Dr. Kamal Ghodeif – Water Management Specialist and EIA Consultant
Suez Canal University, Ismailia , Egypt
e-mails: kghodeif@yahoo.com

SWIM- Sustain Water MED *Network of Demonstration Activities for Sustainable Integrated Wastewater Treatment and Reuse in the Mediterranean.*

Baseline Assessment Study for Wastewater Treatment Plant for Al Gozayyera village, West Kantara City, Ismailia Governorate, Egypt

FINAL REPORT

SUBMITTED TO

SWIM-Sustain Water MED - Egypt

Deutsche Gesellschaft fuer Internationale Zusammenarbeit (GIZ) GmbH
Holding Company for Water and Wastewater (HCWW)
Cairo, Egypt

SUBMITTED BY

Dr. Kamal Ghodeif
Water Management Specialist and EIA Consultant
Suez Canal University – Ismailia - Egypt

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List of abbreviations:

EEAA: Egyptian Environmental Affairs Agency
MWRI: Ministry of water resources and irrigation
MOHP: Ministry of Health and Population
NWRC: The National Water Research Centre
EHD: The Environmental Health Department
MHUNC: Ministry of Housing, Utilities and New Communities
MALR: Ministry of Agriculture and Land Reclamation
MOI: Ministry of Industry
MHESR: Ministry of Higher Education and Scientific Research
NOIF: The National Institute for Oceanography and Fisheries

1 Introduction

1.1 Overview

SWIM-Sustain Water MED (SWM) is implemented in Egypt, Jordan, Morocco and Tunisia with the objective to improve sustainable integrated management of non-conventional water resources, with emphasis on wastewater treatment and reuse. In particular, the project aims to demonstrate:

a) a sustainable concept of locally adapted wastewater and human excreta management in Egypt based on the eco sanitation principle by using different appropriate technologies like the Dry Toilets techniques and resulting in recycling of phosphor as a nutrient to improve soil conditions and treating biologically excreta and wastewater, with the aim of energy and artificial soil production, minimization of resources' consumption and maximization of their reuse;

b) the potential of decentralized / semi centralized low cost wastewater treatment and reuse for rural communities in Egypt;

c) the economic and health benefits for farmers and consumers due to secondary wastewater treatment combined with the application of innovative irrigation and crops technology in Egypt and;

d) the applicability of treated wastewater quality monitoring and early warning systems to promote security and acceptance of wastewater reuse in Egypt, including examples of good water governance between water producers and farmers.

SWIM-Sustain Water MED (SWM) project will conduct pilot activity at rural area of Egypt to demonstrate the potential application of decentralized wastewater management. These measures may contribute in achieving the millennium development goals MDG. The site of the pilot activity in Egypt is at Al Gozayyera village, one of Al-Rayah villages of West Kantara City, Ismailia Governorate (fig. 1). The site is characterized by serious environmental pollution caused by discharging of raw sewage to agricultural drains. The common sewage disposal system at the village is cesspits and open trenches. Egypt's national water strategy foresees decentralized wastewater treatment as the only solution for this dilemma, however, not many decentralized treatment plants exist yet. Another problem in the area is the un-safe indirect reuse of polluted agricultural drainage water due the direct pumping of raw sewage. In order to respond to these problems, it is suggested to construct a wastewater treatment unit at the selected village. The selected area is not connected to the sewer network and urgently needs safe sanitation system. However, an internal sewage network, connecting all buildings to the final point will be constructed through villager's participation. The produced sewage from houses is disposed in tranches nearby the house. Al Gozayyera population is about 1138 inhabitants. The number of houses is about 190. The total land area of the village is 100,000 m^2.

Figure 1: Location map of the investigated site (from Google earth website)

According to the preliminary investigations, there are loyalty and commitments from the village representatives to participate in sanitation project and to cooperate with the project team. About 350 m2 is awarded from local community to be used for implementation of wastewater treatment unit (appendix attached). In addition, land is available for reuse of the treated sewage in agriculture. Egypt has been using treated wastewater to produce wood and other industrial products since the early 1990s. The MALR (Ministry of Agriculture and Land

Reclamation) and the MSEA (Ministry of Sate for Environmental Affairs) have established 24 water-reuse projects across the country including one in Luxor where they grow African mahogany (Khaya senegalensis), mulberry (Morus spp), and physic nut (Jatropha curcas). So far, these projects have been exclusively government driven and private sector participation is absent. An inter-ministerial committee approved the Egyptian Water Reuse Code (Ministerial Decree No. 171/2005) in April 2005.

1.2 Purpose

A baseline study simply defines the "pre-operation exposure" condition for the set of indicators that will be used to assess achievement of the outcomes and impact. When compared with the condition of the same indicators at some point during implementation (mid-term evaluation) and post-operation implementation (final evaluation), the baseline study forms the basis for a 'before and after' assessment or a 'change over time' assessment. Without baseline data to establish pre-operation conditions for outcome and impact indicators it is difficult to establish whether change at the outcome level has in fact occurred.

The purpose of this baseline assessment study is to prepare all necessary data for the design and construction of the Egyptian waste water treatment and reuse pilot activity at Al Gozayyera Village, West Kantara City, Ismailia Governorate, based on the template and guidance given by SustainWaterMED for assessing the baseline conditions of the water reuse pilot activities. This assessment well serves as a basis for informing decision-making and detailed planning of the pilot activity. In general, it will reveal opportunities and risks. The baseline assessment will serve as a tool to make information available to a broad range of stakeholders and to achieve their support based on an analysis and documentation of existing problems in water supply and sanitation.

1.3 Approach and Methodology

We have followed multidisciplinary and integrated approach to conduct this baseline assessment study. We have involve a broad range of stakeholders through continued discussion and questioners. The study lay out has been done in line with GIZ and the EU visibility guidelines with emphasize on the baseline assessment template and common methodological framework provided by SustainWaterMED for assessing the baseline conditions of the water reuse pilot activities. The template has been adapted to the type and level of interventions required at the site. The baseline assessment study will provide information on various aspects of water reuse that will help to make decisions for the design of the pilot activity. We had continuous coordination with SWM Project-coordinator at HCWW. In general our methodology has based on the following items:

- **Literature review** (Searching in public documents, collection of data on existing water and wastewater sources as well as research in literature and case studies on reuse)
- **Stakeholder Analysis & Socioeconomic survey and Gender analyses** (preparation of questionnaires, survey, analysis and interpretation as well as interviews with potential users and other key stakeholders)
- Village survey and data collection (**c**ollection of archival data, legal issues, field survey for status que of water supply, different uses, demands, drinking water and wastewater sanitation; landuse activities, potential sources of pollution, sampling of soil and water samples)
- **Soil and water analyses** (soil, surface water, groundwater, drain-water) for representative number of samples and specific indicators
- **Land leveling (Topographic survey) & Geotechnical investigations** (drilling of shallow test boreholes using hand auger and carrying out grain size analysis for representative samples)
- **Workshops** (Roundtable discussion with local and national professionals in waste water sanitation and potential reuse as well as Public awareness to & hearing from stakholders). It has included assessment workshop with relevant local and national stakeholders in order to inform broad range of stakeholders on the project, its objectives and outline; to identify and explore stakeholders' opinion, issues, and concerns related to water reuse in agriculture and the proposed pilot activity. Moreover, to carry out stakeholder analysis; to gather information for baseline assessment and/or to identify further sources of information for baseline assessment.
- **Final report & Documentation** (Documentation of pilot activity according to template provided)

1.4 Sources of data

- Ismailia Governorate Information Center
- Suez Canal University.
- Ministry of Water Resources and Irrigation
- Local authority of Al-Rayah village
- Direct contact with local communities and personnel interviews

2 Background information:

The background information has been gathered through archival data and field survey in addition to laboratory and office work. Archival data is available mainly at two sources; Ismailia Governorate Information Center and Suez Canal University. Field survey has included GPS survey for geographic location; soil and water sampling, socioeconomic survey as well as other field measurements for environmental parameters. Laboratory and office work has included analysis of soil and water samples and projection of field data on satellite images. Analyses were done at Suez Canal University Central Laboratory.

2.1 Ismailia Governorate

Ismailia governorate is considered a newly established governorate. It was considered a governorate according to the administrative local system in 1960. Ismailia governorate is located along the eastern parts of Egypt at the middle part of Suez Canal. It is surrounded from the East with Sinai and Suez Canal, at the West is the Eastern borders of Nile Delta, at the South the way linking Suez with Cairo and Port Said and Manzala Lake at the North. It covers an areas of about 5066,94 km^2 . It consists of 5 Markaz and major cities; Ismailia City and Markaz, Fayed City and Markaz, El Tal El Kabier City and Markaz, East Kantara City and Markaz, **West Kantara City and Markaz**, in addition to Abou Souier city, El Kassaseen city, also it includes about 25 villages and 712 sub-village and ezbet.

The governorate is producing vegetables like Tomato, cucumber, green pepper, also fruits specially mango and citrus, watermelon, peach, muskmelon by which the governorate is very famous. Also farmers in the governorate cultivate wheat, maze, rise, barley and peanut. It has unique marine environment as it extends along the Suez canal and has two major lakes (El-Temsah lake and The Great Bitter Lakes). This makes Ismailia governorate famous for fishery and tourism industry.

Ismailia Canal is considered the main source of fresh water that carries water from the Nile River to two other governorates Port Said, and Suez. Water in Ismailia Canal is used for drinking, irrigation and industry. It has about 128,500 Km length , 53Km of it inside the borders of Ismailia governorate. It has two main branchs; one extends to the South (Suez fresh water Canal) of about 89.760-Km length and the other extends to the North (Port Said fresh water Canal) of about 76.670 Km length. There are about 36 secondary and tertiary canals subdivided from the main water channels, the total volume of water withdrawn from Ismailia Canal is about 9.5 million m^3/day, the governorate's share from that is 4.7million m^3/day.

According to the Data Information and Supporting Decision Center (Cabinet of Ministers) the population in Ismailia at 1st. of May 2005 is 863.27 persons, with 2.7% growth rate in 2005, while in 1999 the growth rate was 2.9% . Table 1 below indicates population in 2005 in governorate Markaz as well as growth rate for both 1999 and 2005.

Dr. Kamal Ghodeif – Water Management Specialist and EIA Consultant
Suez Canal University, Ismailia , Egypt
e-mails: kghodeif@yahoo.com

Table 1: Population distribution and growth rate in Ismailia governorate

Name of Town/ Markaz	Population in 2005	Growth rate of population (%)	
		In 1999	In 2005
Ismailia	513252	2.11	2
El Tal El Khabier	148262	2.67	2.6
Fayed	87236	2.56	2.40
West Kantara	86706	3.7	3.5
East Kantara	27571	3.37	3.1

Information Center and decision support (Ismailia governorate)

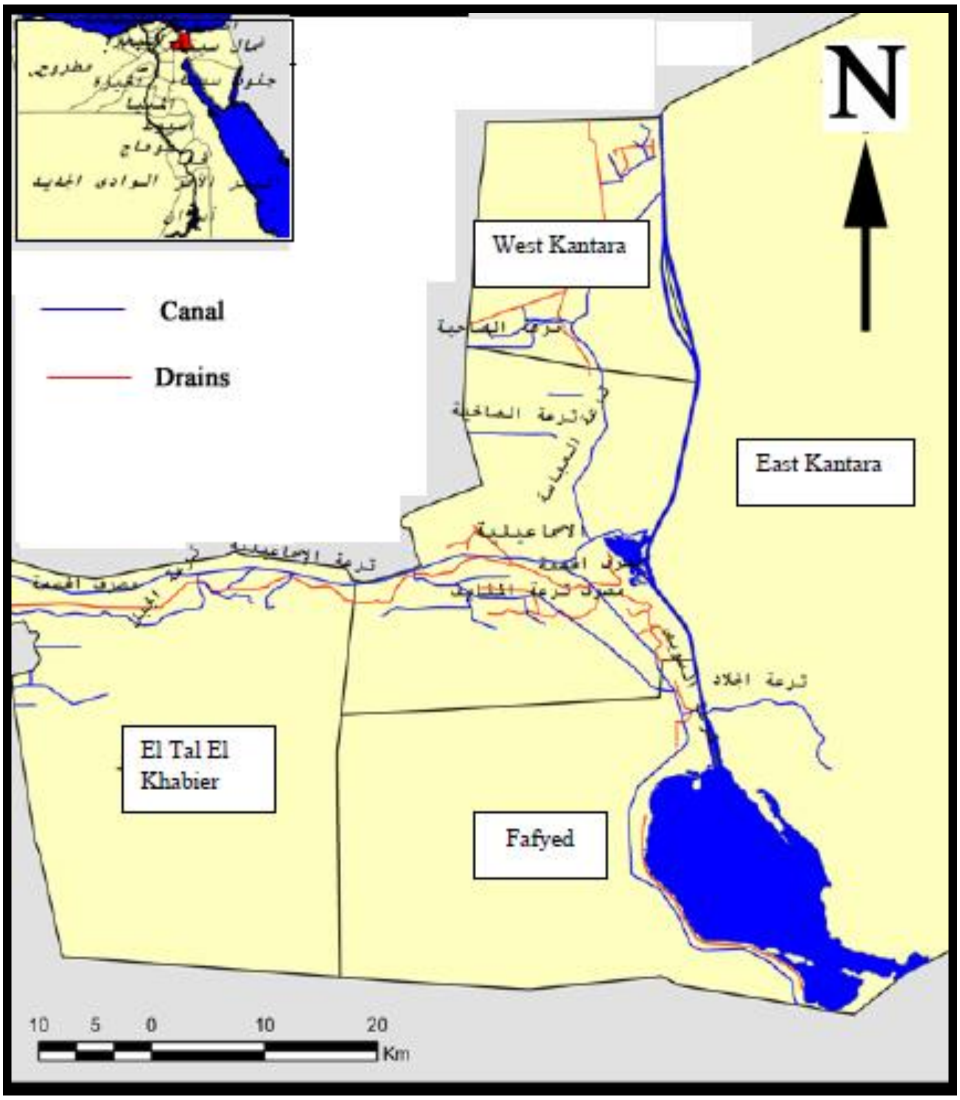

Figure 2: The administrative division of Ismailia Governorate and its main water fresh water canals and drains

2.2 Water Supply and wastewater treatment and reuse in Ismailia

The Ministry of Housing and Utilities and the urban development supervises all institutions in charge of providing water and sanitation services all over Egypt. Two main institutions are in charge of planning and supervision of infrastructure construction in Ismailia and Suez Canal Province:

- The **National Organization for Potable Water and Sanitary Drainage (NOPWASD)** for the province excluding new communities, and
- The **New Urban Communities Authority** is responsible for water supply and sanitation investments in new communities

The **Holding Company for Water and Wastewater (HCWW)** and its 26 affiliated companies are in charge of operation and maintenance of water and sanitation infrastructure. The Holding Company owns all water and sanitation infrastructure in Egypt. Its affiliated company **(Canal Company for Water and Wastewater)** is responsible for Suez Canal Province (Canal governorates; Suez, Ismailia, and Port Said). It is in charge of both water supply and sewerage in the three governorates except drinking water supply for major cities (Suez, Ismailia, and Port Said) that is still under the responsibility of **Suez Canal Authority**.

Ismailia governorate has 45 water plants which produce around 650,000 m^3 per day. The loss of drinking water from distribution system ranges from 20% to 25 %. Drinking water services covers about 100% of the governorate population.

The waste water treatment in the entire governorate is 109,750 m^3 per day (table 2). There are secondary waste water treatment plants in Ismailia City and Markaz (90,000 m^3 per day), City and Markaz of El- Tal El-Kabeer (9,750 m^3 per day) City and Markaz El-Kantara West (10,000 m^3per day). There is no waste water treatment service for the rest of towns and markazes of the governorate. The percent of waste water treatment coverage reaches about 20% of the whole population. People use their own methods; mostly cesspits and then discharge by trucks. El-Kantara West City has wastewater treatment plant at Abu Khalifa Village that discharges effluent into El-Husseinia Drain.

Table 2: The waste water treatment plants in Ismailia governorate

Name of Plant	Site	Capacity	Type of Treatment	Total Treatment	Volume of Drains	Location to Drains
Serabuim	Ismailia City	90,000 m^3 per day	Secondary Biological	90,000 m^3 per day	90,000 m^3 per day	Mahasma
Tal Kebeer	Tal Kebeer City	10,000 m^3 per day	Secondary Biological	10,000 m^3 per day	10,000 m^3 per day	Wadi
Abu Kahlifa	Abu Khalifa – Qnatara West	10,000 m^3per day	Secondary Biological	10,000 m^3 per day	10,000 m^3 per day	Husseinia
Kantara East	Kantara East	7,200 m^3per day	Secondary Biological	Under construction	Under construction	Irrigation Network

Source of information: local units and markazes and cities.

2.2.1 The wastewater treatment and reuse at Serabuim Plant

Serabuim wastewater treatment plant is secondary and uses biological technology. It is used mainly for treatment of wastewater collected from Ismailia City and Markaz. The waste water passes through mechanical filters to remove sludge. Then water passes through sand sinks then two aero sinks. Each sink has 20 blowers. The speed of the blower is 975RPM in case of low oxygen and 834 RPM in case of high oxygen. The water passes through basic sinks then the duo sinks. The water stays in this sinks for five days. Then it passes through the final sinks which depend on the sun and sledges for another five days. Some of this water is used to irrigate the wood forest affiliated to the Ministry of Agriculture. Some of the water goes to the project of silk worm affiliated to the Suez Canal Authority. Some effluent is reused to clean the equipment of the plant. The final and biggest part is poured into El-Mahsmah drain that further discharges into El-Temsah Lake.

2.3 The pilot activity site

The pilot activity (waste water treatment and reuse) is planned to be constructed at Al Gozayyera Village. It is a small suburb (Ezbet) belonging to the mother village called Al-Rayah village that is administratively part of El-Kantara West City of Ismailia governorate. It is located in the eastern part of the Nile Delta, it is about 4-kilometers from El-Salam bridge on the Suez Canal. It is extended between longitudes, 32 16 24 and 32 16 33 E and latitudes, 30 50 19 and 30 50 32 N (Fig. 3).

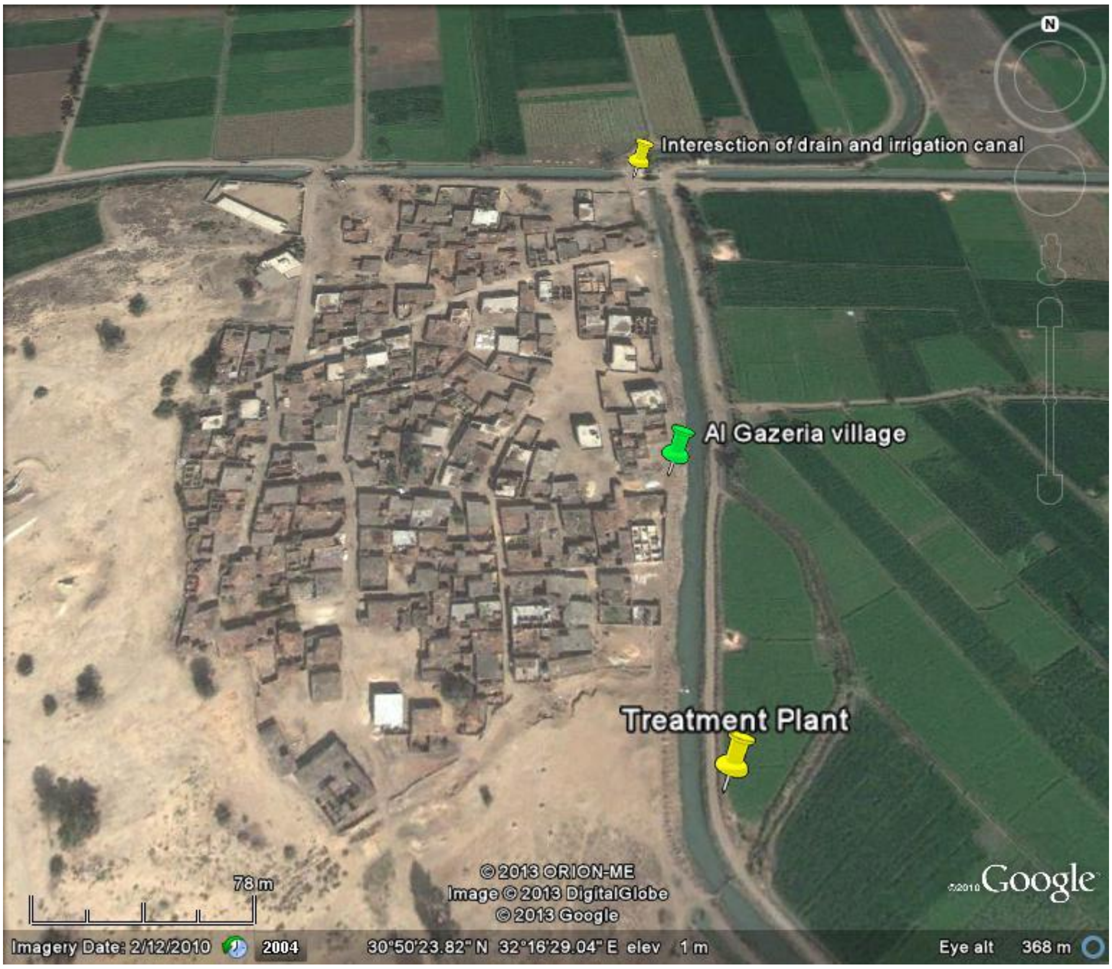

Figure 3: The residential area of the village and the proposed site of the pilot project.

