Specialists, these could be included in the MIS until properly scaled maps have been prepared in ArcView.
- ❑ Monitoring of data entry: encoding, ensuring data is entered per weir/obar-per WUG (not 'bits and pieces' of data on scattered throughout the project area).
- ❑ Training of PIU staff in file management/data entry with the help of (updates) of the already available manuals (in Arabic)?
- ❑ Address any staffing issues related to (timely) data entry with TL/DTL
- ❑ Streamlining of primary/secondary/tertiary canal codes with the gate codes following the completion of the data collection and -entry (in the mean time encoding by data entry staff should be monitored).
- ❑ Timely planning of work by Extensionists to link (combinations of) plots to farmers, develop simple procedure for timely, effective and efficient data entry by project staff to facilitate smooth linkage of (selected) data with GIS.
- ❑ Consult PIM Specialists/PIM Trainers for a selection of WUA formation and performance monitoring indicators for inclusion in PIM database, hereby using forms/reports similar to the WUG formation summary sheets (see also 'Internal Memo' and 'Debriefing Report Second Mission' of Wicher Boissevain, both dated 28th of May 2003-included in binder)-see proposal in Section 4.3.

Miscellaneous

- ❑ Inform about possibilities/costs of using Microsoft Access Developer to produce and installation package for the entire MIS.
- ❑ Collaborate with GIS Specialist in linking attribute data to GIS maps.

¹⁸ The decision to include these sketch files in the MIS or not should follow the plotting and verification of the the gate locations on the satellite imagery. In the mean time, sketches for the Beizag gates (Tuban) might shed some light on the unmatched- and duplicated codes (from the original spreadsheet of Adel Tadras).

- ❑ Decide on the design and implementation of an Equipment component (following consultations with TL/DTL) as part of the MIS using the forms that will be sent by email (from the Zabid PIU Director) as a reference point.

8.2 ACTION GIS

Geo-referencing/rubber-sheeting

- ❑ Finalise geo-referencing/rubber-sheeting for Zabid imagery and layers in close collaboration with International Information Analyst (MIS) and Mr. Qasily; and
- ❑ Assist in finalising geo-referencing/rubber-sheeting for Tuban, using new (cloudless) satellite images.

Digitising and MIS-GIS Linkage

- ❑ Finalise digitising work for Zabid (remaining 3000 ha-up to 15000?): field plots, WUG/WUA command areas, directorates, village (names).
- ❑ Propose a uniform Coordinate System (MIS Concept Paper: UTM zone 38 North Projection with the WGS 84 Spheroid) to be used by all experts in documenting coordinates in the field (to prevent conversion from one system to the other).
- ❑ Planning, monitoring and support of work by PIM- and WM staff in verifying field plots in the field (using printouts of satellite imagery) and in finalising digitising work on field plots (possibly by office staff in Zabid and Tuban following -additional- training).
- ❑ Experiment with and propose procedures for efficient and effective linkage between (selected) geographic GIS and descriptive MIS data (using ArcView 8.2), in close collaboration with the MIS Specialist(s).
- ❑ Discuss hardware (to raise screen refreshing rate) and software requirements (display Arabic labels) for optimal use of ArcView 8.2 with TL/DTL.

8.3 ADDITIONAL DATA REQUIREMENTS/COLLECTION

Project documentation so far have revealed two main objectives for additional data collection:

1. Collection of baseline data¹⁹ for project M&E purposes
2. Linkage between the Spate Management Model (SMM) and the GIS/MIS

The performance of the irrigation system can be monitored through data collection on the allocation of water: spatial extent, frequency of application²⁰, and the cropping pattern. Since no data is available on the water allocation and the answers of individual farmers are not always

¹⁹ In this respect, Olaf Verheijen's Field Visit Report Tuban (dated early June 2003-page 4) notes: 'IIP shall decide how and when it wants to collect the (baseline) data and information for its MIS'.

²⁰ Observations in the field revealed contradicting answers by farmers, after all, what is understood by a 'flood event': water in the canal or certain water levels? In this respect, John Ratsey has requested WM-staff in Zabid to facilitate the registration of flood events by farmers in simple notebooks.

consistent, the project can only look ahead and have designated farmers note down basic information with respect to the water allocation of future floods²¹.

The SMM will also require a fair amount of data on : land and water resources, cropping patterns, irrigation efficiencies etc. The Project should decide on the model parameters that require additional data collection as well as the means of storing this data in the MIS/GIS.

