sustainable sanitation alliance

Case study of sustainable sanitation projects

Community-managed wastewater treatment system El-Moufty El-Kobra, Kafr El-Sheikh, Egypt

Fig. 1: Project location

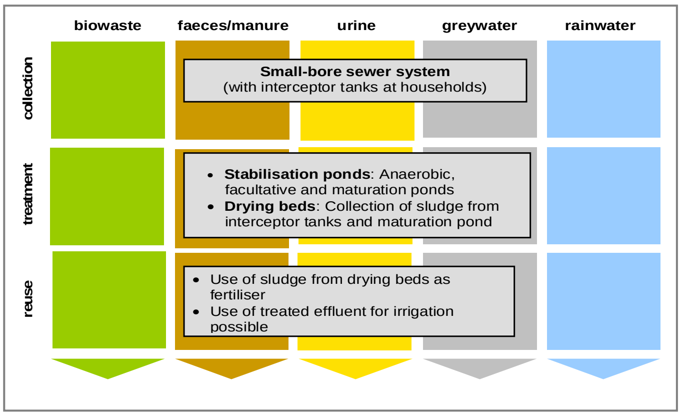

Fig. 2: Applied sanitation components in this project.

1 General data

Type of Project:
Pilot project for a community-managed wastewater treatment system with ponds in a Nile Delta village.

Project Period:
Project Start: April 2002
Start of construction: 2003
End of construction: February 2005
Start of operation: May 2005
Project end: December 2011 (operation ongoing)

Project Scale:
Number of inhabitants covered: 2,750 (design population: 4,500), 420 households (6.5 people per household), flowrate 316 m³/d
Total investment: approx. 300,000 EUR (109 EUR per capita; or 67 EUR per capita if plant was fully loaded as per design)

Address of Project Location:
Village of El-Moufty El-Kobra
Sidi Salem District
Kafr El-Sheikh Governorate (Northern Nile Delta)
Egypt

Planning Institution:
Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH, contracting RODECO Consulting GmbH, Germany

Executing Institution:
Kafr El-Sheikh Water and Sewerage Company (KWSC), Egypt

Supporting Agency:
BMZ (German Federal Ministry of Economic Collaboration and Development) via GIZ

2 Objective and motivation of the project

The motivation of the project was to establish a decentralised wastewater treatment system that offers a simple solution to existing shortcomings and is cost-effective and efficient, hence allows self-management by the village community.

The overall goal of this GIZ "component" (which is part of a larger GIZ programme) was formulated as follows *"Hygienic, appropriate, low-cost wastewater disposal possibilities are accepted and applied by the population and the responsible institutions."*

3 Location and conditions

The project area is located in the middle part of the Nile Delta, close to the Mediterranean Sea. The Nile Delta makes up about two thirds of the total cultivated area in Egypt. The low annual average rainfall has necessitated the dependence on irrigation for agricultural production. To that end a dense network of irrigation and drainage channels, diverting water from the Nile to the Nile Delta for agricultural purposes, is in place. The topography of the Nile Delta is flat and there is a high groundwater table.

Fig. 3: The village Kafr El-Sheikh (source: H. Husselman, 2010**)**

In this area, small scale farmers form the majority, with about 50% owning less than 1 feddan (0.42 ha). Major cultivated crops are maize, rice, wheat, cotton and berseem (animal fodder). The population density[1] is high, around 1600 inhabi-

[1] The average population density worldwide is 50 persons per km² and measures as population per square kilometre of surface area.

tants per km^2, with a population growth of around 1.9% per year.

Fig. 4: Project location in the Nile Delta (source: GoogleMap, 2011).

In the Nile Delta, around 99% of the urban population have access to drinking water supply, in rural areas only about 96%. In contrast, the sewerage coverage is low and the hygienic conditions are of poor standards. In comparison to urban areas, where about 86% of the population are connected to a sewerage system, in rural areas only around 34% are connected. Very often wastewater is running on the streets.

