CONSTRUCTION AUTHORITY FOR
POTABLE WATER AND WASTEWATER (CAPW)
MINISTRY OF HOUSING,UTILITIES AND
URBAN DEVELOPMENT (MOHUUD)

PREPARATORY STUDY FOR ABU RAWASH WASTEWATER TREATMENT PLANT IMPROVEMENT IN CAIRO, ARAB REPUBLIC OF EGYPT

FINAL REPORT

VOLUME II: ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT OF ABU RAWASH WWTP PROJECT

JANUARY 2010

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
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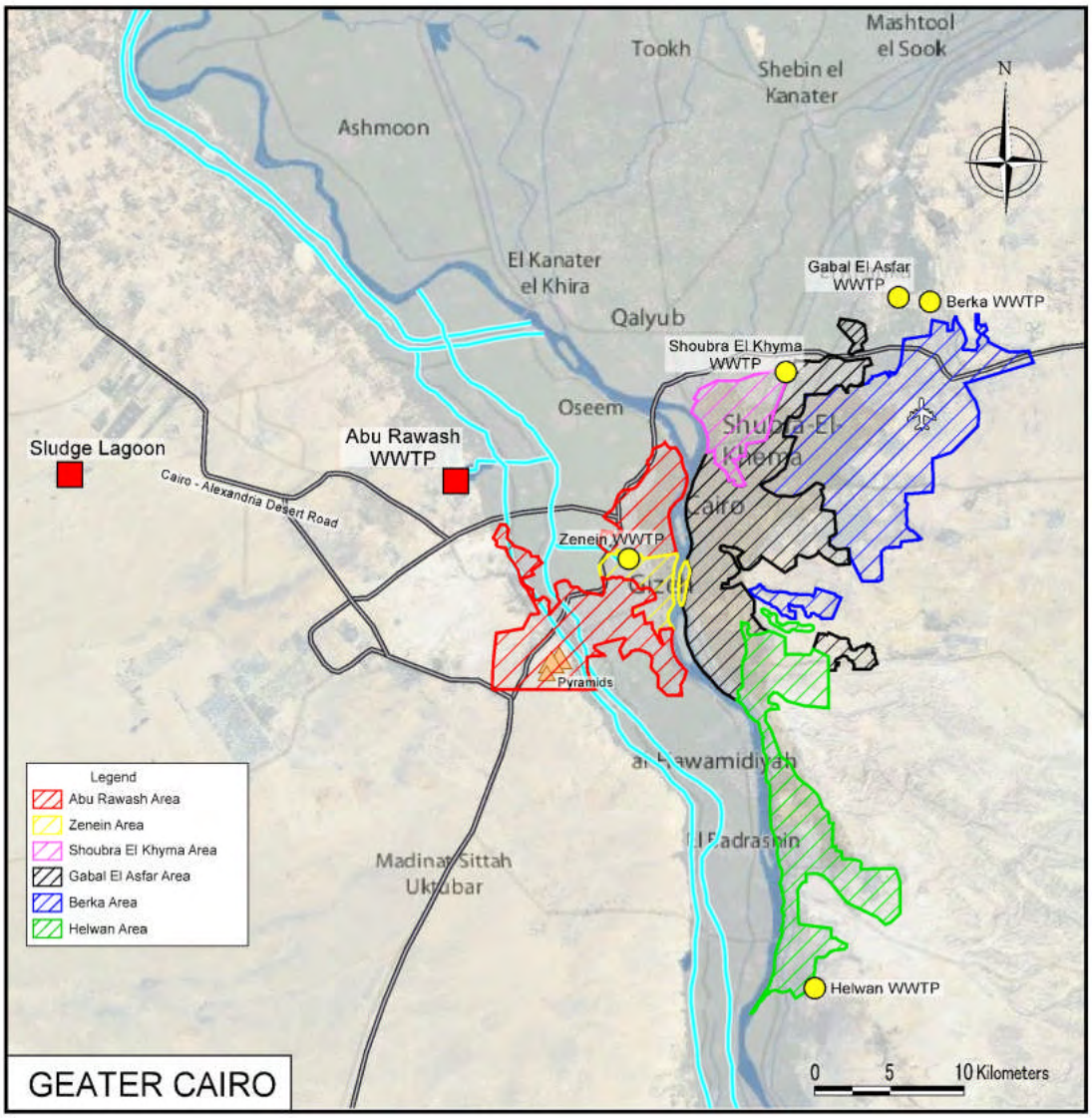
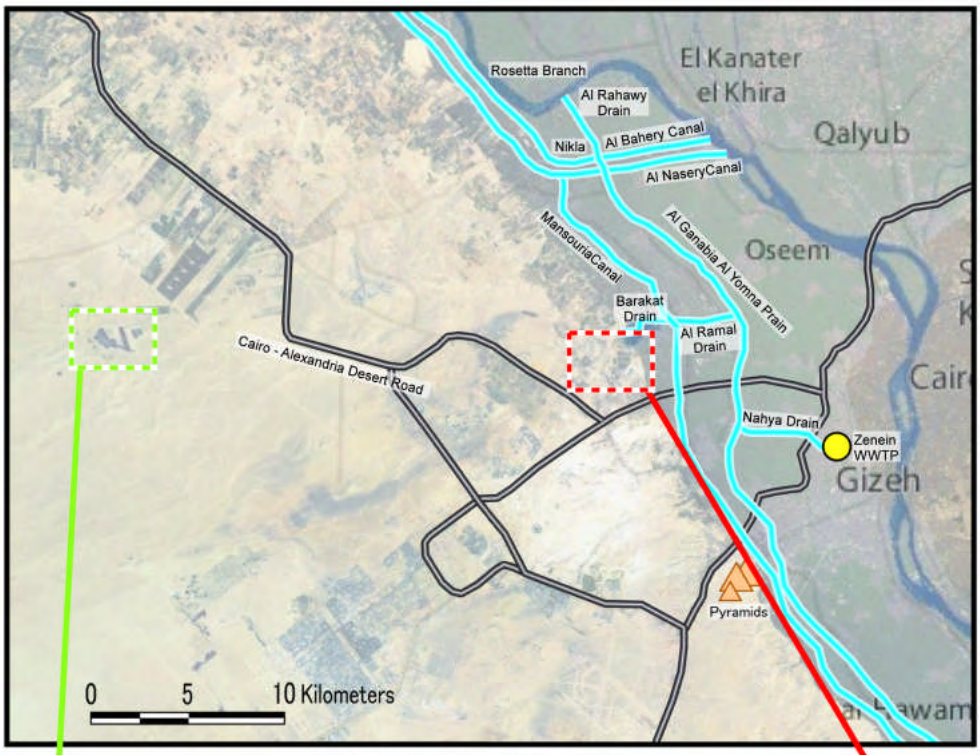


LOCATION MAP (1)



West Bank of River Nile

Sludge Lagoons

Abu Rawash WWTP Site

LOCATION MAP (2)

FINAL REPORT

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ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT OF

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ABBREVIATIONS

BOD	Biochemical Oxygen Demand
CAPW	The Construction Authority for Potable water and Wastewater
CASP	Conventional Activated Sludge Process
COD	Chemical Oxygen Demand
EEAA	Egyptian Environmental Affairs Agency
EIA	Environmental Impact Assessment
F.C.	Foreign Currency
GCSDC	Greater Cairo Sanitary Drainage Company
GCWSC	Greater Cairo Water Supply Company
GDP	Gross Domestic Product
GWWC	Giza Water and Wastewater Company
HCWW	Holding Company for Water and Wastewater
JBIC	Japan Bank for International Cooperation
JICA	Japan International Cooperation Agency
JPY	Japanese Yen
km	Kilometer
L.C.	Local Currency
LE	Egyptian Pound
lpcd	Liter per capita per day
MALR	Ministry of Agriculture and Land Reclamation
MDG	Millennium Development Goals
MMG	Monitoring Management Group
MOF	Ministry of Finance
MOHP	Ministry of Health and Population
MOHUUD	Ministry of Housing, Utilities and Urban Development
MOIC	Ministry of International Cooperation
MOP	Ministry of Planning (now called Ministry of Economic Development)
MSEA	Ministry of State for Environmental Affairs
MWRI	Ministry of Water Resources and Irrigation
m^3/day	Cubic Meter per Day
NOPWASD	National Organization for Potable Water and Sanitary Drainage
ODA	Official Development Assistance
O&M	Operations and Maintenance
PS	Pumping Station

SS	Suspended Solids
TSS	Total Suspended Solids
WWTP	Wastewater Treatment Plant

SUMMARY

(1) Background and Objectives of EIA

Abu Rawash WWTP is located in the west bank region of Nile River to treat wastewater collected in the area. The current inflow to this WWTP has reached almost 1.1 million m^3/day and is increasing with increased population and rapid development in Giza area. The treatment capacity of this WWTP is 400,000 m^3/day (primary treatment only) and newly constructed primary treatment facilities having capacity of 800,000 m^3/day is expected to start soon. However, the level of treatment shall continue to be primary. The effluent from this WWTP is discharged to Barakat drain which flows through a series of drains and is finally discharged to Rosetta branch of River Nile. The primarily treated effluent is expected to have negative impact on water quality of receiving water bodies and its impact on water pollution will be left unsolved.

Considering this background, Egyptian Government requested Japanese Government in November 2007 for ODA Loan and JICA decided to conduct this Study to prepare the improvement plan for Abu Rawash WWTP. Based on the EIA requirements of EEAA and considering Guidelines of JBIC, the preparation of EIA report and providing assistance for its approval has also been undertaken.

The works carried out by Study Team for Environmental and Social considerations include following major activities:

- Providing assistance in the preparation of EIA
- Providing assistance in holding public consultation meeting
- Preparation of Check List

(2) Legal and Administrative Framework

(A) Administrative Framework

The CAPW is responsible for planning, design and construction of municipal drinking water supply systems, and sewerage system to facilitate water supply and sewerage services in Greater Cairo and Alexandria. The CAPW is also responsible for preparing tender documents, tendering, awarding, contracting and supervising the execution of contracts.

Similar function for the remaining part of Egypt is carried out by NOPWASD.

Additionally, HCWW is established to hold water supply and sewerage assets. The purpose of the HCWW is to purify, desalinate, distribute and sell drinking water and to collect, treat and safely dispose of wastewater, either itself or through affiliate companies.

Cairo Water Supply Company and Cairo Sanitary Drainage Company are responsible for operation and maintenance of water supply and sewerage facilities in Cairo and Qalyobia. Accordingly, Giza Water and Wastewater Company is responsible for operation and maintenance of sewerage system and water supply system located in Giza, Sixth October, and Helwan Governorates and Abu Rawash WWTP falls under its responsibility.

Egyptian Environmental Affairs Agency (EEAA) under the Ministry of State for Environmental Affairs, is responsible for formulation of environmental policies, preparation of necessary plans for environmental protection and environment development projects, and monitoring of environment.

(B) Legal Framework of EIA

To protect air, water and land environment quality, several Laws have been formulated by Egyptian Government, of which few are listed below in Table S-1.

Table S-1 Laws Related to Environmental Sector

Laws and Year	Main Issues	Decrees Regulations	Implementing Agency
Law No. 4 on Environment (1994)	Establishment of EEAA and Environmental Trust Fund; Requirement of EIA; Regulation on air environment pollution, water environment pollution, and land environment pollution	Decree No. 338 of 1995 (Executive Regulation)	MSEA; EEAA
Law No. 48 on Protection of Nile and its Waterways against pollution (1982)	Control of pollution of surface waters. This law concerns the protection of the river Nile and other waterways from pollution	Decree No. 8 of 1983 (Setting standards for wastewater discharges to surface waters and Compliance Monitoring by MOHP)	MWRI
Law No. 93 and Decree No. 44 on Wastewater and Drainage (1962)	Control of domestic and industrial wastewater discharges and drainage to public sewers. Decree No. 44 defines laws related to application and request for wastewater services; connection to networks; waste drainage permit; Effluent standards for wastewater draining to public sewers; criteria for reuse of treated effluent and safe reuse of sludge.	Decree No. 643 of 1962 (Standards for wastewater discharges to public sewers) Amended by Decree No. 44 of 2000	MOHUUD

Laws and Year	Main Issues	Decrees Regulations	Implementing Agency
Law No. 102 on Natural Reserves (1983)	Designation and management of natural reserves	Decrees designating sites	MSEA; EEAA
Law No. 10 on Expropriation of Real Estates for Public Interest (1990)	Defining public interest, Assessment of real estates and evaluation of indemnification, Contestation and opposition, and Temporary appropriation of the real estates		Egyptian Authority for Land Surveying (ESA); and MOHUUD

(C) EEAA Guidelines for EIA

According to EEAA Guidelines, the projects are categorized under one of the three categories (Category A, B, or C) according to severity of possible environmental impacts. Category A (White) projects are believed to have little or no negative impact on environment whereas category C (Black) projects are likely to have significant negative impact on environment and therefore category C projects require full EIA, i.e. preparation of EIA report and getting approval of EEAA on it.

Project under this Study is proposed to have a capacity of 1.2 million m^3/day and that is much more than population equivalent of 1 million and therefore falls under category C (Black). Therefore, full EIA is carried out for this Project.

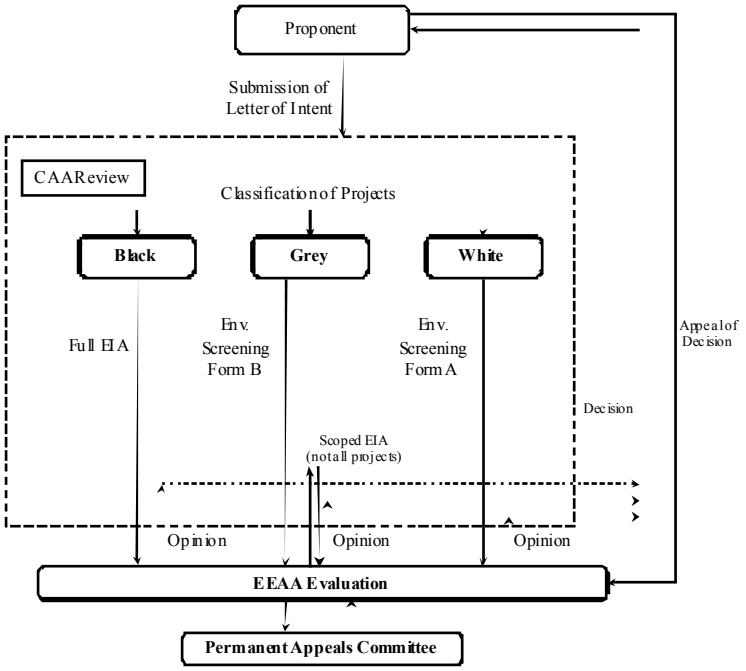


Figure S-1 EIA Procedure through EEAA Guidelines

(3) Project Description

On completion of ongoing works, total treatment capacity of Abu Rawash WWTP will reach 1.2 million m^3/day (primary treatment). Hence, secondary treatment facilities are needed to improve water quality environment of the receiving water bodies. Also, significant increase in sludge volume is expected and additional sludge treatment facilities would be required to handle increased sludge. Considering existing conditions and priorities of CAPW, secondary treatment facilities and extension of existing sludge lagoons are proposed, and components are listed below.

Table S-2 Proposed Project Component

S. No.	Facilities / Dimensions / Specifications	Number of Units
1.	Aeration Tank	
1-1	Rectangular Tank W10m×L162m×D6m (9,315m^3)	24 tanks (4 tanks×6 series)
1-2	Membrane Panel Aerator	24 tanks
1-3	Air Blower 260 m^3/min × 380kW	9 nos. (3 standby)
2.	Final Settling Tank	
2-1	Circular Tank Dia 51m × D3.5m (7,151m^3)	24 tanks (4 tanks × 6 series)
2-2	Clarifier Dia51m × D3.5m × 3.7kW	24 nos.
2-3	Return Sludge Pump 34.7m^3/min × H6m × 55kW	24 nos.
2-4	Waste Sludge Pump 5.2m^3/min × H10m × 15kW	12 nos. (6 standby)
3.	Chlorine Contact Tank	
3-1	Rectangular Tank W5m × L90m × D3m (1,350m^3)	3 tanks
3-2	Chlorine Cylinder 1ton	42 nos.
3-3	Water Supply Pump 4.0m^3/min × H40m × 45kW	6 nos. (3 standby).
4.	Sludge Transfer	
4-1	Sludge Pump 22.8m^3/min × H80m × 450kW	2 nos.
5.	Sludge Lagoon	
5-1	Sludge Lagoon (expansion)	183 ha.

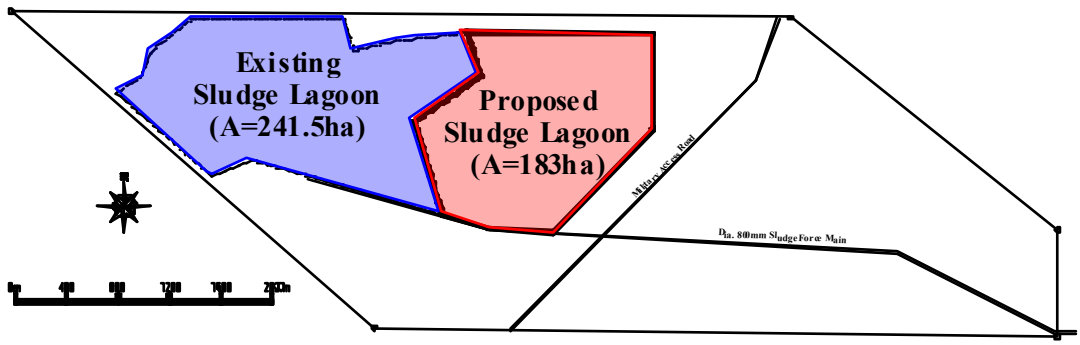


Figure S-2 Existing and Proposed Sludge Lagoon

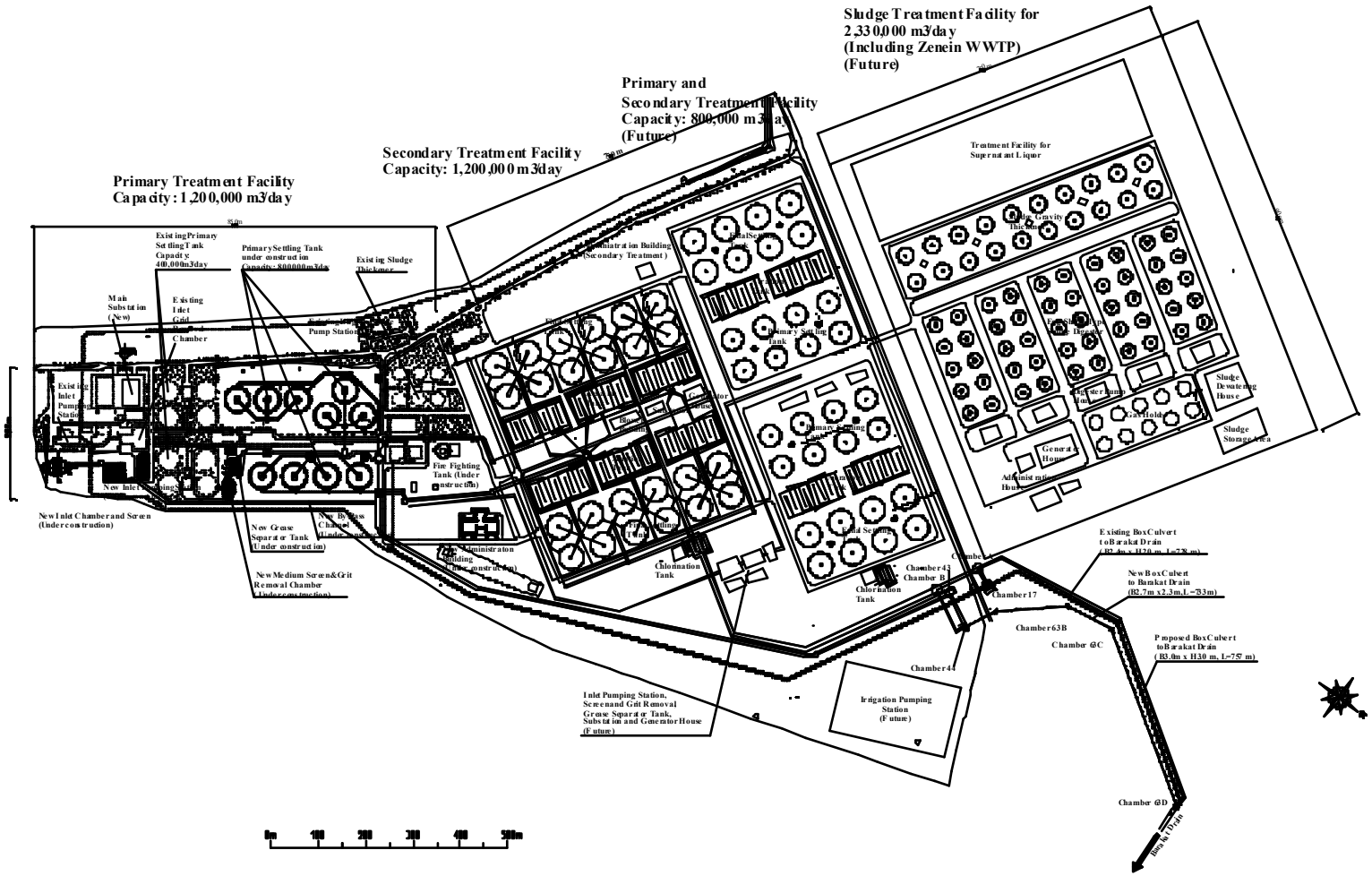


Figure S-3 Existing and Proposed Wastewater Treatment Facilities at Abu Rawash WWTP

(4) Baseline Environmental Data

(A) Physical Environment

The area proposed for construction of secondary facilities of wastewater treatment is located within the boundary of existing Abu Rawash WWTP that is located in the northwestern part of Greater Cairo away from the populated city area. The sludge lagoons are located in the desert further west of Abu Rawash WWTP and in south of Cairo Alexandria desert highway.