This data can quite easily be collected by PIM Extensionists during their WUG-preparation visits includes:

- Alternative water sources: shallow/tubewell irrigation
- Spatial extent/frequency of spate water application
- (Rough estimate) cropping patterns: what do farmers grow, depending on their location along the wadi/availability of water

²¹ John Ratsey (DTL) has requested WM-staff to facilitate the monitoring of water allocation during future flood events (using a simple notebook)

LIST OF APPENDICES

Appendix A: Overview of forms obtained from PIU (Tuban) and TDA (Zabid)

Appendix B: Sample Schematic Drawings

Appendix B-1: Schematic of Wadi Tuban (including WUG/WUA formation progress)

Appendix B-2: Schematic Bert-Salem Command Area

Appendix C: Changes & Additions to the PIM Database

Appendix D: Designed WUG Summary Sheets

Appendix E: Sample Printout GIS-MIS Linkage for Mansub Al Shalabi WUG (Zabid)

A. OVERVIEW OF FORMS OBTAINED FROM PIU (TUBAN) AND TDA

Forms PIU (Tuban)	Description
Crop production (project area)	Production project area (tons), production in Yemen (tons), share of the project in total production Yemen (%)-for each crop type
Quarterly O&M Plan	The planned and implemented exploitation (time and costs) of equipment/machinery for particular works
(Half-month) Summary Report Machine Work	Machine Type (bulldozer, drills etc.), operation hours and completed maintenance
Machine Report	Form showing cause, extent of damage and resulting maintenance requirement
Daily Report for Equipment Operation	Equipment exploitation overviews (diesel, oil, grease)
O&M Implementation Time Schedule	Table showing the monthly planning for O&M works: location, volume of work per location, total volume of work, work type, wadi name and team number.
Farmer Production and Net Income Calculation Table	Summary of costs and benefits of agricultural services and -production per farmer
Agricultural services (per farmer)	Form for each farmer listing costs and duration of 'agricultural services' (production methods, farmer input, irrigation schedule, transportation/marketing means etc.)
Technical Data on Dams Wadi Tuban ²²	Location, name, dimensions and water discharge
Forms TDA	Description
Monthly/quarterly report, TDA	Planned, implemented and achieved (%) days spent on field work, surveying, meetings (morning, afternoon, evening), discussions.
Fertilizers Prices Form, TDA	Unit cost, unit quantity, total cost and description of used fertilizers
Pesticides Prices Form, TDA	Unit cost, unit quantity, total cost and description of used pesticides
Irrigation network costs for one hectare, TDA	Unit cost, unit quantity, total cost and description of irrigation network
Cultivation Costs, TDA	Unit cost, unit quantity, total cost and description of cultivation costs (specified per activity-from land preparation to harvesting) for one hectare of a particular crop
Agricultural Production Prices Form, TDA	Unit cost, unit quantity and overall price (YR) for all crops
Daily Water Discharge and Floods	Forms used to collect data on base- and flood flows (date, time, water level, catchment area, water velocity, discharge (average, max.), general remarks)
Agricultural Enumeration for Summer Season	Farmer name, district, village, total area, agricultural area and specification of crops irrigated by rainfall, spate, open/tubewells
Other Forms from the Wadi Moor Project	Forms related to status of roads, status of gate/concrete structures, status of canals

