الشركة القابضة
لمياه الشرب والصرف الصحي

برنامج إدارة مياه الشرب و الصرف الصحي
Water and Wastewater Management Program

gtz

Since the 1st of January 2011
giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

Report on:

Operations and Maintenance (Plans & Procedures)

By:
David Savery
April 2009

gtz

PN 2006.2063.3; VN 81087234

Strengthening Provision of Services in Qena and Promoting Appropriate Rural Sanitation Options, Egypt

Operations and Maintenance (Plans & Procedures)

David Savery

April 2009

RODECO CONSULTING GMBH

GOPA WORLDWIDE CONSULTANTS

as sub-consultant:

sachsenWasser consulting + operations + management

Contents

Abbreviations

EWRA	Egyptian Water Regulatory Authority
HRD	Human Resources Development
HCWW	Holding Company for Water and Wastewater
LTE	Long Term Expert
NOPWASD	National Organisation for Potable Water and Sanitary Drainage
O&M	Operations and Maintenance
QCWW	Qena Water and Wastewater Company
RGF	Rapid Gravity Filter
SOP	Standard Operating Procedure
STE	Short - Term Expert
TSM	Total Sustainable Management
WTP	Water Treatment Plant
TOR	Terms of Reference

1. Executive Summary

The project “Strengthening Provision of Services in Qena and Promoting Appropriate Rural Sanitation Options” aims at supporting Qena Company for Water & Wastewater (QCWW) in improving its utility management and operation, including the provision of decentralized wastewater services to rural communities. The project is implemented on behalf of GTZ by RODECO Consulting GmbH in association with GOPA Consultants.

This report describes the first of two assignments of an international short-term expert (STE) in Operations and Maintenance (special field: Plans and Procedures) to the project from 7 March to 3 April 2009. A second assignment of the STE is planned for later in 2009.

As a result of the first visit a number of outputs were produced in accordance with the Terms of Reference (TOR). Each of these is individually discussed within the main body of the report with specific documents being provided in the Annex. The methodology employed, the meetings held and details of the site visits undertaken during the assignment are all contained within this report and cross-referenced to the TOR. For the main requirement, namely the production of an Operations and Maintenance Improvement Plan (Annex D), the STE has produced a stand alone document for QCWW and for input and development by the other international short term experts active in similar fields.

Main Conclusions

QCWW is by definition a new organisation and the successful adoption and integration of the staff and assets that used to be managed by the municipal authorities does in itself pose a significant challenge. At a company and strategic level the organisation does not yet have a clear vision of the direction it should go in or how it should get there. Clearly defined company policies, objectives or action plans will be developed later this year; currently the managers of the organisation are reacting to problems as they arise.

This situation is then transgressed throughout QCWW from the top to the bottom of the organisation, which in effect means that sometimes the most urgent business needs are not identified or addressed, whilst other less important needs may be given a higher priority. Thus within the operational functions of the business, and it is particularly evident in the water supply section, the managers are not able to influence the decision making process, which might result in processes being installed or investments being made which are not suitable. This in turn wastes valuable resources and efforts.

Main Recommendations

In the Operations and Maintenance Improvement Plan (Annex D), the STE has identified a number of activities (Section 2, Tables 1-4) which if implemented could generate measurable improvements to the operational performance of the water treatment plants.

Specifically and in addition to the above a number of other recommendations were made as follows:

1. The formation of a process optimisation group with selected staff from QCWW who will be supported by the appropriate experts from this project. The results, findings and outputs of this group then strongly link and benefit the other initiatives as outlined in 2–6 below.

2. An urgent focus on disinfection is needed, including the safety aspects of chlorine drum stores, and the establishment of company standards and key policies within this area.

3. The continuing development of standard operating procedures, local specific procedures/logs and data gathering mechanisms at the local level for the purpose of performance monitoring and reporting.

4. Although some good progress has been made to date by QCWW (supported by project team) work should continue in respect of providing more written information (SOP's & local procedures) for use by plant operators to follow at the local level, for example filter washing sequence and run times, and quality standards/information.

5. The role of the laboratories should be developed in terms of becoming responsible for product quality and for providing the results of analysis to the operational staff in order to monitor trends, in addition to reporting quality failures for action.

6. There is a need to determine a suitable mechanism for prioritising investments linked to asset condition/performance and for improving product quality. (This work will link with the objectives of the master plan unit.)

It is also evident that QCWW needs to adopt a more strategic approach in terms of how the business is managed and operated, which will in itself improve efficiency within the water supply function.

It is therefore recommended at a strategic level in QCWW that:

- clear strategies are developed and the most urgent priorities are identified in order of importance to be addressed.
- goals are set to specify what must be done to attain the QCWW mission. Well-constructed goals are precise and measurable, address important issues, are challenging but realistic, and specify a time period within which they should be achieved.
- key objectives are also set and the rationale behind them is then clearly understood.
- an investment programme is identified to address the most urgent and important areas of greatest need.
- QCWW develops its own company policies, standards and procedures.

2. Introduction

2.1 Overview

The project "Strengthening Provision of Services in Qena and Promoting Appropriate Rural Sanitation Options" aims at supporting Qena Company for Water & Wastewater (QCWW) in improving its utility management and operation, including the provision of decentralized wastewater services to rural communities. The project is implemented on behalf of GTZ by RODECO Consulting GmbH in association with GOPA Consultants.

This report provides the details of the first of two assignments of an international short-term expert (STE) in Operations and Maintenance (special field: plans and procedures) to the project from 7 March to 3 April 2009. A second assignment of the STE is planned for later in 2009.

One of the main outputs of the March assignment was seen to be the development of an Operations and Maintenance Strategy/Plan for water supply. This has been delivered by the STE with the revised title of "Operations and Maintenance Improvement Plan" (Annex D) to be used specifically as a stand alone document by QCWW.

At the STE's suggestion, and as there are a number of other short term experts who have similar and complimentary assignments, it was agreed that the format of the Plan as written would be adopted by the other experts and that their main findings and recommendations would be included within the dedicated Sections of the Plan as follows:

- Section 2 – Water Supply and Treatment Plants.
- Section 3 – Maintenance and Storekeeping.
- Section 4 – Energy Efficiency.
- Section 5 – Network Management and Leakage

The O&M Improvement Plan and the other outputs from the assignment are discussed in more detail in Sections 2-5 of this report, and further details may be found in the appropriate Annex.

2.2 Terms of Reference

According to his Terms of Reference, the STE in close coordination with the project's long-term O&M expert and the QCWW Operations and Maintenance Management Team should:

1) Develop an overall Operations and Maintenance Strategy/Plan for water supply incorporating existing O&M plans and procedures for:
   a) Operational Management Information systems (already prepared)
   b) Performance targets and O&M reporting requirements of the HCWW and EWRA (already prepared)
   c) O&M of treatment plants, compact units and pumping stations
   d) Meeting water quality and quantity targets.

2) Include within the Plan as follows:
   a) Guidelines for carrying out generic operations tasks and activities (checklists) on a shift, daily, weekly, monthly and quarterly basis.
   b) Standard Operating Procedures (SOP)
   c) Operations logs and records (review of)

3) Produce an action/implementation plan for the delivery of the O&M plan.

4) Examine options and recommend an organisational structure for O&M at a District and Village level.

5) Recommend a standard format for O&M manuals to cover water treatment plants, compact units and pumping stations and a methodology for completing the manuals.

6) Identify provisional TOR for the 2nd assignment to be carried out later in the year.

The STE engaged in discussion with the project TL prior to and during the first assignment regarding the wide scope and the significant number of outputs to be completed within the timescale. Although no modifications to the TOR were made (other than the addition of further information/requirements) the TL stressed that the outputs were not expected to be either “in depth” or significantly detailed but were more designed to see the production of simple generic formats or structures that could be progressed and adapted by the long-term O&M expert(s).

The format of this report is designed to reflect above TOR. The outputs and the methodology employed in their achievement are detailed in 2.3.

2.3 Methodology and Outputs

Initial familiarization with QCWW and the local environment was done in the form of a documentation review, meetings/discussions with the TL and the local O&M expert and meetings with key staff from QCWW. In addition, a number of visits were made to water treatment facilities throughout the QCWW service area where interviews with key staff were conducted on site.