Topographic Features:

Abu Rawash WWTP is on the western edge of the Nile delta located in northwest of Greater Cairo. In the east and north side of Abu Rawash WWTP, the topography of the land is relatively flat (altitude ranging from 10 to 20m) and the area slopes gently towards the Nile River. On the other hand, south and west side of Abu Rawash WWTP is occupied by high altitude lands. The land within the fence of Abu Rawash WWTP belongs to the HCWW and therefore no land acquisition will be required for any facilities proposed to be constructed within the fence.

Sludge lagoons are located at about 8 km from the desert highway, and the distance between the cottages of the development zone and the lagoons is not less than 3 km along straight line. The altitude of the sludge lagoon is slightly lower than 100 m in desert area and the northeast and southwest area has slightly higher altitude (more than 120 m). The area surrounding existing sludge lagoons is owned by the HCWW and is not yet used. Therefore, for the construction of proposed additional lagoons, land acquisition would not be required.

Geological Features:

The geology of the desert area of the west side of WWTP and the Sludge Lagoon site is Tmlkh (Lower Miocene, Vividly colored sands and gravels, with silicified tree trunks and Scutella remains), and ToB (Oligocene, Basalt Flows) and ToO (sands and sandstones with clay) are distributed over in the lower layer.

It is reported that, in the area of Abu Rawash WWTP, the formation of in-situ strata is composed of alluvial and diluvial deposits known as river Nile deposits overlying the

bedrock of the calcareous sand, which is a part of Gabal Abu Rawash. The diluvial deposits consist of gravels, coarse sands and clays which are frequently interbedded with outwash.

The groundwater table in the sludge lagoons area lies in the range of 50 to 100 m below the ground surface. Its neighboring area is covered by tertiary sediments, which include formations of considerable porosity such as sands, gravels and sandstone.

Climate:

Cairo experiences a mixture of Mediterranean and desert climates. There are frequent occurrences of wind storms, bringing Saharan dust into the city during the months of March and April. Cairo has two seasons: approximately eight months of summer and four months of winter. In the hottest of the summer months – June, July, and August – the average daily maximum temperature is 34.4°C, and the average daily minimum is 20.8°C. In winter, the average daily maximum temperature in January–February is 19°C, and the average daily minimum is 7.7°C. The average minimum and maximum of humidity is 47% and 64%, respectively. Average annual rainfall is 19.3 mm/year. During April to November winds blow predominantly from the northwest and northeast, and during December to March southerly winds blow. The maximum of average daily evapotranspiration is 8.5 mm/day in June, and the minimum is 2.1 mm/day in January.

Water Pollution:

Based on the collected data and result of the water quality survey undertaken in this Study, it is reflected that the water quality (in terms of BOD) of the effluent receiving drain is not good and significant level of pollution occurs due to discharge of partially treated/untreated wastewater in Barakat and other drains of the network. The trends of data obtained from different sources are similar (Figure S-4) with BOD level higher that defined standards in all cases.

Under this Study, water quality test was also undertaken to understand the level of heavy metals in raw wastewater to WWTP, treated effluent from WWTP, and water in drains. From the results, it was clear that neither wastewater flowing into Abu Rawash WWTP, treated effluent from this WWTP, nor the water in drains is contaminated due to the heavy metals or toxic elements.

From collected data, it is understood that water quality of groundwater obtained from the wells in the neighboring area of Abu Rawash WWTP is good. Based on the information gathered through site visits and personal inquiries, it is learnt that near sludge lagoons the groundwater is obtained in wells at a depth greater than 150 m. The water was tasteless and odorless when tasted from a well in field, however, it was felt to have high hardness and therefore unsuitable for drinking.

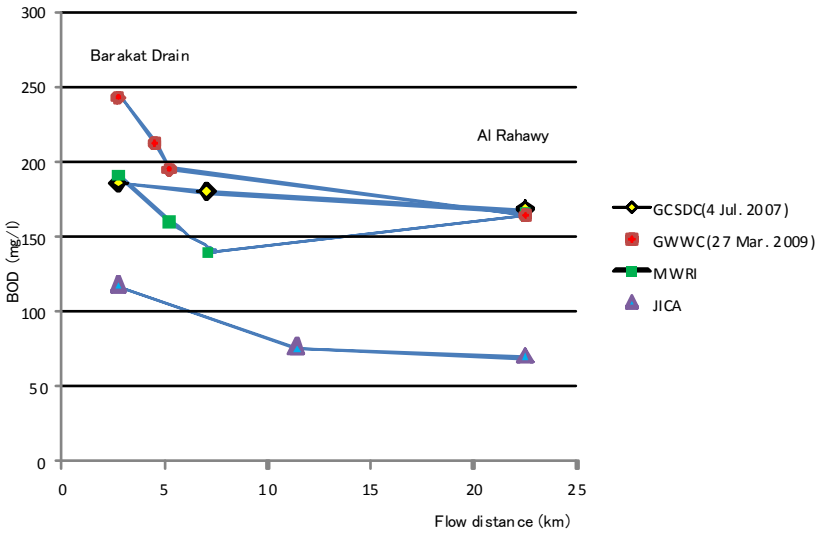


Figure S-4 Existing BOD Level in Drain Networks

Air Pollution:

Since Abu Rawash WWTP is situated at the end of development zone and sludge lagoon is located outside the development zone, it is understood that the level of air pollution in these locations is not worse compared to that at Giza monitoring station.

Noise:

In the Abu Rawash WWTP and its neighborhoods, sources of large noise do not exist. In the neighborhoods of the sludge lagoon, only farms (plantation) are distributed, and the area does not include any fixed noise source.

Odor:

Under this Study, the odor measurement investigations were conducted at three locations

namely, sludge pumping station of the Abu Rawash WWTP, sludge lagoon, and Al Rahawy drain at Nikla. Based on the result of survey, it is observed that at sludge pumping station, odor concentration in the emission from source is high, however, no odor related to sludge is perceived near the boundary of Abu Rawash WWTP. Odor diffusion into air from source can be reduced by improving the existing open inflow pit structure into closed type facilities. In case of sludge lagoons, during sludge drying odor is generated and it can be felt very strong just near the bank of the drying beds. However, in cases when the distance to drying beds gets longer, the intensity of odor decreases significantly. In the case of survey results at Nikla, high level of hydrogen sulfide is observed due to siphon action and lowering of pressure in the outlet, leading to the occurrence of odor problem.

(B) Biological Environment

Natural Preserve Area:

El Hassana Dome Protectorate is located in Giza Governorate. However, there is sufficient distance between this protected area and Abu Rawash WWTP and sludge lagoon, and the implementation of this project is not expected to have any impact on this area. Also, none of the important bird areas are located near proposed site of either secondary treatment facilities or sludge lagoons and therefore the project implementation is not expected to have any negative impact on important birds.

Flora and Fauna:

Proposed site for secondary treatment facilities, in the existing condition, is occupied by the old sludge drying beds (not in operation any more), and flora and fauna do not exist in the proposed site. The effluent receiving water bodies from Abu Rawash WWTP is not suitable for flora and fauna in the existing condition. Therefore, it is judged that proposed project shall not have negative impact on any flora and fauna in the effluent receiving water bodies. The sludge lagoon site is considered to be an artificial favorable environment instead of desert environment, and it is judged that there are no flora and fauna which should be considered to have potential negative impact at the sludge lagoon site.

(C) Socio-economic Environment

Population:

Population in Greater Cairo is expected to increase from 12.4 million in 2006 to 25.4 million in 2037.

Table S-3 Projected Population of Greater Cairo

District Name	Population (thousand persons)			
	2007	2017	2027	2037
East and South Nile	7,123	9,615	11,415	13,552
West Nile	4,148	5,684	6,789	8,109
Helwan	854	1,175	1,369	1,596
Shobra El-Kheima	1,176	1,593	1,857	2,165
Total	13,302	18,066	21,430	25,422

Socio-economics of Giza Governorate:

GDP per capita (per capita gross domestic product) of Giza Governorate is slightly smaller (about 13%) compared to the national average value. The labor force (% of total population) is 30.9% which is almost at the same level as national value. The ratio of poor person to the total population is 13.1%. The unemployment rate of Egypt is high and has reached to 9.3%. The level of public services in terms of electricity and water supply are high in general. However, sufficient services are not offered in sanitation sector and especially the service level is low in rural area. In Giza Governorate, only 35% of rural households and 92% of urban households have access to sanitation. The condition of service level in health sector in Giza Governorate is better than the national average.

Table S-4 Socio-economic Parameters for Cairo and Giza Governorates

Items		Egypt	Cairo Governorate	Giza Governorate
GDP per capita (LE)	2005/06	6,371.7	6,156.5	5,552.0
Poor persons (of total population %) Actual	2004/05	19.6	4.6	13.1
Labor force (15+) (% of total population)	2005	30.2	33.1	30.9
Unemployment rate (%)	Total 2006	9.3	11.0	-
Households with Electricity (%)	2006	99.3	99.5	99.6
Households with access to Piped water (2006)	Urban	98.8	99.2	99.42
	Rural	92.9	-	96.95
Households with access to Sanitation (2006)	Urban	82.5	98.2	91.8
	Rural	24.3	-	35.1
Health units per 100,000 population	2005	3.8	6.2	5.1
Life expectancy at birth (years)	2006	71.3	71.4	69.1

Cultural Heritage:

Abu Rawash WWTP is located at a distance of about 12 km from the Memphis and its Necropolis (one of the World Heritages in Egypt). Therefore, it is judged that implementation of the project shall not cause any negative influence on these heritages. Sludge lagoon is located further 35 km away from Abu Rawash WWTP, and implementation of sludge lagoon extension is not expected to have any negative influence on the tourist industry.

Transportation:

From the desert highway, there exists a road through which one can reach Abu Rawash WWTP travelling straight through a distance of about 3 km. The width of the road is about 7 m, and it is paved road of single-sided one lane. Although the road is paved, the road shoulder and pedestrian walkways are still in the form of sand, and therefore it is anticipated that while large-size trucks pass each other, significant amount of particulate matters will be generated. Moreover, considering width of road great caution shall be required while large and heavy vehicles are passing each other.

(5) Analysis of Alternatives

(A) With and Without Project

Pollution Load Discharged into Effluent Receiving Water Bodies:

The Wastewater of Abu Rawash WWTP is discharged into Barakat Drain, which flows through a series of drains namely Al Ramal, Muheit, and Al Rahawy, and finally it is flowing into Rosetta Branch of River Nile. The discharged pollution load into the effluent receiving water bodies is classified into three regional distributions: from Abu Rawash WWTP, in the upper stream networks, and in catchment area of the effluent receiving water bodies downstream of the Abu Rawash effluent confluence. The discharged pollution loads for these regions are presented below. As shown in Table S-5, effect of this Project in terms of BOD load reduction is significant.

Table S-5 Discharged Pollution Load into Effluent Receiving Water Bodies

Name of Location		Discharged Pollution Load into the Effluent Receiving Water Bodies (BOD ton/day)		
		Existing	Future (Without Project)	Future (With Project)
1.	Abu Rawash WWTP	99.1	117.6	24.0
2.	Al Beeny	15.6 [1]	0.0	0.0
3.	Muheit	8.8	8.8	8.8
4.	Al Ganabia Al Yomna	1.7	1.7	1.7
Sub-total of Upper Stream (②, ③, ④)		26.1	10.5	10.5
-	Catchment area of the effluent receiving water bodies	0.0 [2]	1.2	1.2
Total		125.2	129.3	35.7
		100%	103%	29%

Note:

1. It is presumed that all pollution loads is due to overflow from the South Muheit Pump Station.
2. The septic tank with leaching system is used in this area for discharging human waste and domestic wastewater, and it is assumed that only little of pollution load is discharged into drain networks.

The pollution load from the sewerage facilities (Abu Rawash WWTP and South Muheit Pump Station) contributes about 92% of the total pollution load discharges in the drain networks, and hence is expected to have significant impact on the water quality in the drain networks.

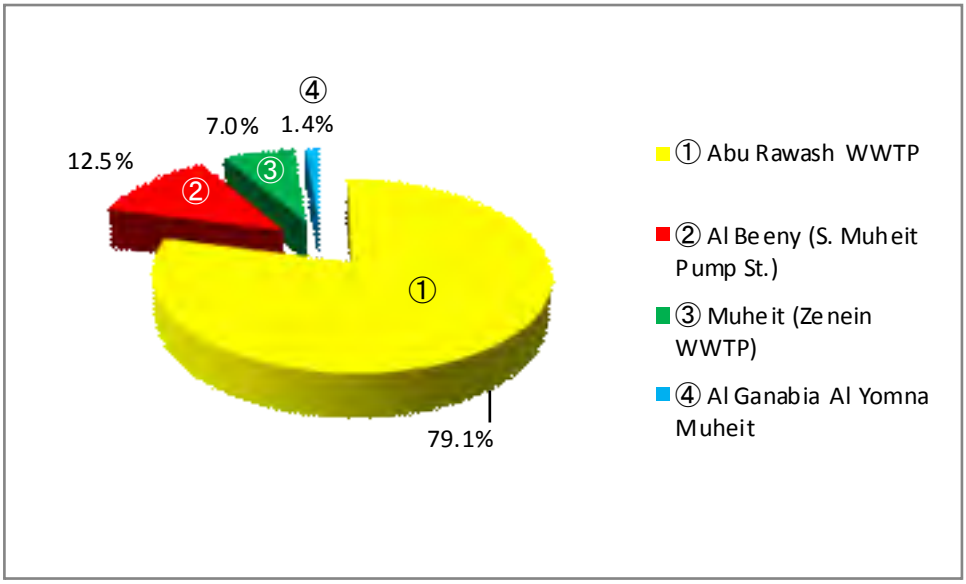
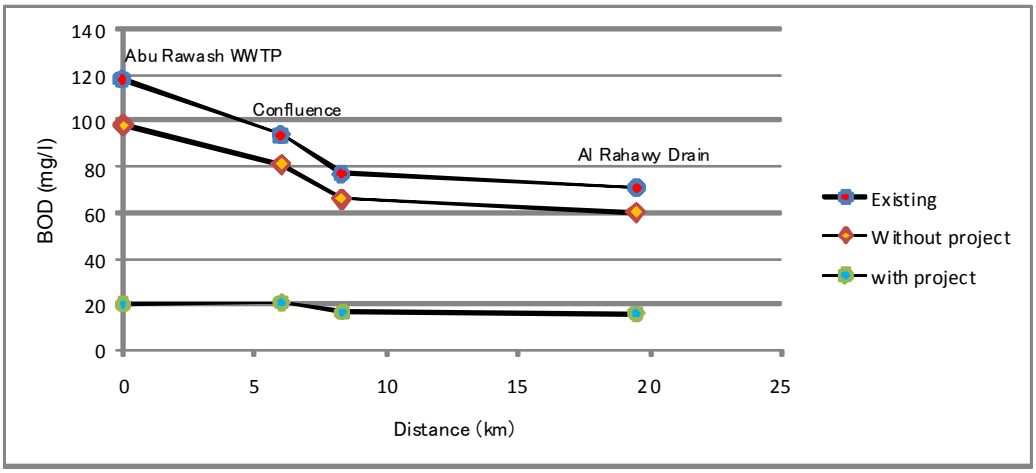


Figure S-5 Distribution Ratio of Discharged Pollution Load (Existing)

Approximate Water Quality Simulation:

Approximate estimates of water quality in terms of BOD load has been carried out based on the available information. The results of approximately simulated water quality in the effluent water bodies are shown in Figure S-6 below. BOD level in case of Without Project is lower than Existing case because in the existing condition, although the total inflow to Abu Rawash WWTP is about 850,000 m^3/day, only half of it is primarily treated and the remaining is discharged untreated. However, in case of Without Project, the total flow of 1.2 million m^3/day shall be treated to the primary level and hence BOD level would be lower in this case.



Notes:
Existing: Total wastewater volume is 850,000 m^3/day, (of this primary treatment is carried out for approximately 450,000 m^3/day)
Without project: Total wastewater volume is 1,200,000 m^3/day (Primary treatment)
With project: Total wastewater volume is 1,200,000 m3/day (Secondary treatment)

Figure S-6 Approximate BOD Levels based on Simulation

Discharged Pollution Load into Rosetta Branch:

Based on the result of pollution analysis, it is expected that following improvements, listed in Table S-6 below, will result upon the implementation of secondary treatment facilities at Abu Rawash WWTP.

Table S-6 Result of Analysis of Alternatives: With and Without Project

Items	Present Situation	Future Situation	
		Without Project	With Project
Discharged Pollution Load into the Rosetta Branch (BOD)	107 ton/day	108 ton/day	29 ton/day
Water Quality in Al Rahawy drain (BOD)	71 mg/l	60 mg/l	16 mg/l

Items	Present Situation	Future Situation	
		Without Project	With Project
Comparison to water quality standard of the maximum limits for re-use of treated effluent (Decree No.44 of 2000)	Exceeds the standard	Exceeds the standard	Within the standard
Comparison to effluent limits for treated discharges into water bodies (Decree No.8 of 1983)	Exceeds the standard	Exceeds the standard	Within the standard
Odor problem in Nikla	Continues	Continues	Resolves

(6) Impact Identification and Mitigation Measures

(A) Impact Identification

Potentially significant impacts of project implementation have been identified considering project components, stages, impact generating activities and type of impact. Matrix has been prepared for construction and operation stages including the environmental factors likely to be affected, and the activities responsible for this. During the construction stage, the main elements of environment that are expected to have minor impacts include air pollution, noise and vibration, and traffic/public facilities. During the operation stage, offensive odor could be caused. All these impacts could be mitigated through appropriate countermeasures.

(B) Foreseeable Adverse Impacts

The adverse impacts have been classified under two categories, namely construction stage and operation stage. Impacts during construction stage may be regarded as temporary or short-term whereas those during operation stage are likely to have long-term effects. The environmental impacts have been discussed separately for the construction stage and the operation stage.

At the construction stage, impacts could be in terms of noise, vibration, increased traffic, dust and solid waste disposal. All these impacts could be mitigated through proper mitigation management at construction stage.

During the operation stage of WWTP, major impacts could be in the form of presence of heavy metals in treated effluent and sludge. Also, the odor and flies problems are expected near the sludge lagoons. These impacts can also be mitigated through monitoring and implementing countermeasures.

(C) Mitigation Measures

Major impacts are not expected either at construction stage or operation stage and only minor impacts are envisaged. These impacts could be mitigated or minimized through measures undertaken during construction and operation stages of the proposed Project. These measures have been discussed in detail in Main Report.

(7) Environmental Management Plan

(A) Risk Analysis and Mitigation Plan

Power Supply: The countermeasures should be planned for power failure and should include alternative sources of power supply either from transmission lines or standby generator.

Electrical and Mechanical Equipment Failure: Provision of spare parts and stand-by facilities at site, and O & M instructions and manuals for emergency should be provided at WWTP.

Chlorine Gas Leakage: In WWTP, chlorine gas is planned to be adopted for disinfection and it is necessary to always store sufficient quantity of the chlorine gas to be used for disinfection. Consideration should be given to equip the storage structure such that chlorine gas does not leak outside of the storage room even in case of leakage from gas cylinder and safety should be ensured.

Heavy Metals and Toxic Substances: To control the inflow of heavy metal and toxic substance into the sewerage system

- Database should be prepared for all the industries in the service area
- Periodical water quality analysis of effluents and the reporting of the result should be made compulsory for the industries discharging effluent into sewerage networks
- Provision should be made for administrative guidance on industrial wastewater management

(B) Environmental Mitigation Plan

It is recommended to establish a staff structure within the implementing agency that should be responsible for implementing the measures against potential negative impacts. In case of the adverse impacts during construction stage, a building constructor shall carry out the measures on the basis of directions of CAPW which is responsible for construction management. CAPW shall be responsible for making decision on important issues. During the operation stage, GWWC shall carry out mitigation measures against negative impacts.

(C) Environmental Monitoring Program

Construction Stage:

During construction stage influence will be short duration and therefore it is important to have measurement result sooner rather than caring for the level of accuracy and accordingly measurement methods should be selected. Air quality and noise level are important parameters that should be monitored during construction stage mainly along the access road and at construction site. The monitoring program for construction stage is given below.