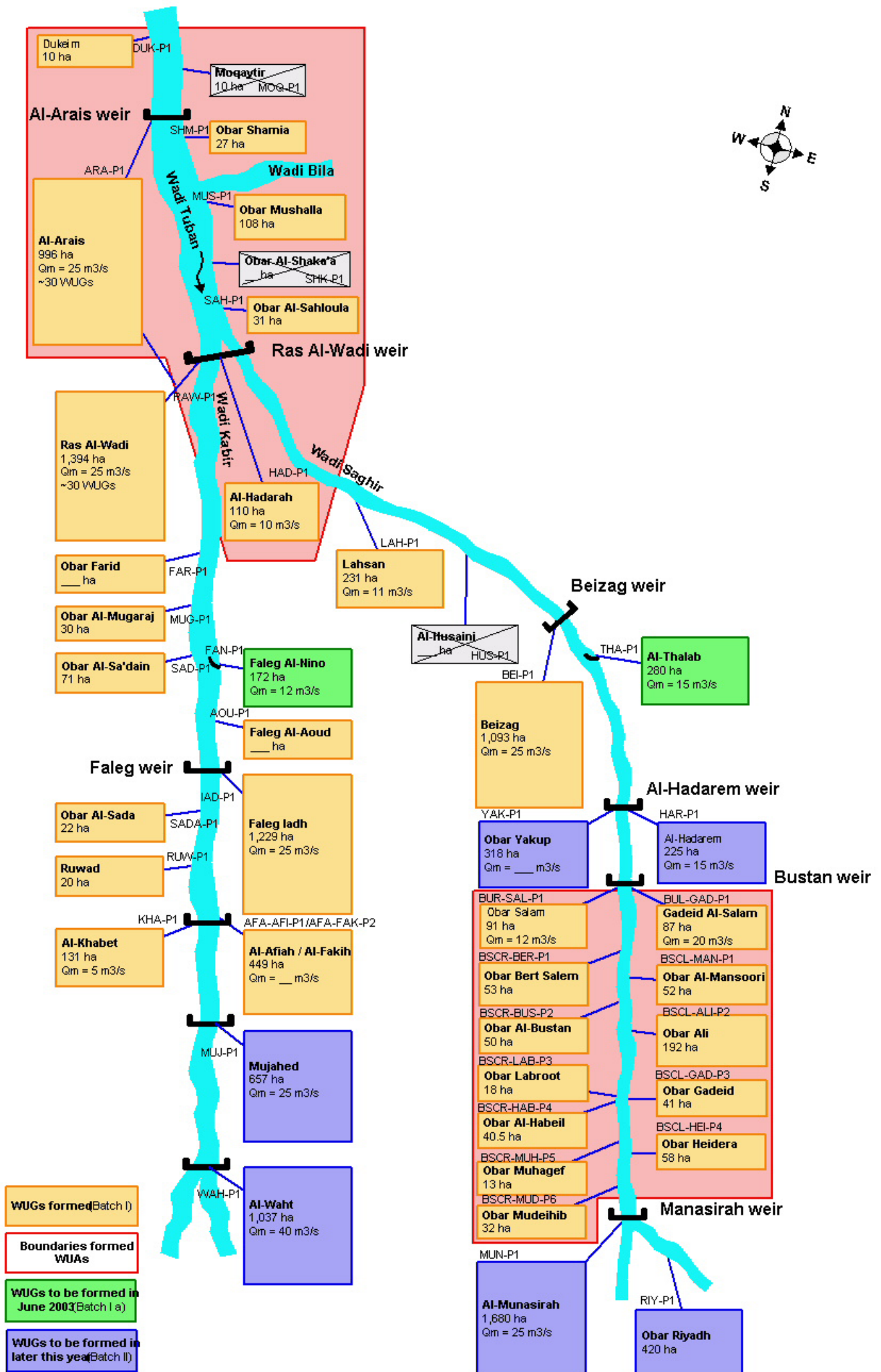
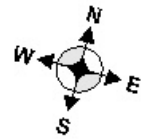
²² So far, the TDA (Zabid) and ID (Tuban) have been reluctant to provide available information collected using these forms (only forms have been provided up to now)