The methodology and approach taken by the STE in all of the meetings held with QCWW staff was to:

- Encourage a free and open discussion regarding the current situation and the problems being faced, with an emphasis on determining the greatest areas of need (as seen from their perspective) for input into the development of an O&M Plan.
- Ensure that a step by step approach should be promoted in terms of addressing the most urgent areas of need without an over promotion on technology; tried, tested and simple methods often deliver the best results.
- Carry out a brief review (accompanied by QCWW staff) of the current practices with respect to O&M and formulate a general view of asset condition and the equipment in use at the water treatment plants.

Document Review

The following Table 1 represents the documents that were reviewed by the STE at the start of the assignment:

Document Title	Date of Issue	Author
Technical Proposal	October 2006	RODECO
Assessment of Design, Operation and Maintenance of Water Treatment Plants	January 2008	Mr E. Goessens (RODECO)
HRD Plan and Report	May 2008	Mr A. Sutton (RODECO)
GTZ Progress Report	January 2009	Mr D. Banner (RODECO)
TSM Paper ACWUA Jordan	October 2008	Mr D. Banner Dr. S. Bayoum
TSM Progress Workshop	August 2008	GTZ

Site Visits and Meetings Held with QCWW Staff

The following Table 2 depicts the installations visited by the STE/LTE and the meetings held with key staff members from QCWW:

Date	Location	Postion Held	Name of Person
8-Mar-09	QWWC Hdqts	Chairman of QWWC	General Mohamed Badry
11-Mar-09	QWWC Hdqts	Head of O&M Sector	Mr. Faisal Abdel Rehim
11-Mar-09	QWWC Hdqts	Master Plan Group	Mrs. Nahla Abdel Salam
Date	**Location**	**Facilities Visitied**	**Names of Person**
12-Mar-09	Qena	Salheia WTP + Intake	Manager of Middle area (Mr. Bahaa El Nazer) Manager of Qena District (Mr. Abdel Salam Mohammed Ibrahim) Manager of Salheia WTP (Mr. Nasr El Din Abbas)
		El Hemedat (CUs)	Manager of lab (Mrs. Mervit Sabry)
		BS in Konouz	Supervisor of the station (Mr. Abdel Razik Hassan)
15-Mar-09		El Toyrate New Plant	Manager of the Plant (Mr. Gaber Gad El Karim)
		Gezeret Dandra GI	Supervisor of the station (Mr. Khamis Mohammed)
		Kerm Emran	Supervisor of the station (Mr. El Shazly Mohammed)
16-Mar-09	Qus	Qus WTP + Intake	Manager of Qus District (Mr. Ayman Ibrahim) Manager of Qus WTP (Mr. Fathi Abdalla)
17-Mar-09	Qus	El Meseed New Plant	Mr. Ayman Ibrahim
		Abo El Goud GI	Mr. Ayman Ibrahim
18-Mar-09	Naji Hammadi	Naji Hammadi WTP	Manager of Middle area (Mr. Mahmoud Abdel Samei) Manager of Naji Hammadi District (Mr. Mohamoud Hussien) Manager of Naji Hammadi WTP (Mr.Kamal Mohammed Gaber) Manager of the Chemical lab. (Mrs. Hayam Abdel Warith)
		El Nagaheia CU	Manager of the Plant (Mr. Ahmed Mohammed)

Picture 1 - A Typical Ground Water Source at Gezeret Dandra

Picture 2 - Discussing Cleaning the Nile Intake for El Toyrate New WTP

Picture 3 - Filter Washing Procedure at El Toyrate New WTP

2.4 Outputs

Apart from this report, the following outputs as depicted in Table 3 below were delivered by the STE during his assignment (referenced to the requirements of the TOR):

Table 3 – Document References

ToR Item Ref.	Title of Document	Electronic file name	Annex
1a -d	An Operations and Maintenance Improvement Plan March 2009	O&M Improvement Plan 0409.	D
2.a	Developing Standard Operating Procedures for QCWW	Example SOP for RGF	A
2.b	Developing Standard Operating Procedures for QCWW	Example SOP for RGF	A
2.c	Station and Plant logs for QCWW	Station logs O&M	B
3.	Operations and Maintenance Implementation Plan (water supply & treatment function)	O&M Implementation plan 240309	D
4.	Agreed with TL not required at this time due to the implementation of the new organisation within QCWW		
5	Developing Operation & Maintenance Manuals for QCWW	O&M Manual TOC	C
6.	Identify Provisional TOR - To be developed		

In principle all of the documents developed to comply with TOR are considered to form some of the essential elements of a future overall Improvement Programme for QCWW in respect of the water supply and treatment function. The development of each document is discussed in the following sections of this report.

While each output document has been included as Annex to this report the STE considers that they should also be ‘stand-alone’ documents and readily available to be reviewed and re-developed in the future by the project’s long-term O&M expert and the technical departments within QCWW.

3. Operations and Maintenance Improvement Plan

The production of an Operations and Maintenance Improvement Plan (Annex D) is seen an essential tool to be used by QCWW for realising the goals and objectives as defined in the mission statement as follows:

> *"Commitment to provide customers the service of drinking water with high reliability and quality in accordance with the standards and the provision of safe sanitation service with attention to its employees and to achieve the highest degree of reliability and excellence through the improvement of overall efficiency and optimal use of available resources and to achieve financial balance".*

Efficient operational management and a pro-active involvement in the decision making process of the business has been recognised by the international water industry as one of the key requirements needed for a successful commercial operation. This approach is currently not firmly embedded within QCWW, and the organisation is reacting to problems as they arise. In this context, the production of an O&M improvement plan can be seen as a suitable way forward for the operational functions to address some of the current deficiencies.

The current position within QCWW is also influenced by the institutional arrangements as follows:

- The political situation at a local, regional and national level.
- The influence and relationship with HCWW.
- The influence and objectives of NOPWASD.
- The relationships between and the interests of the different donor/funding agencies.

3.1 Objectives of the O&M Plan

Clearly the outputs of the operations and maintenance improvement plan must link with the company ideology as contained within the Mission Statement quoted above. The (yet to be developed) QCWW Business Plan should also provide the required focus, which leads to the definition of business priorities in terms of a future investment programme for the water supply function; and to the instigation of the specific activities as detailed in Tables (1-4) within Section 2 of the Improvement Plan.

Thus the aims, objectives and outputs of the O&M Improvement plan are seen to be:

- Improving the level of service delivery to the customer in terms of product quality and quantity.
- Improving operational efficiency whilst at the same time reducing costs, for example reducing energy consumption and chemical costs.
- Instigating measures to optimise and improve the current treatment processes without major investment in civil assets (low-cost quick fixes).
- Introducing standard operating procedures, routines/methods and working practices on a company wide basis.
- Reducing plant downtime and breakdowns by introducing forms of preventative maintenance and improving the availability of spares and equipment.

3.2 Implementation Phase and Next Steps

In accordance with the requirements of the ToR and following discussions with the Team Leader the STE has produced an Implementation Plan (contained in Annex D). It is worthy of mention that this plan should been seen as the start of a long process of promoting change and seeking improvements in all of the operational areas of the business.

The current phase of the Implementation Plan is designed to oversee the introduction of procedural and data collection based activities, although the STE has, amongst other things, recommended the formation of a process optimisation group.

This group, if formed, is seen as an essential contribution or even requirement in terms of improving the current situation. There would be a strong focus on improving plant/process performance by identifying ways to reduce chemical and electricity costs for example, and by setting standards and defining operating parameters and action limits for parts of the process.

4. Standard Operating Procedures for QCWW

The STE was to provide a format for the introduction of Standard Operating Procedures within the water treatment function of QCWW. The STE therefore selected an important area of the process (rapid gravity filtration) and produced a full procedure, which sets out the requirements and standards to be adopted across QCWW. The procedure is included in Annex A of this report and can be used as a stand alone document; it does, however, NOT replace the need for the development of other procedures or instructions that are relevant to local circumstances and conditions.

The suggested layout in Annex A will therefore serve as an example and template to follow for the development of all future procedures.

It should, however, be recognised that within modern water utilities the number of likewise and similar procedures in existence can be in excess of one hundred. The following bullet points therefore suggest the priority procedures that should be developed and introduced for the remaining duration of the Programme:

- Operating rapid gravity filters (developed example as per Annex A)
- Operating horizontal and upward flow clarification plants.
- Operating gas chlorination plants.
- Determining the operating parameters for water treatment processes.
- Determining the appropriate treatment chemicals and their dose rates.
- Operating Compact Units.
- Operating ground water sources.
- Compiling and reporting key data for water production, supply and demand.