Table S-7 Monitoring Program for Construction Stage

Object		Monitoring Point	Parameters	Frequency
Air Pollution	Air quality	Access road and Construction site	Particulates	Arbitrary number of times during the construction period
Noise	Noise	Access road and Construction site	Noise (maximum level)	Arbitrary number of times during the construction period

Operation Stage:

In the operation stage it is required to evaluate the level of influence and make any judgment based on environmental standards. Also, it is required to find out if any new negative impact has come up during operation stage. Therefore, measuring method is selected considering sufficiency in terms of accuracy and its simplicity in use. In case when new influence is expected in future, the measuring method should be improved based on the need of new impacts and desired accuracy or measured parameters. The main items that should be monitored during operation stage at WWTP include influent and effluent quality

level, noise, and odor near sludge pump station. In case of sludge lagoon, the monitoring parameters include odor, groundwater quality in the neighborhoods of sludge lagoon, number of flies, dried sludge quality, and meteorological data. Monitoring program for operation stage is listed below.

Table S-8 Monitoring Program for Operation Stage

Object		Monitoring Point	Parameters	Frequency
Water Pollution	Water quality (Influent and Treated Wastewater)	Inlet/Outlet	pH, Temperature, BOD_5, COD_{Cr}, Total Suspended Solids (TSS), Total Coliforms, Fecal Coliforms, Total Dissolved Solids (TDS)	Daily measurement should be carried out for those parameters that are important for normal operation of wastewater treatment process.
			Oils and grease, Number of enteric nematode cells or eggs, Sodium Adsorption Ratio, Chlorides, Bromides, Cadmium (Cd), Lead (Pb), Copper (Cu), Nickel (Ni), Zinc (Zn), Arsenic (As), Chromium (Cr), Molybdenum (Mo), Manganese (Mn), Iron (Fe), Cobalt (Co)	Four times a year
Noise	Noise	The exterior of the blower facilities WWTP Site boundary	Noise (maximum level)	Four times a year
Odor	Odor	Sludge pump station of Abu Rawash WWTP and site boundary	<Precise measurement> Olfactory measurement Hydrogen sulfide Ammonia	Two times a year for precision measurement
		Sludge lagoon and site boundary	<Simplified measurement> Hydrogen sulfide	Once every month for simplified measurement
Groundwater Contamination	Water quality (Well water)	Irrigation well for plantation in the surrounding area of sludge lagoon	pH, Temperature, BOD_5, COD_{Cr}, Total Suspended Solids (TSS), Total Coliforms, Fecal Coliforms, Total Dissolved Solids (TDS), Oils and grease, Number of enteric nematode cells or eggs, Sodium Adsorption Ratio, Chlorides, Bromides, Cadmium (Cd), Lead (Pb), Copper (Cu), Nickel (Ni), Zinc (Zn), Arsenic (As), Chromium (Cr), Molybdenum (Mo), Manganese (Mn), Iron (Fe), Cobalt (Co)	Two times a year
Noxious insect (fly)	Number of individuals	Sludge lagoon and site boundary	Number of individuals measurement by a fly trap	The accumulated number of trapped flies should be counted once every month

Object		Monitoring Point	Parameters	Frequency
Dried Sludge	Sludge Quality	Dried sludge from sludge lagoon	Zinc, Copper, Nickel, Cadmium, Lead, Mercury, Chromium, Molybdenum, Selenium, Arsenic	Two times a year
Meteorological observation	Meteorological observation	Sludge lagoon	Temperature, rainfall, moisture content, wind speed, wind direction, duration of sunshine, evapotranspiration, etc.	Daily measurement

In long run, establishment of an administrative unit is required in order to carry out the above monitoring. This unit is called Monitoring Management Group (MMG) in this report. The MMG shall consist of organizations relevant to sewerage system, organization which is in charge of environmental management, organizations which manage the water bodies, and local administrative organizations and residents.

(8) Public Consultation

CAPW with assistance from JICA Study Team organized a Public Consultation on 19th December 2009 to solicit the views of all stakeholders concerned or likely to be concerned with the Abu Rawash WWTP Improvement Project. Participants were invited from a wide range of stakeholders including the project developers/sponsors, competent ministries and local authorities, local council, parliamentarians, private sector NGOs/CBOs, researchers, local communities, the media and other interested parties. The total number of participants was more than 50, in addition to CAPW senior managers and members of JICA Study Team. Abu Rawash WWTP General Director, other managers, technicians and staff also participated in the consultation. The participants were categorized into three focus groups.

The meeting included Plenary Session I, Working group sessions, and Plenary Session II. The plenary session I comprised of the introductory speech by CAPW giving an overview of the project in stages, presentation of the JICA Study Team briefing the audience on the proposed improvement project, and visit to the site of Abu Rawash WWTP. It was followed by the Working Group Sessions in which the participants were divided into three focus groups. Focus Group I (WWTP Staff), II (Experts) and III (community) were provided with questionnaires to guide them in their deliberations and to fill up on individual basis. The form filled up by Group I members was compiled by the consultant. Group II and Group III selected a moderator and a rapporteur. Discussions were smooth and interactive. Members

of the current WWTP project team and CAPW officials were represented in each group to clarify issues, as warranted. Their reports were read by their respective rapporteur in the Plenary Session II. The meeting ended with the concluding remarks by CAPW.

In the meeting, unanimous agreement was obtained regarding the importance and priority of the proposed project. It was observed that no one is against the improvement of Abu Rawash WWTP as proposed in this Study.

There was no resistance about the positive impact of the proposed project with regard to reducing health hazards, allowing certain cultivations, especially fish farming, reducing water pollution along drainage networks, etc. However, the possibility of inconvenience to people living in the neighborhoods of WWTP during construction stage in the form of high vehicle traffic, increased dust in air, noise, etc. were raised. Also, during the operation stage, the occurrence of negative impacts such as bad odor, increased insects, etc. were raised during the meeting. Mitigation measures for these negative impacts have been described and discussed in detail in this Report. Also, monitoring for these impacts has been proposed.

It was also suggested to raise the awareness of farmers who use treated effluent or raw wastewater for irrigating crops assuming it to be more fertile in order to avoid health hazards due to fruits, vegetables and other crops grown by such farmers.

Attention was also drawn towards the establishment of improved sludge treatment facilities as soon as possible and to avoid long term use of sludge lagoons. The JICA Study Team has also recommended in the same direction.

Mitigation measures for most of the raises issues have already been included in this Report. Also, monitoring of parameters to check the severity of negative impacts have been formulated and proposed.

(9) Conclusion

For proposed project components in this Study, the main points that need consideration while carrying out environmental impact assessment include any occurrence of resettlement, presence of any source of secondary contamination such as heavy metals or toxic substances, and damage or loss of cultural assets or historical heritage. Proposed sites for project in this Study belong to HCWW, therefore, it is not necessary to acquire any new

land and hence resettlement will not occur. Based on the result of survey and collected information, it is judged that the effluents from wastewater treatment plant cannot become a new contamination source. The implementation of projects proposed under this Study is not expected to cause any negative impact on cultural assets and historical heritage.

According to the Egyptian EIA regulation, this project is categorized as "Black" (Category C) considering the scale of project (objective population is more than 1 million). However, considering the regulations of JBIC Guidelines, it is judged that the project is under Category-B.

There are some items that require careful examination during the construction and operation stages. During construction, the attention is required towards the influence of traffic due to heavy vehicles carrying construction materials in and out of the construction site on air and noise pollution. Also, proper disposal of solid waste generated during construction is needed. During the operation stage, adverse impacts such as generation of odor from sludge lagoon and increase in number of flies could be expected and attention should be paid towards mitigation of these problems.

With the mitigation of adverse impacts, this project is expected to have potential benefits in terms of improved water quality of effluents and improvement of living environment in the neighborhoods of effluent receiving water bodies. Hence, it is recommended to undertake this project in the interest of environment and living conditions of the residents in the area.

CHAPTER 1 INTRODUCTION

1.1 Background

Population of Greater Cairo was estimated to be 12.4 million in 2006. The total wastewater generation from the area in 2008 was estimated to be 4.8 million m^3/day, and out of this the treatment capacity is reported to be available for only 4.1 million m^3/day. Also, some of the existing sewerage facilities do not function as designed because they are old. Consequently, considerable amount of untreated sewage is discharged to water bodies resulting into water pollution in these water bodies. The population in the area is expected to continuously increase and reach 25.4 million in 2037 (almost twice the population in 2006). Wastewater generation in 2037 is estimated to be 8.7 million m^3/day mainly attributed to increased population and industrial wastewater. To handle the collection and treatment of increased wastewater, additional trunk sewers, pumping stations and wastewater treatment plants are needed.

In Greater Cairo, Abu Rawash WWTP is located in the west bank region of Nile River and is supposed to treat wastewater collected in the west bank area. The treatment capacity of this WWTP, as of August 2009, is 400,000 m^3/day. However, the current inflow to this WWTP has reached almost 1.1 million m^3/day and the flow exceeding treatment capacity is discharged to Barakat drain without any treatment. To improve this condition, CAPW began working on the extension of this plant in 2006 to increase its primary treatment capacity by additional 800,000 m^3/day. The extension is expected to complete in the beginning of 2010 and new primary treatment facilities is expected to start working. However, the level of treatment shall continue to be primary. As a result, the effluent will not be able to meet the effluent standards and its impact on water pollution will be left unsolved.

Considering these circumstances, JETRO conducted feasibility study (JETRO F/S) based on the request of the Government of Egypt. JETRO F/S proposed the construction of secondary treatment facilities with a capacity of 1,200,000 m^3/day and sludge treatment facilities and investigated whether JICA ODA Loan was appropriate. It also revealed that EIA (Environmental Impact Assessment) report and its approval is required according to the relevant Laws of Egypt.

Based on this background, JICA decided to conduct this Study including the preparation of EIA report and providing assistance for its approval. This Study also includes necessary

data collection and analysis for preparation of concrete concept of the future project to be financed by JICA.

As a part of this Study, the Environment Impact Assessment report is prepared and presented in this Volume of the Report. For this purpose, baseline data on existing physical, biological, and socio-economic environmental conditions are gathered and included in the EIA report. Also, identification has been made of various negative impacts during construction and operation stages of the proposed project. Mitigation measures have been suggested and environmental management plan is prepared and presented. To explain the contents of this Project to the stakeholders and to gather their opinion, it is planned to organize Stakeholders Meeting as a part of the EIA. Based on the findings and analysis, this Report is prepared and is organized into Chapters comprising Introduction, Legal and administrative framework, Project description, Baseline of environmental data, Analysis of alternatives, Impact identification and mitigation measures, Environmental management plan, Public consultation, and Conclusion.

1.2 Objective of the Environmental and Social Impact Assessment Study

The purpose of the Environmental and Social Impact Assessment Study is to ensure that proposed project components are environmentally and socially sound and sustainable and that the environmental consequences of the project are recognized at early stage and taken into account in the project design.

The major objectives of this part of the Study are to establish baseline data on environmental and social conditions of the project area, to predict the impacts on relevant environmental and social attributes due to the construction and operation of the proposed wastewater treatment facilities and sludge treatment facilities, to suggest appropriate and adequate mitigation measures to minimize/reduce adverse impacts, to prepare environmental mitigation and monitoring plan, to organize public consultation, and to prepare an EIA report to be submitted to EEAA by CAPW for approval.

The works to be carried out under Environmental and Social considerations procedure by the Study team includes following major activities:

1. Providing assistance in the preparation of EIA Report
2. Providing assistance in holding public consultation at scoping stage
3. Providing assistance in preparation of land acquisition and resettlement plan,

if required

4. Preparation of environmental check list

The outcome of these activities shall be included in the Environmental Impact Assessment Report.

1.3 Report Structure

This is Volume II of the Report prepared specially for use by the CAPW. The CAPW can submit it to EEAA and get approval for implementation of this Project. The Report includes information on Legal and administrative framework, Description of proposed project, Baseline data on physical, biological and socio-economic environment, Analysis of alternatives, Identification of impacts during construction and operation stages and related mitigation measures, Environmental management plan including mitigation and monitoring, and Public consultation.

CHAPTER 2 LEGAL AND ADMINISTRATIVE FRAMEWORK

2.1 Administrative Framework

Ministry of Housing, Utilities and Urban Development (MOHUUD) is responsible for sewerage systems at national level. Under this Ministry there are two organizations, i.e., the Construction Authority for Potable water and Wastewater (CAPW) and National Organization for Potable Water and Sanitary Drainage (NOPWASD) and these organizations are responsible for water supply and sewerage systems. The CAPW is responsible for planning, design and construction of municipal drinking water supply systems, and sewerage system to facilitate water supply and sewerage services for Governorates constituting Greater Cairo and town of Alexandria. Similar function for the remaining part of Egypt is carried out by NOPWASD. An additional organization namely Holding Company for Potable Water and Wastewater (HCWW) is established to hold water supply and sewerage assets.

For operation and maintenance of water supply and sewerage facilities, water companies are established district-wise. Cairo Water Supply Company and Cairo Sanitary Drainage Company are responsible for operation and maintenance of water supply and sewerage facilities in Cairo. Accordingly, Giza Water and Wastewater Company is responsible for operation and maintenance of sewerage system and water supply system located in Giza, Sixth October, and Helwan Governorates and therefore Abu Rawash WWTP falls under its responsibility.

A regulatory agency was created in 2004 by Presidential Decree No.136 for monitoring the activities of HCWW mainly emphasizing on two aspects, one being economic regulation focusing on water tariff and non-revenue water and another is technical regulation focusing on water quality improvement and capacity development for O&M. The board of regulatory agency consists of Ministry of Housing as the chairman and other members from Ministry of Health, Ministry of Environment, Ministry of Finance, HCWW, CAPW, etc., which is modified according to the needs from time to time.

2.1.1 Construction Authority for Potable Water and Wastewater

The Construction Authority for Potable Water and Wastewater (CAPW) was established in 2005 by Ministerial Decree No. 372 and its main role include preparation of necessary plans and designs for expansion and improvement of the potable water supply and treatment systems and the wastewater collection and treatment systems in Greater Cairo and Alexandria, and implementation of the related approved projects. In addition, CAPW is also responsible for preparing tender documents, tendering, awarding, contracting and supervising the execution of contracts. It is reported that CAPW has realized several projects on water supply and sewerage in several towns including Greater Cairo and it is well capable of implementation and supervising such projects.

To carry out related activities, CAPW comprises following three (3) central departments:

- Planning and Projects Studies
- Execution Affairs
- Financial & Administrative Affairs

CAPW also has 10 advisory departments that directly assist the Director and is listed below:

- Technical
- Information Technology
- Organization & Administration
- Public Relation
- Statistics
- Environment
- Financial Inspection
- Consultants
- Security
- Legal Affairs

The departments responsible for the formation and implementation of projects include "Central Department for Planning and Projects Studies" and "Central Department for Execution Affairs". In "Central Department for Planning and Projects Studies", there are 4 general departments:

- Technical Research
- Designs & Survey

- Property Confiscation & Real Estate Affairs
- Tendering

Any prospective project for improvement of water supply and sewerage services in Greater Cairo and Alexandria City is planned and designed by "Technical Research Department" and "Design & Survey Department". The tendering is executed by "Tendering Department" and if the land required for proposed project belongs to private owners or any other agencies, the land acquisition is undertaken by "Department of Property Confiscation & Real Estate Affairs".

"Central Department for Financial and Administrative Affairs" is responsible for managing the disbursement of Foreign Loans such as JICA ODA Loan. After awarding, the project is implemented under the supervision of "Central Department for Execution Affairs" (by the general department in charge of the project site location).

2.1.2 Holding Company for Water and Wastewater

Holding Company for Water and Wastewater (HCWW) was established in 2004 by Presidential Decree No. 135 with the purpose of holding water supply and sewerage assets. By virtue of this Presidential decree, the Public Economic Authorities and the Public Sector Companies for Drinking Water and Sanitation in several governorates were transformed into affiliates to the Holding Company. Currently, under HCWW there are 26 companies including Cairo Water Supply Company, Cairo Sanitary Drainage Company, and Giza Water and Wastewater Company, and other companies.

The purpose of the Holding Company is to purify, desalinate, distribute and sell drinking water and to collect, treat and safely dispose of wastewater, either itself or through affiliate companies. It also aims at creating, managing and running a portfolio for its shares, bonds, securities and any other tools or financial documents.

HCWW consists of 4 divisions:

- Technical Affairs
- Planning and Research
- Performance Development
- Administrative and Financial Affairs

The divisions of Technical Affairs, and Planning and Research are directed by a Deputy Chairman and assisted by a general department of Internal Audit for Subsidiary Companies. The latter 2 divisions, i.e. Performance Development, and Administrative and Financial Affairs, are directed by another Deputy Chairman. Each of these divisions is further subdivided into several departments to carry out various activities for providing better services to the customers.

Also, there exist 7 advisory departments that directly assist the Chairman in carrying out its duties and responsibilities.

In addition, Consulting Council meeting is held whenever required for discussing on important issues.

2.1.3 Cairo Sanitary Drainage Company

In 2004, Greater Cairo Sanitary Drainage Company (GCSDC) was established for the purpose of operation and maintenance of the wastewater systems in Greater Cairo by Presidential Decree No. 135. GCSDC is administratively and financially under HCWW. GCSDC consists of four divisions:

- Operation & Maintenance
- Technical Affairs
- Quality Management & Audit
- Financial & Administration Affairs

There also exist advisory departments directly assisting the Chairman.

Upon the completion of construction of new facilities in Greater Cairo, the facilities are transferred from CAPW to HCWW, and GCSDC is responsible for the operation and maintenance of these facilities.

In July 2008, GCSDC was reorganized and divided into Cairo Sanitary Drainage Company and Giza Company responsible for sanitation services in their respective areas.

2.1.4 Cairo Water Supply Company

Greater Cairo Water Supply Company (GCWSC) was established in 2004 by Presidential Decree No. 135, for the purpose of operation and maintenance of the facilities for the

potable water supply services in Greater Cairo. GCWSC is administratively and financially under HCWW and expected to have a significant degree of autonomy. GCWSC consists of following 9 divisions:

- Trade
- Administration
- Logistics
- Financial
- 3 divisions of "Production & Distribution" in 3 areas
- Technical Service
- Projects

The first 4 divisions are supervised by a deputy chairman and the latter 5 divisions by another deputy chairman. The "Trade Division" is responsible for the tariff collection, customer database and customer management.

In July 2008, GCWSC was reorganized and divided into Cairo Water Supply Company and Giza Company responsible for water supply services in their respective areas.

2.1.5 Giza Water and Wastewater Company

Similar to GCSDC and GCWSC, for the water supply and sewerage services in Giza Governorate, Giza Water and Wastewater Company was established in July 2008 through Ministerial Decree No. 369 in 2008. Giza Water and Wastewater Company is also under HCWW both financially and administratively. Its role is to carry out the operation and maintenance of water supply and sewerage facilities in Giza, 6th October, and Helwan Governorates.

For the operation and maintenance of existing Abu Rawash WWTP, the responsible agency is Giza Water and Wastewater Company. Hence, it is expected that on completion of the proposed project under this Study, Giza Water and Wastewater Company will carry out O & M of the entire treatment facilities.

2.1.6 Egyptian Environmental Affairs Agency

The Egyptian Environmental Affairs Agency (EEAA) was initially established in 1982 and was restructured according to Law 4/1994 to represent the executive agency of the Ministry

of State for Environmental Affairs. EEAA is responsible for promoting environmental relations between Egypt and other States, regional and international organizations.

The prime function of EEAA is to formulate environmental policies, prepare necessary plans for environmental protection and environmental development projects, to follow up their implementation, and undertake pilot projects.

To accomplish its objectives, EEAA undertakes several tasks. It prepares draft legislation and decrees, state of the environment studies and formulates the national plan for environmental protection and related projects. It is also responsible for setting the standards and conditions to which applicants of construction projects must adhere before working on the site and during operation. It defines the rates and proportions for the permissible limits of pollutants, and periodically collects national and international data on the actual state of the environment and possible changes. It also sets the principles and procedures for mandatory Environmental Impact Assessment (EIA) of projects. EEAA is responsible for preparation of the environmental contingency plan and its implementation. The agency prepares and implements national and international environmental monitoring program, and implements public environmental education and awareness programs. It is also responsible for managing and supervising the natural reserves of specially protected areas and for implementing pilot projects for the preservation of natural resources and the protection of the environment against pollution.

There exists Department of Environmental Impact Assessment under Environmental Management Section of EEAA that includes General Directorates of energy project, touristic projects, agriculture & infrastructure projects, and industrial projects.

2.2 Legal Framework of Environmental and Social Impact Assessment

Experiencing a rapid increase in population and considering limitations of available resources in Egypt, it has become imperative to protect water resources from pollution. To address the protection of water bodies and safeguarding their water quality, the Egyptian Government has formulated and promulgated several Laws. Existing legal framework in Egypt related to environment, is briefly described in this section and some of these Laws are listed in Table below.