Due to a missing sewer network, in many villages open trenches[2], sometimes starting inside the houses, are used for drainage which leads to groundwater contamination and pollution of drainage channels with wastewater. In many areas, shallow drain ditches are still used (see Fig. 5). Here, the sewage is directly discharged into the nearest drain without any treatment. In many cases, drainage water is used for irrigation purposes. Accordingly, health risks aroused.

The per capita water consumption in the pilot village of El-Moufty was quite low at 35 l/cap/d (prior to the intervention of the project) which generally indicates low hygienic standards. One reason amongst others was that villagers had to save water due to their unsolved wastewater management problems.

A connection to a central sewer system is generally not foreseen for smaller villages in Kafr El-Sheikh Governorate due to governmental budget constraints, amongst others.

The institutional and legal framework with regard to the protection of the Nile and the environment comprises of the following:

- Law 48/1982 (quality parameters for effluent) and Law 4/1995 concerning Pollution Protection of the River Nile and Water Channels
- Law 93/1962: Executive Regulations for Effluent Discharge
- Decree 9/1989
- Law 44/2000 (quality parameters for reuse)

Fig. 5: Wastewater in the streets of El-Moufty El-Kobra before the project in 2002, a common situation in the villages of the Nile Delta (source: GIZ; 2002).

The project village of El-Moufty El-Kobra in the Kafr El-Sheikh governorate has around 2750 inhabitants, of which approximately 90% are farmers with a relatively low income. There are three schools, three mosques, one health clinic and one youth club in the village.

4 Project history

The project was part of the GIZ component called "Decentralised Wastewater Management in the Governorate of Kafr El-Sheikh" (2001 to 2011) as part of the larger programme called "Water Supply and Wastewater Management"[3] which runs until 2017. During this period, a framework concept was developed, a pilot village selected, and the construction, implementation, and later replication of the project was initiated.

El-Moufty El-Kobra was chosen as a pilot project based on the following selection criteria:

- < 3,000 inhabitants (in 2002: only 1,000 to 1,500 inhabitants).
- Existing electricity and water connections.
- Availability of drain for the treated effluent.
- Readiness to establish a Community Development Association (CDA).
- Provision of land for pump station(s) and treatment plant by villagers.
- Agreement of households to pay a monthly fee for operation and maintenance of the wastewater system.
- Additional criteria applied:
    - Some channels are already existing in the village.
    - Provided land for the treatment plant must not be more than one kilometre away from the village.

The start-up phase was accompanied by the organisation of planning workshops and execution of detailed surveys. Technical solutions for decentralised systems and financial models for construction and operation with the participation of the

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The average population in Egypt was 75 persons per km² in 2008. Source: United Nation's Demographic Yearbook 2008, URL: http://unstats.un.org/unsd/demographic/products/dyb/dybsets/2008%20DYB.pdf.

[2] Trenches = pit of rectangular shape 2-3 m in length, 1 m wide and 2 m deep; bottomless; lead to pollution in worst case when overflowing in drainage channels.

[3] For further information: http://www.gtz.de/en/weltweit/maghreb-naher-osten/aegypten/23074.htm.

community and the private sector were developed. In 2003, the final design report was presented, the tendering process conducted and a Community Development Association[4] (CDA) established. The construction, electrical connection and commissioning were completed in February 2005. In May 2005, the Operation and Maintenance (O&M) contract started.

Within the following 'Water Supply and Wastewater Management' (2005 – 2011) programme the project is continued and monitored. Advice is still given where necessary, especially for strengthening the partner organisation, the Kafr El-Sheikh Water and Sewerage Company (KWSC). Furthermore, surveys for the identification of further villages, suitable for such a decentralised approach, were conducted.

During the whole project period, several awareness campaigns and trainings for O&M have been carried out. The performance of the system is good.

The village of El-Moufty was selected as a pilot and replication of the model in other villages was planned and undertaken (see Section 11).