B. SAMPLE SCHEMATIC DRAWINGS

B1 SCHEMATIC OF WADI TUBAN

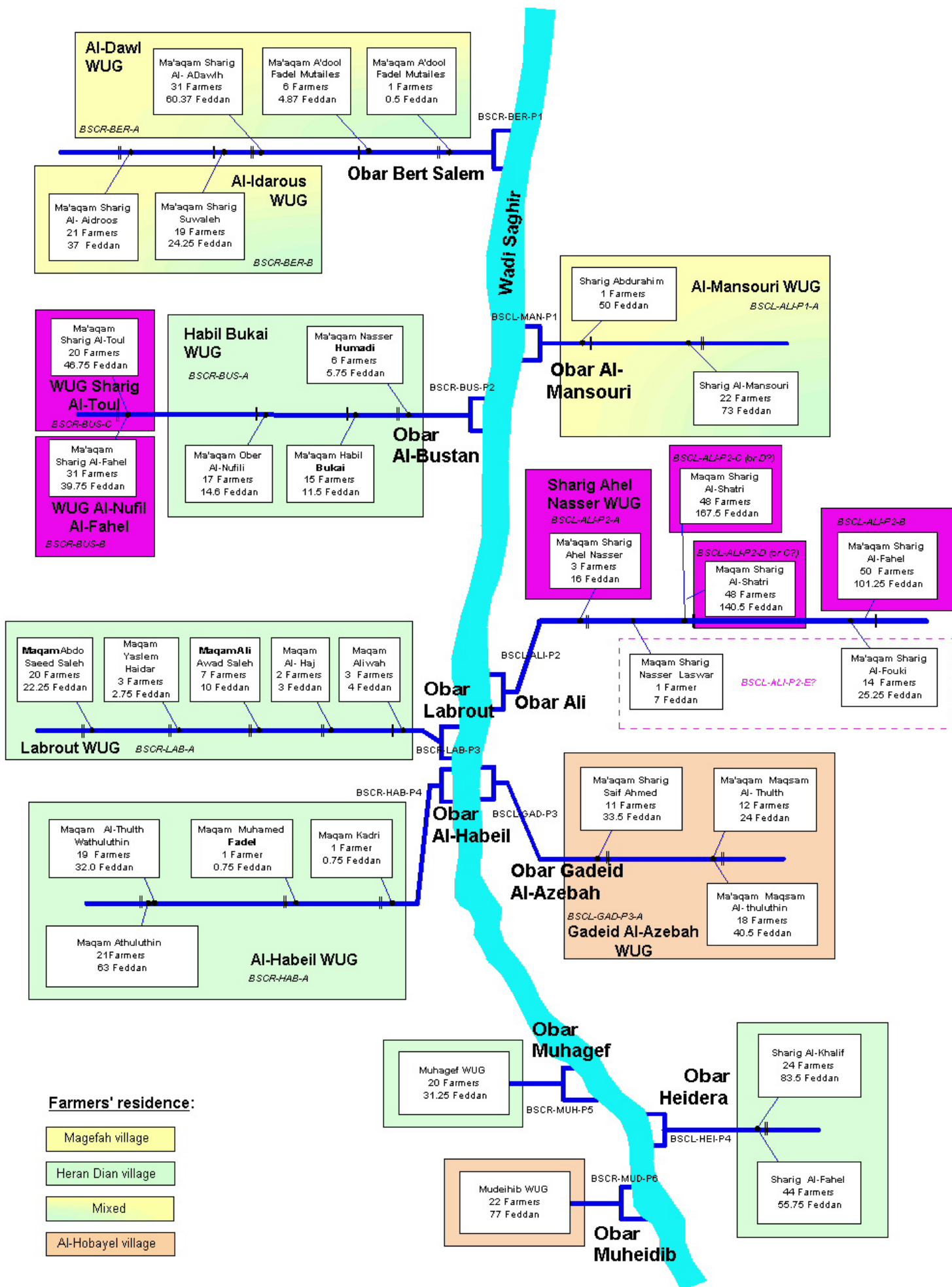
Schematic layout of Wadi TUBAN

Wadi TUBAN



B2 SCHEMATIC OF BERT-SALEM COMMAND AREA

Bert Salem irrigation schemes - schematic



C. CHANGES & ADDITIONS TO THE PIM DATABASE

The following Changes/Additions are suggested to be made in the PIM Database for WUA Formation- and Performance Monitoring

Current Fields	Required Changes
<u>Table WUA Fields</u> WUA_Code, WUA_Canal_Code(s), WUA_Name (English/Arabic), WUG_Code	<ul style="list-style-type: none"> ▪ WUA_Code: use abbreviations weirs/obars ▪ Remove WUG_Code (since WUA_Code is designated to each WUG)
<u>Table WUA Canals</u> WUA_Canal_Code(s), Canal_Name (English/Arabic)	<ul style="list-style-type: none"> ▪ Enable multiple WUA_Canal_Code(s) entries (as many as 12 canals in the case of Bert Salem-Al Bustan WUA)²³, WUA_Canal_Code(s) should be one level higher than WUG canal code
<u>Table WUA Formation</u> WUA_Code, WUA_Canal_Code(s), Formation_Date, Leader_Name (English/Arabic), Village_Name (English/Arabic), WUA_Formation_Meeting_Date, Secretary_Name (Arabic)	<ul style="list-style-type: none"> ▪ Change Formation_Date to 'WUA_Foundation Date' ▪ Besides Leader_Name (should be 'Chairman'), include 'Secretary', 'Treasurer' and separate or one long field for other Board of Director positions (as many as 12 names in the case of Bert Salem-Al Bustan WUA, include their Village Name and Canal/Obar as well. ▪ Include 'Audit Committee Members', include their Village Name and Canal/Obar.
Additional Fields (besides changes-see table above)	
<u>Farmer Table</u> <ul style="list-style-type: none"> ▪ Membership of WUA, Payment of Membership Fee (YR 100) and WUA Share (YR 1000). ▪ Attendance Awareness Meetings, currently being prepared by PIM-staff (see Field Visit Report Tuban, Olaf Verheijen-page 8) 	
<u>Village Table</u> <ul style="list-style-type: none"> ▪ Summary Sheet on Villages of WUGs²⁴ (see hardcopy Bert Salem Complex): unless these could be generated automatically with up-to-date data on farmers (which is not the case), maybe redundant (too late) to incorporate. With timely data entry in Zabid, these forms could assist PIM-staff in (future) WUA formation activities. ▪ Awareness Meetings held (with data entry behind schedule maybe redundant). 	
<u>WUA Table</u> <ul style="list-style-type: none"> ▪ Formation of Farmer Design Committees and WUA Preparatory Committees (with data entry behind schedule maybe redundant). ▪ Participatory Planning and Design of Rehabilitation Works-milestones (since this activity is just starting in formed WUAs, monitoring of this step with help of the PIM database could be considered-check relevancy with PIM-staff). ▪ Completed WUA Management Trainings: 1) Financial Management/Audit, 2) Administrative Management, and 3) Technical (O&M) Management 	