5. Station and Plant Logs for QCWW

The STE was asked to suggest and review the previously prepared (and now printed) station logs and data capture sheets. With that in mind the following list was produced as a stand alone or suggested list of contents for the type of information that should be included and available in a station log.

Upon review of the proposed logs, some of the requirements in the STE's suggested list were missing, nevertheless it is recommended that the introduction of the printed station logs as produced by the long term O&M expert proceeds on a trial basis and is then reviewed by the STE during his second assignment.

The following information is available as a stand-alone document in Annex B:

What Should a Station Log Contain?

Clear and accurate records of operational performance are essential to monitor the performance of the plant and for analysing trends for the early detection of problems.

Details that should be entered in the station log are:

- Visits to site.
- Reasons for visits.
- Incidents and events.
- Actions.

What Should be Recorded in a Station Log?

The following list is suggested (but not limited to) what a station log may contain:

- All process changes (pumps, chemical doses, flow).
- Results of on-site tests (e.g. chlorine residual measurements).
- Actions from on site tests.
- Instructions relating to plant operation.
- Chemical deliveries (arrival and departures).
- Incidents/irregular occurrences.
- Site-specific requirements.
- Quality target exceedances.
- Equipment status (duty/standby/failed).
- Plant calibrations (routine and non routine).
- Maintenance activities (e.g. pumps out of service).
- Changes to station residual limits.

6. Operation & Maintenance Manuals for QCWW

The STE was to suggest a format for the future development of operations and maintenance manuals for the Water Supply Function of QCWW. Many different forms of operations and maintenance manuals are in use within the water industry worldwide and it will therefore be necessary for the project decision makers to consider the use and value that may be gained by the recipient utility in embarking on a programme to develop such manuals, which in itself can be a costly and time consuming exercise.

Following a number of site visits made by the STE it was concluded that the current situation suggests an almost complete lack of any type of O&M manuals, which is not unexpected given the age of some of the plants. However it is unusual that the two new treatment plants at El Toyrate and El Meseed recently visited by the STE also do not have at the very least some form of maintenance manuals provided for the relatively newly installed electrical/mechanical equipment.

This shortcoming could very easily be addressed by including the need for such specific manuals in the contract documents, thereby placing the onus on the contractor or sub-contractor to provide them. Indeed if it is the case that the clause already exists it would appear that the contractor(s) are then failing in their duty to provide them.

Suggested Way Forward for QCWW

Notwithstanding the need for specific technical manuals as previously described, and these are also considered to be essential, it is suggested that QCWW adopts a “Works Manual” type of approach for use within the operational department of the water supply function. The manual would provide and act as a source of reference for all of the written information and plans, which are considered necessary to operate the plant/process within the required limits for water quality and quantity.

A simple step-by-step approach is required to build up the information needed to operate the treatment plants. The emphasis should be on the inclusion of information that is not overly complicated but contains sufficient details and data to be of value to all persons who may need to use it.

A suggested Table of Contents for major treatment plants and compact units is included in Annex C of this report and should only be seen as a standard to aim for by the company as part of its natural evolution. It is acknowledged that much of the information will not be currently available, however this does not preclude the fact that much of it should be available as standard. The Table of Contents is meant to serve as a guide.

In addition, at this stage, given the situation the STE has experienced in the field, it does not seem necessary to include any other situations (wellfields/pumping stations) as these could very easily be developed in the future if the need arose.

Picture 4 – Qus WTP: O&M manuals should be available for this type of equipment.

7. Conclusions

QCWW is by definition a new organisation and the successful adoption and integration of the staff and assets that used to be managed by the municipal authorities does in itself pose a huge challenge.

There are significant problems that need to be addressed within the current organisation of the QCWW particularly in respect of operational efficiency and the general poor condition of the underground and surface assets. Notwithstanding the physical state of the assets the current institutional and functional arrangements within QCWW are not seen as beneficial, although the STE acknowledges that at the time of his visit, QCWW is preparing to implement a new organisational structure, which will promote change and generate improvements in efficiency.

The interests of the HCWW and for example NOPWASD often conflict, which might lead to delays to the commissioning of new investments, inappropriate use and selection of technology, poor construction supervision/techniques and a lack of design standards.

At a company and strategic level the organisation still needs to develop clearly defined company policies, objectives or action plans. Currently, the managers of the organisation are reacting to problems as they arise. This situation is then transgressed throughout QCWW from the top to the bottom of the organisation, which means that sometimes the most urgent business needs are not identified or addressed, whilst other less important needs may be given a higher priority. For instance within the operational functions of the business, and it is particularly evident in the water supply section, the managers are not able to influence the decision making process, which might result in processes being installed or investments being made which are not suitable. This in turn wastes valuable resources and efforts.

8. Recommendations

In the Operational and Maintenance Improvement Plan (Annex D) the STE has identified a number of activities (Section 2, Tables 1-4) which if implemented could make measurable improvements to the operational performance of the water treatment plants.

Specifically and in addition to the above mentioned activities the following recommendations were made:

1. The formation of a process optimisation group with selected staff from QCWW who will be supported by the appropriate experts from this project. The results, findings and outputs of this group then strongly link and benefit the other initiatives as outlined in 2–6 below.
2. An urgent focus on disinfection is needed, including the safety aspects of chlorine drum stores, and the establishment of company standards and key policies within this area.
3. The continuing development of standard operating procedures, local specific procedures/logs and data gathering mechanisms at the local level for the purpose of performance monitoring and reporting.
4. The continuing process of the publication, in the form of visual signs and information for plant operators at the local levels for example filter washing sequence and run times, and quality standards/information.
5. The role of the laboratories should be developed in terms of becoming responsible for product quality and for providing the results of analysis to the operational staff in order to monitor trends, in addition to reporting quality failures for action.
6. There is a need to determine a suitable mechanism for prioritising investments linked to asset condition/performance and for improving product quality (This work will link with the objectives of the master plan unit).

QCWW needs to adopt a more strategic approach in terms of how the business is managed and operated, which will in itself improve efficiency within the water supply function. It is therefore recommended at a strategic level in QCWW that:

- Clear strategies are developed and the most urgent priorities are identified, at the moment everything is deemed to be urgent.
- Goals are set to specify what must be done to attain the QCWW mission. Well-constructed goals are precise and measurable, address important issues, are challenging but realistic, and specify a time period within which they should be achieved.
- Key objectives are also set and the rationale behind them is clearly understood.
- An investment programme is identified to address the most urgent and important areas of greatest need.
- QCWW develops its own company policies, standards and procedures.

The STE recognises that the above points will take some time to develop and are at this point outside the scope of the current TOR. Nevertheless, they are deemed to be necessary and it is understood that they will be partly addressed (business planning) later in 2009.

Annex A –

Example SOP for Rapid Gravity Filters

Developing Standard Operating Procedures for QCWW

Introduction

This procedure sets out the format, framework and STANDARDS to be adopted on a company wide basis and is applicable to all of the water treatment plants within QCWW. This procedure does not replace the need for the development of other procedures or instructions that are relevant to local circumstances and conditions.

The following layout will therefore serve as an example and template to follow for the development of all future procedures. It should be recognised that within modern water utilities the number of likewise and similar procedures in existence can be in excess of one hundred. Therefore the following bullet points suggest the priority procedures that should be developed and introduced for the remaining duration of the Programme:

- Operating rapid gravity filters (developed example as per next section)
- Operating horizontal and upward flow clarification plants.
- Operating gas chlorination plants.
- Determining the operating parameters for water treatment processes.
- Determining the appropriate treatment chemicals and their dose rates.
- Operating Compact Units
- Operating ground water sources
- Compiling and reporting key data for water production, supply and demand.

WT 01 Operating Rapid Gravity Filters

This procedure describes the inspection, monitoring and control activities to be carried out for the process management of rapid gravity filters.

Scope

This procedure applies to all conventional rapid gravity filters using single, dual or multi media and their associated washing systems

The procedure covers the following aspects:

- Routine plant inspection
- Routine plant monitoring
- Control actions in response to monitoring and inspections.

The procedure does not cover the following situations:

- Package plants for example compact units.
- Iron and manganese removal filters.
- Wash water recovery.