5 Technologies applied

A simple and cost-effective wastewater treatment system (Fig. 6) was chosen in order to allow for self-management of the village community. A **Small-bore sewer**[5] system and a treatment plant have been installed. In contrast to the conventional sewer system, here an **interceptor tank** is installed between the connected houses and the sewerage line, which is connected to the treatment and disposal network. Most of the households in the village now use flush toilets (still to be determined if this applies to all households and what toilets were used before the intervention).

In the interceptor tanks, solids like grit and grease are collected in order to avoid blockage in the sewerage line. The liquids, which often have the highest pollution potential, are discharged into the wastewater. Part of the anaerobic digestion is taking place already in these tanks.

Several households are connected to one interceptor tank. For this system, no changes were necessary in the squatting toilets and wastewater pipe network of houses. The interceptor tanks have to be cleaned out every six months. The liquids are transported through sewers to a pumping station (Fig. 7) that is connected to the treatment plant. The pumping station consists of two alternatively operating submersible high pressure pumps with a standby generator.

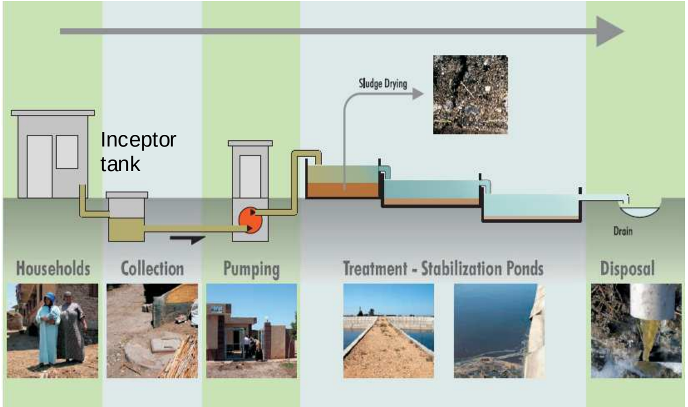

Fig. 6: Schematic of the rural sanitation system, with a Small Bore Sewer System connected to a pond system for treatment (source: GIZ; 2006).

Fig. 7: Pumping station of El-Moufty El-Kobra. On the right picture: Head of the CDA (source: N. Stuber; 2010).

The **treatment plant** consists of 2x3 stabilisation ponds (Fig. 8). The first stabilisation pond is for anaerobic processes (not covered), the second for facultative treatment, and the third for maturation (for details regarding this technique see also Tilley et al., 2008). The first two ponds reduce organic matter content, measured as biological oxygen demand (BOD), the maturation pond reduces pathogens. No information is available on the daily quantity of effluent.

Fig. 8: Treatment plant of Moufty El-Kobra, with the three stabilisation ponds. In the forefront, the sludge drying bed is seen (source: N. Stuber; 2010).

The solids collected in the interceptor tanks and the sludge of the anaerobic ponds are deposited in four **drying beds** (Fig. 8). A routine in desludging the interceptors as well as the anaerobic ponds does not exist (for details see Chapter 11).

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[4] The Community Development Association functions as a local non-governmental organisation. It is in charge of managing, operating and maintaining the wastewater system for the village community.

[5] A small bore sewer is a solids-free sewer. A network of small-diameter pipes that transports solids-free or pre-settled wastewater (such as the effluent from septic tank or biogas settlers). As solids are removed, the diameter of the sewers can be much smaller than for conventional sewers and they can be constructed using less conservative design criteria (lower gradients, fewer pumps, reduced pipe depth, etc.) resulting in significantly lower investment costs. (see also: http://www.sswm.info/category/implementation-tools/wastewater-collection/hardware/sewers/solids-free-sewers)

6 Design information

The wastewater system is designed for a period of 20 years, taking into consideration population growth, thus the design population is 4,500 (population at start of project in 2002: 2,750 citizens).