According to our current study (August – September 2013) the number of houses in the village is about 190. The total land area of the residential area of the village is about 100,000 m^2. It is surrounded with two water bodies; North Al-Rayah Drain and irrigation tertiary canal. It is located at the end part of the irrigation canal thus the farmers suffer from deficiency in their irrigation water. Al Gozayyera population is about 1138 inhabitants, the males represent about 49.6% and females are 51.4% of the total population. Total work power of the village is 184 person; most of them are free workers (43%) and employers (22.8) and farmers (16.3) and others (17.4). Most of the village residents are working in the agriculture sector (at their own farms and/or with their neighbors) beside their original jobs as well as they are breeding domestic animals. Thus the main source of income is the agriculture sector.

The village is receiving drinking water from the main treatment plant of El-Kantara West City. The people have abandoned their hand pumps and closed it completely. They rely solely on the governmental supply of drinking water. Most of the village houses have private storage tanks to store drinking water for emergency shut off of supply. People have mentioned that it is frequent to spend few hours without continuous drinking water supply. The average daily water consumption from drinking water is about 50 liters. According to the current population (1138) and normal growth rate at West Kantara (3.5%) we have estimated current and future wastewater discharge. The current discharge is estimated to be 56.9 m^3/day and after ten years it will reach about 76.8 m^3/day. The governmental and public buildings such as Mosque, Primary School and guesthouse uses about 10 m3/day.

The common sewage disposal system at the village is cesspits and open trenches (photo 1). These open pits are sometimes sealed with cement and others are not. The cemented pits are sucked by trucks and next discharged into nearby drains and irrigation canals with average frequency once per month. The unsealed pits discharges directly into the underground through the unsaturated zone. These activities may threat groundwater resources and surface water environment.

Photo 1: The common sewage disposal systems at the village

The village is endangered by serious environmental pollution caused by discharging of raw sewage to agricultural drains as well as to underground cesspits. People at the end of irrigation canals suffer from shortage of irrigation water thus they use the agriculture drain to irrigate their crops. In order to respond to these problems, it is suggested to construct a wastewater treatment unit at the selected village. The selected area is not connected to the sewer network and urgently needs safe sanitation system. However, an internal sewage network, connecting all buildings to the final point will be constructed through villager's participation. The local community has awarded land (about 350 m^2) to construct pilot activity on it. In addition, land is available nearby the proposed site for wastewater reuse in agriculture.

2.4 Short description of planned pilot activity

SWIM-Sustain Water MED (SWM) project will conduct pilot activity at rural area of Egypt to demonstrate the potential application of decentralized wastewater management. It is planned to construct a wastewater treatment unit at Al Gozayyera village. Moreover, an internal sewage network, connecting all buildings to the final collection point will be constructed through villager's participation. The pilot activity will be a real demonstration project for low cost wastewater treatment and reuse for rural communities in Egypt. It will show the applicability of treated wastewater quality monitoring program and early warning systems to promote security and acceptance of wastewater reuse in Egypt. More detail about wastewater treatment technologies and reuse as well as appropriate options for Egyptian conditions will be shown later in this report.

3 Environmental setting:

3.1 Climate:

Ismailia governorate has an arid climatic conditions denominated by a long hot, rainless summer and a mild winter. The average monthly temperature, humidity, wind speed, fog and Evaporation is illustrated in table 3. It has strong wind in winter and spring, North and East North winds prevail in Summer while North and West North winds prevail in the Winter. The maximum monthly average for temperature is 35.1 C° in July and August. During night the temperature decreases and the minimum average limit is 7.1C° in January. It has very high evaporation rate and meagre rainfall that rarerly exceeds 50 mm/year. Climatic data for Ismailia governorate is collected for the period from 1958-1995 and represented graphically (figures 4, 5, 6). The average annual precipitation reaches about 30 mm. Most of this precipitation occurs with low intensities during the months from October to March. The relative humidity varies between 38% in spring (April) and 63% in winter (January). The average daily evaporation varies between 4.8 mm/day in winter and 12.4 mm/day in summer.

Table 3: The average monthly climatic data for Ismailia governorate. (Source is the General Authority for Meteorology)

Month	Average of temperature			Humidity	Wind speed	Fog	Evaporation
	Max	Min	Avg				
January	19.9	7.1	11.9	63	1.57	3.2	130.2
February	21.1	7.5	12.3	63	1.80	3.4	140.0
March	23.9	9.4	15.2	45	2.12	3.4	232.5
April	28.7	12.0	17.7	38	1.85	2.7	218.0
May	31.2	15.7	21.4	41	1.71	3.0	303.0
June	35.1	18.7	25.6	43	1.44	1.3	357.0
July	35.1	20.5	25.8	53	1.73	1.1	319.3
August	35.1	20.6	25.8	55	1.57	1.3	288.3
September	32.8	19.1	24.0	52	1.35	1.4	234.0
October	30.3	17.2	21.9	58	1.44	2.1	189.1
November	25.7	14.2	18.2	61	1.17	2.9	135.0
December	21.6	9.3	13.7	61	1.44	3.6	127.1

Temperature (C^0); Relative humidity (%); Wind speed (m/s) ; Fog (changed into fog drops in mm/squared meters/month) and Evaporation (mm/month).

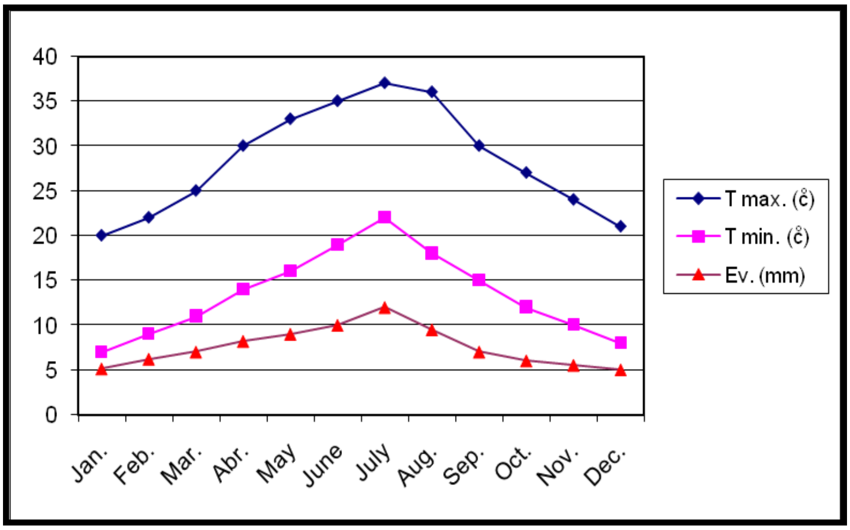

Figure 4: Average monthly variation of temperature and evaporation (mm/day)

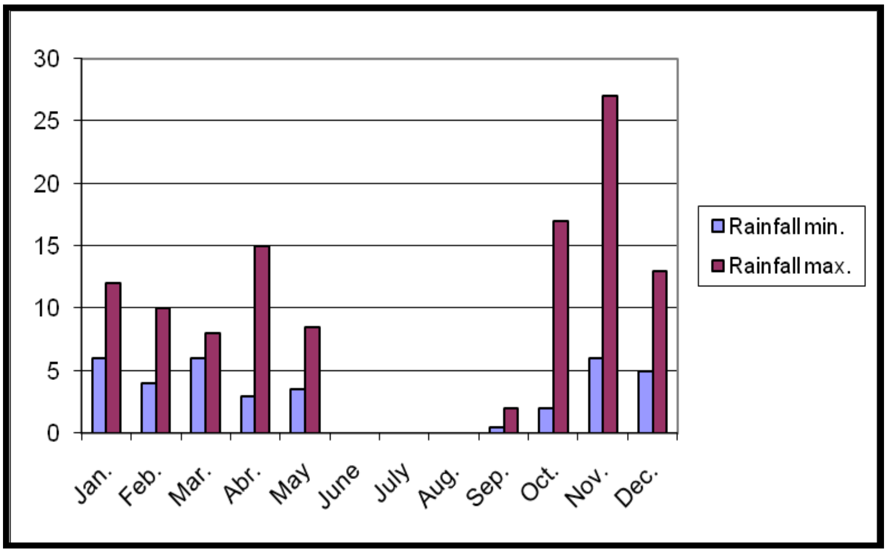

Figure 5: Average monthly variation of maximum and mean rainfall

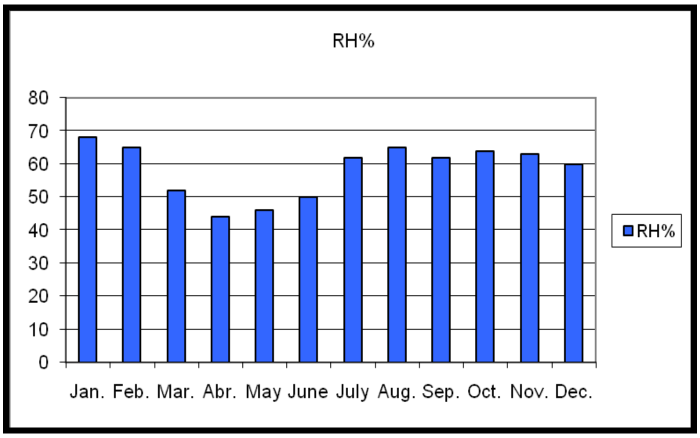

Figure 6: Average monthly variation of relative humidity

3.2 Geomorphology and landuse

The investigated site is located along the north eastern part of the Nile Delta. The investigated site is dominated by low land flat areas with presence of relatively raised islands (Fig. 7). These raised islands were called turtle backs by Said, 1962. Over one of these islands Al Gozayyera village had been constructed. Its name in Arabic is derived from such islands that are widely distributed along the eastern Nile Delta. Since the pharaohs times these islands are used as residential areas and still so. The low flat areas are used either for cultivation or breading fish.

Figure 7: Satellite image for the investigated site and its surroundings.

Dr. Kamal Ghodeif – Water Management Specialist and EIA Consultant
Suez Canal University, Ismailia , Egypt
e-mails: kghodeif@yahoo.com

The low land flat areas are covered by fertile Nile Delta soils that are arable land. Other parts of the low land areas are either clay swamps or fish farms. The geomorphologic setting and distribution of soil types in the vicinity of the investigated site is given by Abdel Kawy and Belal, 2011. The geomorphologic map (Fig. 8) shows the distribution of soil types and main land forms in the vicinity of the investigated site. The physiographic and soil map legend of the investigated area is shown in table below.

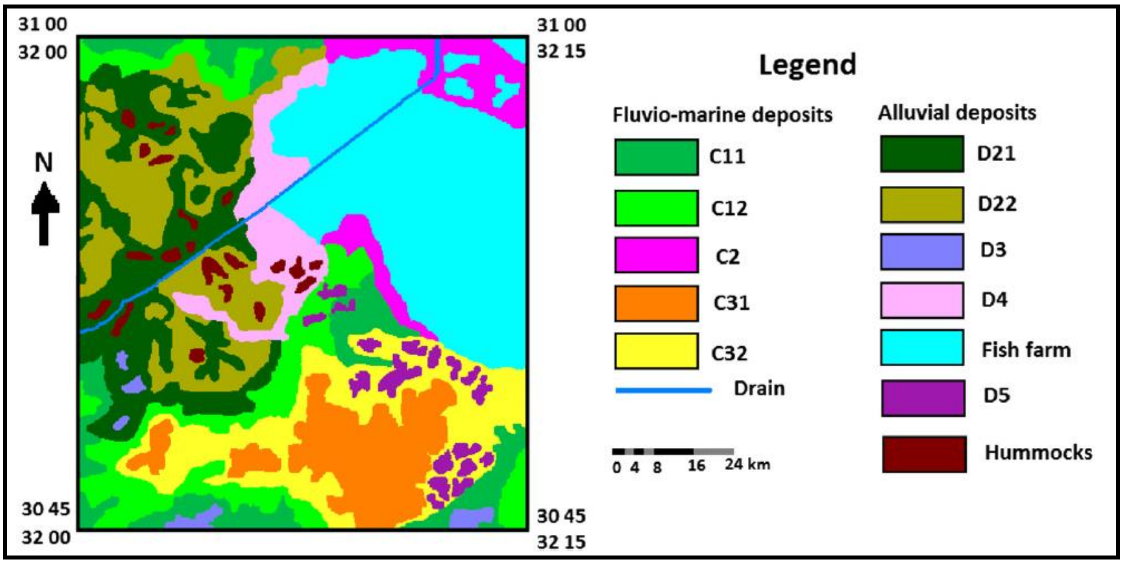

Figure 8: Land forms and soil map (after Abdel Kawy and Belal, 2011)

Table 4: Legend for figure 8.

Landscape	Relief	Lithology/origin	Land form	Mapping unit
Coastal plain	Gently undulating	Fluvio-marine deposits	Clay flats	
			Relatively high	C11
			Relatively low	C12
			Clay swamps	C2
			Old sandy deposits remnants	
			Relatively high	C31
			Relatively law	C32
Young sub-deltaic deposits	Flat to almost flat	Alluvial deposits	Scattered small hills (Hummocks)	D1
			Flat plains	
			Relatively high	D21
			Relatively low	D22
			Marches	D3
			Intermittent wet land	D4
			Gypsiferous deposits	D5

Two main landscapes characterize this area, the fluviomarine plain and the river terraces, where both of them originated from fluvial and deltaic origin. Between these two landscapes, there is a wide transitional zone, strongly affected by wind action and consisting of nearly flat plains, gypsiferous sandy soils, wind blown sand soils, with dunes or hummocky relief and small strip of transitional soils. The area in general has fairly flat relief except the river terraces and sand dunes, which have an undulating or hummocky relief (ASRT, 1978). The northern and eastern parts of the study area include young fluvio-marine deposits, which were originally transported and deposited by both the river and the sea, and are composed of clay and silty clay inter-layered with lenses of quartz sand, and highly enriched with salts. The southern parts of the area include young eolian deposits, which are distributed as sand sheets developed into hummocks or sand dunes of variable size. On the other hand, the western parts include subdeltaic deposits that are composed of medium and fine quartz sand (Said, 1993).

3.4 Water Resources

Ismailia Canal is considered the main source of fresh water that carries water from the Nile River to two other governorates Port Said, and Suez. Water in Ismailia Canal is used mainly for irrigation and drinking. It has two main branchs; one extends to the South and the other extends to the North (Port Said fresh water Canal). **Port Said fresh water Canal** has about 76.670 Km length. It supplies many secondary and tertiary canals; one of these tertiary canals supply irrigation water to Al Gozayyera village. The village is surrounded by two **agriculture drains** these are; North ismailia drain and North Al Rayah drain. The main water canals and drains in the investigated site are shown in figure 9. Farmers at irrigation canal tails, where there are water shortage, usually use agriculture drainage in irrigation. Due to high salinity at North Ismailia drain they have used only North Al Rayah drain for irrigation.

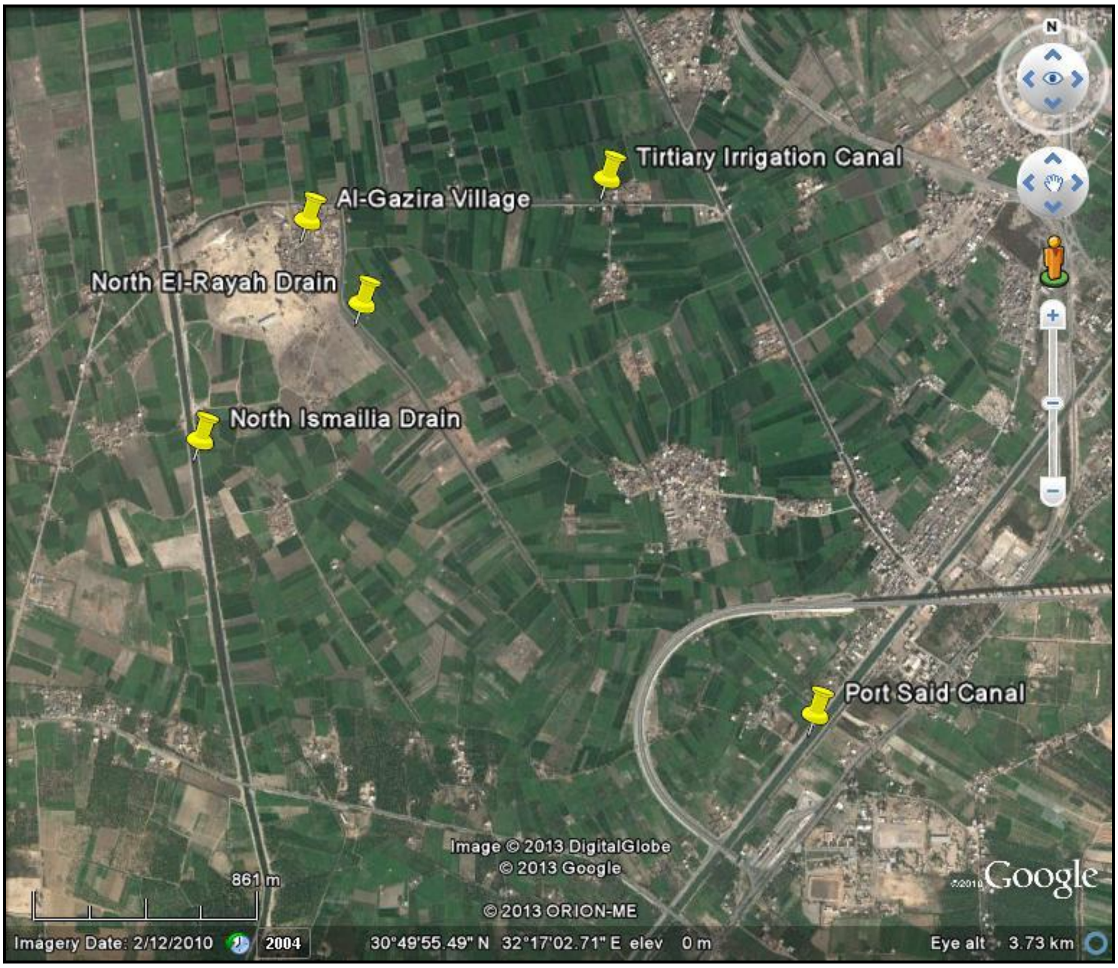

Figure 9: Main water canals and drains in the vicinity of the investigated site

The main groundwater aquifer (Eastern Nile Delta aquifer) is formed by the Quaternary alluvial deposits that consist of sand and gravel with a relatively high hydraulic conductivity. Intercalations of relatively thin layers of clay occur. The groundwater exists at shallow depths ranges from 4 to 6 meters under cultivated land and residential area respectively. The groundwater aquifer is unconfined under the residential area and gradually becomes semi-confined under the cultivated land. The Quaternary aquifer in the vicinity of the study area has an average thickness of about 300 meters. It underlies the flood plain. The thickness of the nilotic silt and clay increases northward. In the Nile flood plain the aquifer is covered by a Holocene clay layer which creates semi-confined conditions towards the fringes of the Nile Delta. The aquifer is in fact a large storage reservoir supplied by the Nile water through the irrigation system. The regional flow of groundwater is directed northward to the Mediterranean Sea. The average thickness of the clay cap is less than 20 meters. The thickness increases northward where it reaches about 70 meters along the Mediterranean coast. The clay cap is followed by silty soft clay or sandy clay layers. The clay cap is anisotropic with permeability in the vertical direction much less than in the horizontal direction.