Summary Table

What is the purpose of the S.O.P.	For use in defining the inspection, monitoring and control of rapid gravity filters.
Key actions needed to ensure compliance with the procedure.	• Check pumps, air-blowers and pipe-work on a daily basis for signs of damage, failure or leakage. • Observe an automatic backwash at a minimum occasion of 1 per month for each filter. • Monitor turbidity of filtered water for individual filters. • Where applicable, check that filter washing starts automatically in sequence as per programme. • Measure and record filter media depths at least twice per year and on an annual basis check surface layer for signs of blinding. • All filters must be washed if out of service for more than 48 hours.
The requirement for local procedures and what to include in them.	Details of required local procedures are contained within this document.
Additional advice and Instructions included in the procedure.	• Control actions required if filtered water quality is outside of operating limits. If media is being lost, or if air scour is uneven. • Operating parameters are included in this procedure.
Requirement for review of this procedure.	Review (before implementation) and amend, if required on a six monthly basis.

Organisational Responsibilities

The Chairman of QCWW assumes overall responsibility for the implementation of the procedure within the organisation; however the following stipulations apply:

- The Area Managers shall make available sufficient resources to ensure that all plant managers and operators receive appropriate training regarding this procedure and the practices to be followed to protect customer health.
- The District Managers shall assume overall responsibility for preparing local procedures and for implementing local practices and the incorporation of the key issues as identified in this document.
- Plant managers and operators using these procedures should be sufficiently qualified and competent in respect of water treatment and hygiene code principles.
- If necessary, responsibilities should be reassigned following future re-organisations.

Guiding Principles

The successful management of the process depends upon the following actions:

- Ensuring that the quality of the water entering the filters is maintained within the quality limits for the works.
- Ensuring that filtered water quality is maintained within the quality limits for the works.
- Ensuring that filters are washed and returned to service in accordance with local operating procedures or instructions.
- Observing the backwashing operation and rectifying any problems.
- Correct and timely actions being taken when breakdowns occur and abnormal conditions are observed.
- Minimising the use of treated water and power for backwashing without compromising filtered water quality.

The **Operating Parameters** for rapid gravity filters are defined as follows:

- Filtered water
  - turbidity
  - colour
  - residual coagulant
- Filter wash
  - air scour duration/pressure/flow
  - backwash duration/pressure/flow
  - standing time
  - filter run time
  - headloss
- Flow rate to filter
- Media depth

All on site tests must be carried out in accordance with Egyptian standards for water quality testing.

The water treatment plant must be operated within the water quality parameters given in the Operations and Maintenance Manual or local instruction.

Local Instructions (to be developed)

- Method and frequency for monitoring and inspecting rapid gravity filters.
- Location of sampling points.
- Method for backwashing filter in automatic mode.
- Method for backwashing filter in manual mode.
- Method for removing filter from service.
- Method for draining down a filter and checking media depth.
- Method for re-commissioning a filter.

Routine Inspections

Unless local procedures dictate otherwise the operators shall make the following routine inspections for each filter unit:

- Record and observe an automatic or manual cycle for each filter on a monthly basis.
- Check backwash pumps and pipework on a daily basis for signs of leakage, damage, noise or other problems.
- Check air blowers and pipework on a daily basis for signs of leakage, damage, noise or other problems.

Any problems identified during the inspection shall be recorded in the shift log book and reported to supervision.

Routine Monitoring and Control

These instructions apply on a company wide level and their implementation will depend upon the local circumstances in place and should be practiced in compliance with local procedures.

1. It is desirable that turbidity monitors are installed to monitor individual filter water quality.
2. Any filter that has been standing for a period greater than 48 hours should be backwashed before being returned to normal operation.
3. On filter start up, optimise the slow start or run to waste function where installed, where this is not the case local instructions must describe the optimum method for start up.
4. Carry out on site testing in accordance with the local “On site Water Quality Testing Manual” if available.
5. Compare sample results with local target values and action limits.

6. Report any results exceeding the action limits to the supervisor or manager and take controlling actions to bring the turbidity back within the target range. (Refer to non routine monitoring control in next section)
7. Monitor trends in filtered water turbidity and report any noticeable deterioration in water quality to plant supervision.
8. Check the effectiveness of backwashing, and that filters are washed in the correct sequence and duration. For auto systems check that filter washing is initiated correctly at the pre-set or headloss value.
9. Check for filter media loss twice per year by measuring the level of the media surface against a fixed reference point for each filter. Local procedures should be developed for measuring media loss and recording results.
10. The Process/Quality Advisor will carry out an annual performance check of the filters within his or her area of control. The overall assessment of the performance should be recorded and the results written up with recommendations for remedial actions to be taken. The performance checks should include:
    - Review results of media depth checks performed by the operational staff.
    - Review available filtration data regarding works control and monitoring systems.
    - Review the results of turbidity monitoring to ensure that the monitors (if installed) are in good working order.
    - Carry out checks of the media surface layer at random positions for signs of blinding or other problems.
    - Carry out a detailed investigation of each filter grouping to include an assessment of satisfactory filter operation, backwashing, of satisfactory start up and for visual check of media surface for signs of clogging or the formation of mud balls.
    - Filters should be grouped according to design and operational similarity and a representative filter should be chosen from each group for investigation on a rolling programme.

Non-Routine Monitoring and Control

- All non-routine activities must be recorded in the appropriate logbook and reported to supervision in accordance with local instructions or procedures.

- All water quality limits and works shutdown limits should be clearly documented and displayed.

- Local procedures must exist (and should be written) for response to these action limits and must include recording equipment and reporting requirements to supervision and management.

The following Tables represent some of the most common problems that can occur and are therefore considered to be "non-routine". The steps dictated within the Tables show the actions that should be taken to correct the problem.

Identified Problem – Uneven Air Scour Patterns and Loss of Media

Steps	Actions
1.	**Are the airflow rates and pressures correct?** If YES, go to Step 2. If NO, check the programmed flow and pressure setpoints and check air blower equipment, valves and pipework, rectify any faults.
2.	**Is the filter media depth correct and uniform?** If YES, go to Step 4. If NO, go to Step 3.
3.	**Is the backwash water flow rate correct?** If YES, there may be a problem with the under-drain system, which is causing media to be lost or unevenly distributed. Report to Plant Manager who will arrange for inspection of the under-drain system and the necessary repairs. If NO, check the backwash set points; check pumps, valves and pipework.
4.	**Is there evidence of blinding or formation of "mud balls" in the surface layers of the filter?** If YES, report the problem to the Plant Manager who will arrange for cleaning and replacement of the media. If NO, go to Step 5.
5.	**Is the air scour pattern still uneven?** If YES, remove the filter and seek specialist advice from the plant manager and process advisor. If NO, backwash the filter and return to service and perform regular checks of the air scour pattern over the next few wash cycles.

Identified Problem – Filtered Water Turbidity Outside of Action Limits.

Steps	Actions
1.	**Is the on line turbidity monitor reading correctly? (if installed)** If YES, go to Step 2. If NO, arrange for calibration or maintenance of the monitor. In the interim perform regular manual tests for turbidity in accordance with the On site Water Quality Testing manual.
2.	**Is the turbidity problem on just one filter unit?** If YES, go to Step 3. If No, go to Step 4.
3.	**Is the backwash sequence correct? (if automatic)** If YES, go to Step 4. If NO, arrange for re-programming of the backwash sequence or repair of faults on the backwash equipment. Remove the filter from service until the repair can be carried out.
4.	**Has the flow through the filter(s) exceeded design capacity?** If YES, reduce flow to within the works rated capacity for the filter(s) and ensure even distribution across all filters. If NO, go to Step 5.
5.	**Is the water quality prior to filtration (clarification) within action limits?** If YES, report to plant manager, the plant MUST be shutdown if problem persists or reaches works shutdown limit. If NO, follow local procedures to bring water quality prior to filtration back to within normal operating range. The plant MUST be shutdown if problem persists or reaches works shutdown limit.

Identified Problem – Filtered Water Coagulant (Aluminium residual) Outside of Action Limits.