²³ Due to the large number of independent main canal systems grouped together in one WUA (the case in both Bustan-Bert Salem and Al-Arais WUAs), the WUA will have to maintain separate financial records for each of these independent canal systems.

²⁴ These are currently being prepared by PIM-staff in Tuban (see Field Visit Report Tuban Olaf Verheijen-textbox page 5).

D. DESIGNED WUG SUMMARY SHEETS

Annex D.1: Photocopy of old Excel 'Summary Sheet for Formation of WUGs per Canal System: used to keep track of WUG formation→ to be replaced with automatically generated report based on entered data (see Annex D.2)

Annex D.2: New Access 'WUG Formation Summary Sheets (Wadi Tuban) entered up to 28-5': to replace old Excel forms (see Annex D.1), based on entered data

Annex D.3: New 'WUG Formation Summary Sheets (Wadi Tuban), version 1: Name and Canal Codes from Excel Sheets'-summary data identical to old Excel sheets-see Annex D.1, temporary stored in Access (to get users-PIM staff acquainted with the forms) prior to use of automatically generated summary sheets based on entered data

Annex D.4: New 'WUG Formation Summary Sheets (Wadi Tuban), version 2: New Name and Canal Codes-summary data identical to old Excel sheets-see Annex D.1 (identical to data shown in Annex D.3), but with new WUG name and WUG canal codes (in accordance with agreed upon coding system)

WUG Formation Summary Sheets (Wadi Tuban) entered up to 28-5-2003

WUG_Code	Canal_Code	No. of WUG Canals	Area (feddan)	Total No. of Farmers	Female Farmers	Owner-operators	Share-croppers	Tenants	Bene-ficiaries	Non Operating Landowners	WUG Members	For-mation Date	WUGs_Leaders
AFA-AFI-P1-A	AFA-AFI-P1	11	81.75	61	4	14	47	0	0	0	61	02-Mar-03	Abdo AL-Hakem Abdulla Darwst
AFA-AFI-P1-B	AFA-AFI-P1	3	62.5	48	2	7	31	0	10	0	48	16-Mar-03	Kamal Saleh Awad Shaikh
AFA-AFI-P1-C	AFA-AFI-P1	9	148.25	59	2	8	40	0	11	0	59	19-Mar-03	Fadi Mohssen Ali Saif
AFA-FAK-P1-A	AFA-FAK-P1	7	104.84	70	3	14	50	0	5	0	69		Yaseen Saleh Moagam
AFA-FAK-P1-B	AFA-FAK-P1	8	47	38	3	3	31	0	4	0	37		Taleb Abdullah Ahmed
AFA-FAK-P1-C	AFA-FAK-P1	6	57.25	35	0	1	25	0	9	0	35		Gaderi Awad Gaber
BSC-LAU-P2-A	BSC-LAU-P2	2	26.25	17	6	14	1	0	2	0	17	16-Feb-03	Anees Nasser Ali AL-A'awar
BSC-LAU-P2-B	BSC-LAU-P2	1	88	44	15	0	44	0	0	0	44	18-Feb-03	Othman Hussein AH-Haj
BSC-LAU-P2-C	BSC-LAU-P2	1	155.25	47	10	0	0	0	47	0	46	22-Feb-03	Mahmood Khadher Owidhan
BSC-LGAD-P3-A	BSC-LGAD-P3	3	98	41	0	40	0	0	1	0	41	24-Feb-02	Aidaros Ali Banasser
BSC-LMAN-P1-A	BSC-LMAN-P1	2	123	23	6	18	5	0	0	0	23	12-Mar-03	Adool Fadhi Motaitas
BSC-LBER-P1-A	BSC-LBER-P1	3	109.88	38	0	0	34	0	4	0	38	15-Mar-03	Yahia Saleh Zaabal
BSC-LBER-P1-B	BSC-LBER-P1	1	36	21	0	0	21	0	0	0	21	17-Mar-03	Yahia Saeed Abdullah Hadi
BSC-LBUS-P2-A	BSC-LBUS-P2	2	16.88	21	5	18	3	0	0	0	21	02-Mar-03	Saleh Fadhi Ali Awad
BSC-LBUS-P2-B	BSC-LBUS-P2	2	52.51	47	14	47	0	0	0	0	45	10-Mar-03	AL-Shaikh Salem Abdullah Saleh
BSC-LBUS-P2-C	BSC-LBUS-P2	1	46.75	20	10	20	0	0	0	0	20	22-Mar-03	Awli Nasser Awidan
BSC-LHAB-P4-A	BSC-LHAB-P4	4	93	41	0	33	4	0	4	0	41	09-Feb-03	Ali Saleh Awad
BSC-LLAB-P3-A	BSC-LLAB-P3	5	44.25	38	21	38	0	0	0	0	35	04-Feb-03	Ahmed Mahdi Olaiwah
BUR-LSAL-P1-A	BUR-LSAL-P1	1	57.47	30	0	30	0	0	0	0	30	14-Apr-03	Arif Saleh Sallam
GAD-P1-A	GAD-P1	6	51.75	36	0	25	11	0	0	0	36	25-Mar-03	Yahia Fadhi Kardoom
GAD-P1-B	GAD-P1	4	107.5	61	0	17	42	0	2	0	58	01-Apr-03	Mohammed Saeed Badas
KHA-P1-A	KHA-P1	11	93.75	20	4	1	19	0	0	0	20	29-Mar-03	Amin Ali Saed Saleh AL-Hadrami
	Totals	93	1701.83	856	105	348	408	0	99	0	845		