The **water quality** of the surrounding water environment is shown in table 5. The three fresh water canals (Ismailia, Port Said, Irrigation tertiary canal) have similar water quality as they come from one source (Nile River). All have TDS values less than 400 mg/l. All have feacal coliform bacteria but with different count (table 5). The water quality of the agriculture drains is totally different; one (North Ismailia drain) has high salinity (Ec= 10160 µS/cm) and the other North Al Rayah has lower salinity (EC = 1622 µS/cm). Both drains have high count of pathogenic bacteria. The groundwater salinity is below 500 mg/l with high content of ammonia table 5. Groundwater exists at shallow depths thus are subjected to leakes from existing sewage disposal system that discharges directly to underground.

Dr. Kamal Ghodeif – Water Management Specialist and EIA Consultant
Suez Canal University, Ismailia , Egypt
e-mails: kghodeif@yahoo.com

Table 5: Water quality in the vicinity of the investigated site

Parameter	units	Ismailia Canal	Port Said Canal	Irrigation tertiary Canal	North AL-Rayah Drain	North Ismailia Drain	Groundwater well
Temp	°C	26.9	25.3	30.4	30.2	27	24.2
pH	-	7.82	8.31	7.89	7.6	7.44	7.86
EC	µS/cm	394	444	379	1622	10160	613
O2	mg/L	3.88	5.32	4.35	2.25	3.31	2.9
Fe total	mg/L	0.03	0.05	0.08	0.09	0.08	0.19
Mn total	mg/L	0.2	0.3	0.1	1.3	0.4	0.6
NO3-N	mg/L	0.6	4.5	1.0	0.9	2.5	3
NH3-N	mg/L	0.2	<0.1	<0.1	<0.1	<0.1	1.16
Br	mg/L	<5	<5				<5
Ca	mg/L	35.1	38				30.7
Mg	mg/L	11.9	15				14.2
Na	mg/L	35.6	39				135
K	mg/L	5.5	6				5.9
Cl	mg/L	26	28				86.7
SO4	mg/L	30	34	24	114	653	90
DOC	mg/L	4.3	3.5				1.8
UV-254	1/m	6.2	5.6				2.7
total feacal coliform	cfu /100 ml	600	1200	1600	$2*10^3$	$6*10^3$	Nil

Dr. Kamal Ghodeif – Water Management Specialist and EIA Consultant
Suez Canal University, Ismailia , Egypt
e-mails: kghodeif@yahoo.com

4 Land leveling (topographic survey)

A topographic survey of the land has been done to determine the high points and low points of the ground surface. The proposed track of the sewer lines and treatment plant has been recognized. Land leveling has been done using Theodolite (photo 2). Profiles have been distributed to cover the proposed track of main collection sewer pipes and treatment plant. They have followed the main roads in the village and within the residential area. The site layout and distribution of land leveling profiles is shown in figure number 11.

Photo 2: Land leveling at the village bridge.

The results of land leveling and directions of different profiles are shown in figures numbers 11, 12, 13, 14, 15, 16 and 17. The results are documented by landmarks and signs along the main profiles on the ground.

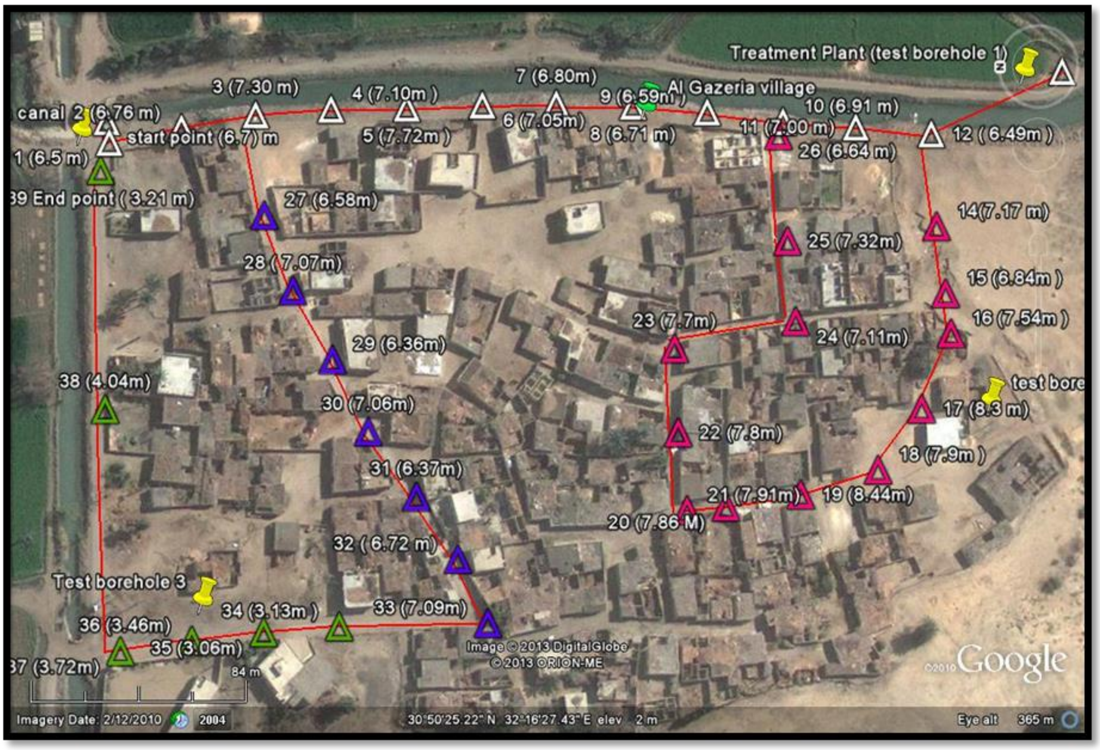

Figure 10: Site layout shows the distribution of four profiles

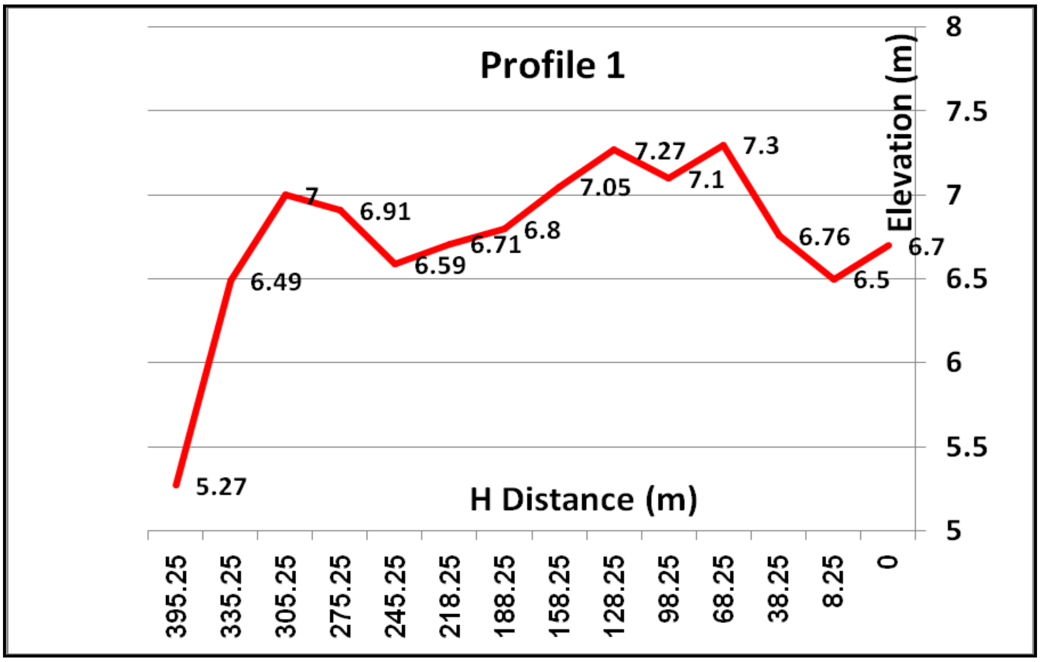

Figure 11: Land leveling through profile number 1

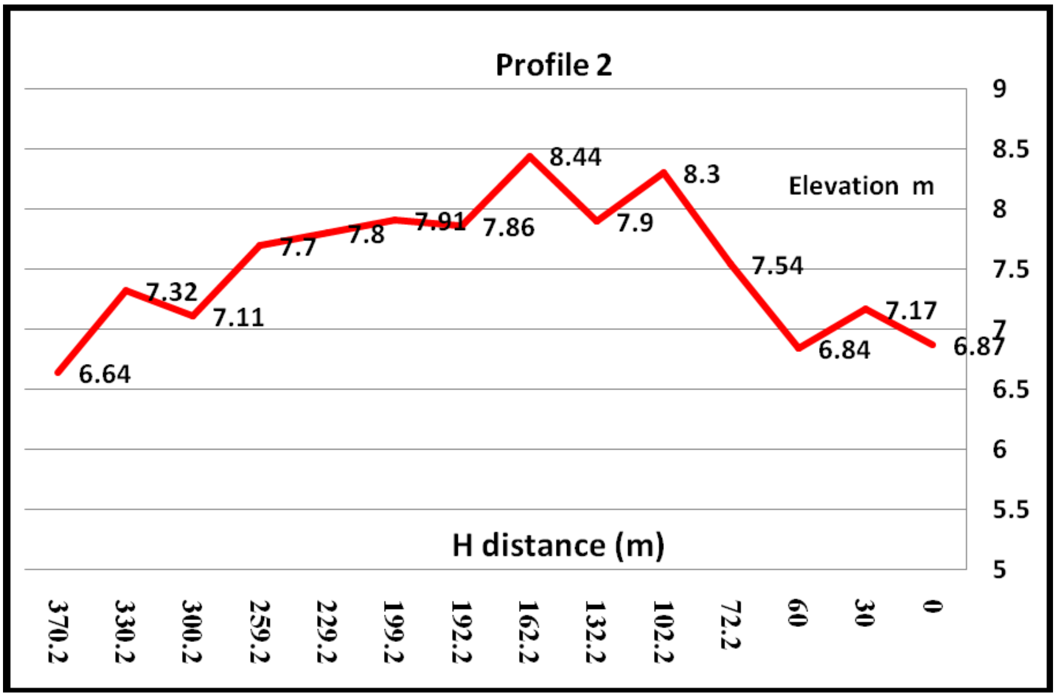

Figure 12: Land leveling through profile number 2

Figure 13: Distribution of profile number 2 along the residential area

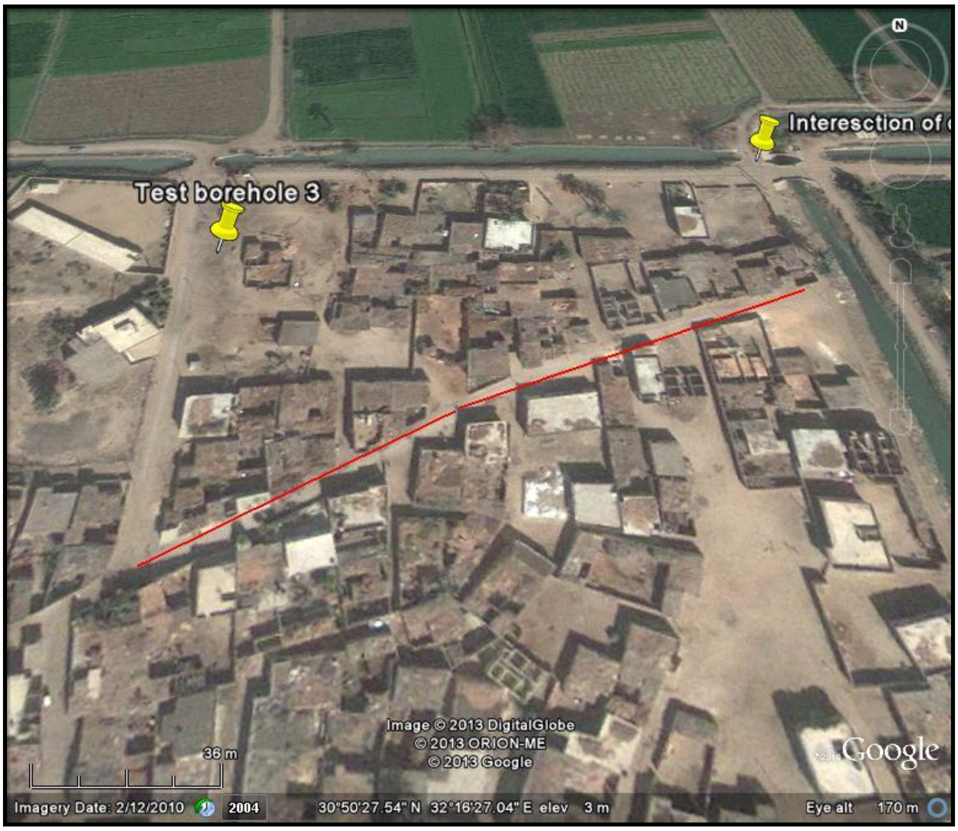

Figure 14: Distribution of Profile Number 3 along the residential area

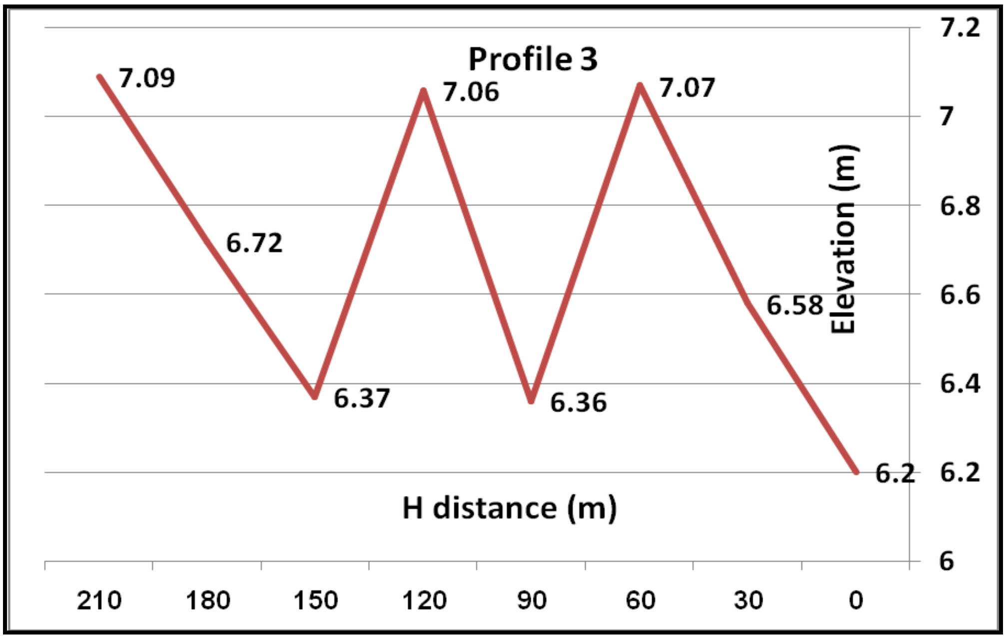

Figure 15: Land leveling through profile number 3

Figure 16: Distribution of profile number 4 near the mosque and primary school

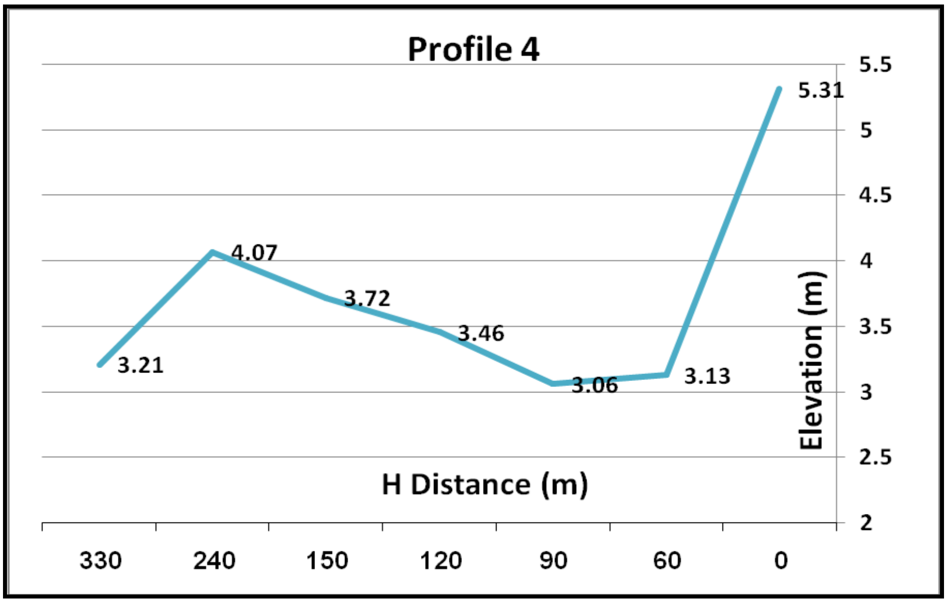

Figure 17: Land leveling through profile number 4

In summery land leveling has been done for total lengths of about 1305 meters. The maximum difference in ground surface elevations among the four profiles is about 5-meters. Priority for main sewer lines is recommended to follow profiles numbers 1 and 3 respectively. The other two profiles have second priority to cover the whole village residential area and public buildings (mosque and primary school).

5 Geotechnical investigations

Geotechnical investigation has included drilling of test boreholes to recognize the subsurface lithology and describe soil characteristics as well as measuring water table level of shallow groundwater. We have used hand auger to drill three test boreholes of average depth 4-meters (photo 3). The distribution of test boreholes (Fig. 19) has reflected the different landuse types. These profiles have been drilled in both the cultivated land (proposed site for wastewater treatment plant) and residential areas (sewerage network).

Photo 3: Drilling test boreholes to investigate subsurface section at the proposed site for construction of wastewater treatment plant (profile No. 1)

The results of geotechnical investigations at the three profiles are shown in figure 20. The first profile (test borehole No. 1) shows the occurrence of silt at the first 25 cm of the cultivated land and next dense clay layer dominates until 3.25 meters below ground surface. The white very coarse sand has appeared at the bottom of profile No. 1.

Figure 19: Distribution of geotechnical test borehole at Al-Gozayyera village

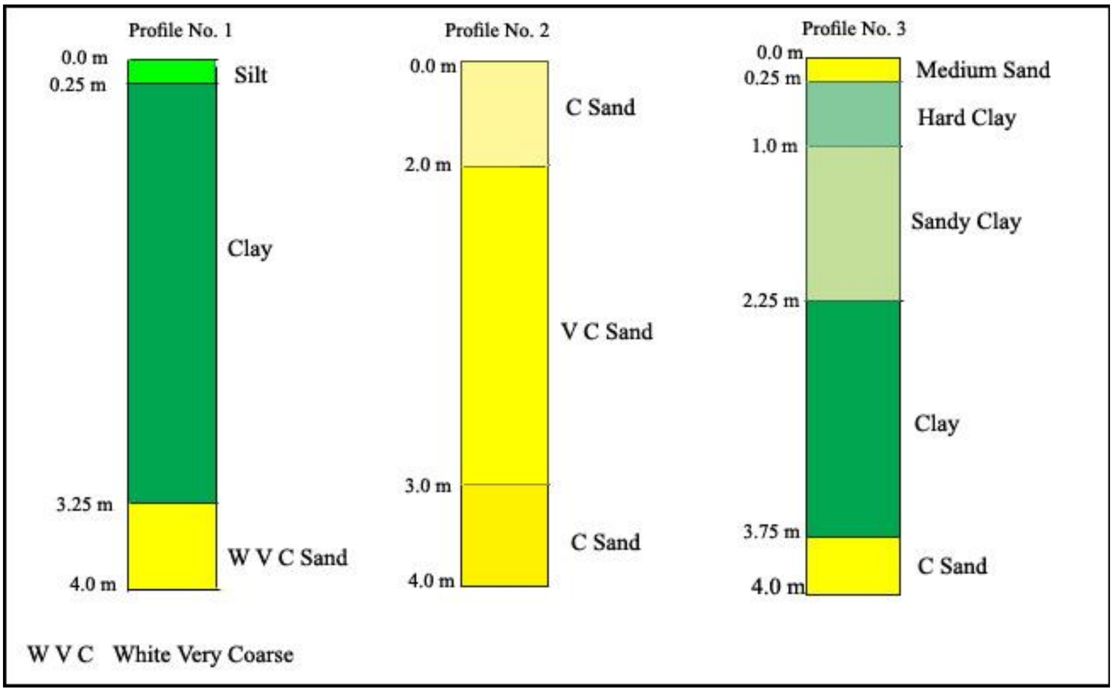

Figure 20: The geotechnical profiles at proposed treatment plant and residential area.