Steps	Actions
1.	**Is the on line aluminium monitor reading correctly? (if installed)** If YES, go to Step 2. If NO, arrange for calibration or maintenance of the monitor. In the interim perform regular manual tests for turbidity in accordance with the On site Water Quality Testing manual.
2.	**Is the water quality prior to filtration (usually clarification) within action limits?** If YES, go to Step 3. If NO, follow local procedures to bring water quality prior to filtration back within target values.
3.	**Are the levels of soluble iron/aluminium in the filtered water higher than usual or higher than the action limit?** If YES, the problem is due to poor clarification performance. Follow local instructions to optimise clarification pH and coagulant dose. Seek specialist advice from the process advisor to optimise clarification. If NO, go to Step 4.
4.	**Are all the filters in the group affected?** If YES, seek specialist advice regarding checking raw water quality and optimising the process. If NO, go to Step 5.
5.	**Is the backwash sequence correct?** If YES, go to Step 6. If NO, arrange for re-programming of the backwash sequence or repair of faults on the backwash equipment. Remove the filter from service until the repair can be carried out.

6.	**Has the flow through the filter exceeded design capacity?** If YES, reduce flow to within the works rated capacity for the filter and ensure even flow distribution across all filters. If NO, seek specialist advice regarding additional checks on raw water quality and optimising the process.

References.

Examples include:

- References to existing procedures (or new ones to be written) particularly in respect of laboratory procedures.
- Existing Egyptian Water Quality Standards.
- Any relevant Information from the HCWW.

Annex B –

Information Requirements for Station/Plant Logs

Station and Plant Logs for QCWW

Introduction

Consistent with the Programme Objectives and the Terms of Reference the STE has been asked to suggest and review the existing station logs and the previously prepared/printed station logs, which will be shortly implemented within QCWW.

What Should a Station Log Contain?

Clear and accurate records of operational performance are essential to monitor the performance of the plant and for analysing trends for the early detection of problems.

Details that should be entered in the station log are:

- Visits to site.
- Reasons for visits.
- Incidents and events.
- Actions.

What Should be Recorded in a Station Log?

The following list is suggested (but not limited to) what a station log may contain:

- All process changes (pumps, chemical doses, flow)
- Results of on-site tests (e.g. chlorine residual measurements)
- Actions from on site tests.
- Instructions relating to plant operation.
- Chemical deliveries (arrival and departures)
- Incidents/irregular occurrences.
- Site-specific requirements.
- Quality target exceedances.
- Equipment status (duty/standby/failed)
- Plant calibrations (routine and non routine)
- Maintenance activities (e.g. pumps out of service)
- Changes to station residual limits.

Annex C –

Table of Contents for O&M Manuals

Developing Operation & Maintenance Manuals for QCWW

Introduction

Consistent with the Programme Objectives and the Terms of Reference the STE has been asked to suggest a format for the future development of operations and maintenance manuals for the Water Supply Function of QCWW.

Many different forms of operations and maintenance manuals are in use within the water industry worldwide and it is therefore necessary to consider the use and value that may be gained by the recipient utility in embarking on a programme to develop such manuals, which in itself can be a costly and time consuming exercise.

Current Situation

Following a number of site visits made by the short term expert (STE O&M Procedures and Plans) the current situation suggests an almost complete lack of any type of O&M manuals, which is not unexpected given the age of some of the plants. It is, however, unusual that the two new plants at El Toyrate and El Meseed visited by the STE also do not have as a minimum at least some manuals provided to carry out maintenance of the recently installed electrical/mechanical equipment.

This shortcoming could very easily be rectified by including the need for such specific manuals in the contract documents, thereby placing the onus on the contractor or sub-contractor to provide them. Indeed if it is the case that the clause already exists it would appear that the contractor(s) are then failing in their duty to provide them.

Suggested Way Forward for QWCC

Notwithstanding the need for specific technical manuals as previously described, and these are also considered to be essential, it is suggested that QCWW adopts a “Works Manual” type of approach for use within the operational department of the water supply function. The manual would provide and act as a source of reference for all of the written information and plans, which are considered necessary to operate the plant/process within the required limits for water quality and quantity.

A simple step-by-step approach is required to build up the information needed to operate the treatment plants. The emphasis should be on the inclusion of information that is not overly complicated but contains sufficient details and data to be of value to all persons who may need to use it.

The following section outlines a suggested table of contents for major treatment plants and compact units; this should only be seen as a standard to aim for by the Company as part of its natural evolution. It is acknowledged that much of the information will not be currently available, however this does not preclude the fact that much of it should be available as standard. This table of contents is meant to serve as a guide only.

In addition, at this stage, given the situation the STE has experienced in the field it does not seem necessary to include any other situations (wellfields/pumping stations) as these could very easily be developed in the future if the need arose.

Draft TOC - Works Manual for all types of Water Treatment Plants

SECTION 1 – INRODUCTION

- A general introduction and explanation of how to use the manual.
- A definition of the various responsibilities within QCWW for the plant and details of the number of staff.
- A general site layout plan.
- A general schematic(s) or plan(s) of the area supplied by the treatment plant.
- Geographic/demographic information for example a location plan and numbers of customers served.
- An overview of the plant design capacity and average daily outputs.
- Details of relevant safety information for visitors regarding known hazards.

SECTION 2 – PLANT DESCRIPTION – PROCESS OPERATIONS

- Overall targets for water quality and quantity.
- A list of the prescribed water quality standards.
- An overall description of the treatment processes in use on the site.
- An individual description of each stage of the process, (not too detailed) but including main design parameters, flow rates, velocities, retention times, contact times etc.
- Details of water quality sampling points and tabulated results of analysis.
- List of chemicals in use and the quantities held on site.
- A description of measurement points and works metering.
- A list of SOP's and local procedures in use.
- The inclusion of any relevant drawings in existence.

SECTION 3 – PLANT DESCRIPTION – ASSETS - CIVIL, ELECTRICAL & MECHANICAL PLANT

- List and details of all relevant site drawings, for example pipeline layouts, HV/MV electrical system layout, civil assets and structures.
- Details of types of pumps, motors, valves in use and cross referenced to the process.
- Details of instrumentation and dosing systems/equipment for chlorine and aluminium sulphate.
- Details of general items in use, for example lifting equipment.

SECTION 4 – SAFETY& HYGIENE ASPECTS

- Company safety policy and links to TSM.
- Company hygiene policy for employees working in direct contact with potable water.
- Emergency procedures - for example handling a major incident such as a significant failure of chlorine drum.

SECTION 5 – GENERAL INFORMATION, DATA and RECORDS

- References to company policies and other relevant procedures.
- References to legislation.
- Water production information, water quality compliance with standards, annual chemical use and costs, electricity consumption and annual costs.
- A description of measurement points and works metering.
- A list of SOP's and local procedures in use.
- The inclusion of any relevant drawings in existence.

Annex D –

Operations and Maintenance Improvement Plan

gtz

PN 2006.2063.3; VN 81087234

Strengthening Provision of Services in Qena and Promoting Appropriate Rural Sanitation Options, Egypt

Operations and Maintenance Improvement Plan
(Draft)

David Savery

April 2009

RODECO CONSULTING GMBH

as sub-consultant:

sachsenWasser consulting + operations + management

GOPA WORLDWIDE CONSULTANTS

Contents

Annex

Abbreviations

ADVAC	Abbreviation for a Financial Management Software Programme
BW	Back-Wash
FC	Financial Contribution (KfW Programme)
FRC	Free Residual Chlorine
GIS	Geographical Information System
HCWW	Holding Company for Water and Wastewater
HRD	Human Resources Development
ICA	Instrumentation Control & Automation
MARS	Management and Reporting System
NOPWASD	National Organisation for Potable Water and Sanitary Drainage
QCWW	Qena Water and Wastewater Company
STE	Short -Term Expert
WTP	Water Treatment Plant
ToR	Terms of Reference

1. Benefits of an Operations and Maintenance Plan

The project “Strengthening Provision of Services in Qena and Promoting Appropriate Rural Sanitation Options” aims at supporting Qena Company for Water & Wastewater (QCWW) in improving its utility management and operation, including the provision of decentralised wastewater services to rural communities. The project is being implemented on behalf of GTZ by RODECO Consulting GmbH, in association with GOPA Consultants.

Traditionally the importance of the operational functions within government run water utilities is often overlooked in favour of functions that are seen to add more value such as engineering or administration. By contrast commercial water utility operators recognise that the operational functions form the core business activity and are thereby seen to be most important. Experience has shown that in a commercial undertaking operational functions relate to being:

- Able to deliver financial savings whilst at the same time improving performance and efficiency.
- Responsible for product quality and providing an improved level of service to the customer.
- Able to influence and promote good practices that can reduce harmful impacts and effects on the environment.
- Best placed to specify and input into future capital schemes so as to capture experience and reduce the risk of error and incorrect design.