WUG Formation Summary Sheets (Wadi Tuban) entered up to 28-5-2003

WUG_Code	Canal_Code	No. of WUG Canals	Area (feddan)	Total No. of Farmers	Female Farmers	Owner-operators	Share-croppers	Tenants	Bene-ficiaries	Non Operating Landowners	WUG Members	For-mation Date	WUGs_Leaders
AFA-AFI-P1-A	AFA-AFI-P1	11	81.75	61	4	14	47	0	0	0	61	02-Mar-03	Abdo AL-Hakem Abdulla Darwst
AFA-AFI-P1-B	AFA-AFI-P1	3	62.5	48	2	7	31	0	10	0	48	16-Mar-03	Kamal Saleh Awad Shaikh
AFA-AFI-P1-C	AFA-AFI-P1	9	148.25	59	2	8	40	0	11	0	59	19-Mar-03	Fadi Mohssen Ali Saif
AFA-FAK-P1-A	AFA-FAK-P1	7	104.84	70	3	14	50	0	5	0	69		Yaseen Saleh Moagam
AFA-FAK-P1-B	AFA-FAK-P1	8	47	38	3	3	31	0	4	0	37		Taleb Abdullah Ahmed
AFA-FAK-P1-C	AFA-FAK-P1	6	57.25	35	0	1	25	0	9	0	35		Gaderi Awad Gaber
BSC-LAU-P2-A	BSC-LAU-P2	2	26.25	17	6	14	1	0	2	0	17	16-Feb-03	Anees Nasser Ali AL-A'awar
BSC-LAU-P2-B	BSC-LAU-P2	1	88	44	15	0	44	0	0	0	44	18-Feb-03	Othman Hussein AH-Haj
BSC-LAU-P2-C	BSC-LAU-P2	1	155.25	47	10	0	0	0	47	0	46	22-Feb-03	Mahmood Khadher Owidhan
BSC-LGAD-P3-A	BSC-LGAD-P3	3	98	41	0	40	0	0	1	0	41	24-Feb-02	Aidaros Ali Banasser
BSC-LMAN-P1-A	BSC-LMAN-P1	2	123	23	6	18	5	0	0	0	23	12-Mar-03	Adool Fadhi Motaitas
BSC-LBER-P1-A	BSC-LBER-P1	3	109.88	38	0	0	34	0	4	0	38	15-Mar-03	Yahia Saleh Zaabal
BSC-LBER-P1-B	BSC-LBER-P1	1	36	21	0	0	21	0	0	0	21	17-Mar-03	Yahia Saeed Abdullah Hadi
BSC-LBUS-P2-A	BSC-LBUS-P2	2	16.88	21	5	18	3	0	0	0	21	02-Mar-03	Saleh Fadhi Ali Awad
BSC-LBUS-P2-B	BSC-LBUS-P2	2	52.51	47	14	47	0	0	0	0	45	10-Mar-03	AL-Shaikh Salem Abdullah Saleh
BSC-LBUS-P2-C	BSC-LBUS-P2	1	46.75	20	10	20	0	0	0	0	20	22-Mar-03	Awli Nasser Awidan
BSC-LHAB-P4-A	BSC-LHAB-P4	4	93	41	0	33	4	0	4	0	41	09-Feb-03	Ali Saleh Awad
BSC-LLAB-P3-A	BSC-LLAB-P3	5	44.25	38	21	38	0	0	0	0	35	04-Feb-03	Ahmed Mahdi Olaiwah
BUR-LSAL-P1-A	BUR-LSAL-P1	1	57.47	30	0	30	0	0	0	0	30	14-Apr-03	Arif Saleh Sallam
GAD-P1-A	GAD-P1	6	51.75	36	0	25	11	0	0	0	36	25-Mar-03	Yahia Fadhi Kardoom
GAD-P1-B	GAD-P1	4	107.5	61	0	17	42	0	2	0	58	01-Apr-03	Mohammed Saeed Badas
KHA-P1-A	KHA-P1	11	93.75	20	4	1	19	0	0	0	20	29-Mar-03	Amin Ali Saed Saleh AL-Hadrami
Totals		93	1701.83	856	105	348	408	0	99	0	845		