The following design data gives an overview on the design:

- Interceptor tanks: round tanks with a capacity of 1.25 m^3
- Diameters of the sewers: 100 to 250 mm
- Length of sewers: approx. 9 km
- Distance of pumping station to treatment plant: 700 m
- Sewage discharged per day: approx. 200 m^3
- Nominal capacity of plant: 450 m^3 per day
- Total surface used by the plant: 6,000 m^2. This means an area of 2.2/4.8 m^2/EP (calculated with 2,750/1,250 persons)

Dimensions of the stabilisation ponds:

- Anaerobic pond: mid-depth area 970 m^2; depth 5 m,
- Facultative pond: area 2,070 m^2; depth 1.5 m,
- Maturation pond: area 1,490 m^2; depth 1.5 m.

The sludge has to remain for 5 years in the anaerobic ponds to be stable, according to Egyptian standards. Sludge removal is therefore done once in 5-6 years.

7 Type and level of reuse

By treating the wastewater, organic matter and obtained nutrients which are collected in the sludge, could be reused after a certain resting time in the drying beds.

Nitrogen and phosphorus contained in the wastewater are not removed in the ponds, and are thus still contained in the treated wastewater. This can actually be an advantage if the treated wastewater was used for irrigation purposes. Currently, the treated wastewater is discharged into a nearby drainage channel from which it is partly reused for irrigation purposes (to be confirmed).

At the beginning of the project, the quality of the final effluent from the treatment plant met the codes of the Egyptian Standard (Law 48/1982, see Table 1). It was even better than the water quality in the drain (The water in the drains comes from the irrigated fields which are equipped with a drainage system to avoid capillary rise). However, some households dumped animal faeces into the system, and as a result of this misuse, the effluent quality does not comply with the Egyptian Standards anymore (no measured values available).

The low quantities of sludge from the stabilisation ponds do not allow large scale use, but the O&M contractor uses it on his private land for agricultural purposes.

Table 1: Performance of wastewater treatment in stabilisation pond system.[6]

Criteria	Inlet	Outlet	Egyptian standard for effluent quality
Suspended solids (mg/l)	152	21	<60
COD (mg/l)	782	40	<100
BOD_5 (mg/l)	450	28	<60
Total coliforms	$1.5x10^{12}$	$2.6x10^{2}$	$<5x10^{3}$
Nematode eggs	no data	2 eggs /100 ml	<5 eggs /100 ml

8 Further project components

Most important factor was the community based approach and thus the participation of the population in each step. In this regard a community development association (CDA) was established in order to represent the community and to assure a legal framework for the collection of fees for the wastewater services. The CDA board meets weekly or at least monthly to discuss project affairs. Women are encouraged to participate. Capacity building courses on finance, administration and management topics have been carried out. The responsible persons for the operation and maintenance (O&M), contracted by the CDA, received on-the-job training, and were trained on the development of an operational manual, record keeping and basic report writing skills.

The public company KWSC (Kafr El-Sheikh Water and Sewerage Company) was strengthened and support has been provided by GIZ for capacity development in order to be able to provide advice with respect to design and O&M of decentralised systems.

Awareness raising campaigns in local schools and mosques made up important parts of the project. It comprised topics like

- Objective of the project and role of the villagers and other stakeholders,
- Health promotion trainings for women,
- Water pollution and water borne diseases,
- Environmental sanitation and protection,
- Personal hygiene,
- Solid waste management.

Furthermore, the project team gave support and advice to relevant authorities, e.g. regarding stopping the application of groundwater lowering systems.

9 Costs and economics

The investment costs (Table 2) are relatively low compared to other systems (around 300,000 EUR), but still too high to be financed by the community alone. 10% of the capital costs were financed by the community (as by provision of land), the remaining investment costs for planning, design and construction were supplied by GIZ. A split of the investment costs between infrastructure and labour is not available.

[6] Date of measurement and number of samples is unknown.