The second profile (test borehole No. 2) shows the dominance of sand in the whole section. It starts with yellow coarse sand and next very coarse sand and at the end coarse sand appears once again. It is part of sandy island that is raised relative to the surrounding valley flat it is used mainly for residential areas while valley flat areas is cultivated. The third profile (test borehole No. 3) shows alternating layers of sand and clay with relative abundance of sandy clay and clay layers. It is about 40 meters away from the cultivated land that is covered with silt and clay.

6 Stakeholder Analysis & Socioeconomic survey and gender analyses

Detailed stakeholder analysis was carried out including an analysis of the different levels of awareness and acceptance of water reuse of all relevant stakeholders'. Intensive survey has been done to the pilot area (village) from door to door including description of socioeconomic and gender issues. The proposed project for wastewater treatment and reuse will be constructed at Al Gozayyera village at West Kantara district in Ismailia province. It will be a pilot project that can be applied at the level of the republic in small gatherings (Manors, small and medium villages in terms of population). To achieve this goal, a model questionnaire was developed to survey the local community and families of the village under study to be able to devise the foundations for the design of the treatment plant and ensure sustainable operation at the required efficiency. The questionnaire is prepared by a specialist and the survey has been conducted on the ground with assistance by individuals from the local community. The survey team has interviewed relevant people living within the study area. The questionnaire has covered different levels of culture and education as well as gender. The questionnaire has emphasized on the following data:

- Basic socioeconomic issues (population, irrigation, welfare).
- Water Supply (government, private and conjoint) and water demand (domestic and agriculture).
- Irrigation water (sufficient, alternatives , reuse)
- Existing drinking and sanitation system (their priorities)
- Pollution susceptibility.
- Water Management Issues.
- Wastewater reuse culture.

A comprehensive survey from home to home for a number of 190 families who represent all residents of Aljazeera village that is affiliated to Al-Rayah mother Village that belongs to EL-Kantara West City and Markaz. This is done to know their opinion on the issue of treated wastewater reuse in agricultural irrigation, also, to identify the socioeconomic conditions in the village, with a focus on drinking water and sanitation issues. It also has explored their acceptance for pilot activity of wastewater treatment and reuse for agricultural irrigation. The model for the used questionnaire is attached in appendix number 1a & b (in English and Arabic). We have identified key stakeholders which will have the most influence in the successful implementation of the project and should thus be involved in the activities (list of key stakeholders is attached). We have aggregated the results of the questionnaire in the following paragraphs.

Public opinion

• 100 % of those interviewed think that there is a lack of water (irrigation and drinking) that reach them.
• 100 % of those interviewed say they are drinking from the governmental water source directly and without any further treatment at home.
• 100 % of those interviewed say they are using cesspits to dispose their wastewater.
• 100 % of those interviewed think that the current water price is suitable for them, and 55 % say they are willing to accept an increase of the tariff for the availability of better services.
• 80 % of those interviewed think that water sources available for irrigation can be increased through reuse of treated wastewater.
• 100 % of those interviewed think that they are willing to participate in the sewerage network and connecting the family home with it.
• 60 % of those interviewed said they are aware of the possibility of using treated wastewater for agricultural irrigation.
• 100 % of those interviewed think that there is a shortage of irrigation water available for agriculture.
• 100 % of those interviewed think that the reuse of treated wastewater is a solution to the problem of lack of water for agricultural irrigation.
• 40 % of those interviewed say they do not know how to produce sludge from wastewater treatment plants.
• 80 % of those interviewed think they are ready to use sludge as a fertilizer if it is safe and non-polluting.

Basic data

• The number of surveyed families is 190
• The total population number is 1138 (the number of males is 565 and number of females is 573)
• The number of those enrolled in primary education is 204 students, including 112 girls and 92 boys. About 67 students are distributed on both pre-university education (94%) and university education (6 %).
• The number of professionals in the village is 184 individual distributed among; workers (43 %), employees (22.8 %), farmers (16.3 %) and other professions (17.4 %). Most of the villagers work in the agricultural sector beside their original professions.

• About 95 % of the village families breed livestock and poultry to satisfy their needs of meat and dairy products essentially.
• There is an electricity network in the village and all the families are connected to it. There is a primary school for the children of the region. The nearest health unit exists in Al-Rayah Village that is about 4-kilometers away. Farmers of Aljazeera are following the agricultural association in Al-Rayah Village.
• The economic situation in the village lies between medium and below medium with a ratio of 72% and 28 % respectively.
• The average number of acres owned per family is about 3-acres.
• The most important crops in the village are maize and rice in summer and wheat, alfalfa and beets in winter. The average consumption of maize acre from irrigation water ranges from about 2300 to 2500 m^3/season, while the consumption of rice acre is about 7000 m^3/season. On the other hand, consumption per acre of wheat ranges from 2500 to 3000 m^3/season while the average consumption of beet acre of irrigation water is about 3500 m^3/season.

Drinking water

• Drinking water supply is governmental and all homes are connected to the network. There are no hand pumps in the village or any other sources of drinking water. Drinking water is used only for drinking and other household uses.
• The average consumption of drinking water in the village per capita:

less than 25 liters / day	Greater than 25 liters / day
No. (41)	No. (149)
Percentage (22%)	Percentage (78%)

The global average per capita use in the city is about 250 liters/day, while in Egypt; the average consumption per capita is about 150 liters/day. In the village, the average consumption per capita reduces greatly to be about 50 liters/day.
• 100 % of those interviewed think that the amount of water they receive is not enough.
• The Egyptian government subsidizes drinking water and the price is unified all over Egypt (about 0.3 LE per cubic meter)
• About 100 % of those interviewed believe that the pricing of water is appropriate and water condition is suitable to some extent for drinking
• The sources of water available for irrigation can be increased through the use of agricultural drainage water and the demand for irrigation water can be reduced by cultivating crops with less water consumption.

Sanitation

• 100% of those interviewed said there is no network for wastewater collection and most of toilets are traditional and they use a system of underground pits (cesspits) for sewage discharge.
• 100% of those questioned believe that the provision of sewer service will solve some health problems and they are willing to pay the cost of connection to the sewerage network.
• 79% of those interviewed think they are aware and familiar with the reuse of treated wastewater for agricultural irrigation.
• 100% of those questioned believe that there is a shortage in the amount of water available for agricultural irrigation and that the reuse of treated wastewater would be a solution to the problem of shortage in irrigation water.
• 80% of those questioned are fully prepared to buy crops irrigated with treated wastewater and that this project is of great benefit to the village.
• 100% of those interviewed mentioned some of the concerns that they believe is linked to the project, such as health problems for individuals because of the spread of mosquitoes.
• 76% of those interviewed had heard about the sludge and that they are ready to use it as fertilizer for their crops.
• Villagers watch the passage of some migratory birds from their village at the beginning of winter season (White Stork and Iraqi ducks).

7 Legal and institutional framework

There is a wide variety of legislation in Egypt for the control of the impact of human activity to minimise its harmful and nuisance impacts on the environment. Thus this environment legislation is concerned with surface water contamination, soil pollution and degradation, air contamination, noise, energy consumption and effects on human beings and other living organisms. Other legislation is concerned with the impact of the human exploitation of natural resources; the visual effects of building developments and redevelopments; that may harm sites of historic/ architectural / archaeological importance. The environmental and health laws are the most relevant in Egypt. Legislation in Egypt is still far behind and needs propositions from such projects.

A legal basis for controlling water pollution exists through a number of laws and decrees. Law 48/1992 regarding the protection of the river Nile and other waterways from pollution, and Law 4/1994 on Environmental protection are the most important ones and are discussed below.

7.1 Relevant laws and decrees

Law 48/1982 and Decree 8/1983

Law 48 of 1982 specifically deals with discharges to water bodies. This law prohibits discharge to the river Nile, irrigation canals, drains, lakes and groundwater without a license issued by the MWRI. Licenses can be issued as long as the effluents meet the standards of the laws. The license includes both the quantity and quality that is permitted to be discharged. Discharging without a license can result in a fine. Licenses may be withdrawn in case of failure to immediately reduce discharge, in case of pollution danger, or failure to install appropriate treatment within a period of three months.

Under the law, the Ministry of Interior has police power while the Ministry of Health and Population is the organization responsible to give binding advice on water quality standards and to monitor effluents/discharges. Law 48 does not cover ambient quality monitoring of receiving water bodies although some standards are given.

Law 48 recognizes three categories of water body functions:

- Fresh water bodies for the Nile river and irrigation canals;
- Non-fresh or brackish water bodies for drains, lakes and ponds;
- Groundwater aquifers.

Ambient quality standards are given for potable resources which are intended as raw water supplies for drinking water. The implementing Decree 8 of 1983 specifies the water quality standards for the following categories:

- The Nile river and canals into which discharges are licensed (article 60);
- Treated industrial discharges to the Nile river, canals and groundwater;

- Upstream the Delta barrages discharging more than 100 m3/day (article 61);

- Downstream the Delta barrages discharging more than 100 m3/day (article 61);

- Upstream the Delta barrages discharging less than 100 m3/day (article 62);

- Downstream the Delta barrages discharging less than 100 m3/day (article 62);

- Drain waters to be mixed with the Nile river or canal waters (article 65);
- Treated industrial and sanitary waste discharges to drains, lakes and ponds (article 66);
- The drains, lakes and ponds into which discharges are licensed (article 68);

Discharge of treated sanitary effluents to the Nile River and canals is not allowed at all (article 63) and any discharge of sanitary waste into other water bodies should be chlorinated (article 67). The water quality standards are generally based on the drinking water standards and are not linked to all other functions a water body may have. The use of agrochemicals for weed control is also regulated in the law.

Law 4/1994

Through Law 4 of 1994 the EEAA is the authority responsible for preparing legislation and decrees to protect the environment in Egypt. The agency also has the responsibility for setting standards and for carrying out compliance monitoring. It should participate in the preparation and implementation of the national programme for environmental monitoring and utilization of data (including water quality). The agency is also charged with establishing an "environmental Protection Fund" which would include water quality monitoring. With respect to the pollution of the water environment, the law states that all provisions of Law 48/1982 are not affected and further, Law 4 only covers coastal and seawater aspects. Nevertheless a number of issues are unclear**:** The MWRI remains the responsible authority for water quality and water pollution issues, although the definition of "discharge" in Law 4 specifically includes discharges to the Nile River the waterways. EEAA is responsible for coordinating the pollution monitoring networks.

In Law 4 it is stated that all facilities discharging to surface water are required to obtain a license and maintain a register indicating the impact of the establishment's activity on the environment. The register should include data on emissions, efficiency and outflow from treatment units and periodic measurements. EEAA will inspect the facilities yearly and follow-up any non-compliance. This provision is confusing or creating duplication because Law 48/1982 also includes certain standards for effluents with MOHP as compliance monitoring organization and only MOHP laboratory results are considered to be official. Both laws create funds where fines are collected and which are used to fund monitoring and other activities.

7.2 Relevant institutions

Responsibilities of Institutions Affecting Water Quality

The institutions involved with water quality management in Egypt are generally line-management ministries with responsibilities in areas that are related to, but not necessarily coincident with, environmental protection. The Ministry of Health and the Ministry of Industry have many other functions, many of which conflict with water quality management. Egypt lacks such a relatively strong central coordinating or managing body, although the Egyptian Environmental Affairs Agency (EEAA) has some of the appropriate rules (coordination, studies and evaluation). Following are discussions of the institutions with major roles in water quality management.

Ministry of Water Resources and Irrigation (MWRI)

The MWRI is formulating the national water policy to face the problem of water scarcity and water quality deterioration. The overall policy's objective is to utilize the available conventional and non-conventional water resources to meet the socio-economic and environmental needs of the country. Under law No. 12 of 1984, MWRI retains the overall responsibility for the management of all water resources, including available surface water resources of the Nile system, irrigation water, drainage water and groundwater. The MWRI is the central institution for water quality management. The main instrument for water quality management is Law 48. The MWRI is responsible to provide suitable water to all users but emphasis is put on irrigation. It has been given authority to issue licenses for domestic and industrial discharges. The responsibility to monitor compliance to these licenses through the analyses of discharges has been delegated to MOHP. The National Water Research

Centre (NWRC) supports the MWRI in its management. Within the NWRC, three institutes are focusing on the Nile, the irrigation and drainage canals and groundwater (NRI, DRI, RIGW). NWRC maintains a national water quality monitoring network and contracts portions of the monitoring activity to these institutes. NWRC also operates a database where all MWRI water quality data is consolidated. NWRC also operates a modern, well equipped water quality laboratory.

Egyptian Environmental Affairs Agency (EEAA)

The central organization for environmental protection is the EEAA. This agency has an advisory task to the Prime Minister and has prepared the National Environmental Action Plan of Egypt 2002/17 (2002). The Minister of State for Environment heads the agency. According to Law 4, it has the enforcing authority with respect to environmental pollution except for fresh water resources. Through Law 48, the MWRI remains the enforcing authority for inland waterways. The EEAA is establishing an Egyptian environmental information system (EEIS) to give shape to its role as coordinator of environmental monitoring. Moreover, staff is being prepared to enforce environmental impact assessment (EIA). Major industries have been visited in view of their non-compliance with respect to wastewater treatment. Compliance Action Plans (CAP's) are being agreed upon to obtain a grace period for compliance. Additionally EEAA is monitoring waste from Nile ships and is responsible for coastal water monitoring. In cooperation with the MWRI, an action plan was implemented to reduce industrial pollution of the Nile.

Ministry of Health and Population (MOHP)

The MOHP is the main organization charged with safeguarding drinking water quality and is responsible for public health in general. Within the framework of Law 48/1982, this Ministry is involved in standard setting and compliance monitoring of wastewater discharges. The Environmental Health Department (EHD) is responsible for monitoring with respect to potable water resources (Nile River and canals). The MOHP samples and analyses all intakes and treated outflows of drinking water treatment plants. Also water from drinking water production wells is monitored. In case of non-compliance of drinking water quality, especially with respect to bacterial contamination, MOHP takes action. Within the framework of Law 48 MOHP samples and analyses drain waters to be mixed with irrigation waters, industrial and domestic wastewater treatment plant effluents and wastes discharged from river vessels. In case of non-compliance of discharges, the MWRI generally takes action upon notification from the MOHP.

Ministry of Housing, Utilities and New Communities (MHUNC)

Within the Ministry of Housing, Utilities and New Communities, the National Organization for Potable Water and Sanitary Drainage (NOPWASD) has the responsibility for planning, design and construction of municipal drinking water purification plants, distribution systems, sewage collection systems, and municipal wastewater treatment plants. Once the facilities have been installed, NOPWASD organizes training and then transfers the responsibilities for operation and maintenance to the regional or local authorities.

Ministry of Agriculture and Land Reclamation (MALR)

MALR develops policies related to cropping patterns and farm production. Moreover they are in charge of water distribution at field level and reclamation of new agricultural land. With respect to water quality management issues, their policies on the use and subsidy reduction of fertilizers and pesticides is important. In addition, MALR is responsible for fisheries and fish farms (aquaculture). The Soil, Water and Environment Research Institute is part of the MALR and is responsible for research on many subjects such as water and soil quality studies on pollution, bioconversion of agricultural wastes, reuse of sewage wastewater for irrigation, saline and saline-alkaline soils, fertilizer and pesticide use and effects.

Ministry of Industry (MOI)

The government has owned the majority of industries in Egypt for many decades. Within the MOI, the General Organization for Industrialization (GOFI) manages the publicly owned facilities. The present government is in the process of privatization of industries. At this moment GOFI still manages approximately 300 industrial facilities. MOI maintains a register of all industries in Egypt including design data related to processes used and quantities of water taken in and discharged by each facility.

Ministry of Higher Education and Scientific Research (MHESR)

Two of the research institutes of the Ministry of Higher Education and Scientific Research (MHESR), namely the National Research Center (NRC) and the National Institute for Oceanography and Fisheries (NIOF), collect samples for specific research projects. Both institutes have modern well-equipped water quality laboratories.

Ministry of Interior

The Ministry of Interior, Egypt's national police force, has for some time maintained the Inland Water Police, a special police force for enforcement of Law 48 and protection of the environment in general. The Inland Water Police provides guidance to citizens and takes enforcement actions for violations of environmental laws. Law 4/1994 provides additional authority for this environmental police force, specifying that the MOW shall form a police force specialized in environmental protection within the Ministry and in its Security Departments in the governorates. (Article 65 of the Executive Regulations).

It is worth mentioning that the Egyptian legislation has been concerned with the environmental resources since long time; and has organized the human activities that affect the environment. However, for political and economic reasons it became difficult for the Egyptian legislator to apply these laws and for the citizens to abide with these regulations.

Non-Governmental Organizations

Non-Governmental Organizations (NGOs) in Egypt have an important role to play in contributing to the country's social, economic, and democratic development. In this respect, the Egyptian government has been encouraging and supporting the establishment of various NGOs, especially those working in the fields of environmental awareness and protection. Currently, there are more than 2,000 environmental NGOs in Egypt, some of them are more active than others, but collectively they play an indispensable role in raising public awareness towards environmental issues, and in conducting environmental protection and conservation activities.

Gaps and Overlaps in the Legislative Framework

Various aspects of environmental protection were addressed before Law 4/94. These were traditional regulatory measures that focused on end-of-pipe controls implemented through command-and-control regulations. Not surprisingly the result is piecemeal, leaving gaps and causing overlaps. Law 4/94 was a step towards introducing more flexible and more effective tools for dealing with environmental problems. The source of institutional overlap between ministries and agencies involved with environmental issues lies with the originating legislation.

Compliance with Environmental Laws and Regulations

The environmental laws that are regulating the environment in Egypt include penalties to those who do not abide with the law. These penalties may tackle the form of restricting the freedom of the citizens who break the law or charge financial fines. Enforcing environmental law is done through specified responsible agencies. Enforcing the law is achieved through various means such as regular administrative inspection, sudden inspection and complaints from individuals or NGOs.

Egyptian environmental laws have not been enforced adequately for a variety of reasons, including:

- Lack of adequate authorities with necessary resources to carry out inspection and enforcement;
- Lack of public awareness regarding the magnitude of the environmental problems and their negative effects;
- the regulatory approach is not effective because standards generally do not allow the flexibility necessary for the polluter and the regulatory agency to negotiate quick agreement on a compliance schedule;
- Instead, Egyptian regulators concentrate on informing the polluter of a violation
  – but there are no provisions for phasing in compliance measures after the violation has been announced and;
- There is no sufficient coordination and cooperation among the ministries and governmental institutions regarding the issue of environmental protection.

Environmental Education/ knowledge

Education and awareness are essential tools in highlighting the importance of environmental protection. In this respect, there have been recent initiatives aimed at enhancing and developing environmentally literate citizens who share a concern for environmental protection issues. This could be realized through introducing environmental education and training programs on both formal and informal levels of education. Formal education is that directed at schools and universities, while informal education is directed to all strata of society, at all ages and cultural levels.

Federal education has been carried out at each educational stage such as primary schools, preparatory schools, and universal.

Non-formal education is all-important to environmental awareness, since it targets a wide range of groups and includes all strata of society. Mass media and newspapers play a very important role in effective environmental education programs of this type.

EEAA, realizing the importance of raising the public's environmental awareness, is providing continuous support to environmental training and awareness activities and initiatives. This is reflected in the protocol between the Ministries of Education and Environment signed in 1999. The protocol addresses the integration of environmental dimensions in the formal curricula, the development of teacher-training materials, and the design of informal environmental training programs. A collaborative partnership between EEAA and the various channels of mass media has been developed. Within this framework, EEAA has sponsored several daily and weekly environmental radio and TV programs in addition to the environmental sections in major newspapers.