WUG Formation Summary Sheets (Wadi Tuban)

Version 1: Name and Canal Codes from Excel Sheets

WUGs_Name/Code	Canal(s)_Name/Code	Area (feddan)	Total No. of Farmers	Female Farmers	Owner-operators	Share-croppers	Tenants	Bene-ficiaries	Non Operating Landowners	WUG Members	For- mation Date	WUGs_Leaders
DIVER_WEIR_UQMA: AL-ARAS		WEIR_OBAR_CODE: ARA										
PRIMARY_CANAL AL-ARAS												
WADI_BANK												
ARA-P14-B	P14-B	0										
ARA-P-20-21-22-23-24-9-24-10	P-20-21-22-23-24-9-24-10-25-26	0										
ARA-P-3-3a-5-6-7-16	P-3-3a-5-6-7-16	0										
ARA-P8-A	P8-A	0										
AL-Abad AL-Garaeb	AL-Abab AL-Garaeb	84	35	9	1	0	0	34	0	18	09-Mar-03	Abd AL-Lssecie Alwan
AL-Araes 1	P-24-1+2	139	49	16	3	0	0	45	0	23	22-Feb-03	Alawy Ail AL-Dah
AL-Araes 2	P-24-3+4	113	35	2	2	0	0	35	0	18	23-Feb-03	AL-Hag Saleh Ail Saad
AL-Araes 3	P-24-5+6	90	18	5	0	0	0	18	0	11	25-Feb-03	Hasan Saleh Horesh
AL-Dukaym	Obar AL-Dukaym	50	19	4	14	0	0	5	0	16	03-Mar-03	Abd Turky Nasr
AL-Fahl	P-20-22	105	44	12	18	0	0	26	0	33	10-Mar-03	Ahmad Mohamad Hashem
Al-Hadara	Obar Al-Hadara	142	56	9	0	0	0	56	0	30	05-Feb-03	Mohsen Haji Ham modah
AL-Makshabah	Makshbah	96	37	7	0	0	0	37	0	37	05-Mar-03	Hasan Ali AL-Rogay
AL-Sabiel	P-14-3	67	25	12	0	0	0	25	0	13	12-Mar-03	Ahmad Hashem Saleh
Assahlola	Obar Sahlola	61	25	9	0	0	0	25	0	26	08-Feb-03	Mohsen Kilah Awad
Obar AL-Mashela A	Obar AL-Mashela	81	33	17	3	0	0	30	0	17	18-Mar-03	Moham d Mohsen Fadel AL-R
Obar AL-Mashela B	Obar AL-Mashela	84	36	12	0	0	0	36	0	19	18-Mar-03	Hasan Mohamad Awad
Obar AL-Shamia	Obar AL-Shamia	48	18	6	0	0	0	18	0	11	29-Mar-03	Faies Sad Abdo AL-Rab
Obar Gool Belah	Obar Gool Belah	28	14	9	1	0	0	13	0	10	31-Mar-03	Saeed Ali Ahmad
Obar Gool Larwah+Gool Hasan AL-Arais		33	21	1	11	4	0	6	0	20	17-Mar-03	Salh Moham d Salh Salim
Obar Gool Shumaila	Obar Gool Shumaila	31	13	7	2	1	0	10	0	9	02-Apr-03	Abd AL-Rab Mohssen
P.24.7-8	P.24.7-8	85	26	2	26	0	0	0	0	14	06-Apr-03	Mohamed Ali AL-Hateer
P.26	P.26	84	27	8	27	0	0	0	0	24	12-Apr-03	Mohamed Sued Muqbal
P.8	P.8	135	47	5	2	2	0	23	0	27	15-Apr-03	Nabeel Fadel Ban Ahmed
P-1+2	P-1+2	86	31	8	0	4	0	27	0	17	15-Mar-03	Amen Ali Kaleb Mohamad