Taking the design population into account, the construction costs for the small bore sewer system were 38 EUR/cap (267 LE[7]/cap), and for the wastewater stabilisation ponds around 31 EUR/cap (220 LE/cap). Taking the village size at the time of the construction into account (i.e. less population), the construction costs of the sewer system and stabilisation ponds were approx. 110 EUR/cap. At project start, each household was supposed to pay around 100 EUR mainly for the provision of land (amounting to approx. 40,000 EUR). Furthermore, each household had to pay the connection to the interceptor tank or sewer network. How much each household paid is not known anymore.

Operating costs are totally covered by the villagers. The CDA collects a monthly fee from each household. This tariff covers costs of O&M (around 0.6 EUR) and reinvestments (future expenditures). The O&M costs include staff, transport, maintenance, repairs as well as solid waste collection. The households have to pay a flat rate of around **1 EUR per month**. For people with little or no financial means the tariff differs (e.g. social tariff) and is defined by the CDA in a case by case approach (no information is available on details). If full cost recovery of the system was required, the households would have to pay around 3 EUR per month.

The fee is collected every six months. The person in charge of money collection receives 7% of the sum as salary. The CDA is responsible for managing the assets and the collected fees in a profitable way. Fig. 9 shows the collected, disbursed and surplus money from 2006 to 2009.

The Ministry of Social Insurance and Social Affairs supervises the financial flows of the CDA and gives advice. The KWSC is paying the electricity bill (to be checked).

Table 2: Investment and operation costs of the wastewater treatment system of El-Moufty El-Kobra.

Total investment cost*	300,000 EUR
Investment cost per capita	60 EUR
Operating cost (monthly)	ca. 214 EUR
Monthly fee/household	1 EUR

*: 49% was cost for sewer system (is the approximate length of sewer pipes known?), 51% cost for treatment station, pumping station and force main. Costs for land are not included.

Before the implementation of the project, the trenches had to be emptied twice a month, for a cost of around 5.30 EUR per month per household. Thus, the operation of the new system is cheaper.

Recently, the costs for similar treatment systems increased enormously. The reasons are unknown, but it can be assumed that inflation plays a role as well as lacking interest of construction companies in such small size contracts (and hence raise the prices so to make it attractive to them). Also, the fact that the World Bank is going to finance some of the projects is assumed to raise prices.

[7] LE = Egyptian Pound; 2006 cost reference. The average monthly salary of a family in Moufty El-Kobra is approximately 200 to 250 LE. 1 EUR ~ 7 LE.

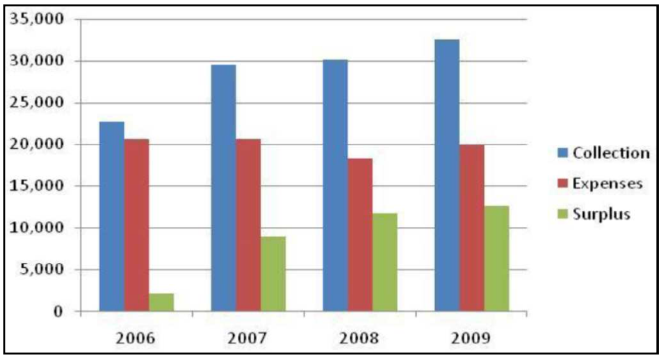
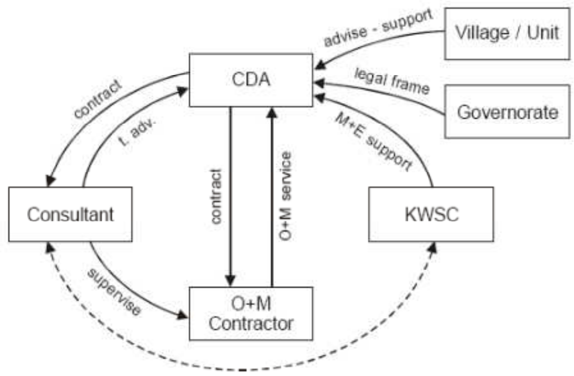


Fig. 9: Money collection, expenses and surplus (in Egyptian Pound) of the CDA of El-Moufty El-Kobra (source: GIZ; 2010).