Table 2-1 Relevant Laws and Decrees in Environmental and Social Sector

Laws and Year	Main Issues	Decrees Regulations	Implementing Agency
Law No. 4 on Environment (1994)	Establishment of EEAA and Environmental Trust Fund; Requirement of EIA; Regulation on air environment pollution, water environment pollution, and land environment pollution	Decree No. 338 of 1995 (Executive Regulation)	MSEA; EEAA
Law No. 48 on Protection of Nile and its Waterways against pollution (1982)	Control of pollution of surface waters. This law concerns the protection of the river Nile and other waterways from pollution	Decree No. 8 of 1983 (Setting standards for wastewater discharges to surface waters and Compliance Monitoring by MOHP)	MWRI
Law No. 93 and Decree No. 44 on Wastewater and Drainage (1962)	Control of domestic and industrial wastewater discharges and drainage to public sewers. Decree No. 44 defines laws related to application and request for wastewater services; connection to networks; waste drainage permit; Effluent standards for wastewater draining to public sewers; criteria for reuse of treated effluent and safe reuse of sludge.	Decree No. 643 of 1962 (Standards for wastewater discharges to public sewers) Amended by Decree No. 44 of 2000	MOHUUD
Law No. 102 on Natural Reserves (1983)	Designation and management of natural reserves	Decrees designating sites	MSEA; EEAA
Law No. 10 on Expropriation of Real Estates for Public Interest (1990)	Defining public interest, Assessment of real estates and evaluation of indemnification, Contestation and opposition, and Temporary appropriation of the real estates		Egyptian Authority for Land Surveying (ESA); and MOHUUD

2.2.1 Law Number 4 of 1994

Law Number 4 of 1994 constitutes the basic law on environment, and includes laws related to creation and setting the responsibilities of EEAA, laws on establishment of the Environmental Protection Fund and provision of an incentive system for environmental protection efforts by establishments, organizations and individuals. This Law consists of six Parts and altogether 104 Articles are included in these Parts. Preliminary Part (Articles 1 to 18) includes definition of various terminologies used in the Law and describes about the Egyptian Environmental Affairs Agency, its constituents, roles and functions. This Part also explains about Environmental Protection Fund and incentives for environmental protection activities or projects. Part One of the Law (Articles 19-33) defines laws related to Protection of Land Environment from Pollution, Part Two (Articles 34-47) includes laws related to Protection of Air Environment from Pollution. Similarly, Part Three (Articles 48-83)

consists of laws related to Protection of Water Environment from Pollution and Part Four (Articles 84-101) describes Penalties for different cases. Articles 102 to 104 constitute Final Provisions indicating the right to report any violation of the provisions of this Law. Some revision has been carried out in this Law in year 2009 related to Penalty. According to this revision, in Article 84, addition has been made for penalty against violation of Articles 19 and 22.

Article 5 of this Law lists main activities of the EEAA. These include formulation of the general policy and necessary plans for the protection and promotion of the environment and following up the implementation of such plans in coordination with the competent administration authorities.

According to Article 29, it is forbidden to displace hazardous substances and wastes without a license from the competent administrative authority for protection of land environment from pollution. Article 69 of this Law prohibits all establishments to discharge or throw any untreated substances, which may cause pollution along the Egyptian sea shores or adjoining waters either directly or indirectly. Each day of such prohibited discharge shall be considered as a separate violation.

Articles 34 to 47 describe regulations related to pollution of air environment. Article 34 states that the total pollution emitted by all the establishments in one area should be within permissible level. According to Article 36, it is prohibited to use machines, engines or vehicles whose exhaust emissions exceed the limits set by the Law. Article 42 mentions that total sounds emanating from machinery and equipment operation in one area shall be within permissible levels and appropriate machinery and equipment should be selected to ensure this. Article 44 states that establishments shall take necessary measures to maintain temperature and humidity inside the work-place within permissible limits.

This Law also sets the environmental impact assessment requirements for projects in Egypt and also identifies the requirements for establishments emitting pollution, including licensing and registration, record keeping and reporting. Measures concerning the assessment of environmental impact of establishments or projects are described in Articles 19 to 23, 70, 71, and 73 of this Law.

In addition to the Articles, this Law also includes eleven (11) Annexures including information on criteria for liquid wastes to be disposed of in marine environment,

establishments that require evaluation of environmental impact, land birds and animals prohibited to be hunted, the maximum limits of outside air pollutants, permissible limits of sound, permissible limits of air pollutants inside places of work for industries, limits of temperature and humidity, and conditions and limitations of solid waste management, etc. Annexure 1 of this Law defines criteria and specifications for certain liquid wastes when disposed of in marine environment and is presented in Table 2-2.

Table 2-2 Effluent Limits for Liquid Discharges into Marine Environment

Parameter	Upper Limits
Temperature	38°C
pH	6-9
BOD_5	60 mg/l
COD (Dichromate)	100 mg/l
Total Suspended Solids	60 mg/l
Total Dissolved Solids	2000 mg/l
Turbidity	50 NTU
Phosphates (PO_4)	5 mg/l
Nitrates (NO_3)	40 mg/l
Ammonia (Nitrogen) (NH_4-N)	5 mg/l
Mercury	0.005 mg/l
Lead	0.5 mg/l
Cadmium	0.05 mg/l
Arsenic	0.05 mg/l
Chromium	1 mg/l
Copper	1.5 mg/l
Nickel	0.1 mg/l
Iron	1.5 mg/l
Manganese	1 mg/l
Zinc	5 mg/l
Silver	0.1
Barium	2
Cobalt	2
Other Metals	0.1
Probable counts for the coliform group in 100 cm^3	4000

Source: Annexure 1 of Law Number 4 of 1994

The proposed project includes construction of secondary treatment facilities for wastewater during implementation stage, the operation and maintenance of constructed facilities and consequent discharge of treated effluent during post-implementation stage. In Part One of this Law, under Protection of Land Environment from Pollution, it is mentioned that the competent administrative authority or licensing authority of any Projects involving construction works shall assess the environmental impact of the establishment for which license is sought and copy of the environmental impact assessment should be sent to the EEAA for its opinion and approval. This will include extensions and renovations of existing facilities. Also, in Part Three of this Law, under Pollution from Land Based Sources, it is mentioned that it is prohibited for all establishments to discharge or throw any untreated substance, wastes or liquids which may cause pollution in adjoining water bodies either directly or indirectly.

In Article 34 of Part 2 of Law 4 it is mentioned that the air pollution resulting from the total establishments in one area shall be within the range indicated in Annexure 5 of this Law as presented in Table below.

Table 2-3 Maximum Limits of Outside Air Pollutants

Parameter	Maximum Limit ($\mu g/m^3$)	Period of Exposure
Sulphur Dioxide	350 150 60	1 hr 24 hrs 1 year
Carbon Monoxide	30 mg/m^3 10 mg/m^3	1 hr 8 hrs
Nitrogen Dioxide	400 150	1 hr 24 hrs
Ozone	200 120	1 hr 8 hrs
Suspended Particles (measured as black smoke)	150 60	24 hrs 1 year
Total Suspended Particles	230 90	24 hrs 1 year
Thoracic Particles (PM10)	150 70	24 hrs 1 year
Lead	0.5	An average of 24 hrs all over 1 year in the urban areas
	1.5	An average of 24 hours all over 6 months in the industrial zone

Source: Annexure 5 of Law Number 4 of 1994

Article 44 of Law 4 defines the permissible limits of noise or loudness for various conditions and these limits are described in Annexure 7 of the Law. These limits are presented in Table below. It is mentioned that in case when noise intensity levels are higher than 90 Decibels, the period of exposures should be reduced as defined in the Standards given in Annexure 7. The Annexure also defines the maximum limit of noise intensity in different areas such as rural residential, suburban residential, town residential, residential area with commercial activities or on roads, trading and administrative areas, downtown, and industrial zones and is given for different time zones, these limits are presented in Tables below.

Odor Limits

No standards have yet been defined for offensive odor control in different environments in the Egyptian regulations. Therefore, standards of Japan have been used in this Study for this purpose.

Table 2-4 Limits of Sound Intensity inside Places of Work and Indoor Places

Place and Activity	Maximum Limit Permissible for Equivalent Noise Intensity LAeq in Decibel (A)
Places of work with shifts up to 8 hours	90
Places of work which require hearing sound signals, and good hearing of speech	80
Work rooms for computer or typewriter	70
Work rooms to follow up, measure and adjust operation	65
Work rooms for activities which require routine mental concentration, and control rooms	60

Source: Annexure 7 of Law Number 4 of 1994

Table 2-5 Limits of Noise Intensity in Different Categories of Land uses

Type of Land use	Maximum Limit of Equivalent Noise Intensity LAeq (Decibel)		
	All Day (7:00~18:00)	Evening (18:00~22:00)	All Night (22:00~7:00)
Rural residential areas, hospitals, and gardens	45	40	35
Residential suburbs, with existence of little	50	45	40

	Maximum Limit of Equivalent Noise Intensity LAeq (Decibel)		
movement			
Town residential areas	55	50	45
Residential areas having workshops or commercial activities, or on the public roads	60	55	50
Trading and administrative areas, and downtown	65	60	55
Industrial zones (heavy industries)	70	65	60

Source: Annexure 7 of Law Number 4 of 1994

2.2.2 Law Number 48 of 1982

This law is related to Protection of the River Nile and waterways against pollution. This Law controls effluent discharges to natural water bodies such as two branches of the Nile river and streams, feeders and canals of all levels and ducts, drainage of all levels, lakes, ponds, and subsoil water reservoirs. According to this Law, all establishments (shops, buildings, commercial, industrial or touristic and sanitary drainage systems) are not allowed to throw or discharge any solid, liquid or gaseous waste products into waterways without the permission of the MWRI and according to measures and rules to be determined by order of MWRI upon suggestion of MOHP. The permission shall specify the measures and specifications of each case separately. This Law also specifies a monitoring and testing regime that is administered by the MOHP. This law includes 20 Articles and has been promulgated by Decree Number 8 of 1983.

2.2.3 Decree Number 8 of 1983

This Decree promulgates the regulations of Law No. 48 of 1982 and relates Protection of the River Nile and Waterways against pollution. It is comprised of 83 Articles in a total of 8 Sections related to licensing discharge treated effluent into waterways, their sampling and analysis.

Article 6 of this Decree states that it is prohibited to discharge industrial fluid wastes, or to drain wastewater into potable water surfaces and underground water reservoirs. The license for discharging treated effluents shall be issued by the MWRI upon request and on the basis of analysis result of effluent sample obtained from the MOHP. Article 24 of this Decree describes that sampling of effluent shall be carried out at least once every three months for establishments that have been licensed to discharge and quality analysis shall be carried out by laboratories of MOHP.

In Section 6 of this Decree (Articles 60 to 69), the laws are defined for effluent quality limits of wastewater which are licensed to be discharged into potable surface water or non-potable surface water. The maximum limits defined according to this Decree and Law 48 of 1982 for discharging treated effluents for different cases are presented in Table 2-6 below.

Table 2-6 Effluent Limits for Treated Discharges into Water Bodies

Parameter	Effluent Limit of Discharges			
	To Potable Water Body		To Non-potable Water Body	
	Nile (Main Stream)	Underground Reservoir & Nile Branches/ Canals	From Municipal	From Industrial
pH	6 – 9	6 – 9	6 – 9	6 – 9
Temperature (ºC)	35	35	35	35
BOD_5 (mg/l)	30	20	60	60
COD, dichromate (mg/l)	40	30	80	100
COD, permanganate (mg/l)	15	10	40	50
Total suspended solids (mg/l)	30	30	50	60
Total dissolved solids (mg/l)	1200	800	2000	2000
Phosphate (PO_4)	1	1	-	10
Nitrate (NO_3)	30	30	50	40
Probable counts for the coliform group in $100cm^3$	2500	2500	5000	5000
Total Heavy Metal	1	1	1	1

Source: Decree No. 8 of the Year 1983, MWRI

2.2.4 Decree Law Number 93 of 1962 and Decree Number 44 of the Year 2000

The Law Number 93 of 1962 is related to public sewerage system and discharge into it, and water courses and discharge into the water courses. This Law consists of 22 Articles and regulates domestic and industrial liquid discharges into sewerage system and other water courses. However, the executive statutes of this law has been amended by Decree No. 44 of Year 2000 issued by the MOHUUD.

Decree No. 44 of Year 2000 amends the Executive Statutes of Law No. 93 of 1962 and concerns the Drainage of Liquid Wastes and was issued by the MOHUUD. This Decree consists of 24 Articles and defines the laws related to application and request for wastewater

services, connection to wastewater collection networks, wastes drainage permit, methods of sampling, criteria and conditions of liquid wastes, effluent criteria of industrial and commercial buildings draining into public wastewater collection networks, criteria for re-use of treated effluent for different level of treatment processes, handling and safe re-use of sludge from WWTPs, and method of sludge analysis. Of these Articles some important ones are described below.

Article 14 of this law defines the criteria and specifications to be fulfilled in case of the liquid wastes discharged from industrial or commercial establishments authorized to be drained in public sewerage system. The effluent limits are presented in Tables 2-7 and 2-8 below.

Table 2-7 Upper Limit of Effluent Quality Discharging into Wastewater Networks

Parameter	Limits
Temperature	43°C
pH	6-9.5
BOD_5	600 mg/l
COD (Dichromate)	1100 mg/l
Total Suspended Solids	800 mg/l
Oils and Lubricants	100 mg/l
Solute Sulfides	10 mg/l
Total Nitrogen	100 mg/l
Total Phosphorus	25 mg/l
Cyanide	0.2 mg/l
Phenol	0.05 mg/l
Precipitates/liter - After 10 minutes - After 30 minutes	 8 cm^3 15 cm^3

Source: Decree No. 44 of the Year 2000, MOHUUD

Table 2-8 Upper Limits of Heavy Metals for Effluents to Wastewater Networks

Parameter	Upper Limits (mg/l)
Hexavalent Chromium	0.5
Cadmium	0.2
Lead	1
Mercury	0.2

Parameter	Upper Limits (mg/l)
Silver	0.5
Copper	1.5
Nickel	1
Tin	2
Arsenic	2
Boron	1
Their total shall not exceed	5

Source: Decree No. 44 of the Year 2000, MOHUUD

Article 15 of this law defines general conditions and criteria to be fulfilled in case if treated effluent is re-used for agricultural purposes. According to this article, treated effluent shall not be used for land irrigation except after obtaining permission from the MOHP or concerned authorities determined by the MOHUUD. Also, the cultivation of vegetables, fruits, or plants that are eaten green shall be prohibited in farms irrigated with primary or secondary effluent. Defined upper limits of effluent to be re-used are given in Tables 2-9 and 2-10 below. Article 15 also states that primary effluent should be used for irrigating wood trees, and the secondary effluent could be used for irrigating palm trees, cotton, linen, hemp, jute, fodder crops, husk and peel crops, vegetables that are taken after cooking, flower nursery and fruits that are taken after processing thermally. The effluent after advanced treatment of wastewater could be used for irrigating plants that are eaten green, all kinds of crops, fodder and green pastures, husk and peel plants, etc.

Table 2-9 Quality Standards for Effluents of Various Treatment Levels for Reuse

S. No.	Particulars	Unit	1st group water treated primarily	2nd group water treated secondarily	3rd group Advanced treated water
1	BOD_5	mg/l	300	40	20
2	COD (Dichromate)	mg/l	600	80	40
3	Total suspended solids (TSS)	mg/l	350	40	20
4	Oils and lubricants	mg/l	Not Applicable	10	5
5	Number of enteric nematode cells or eggs	Number/l	5	1	1
6	Number of fecal coliform Cells	/100 ml	Not Applicable	1000	100
7	Maximum concentration of total soluble salts "According to the Degree of Plant Endurance"	mg/l	Up to 2500	Up to 2000	Up to 2000
8	Percentage of sodium absorption (permeability according to type of soil and plant)	Percentage %	25	20	20
9	Concentration of Chlorides	mg/l	Up to 350	Up to 300	Up to 300
10	Concentration of Bromides	mg/l	Up to 5	Up to 3	Up to 3

Source: Decree No. 44 of the Year 2000, MOHUUD

Table 2-10 Heavy Metals Standards for Effluents of Various Treatment Levels for Reuse

Degree of Treatment/ Criteria-Mineral	Unit	First Group Primary	Second Group Secondary	Third Group Advanced
Cadmium	mg/l	0.05	0.01	0.01
Lead	mg/l	10	5	5
Copper	mg/l	Not Applicable	0.2	0.2
Nickel	mg/l	0.5	0.2	0.2
Zinc	mg/l	Not Applicable	2	2
Arsenic	mg/l	Not Applicable	Not Applicable	0.1
Chromium	mg/l	Not Applicable	Not Applicable	0.1
Molybdenum (Green Fodder Only)	mg/l	Not Applicable	0.01	0.01
Manganese	mg/l	0.2	0.2	0.2
Iron	mg/l	Not Applicable	5	5
Cobalt	mg/l	Not Applicable	0.05	0.05

Source: Decree No. 44 of the Year 2000, MOHUUD

Part 8 of this decree regulates the handling and safe re-use of the sludge resulting from WWTPs to ensure protection of environment and public health. It states that for sale or re-use of sludge in cultivation, it should be properly treated through fixation using one of the safe methods of aerobic fermentation, anaerobic fermentation, thermal treatment, lime addition, composting or co-composting with organic materials, or by storing in stacking areas with direct exposure to sunlight for a period of six months. It includes the definition and regulations of handling sludge outside the WWTP and the standards of using the sludge in agriculture and defines the maximum limits of heavy metals in dry sludge to be used in agriculture. These limits are presented in Table 2-11 below. This law forbids the use of sludge in Nile alluvium lands, in lands with shallow groundwater level of less than 1.5 m from ground surface, public gardens or playgrounds, lands cultivated with vegetables that are eaten raw or with fruits touching the ground surface or grown underground or eaten unpeeled.

Table 2-11 Maximum Limits of Heavy Metals in Dry Sludge for Agricultural Uses

Parameters	Symbol	Max limit of safe sludge mg/kg
Zinc	Zn	2800
Copper	Cu	1500
Nickel	Ni	420
Cadmium	Cd	39
Lead	Pb	300
Mercury	Hg	17
Chromium	Cr	1200
Molybdenum	Mo	18
Selenium	Se	36
Arsenic	As	41

Source: Decree No. 44 of the Year 2000, MOHUUD

The count of Faecal Coliform in dry sludge shall not exceed 1000 per unit gram of dried sludge on dry weight basis. According to this Law, if the dried sludge contains heavy metals or pathogens exceeding the defined limits, it should be safely buried in pits according to the recognized technical specifications or it could be incinerated if it does not produce hazardous gas.

2.2.5 Law 102 of 1983 concerning Natural Reserves

Protected areas are defined as any area on the ground, the territorial water or the inland water containing the creatures, plants, living animals, fish or the natural phenomena of cultural, scientific and tourism or aesthetic value, as determined by a Prime Minister decree upon a proposal of EEAA. Law prohibits the works, disposals, activities or procedures, and transactions which may destroy, damage, or cause a deterioration of the physical environment, fauna, flora or aesthetics of the reserve area, including the following activities:

- Damaging or transporting the plants in the reserve areas.
- Damaging or destroying the geological or geographical formations or the areas which are considered a habitat of some species of animals, plants or for their reproduction.
- Catching, transporting, killing or bothering land or sea creatures or animals or taking any measures for such purpose.
- Bringing strange creatures into the reserve areas.
- Polluting soil, water, air in the protected area by any ways

This Law includes 11 Articles and prohibits the construction of buildings, facilities, roads or exercise of any agricultural, industrial, or commercial activities in the reserve area except by approval and license of the competent administrative authorities, subject to the conditions, provisions and measures, determined by Prime Minister. The Law also prohibits the exercise of any activities, transactions, actions, or experiments in the surrounding area of the reserve areas except on the permission of the competent administrative authorities.

2.2.6 Law No. 10/1990 concerning the Expropriation of Real Estates for Public Interest

One of the laws governing the expropriation of property in Egypt is the Law No. 10 of 1990 on Expropriation of Real Estates for Public Interest. It contains five Chapters and a total of 29 Articles in these Chapters. Article 2 in Chapter One defines the works in public interest and lists water and wastewater projects to be one among them. Section Two of this document (Resettlement Policy Framework) provides a comprehensive description of all the laws concerned with land expropriation and the related compensation measures in Egypt.

2.2.7 Law Protecting Cultural Heritage

The law governing the protection of cultural heritage in Egypt is Law 117 of 1983, which covers issues such as the definition of private property, system of ownership, and extension of protection – including registration, archaeological excavations, and authorities responsible for protection.

2.3 JBIC Guidelines for EIA

The objective of the JBIC Environmental Guidelines (*JBIC Guidelines for Confirmation of Environmental and Social Considerations, April 2002*), is to contribute to the efforts by the international community, particularly developing regions, towards sustainable development, through consideration of the environmental and social aspects in all projects subject to lending or other financial operations by JBIC. Environmental and social considerations refer not only to the natural environment, but also to social issues such as involuntary resettlement and respect for the human rights of indigenous peoples.

The JBIC Guidelines is based on a policy, which stipulates that all projects it supports are carried out in an environmentally responsible manner and that projects must comply with all local environmental laws and procedures in addition to appropriate JBIC guidelines.

The JBIC procedures and policies with regard to conducting environmental assessments are described in the JBIC Environmental Guidelines (April 2002). Parts 1 and 2 of the Guidelines identify the process of determining level of investigation required in the environmental assessment. It includes mainly basic policies, objectives, basic principles, procedure, disclosure of information, information on environmental review, implementation, contents of EIA report for Category A projects, information needed for screening process, checklist categories and items, and items required for monitoring. It provides an illustrative list of Category "A" developments which require a full EIA and includes (among others) sewage and wastewater treatment projects having sensitive characteristic or located in sensitive area or their vicinity.

2.3.1 JBIC's Policies relating Environmental Conservation

The objective of the Guidelines is to encourage project proponents to implement appropriate environmental and social considerations in accordance with the Guidelines, by making clear

its procedures (both before and after funding decisions are made), criteria for decision-making and requirements which projects subject to funding are to meet. In so doing, JBIC endeavors to ensure transparency, predictability and accountability in its confirmation of environmental and social considerations.