The efficient and effective management of the operational functions within any water utility is therefore seen as essential for delivering improvements to the customer in terms of product quality and availability, and for delivering efficiency savings in order to enhance the financial viability of the enterprise.

The production of an operations and maintenance improvement plan is seen as an essential tool to be used by QCWW for realising the goals and objectives as defined in the mission statement as follows:

> ***“Commitment to provide customers the service of drinking water with high reliability and quality in accordance with the standards and the provision of safe sanitation service with attention to its employees and to achieve the highest degree of reliability and excellence through the improvement of overall efficiency and optimal use of available resources and to achieve financial balance”.***

Thus, the successful implementation of operations and maintenance improvement plans coupled with the proposed organisational re-structuring and HRD plan will be a key requirement in terms of delivering the business improvements required to achieve the company mission.

1.1 Overview of Current Situation

To date the work carried out by the project team as part of the overall Programme has provided significant support to the managerial staff of QCWW. A number of initiatives promoted by the project team have seen the introduction of information technology systems, a HRD plan, a dedicated staff training centre and appropriate training courses being delivered. In addition, support has been provided in respect of commercial/financial management, and in the operational and technical areas of the business.

The introduction of the ADVAC financial management system delivers tangible benefits in terms of allocating and measuring the costs of providing the services for the water and wastewater functions, and the MARS IT system enables the business process to become more standardised and measurable by the introduction of performance indicators. The initiative to roll out the implementation of the G.I.S. system (FC project) throughout QCWW provides the basis for a standardised approach for those operating functions that assume responsibility for the daily management of the business.

However, significant problems remain to be addressed within the current organisation of the QCWW particularly with respect to operational efficiency and the generally poor condition of the underground and surface assets. Notwithstanding the physical state of the assets the current institutional and functional arrangements within the QCWW are not seen as beneficial although the STE acknowledges that at the time of his visit, QCWW is preparing to implement a new organisational structure, which will promote change and generate improvements in efficiency.

1.2 Objectives of O&M Improvement Plan

Clearly the outputs of the operations and maintenance improvement plan have to link with the company ideology as contained within the Mission Statement. The (yet to be developed) QCWW Business Plan should also provide the required focus, which leads to the definition of business priorities in terms of the future investment programmes for the water supply function; and to the instigation of the specific activities (in order of priority) as detailed in the Tables that are found within Sections 2–5[1] of this improvement plan.

Thus the aims, objectives and outputs of the O&M Improvement Plan are seen to be:

- Improving the level of service delivery to the customer in terms of product quality and quantity.
- Improving operational efficiency whilst at the same time reducing costs, for example reducing energy consumption and chemical costs.
- Instigating measures to optimise and improve the current treatment processes without major investment in civil assets. (low cost quick fixes)
- Introducing standard operating procedures, routines/methods and working practices on a company wide basis.
- Reducing plant downtime and breakdowns by introducing forms of preventative maintenance and improving the availability of spares and equipment.

[1] Sections 3-5 refer to the results of other experts' assignments and will be added subsequently.

1.3 Scope of O&M Improvement Plan

As previously stated it is seen that the operational functions form the core business activity; therefore the scope of the O&M Improvement Plan will cover (in time) the following listed functions, which are all relative to the current (and proposed) institutional arrangements within QCWW:

1) Water supply and treatment plants
2) Maintenance and Storekeeping
3) Energy Efficiency
4) Network Management and Leakage

Notwithstanding the above, it is also recognised that there is a considerable overlap and commonality between each of the functions in terms of objectives and that there is a clear need to co-operate and to co-ordinate the respective activities. To that end it is therefore intended that the Sections 2-5[2] of this plan will be specifically developed by the international and local experts alike as part of their specific project assignments.

2. Water Supply and Treatment Plants

2.1 Current Situation

The current situation within QCWW regarding the overall approach, design and operation of water treatment plants and associated equipment is in most parts still as per the situation described in the report titled “Assessment of Design, Operation and Maintenance of Water Treatment Plants” of January 2008. The STE (Procedures and Plans) has therefore considered the findings of this report and other relevant documentation prior to the production of the O&M improvement plan.

The STE is generally in agreement with the recommendations contained within the January 2008 report, some of which have been incorporated into this Section (See 2.3.1) of the O&M improvement plan. In addition, a number of visits were made to the sites and interviews with key members of staff were conducted. A complete list of site visits and meetings conducted by the STE can be found in the main assignment report of April 2009.

The current position within QCWW is also influenced by the institutional arrangements:

- The political situation at a local, regional and national level.
- The influence and relationship with HWCC.
- The influence and objectives of NOPWASD.
- The relationships between and the interests of the different donor/funding agencies.

Whilst applauding the introduction and the recognition of the need for standard operating procedures (SOP) and local procedures within QCWW, the STE would also like to point out that there is a requirement to develop company-wide policies and standards, which once intro-

[2] It is planned to compile all of the other experts’ recommendations for the Improvement Plan in a separate document of similar format.

duced would help to reduce the effects of the institutional arrangements on the operational departments of the utility.

Efficient operational management and a pro-active involvement in the decision making process of the business has been recognised by the international water industry as one of the key requirements needed for a successful commercial operation. This approach is currently not firmly embedded within QCWW and the organisation is reacting to problems as they arise. In this context, the production of an O&M improvement plan can be seen as a suitable way forward for the operational functions to address some of the deficiencies.

2.2 Water Supply Operational Improvement Programme (Tabulated Format)

The STE has developed the following Tables based on the results of a brief study of the current operational situation within QCWW. The Tables are seen as an extremely effective planning tool and can be used by the functional managers, and short/long-term experts alike to develop, co-ordinate and implement the various activities (once prioritised and costed) contained therein.

The Tables whilst basically representing the water supply and treatment function within QCWW do take into account some of the other initiatives that are ongoing, for example the planned installation of bulk water meters.

More importantly, each Table defines the specific objectives to be achieved and the approach and principle actions required to support the objectives of QCWW in accordance with its Mission Statement.

The ownership, priorities, costs, and timescales for the implementation of ALL of the activities identified within Tables 1-3 have not been FULLY included in the Implementation Plan (see Annex) as many of the measures require engineering design and funding, see Section 2.4 Next Steps for further details.

Table 1 Ops Improvement Plan - Water Supply Treatment Plants and Borehole Sources.

Current Situation	Specific Objectives	Approach and Principle Actions	Target Benefits by 2011
Water quality problems, loss of supply, reliability of equipment, poor energy efficiency, lack of ICA and telemetry. Lack of operational procedures, functional clarity and issues relative to staff training Lack of spares and planned and preventative maintenance	To achieve consistent improvements in water quality To improve works outputs in terms of production and quantities delivered to the customer. To take measures and actions to improve operational efficiency.	Review and assess the feasibility of the following actions and link with the objectives of the business plan to determine order and priorities. • Automate/meter chemical dosing systems for coagulation and disinfection systems. • Install instrumentation equipment to monitor water treatment processes (PH, turbidity, alkalinity, CL2 and other parameters where appropriate). • Develop standard operating procedures on a company wide basis. • Automate process control/pumping systems and establish the requirement for telemetry and remote monitoring of sources • Introduce training programmes, standard working practices, local procedures/reporting systems and works logs. • Introduce routine operations for example cleaning of water intakes to improve water quality/quantity. • Establish process optimisation teams and increase the role and responsibility of the laboratory in respect of process control. • Establish procedures to identify/review most troublesome assets and operational problems. • Instigate small-scale repairs, modifications and changes to plant and equipment pending major improvement scheme. • Rehabilitate rapid gravity filters (replace media, valves, backwash and air scour equipment) • Replace and automate borehole pumps and establish water quality protection zones. • Optimise borehole sources and install systems to reduce iron and manganese (where appropriate) • Introduce new and reliable energy efficient plant and equipment. • Install source meters to monitor outputs and production • Introduce data collection systems to monitor electricity consumption and chemical use.	Final water quality achieving a stable higher standard (with a good quality margin at sample outlet points). Improved potable water quality compliance with Egyptian standards. Improved operational efficiency, control and reduction of energy and chemical costs Well trained/managed workforce. Consistent and standardised working practices and approach Customer benefits derived from improved product quality and reliability of supply Reduction in UFW made at treatment plants.

Table 2 Ops Improvement Plan - Water Supply Booster Stations.