10 Operation and maintenance

Operation and management is in the responsibility of the CDA. Responsibilities are (theoretically) clearly defined. The applied management system is shown in Fig. 10.



FUNCTION	STAKEHOLDER IN CHARGE
Principal service provider / project manager	Community Development Association (CDA)
Operation & Maintenance	O&M Operator (Contractor from private sector)
Work supervision & technical advise	Consultant (private sector)
Overall supervision and monitoring	KWSC
Provision of legal framework	Governor's office
Support in management and legal enforcement	Village Unit

Fig. 10: Applied management system, key stakeholders and functions (GIZ, 2007). Dashed line between consultant and KWSC means that the actual contract is between them, but the CDA is officially the main contract partner of the consultant.

The CDA leads the central role as community agent, service provider and project manager. It is responsible for the selection and employment of an O&M contractor and can purchase necessary material. The contracting of the O&M service provider during the project phase was supervised by the consultant. The Local Village Unit (LVU[8]) and the consultant provide the CDA with (technical) advice and support. The contractor received on-the-job training and an O&M manual.

The KWSC, in general, is responsible for water and wastewater service provision in the governorate, and is the executing

[8] Local Village Unit: administrative body that represents the governorate for a group of villages.

institution of the project. The role of the KWSC for the wastewater system in El-Moufty El-Kobra is monitoring and provision of advice, and they are responsible for regular inspections, as well as for the tendering procedure. Within the project a reporting and monitoring system was established. What is more, KWSC is foreseen to take over the role of the leading external support agency (i.e. GIZ) after its exit.

On the national level, the Holding Company for Water and Wastewater (HCWW – state-owned company belonging to the Ministry of Housing, Utilities and Urban Development) has the overall responsibility for water and wastewater, it coordinates and supervises water and wastewater companies at governmental level, like the KWSC. It has to monitor and supervise the O&M, as well as give technical support if requested.

11 Practical experience and lessons learnt

The approach is highly participatory through the community based approach and the involvement of the villagers through the CDA, the Local Village Unit, the private sector entrepreneur, and the KWSC in planning and decision making from the beginning of the project. For future projects it is important to stress that the villages themselves (the CDA of a village) have to request a wastewater system. This was not the case in this pilot system. Here, the village was selected on a higher level and then people were asked if they are willing to participate.

In general, the villagers are satisfied with the involvement and project planning. Through the formation of the CDA the villagers were empowered, including women. Due to great participation, villagers developed a sense of ownership and a feeling of responsibility towards the sanitation system. Awareness campaigns were essential and have shown promising results with greater understanding with regard to sanitation and environmental issues.

Due to the simple technology chosen and the simple O&M, the CDA was able to easily contract a private service provider for this task. For a successful O&M it is important that the O&M contractor is from the village and accepted by the villagers. He must have knowledge about the village, can be held accountable and has a strong feeling of commitment. This guarantees a higher level of sustainability and effectiveness of the system.

Furthermore, the payment by the community members for such a system is very crucial to gain ownership and to sustain the system in the future. Through the supervision of the financial transactions of the CDA by the Ministry of Social Insurance and Social Affairs, transparency and accountability should be assured.

In summary, the main lessons learnt and conditions for similar projects are the:

- Importance of demand driven approach and agreement on terms of cooperation,
- Creation of ownership, responsibility and accountability,
- Involvement of all relevant stakeholders,
- Sharing of financial responsibility from the beginning of the project.

The monthly fee for the services is within the willingness to pay. Some villagers stated that they even would pay a higher price, if a good and trouble free sewerage system was provided. However, others state that they are not willing or, what is more, not able to pay higher fees. In this regard, future project planning must consider how to allow higher fees in order to gain a cost recovery of the construction investment costs, what is not yet the case.