In the course of achieving this objective, JBIC confirms that project proponents are undertaking appropriate environmental and social considerations, through various measures, so as to prevent or minimize the impact on the environment and local communities which may be caused by the projects for which JBIC provides funding, and not to bring about unacceptable effects. It will thus contribute to the sustainable development of developing regions.

In its confirmation of environmental and social considerations, JBIC places importance on dialogue with the host country (including local governments), borrowers and project proponents regarding environmental and social considerations, while respecting the sovereignty of the host country. It also emphasizes on transparent and accountable processes, and participation of stakeholders, in confirmation of environmental and social considerations.

JBIC makes the utmost efforts to ensure that appropriate environmental and social considerations are undertaken, in accordance with the nature of the project for which JBIC provides funding, as stated in the Guidelines, through such means as loan agreements.

In making its funding decisions, JBIC conducts screenings and reviews of environmental and social considerations to confirm that the requirements are duly satisfied.

(A) **Screening:** The purpose of screening is to classify the project as category A, B, C or FI. The categorization is based on their degree of potential impacts on the environment. While screening process considering potential environmental impacts, the factors taken into account includes the sector and scale of the project, degree and uncertainty of its potential environmental impact and the environmental and social context of the proposed project site and surrounding areas. Of the categories defined in the Guidelines, only categories A and B that are most related to the sewerage projects are discussed below.

(i) *Category A*: A project is classified as category A if it is likely to have

significant adverse impacts on the environment. A project with complicated or unprecedented impacts which are difficult to assess is also classified under this category. This category includes projects in sensitive sectors (i.e., sectors that are liable to cause adverse environmental impacts) or with sensitive characteristics (i.e., characteristics that are liable to cause adverse environmental impacts) and project located in or near sensitive areas.

(ii) *Category B*: A project is classed under this category if it is likely to pose potential negative environmental impacts that are less severe than those of Category A. In most cases, normal mitigation measures can be designed more readily for such projects. The projects funded by Engineering Service Loans that are JBIC ODA loans for survey and design are classified as category B.

(B) **Environmental Review:** After screening of the project, the environmental review is undertaken. This includes conducting a review of environmental and social considerations and to confirm that the requirements are duly satisfied, when making a decision on funding. The purpose is to examine the potential negative and positive environmental and social impacts of project activities. The measures necessary to prevent, minimize, mitigate or compensate for potential negative impacts are evaluated. For Category A projects, EIA report must be submitted by the borrower. For Projects, in which large-scale involuntary resettlement is required, basic resettlement plans must be submitted. For Category B projects, if EIA is available, it may be referred to while review, but this is not mandatory requirement.

2.3.2 Environmental and Social Considerations Needed for JBIC Funded Projects

The environmental and social considerations required for funded projects are stated in the Guidelines. It includes Underlying Principles; Examination of Measures; Scope of Impact to be Examined; Compliance with Laws, Standards and Plans; Social Acceptability and Social Impacts; Involuntary Resettlement; Indigenous Peoples; and Monitoring. As stated in the JBIC Environmental Guidelines, appropriate environmental and social considerations are undertaken, according to the nature of the project, based on the items described below.

(A) Underlying Principles

Environmental impact which may be caused by a project must be assessed and examined from the earliest planning stage possible. Alternative proposals or minimization measures to prevent or reduce adverse impact must be examined and incorporated into the project plan.

Such examination must include analysis of environmental costs and benefits in as quantitative terms as possible and be conducted in close harmony with economic, financial, institutional, social and technical analysis of the project.

The findings of the examination of environmental and social considerations must include alternative proposals, mitigation measures and be recorded as separate documents or as a part of other documents. The EIA reports must be produced for projects in which there is a reasonable expectation of particularly large adverse environmental impact.

For projects that have particularly large potential adverse impact or are highly contentious, a committee of experts may be formed to seek their opinions, in order to increase accountability.

(B) Examination of Measures

Multiple alternative proposals must be examined to prevent or minimize adverse impact and to choose a better project option in terms of environmental and social considerations. In examination of measures, priority is to be given to the prevention of environmental impact, and when this is not possible, minimization and reduction of impact must be considered next. Compensation measures must be examined only when impact cannot be prevented by any of the aforementioned measures.

Appropriate follow-up plans and systems, such as monitoring plans and environmental management plans, must be prepared; and costs of implementing such plans and systems, and financial methods to fund such costs, must be determined. Plans for projects with particularly large potential adverse impact must be accompanied by detailed environmental management plans.

(C) Scope of Impact to be Examined

Environmental impact to be investigated and examined includes factors that impact human health and safety as well as the natural environment, such as: air, water, soil, waste,

accidents, water usage, ecosystems, and biota. Social concerns include: involuntary resettlement of the affected population, the indigenous people, cultural heritage, landscape, gender, children's rights and communicable diseases such as HIV/AIDS and impact that may lead to trans-boundary and global environmental problems.

In addition to the direct and immediate impact of projects, derivative, secondary and cumulative impacts are also to be examined and investigated to a reasonable extent. It is also desirable that the impact which can occur at any time during the duration of the project be continuously considered throughout the life cycle of the project.

(D) Compliance with Laws, Standards and Plans

Projects must comply with laws, ordinances and standards relating to environmental and social considerations established by the governments that have jurisdiction over the project site (including both national and local governments). They are also to conform to environmental and social consideration policies and plans of the governments that have jurisdiction over the project site.

Projects must, in principle, be undertaken outside protected areas that are specifically designated by laws or ordinances of the government for the conservation of nature or cultural heritage (excluding projects whose primary objectives are to promote the protection or restoration of such designated areas). Projects are also not to impose significant adverse impact on designated conservation areas.

(E) Social Acceptability and Social Impacts

Projects must be adequately coordinated so that they are accepted in a manner that is socially appropriate to the country and locality in which the project is planned. For projects with a potentially large environmental impact, sufficient consultations with stakeholders, such as local residents, must be conducted via disclosure of information from an early stage where alternative proposals for the project plans may be examined. The outcome of such consultations must be incorporated into the contents of the project plan.

Appropriate consideration must be given to vulnerable social groups, such as women, children, the elderly, the poor, and ethnic minorities, all of whom are susceptible to environmental and social impact and who may have little access to the decision-making

process within society.

(F) Involuntary Resettlement

Involuntary resettlement and loss of means of livelihood are to be avoided where feasible, exploring all viable alternatives. When, after such examination, it is proved unfeasible, effective measures to minimize impact and to compensate for losses must be agreed upon with people who will be affected.

People to be resettled involuntarily and people whose means of livelihood will be hindered or lost must be sufficiently compensated and supported by the project proponents, etc. in timely manner. The project proponents, etc. must make efforts to enable the people affected by the project, to improve their standard of living, income opportunities and production levels, or at least to restore them to pre-project levels. Measures to achieve this may include: providing land and monetary compensation for losses (to cover land and property losses), supporting the means for an alternative sustainable livelihood, and providing the expenses necessary for relocation and the re-establishment of a community at relocation sites.

Appropriate participation by the people affected and their communities must be promoted in planning, implementation and monitoring of involuntary resettlement plans and measures against the loss of their means of livelihood.

(G) Indigenous Peoples

When a project may have adverse impact on indigenous peoples, all of their rights in relation to land and resources must be respected in accordance with the spirit of the relevant international declarations and treaties. Efforts must be made to obtain the consent of indigenous peoples after they have been fully informed.

(H) Monitoring

It is desirable that, after a project begins, the project proponents monitor: (i) whether any situations that were unforeseeable before the project began have arisen, (ii) the implementation situation and the effectiveness of the mitigation measures prepared in advance, and that they then take appropriate measures based on the results of such

monitoring.

In cases where sufficient monitoring is deemed essential for the achievement of appropriate environmental and social considerations, such as the projects for which mitigation measures should be implemented while monitoring their effectiveness, project proponents must ensure that project plans include monitoring plans which are feasible.

It is desirable that project proponents make the results of the monitoring process available to project stakeholders.

When third parties point out, in concrete terms, that environmental and social considerations are not being fully undertaken, it is desirable that a forum for discussion and examination of countermeasures be established based on sufficient information disclosure and include the participation of stakeholders in the relevant project. It is also desirable that an agreement be reached on procedures to be adopted with a view to resolving the problem.

2.3.3 EIA Report Content required by JBIC Guidelines

According to the JBIC Guidelines, the following conditions should be met in preparation of the EIA Report:

- When assessment procedures already exist in host countries, and projects are subject to such procedures, borrowers and related parties must officially complete those procedures and obtain the approval of the government of the host country.
- EIA reports (which may be referred to differently in different systems) must be written in the official language or a language widely used in the country where the project is to be implemented. When explaining projects to local residents, written materials must be provided in a language and form understandable to them.
- EIA reports are required to be made available in the country and to the local residents where the project is to be implemented. The EIA reports are required to be available at all times for perusal by project stakeholders such as local residents and that copying be permitted.
- In preparing EIA reports, consultation with stakeholders, such as local residents, must take place after sufficient information has been disclosed. Records, etc. of such consultations must be prepared.
- Consultations with relevant stakeholders, such as local residents, should take place if necessary throughout the preparation and implementation stages of a project.

Having consultations is highly desirable, especially when the items to be considered in the EIA are being selected, and when the draft report is being prepared.

As stated in the Guidelines, EIA reports should cover the items enumerated below.

- Executive Summary
- Policy, legal and administrative framework
- Project description
- Baseline data
- Environmental Impacts
- Analysis of alternatives:
    - Project site;
    - Technology;
    - Design
    - Operation, including the "without project" situation.
- Environmental Management Plan (EMP).
- Consultation.

2.4 EEAA Guidelines

There exists a *"Guidelines for Egyptian Environmental Impact Assessment"* to help the competent administrative authorities (CAA) and the licensing agencies in implementing requirements of Law Number 4 of 1994 concerned with the Environmental Impact Assessment. According to the Environment Law (Law Number 4 of 1994), EIA must be performed for new establishments or projects and for expansions or renovations of existing establishments. The Articles 19, 20, 21, 22, 23, 70, 71, and 73 of Law Number 4 of 1994 stipulate measures related to the environmental impact assessment. These are complemented by the provisions of Articles 10 to 19, and 57 to 60 of the Executive Regulations issued by the Prime Minister's Decree No. 338 of 1995.

This Law states that before any construction works are initiated for certain establishments or projects or a license is issued by the competent administrative authority or licensing authority for such projects, its environmental impacts must be evaluated. Such projects are identified based on the following main principles:

1. Type of activity performed by the establishment
2. Extent of natural resources exploitation
3. Location of the establishment
4. Type of energy used to operate the establishment

The number of projects subject to this provision is many and would result into a heavy burden to the CAA and the EEAA. Therefore, a flexible system for the management of EIA projects has been developed to accomplish the objective using limited economic and technical resources. This includes a flexible screening system in which the projects are classified into three groups or classes reflecting different levels of environmental impact assessment according to severity of possible environmental impacts. These Groups are:

1. Category A (White List) – Projects that are believed to have little or no negative impact on the environment and where EIAs are not required
2. Category B (Grey List) – Project that may result in substantial environmental impact and it therefore has to be determined if a partial EIA should be carried out
3. Category C (Black List) – Projects that are likely to have a significant negative impact on the environment, and therefore requires a complete EIA

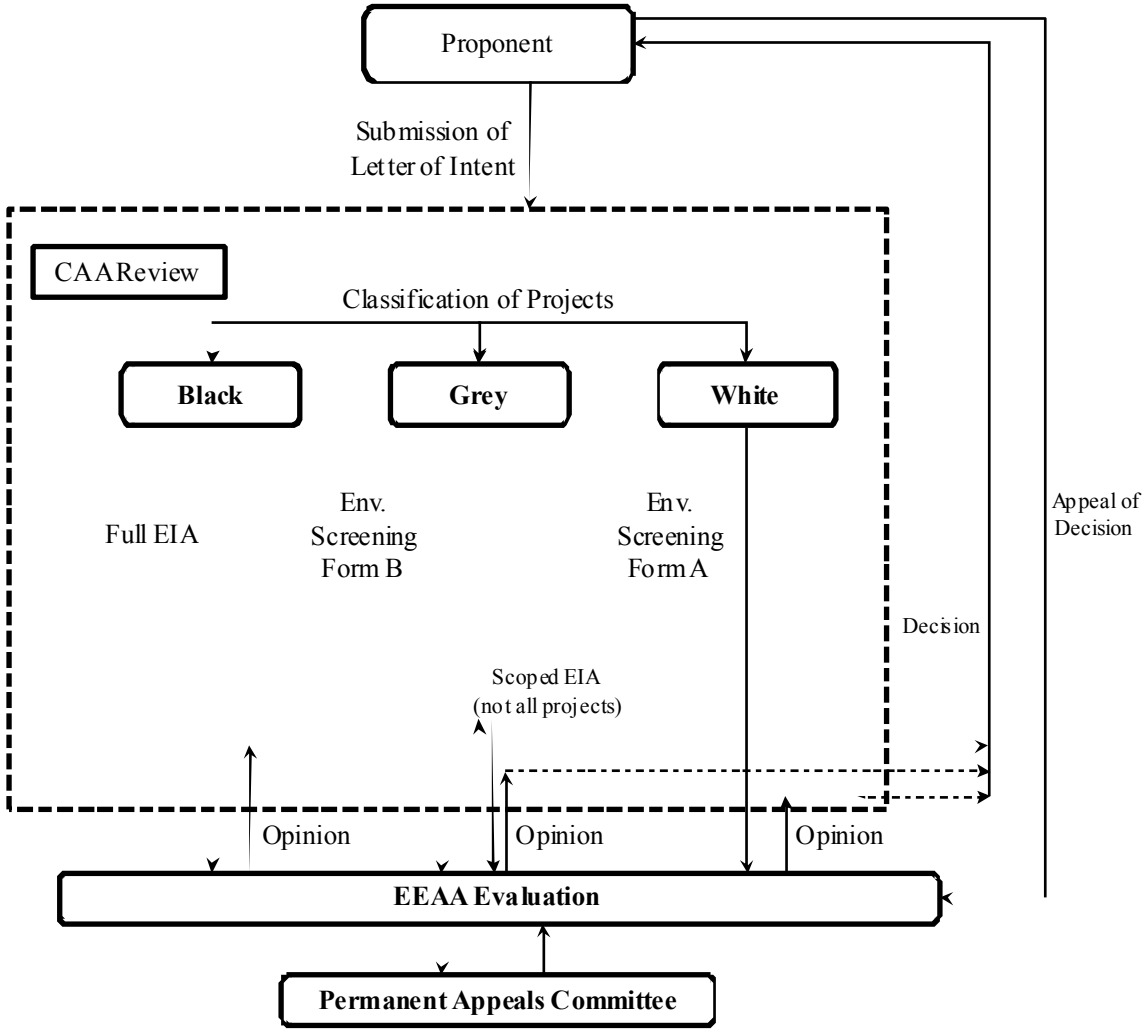
An overview of EIA system followed by the EEAA and processing of application is presented in Figure 2.1 below and the procedure is described in following sections for various categories of projects.

(A) Category A (White List) Project

This category includes projects that pose minor environmental impacts. For such projects, the proponent needs to fill up the Environmental Screening Form A and submit it to CAA along with a letter of intent to undertake that project. The CAA registers the documents and checks if the categorization has been made correctly and whether the information submitted complies with the required information. After checking the documents, the CAA formally submits the application to the EEAA for review and evaluation. On review and evaluation, the EEAA submits its opinion and possible proposals for measures to be taken to ensure the protection of environment within 60 days of the EEAA's receipt of the completed application documents. The EEAA also registers the documents, its opinions and proposals in its records. The CAA officially notifies proponent by registered letter and forwards a

copy of the decision to the EEAA and ensures implementation of the decision.

For the sewerage projects, the CAA is expected to be the Ministry of Housing, Utilities and Urban Development and those wastewater treatment plants which cover 1000 PE (population equivalents) or less are classified under this category.



Source: Guidelines for Egyptian Environmental Impact Assessment

Figure 2-1 EIA System and Processing of Application

(B) Category B (Grey List) Project

The projects that are expected to have major environmental impacts are included in this category. For this category of projects, the proponent needs to fill up Environmental Screening Form B. The EIA in this case is processed in two stages: Screening (filling out Environmental Screening Form B) and if required, a scoped EIA on certain identified

impacts. The procedure is similar to the case of white list projects. However, in this case, the proponent might be requested to complete a scoped EIA Study for certain impacts of the project in accordance with the Terms of Reference prepared by the EEAA. If such a request is made, the proponent must submit a completed study to the CAA. The CAA registers the study and checks if information included in submitted EIA Study complies with the required information. Upon checking the documents, CAA submits the documents to EEAA for review and evaluation. On completion of review and evaluation (within 60 days of receiving the documents), the EEAA submits its opinion to the CAA with possible proposals (if any) for measures to be taken to ensure protection of the environment. Subsequently, the CAA notifies the developer of project by registered letter about the final result of evaluation which could be either approval of project including possible measures to be taken to ensure environment protection or a disapproval of the proposed project. The CAA forwards a copy of its decision to the EEAA, and it is registered by the EEAA in its EIA register. The CAA ensures implementation of the decision.

For the sewerage projects in this category also, the CAA is expected to be the Ministry of Housing, Utilities and Urban Development. The wastewater treatment plants with a capacity ranging from 1000 PE to 1 million PE are classified under this category.

(C) Category C (Black List) Project

The projects that are expected to cause potential and substantial environmental impacts are included in this list and these projects need a full EIA study. For these projects, the developer applies to the CAA with a letter of intent along with three copies of the full EIA study on the project in accordance with the relevant "sectoral guidelines for establishments that need full EIA" (Annex 1 of "Guidelines for Egyptian Environmental Impact Assessment"). The CAA registers the documents and checks if categorization of the project is correct and the information included in EIA study complies with the requirements. Upon checking the documents, the CAA formally submits all documents to the EEAA for review and evaluation. After evaluation of documents, the EEAA submits its opinion to the CAA along with possible proposals for measures to be taken to ensure environment protection. The EEAA registers the documents, its opinion and proposals in its EIA register. Subsequently, the CAA notifies the final result to the developer of project through registered letter. The results could be in form of an approval of the project including possible measures to be taken to ensure environment protection or a disapproval of the project. The CAA forwards a copy of decision to the EEAA and it is recorded by the EEAA in its EIA register.

The implementation of decision is ensured by the CAA.

The CAA for the sewerage projects in this category is expected to be the Ministry of Housing, Utilities and Urban Development. The wastewater treatment plants with a capacity of more than 1 million PE are classified under this category.

Proposed project in this Study (secondary treatment facilities at Abu Rawash WWTP) is planned to have a treatment capacity of 1.2 million m^3/day. This capacity is much greater than population equivalent of 1 million. Therefore, based on the defined criteria of EEAA, the proposed project would be categorized under Category C (Black List) project. Hence, according to the Egyptian requirements, full EIA study shall be required and EIA study report should be submitted and approval obtained from the EEAA for implementation of this project. As mentioned earlier, the CAA for this project is expected to be the Ministry of Housing, Utilities and Urban Development and the proponent would be CAPW.

2.4.1 Guidelines for Complete EIA Report of Wastewater Related Project

Information required to be included in EIA report as per *"Guidelines for Egyptian Environmental Impact Assessment"* is described below.

(A) Description of the Proposed Project

Detail description of the project should be provided using maps wherever necessary. This shall include data on location, general layout, process description and diagram, size in terms of present and future population and population equivalents, anticipated influent and effluent characteristics, average annual or monthly discharge data. The information on pre-construction, construction and operation and maintenance activities, staff composition, supports, facilities and services should also be included. Life of major components and offsite investments should also be described for the project.

(B) Description of the Environment

Information on physical/chemical, biological and socio-cultural environments related to the project are important and should be included in EIA study report. Information related to physical/chemical environment of the project should include data on geology, soils, general description of overall study area, topography, climate, wind, temperature, rainfall, and

description of receiving water body, etc. The data on biological environment should describe terrestrial communities in areas affected by construction, facility siting, land application or disposal; aquatic, estuarine or marine communities in affected waters; sensitive habitats; rare or endangered species; and species of commercial importance affected by the projects. Information on socio-cultural environment should include data related to present and future population; present land use, planned development activities, community structure; present and projected employment, income distribution, recreation, public health, cultural properties.

(C) Legislative and Regulatory Considerations

The data on pertinent regulations and standards related to environmental quality, pollutant discharge to surface waters and land, industrial discharge to public sewers, water treatment and reuse, agriculture and landscape use of sludge, protection of sensitive areas, protection of endangered species, siting land use control, etc., at international, national, regional, and local levels should be provided.

(D) Potential Impacts of the Proposed Project

Any significant impact that project is expected to have should be identified and included in the EIA report. The changes due to project activities on employment opportunities, wastewater effluents, air emissions, solid wastes, land use, infrastructure, exposure to disease, traffic, and socio-cultural behavior, etc. should be described. Assessment should be made of changes caused by project activities on baseline environmental conditions. This should include information on extent of water quality improvement in receiving water bodies, beneficial uses, length of stream or stretch of other water body which will experience positive or negative effects due to effluent discharge, etc. Information on anticipated sanitation and public health benefits, and projected quantitative changes in beneficial uses such as fisheries, recreation and tourism, water available for potable supply, irrigation and industrial uses should be described in EIA report.