Current Situation	Specific Objectives	Approach and Principle Actions	Target Benefits by 2011
Reliability of equipment, poor energy efficiency, lack of ICA and telemetry. Lack of spares and planned and preventative maintenance Lack of operational procedures, functional clarity and issues relative to staff training	To achieve consistent improvements in service delivery to customers To take measures and actions to improve operational efficiency .	Review and assess the feasibility of the following actions and link with the objectives of the business plan to determine order and priorities. • Introduce training programmes and standard working practices • Introduce a planned maintenance programme • Establish procedures to identify/ review most troublesome assets and operational problems. • Develop standard operating procedures • Instigate small-scale repairs, modifications and changes to plant and equipment pending major improvement scheme. • Automate process control/pumping systems and establish the requirement for telemetry and remote monitoring • Introduce new and reliable energy efficient plant and equipment • Install bulk supply meters to monitor outputs • Introduce pressure sensors for remote monitoring of network pressures • Introduce data collection systems to monitor electricity consumption • Use and develop hydraulic models to determine optimum operational requirements and system performance.	Customer benefits derived from improved reliability of supply. Improved operational efficiency, control and reduction of energy costs. Greater control and management of the network. General reduction of network operating pressures Well trained and managed workforce force Consistent and standardised working practices and approach

Table 3 Ops Improvement Plan - Water Supply Raw/Treated Water Tanks and Service Reservoirs.

Current Situation	Specific Objectives	Approach and Principle Actions	Target Benefits by 2011
Lack of general, operational and routine maintenance Issues of water quality due to lack of cleaning programmes, ingress of insects and/or rainwater. Possible water losses due to structural weaknesses	To optimise the operational performance of service reservoirs To maintain the serviceability of the reservoir by instigating an inspection programme .	Review and assess the feasibility of the following actions and link with the objectives of the business plan to determine order and priorities. • Instigate a programme of inspections to identify maintenance requirements and urgent repair works • Prioritise and categorise repairs according to level of risk • Introduce a planned inspection and cleaning programme • Establish procedures to identify and review operational problems. • Develop standard operating procedures • Instigate small-scale repairs, modifications and changes to plant and equipment pending major improvement scheme. • Automate pump/level control systems and establish the requirement for telemetry and remote monitoring • Install bulk supply meters to monitor inflows and outflows • Identify structural defects to be addressed by major capital expenditure and schemes.	Customer benefits derived from improved reliability of supply. Improved operational efficiency, control and reduction of energy costs Greater control and management of the network Well trained and managed workforce force Consistent and standardised working practices and approach

2.3 Key Recommendations, Approach & Priorities

In consideration of the objectives as stated in Section 1.3 of this improvement plan and as a result of the investigations and site visits made during the STE's first assignment, the following points are therefore recommended as priority/focus areas:

1. The formation of a process optimisation group with selected staff from QCWW who will be supported by the appropriate experts from this project (see 2.3.1 below). The results, findings and outputs of this group then strongly link and benefit the other initiatives as outlined in 2–6 below.
2. An urgent focus on disinfection is needed, including the safety aspects of chlorine drum stores, and the establishment of company standards and key policies within this area.
3. The continuing development of standard operating procedures, local specific procedures/logs and data gathering mechanisms at the local level for the purpose of performance monitoring and reporting.
4. The continuing process of the publication, in the form of visual signs and information for plant operators at the local levels for example filter washing sequence and run times, and quality standards/information.
5. The role of the laboratories should be developed in terms of becoming responsible for product quality and for providing the results of analysis to the operational staff in order to monitor trends, in addition to reporting quality failures for action.
6. There is a need to determine a suitable mechanism for prioritising investments linked to asset condition/performance and for improving product quality (This work will link with the objectives of the master plan unit).

2.3.1 Process Optimisation Group

The STE considers that in respect of improving operational performance for water treatment plants the most significant low cost/high impact option could be achieved by the formation of a process optimisation group within QCWW. The group should report directly to QCWW O&M Sector Manager and as a minimum should consist of the following key staff and experts:

- The project long-term laboratory expert and the project long-term operations and maintenance expert (Support and review provided by the ST Experts O&M and chemical engineer).
- Three fully qualified and experienced laboratory staff, one from the central lab, and the other two from the Northern/Southern areas respectively.
- A suitably qualified and experienced treatment plant manager from QCWW.
- Suitably qualified and experienced mechanical/electrical engineer (one of each) from QCWW.

The outputs of the group would be used to determine future (low cost high impact) investment priorities and allow for the development of the (now missing) company standards and policies. For example various types of filter sand and gravel are in use across the treatment plants. This is because the type of sand is dependent on what a contractor may provide and not what the company specifies. A company standard would dictate the type of media to be used in certain situations.

Terms of reference may need to be written for this group if the ideology is accepted by QCWW, however the following Table is taken from Section 5 of the report "Assessment of Design, Operation and Maintenance of Water Treatment Plants" of January 2008 and provides a suitable position and basis from which to start.

Table 4 – Ops Improvement Plan Process Optimisation

- **WTP**
  - Water treatment efficiency …. **Objective 90 %.**
    - Follow-up of raw water pumps operation (operation time) – estimated flow (design capacity by default – evaluation of pumping capacity via time % known volume).
    - Follow-up (if possible) of drinking water pumps operation (operation time) – estimated flow (design capacity by default – evaluation of pumping capacity via time % known volume).
  - Energy consumption.
    - Electrical meter when existing, if not operation time and design energy consumption.
  - Operation & Maintenance of E&M equipment.
    - Operation period …. **Objective 8 H/period.**
    - Follow-up (repairs – etc.).

- **Pre-chlorination**
  - Breakpoint chlorination at laboratory level (jar test).
  - Determination of contact time and improve if possible.
  - Control of dosage (kg/h) between the different process lines.
  - Monitor monthly consumption.
  - FRC at outlet of sedimentation tanks …. **Objective 0.2 to 0.4 mg/l.** Avoid FRC losses in atmosphere. Increase C if needed ("C*t" not sufficient for resistant organism) or clean sedimentation tank regularly with high HTH concentration.
  - FRC minimum at outlet of filtration units … …. **Objective 0.05 mg/l.**
  - Control of taste and odour – refer to standard method.

- **Sedimentation**
  - Verification of design parameters.
  - Verification of residence time and control of possible short-circuits (tracer testing if needed).
  - Verification of sedimentation performance …. **Objective 1 NTU in 95 % of the time as raw turbidity is below 10 NTU.**
  - Limit losses of FRC in atmosphere.
  - If possible modify structures accordingly.

- **Filtration**
  - Verification of design parameters.
  - Control of inlet flow – flow distribution between different process lines and filters.

- Verification of filtration performance …. **Objective 0.3 NTU in 95 % of the time.** Follow-up of filters individually. Monitor filter run periods and evolution.
- Avoid WTP flow modification if filters are at the end of the run period. BW filters if needed before flow modification.
- Control of D10 – D60 – Cu parameters.
- Constant flow – variable level: Maintenance of minimum 20 cm water above the sand after BW (temporary basis solution). Do not exceed 80 cm – 100 cm of head losses before BW. Preferably limit the head losses to the filter static head.
  - Monitor filters profile regularly.
- Optimization of the BW procedure. For "Conventional filters – Uniform media » start with air for 3 to 5 minutes max. and then water for 5 to 10 minutes. Repeat the procedure if needed.
  - Monitoring of clean sand head loss evolution.
  - Monitor backwash turbidity profile.
  - Sludge retention profile to be check after BW procedure optimisation.

➢ **Disinfection**

- Check contact time via water level in water reservoir. Evaluation of "C*t".
- Control of dosage (kg/h) and monthly consumption.
- FRC at outlet of water tank …. **Objective min 0.2 mg/l – max. 1.5 mg/l at first customers.**
- Control of taste and odour … refer to standard method.

➢ **Chemical dosage - Aluminium Sulphate**

- Control of dosage pumps flow (calibration).
- Control of concentrate solution of aluminium sulphate (density). Perform similar jar test with "in situ" solution.
- Control of laboratory parameters on WTP (pH & turbidity mainly).
- Visually comparison between "in situ" results and jar test results.