WUG Formation Summary Sheets (Wadi Tuban)

Version 2: New Name and Canal Codes (to check)

WUGs_Name/Code	Canal(s)_Name/Code	Area (feddan)	Total No. of Farmers	Female Farmers	Owner-operators	Share-croppers	Tenants	Bene-ficiaries	Non Operating Landowners	WUG Members	For-mation Date	WUGs_Leaders
DIVER_WEIR_UQMA:	AL-ARAI5		WEIR_OBAR_CODE:		ARA							
PRIMARY_CANAL	AL-ARAI5											
WADI BANK												
ARA-P14-B?	ARA-P14-?	0										
ARA-NEW?	ARA-NEW?	0										
ARA-NEW??	ARA-NEW??	0										
ARA-P8-A?	ARA-P8-1?	0										
ARA-P????	ARA-P????	84	35	9	1	0	0	34	0	18	09-Mar-03	Abd AL-Lssecie Alwan
ARA-P24-A	ARA-P24-1-2	139	49	16	3	0	0	45	0	23	22-Feb-03	Alawy Ali AL-Dah
ARA-P24-B	ARA-P24-3-4	113	35	2	2	0	0	35	0	18	23-Feb-03	AL-Hag Saleh Ali Saad
ARA-P24-C	ARA-P24-5-6	90	18	5	0	0	0	18	0	11	25-Feb-03	Hasan Saleh Horesh
ARA-P???	ARA-P???	50	19	4	14	0	0	5	0	16	03-Mar-03	Abd Turky Nasir
ARA-P20-22-A	ARA-P20-22	105	44	12	18	0	0	26	0	33	10-Mar-03	Ahmad Mohamad Hashem
ARA-P?	ARA-P?	142	56	9	0	0	0	56	0	30	05-Feb-03	Mohsen Haji Hammodah
ARA-P????	ARA-P????	96	37	7	0	0	0	37	0	37	05-Mar-03	Hasan Ali AL-Rogay
ARA-P14-C	ARA-P14-3	67	25	12	0	0	0	25	0	13	12-Mar-03	Ahmad Hashem Saleh
ARA-P??	ARA-P??	61	25	9	0	0	0	25	0	26	08-Feb-03	Mohsen Kileh Awad
ARA-??	ARA-??	81	33	17	3	0	0	30	0	17	18-Mar-03	Moham d Mohsen Fadel AL-R
ARA-???	ARA-???	84	36	12	0	0	0	36	0	19	18-Mar-03	Hasan Mohamad Awad
ARA-????	ARA-????	48	18	6	0	0	0	18	0	11	29-Mar-03	Faies Sad Abdo AL-Rab
ARA-?????	ARA-?????	28	14	9	1	0	0	13	0	10	31-Mar-03	Saeed Ali Ahmad
ARA-?	ARA-?	33	21	1	11	4	0	6	0	20	17-Mar-03	Salh Moham d Salh Salim
ARA-?????	ARA-?????	31	13	7	2	1	0	10	0	9	02-Apr-03	Abd AL-Rab Mohssen
ARA-P24-D	ARA-P24-7-8	85	26	2	26	0	0	0	0	14	06-Apr-03	Mohamed Ali AL-Hateer
ARA-P26-A	ARA-P26	84	27	8	27	0	0	0	0	24	12-Apr-03	Mohamed Sued Muqbal
ARA-P8-B?	ARA-P8-2?	135	47	5	2	2	0	23	0	27	15-Apr-03	Nabeel Fadel Ban Ahmed
ARA-P1-P2-A	ARA-P10-1-2	86	31	8	0	4	0	27	0	17	15-Mar-03	Amen Ali Kaleb Mohamad
ARA-P10-A	ARA-P10	193	55	13	4	0	0	51	0	29	02-Apr-02	Saleh Nasir Harib
ARA-P12-A	ARA-P12(-1)?	90	30	11	5	0	0	25	0	17	31-Mar-02	Abdul Jabar Fadel Jaber

E. SAMPLE PRINTOUT GIS-MIS LINKAGE FOR MANSUB AL SHALABI WUG