(E) Alternatives to the Proposed Project

The alternatives that were examined in the course of project preparation should be described. Alternatives are considered using factors such as siting, design, technology selection, construction techniques and phasing, operation and maintenance procedures, etc.

(F) Development of Monitoring Plan

A detailed plan should be included to monitor the impacts of the project during construction and operation. The plan shall include estimate of capital and operating costs also.

(G) Secure Interagency Coordination and Public/NGO Participation

Coordination with other government agencies should be made and views of NGOs and affected groups should be considered. Records of meetings, communications and comments are necessary and should be prepared.

CHAPTER 3 PROJECT DESCRIPTION

3.1 General

Greater Cairo is experiencing rapid economic growth and thereby has also resulted into increased population in this metropolis. However, provision of services and utilities including sewerage has not been able to keep in pace with the rising population. The lack of adequate sewerage facilities has resulted into negative impact on living environment and water quality in water bodies.

3.1.1 Existing Situation of Sewerage System

There are 16 surface water treatment plants (WTP) serving the Greater Cairo. Of these, 11 WTPs draw raw water from Nile River and the remaining five (5) WTPs draw their raw water from canals. The total water treatment capacity of 18 WTPs (including two planned ones) is reported to be 7.8 million m^3/day. In addition to surface water, some area also receives water supply from groundwater. However, the share of groundwater is very small as compared to the total water supplied.

Sewerage systems in Greater Cairo are geographically divided into three independent districts, viz. East Bank of the River Nile, West Bank of River Nile and Helwan. In each of these three districts, there are still some pockets that are not served by existing sewer networks. Altogether, there are six (6) major wastewater treatment plants (WWTPs) in Greater Cairo. Of these, three are located in East Bank (Al-Gabal Al-Asfer, El-Berka, and Shobra El-Kheima) with total treatment capacity of 2.93 million m^3/day, two in West Bank (Abu Rawash and Zenein) with total treatment capacity of 0.73 million m^3/day, and one in Helwan with total treatment capacity of 0.38 million m^3/day. In addition to this, on the East Bank, four (4) small WWTPs also exist that are located in 15th May City, Al-Haikestep, Badr City and New Cairo City. Also, in New Cairo city on the East Bank, three additional WWTPs are planned to be constructed in future. On the West Bank also, one small WWTP is working in 6th October City. Another WWTP exist in Al-Sheikh Zayed that used oxidation ponds for treating wastewater. However, its operation has been abandoned because of manifold increased inflow to this WWTP making it very difficult to handle total flow. The elevation of this WWTP is high and therefore, at present flow from this WWTP is diverted to Abu Rawash WWTP by gravity.

Wastewater production estimated based on the volume of water supply is 4.8 million m^3/day and exceeds the total wastewater treatment capacity of 4.1 million m^3/day by 0.7 million m^3/day. Consequently, wastewater in excess of the existing treatment capacity is discharged into nearby drains that finally go into branches of River Nile without any treatment. In addition, taking into account future increase of wastewater due to population growth, treatment capacities of the existing sewerage facilities are urgently needed to increase. This includes expansion of WWTPs facilities, increase in capacity of pumping stations, and construction of trunk sewers, which could serve the unsewered areas at present. The extension and rehabilitation of the sewerage systems would certainly require a huge amount of investment. Therefore, financial assistance from overseas donor agencies would be required.

Of the six major WWTPs, the plants that could be expanded to accommodate increasing wastewater flow are only three, viz. Al Gabal Al Asfer WWTP located in East Bank, Abu Rawash WWTP in West Bank, and Helwan WWTP in Helwan.

The existing WWTP at Abu Rawash has treatment capacity of only 400,000 m^3/day with primary level of treatment. Currently, additional primary treatment facilities with capacity of 800,000 m^3/day are in final stage and are expected to start operation by the beginning of 2010. On completion of ongoing works, total treatment capacity of Abu Rawash WWTP will reach to 1.2 million m^3/day (primary treatment). This capacity will be sufficient to treat future inflow for some years. However, only primary treatment is provided by the extension work, and treated effluent will remain insufficient to satisfy legal requirements. Hence, provision of secondary treatment facilities is indispensable to satisfy the requirements and to improve water quality environment of the receiving water bodies.

Produced sludge at Abu Rawash WWTP together with sludge received from Zenein WWTP is currently pumped to desert area located at a distance of about 35 km for treatment in sludge lagoons. Significant increase of sludge volume is expected when extension of primary treatment facilities and consecutive construction of secondary treatment facilities are completed. Additional sludge treatment facilities would be required to handle increased sludge.

3.1.2 Project Objectives

The overall goal of this project is to improve quality of life through improvement in

environmental conditions. This can be achieved through abatement of water pollution in the effluent receiving water bodies and by improvement of water and living environment through the implementation of secondary treatment facilities at Abu Rawash WWTP. It is expected that outcome of this Study will be used for facilitating implementation of construction of Abu Rawash secondary treatment facilities and extension of sludge lagoons. To accomplish these goals and objectives, this Study is undertaken in order to prepare project components to treat total inflow to Abu Rawash treatment plant to defined level of effluent standards before discharging into water bodies. The proposed project shall include project cost and implementation plans and evaluation of the project. As a part of this Study, it is also required to prepare EIA report to be submitted by the CAPW to EEAA for its approval before implementation of proposed project activities.

3.2 Description of the Proposed Project

To improve the existing condition of wastewater treatment in Abu Rawash WWTP, the components of proposed project include secondary treatment facilities with a total capacity of 1,200,000 m^3/day and extension of sludge lagoons located in the desert to meet the requirement of treating generated sludge from Abu Rawash WWTP and Zenein WWTP. The facilities proposed to be constructed for secondary treatment of wastewater and sludge treatment include Aeration tanks, Final settling tanks, Chlorine contact tank, Sludge pumps, and Extension of Sludge lagoons. The information on units and dimensions/specifications for these facilities are presented in Table 3-1 below. The layout plan for proposed secondary treatment facilities is illustrated in Figure 3-1.

Table 3-1 Proposed Components under this Project

No.	Facilities / Dimensions / Specifications	Number of Units
1.	Aeration Tank	
1-1	Rectangular Tank W10m×L162m×D6m (9,315m^3)	24 tanks (4 tanks×6 series)
1-2	Membrane Panel Aerator	24 tanks
1-3	Air Blower 260 m^3/min × 380kW	9 nos. (3 standby)
2.	Final Settling Tank	
2-1	Circular Tank Dia 51m × D3.5m (7,151m^3)	24 tanks (4 tanks × 6 series)
2-2	Clarifier Dia51m × D3.5m × 3.7kW	24 nos.
2-3	Return Sludge Pump 34.7m^3/min × H6m × 55kW	24 nos.
2-4	Waste Sludge Pump 5.2m^3/min × H10m × 15kW	12 nos. (6 standby)
3.	Chlorine Contact Tank	
3-1	Rectangular Tank W5m × L90m × D3m (1,350m^3)	3 tanks
3-2	Chlorine Cylinder 1ton	42 nos.

No.	Facilities / Dimensions / Specifications	Number of Units
3-3	Water Supply Pump 4.0m^3/min × H40m × 45kW	6 nos. (3 standby).
4.	Sludge Transfer	
4-1	Sludge Pump 22.8m^3/min × H80m × 450kW	2 nos.
5.	Sludge Lagoon	
5-1	Sludge Lagoon (expansion)	183 ha.

The layout plan for existing sludge lagoons and proposed sludge lagoons are presented in Figure 3-2. Total areal extent of existing sludge lagoons is about 241.5 ha and for increased sludge generated from primary and secondary treatment facilities of 1.2 million m^3/day, an additional 183 ha of sludge lagoons shall be constructed. Proposed location for extension of sludge lagoons also belong to the HCWW and therefore, land acquisition is not required for this purpose. Some of the photographs showing proposed locations of secondary treatment facilities, treated effluent channels, and sludge lagoons are presented in Figure 3-3.

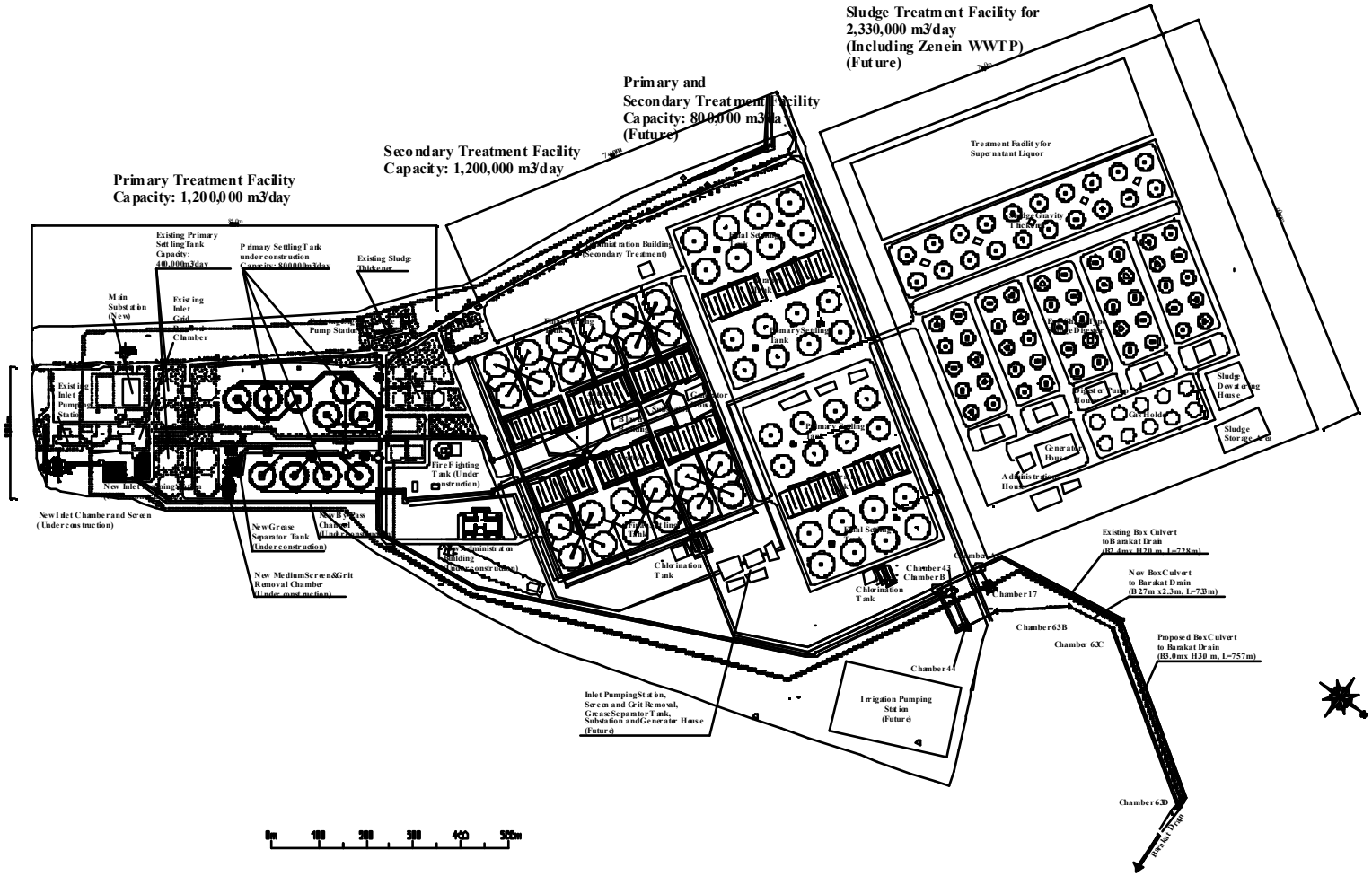
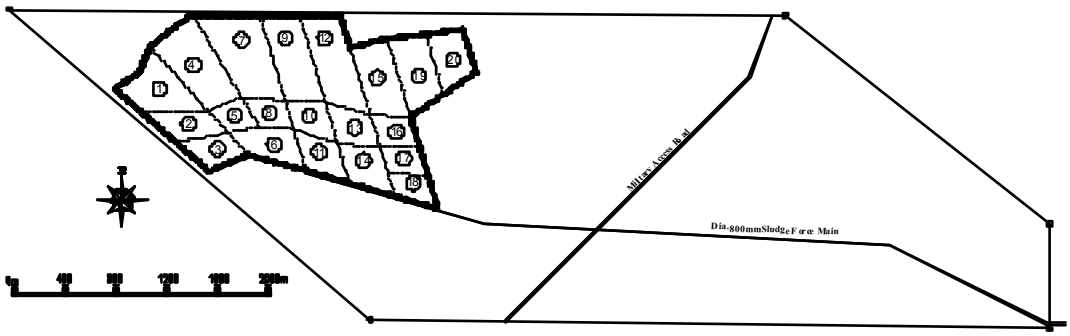


Figure 3-1 Proposed Wastewater Treatment Facilities at Abu Rawash WWTP



1	16.6 ha	5	4.9 ha	9	19.7 ha	13	8.4 ha	17	5.6 ha
2	8.8 ha	6	11.1 ha	10	7.9 ha	14	8.9 ha	18	5.5 ha
3	8.2 ha	7	26.4 ha	11	8.3 ha	15	16.3 ha	19	16.1 ha
4	23.6 ha	8	5.7 ha	12	21.2 ha	16	6.5 ha	20	11.8 ha
Total = 241.5 ha									

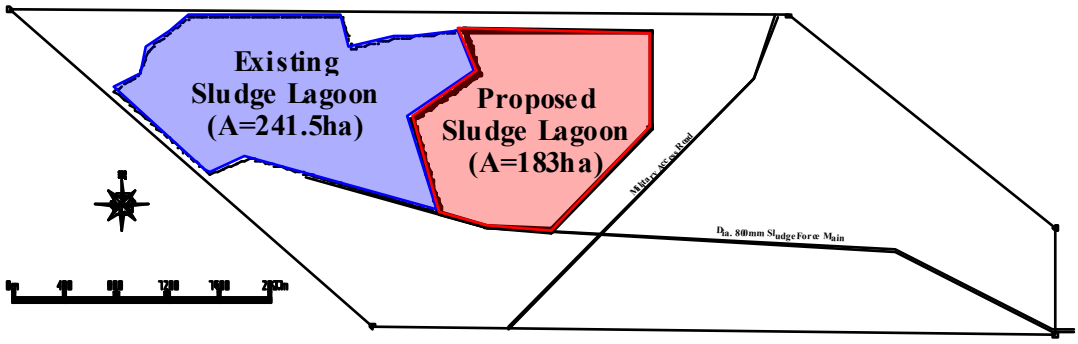


Figure 3-2 Existing and Proposed Sludge Lagoons in Desert

Access Road to Abu Rawash WWTP

Proposed Location of Secondary Treatment Facilities

View from Barakat Drain along which Proposed Effluent Channel could be Constructed

Another View from Barakat Drain along which Proposed Effluent Channel could be Constructed

Figure 3-3 Photographs showing Location of Project Components

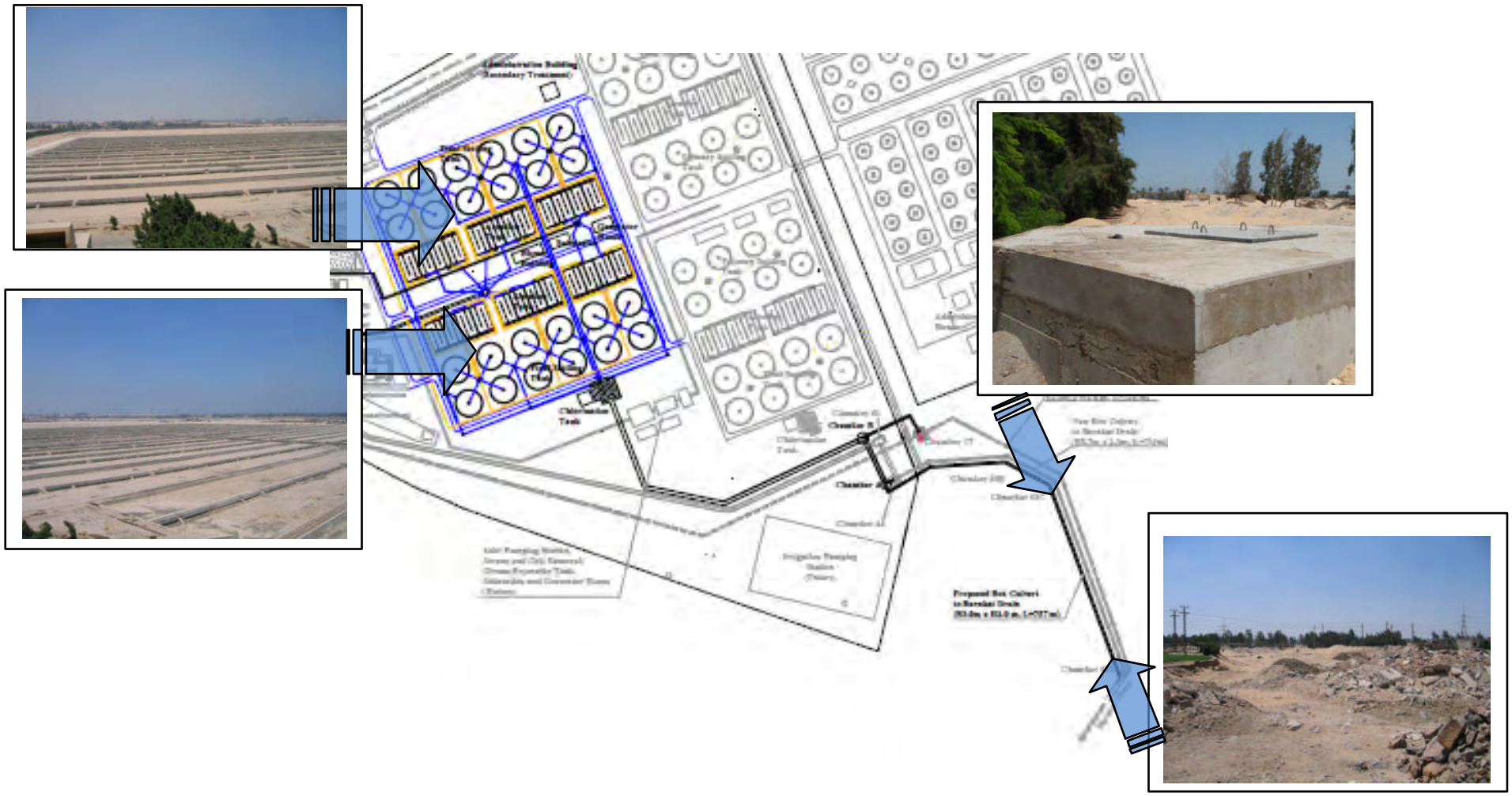


Figure 3-4 Location of Proposed WWTP Facilities

CHAPTER 4 BASELINE OF ENVIRONMENTAL DATA

4.1 Physical Environment

Cairo, the capital city of Egypt, is the largest city in Egypt as well as one of the most densely-populated cities in the world. The city has long been a center of the region's political and cultural activities. Cairo is located on the banks and islands of the Nile River in the north of Egypt, immediately south of the point where the river leaves desert-bound valley and bifurcates into two branches into the low-lying Nile Delta region. In May 2008, Greater Cairo was divided into 4 new governorates: Cairo, Helwan, Giza and the 6th of October Governorates. Cairo, like many large cities in developing countries, suffers from high levels of pollution.

Cairo is also the economic center of Egypt. Major part of the nation's commerce is generated there, or passes through the city. The economic development and growing population has fueled rapid construction in the city. Rapid growth until recently has surpassed well ahead of city services and resulted into lack of adequate services in terms of homes, roads, electricity, telephone, water supply, and sewerage, etc.

4.1.1 General Description of Project Area

In general, the sewerage projects are expected to have positive impacts in terms of improvement in water quality of water bodies that receives partially treated/untreated wastewater in the project area and also with respect to improvement in the living environment in and around project area. However, it is important to envisage and analyze any potential negative impacts that could be caused by implementation of the project during construction and operation stages and to implement measures in order to mitigate negative impacts due to proposed project components.