2.3.2 Disinfection & Chlorine Installations

The importance of correct and safe disinfection techniques including the safety aspects in terms of handling/managing chlorine installations at the water treatment plants is obvious and cannot be overstated. Therefore in view of the overall poor standards of equipment and installations, inadequate control systems and the lack of effective gas monitoring systems the STE recommends:

- That a thorough review of all the aspects relating to disinfection performance (outputs from the process optimisation group will help) and chlorine installations should be carried out with a view to establishing clear standards, policies and procedures to be adopted by QCWW.

There should be a strong focus and emphasis on the safety aspects and risks associated with handling chlorine drums and chemical storage facilities as the current practices pose significant risks to the plant operators and to the public at large should a significant incident or gas escape occur.

Chlorine Drum Store at Salheia WTP Under Refurbishment 120309

Clearly this is outside the scope of this project and the STE is aware that some other initiatives are ongoing (TSM and QCWW actions by the Technical Services Department) nevertheless some support will be provided by the STE during his next input in respect of establishing company standards, policies and procedures.

2.4 Next Steps and Implementation Plan

Clearly, the full implementation of all of the activities and recommendations contained within Tables 1-3 and in Section 2.3 of this plan would not be a realistic objective to be achieved within the timescales of this project, unless additional funding and significant technical support was provided to QCWW. Moreover, the recommendations arising as a result of the other STE inputs, as detailed within Sections 3-5[3] of this document have also to be considered.

Nevertheless, there are a number of initiatives that can be implemented by taking a step-by-step approach and these are included in the Activity Schedule.

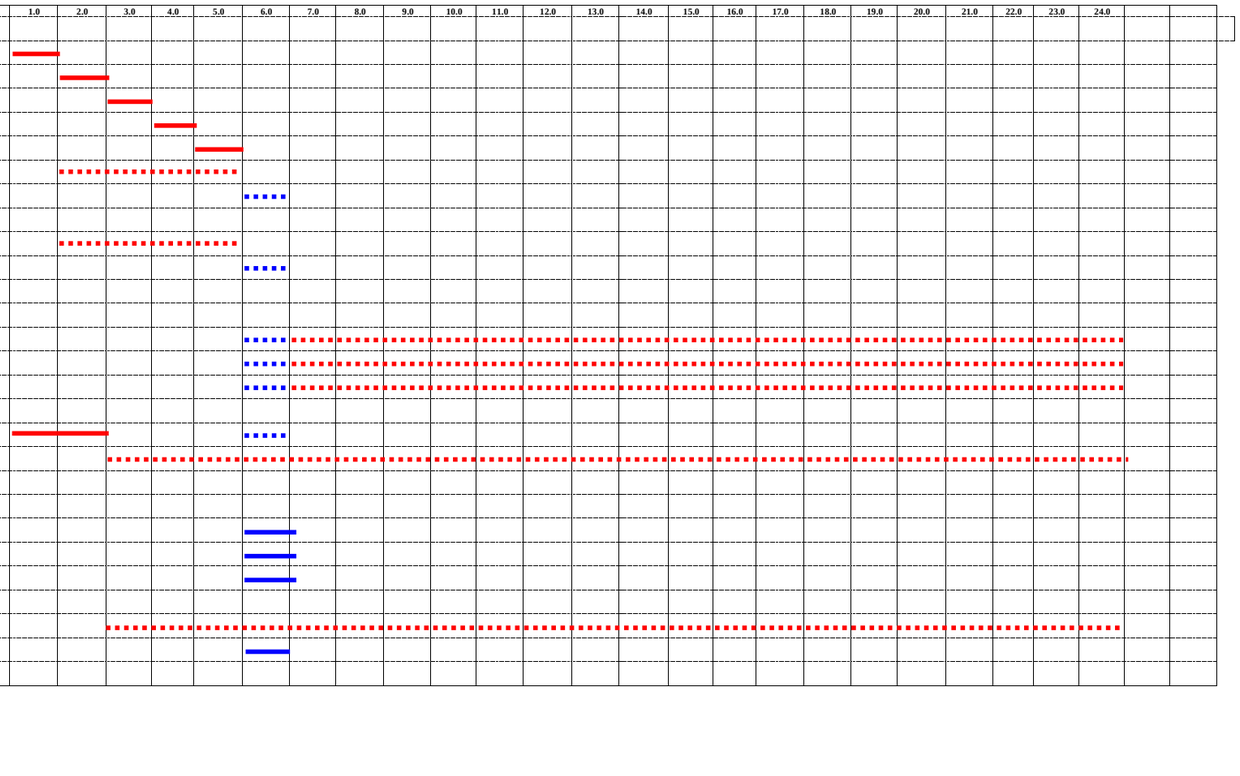
[3] To be added later

Annex A

Operations and Maintenance Implementation Plan
Activity Schedule

Operations and Maintenance Implementation Plan - Water Supply and Treatment Function

Cross Reference to O&M Plan	Activity	Responsibility	Comments or Support Requirements
Section 2 Tables 1,2 &3	**Develop Standard Operating Procedures for the Following Parts of the Treatment Process:**	QCWW	As required by the STE TOR's, refer to template provided by STE
	Operating rapid gravity filters	QCWW	See "QWWC WT 01 Operating RGF – prepared March 2008"
	Operating horizontal and upward flow clarification plants	QCWW	Supported by Project Team LTE/STE O&M experts and process optimisation group
	Operating Gas Chlorination Plants	QCWW	Supported by Project Team LTE/STE O&M experts and process optimisation group
	Determining the appropriate treatment chemicals and there dose rates	QCWW	Supported by Project Team LTE/STE O&M experts and process optimisation group
	Determining the operating parameters for water treatment processes	QCWW	Supported by Project Team LTE/STE O&M experts and process optimisation group
	Introduce Procedures within QWCC	QCWW & Project staff	
	Review procedures as produced to date and assist where required	Project staff	Short term expert to support and review
Section 2 Tables 1,2 &3	**Introduce Works Logs and Basic Data Capture Systems:**		
	Introduce daily logs and data capture sheets for the major WTPlants	QCWW & Project staff	To date logs and recording sheets have been produced
	Review logs and use of data	Project staff	
Section 2 Tables 1,2 &3	**Reservoir & Tank Inspection & Cleaning Programme:**	QWWC & Project staff	Some activities taken from the Tables have been combined
	Instigate Introduce and produce a cleaning/inspection programme for raw/treated water tanks/reservoirs.	QCWW	Some minor support could be provided by LTE/STE
	As part of the inspection identify maintenance requirments and carry out small repair works	QCWW	Prioritise repairs according to risk
	Identify and list major structural defects to be addressed by future investment programme.	QCWW	Prioritise repairs according to risk
Section 2 Tables 1,2 &3	**Works Intake Inspection & Cleaning Programme**	QCWW	Some activities have already commenced
	Prepare inspection & cleaning programme	QCWW	Positive results have been achieved in terms of quality and reduction of energy costs to date
	Implement Programme	QCWW	
Section 2.3 Key Recommendations	**Process Optimisation**	QCWW & Project staff	
	Gain agreement to the formation of a process optimisation group from Chairman	Project staff	The formation of this group is considered to be essential for delivering improvements in ops performance in the future for QCWW
	Expand Terms of Rreference as suggested in 2.3 of report	Project staff	
	Appoint group members & nominate leader	QCWW & Project staff	Project staff can support the extent of which must be determined at that time.
Section 2 Tables 1,2 &3	**Outstanding Activities Needing Prioritising, Design & Cost Appraisal**		
	All recommendations to be reviewed by QCWW and further developed as appropriate	QCWW	Appropriate support should be provided by the proejct as required
	STE to review at next assigenment	Project staff	



Notes:

Project will support QCWW where identified

Key:

QCWW
Project STE
QWCC/project staff
QCWW/STE

Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH
Water & Wastewater Management Program
Holding Company for Water and Wastewater (HCWW),
Corniche El Nil, Water Treatment Plant-Road El Farag
Tel.: +2 02 245 98 405/411
Fax: +2 02 245 98 405/411
Website: www.gtz.de

الوكالة الألمانية للتعاون الفني
برنامج إدارة مياه الشرب و الصرف الصحي
الشركة القابضة لمياه الشرب و الصرف الصحي
كورنيش النيل محطة مياه ريض الفرج
تليفون : ٠٠٢٠٢ ٢٤٥ ٩٨ ٤٠٥/٤١١
فاكس: ٠٠٢٠٢ ٢٤٥ ٩٨ ٤٠٥/٤١١
موقع إلكتروني: www.gtz.de