Relevant Organizations

- Environmental Information and Public Awareness Department, EEAA
- Ministry of Education, Environmental Education Department
- Ministry of Scientific Research and Higher Education

Conclusion

From this brief description, it can be assumed that the laws are sufficiently stringent and the institutions appropriate for effective implementation of those laws. It was consistently stated, however, that none of the applicable laws are enforced, and pollution control is essentially non-existent.

There are several apparent reasons for this, the most significant being the government's failure to take environmental action seriously and to insist on implementation of the existing laws. This attitude is now changing; the organization assigned the rule of supervising the enforcers is EEAA. This is a step forward, although EEAA may lack the expertise to carry out this function.

7.3 Egyptian Code for the Reuse of treated Wastewater in Agriculture (501/2005)

The Ministry of Housing, Utilities, and New Communities, supported by seven technical committees, issued the Code for the Reuse of Treated Wastewater in Agriculture (hereafter, "the Code"). The Code stipulates exact requirements in planning and approval procedures, responsibilities, permitted use according to effluent quality, and monitoring. The Code regulates only the direct use of wastewater, not the wastewater discharged into drains.
According to the Code, the reuse of treated wastewater—irrespective of the treatment level—is prohibited for the production of vegetables, whether eaten raw or cooked; export-oriented crops (i.e. cotton, rice, onions, potatoes, and medicinal and aromatic plants); as well as citrus fruit trees; and irrigating school gardens.
Restrictions are in place for type of crops, irrigation methods, and health precautions. The existing reuse schemes are operated by public institutions, mainly ministries such as the Ministry of Housing, Utilities, and New Communities, MALR, and MSEA.
Plants and crops irrigated with treated wastewater are classified into three agricultural crop groups that correspond to three different levels of wastewater treatment. Biological and chemical standards for these three levels of treatment are set as well. The Code further stipulates conditions for irrigation methods and health protection measures for farm workers, consumers, and those living on neighboring farms.

The Code classifies wastewater into three grades (designated A, B, and C) as follows, depending on the level of treatment it has received, and specifies the maximum concentrations of specific contaminants consistent with each grade., and the crops that can, and importantly cannot, be irrigated with each grade of treated wastewater. (Tables 6 & 7)

Grade A is advanced, or tertiary, treatment that can be attained through upgrading the secondary treatment plants (i.e. Grade B plants) to include sand filtration, disinfection and other processes.

Grade B represents secondary treatment performed at most facilities serving Egyptian cities, townships and villages. It is undertaken by any of the following techniques: activated sludge, oxidation ditches, trickling filters, and stabilization ponds.

Grade C is primary treatment that is limited to sand and oil removal basins and use of sedimentation basins.

Table (6) Limit values for Treated Wastewater Reused in Agriculture (mg/l)

Treatment Grade Requirements		A	B	C
Effluent limit values for BOD and Suspended Solids (SS)	BOD_5	<20	<60	<400
	SS	<20	<50	<250
Effluent limit value for fecal coliform and nematode cells or eggs (per liter)	Fecal coliform count (2) in 100 cm^3	<1,000	<5,000	Unspecified

Excerpted from: "Egyptian Code for the Use of Treated Wastewater in Agriculture," February 2005

Table (7) Classification of Plants and Crops Irrigable with Treated Wastewater

Grade	Agricultural Group	
A	G1-1: Plants and trees grown for greenery at touristic villages and hotels.	Palm, Saint Augustin grass, cactaceous plants, ornamental palm trees, climbing plants, fencing bushes and trees, wood trees and shade trees.
	G1-2: Plants and trees grown for greenery inside residential areas at the new cities.	Palm, Saint Augustin grass, cactaceous plants, ornamental palm trees, climbing plants, fencing bushes and trees, wood trees and shade trees.
B	G2-1: Fodder/ Feed Crops	Sorghum sp
	G2-2: Trees producing fruits with epicarp.	On condition that they are produced for processing purposes such as lemon, mango, date palm and almonds.
	G2-3: Trees used for green belts around cities and afforestation of high ways or roads	Casuarina, camphor, athel tamarix (salt tree), oleander, fruit-producing trees, date palm and olive trees.
	G2-4: Nursery Plants	Nursery plants of wood trees, ornamental plants and fruit trees
	G2-5: Roses & Cut Flowers	Local rose, eagle rose, onions (e.g. gladiolus)
	G2-6: Fiber Crops	Flax, jute, hibiscus, sisal
	G2-7: Mulberry for the production of silk	Japanese mulberry
C	G3-1: Industrial Oil Crops	Jojoba and Jatropha
	G3-2: Wood Trees	Caya, camphor and other wood trees.

Excerpted from: "Egyptian Code for the Use of Treated Wastewater in Agriculture," February 2005

Article 6: Irrigation Methods for Reuse Crops

According to the Code, the following irrigation methods are permitted when using treated wastewater:

- Flood irrigation (furrow irrigation), wetting almost all the soil surface
- Basin irrigation, using irrigation pipes to deliver water to the basins
- Strip irrigation, where water covers only part of the soil surface

• Drip irrigation, which ensures the least contact of the treated municipal wastewater with the irrigated plants and the agricultural laborers

• Sub-surface irrigation, which minimizes contact with the treated municipal wastewater used in irrigation

• Pressurized irrigation, which is controlled by valves regulating the flow of treated municipal wastewater.

• Pop-up sprinklers, characterized by low pressure and high discharge at an angle of 11° with the horizontal plane.

Article 7: Occupational Health and Safety

The Code describes health and safety measures to reduce public hazards related to water reuse in agriculture and recognizes five target groups:

1. Farm workers
2. Harvesters and processors (workers)
3. Consumers
4. Public and other users of open spaces and gardens
5. Passers-by and residents who live near the reuse sites.

The Code has defined mandatory safety measures for farm workers and harvesters.

8 Environmental risks

In general construction of wastewater treatment plant will have a positive environmental impact on the village and its vicinity. It is expected to have long-term improvement in both public health and environment. Nevertheless, construction of wastewater treatment project may also have adverse impact on the environment. These environmental risks are identified and mitigation measures are recommended. The potential environmental risks that may initiate from the pilot activity of wastewater treatment and reuse include; surface water bodies, soil and groundwater.

8.1 Risks on the surface water environment

The surface water environment in the vicinity of the facility includes irrigation canals, agriculture drains and drinking water supplies. The village has its drinking water supply through drinking water network that is connected with El-Kantara West water treatment plant. Its water intake is constructed on Port Said Sweet Canal. The drinking water network is fitted at one meter depth below ground surface. There are one small tertiary irrigation canal that is used for irrigation. Nevertheless, the farmers are suffering from water deficiency due to their location at the end of the irrigation canal thus they reuse agriculture drain water (North Al Rayah drain). The village is located between two agriculture drains; one big called North Ismailia drain and the other is moderate in both size and flow is called North Al Rayah drain.

Surface water bodies are affected by wastewater reuse in agriculture if they are located close to the irrigation site and receive water from drainage and runoff; although the impact is lower than that from direct discharge of wastewater to them, effects also occur. If too much nitrogen or phosphorus is washed into water bodies, it can lead to eutrophication and subsequent oxygen depletion, which also harms aquatic plant and animal life possibly leading to further deterioration of the water quality and may impair the aesthetic value of the water body.

It is expected to discharge the wastewater effluent after secondary treatment to North Al Rayah drain that already reused for irrigation during drought periods and dryness of irrigation canal. Sound Measures should be considered to follow Egyptian Code for effluent discharge to agriculture drain and also precautions and emergency plan should be set to deal with plant failure and/or overload. Treatment will significantly reduce nutrient load but it is necessary to guarantee conversation of nitrogen ammonia into nitrate through nitrification. Proposed treatment may have small reduction in feacal coliform thus reduction of coliform counts to Egyptian code should be done.

8.2 Risks of groundwater pollution

The impact on groundwater quality depends on several factors, such as the irrigation rate, the irrigation water quality, the treatment given to water by soils, the vulnerability of the aquifer, the form in which irrigation is performed, the rate of the artificial recharge compared with the natural rate, the original quality of underground water and its potential use, the time under irrigation and the type of crops (Foster et al. 2004, cited in WHO 2006). The amount of nitrogen leached depends on crop demand, hydraulic load due to rain and irrigation water, soil permeability and nitrogen content in soils. While salinity and TDS > 2000 mg/l can turn groundwater unsuitable for some uses, e.g. for drinking water or irrigation, TDS >500 mg/l only causes flavor but not health problems in water supplies.

The groundwater in Al Gozayyera village exists at shallow depths ranges from 4 to 6 meters under cultivated land and residential area respectively. The groundwater aquifer is unconfined under the residential area and gradually becomes semi-confined under the cultivated land. The provision of proper treatment will reduce or eliminate any significant potential for infiltration of sewage into soil and groundwater. The proposed site for the treatment plant is underline with about 3.5 meters of dense clay that will prevent any leakage to the groundwater reservoir. Under the residential area where sand dominates; it is recommended to coat the sewerage network with dense plastic sheets to protect unconfined aquifer under the residential area from any potential leakage in the future.

8.3 Impact on nearby residential houses:

About 100% of those interviewed village residents mentioned some of the concerns that they believe is linked to the project, such as health problems for individuals because of the spread of mosquitoes. Mosquito's larvae generally live in small, shallow water bodies where disturbance of the surface layer is uncommon. The polishing step may provide suitable habitat for mosquito breeding. This will be taken into consideration during final design. Village residents are also afraid from widespread of offensive odor. The treatment plant is about 100 meters away from houses and treatment option will be closed system with anaerobic treatment thus these concerns will not impact on the nearby residential houses.

9 Health risks

The potential public health risks from inadequate wastewater collection, treatment and disposal have long been Known (Feachem et. Al., 1980). During the early 19th century the River Thames was an open sewer, with disastrous consequences for public health in London, including cholera epidemics. In 1854 London physician Dr John Snow discovered that the disease was transmitted by drinking water contaminated by sewage. Proposals to modernize the sewerage system had been made during 1856, but were neglected due to lack of funds. However, after the Great Stink of 1858, Parliament realized the urgency of the problem and resolved to create a modern sewerage system (Wikipedia, 2013). On the lift caricature commenting on a letter of Faraday's on the state of the river in The Times in July 1855 (Michael Faraday giving his card to Father Thames).

In all Egyptian villages, improper practices of sewage disposal threat human health. Most of health risks occurs due to transport of waterborne diseases through ingestion, and/or direct contact with contaminated water and food products. The pilot activity of waste water treatment and potential reuse will improve the sanitation condition at Al Gozayyera village. Counter measures including technological and other risk prevention approaches will be identified. Health risks associated with water reuse are mainly due to pathogenic microorganisms contained in wastewater, such as bacteria, viruses and parasites. Various groups of persons may be affected in different ways and to variable degrees. These will include wastewater treatment plant workers and Farmers that may reuse wastewater effluent for irrigation and finally crops dealers and consumers.

The Egyptian Code **(Article 7 regarding occupational health and Safety)** describes health and safety measures to reduce public hazards related to water reuse in agriculture and recognizes five target groups:

1. Farm workers
2. Harvesters and processors (workers)
3. Consumers
4. Public and other users of open spaces and gardens
5. Passers-by and residents who live near the reuse sites.

The target groups in Al Gozayyera are (1), (2) and (3). The treated wastewater will not be used to irrigate public gardens and the site will be isolated from local residents. The Code has defined mandatory safety measures for farm workers and harvesters. The effluent can be used to irrigate non-freshly eaten crops. Thus it is recommended to be particularly vigilant on health and safety issues in the production of cut flowers because they require extensive management and care during growth that will inevitably increase worker exposure to treated wastewater. Adequate counter-measures should be applied such as: irrigation system management and irrigation techniques, human exposure control and health education.

To prevent excessive risks of enteric infections (bacterial and viral origin) for those working in wastewater-irrigated fields wastewater should be treated to a maximum of 104 thermotolerant coliforms per 100 ml (WHO 2006). Moreover, measures to restrict the contact of children with wastewater through play or work should be implemented.

It is not expected to get on heavy metals in domestic wastewater especially in small village like Al Gozayyera. There is no industry at all in the target village so heavy metals are usually very low. Moreover, regardless of the metal content of the wastewater, a metal will not be absorbed by plants unless it first reaches a threshold concentration in the soil. Therefore, even if domestic wastewater is reused in agricultural irrigation for long periods of time (several decades) it results in the accumulation of heavy metals in the arable soil layer, but does not cause negative effects in crops.

10 Potential Wastewater Treatment Technologies for Egyptian Conditions

10.1 Specific Egyptian conditions in rural areas:

The Rural population (% of total population) in Egypt was last reported at 57.20 in 2010, according to a World Bank report published in 2012. Rural population refers to people living in rural areas as defined by national statistical offices. It is calculated as the difference between total population and urban population. The rural areas in both Delta and Canal Cities region are characterized by the following:

- Warm Climate
- Limited land availability, due to high cost of land in Nile Delta
- Unreliable electricity supply
- Skilled labor not easily available for sanitation sector
- Low affordability / acceptance of high wastewater tariff
- Quality of works in terms of concrete structures is mostly good quality and Electro-mechanical equipment is frequently poor quality. Limited resources leads to slow and unreliable and often no preventive maintenance
- Strict standards for carbon parameters: COD, BOD, TSS and Disinfection requirements

10.2 Treatment Technologies

Satisfactory disposal of wastewater, whether by surface, subsurface methods or dilution, is dependent on its treatment prior to disposal. Adequate treatment is necessary to prevent contamination of receiving waters to a degree which might interfere with their best or intended use, whether it will be used for water supply, recreation, or any other required purpose.

Wastewater treatment consists of applying known technology to improve or upgrade the quality of a wastewater. Usually wastewater treatment will involve collecting the wastewater in a central, segregated location (the Wastewater Treatment Plant) and subjecting the wastewater to various treatment processes. Most often, since large volumes of wastewater are involved, treatment processes are carried out on continuously flowing wastewaters (continuous flow or "open" systems) rather than as "batch" or a series of periodic treatment processes in which treatment is carried out on parcels or "batches" of wastewaters. While most wastewater treatment processes are continuous flow, certain operations, such as vacuum filtration, involving as it does storage of sludge, the addition of chemicals, filtration and removal or disposal of the treated sludge, are routinely handled as periodic batch operations.

Wastewater treatment, however, can also be organized or categorized by the nature of the treatment process operation being used; for example, physical, chemical or biological. A complete treatment system may consist of the application of a number of physical, chemical and biological processes to the wastewater.

This section of the report contains a general overview of treatment technology options; provide a background about all the technologies, and then the most suitable selection for the Egyptian rural conditions.

Conventional Activated Sludge (CAS)

A CAS system is a series of biological treatment steps that degrade the biological materials from the sewage or wastewater.

The first step of a CAS system is the aeration tank, where the wastewater is mixed with air to activate micro-organisms. While digesting the wastewater, the organisms collide with each other, forming larger particles called flocs, which have a larger capacity to degrade the biological components of the wastewater. The aeration basin is followed by a secondary clarifier or settling tank. During this step, micro-organisms with their adsorbed organic material settle.

Water from the clarifier is transported to installations for disinfection and final discharge or to other tertiary treatment units for further purification. The surplus micro-organisms can easily be channeled to any of our sludge treatment solutions where energy can be recovered from the biosolids. This additional step closes the energy cycle of the wastewater treatment plant allowing it to run independently of fossil fuel. Another part of the micro-organisms is fed back into the aeration tank in order to keep the load of micro-organisms at a sufficient level for the biological degrading processes to continue.

In general, activated sludge systems are highly efficient for organic matter and nutrient removal, though pathogen removal is low. In the view of reuse of the effluent in agriculture, it is not beneficial to remove all nutrients while standards for pathogen removal are barely met.

Activated sludge processes can be operated either in high-rate or extended-aeration mode. In the high-rate mode (high nutrient input per unit of microbial biomass), organic waste consumed by the activated sludge produces a high amount of excess sludge. In extended-aeration systems (low-rate: low nutrient input per unit of microbial biomass), biological oxygen demand (BOD) removal is higher and little excess sludge is produced. Yet, extended-aeration processes are slower and can thus treat less wastewater at a time. Layout of these treatment steps are shown below in Figure 21.

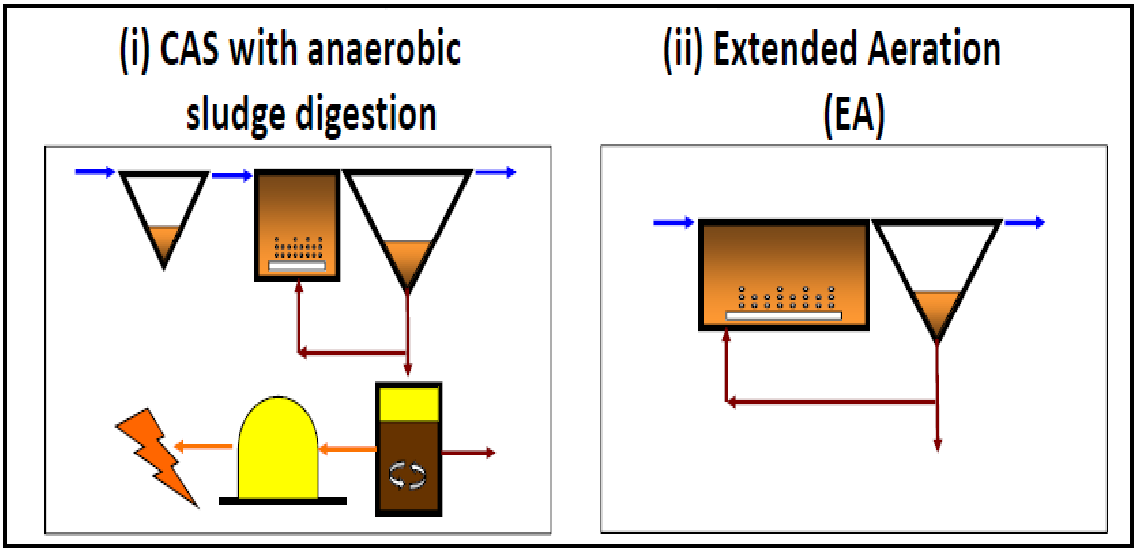

Figure (21) Conventional Activated Sludge (CAS) and Extended Aeration (EA)

Table 8: Advantages and Disadvantages of Wastewater Conventional Treatment

Technology	Comparison	
	Advantages	**Disadvantages**
Activated Sludge	- High treatment efficiencies possible for BOD, COD, TSS, N, P. - High flexibility in operating conditions. - Possibility of producing electric energy from biogas. - Low land requirements of CAS, somewhat higher land requirements for EA. - High effluent quality	- Low pathogen removal. - Requires skilled personnel (particularly CAS). - Dependence on uninterrupted power supply. - Some automation required. - Biogas is explosive; therefore risky in case of improper operation. - High maintenance requirements. - Dependence on some foreign spare parts almost inevitable (particularly CAS). - High CAPEX and OPEX.

		- Mixing of industrial effluent with domestic wastewater can lead to toxicity and major malfunctioning and make the recycling of nutrients almost impossible.

Sequencing Batch Reactor (SBR)

Sequencing batch reactors (SBR) or sequential batch reactors are industrial processing tanks for the treatment of wastewater. SBR reactors treat waste water such as sewage or output from anaerobic digesters or mechanical biological treatment facilities in batches. Oxygen is bubbled through the waste water to reduce biochemical oxygen demand (BOD) and chemical oxygen demand (COD) to make suitable for discharge into sewers or for use on land.

While there are several configurations of SBRs the basic process is similar. The installation consists of at least two identically equipped tanks with a common inlet, which can be switched between them. The tanks have a “flow through” system, with raw wastewater (influent) coming in at one end and treated water (effluent) flowing out the other. While one tank is in settle/decant mode the other is aerating and filling. At the inlet is a section of the tank known as the bio-selector. This consists of a series of walls or baffles which direct the flow either from side to side of the tank or under and over consecutive baffles. This helps to mix the incoming Influent and the returned activated sludge (RAS), beginning the biological digestion process before the liquor enters the main part of the tank (Figure 22).