There are three areas that are expected to experience minor adverse impacts by implementation of proposed project. Hence, in principle, these areas are set as the Scope of Study for preparation of the EIA report. These three areas include:

- The proposed site of the secondary treatment and its supplementary facilities under this Study (the existing Abu Rawash WWTP site and its surrounding area)
- The site of the existing sludge treatment facilities (Sludge Lagoons), and its

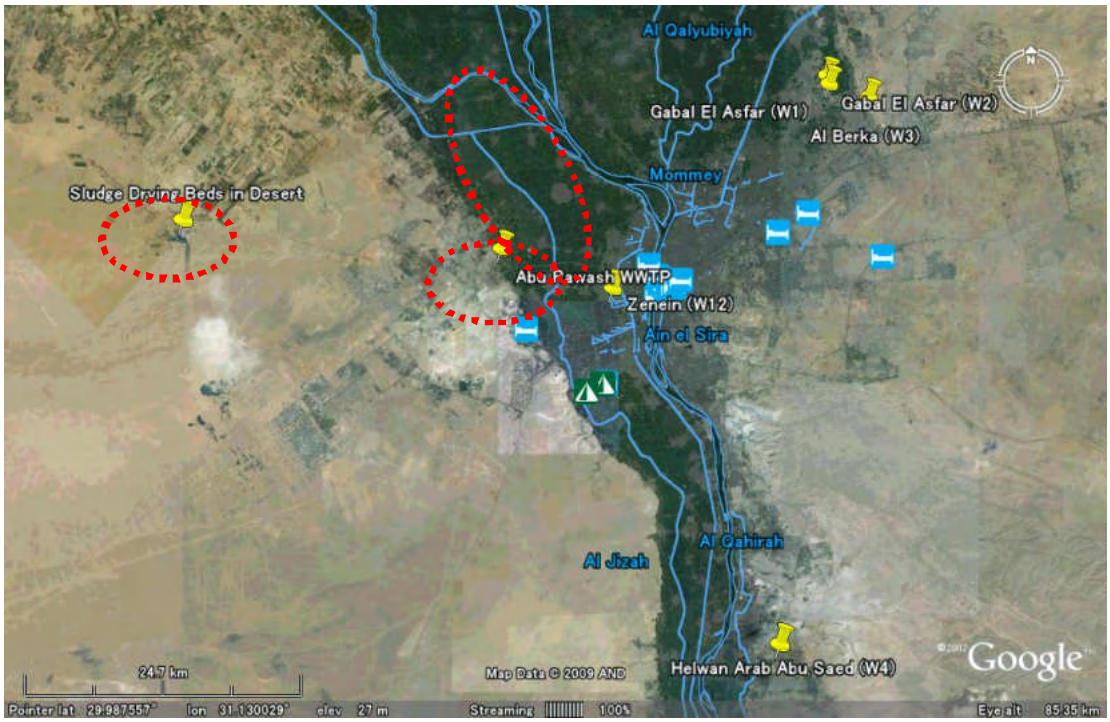
surrounding area

- The effluent receiving water bodies from Abu Rawash WWTP, and its surrounding area (agricultural drain canal: from Barakat drain to Al Rahawy drain)

However, in cases when baseline data is not available for the above-mentioned areas, the data is collected and presented for a relatively broader area. Based on the collected information, in this part of the Study, the baseline data is described under the following categories.

- Physical Environment : Topography and Geology, Climate and Meteorology, and Pollutions (Water Pollution, Air Pollution, Noise and Vibration, Odor and others)
- Biological Environment: Nature Preserve Area, and Flora & Fauna
- Socio-economic Environment: Community structure, Socio-economic indicator, Public Services, Cultural Heritage, and Water utilization

The area proposed for construction of secondary facilities of wastewater treatment is located within the boundary of existing Abu Rawash WWTP. Abu Rawash WWTP is located in the northwestern part of Greater Cairo away from the populated city area. The sludge lagoons are located in the desert further west of Abu Rawash WWTP and in south of Cairo Alexandria desert highway.



Source: Google

Figure 4-1 Map showing Relative Location of WWTP and Sludge Lagoons

4.1.2 Topography and Geology

(A) Topographical Feature

(i) Abu Rawash WWTP

The following are salient features related to topography of the area around Abu Rawash WWTP:

- Abu Rawash WWTP is on the western edge of the Nile delta located in northwest of Greater Cairo.
- In the east and north side of Abu Rawash WWTP, the topography of the land is relatively flat (altitude ranging from 10 to 20 m) and the area slopes gently towards the Nile River. In this area, rural villages are located sporadically and much of the area is occupied by agricultural fields.
- On the other hand, south and west side of Abu Rawash WWTP is occupied by high altitude lands.
- Along the desert highway, the residential and commercial area are located

that have been newly developed.

- In the west of the WWTP, a vast area of land is occupied by desert.
- The discharge from WWTP flows to Barakat drain and through a series of agricultural drain networks (shown in green color line in Figure 4-3), it is finally discharged into Rosetta Branch of river Nile. The agricultural drain networks flows through Nile delta area that has altitude ranging from 10 to 20 m.

In the neighborhoods of the WWTP boundaries, there are only few houses and on the eastern side agricultural fields are located. In the west, there is no agricultural field and few houses are located very far from the WWTP along the Cairo-Alexandria road. In the south, there are barren lands and some agricultural fields. The land within the fence of Abu Rawash WWTP belongs to the HCWW and therefore no land acquisition will be required for any facilities proposed to be constructed within the fence.

Source: Google

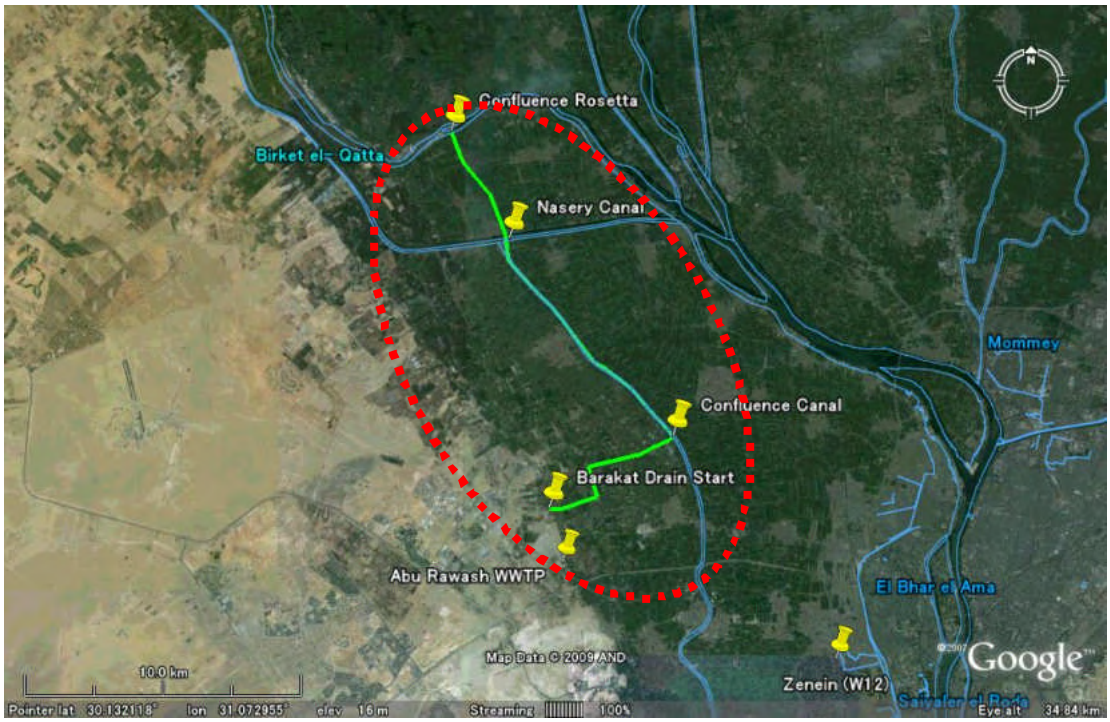
Figure 4-2 Map showing Location around Existing Abu Rawash WWTP

(ii) Sludge Lagoon

Main points related to topography in the area of sludge lagoons are listed below.

- The existing sludge treatment facilities (Sludge Lagoons) are located in the desert at a location of about 35 km from Abu Rawash WWTP and are used for drying the sludge generated from Abu Rawash and Zenein WWTP.
- The Sludge Lagoon is in the southwest side of the development zone along the desert highway. The development zone has cottages along the road side, and there exist a continuous zone of plantation between the sludge lagoons and the desert highway.
- Sludge lagoons are located at about 8 km from the desert highway, and the distance between the cottages of the development zone and the lagoons is not less than 3 km along straight line.
- The altitude of the sludge lagoon is slightly lower than 100 m in desert area and the northeast and southwest area has slightly higher altitude (more than 120 m).
- The plantations that is located adjoining the north and southwest of the sludge lagoon use drip irrigation system utilizing groundwater as source of water. The grains, vegetables and fruits grown in these plantations include olive, lemon, tomato, and corn, etc.
- The population settled in these plantation zones is very small and mainly include people who are related to harvesting or agricultural work, and the agricultural workers visiting to this area from outskirts of Cairo mainly for working in plantation zones.
- In the south and east side of this lagoon, most of the land is barren and the desert area continues to a very far distance especially to the south.

In the existing sludge lagoons, there are 20 basins with a total area of 241.5 ha. The area surrounding existing sludge lagoons is owned by the HCWW and is not yet used. Therefore, for the construction of proposed additional lagoons, land acquisition would not be required.



Source: Google

Figure 4-3 Map showing Area in neighborhoods of Agricultural Drains

Source: Google

Figure 4-4 Map of Sludge Lagoons in Desert and its Surrounding Area

(B) Geological Feature

The Abu Rawash WWTP is located in the westernmost edge of Nile deposits-Cultivated area formed of the Nile River. The hill located on the southern side of WWTP is formed of the following geological formations, and it is the beginning of the desert area and not formed of the Nile sediment.

The geology of the desert area of the west side of WWTP and the Sludge Lagoon site is Tmlkh, and ToB and ToO are distributed over in the lower layer (Refer Figures 4-5 and 4-6).

- ToB: Oligocene, Basalt Flows: Olivine basalt sheets: 15 m thick
- Tmlkh: Lower Miocene, Gebel Khashab Red Beds: Vividly colored sands and gravels, with silicified tree trunks and Scutella remains, 67 m thick.
- ToO: Gebel Qatrani Formation: sands and sandstones with clay and marl intercalations, including vertebrates and silicified tree trunks, 20 m thick.

Source: Geological Map of Greater Cairo Area (Surveyed and compiled by the Egyptian Geological Survey and Mining Authority, 1983)

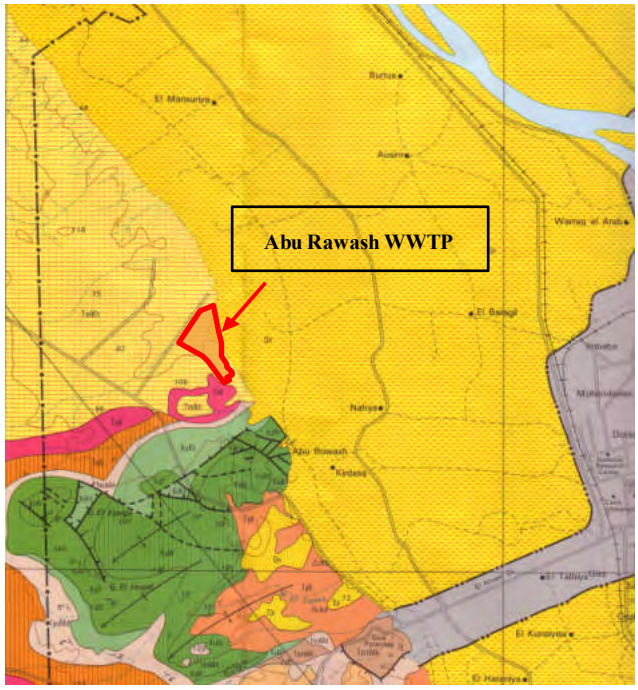


Figure 4-5 Geological Map of Abu Rawash WWTP and Surrounding Area

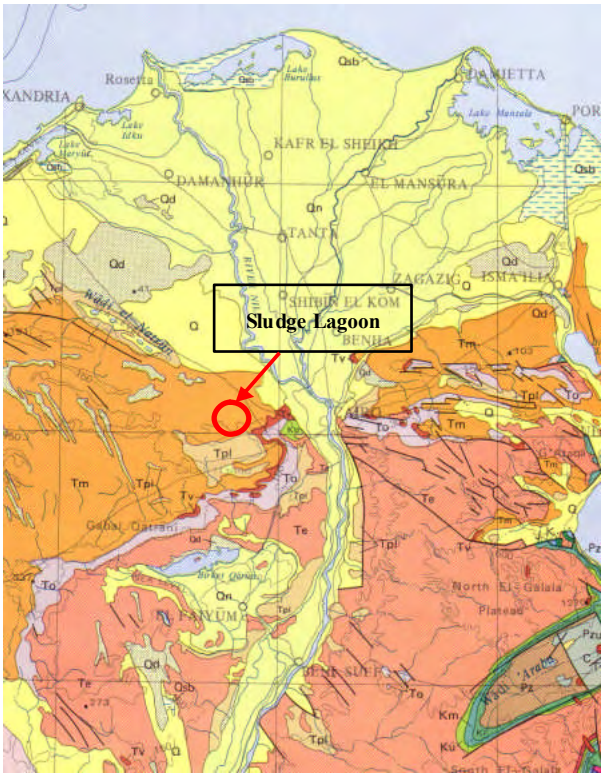


Figure 4-6 Geological Map of Sludge Lagoon and Surrounding Area

(i) Geology of Sludge Lagoon Area

It is reported (Ref: AMBRIC Report on West Bank Sludge Handling Facilities, 1991) that the groundwater table in the sludge lagoons area lies in the range of 50 to 100 m below the ground surface. The report also mentions that there will be no risk of groundwater pollution during the operation phase of sludge lagoons.

Based on the findings of other Study, it is found that the formations in 6th October City (located south of the sludge lagoons areas) is covered by tertiary sediments, which include formations of considerable porosity such as: sands, gravels and sandstone. Oligocene basaltic flows occur as basaltic sheets reaching a thickness of about 30 m.

(ii) Geology of Abu Rawash WWTP Area

It is reported that, in the area of Abu Rawash WWTP, the formation of in-situ strata is composed of alluvial and diluvial deposits known as river Nile deposits overlying the

bedrock of the calcareous sand, which is a part of Gabal Abu Rawash.

The diluvial deposits consist of gravels, coarse sands and clays which are frequently interbedded with outwash. It is reported that Nile alluvium is about 8.5 m in thickness in the inner delta. Around the delta, it is less or has the same thickness.

Estimating the junction between the alluvial and the diluvial deposits with reference to the SPT (Standard Penetration Test) N-values and the soil testing results, the continuous cohesive soils deposited underground at a depth approximately between 8.0 and 11.0 m can be considered as the base of the alluvial deposits. The layers up to a depth of 25 m are described below based on the data presented in old report.

First Upper Sand Layer, Su_I

It is composed of fine or medium sands that include little fine grains. The SPT N-value is less than 10 and the relative density varies from loose to medium dense. The soils are yellowish brown and extend in a layer of about 1.0 to 4.0 m thick.

Second Upper Sand Layer, Su_{II}

This layer is yellowish brown in color and is comprised of fine or medium sand including fine gravels. The relative density of the layer varies from medium dense to dense and thickness of this layer approximates 4.0 to 7.0 m.

Clay Layer, C

It consists of clays or silts containing irregular traces of fine sand and is dark brown or dark gray in color. The continuity of this layer is good across the site.

Middle Sand Layer, $Sm_{(s/c)}$

This layer is composed of fine or medium sands and clays but is richer in sand. The relative density is medium dense or dense in case of sands and the consistency of clays varies from soft to stiff.

Lower Sand Layer, S_I

This layer is mainly comprised of coarse-grained sands that include fine gravels or fine-grained sands. The color of soil in this layer is dark gray or light gray.

4.1.3 Climate and Meteorology

Cairo experiences a mixture of Mediterranean and desert climates, but often has a high humidity due to the river valley's effects. There are frequent occurrences of wind storms, bringing Saharan dust into the city during the months of March and April. Cairo has two seasons: approximately eight months of summer and four months of winter. The meteorological data in a west Cairo area is shown in Table 4-1. This data is the average value for years 1968 to 2006. The outline of climate and meteorology in this area is described based on this data.

(A) Temperature

In the hottest of the summer months – June, July, and August – the average daily maximum temperature is 34.4°C, and the average daily minimum is 20.8°C. Occasionally, the summer temperature has reached as high as 47°C. During winter, the strong sun result into warm and dry days, but nights are cool and humid, often freshened by breezes from the Nile. The average daily maximum temperature in January–February is 19°C, and the average daily minimum is 7.7°C. In a city near Cairo called New Cairo, the temperatures often drop below zero during winter. New Cairo's weather is generally cooler than that of Cairo due to its high altitude. Since it is an area of the dry climate, the temperature change during a day is large.

(B) Relative Humidity

The average minimum and maximum of humidity is 47% and 64%, respectively. As a general trend, the relative humidity is high in winter and drops in summer. The zone remains dry throughout the year; the seasonal variation of humidity is small, within a range of 17%.

(C) Rainfall

Based on the data presented in Table 4-1, it is observed that the rainfall is very low and

average monthly rainfall lies in the range of 0-3.6 mm. Average annual rainfall is 19.3 mm/year. The monthly precipitation of more than 3 mm/month is experienced only in the months of November to March (five months). The total precipitation for the remaining seven months (from April to October) is very small (2.5 mm). It could be said that the area has a very low level of rainfall.

(D) Wind

On average, excellent wind blows from north-northeast and north-northwest. In about 60% cases in year, the wind direction is in the range of 215 to 44 degrees. In about 53% cases, generated wind velocity lies in the range of 3.0-5.1 m/sec (Table 4-2). Seasonal variation is observed in wind pattern, from April to November winds blow predominantly from the northwest and northeast, and during December to March southerly winds blow.

(E) Evapotranspiration

The seasonal variation in amount of evapotranspiration is influenced by humidity, wind and precipitation. It has been observed from data that evapotranspiration is small in winter and it has a tendency of becoming higher in summer. The maximum of average daily evapotranspiration is 8.5 mm/day in June, and the minimum is 2.1 mm/day in January (Table 4-3).

Table 4-1 Climate Data for Abu Rawash Area in Greater Cairo

Months	Maximum Air Temperature (°C)	Minimum Air Temperature (°C)	Dry Air Temperature (°C)	Relative Humidity (%)	Monthly Rainfall (mm)
January	18.2	7.7	12.7	62	3.6
February	19.6	8.5	13.7	57	3
March	22.6	10.3	16.3	54	3.2
April	27.4	13.5	20.1	48	0.8
May	30.9	16.4	23.4	47	0.6
June	33.7	19.4	26.2	49	0
July	34.4	20.8	27.1	56	0
August	34.1	21	27	60	0
September	32	19.7	25.3	59	0.01

Months	Maximum Air Temperature (°C)	Minimum Air Temperature (°C)	Dry Air Temperature (°C)	Relative Humidity (%)	Monthly Rainfall (mm)
October	28.7	17.2	22.5	61	1.1
November	23.9	13	18	64	3.4
December	19.7	9.1	14.1	63	3.6

Source: JETRO Study on Abu Rawash WWTP in Cairo, 2008
Note: - Prepared based on data collected at a Meteorological Station located in West Cairo and represents an area of 50 km radius.
- Collected from Climate Department, Egyptian Meteorological Authority, Arab Republic of Egypt
- Average based on the data of 1968 to 2006.

Table 4-2 Wind Data for West Cairo Station

Station no. 368 "West Cairo Station" from (1/1968) to (12/2006)

Wind Direction	Knot / m/sec	Wind Speed (%) 01--03 (0.5 - 1.5)	04--06 (1.5 - 3.0)	07--10 (3.0 - 5.1)	11--16 (5.1-8.1)	17--21 (8.2 - 10.7)	22--27 (10.8 - 13.7)	All Speed
N	345-14	3.4	4.6	6.4	4.4	0.2	0.0	19.0
	15-44	2.3	4.8	8.3	6.3	0.6	0.0	22.3
	45-74	0.8	1.6	2.6	1.9	0.2	0.0	7.2
	Sum	6.5	11.0	17.3	12.6	1.0	0.0	48.5
E	75-104	0.6	0.7	0.7	0.4	0.0	0.0	2.4
	105-134	0.5	0.5	0.2	0.0	0.0	0.0	1.2
	135-164	0.6	0.5	0.2	0.1	0.0	0.0	1.5
	Sum	1.7	1.7	1.1	0.5	0.0	0.0	5.1
S	165-194	0.8	0.8	0.6	0.3	0.1	0.0	2.6
	195-224	0.8	1.2	1.1	0.7	0.2	0.1	4.0
	225-254	0.9	1.4	1.5	1.0	0.3	0.1	5.1
	Sum	2.5	3.4	3.2	2.0	0.6	0.2	11.7
W	255-284	1.5	1.8	1.6	1.0	0.2	0.1	6.3
	285-314	2.4	2.9	2.4	0.9	0.1	0.0	8.8
	215-344	3.7	5.5	5.5	2.6	0.1	0.0	17.4
	Sum	7.6	10.2	9.5	4.5	0.4	0.1	32.5
All Direction		18.5	26.2	52.7	19.7	2.1	0.4	100.0

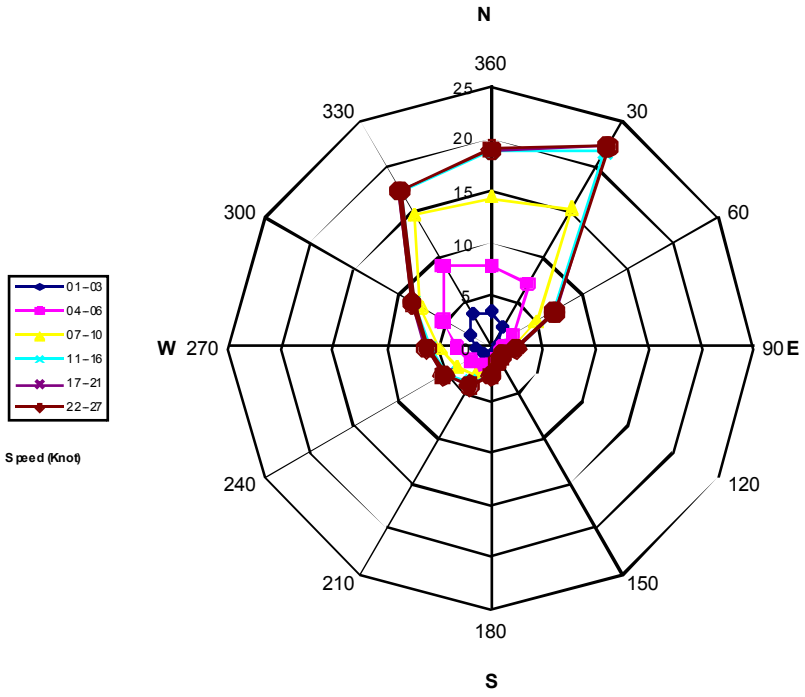
Remarks:
1- Unit of surface wind speed (Knot) = 1.85 Km/hr =0.51m/sec
2- Prevailing wind direction for "West Cairo Station" as annual normal "North West/ North East"
(Data Source: Egyptian Meteorogical Authority Climate Department)

Source: JETRO Study on Abu Rawash WWTP in Cairo, 2008

Table 4-3 Evapotranspiration in Greater Cairo Area

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2.1	3.1	4.4	5.9	7.5	8.5	7.8	7.1	5.9	5.0	3.2	2.2

Source: Environmental Assessment, East Bank Wastewater Project, Stage II, 1995



Source: JETRO Study on Abu Rawash WWTP in Cairo, 2008

Figure 4-7 Wind Direction Pattern

4.1.4 Water Pollution (Surface Water and Groundwater)

The existing status of water pollution in the project area is described under the heads of surface water bodies and groundwater.