The responsibility and willingness of the CDA to use the revenues of the collected fees effectively has to be improved. The revenues should be invested by the CDA whenever needed (e.g. for damages, measurements, etc.). This responsibility is not fully developed yet. For the time being, the CDA still expects monitoring and technical support by GIZ when required.

Currently, misuse of the system is a challenge. Animal husbandry (animals living within the households/farms) is very common in the village. As some villagers loaded animal faeces in the system, several problems arose. Firstly, the water quality of the effluent decreased, and was not anymore in accordance with the Egyptian Standards of Law 48/1982. The Ministry of Health is conducting water analyses and is seeking to punish the violator or the respective responsible body (which is the CDA, as being responsible for the management). Punishments include fines or even jail sentences, depending on the violating act.

However, newer surveys in May 2011 showed that the misuse by disposal of stable-wash water (manure pollution) was tremendously reduced (almost nil). However, it was discovered that industrial wastewater is causing a new conflict of interest. A milk-lab (= yoghurt and local cheese maker) is discharging wastewater with a very low pH into the system, which made the system/ponds almost septic. Also, a huge backlog of maintenance on interceptors and treatment plant is contributing to the low effluent quality (For some maintenance heavy equipment needs to be rent, therefore, the O&M contractor postpones maintenance as this costs him additional money). Desludging of the milk-lab interceptor and anaerobic pond already improved the quality of the effluent. The CDA is reluctant to disconnect the milk-lab due to conflict of interest as the CDA chairman is a relative of milk-lab owner.

The villagers are expected to have a clear regulation in the future, on how to take legal actions against those abusing the system. A linkage to the Local Village Unit, which can take legal actions, should be improved in order to make it easier for the CDA to report to them. The CDA demands more support by the KWSC in monitoring and advice, and in conducting analyses. The project team in cooperation with the villagers is in the process of identifying solutions to improve the effluent quality. It needs to be a feasible technical solution. One proposal by the villagers is to collect the animal waste in separate containers, which some villager already do.

With regard to the KWSC, its interest and commitment to the project remains a challenge. As the KWSC does not receive any financial benefits, given that the community-based approach is in the hands of the village community, the interest in the project is low. Furthermore, experience and management capacities are lacking for a responsible and sustainable infrastructure management. Trust is lacking between the CDA and the KWSC.

A disadvantage of the chosen simple treatment system, i.e. ponds, is the requirement of relatively large areas which could otherwise be used for farming. As more and more agricultural land is lost due to urbanisation, this fact should not be neglected.

Table 3: Similar community-managed wastewater treatment systems with ponds, operational and in planning, in the governorate of Kafr El-Sheikh with support of GIZ (source: http://wwmpegypt.com/43.html, 2011).

Village	District	Type of Wastewater System	Present Population (capita)	Source of Funding	Comments
El Moufty	Sidi Salem	Small bore sewer	3,779	GTZ	operational since 2005
Om Sen	El Reyad	Shallow sewer	4,848	SFD	operational since 2007
Koleaah	El Hamoul	Shallow sewer	1,517	SFD	operational since 2009
Om Shour	El Hamoul	Coventional	3,800	Egyptian gov.	operational by April 2011
Handakokha	El Hamoul	Conventional	2,249	Egyptian gov.	operational by Dec. 2010
Kafr El Gedid	Kafr El Sheikh	Conventional	4,396	Egyptian gov.	operational by Jan. 2011
Kouzman	Keleen	Conventioanl	5,158	Egyptian gov.	operational by Jan. 2011
Kheregin 3 - El Fayrouz	El Reyad	Small bore sewer	3,400	WB	being tendered
Kheregin 5 - Om El Koraa	El Reyad	Small bore sewer	3,500	WB	being tendered
Kheregin 6 - El Kadesaya	El Reyad	Small bore sewer	2,000	WB	being tendered

The pilot village and its system, which is unique in Egypt, serve as a model in the governorate for upscaling this concept of simple community-managed wastewater treatment plants. Since the start of the operation in 2005 it provided around-the-clock service. In two other villages, construction of similar wastewater treatment systems have been completed, and systems in four further villages are currently under construction. For another five villages, designs have been completed. Funds are provided by the World Bank and the Egyptian government (Table 3).