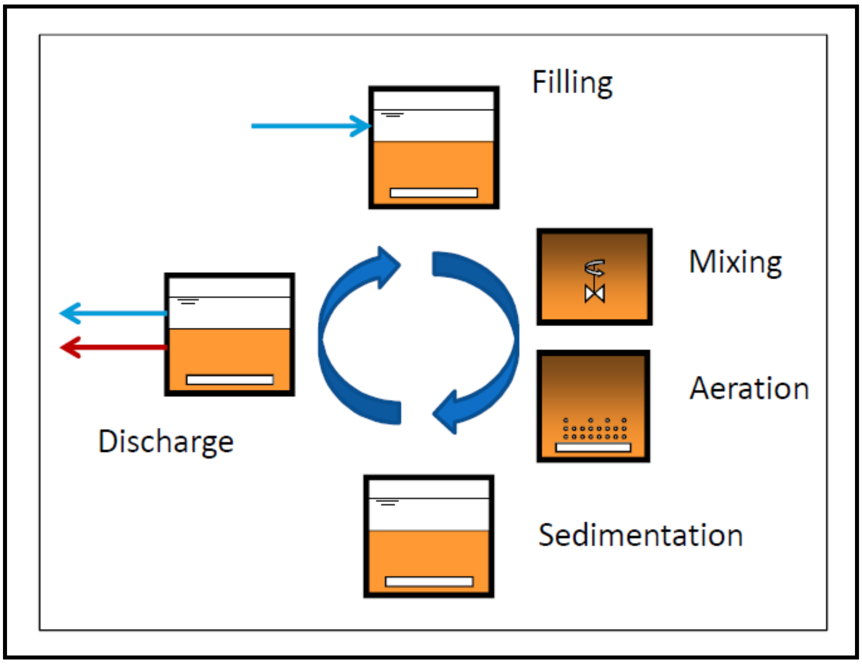

Figure 22: Sequencing Batch Reactor (SBR)

Table 9: Advantages and Disadvantages of Sequencing Batch Reactor (SBR)

Technology	**Comparison**	
	Advantages	**Disadvantages**
Sequencing Batch Reactor (SBR)	- High treatment efficiencies possible for BOD, COD, TSS, N, P. - High flexibility in operating conditions. - Possibility of producing electric energy from biogas (SBR + Anaerobic sludge digestion) - Less land requirements than CAS, due to compact tank construction.	- Low pathogen removal. - Requires skilled personnel (Particularly SBR with sludge digestion). - Dependence on uninterrupted power supply. - More automation required than for CAS/EA. - Biogas is explosive (Risk in case of improper operation). - High maintenance requirements. - Dependence on some foreign spare parts almost inevitable. - High CAPEX and OPEX, but slightly cheaper than CAS/EA

Moving Bed Bio-Reactor (MBBR)

Moving Bed Biofilm Reactor (MBBR) processes improve reliability, simplify operation, and require less space than traditional wastewater treatment systems. MBBR technology employs thousands of polyethylene biofilm carriers operating in mixed motion within an aerated wastewater treatment basin. Each individual biocarrier increases productivity through providing protected surface area to support the growth of heterotrophic and autotrophic bacteria within its cells. It is this high-density population of bacteria that achieves high-rate biodegradation within the system, while also offering process reliability and ease of operation. This technology provides cost-effective treatment with minimal maintenance since MBBR processes self-maintain an optimum level of productive biofilm. Additionally, the biofilm attached to the mobile biocarriers within the system automatically responds to load fluctuations (Figure 23).

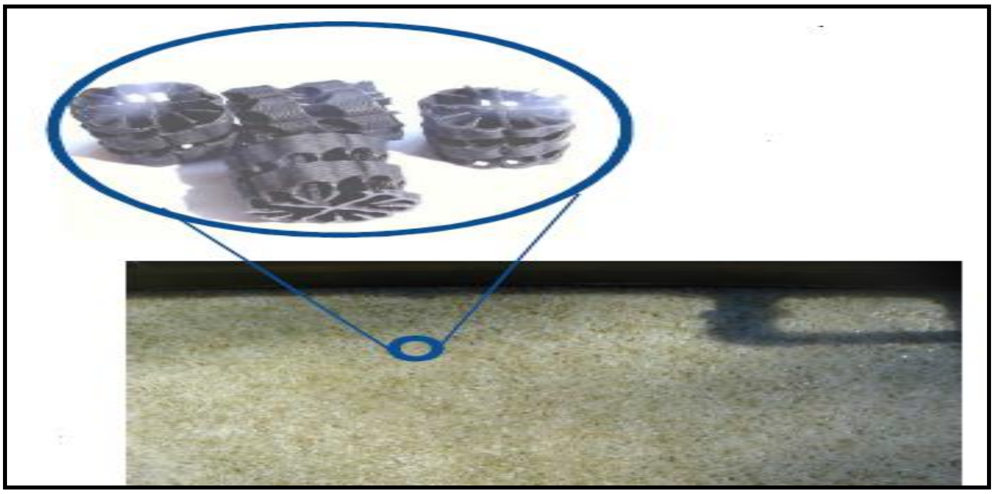

Figure 23: Moving Bed Bio-Reactor (MBBR)

Table 10: Advantages and Disadvantages of Moving Bed Bio-Reactor (MBBR)

Technology	Comparison	
	Advantages	**Disadvantages**
	- High treatment efficiencies possible for BOD, COD, TSS, N, P. - High flexibility in operating conditions. - Production of electric	- Low pathogen removal. - In case of high organic peak loads biological system is less stable due to reduced aeration tank volume.

Moving Bed Bio-Reactor (MBBR)	energy from biogas possible (MBBR with anaerobic sludge digestion). - Less land required than in case of CAS due to reduced tank volume.	- Requires skilled personnel (Particularly MBBR with sludge digestion). - Dependence on uninterrupted power supply. - Biogas in explosive → Risk in case of improper operation. - High maintenance requirements. - Plastic media is lost due to abrasion and fresh media has to be added from time to time. - Dependence on some foreign spare parts almost inevitable. - High CAPEX and OPEX, often higher than CAS/EA.

Trickling Filter (TF)

Trickling filter is an attached growth process i.e. process in which microorganisms responsible for treatment are attached to an inert packing material. Packing material used in attached growth processes include rock, gravel, slag, sand, redwood, and a wide range of plastic and other synthetic materials (Figure 4).

The wastewater in trickling filter is distributed over the top area of a vessel containing non-submerged packing material. Air circulation in the void space, by either natural draft or blowers, provides oxygen for the microorganisms growing as an attached biofilm. During operation, the organic material present in the wastewater is metabolised by the biomass attached to the medium. The biological slime grows in thickness as the organic matter abstracted from the flowing wastewater is synthesized into new cellular material. The thickness of the aerobic layer is limited by the depth of penetration of oxygen into the microbial layer. The micro-organisms near the medium face enter the endogenous phase as the substrate is metabolised before it can reach the micro-organisms near the medium face as a result of increased thickness of the slime layer and lose their ability to cling to the media surface. The liquid then washes the slime off the medium and a new slime layer starts to grow. This phenomenon of losing the slime layer is called sloughing.

The sloughed off film and treated wastewater are collected by an under drainage which also allows circulation of air through filter. The collected liquid is passed to a settling tank used for solid- liquid separation.

Figure 24: Advantages and Disadvantages of Trickling Filter (TF)

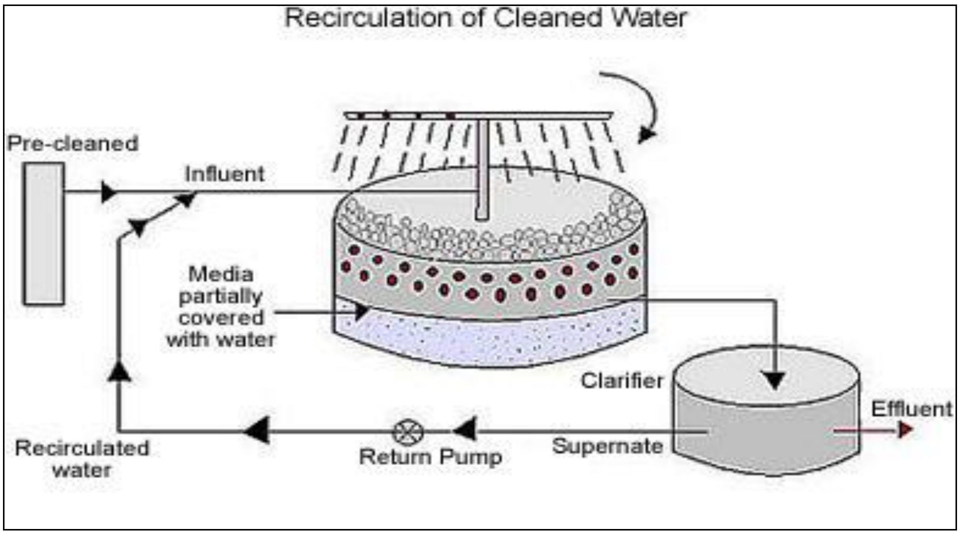

Table (11) Advantages and Disadvantages of Trickling Filter (TF)

Technology	Comparison	
	Advantages	**Disadvantages**
Trickling Filter (TF)	- Production of electric energy from biogas possible (TF with anaerobic digestion. - Similar land requirements as CAS, if plastic media is used in TF. - Plastic media and filter height of 5-6 m allow to reduce footprint and to increase efficiencies. - No especially skilled personnel required (particularly TF with Imhoff tank). - Substantially lower energy demand than CAS. - Relatively low maintenance requirements. - Once installed, low dependence on foreign spare parts. - Slightly lower CAPEX than CAS. - Substantially lower OPEX than CAS.	- Slightly lower treatment efficiencies than CAS for BOD, COD, TSS, N, P. - Low pathogen removal. - Process affected my climate conditions (performs poorly in colder climates) - Less flexibility in operating conditions. - Dependence on uninterrupted power supply (for pumping only). - Biogas is explosive → risk in case of improper operation. -

Dr. Kamal Ghodeif – Water Management Specialist and EIA Consultant
Suez Canal University, Ismailia , Egypt
e-mails: kghodeif@yahoo.com

Rotating Biological Contactor (RBC)

A rotating biological contactor or RBC is a biological treatment process used in the treatment of wastewater following primary treatment. The primary treatment process removes the grit and other solids through a screening process followed by a period of settlement. The RBC process involves allowing the wastewater to come in contact with a biological medium in order to remove pollutants in the wastewater before discharge of the treated wastewater to the environment, usually a body of water. A rotating biological contactor is a type of secondary treatment process. It consists of a series of closely spaced, parallel discs mounted on a rotating shaft which is supported just above the surface of the waste water. Microorganisms grow on the surface of the discs where biological degradation of the wastewater pollutants takes place (Table 12 & Figure 25).

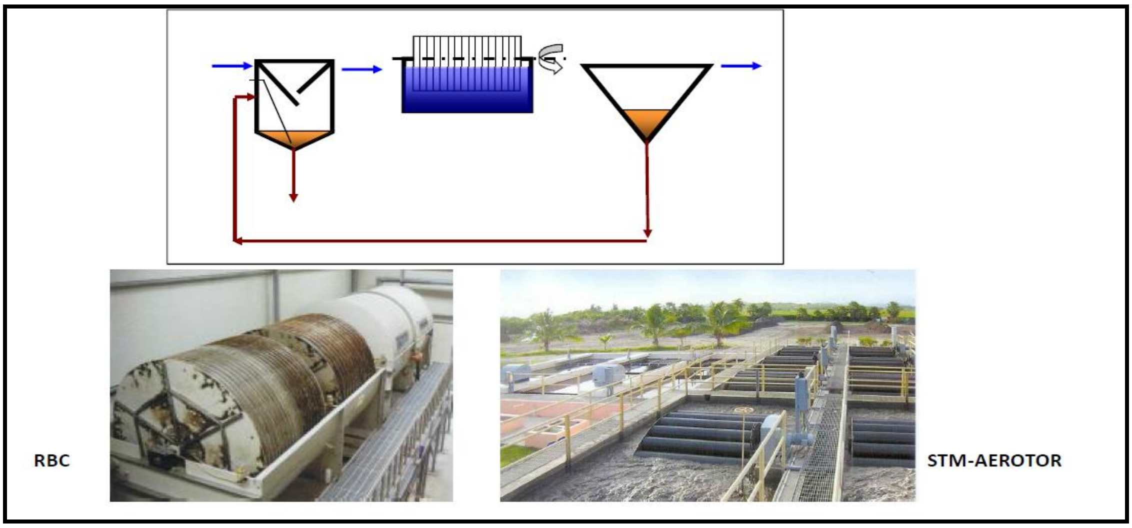

Figure 25: Rotating Biological Contactor (RBC)

Table 12: Advantages and Disadvantages of Rotating Biological Contactor (RBC)

Technology	**Comparison**	
	Advantages	**Disadvantages**
Rotating Biological	- No specially skilled personnel required. - Substantially lower energy demand than CAS.	- Slightly lower treatment efficiencies than CAS for BOD, COD, TSS, N, P. - Low pathogen removal.

Contactor (RBC)	- Relatively low maintenance requirements. - Once installed, low dependence on foreign spare parts. - Similar CAPEX as CAS. - Substantially lower OPEX than CAS.	- Larger land requirements than CAS. - Little flexibility in operating conditions. - Dependence on uninterrupted power supply (for shaft drive). - Sensitive to toxic shock loads. - If not constructed in high quality, frequent failure of critical parts: shaft, bearing, drove, disks.

Upflow Anaerobic Sludge Blanket Reactor (UASB)

Upflow Anaerobic Sludge Blanket (UASB) reactors are such anaerobic treatment systems based on break-down of organic pollutants by anaerobic digestion. They can treat high-strength industrial wastewater. They can also be used in decentralised and centralised treatment systems for domestic wastewaters; yet this use is still relatively new and not always successful as their performance is highest for high-load influents (Figure 26).

UASB can retain a high concentration of active suspended biomass, leading to a good removal performance of organics (biological oxygen demand, BOD, and chemical oxygen demand, COD) and total suspended solids (TSS). However, pathogens and nutrients are not removed.

UASB are suited for centralized or decentralized treatment systems at community level if skilled labour and electricity are available. They are particularly adapted for densely populated urban areas as they have low land requirements. UASB can treat industrial wastewater (brewery, distillery, food processing and pulp and paper waste and blackwater, even though its application to domestic sewage is still relatively new and they are not resistant to shock loading and are not adapted for low strength influent.

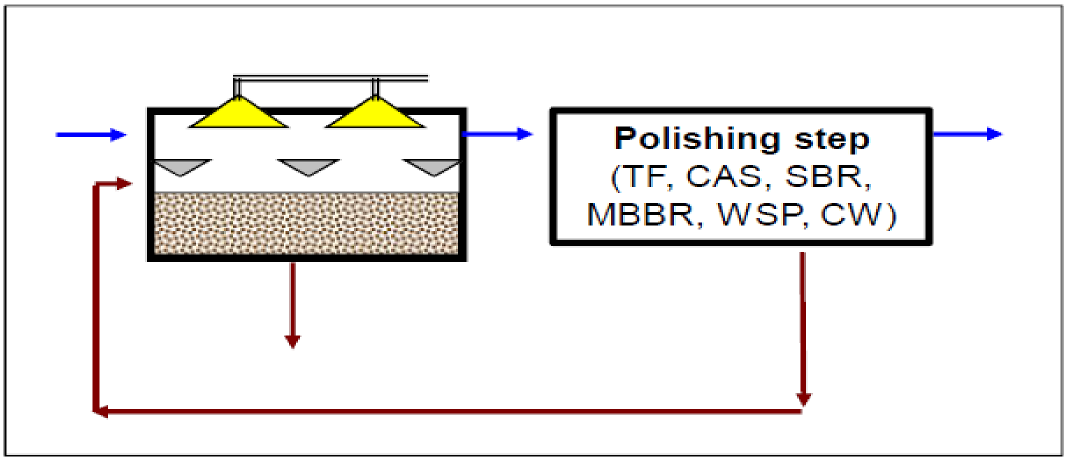

Figure 26: Upflow Anaerobic Sludge Blanket Reactor (UASB)

Table 13: Upflow Anaerobic Sludge Blanket Reactor (UASB)

Technology	**Comparison**	
	Advantages	**Disadvantages**
Upflow Anaerobic Sludge Blanket Reactor (UASB)	- Production of electric energy from biogas is possible. - Low energy demand (usually just pumping). - Low land requirements. - Low sludge yield, and well stabilized sludge. - Once installed, low dependence on foreign spare parts. - Similar CAPEX as CAS. - Substantially lower OPEX than CAS.	- Treatment efficiency for BOD, COD, TSS, N, P usually insufficient; hence requirement for aerobic post-treatment (polishing step). - Low pathogen removal. - Skilled personnel with good process understanding required. - Scum formation on surface requires frequent removal so gas collection system does not plug (doesn't get clogged) - Good pre-treatment required: fine screens, grit and fat removal. - Little flexibility in operating conditions. - If not constructed with high quality materials, substantial corrosion problems.

Anaerobic Baffled Reactor (ABR)

Anaerobic baffled reactors (ABR) – also called baffled or improved septic tanks – are upgraded septic tanks which aim to enhance the removal efficiency for non-settleable and dissolved solids. As septic tanks, ABRs are based on a physical treatment (settling) and a biological treatment (anaerobic digestion).

An ABR consist of a tank and alternating hanging and standing baffles that compartmentalize the reactors and force liquid to flow up and down from one compartment to the next, enabling an enhanced contact between the fresh wastewater entering the reactor and the residual sludge, containing the microorganisms responsible for anaerobic digestion of the organic pollutants. The compartmentalized design separates the solids retention time from the hydraulic retention time, making it possible to anaerobically treat wastewater at short retention times of only some hours. The baffled design of the ABR ensures a high solids retention resulting in high treatment rates, while the overall sludge production is characteristically low.

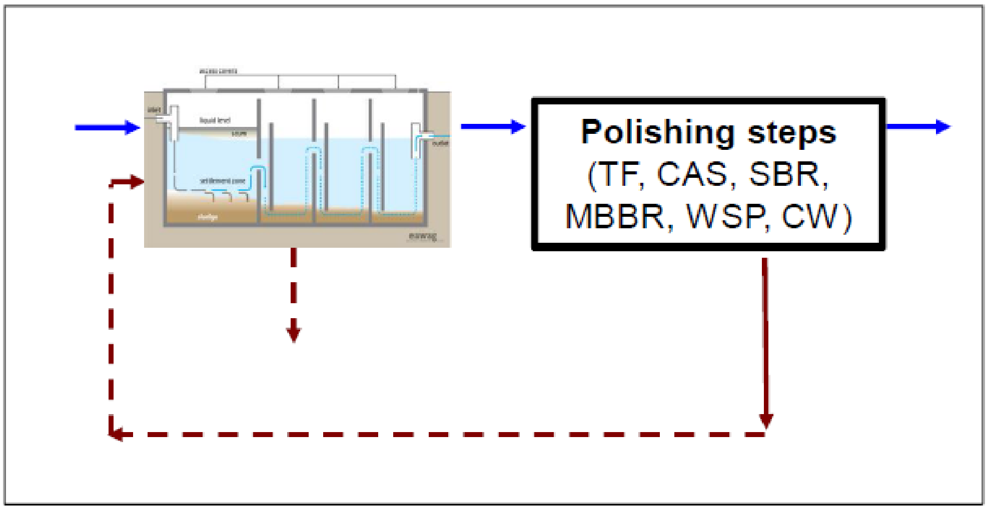

Figure 27: Anaerobic Baffled Reactor (ABR)

Table 14: Anaerobic Baffled Reactor (ABR)

Technology	**Comparison**	
	Advantages	**Disadvantages**
Anaerobic Baffled Reactor (ABR)	- Low energy demand (only pumping). - Low land requirements. - Unskilled personnel sufficient. - Low sludge yield, and well stabilized sludge. - No foreign made spare parts required. - Low CAPEX. - Substantially lower OPEX than CAS.	- Treatment efficiency for BOD, COD, TSS, N, P insufficient; hence requirement for aerobic post-treatment. - Low pathogen removal. - No flexibility in operating conditions. - If not constructed in high quality, heavy corrosion problems

Waste Stabilization Ponds (WSP)

Waste stabilization ponds (WSP) are generally the wastewater treatment process of first choice in most situations in developing countries. They are suitable for both large and small populations (from a few hundreds to hundreds of thousands). This TOP introduces WSP for both the specialist design engineer and the non-specialist.

WSP have several important advantages for developing countries: low capital costs, simple (but essential) operation and maintenance, and high performance. They can easily be designed to produce high-quality effluents suitable for restricted and unrestricted irrigation and for fish and aquatic vegetable culture. Their principal disadvantage is that, because they are an entirely natural method of wastewater treatment (they obtain all their energy directly from the sun), they require much more land than conventional electromechanical processes such as activated sludge. However, land increases in value over time and its purchase should therefore be regarded as an investment

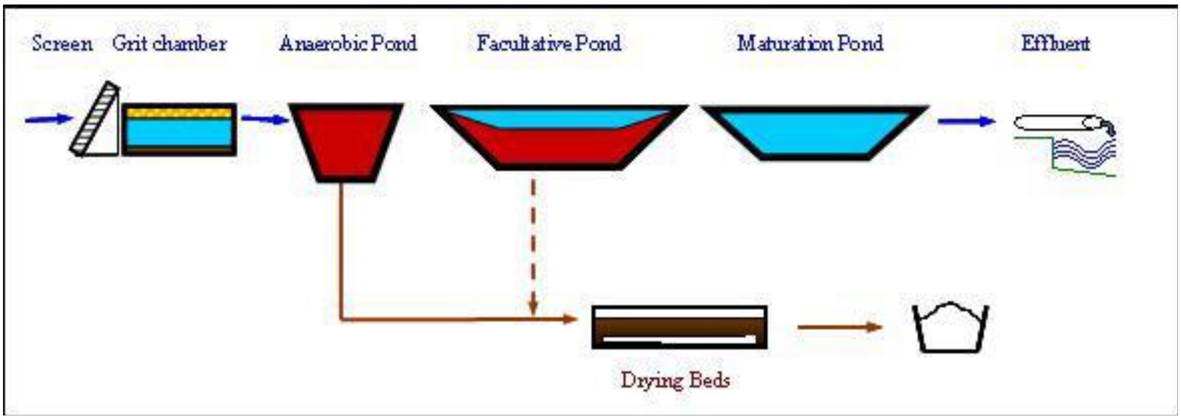

Figure 28: Waste Stabilization Ponds (WSP)

Table 15: Waste Stabilization Ponds (WSP)

Technology	**Comparison**	
	Advantages	**Disadvantages**
Waste Stabilization Ponds (WSP))	- High pathogen removal (HRT > ca 10 days). - Low energy demand. - Unskilled personnel sufficient. - Low sludge yield, and well stabilized sludge. - No dependence on foreign spare parts.	- Treatment efficiency for BOD, COD, TSS, can usually only match requirements if filtered samples are used because of algae - No reliable design tools for N,P removal. - Substantial land requirements. - No flexibility in operating conditions. - "Low maintenance" - Equipment for periodic sludge removal is frequently not in place. - CAPEX can be similar to CAS, if difficult soil conditions.

Dr. Kamal Ghodeif – Water Management Specialist and EIA Consultant
Suez Canal University, Ismailia , Egypt
e-mails: kghodeif@yahoo.com

Constructed Wetlands (CW)

Constructed wetlands are secondary treatment facilities for household (blackwater or greywater, in some cases also brownwater) and/or biodegredable municipal or industrial wastewater. Constructed wetlands are a treatment step of DEWATS systems and they can even be used as a tertiary treatment system for polishing after activated sludge or trickling filter plants. The plants grown in the wetland may be used for composting or biogas production. Basically, there are three different types of constructed wetlands (CWs). They are classified according to the water flow regime as:

- Free-surface constructed wetlands (FWS)
- Horizontal flow constructed wetlands (HF)
- Vertical flow constructed wetlands (VF)

These three types of CWs may be combined with each other in hybrid constructed wetlands in order to exploit the specific advantages of the different systems.

One of the main advantages of CWs are, that they are natural systems and thus not require chemicals, energy or high-tech infrastructure. Moreover, they are suited to be combined with aquaculture or sustainable agriculture (irrigation).

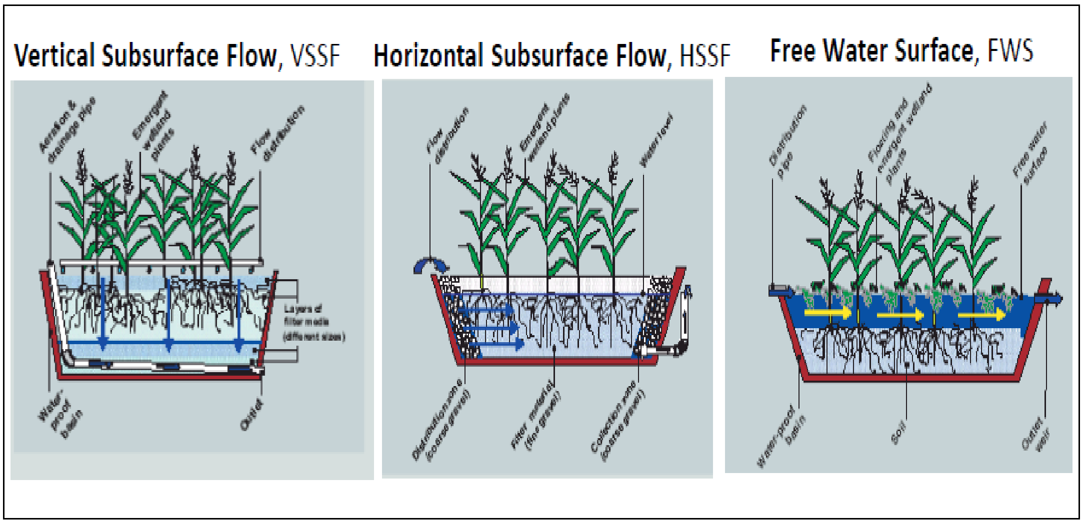

Figure 29: Constructed Wetlands (CW)

Table 16: Constructed Wetlands (CW)

Technology	Comparison	
	Advantages	**Disadvantages**
Constructed Wetlands (CW)	- Treatment efficiency for BOD, COD, TSS, N, P can be designed similar to CAS. - Substantially better pathogen removal than CAS. - Efficient heavy metal removal. - Low energy demand. - Unskilled personnel sufficient. - Low sludge yield, and (depending on system) well stabilized sludge; "French hybrid system (VSSF-VSSF)" even without sludge production. - No dependence on foreign spare parts. - Low maintenance requirements. - Substantially lower OPEX than CAS. - CAPEX usually less than for CAS.	- Treatment efficiency for BOD, Large land requirements. - Little flexibility in operating conditions. - Systems with pre-sedimentation require good maintenance of that stage; if not done properly: risk of filter bed clogging.

The pilot plant will be designed according to the state-of-art of wastewater treatment technology. It is intended to serve the community West Kantara Directorate as part of the project's target area of Ismalia Governorate. According to the Egyptian Code (501/2005 and its modifications) for reuse of treated wastewater in agriculture purposes, wastewater should be subjected to treatment to achieve treated wastewater quality based on the intended usage. It should consider the international standards for waste water reuse in agriculture (FAO Guidelines on "Water Quality for Agriculture" (Ayers and Westcot 1985). It is essential to include references of these technologies in similar projects and provide any available monitoring program.

Dr. Kamal Ghodeif – Water Management Specialist and EIA Consultant
Suez Canal University, Ismailia , Egypt
e-mails: kghodeif@yahoo.com

Comparison of Treatment Technologies:

i) Technical comparison (for Egyptian conditions)

Item	CAS w.d.*	CAS (EA)	SBR	MBBR (EA)	RBC+ Imh**	TF+ Imh	UASB +TF	ABR +TF	WSP	CW
Appropriateness of technology	-	+	-	-	+	+	+	+	+	+
Ease of operation	-	+/-	-	-	+	+	+/-	+	+	+
Safety against peak loads	+	+	+	+/-	+/-	+/-	+/-	+	+	+
Dependence on uninterrupted power supply	-	-	-	-	-	-	+/-	+	+	+
Dependence on foreign spare parts	-	+/-	-	-	+/-	+/-	+/-	+	+	+
Land requirements	+	+	+	+	+	+	+	-	-	-

***w.d.: with digestion** ****Imh: Imhoff tank**

ii) Environmental Comparison (for Egyptian conditions)

Item	CAS w.d.*	CAS (EA)	SBR	MBBR (EA)	RBC+ Imh**	TF+ Imh	UASB +TF	ABR +TF	WSP	CW
Compliance with Egyptian effluent criteria	+	+	+	+	+	+	+	+	+/-	+
Risk of odour / noise	+	+	+	+	+	+	+	+	+/-	+
CO_2 – Equiv. emissions	-	-	-	-	+	+	+/-	+/-	+	+
Ease of upgrading to meet stricter effluent standards	+	+	+	+	+	+	+	+	-	+

iii) Financial comparison (for Egyptian conditions)

Item	CAS w.d.*	CAS (EA)	SBR	MBBR (EA)	RBC+ Imh**	TF+ Imh	UASB +TF	ABR +TF	WSP	CW
CAPEX	-	-	-	-	+/-	+/-	+/-	+/-	+/-	+/-
OPEX	-	-	-	-	+	+	+	+	+	+

10.3 Important lessons learned from Egypt's WWTPs

The analysis of lessons learnt from other projects will focus on projects that took place in similar environmental and socio-economic contexts. This will cover national and/or international water reuse projects. The project description will include:

- Project name;
- Responsible organization;
- Date of project implementation;
- Summary of project aim , contents and conclusion;
- Relevant lessons learnt for the SustainWaterMED pilot activity.

Based on the site visits to the following wastewater treatment plants lessons learnt were concluded:

i. Nathay WWTP (UASB + TF)
ii. Sahragt – El Sughra (Imhoff + TF)
iii. Abd El Kareem Eissa (ABR)
iv. Thawit El Kradsa (CAS)
v. Sanhour (UASB + CAS (under construction)

Lessons learnt:

The following are the lesson learnt from the assessment of the existing situation in Egypt:

Design:

i. Frequent complaints about hydraulic overloading.
ii. While certain treatment units seem to be properly designed, some are not.
iii. Pre-treatment if often insufficient (Screen, grit & O and G removal)
iv. Certain details are often not operator-friendly or even dangerous (health and safety).

Quality of construction materials:

i. Wrong materials particularly in anaerobic stages → heavy corrosion.
ii. Concrete quality: mostly OK.
iii. Biogas systems not gas-tight.

Operation and Monitoring:

i. Erratic influent flow (pump stations in villages), long periods without inflow.
ii. Unreliable energy supply + lack of fuel for generator.
iii. Very rudimentary monitoring, almost no feedback to O&M.
iv. Lack of clear SOPs

The best treatment technology cannot work properly, if certain design and construction details are not properly executed. Standardization of design criteria, technical specifications, and SOP would help.

Appropriate technology for rural areas in Egypt

There are some Criteria for WWTPs in rural areas that must be taken into consideration:

i. One should choose a simple and reliable process.
ii. Construction and O&M costs should be reasonable.
iii. Decentralized treatment plants are often more expensive (to build and operate) than larger centrally located plants (cluster concept).
iv. Use of the least amount of land (in the densely populated agricultural areas).
v. Low power consumption.
vi. Minimum of mechanical equipment.
vii. Local availability of spare parts.

What is the targeted size of villages?

i. Total number of villages ≈ 4600
ii. Total number of satellite villages ≈ 27000
iii. Total rural population ≈ 50 million
iv. Targeted village size: 1000 – 25,000 capita
v. Plant hydraulic capacity: 100 – 2500 m^3/day
vi. Smaller satellite villages can be served in a cluster or are served by unconventional treatment systems (ABR – anaerobic reactor– upflow septic tank baffled reactor)

vii. These unconventional anaerobic systems do not meet existing Egyptian effluent standards, but need polishing step (aerobic).

Criteria of the Suitable Wastewater Treatment Technologies for Egyptian Condition:

- Any technology which works for larger populations can also be adapted to smaller populations.
- Size of plant often determines which technology leads to lower capital costs.
- Community often does not care so much about the technology but the location of the plant and the amount of land required (especially where land is a precious commodity as in Nile Delta).
- Environmental nuisances (odor, noise) can be of concern.
- Operation and maintenance of the plant should not require highly skilled labor (employ village people).

Conclusion

Based on the above assessment, the finding of Al Gozayyera village intensive survey and the current & future energy and water crisis in Egypt, Anaerobic Biogas Production-Digestion Unit followed by a polishing step for effluent reuse is highly recommended. The effluent can be used to irrigate non-freshly eaten crops.

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الجهاز المركزي للتعبئة العامة والإحصاء ، تعدادات الإسماعيلية
مركز معلومات مجلس الوزراء
مركز معلومات محافظة الإسماعيلية

Appendices

Basic data about mother village (Al Rayah) and about Al Gozayyera (in Arabic) given by local governmental administration

Dr. Kamal Ghodeif – Water Management Specialist and EIA Consultant
Suez Canal University, Ismailia , Egypt
e-mails: kghodeif@yahoo.com

وزارة مرافق مياه الشرب والصرف الصحي

الشركة القابضة لمياه الشرب والصرف الصحي

البرنامج القومي للصرف الصحي فى القرى المصرية
(قاعدة بيانات)

المحافظة: الإسماعيلية القرية: الرياح المركز/ الوحدة المحلية: قنطرة شرق الكود:

الملامح العامة للقرية

عدد السكان: ٤٠,٠٠٠

مساحة القرية (كم٢): ١٢٥ كم٢

[illegible]: ٣٤ ٤٣٦

[illegible]: ٣٨ - ٣١

البعد عن المركز أو المدينة: [illegible] لمدينة القنطرة غرب

القرى / العزب التابعة لها: [illegible]

[illegible]

عدد المدارس: ٨ مدارس [illegible] ١ [illegible] ٢

نسبة الأمية: ٢ ٪

وحدات صحية: ٢ [illegible]

[illegible]

مساحة الرقعة الزراعية: [illegible] فدان

نوع المحاصيل: القمح - [illegible]

[illegible]

البنيـــة الأساسيــة

المباني

سكنية / طينية: ٤٩٠ مسلح ١٠ % طين

عدد الطوابق: دور + دورتين

التوسع العشوائي:

الصرف الصحي

ترنشات: ترنشات

طرق التخلص منها: [illegible]

مكان التخلص: المصرف - مراكز [illegible]

شبكة صرف صحي: لا يوجد

محطة معالجة: [illegible]

مياه الشرب

مصدر مياه الشرب: [illegible]

خدمة وصلات المياه: [illegible]

انقطاعه على مدار اليوم: متقطع

الضغوط: ٤ بار

تواجد طلمبات حبشية: لا يوجد

الكهرباء

مستوى الخدمة: جيدة

الطرق

مرصوفة: ٥ كم

ترابية: ٣ كم

الغاز

البيئـــة / الوعي البيئي

مكان التخلص من مخلفات المنازل (القمامة): [illegible]

مكان التخلص من المخلفات الزراعية: [illegible]

الموارد المتاحة

الموارد البشرية

المهارات والمهن التخصصية: نجار - تصنيع [illegible]

المهارات الحرفية: تصنيع [illegible] - حدادة

الجمعيات الأهلية

طبيعة النشاط: [illegible]

مستوى الخدمة: [illegible]

المشروعات التنموية السابقة: [illegible]

أخرى

توافر أصول أملاك دولة: [illegible]

الأراضي المتاحة وموقعها بالنسبة للقرية: [illegible]

امكانية المساهمة في مشروع الصرف الصحي: [illegible]

امكانية توفير قطعة أرض لتيهوره الذاتية: [illegible]

بيانات إضافية

اسم شخص يمكن الرجوع اليه في حالة الحاجة لاستكمال بيانات اخرى

١- الاسم: [illegible] تليفون ارضي: تليفون محمول: [illegible]

٢- الاسم: [illegible] تليفون ارضي: [illegible] تليفون محمول: [illegible]

رئيس [illegible] : د. رفعت عبد الوهاب تصميم: د. [illegible] التحرير

محافظة الإسماعيلية
رئاسة مركز ومدينة القنطرة غرب
الوحدة المحلية لقرية الرياح

دراسة عن منطقة الجزيرة

مقدمه:

هي احدى توابع الوحدة المحلية لقرية الرياح – مركز القنطرة غرب – محافظة الإسماعيلية وهي عبارة عن كتلة سكنية تقع في الجهة الغربية للقرية يطل عليها كوبرى السلام من الناحية الشرقية للمنطقة

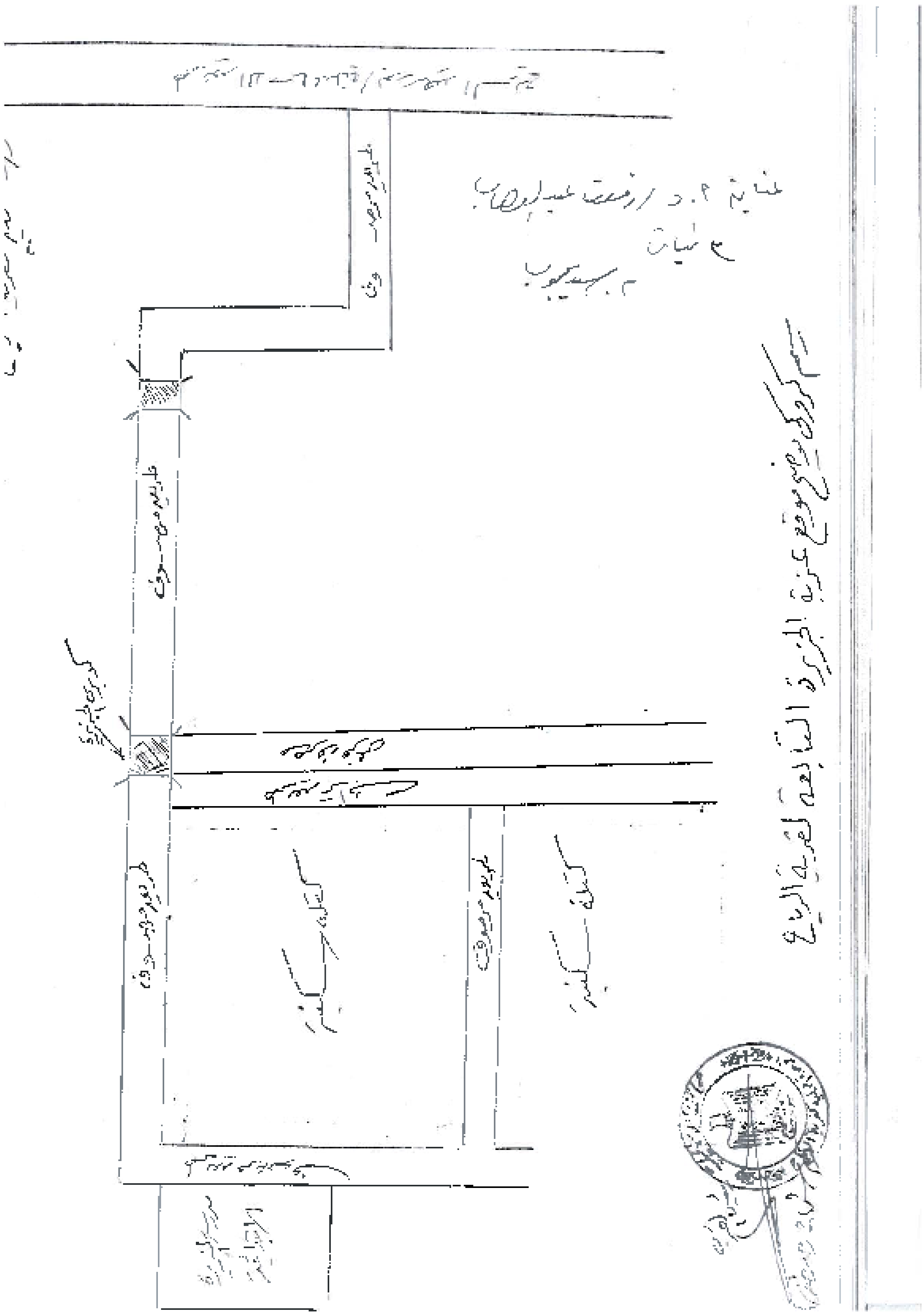
عدد المنازل	عدد السكان	المساحة	ملاحظات
١٨٨	١٠٠٠ نسمة	١٠٠,٠٠٠م٢	

تتكون المنطقة من عدد ١٨٨ منزل ريفي يقيم بها حوالي ١٠٠٠ نسمة يعمل معظمهم بزراعة الأراضي الخاصة بهم والمجاورة للكتلة السكنية ويقومون بزراعتها بمحاصيل (القمح – الذرة – الخضروات) والتي هي المصدر الرئيسي للدخل كما يقومون بتربية الماشية وغيرها لسد احتياجاتهم الغذائية .