After the departure of the GIZ-funded project staff in December 2011, the wastewater treatment system and the established structures with the CDA, O&M contractor and other stakeholders should be strong enough to continue the system in a sustainable manner.

12 Sustainability assessment and long-term impacts

A basic assessment (Table 4) was carried out to indicate in which of the five sustainability criteria for sanitation (according to the SuSanA Vision Document 1) this project has its strengths and which aspects are not emphasised (weaknesses).

Remarks on the assessment:
Health and hygiene: Stabilisation ponds are marked “0” as sometimes there is odour from the ponds. The distance of ponds to houses is approx. 1 km.
Transport and reuse: Marked “0” as depending on the weather and possible misuse of the system the quality of the effluent into the drain may vary.
Environmental and natural resources: Sewer network and stabilisation ponds are marked “0” due to the construction materials and flush water used, especially the PVC pipes (effluent is directed in an existing drain, no materials used.)
Technology and operation: Marked “0” for sewer network: A small bore sewer system approach has been used and so pipelaying needs to be quite accurate to ensure proper slopes and sufficient flow rate. Small mistakes can have quite some influence.

Finance and economics, socio-cultural and institutional: no comments.

Table 4: Qualitative indication of sustainability of system. A cross in the respective column shows assessment of the relative sustainability of project (“+” means: strong point of project; “o” means: average strength for this aspect and “–“ means: no emphasis on this aspect for this project).

	collection and transport*			treatment **			transport and reuse***		
Sustainability criteria	+	o	-	+	o	-	+	o	-
• health and hygiene	X				X			X	
• environmental and natural resources		X			X		X		
• technology and operation		X		X			X		
• finance and economics	X			X			X		
• socio-cultural and institutional	X			X				X	

* sewer system ** stabilisation ponds *** effluent reuse (currently not taking place or not in a controlled manner)

Sustainability criteria for sanitation:
Health and hygiene include the risk of exposure to pathogens and hazardous substances and improvement of livelihood achieved by the application of a certain sanitation system.
Environment and natural resources involve the resources needed in the project as well as the degree of recycling and reuse practiced and the effects of these.
Technology and operation relate to the functionality and ease of constructing, operating and monitoring the entire system as well as its robustness and adaptability to existing systems.
Financial and economic issues include the capacity of households and communities to cover the costs for sanitation as well as the benefit, such as from fertiliser and the external impact on the economy.
Socio-cultural and institutional aspects refer to the socio-cultural acceptance and appropriateness of the system, perceptions, gender issues and compliance with legal and institutional frameworks.

For details on these criteria, please see the SuSanA Vision document "Towards more sustainable solutions" (www.susana.org).

With regards to long-term impacts of the project, the main impact of the project is improved community hygiene through a wastewater treatment system based on a community approach. Before the project, there was no wastewater management in the village. In comparison to the traditionally used wastewater trenches, the new system reduces health risks significantly. No wastewater is found in the streets of the village anymore.

Another positive development is that households now can use washing machines due to the connection to a sewerage system. This relieves burdens especially from the women, who before had to do their washing at the closest water source (river or channel). The water consumption has increased from around 35 l/person*d to 68 l/person*d, which implies higher hygiene standards.

Awareness about health and environmental issues was lacking before the start of the project. Through the awareness campaigns, knowledge about water related diseases, hygienic and environmental aspects improved. People now are trying harder to keep the environment clean. One example is that the village started with the collection of solid waste. In general, with the CDA the people now have an institution through which they can communicate their demands.

13 Available documents and references

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SuSanA 2012

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