- يتوفر بالمنطقة مصادر الكهرباء اللازمة لإنارة المنازل وكذلك خطوط مياة الشرب النقية ومصدرها محطة مياة القنطرة غرب الكبرى والتي تبعد عن المنطقة حوالي ٥ كم
- تقدر مساحة المنطقة للكتلة السكنية التي يعيشون بها حوالي ١٠٠,٠٠٠ م٢ يتخللها شوارع تتراوح بين ٦ & ٤م والبعض منها مرصوف كما يربط المنطقة بالقرية الأم طريق مرصوف بعرض حوالي ٦م والذى يجعل الوصول الى المنطقة سهل وجسور مابين المنطقة والطريق السريع بطول حوالي ٤ كيلو متر
- يتوافر بالمنطقة مدرسة تعليم ابتدائية لأبناء المنطقة وبعض الخدمات وتتبع المنطقة القرية الأم في بعض الخدمات كالجمعية الزراعية وغيرها . وذلك على بعض ٤ كيلومتر تقريباً

رئيس القرية
([illegible] مصطفى)

Dr. Kamal Ghodeif – Water Management Specialist and EIA Consultant
Suez Canal University, Ismailia , Egypt
e-mails: kghodeif@yahoo.com



List of Key stakeholders and experts attended first workshop (in Arabic)

محافظة الإسماعيلية
رئاسة مركز ومدينة القنطرة غرب
قرية الرياح

م	الاسم	الوظيفة	رقم التليفون
١-	حسني محمد رشد	رئيس قرية الرياح	٠١٢٢٥٧٢٢٤١٢
٢-	كرم جمعاوي مصطفى	سكرتير عام مجلس الرياح	٠١٠٢٨٢٩١٥١
٣-	محمد عبد الله محمد	سكرتير قرية الرياح	٠١٢٢٥١٨٧٠٩
٤-	جواد محمد محمودة	مفتش بالتربية والتعليم	٠١٢٢٦٥٢٣٦٧٥
٥-	علي إبراهيم عبد الغني	مدرس بالتربية والتعليم	٠١٢٢٩٨٥٨٠٣٤
٦-	محسن علي محمد	أعمال حرة	٠١٢٢٠٢٢٨٠٦٤
٧-	محمود محمد حسين علام	رئيس وحدة تحسين الأراضي بالمركز	٠١٢٢٥٧٢٢٠١٠
٨-	فرج محمد سليمان	أعمال حرة	٠١٢٨٩٨٥٩٨٢
٩-	أحمد محمد حسين علام	موظف بقرية الرياح	٠١٠٩١٥٩٠٤١٧
١٠-	محمد محمد حسن والي	موظف بقرية الرياح	٠١٢٢١٨٨٨٠٧٣
١١	د. [illegible]	[illegible]	0'270000585
١٢-	م. جمال عبد الحميد ذكي	مدير عام مرفق مياه الصرف الصحي بالمنطقة	٠١٢٢٨٤٢٢٦٥٤
13	Stephen Greenhalgh	GIZ ADVISER	0267771713
١٤	أ.د. كمال عودة أبو عفيفة	أستاذ كلية العلوم	01006827204
١٥	م. طلعت عبد الله محمد حسنين	مهندس مدني	01005050992
١٦	م. محمد سويلم سليمان	مدير عام مرفق مياه الصرف الصحي بالمركز	٠١٢٢٤٨٢٠٢١

Questioner (English and Arabic)

.

(Questionnaire)

Preface

The holding company for water and wastewater (HCWW) aims through a project funded by the European Union, supervised by the German Society for International Cooperation (GIZ) and entitled "Wastewater treatment and reuse", to construct a wastewater treatment plant in order to reuse it in agriculture. This will be done in Aljazeera village at West Kantara district in Ismailia province as a pilot project that can be applied at the level of the republic in small gatherings (Manors, small and medium villages in terms of population).

To achieve this national goal, a model Questionnaire was developed to survey the local community and families of the village under study to be able to devise the foundations for the design of the treatment plant and ensure sustainable operation at the required efficiency.

Basic data

Name: ………………………………(optional)

1. What is the number of family members (facility)? Males ……. Females …….. ages ….
2. What is the number of individuals enrolled in universities and technical education of both genders?
3. Are there graduates among family members and are they working or not (Pre University – University)
4. Is there an electricity network at the village and is the family home connected to the network?
5. What are the main sources of income to live? What are the basic professions of family members?
6. What is the number of cattle and small animals and poultry hold by the family? How much water does it consume?

Cattle and buffalo ………………………

Sheep and goats ……………………….

Chickens and birds …………………….

Others ……………….

7. What are the main agricultural activities and the most important products of the village?

8. What kinds of crops? …… Summer ….. ………… Winter … ….

9. What is the area of the land owned by the family? How much water does it consume in the season? ……… . Summer … winter … ………

10. What is the average level of income in the family? (Annual income) … How would you describe the village welfare?

11. Does family owns any of the items listed below;

Items	Number
Television (TV)	
Refrigerator	
Radio or recording device	
Washing machine	
Computer (PC)	
Home phone	
Mobile phone	
A car or a tractor or other	

12. Are there any schools in the village? If not, what is the distance to the nearest school?

13. What is the average educational attainment in the village? (pre university – university – post university)

14. Are there any hospitals / health care centers in the village? If not, where is the nearest health facility?

Drinking water

15. What is the main source of drinking water supply in the village? (Governmental Supply) does family home is connected to the network (connected – not connected)

16. What is the source of water are you using? (Governmental – private well – Transfer carts – Ethiopian pump – more than one source)

17. Is there any Ethiopian pumps in the village? Moreover, what proportion of people dependent on them? Or is it used only in case an interruption of governmental water supply occurred?

18. How much is your daily consumption of water?

19. Is the amount of water that you receive adequate and continuous? Yes – No

20. What are your uses of water? (Drinking – household – Agriculture – livestock watering – other purposes)

21. How much does it cost per cubic meter (or small or large car) of water?

22. Do you have trees at house garden irrigated by drinking water? What are the cultivated area almost? Yes – no the cultivated area ( )

23. Do you drink directly from the water source? Yes – No (what is the mean you use to purify water?)

24. Are you currently using contaminated water? Yes – No – I do not know

25. Is the current pricing of water? Suitable – not suitable – Are you willing to accept increasing the tariff for the provision of better service?

26. Is the water condition now suitable for drinking and irrigation? Suitable – Not Suitable – somewhat appropriate – I do not know

27. How could available water sources for irrigation be increased?

28. How do you think the water be maintained on and its demand for drinking and agriculture reduced? (Change the crop types – changing the pattern of the current storage and logistics – Other)

Sanitation

29. Is there a network of wastewater collection in the village and a treatment plant? (Yes – No)

30. What kind of toilet used in the family / village?

31. Do you have a wastewater tank or discharge directly on the surface of the land? (Yes – No – direct discharge)

32. Do you think that providing sewer service to the area will solve some of the problems associated with it? What and how?

33. Are you willing to be included in the sewerage network and connect the family home to the public network for sanitation or prefer private latrines?

34. Are you willing to pay the cost of connection to the sewerage network, as well as pay for providing sewage service for your home?

35. Have you ever heard at any time before the concept of "reuse of treated wastewater for agricultural irrigation?"

36. Do you think that there is a shortage of water available for agricultural irrigation?

37. Do you think that the reuse of treated wastewater is a solution to the problem of lack of irrigation water?

38. Have you ever used or seen one of your neighbors while using treated or untreated wastewater for irrigation?

39. Are you ready for reuse of treated wastewater for agricultural irrigation if it is guaranteed and authorized by law and does not require you to change the pattern of irrigation or agriculture, and whether you are ready to pay a price for the use of wastewater?

40. Do you think that the treated sewage water has an advantage above fresh water in irrigation, because of including most of the nutrients needed by the plant (such as nitrogen and phosphate)?

41. Have you ever heard of sludge produced from sewage treatment plants, and whether you are ready for use it as a fertilizer if it is safe and not polluted with germs, as well as pay for the sludge?

42. Do you find in your religious traditions any objection to the use of wastewater, or is it permissible under conditions of not harming users of water (Do you think it is religiously forbidden – not forbidden – I do not know)

43. What kind of concerns do you think linked to the reuse of treated wastewater for agricultural irrigation?

A. Water and soil pollution (drinking water pumps – surrounding soil)
B. Health problems of individuals and the spread of mosquitos
C. Contamination of agricultural products and fruits
D. Effects on birds friendly to the farmer
E. Impacts on agriculture and animal husbandry

44. Do you see migratory birds passing through your village? If the answer is yes, when is the time of migration?

45. What kind of advantages do you think in collection and treatment of sewage?

46. Are you willing to buy crops irrigated with treated wastewater?

47. Do you think that the implementation of this project will be of benefit to your village and contribute to the development programs of the village and community? "

****

Important note:

This data are strictly confidential, will be only used for research purposes, and will not be seen by anybody except research specialists.

(إستمارة إستبيان)

تمهيد

تسعي الشركة القابضة لمياه الشرب والصرف الصحي من خلال مشروع ممول من الإتحاد الأوروبى وتحت إشراف الهيئة الألمانية (giz) بعنوان" معالجة مياه الصرف الصحي وإعادة استعمالها" لتنفيذ محطة لمعالجة مياه الصرف الصحي بهدف إعادة استخدامها فى الزراعة وذلك بقرية الجزيرة – مركز القنطرة غرب – محافظة الإسماعيلية كمشروع إسترشادى يمكن تطبيقة على مستوى الجمهورية فى التجمعات الصغيرة (العزب والقرى الصغيرة والمتوسطة من حيث عدد السكان).

ولتحقيق هذا الهدف القومى تم إعداد نموذج إستبيان لمسح المجتمع المحلي والأسر للقرية تحت الدراسة حتى يمكن إستنباط الأسس المتعلقة بتصميم محطة المعالجة وضمان إستمرارتشغيلها بالكفاءة المطلوبة.

بيانات أساسية

الأسم :.....................................(اختياري)

1. ما هو عدد أفراد الأسرة (المنشأة)؟ الذكور .... الإناث........الأعمار..
2. ما هو عدد الأفراد الملتحقين بالمدارس والجامعات والتعليم الفني من الجنسين
3. هل بين أفراد الأسرة خريجين وهل يعملون أم لا (ما قبل الجامعي – جامعي)
4. هل يوجد بالقرية شبكة كهرباء وهل منزل الأسرة متصل بالشبكة؟
5. ما هي مصادر الدخل الأساسي للعيش ؟ وما هي الحرف الأساسية لأفراد الأسرة
6. ما هو عدد الأبقار والدواب والدواجن الصغيرة في الأسرة؟ كم تستهلك ماء لها؟
   الأبقار والجاموس.........................
   الخراف والماعز.........................
   الدجاج والطيور.........................
   أخرى.........................
7. ما هي الأنشطة الزراعية الرئيسية وأهم المنتجات من القرية؟
8. ما أنواع المحاصيل ؟...... صيفاً .... شتاءً.......
9. ما هي المساحة المملوكة للأسرة وكم تستهلك ماء لها في الموسم؟ ....صيفاً شتاءً....
10. ما هو متوسط مستوى الدخل في الأسرة؟ (الدخل سنوي) كيف تصف حالة الرفاهية بالقرية؟
11. هل تمتلك الأسرة أي من العناصر المذكورة أدناه؟

البنود	العدد

تلفزيون	
ثلاجة	
جهاز تسجيل راديو	
غسالة آلية	
الكمبيوتر	
هاتف منزلي	
الهاتف المحمول	
سيارة أو جرار زراعي أو أخري	

12. هل هناك مدارس في القرية ؟ إذا لم يكن كذلك ، ما هي المسافة لأقرب مدرسة؟
13. ما هو متوسط التحصيل التعليمي في القرية؟ (ما قبل الجامعي –جامعي – ما بعد الجامعي)
14. هل هناك أي مستشفيات /مراكز الرعاية الصحية في القرية؟ إذا لم يكن كذلك، أين يقع أقرب مرفق صحي ؟

مياه الشرب

15. ما هو المصدر الرئيسي لإمدادات مياه الشرب في القرية؟ (إمدادات حكومية) هل منزل الأسرة متصل بالشبكة (متصل – غير متصل)
16. ما هو مصدر الماء الذي تستعمله ؟ (حكومي– بئر خاص – نقل بعربات – طلمبة حبشية – أكثر من مصدر)
17. هل يوجد بالقرية طلمبات حبشية ؟ وما نسبة المعتمدين عليها أم تستخدم فقط في حالة انقطاع إمدادات المياه الحكومية
18. كم استهلاكك اليومي من المياه؟
19. هل كمية المياه التي تصلك كافية ومستمرة ؟ نعم – لا
20. ما هي استعمالاتك للماء؟ (شرب – استخدام منزلي – زراعة – سقى المواشي – أغراض أخري)
21. كم سعر المتر المكعب (أو العربية الصغيرة أو الكبيرة) من الماء؟
22. هل لديك أشجار بحديقة المنزل تسقيها من مياه الشرب ؟ وما هي المساحة المزروعة تقريبا؟ نعم – لا المساحة المزروعة (   )
23. هل تشرب من مصدر الماء مباشرة ؟ نعم –لا (ما هي الوسيلة التي تستخدمها لتنقية المياه؟)
24. هل الماء الذي تستخدمه حاليا ملوث ؟ نعم – لا – لا أدري
25. هل تسعيرة الماء الحالية ؟ مناسبة – غير مناسبة – هل لديك استعداد لقبول زيادة التعريفة مقابل تقديم خدمة أفضل
26. هل وضع المياة الآن مناسب للشرب وللري ؟ مناسب – غير مناسب – مناسب إلى حد ما – لا دري

27. كيف يمكن زيادة مصادر المياه المتاحة للري ؟
28. برأيك كيف يمكن الحفاظ على الماء وتقليل الطلب عليه للشرب وللزراعة ؟ (تغيير نوعية المحاصيل – تغيير نمط التخزين والإمداد الحالي– أخري)

الصرف الصحي

29. هل هناك شبكة تجميع مياه الصرف الصحي في القرية ومحطة للمعالجة؟ (نعم – لا)
30. ما هو نوع المرحاض/ التواليت المستخدم في الأسرة / القرية ؟
31. هل لديك خزان للصرف الصحي ام تصرف مباشرة على سطح الأرض ؟ نعم – لا – صرف مباشر
32. هل دخول خدمة الصرف الصحي إلى المنطقة برأيك ستحل بعض المشاكل المرتبطة بها ؟ ما هي وكيف؟
33. هل لديك استعداد للاشتراك في شبكة الصرف الصحي وربط منزل الأسرة بالشبكة العامة للصرف الصحي أم تفضل الحفر الصحية الخاصة
34. هل أنت علي استعداد لدفع تكلفة الربط على شبكة الصرف الصحي وكذلك دفع مقابل توفر خدمة الصرف الصحي لمنزلك ؟
35. هل سمعت في أي وقت مضى مفهوم "إعادة استعمال مياه الصرف المعالجة في الري الزراعي"؟
36. هل تعتقد أن هناك نقص في كميات المياه المتاحة للري الزراعي ؟
37. هل تري أن إعادة استعمال مياه الصرف المعالجة حل لمشكلة نقص مياه الري؟
38. هل سبق لك أن استعملت أو رأيت أحد جيرانك يستعمل مياه الصرف المعالجة أو غير المعالجة في الري ؟
39. هل أنت مستعد لإعادة استعمال مياه الصرف المعالجة في الري الزراعي إذا ما كانت مضمونة ومرخصاً بها قانوناً ولا تتطلب منك تغير نمط الري أو الزراعة ، وهل أنت مستعد لدفع ثمن لاستعمال مياه الصرف
40. هل تعتقد أن لمياه الصرف الصحي المعالجة ميزة علي المياه العذبة في مجال الري لأنها تضم معظم العناصر المغذية التي يحتاجها النبات (مثل نيتروجين وفوسفات)؟
41. هل سمعت من قبل عن الحمأة التي تنتج من معامل معالجة مياه المجاري، وهل أنت علي استعداد لاستعمالها كسماد إذا كانت مأمونة وغير ملوثة بالجراثيم وكذلك دفع ثمن الحمأة ؟
42. هل تجد في الثقافة الدينية التي تتبعها أي مانع من أن استعمال مياه الصرف أم أنه جائز وفق شروط لا تلحق الأذى بمستخدمي المياه (هل تعتقد أنها ممنوعة دينياً – غير ممنوع – لا أدري)
43. ما نوع المخاوف التي تعتقد أنها مرتبطة بإعادة استعمال مياه الصرف المعالجة في الري الزراعي ؟
أ . تلوث المياه والتربة (طلمبات مياه الشرب – التربة المحيطة)
ب .مشاكل صحية للأفراد وانتشار للناموس
ج . تلوث المنتجات الزراعية والفواكه

د .الآثار على الطيور صديقة الفلاح
هـ .الآثار على الزراعة وتربية المواشي

44. هل تري طيور مهاجرة تمر من قريتك؟ إذا كان الجواب نعم ، متى وقت الهجرة؟
45. أي نوع من المزايا في رأيك لدي تجميع ومعالجة مياه الصرف الصحي ؟
46. هل أنت مستعد أن تشتري المحاصيل المروية بمياه الصرف المعالجة
47. هل تعتقد أن تنفيذ هذا المشروع سيكون ذو فائدة لقريتك ويساهم في برامج تنمية القرية والمجتمع"؟

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ملحوظة هامة:

هذة البيانات سرية للغاية وسوف يتم إستخدامها فقط لأغراض البحث ولن يطلع عليها احد سوي المختصين بالبحث.

Minutes of the second workshop meeting

Tuesday 8 October 2013

The workshop has been held at Al Gozayyera village, Ismailia governorate, Egypt. The main objective was to introduce the results of the baseline study to stakeholders and village residents and give them an overview about **SWIM** project and its activity at their village. The participants were about 75 representing village residents; 6 representing the local authority at the mother village (Al-Rayah) and city (El-Kantara). The Canal Company for water and wastewater is represented by its chief General Mahmoud Zaki and 1 Engineer from Ismailia head office as well as local professional working at El-Kantara wastewater treatment plant. The GIZ is represented by Prof. Ismail Al Baz, Eng. Ernst Doering, Eng. Irene Sander and Eng. Aya El Wattar. The Holding company for water and waste water is represented by Prof. Rifaat Abdel Wahab. The main findings of the baseline study are represented by the consultant Dr. Kamal Ghodeif and his assistants.

- Project coordinator Prof. Rifaat Abdel Wahab has introduced SWIM project and its activity at Al Gozayyera village and gives an overview about project steps with emphasize about project credibility and professional execution of the wastewater treatment plant to be guide for similar small scale projects in Egypt.
- General Mahmoud Zaki has expressed willingness to cooperate in the future, depending on the success of the pilot project. Implementation of the project on a larger scale needs proper management plan.
- Eng. Ernst Doering has strengthened the people's ownership of the project by highlighting that the GIZ and EU help with the financial and technical support, but the project finally belongs to the village people.
- Prof. Ismail Al Baz has appreciated local community participation in the project by granting land and their willing to cooperate also during further steps of the project. He has highlighted the success stories and its role to train and raise the capacity of employee at similar projects.
- Dr. Kamal Ghodeif has explained the main findings of the baseline study with emphasize on water environment and its impact on local residents and mitigation measures that should be taken into consideration to protect the environment in general and risks of continuity for the statuesque of sewage disposal system. He has Thanked villagers for their proactive participation in the baseline study.
- Brief explanation of the proposed treatment process (Anaerobic Reactor)- The anaerobic treatment unit could be followed by secondary treatment and the effluent can be used to irrigate non-freshly eaten crops.
- The village residents and local authorities have expressed full support and participation to the project. The villagers have granted the land for the treatment plant and they will help in further steps such as excavation and connections.

Photos from the public participation