(A) Effluent Receiving Water Bodies (Agricultural Drain Networks)

The treated wastewater of Abu Rawash WWTP is discharged into Barakat Drain which later on joins into an agricultural drain, and the effluent flows through Abdel Rahman, Al Ramal drain, Muheit, Al Rahawy and finally discharges into Rosetta Branch of River Nile (Figure 4-8).

At Present, Abu Rawash WWTP has primary treatment facilities with a capacity of 400,000 m^3/day), and additional primary treatment facilities with capacity of 800,000 m^3/day is expected to be completed soon. It is observed that a part of collected wastewater is discharged untreated into drains due to lack of treatment capacity at Abu Rawash WWTP and other locations upstream. This has resulted into significant level of pollution in drain networks. The situation of water quality can be grasped from the following data, and water quality plots presented in Figure 4-9 (For details please refer to Appendix-1).

- Greater Cairo Sanitary Drainage Company (4 Jul. 2007)
- Giza Water and Wastewater Company (27 Mar. 2009)
- Ministry of Water Resources and Irrigation (unknown)
- JICA (10 and 12 Aug. 2009)

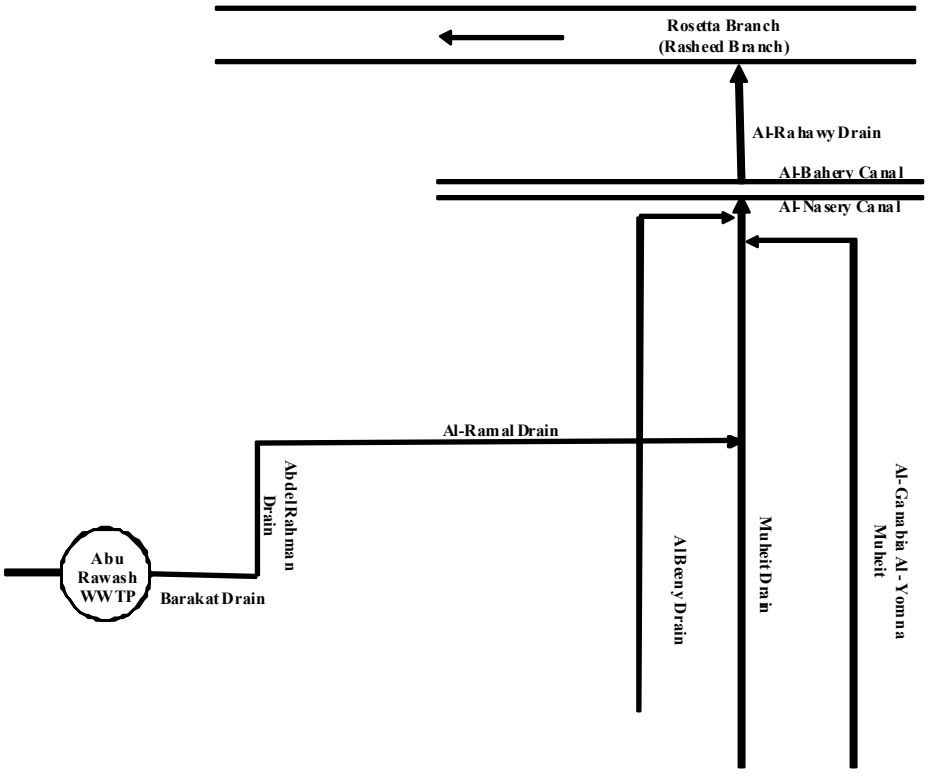


Figure 4-8 Schematic of Drain Networks from Abu Rawash WWTP to Rosetta

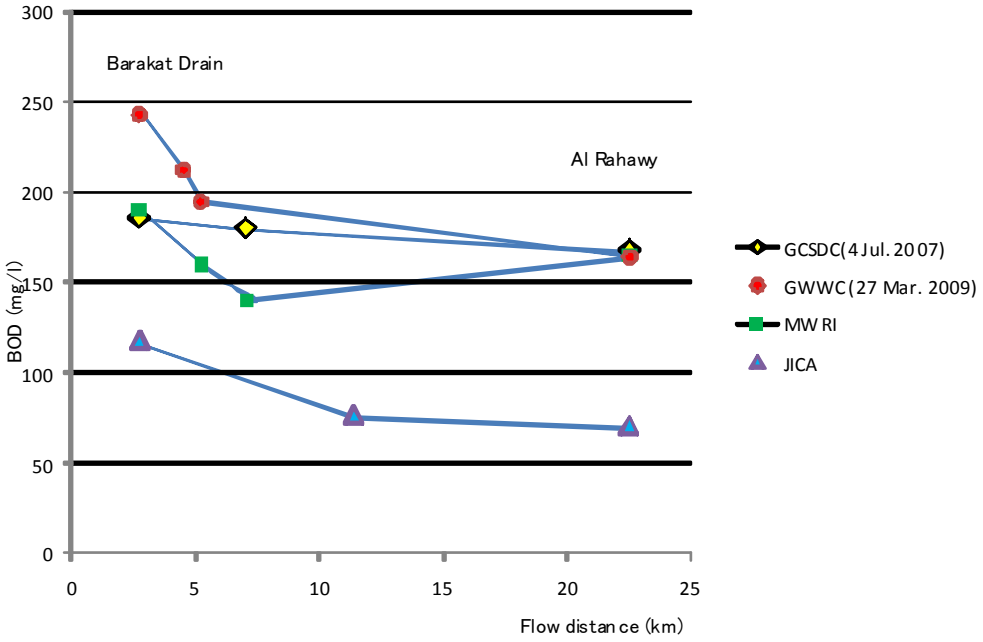


Figure 4-9 Existing Situation of Water Quality in Drain Networks

From Figure 4-9, it is reflected that the water quality (in terms of BOD) of the drain is not good and significant level of pollution occurs due to discharge of partially treated/untreated wastewater in Barakat and other drains of the network. It is also observed that after the discharge of effluent from WWTP, the water quality improves due to long travel time from Barakat along the drain courses. The result of JICA study samples has lower BOD levels in upstream stretches compared to other results, however the trend is similar. It may be attributed to the fact that even the raw wastewater quality has very wide variation since 2007 and on the sampling day of JICA Study Team, the BOD of raw wastewater was on lower side. In conclusion, it is understood that the control of pollution in drains are not given desired level of attention yet.

(B) Heavy Metals and Toxic Substances

The level of contamination due to heavy metals and toxic substances in the wastewater of Abu Rawash WWTP and its effluent receiving water bodies have been clarified through the results of water quality survey carried out by the JICA Study in August 2009. This water quality survey is carried out in order to obtain the basic data that is required for judging whether the treated wastewater of the Abu Rawash WWTP and drain water meet the effluent water quality standards and the water quality standard for irrigation. Results of

water quality analysis are shown in Table 4-4.

The sampling was carried out, for analysis of heavy metals, at locations listed below. For the details on location of these sampling points, refer Figure 1 in Appendix 1.

Sampling Location	
1	Abu Rawash WWTP (Raw wastewater)
2	Abu Rawash WWTP (Primary treated wastewater)
3	Barakat Drain (Discharged wastewater from WWTP)
4	Muheit Drain (midpoint of this drain)
5	Al Rahawy Drain

Table 4-4 Results of Water Quality Survey for Heavy Metals and Toxic Substances

Parameters	Unit	Sampling Point					Standard -A	Standard -B
		No.1	No.2	No.3	No.4	No.5		
Result for Sampling on 10th August 2009								
Chlorides	mg/l	-	-	-	-	118	300	-
Bromides (Br)	mg/l	-	-	-	-	<0.05	3	-
Manganese (Mn)	mg/l	-	-	-	-	0.3	0.2	-
Oils and grease	mg/l	-	-	-	-	18	10	-
Cadmium (Cd)	mg/l	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	-
Lead (Pb)	mg/l	<0.01	<0.01	<0.01	<0.01	0.2	5	-
Copper (Cu)	mg/l	<0.01	<0.01	<0.01	<0.01	<0.01	0.2	-
Nickel(Ni)	mg/l	<0.01	<0.01	<0.01	<0.01	<0.01	0.2	-
Zinc (Zn)	mg/l	<0.05	<0.05	<0.05	<0.05	0.1	2	-
Arsenic (As)	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	N.A.	-
Chromium (Cr)	mg/l	<0.01	<0.01	<0.01	<0.01	<0.01	N.A.	-
Molybdenum(Mo)	mg/l	-	-	-	-	<0.005	0.01	-
Iron (Fe)	mg/l	-	-	-	-	1.3	5	-
Cobalt (Co)	mg/l	<0.01	<0.01	<0.01	<0.01	<0.01	0.05	-
Total Heavy Metal	mg/l	<0.1	<0.1	<0.1	<0.1	-	-	1
Results for Sample Collected on 12th August 2009								
Chlorides	mg/l	-	-	-	-	120	300	-
Bromides (Br)	mg/l	-	-	-	-	<0.05	3	-
Manganese (Mn)	mg/l	-	-	-	-	0.1	0.2	-
Oils and grease	mg/l	-	-	-	-	21	10	-
Cadmium (Cd)	mg/l	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	-
Lead (Pb)	mg/l	<0.01	<0.01	<0.01	<0.01	<0.01	5	-
Copper (Cu)	mg/l	<0.01	<0.01	<0.01	<0.01	<0.01	0.2	-
Nickel(Ni)	mg/l	<0.01	<0.01	<0.01	<0.01	<0.01	0.2	-
Zinc (Zn)	mg/l	<0.05	<0.05	<0.05	<0.05	<0.05	2	-
Arsenic (As)	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	N.A.	-
Chromium (Cr)	mg/l	<0.01	<0.01	<0.01	<0.01	<0.01	N.A.	-
Molybdenum(Mo)	mg/l	-	-	-	-	<0.005	0.01	-
Iron (Fe)	mg/l	-	-	-	-	0.7	5	-
Cobalt (Co)	mg/l	<0.01	<0.01	<0.01	<0.01	<0.01	0.05	-
Total Heavy Metal	mg/l	<0.1	<0.1	<0.1	<0.1	-	-	1

Notes: Standard-A: Decree No.44 of 2000 (Maximum limits for re-use of treated effluent: 2nd group water treated secondarily)

Standard-B: Decree No.8 of 1983 (Effluent limits for treated discharges into water bodies)

It became clear from the above results that neither wastewater flowing into Abu Rawash WWTP, treated effluent from this WWTP, nor the water in drains is contaminated due to the heavy metals or toxic elements. However, the level of manganese is observed to be little higher than the defined limit, possibly due to low level of DO available in treated effluent. The water quality in the effluent receiving water bodies is expected to improve by this project, through the improvement in dissolved oxygen level and consequent decrease in manganese level.

(C) Groundwater

Groundwater in the neighborhoods of Abu Rawash WWTP is through the recharge of the Nile River, and hence sufficient groundwater of good quality is obtained. There are signs that several groundwater withdrawal pumps are located on the northern side of Abu Rawash WWTP, and water tanker trucks carrying water from these pumps are seen frequently. Moreover, there is one groundwater withdrawal pump station located about 3.5 km northeast of Abu Rawash WWTP. This pumping well has a depth of about 60 m, and water is pumped using submersible pump (1,400 m^3/day). This pumping station is used for supplying water to the business zone developed along the desert highway. The water quality data on this pumping well are presented below in Table 4-5.

Table 4-5 Groundwater Quality Data near Abu Rawash WWTP

Parameters	Groundwater	WHO Guideline
Chlorides (mg/l)	65	250
Fluorides (mg/l)	0.05	1.5
Sulphates (mg/l)	70	400
Sodium (mg/l)	60	200
Calcium (mg/l)	67	100
Magnesium (mg/l)	32	30 - 50
Iron (mg/l)	0.2	0.3
Manganese (mg/l)	0.05	0.1
Total Hardness (mg/l)	300	500
TDS (mg/l)	500	1,000
pH	8.3	6.5 – 8.5

From the data in Table 4-5, it is understood that water quality of groundwater obtained from this pumping station is of good quality similar to tap water. Therefore, it is judged that groundwater in the neighboring area of Abu Rawash WWTP is good.

To have an idea of groundwater in the area near sludge lagoons, visits and personal inquiries were carried out in the adjoining plantations, and the following information on groundwater was obtained through these visits and discussions.

- The groundwater is obtained in wells at a depth greater than 150 m only.
- The water was tasteless and odorless when tasted from a well in field, however, it was felt to have high hardness and therefore unsuitable for drinking.
- Groundwater is mainly used for irrigation. (Drip irrigation system)
- Groundwater is not recharged but it is thought that there might exist fossil water that is being pumped up.
- It is not certain if the available groundwater in existing situation is sufficient to obtain water for irrigation in the future.

4.1.5 Air Pollution

In Egypt, the following are considered to be the main causes of air pollution:

- industrial pollution sources including power stations, oil refineries and other industries such as iron and steel, fertilizers, textiles, bricks, cement and food industries
- mobile sources such as vehicles, which are considered as one of the most important pollution sources due to their environmentally polluting emissions.
- open burning of municipal wastes
- open burning of rice straw in Delta regions resulting in the release of dense fumes that pollute air during autumn periods.

Also, seasonal winds transfer dusts from the desert resulting in higher concentration of dusts during certain times of the year. The situation is aggravated by rare occurrence of rainfall and high dryness of air.

In Egypt, air pollution is monitored through EEAA monitoring network that has 78 stations and of this 41 stations are located in Greater Cairo. These stations are spread in many sites such as industrial, residential, urban and remote areas. This also includes 4 monitoring stations in the neighborhoods of the Study area: Cairo University, Giza Square, 6th October, and Mohandseen. The air pollutant indicators that are monitored in these stations include Particulate Matters less than10 microns (PM10), Sulphur Dioxide (SO_2), Nitrogen Dioxide

(NO_2), Nitric Oxide (NO), Carbon Monoxide (CO), Ozone (O_3), Lead (Pb) and Smog.

Source: Egypt State of the Environment Report 2007, EEAA, MSEA

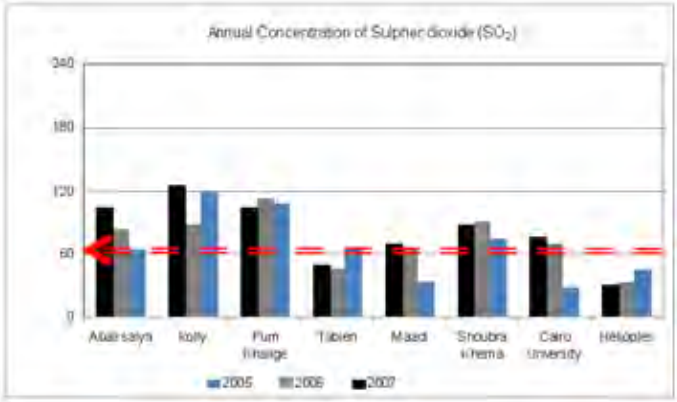
Figure 4-10 Monitoring Stations for Air Quality in Greater Cairo

(A) Sulphur Dioxide (SO_2)

Sulphur Dioxide gas (SO_2) is primarily generated as a result of oxidization of sulphur residues in liquid oil fuel during combustion whether in fixed sources, such as power stations and factories, or mobile sources particularly gas oil operated vehicles.

Air quality indicators with respect to sulphur dioxide have shown the following main points:

- Sulphur dioxide concentration has not exceeded its permissible maximum exposure limit for one hour (350 microgram/m^3) except for small periods in 2007.
- Sulphur dioxide annual average concentrations in all monitoring sites countrywide did not exceed the permissible level except in two sites in Greater Cairo (Fom El Khalig and Qulaly), which are two highly dense traffic areas due to their location in downtown Cairo.
- Comparing SO_2 monitoring results in Greater Cairo during 2007 with the results of the past three years (Figure 4-11) it is reflected that there is gradual decrease of SO_2 during recent years in some areas such as Shoubra El Kheima , Maadi and Cairo University (Cairo University is located in central area of the Giza Governorate) due to several factors, most significant is the continuous operation of power stations using natural gas instead of fuel oil.



Source: Egypt State of the Environment Report 2007, EEAA, MSEA

Figure 4-11 Annual Average of SO_2 Concentration in Cairo during Past Three Years

(B) Nitrogen Dioxide (NO_2)

Annual limit of NO_2 gas is not defined in the Law No.4 of 1994 on Environment Protection, therefore, the annual limit of 40 µg/m^3 imposed by World Health Organization (WHO) could be considered as a guideline.

It is noticed that monitoring Stations in the Giza Governorate, Cairo University and Mohandseen have exceeded this permissible annual limit during 2007. However, these did not exceed the permissible limit prescribed in the Egyptian Environment Protection Law (400µg/m^3 – for one hour exposure).

During 2007, the annual average concentration of NO_2 exceeded the WHO maximum annual limit (40 µg/m^3) in all monitoring locations in Greater Cairo. This may be attributed to the rise in numbers of vehicles during the past years; a factor that led to the increase of fuel combustion rates and consequently the increase in NO_2 average annual concentrations exceeding the internationally permissible guideline.

Table 4-6 Annual Average Concentration of NO_2 during Last Three Years

Location	Average Annual NO_2 (µg/m^3)			WHO (µg/m^3)
	2005	2006	2007	
Giza		98.8	119.3	40
Cairo University	108.3	70.3	85.4	
Mohandseen			82.4	

Source: Egypt State of the Environment Report 2007, EEAA, MSEA

(C) Particulate Matters (PM10)

Particulate matters are considered a major air pollutant in Greater Cairo region owing to the multiplicity of pollution sources. In recent years, focus has been directed towards monitoring suspended particles especially the concentrations of particulate matters less than 10 micron (PM_{10}) suspended in the air that are of grave risk to public health as they are significantly inhaled and settle in the lungs causing subsequent health problems. The maximum limit of outside air pollutant in terms of PM10 is 150 µg/m^3 (24 hour exposure).

The particulate matters pollution sources, in dense traffic, residential or industrial areas, may be different. However, they are the persistent source of pollution and contribute differently to such a problem in the respective locations depending on their proximity to the source of pollution.

Table 4-7 Annual Average PM10 (μg/m^3) in some Locations of Greater Cairo

Location	Type	1999	2000	2001	2002	2003	2004	2005	2006	2007	Env. Law 4/94
Giza (Faculty of Agriculture	Traffic	166	162	183	155	148	149	139	132	149	150
6th of October City	Residential	136	127	135	122	106	116	97	93	122	

Source: Egypt State of the Environment Report 2007, EEAA, MSEA

(D) Lead

Human exposure to lead pollution could be in different forms such as through air inhalation or taking in lead- or lead-derivatives- polluted food. Most important of such forms is inhaling lead in the form of suspended air particles or dusts, leading to the accumulation of such poisonous element in human blood through the respiratory system. Lead badly affects both digestive and immunity systems as well as the kidneys, liver and blood vessels. It has also been proven that children's body absorb much more lead compared to adults' body and hence pose higher risks to children. Lead monitoring results showed that all lead measurements monitored in residential areas did not exceed the permissible limit provided for in the Environment Protection Law Executive Regulations. This was the impact of strict enforcement of the Environment Protection Law and amendments introduced by EEAA for the purpose of reducing the lead permissible level in both residential and industrial areas to 0.5μg/m^3 and 1.5μg/m^3 respectively instead of 1μg/m^3 in all areas alike whether residential or industrial.

Comparing lead concentrations monitored during the monitoring years starting from 2001, averaging higher than the Executive Regulations permissible levels, it is noticed that lead concentrations in residential areas were 1.01μg/m^3, while they currently do not exceed 0.37μg/m^3. Also, concentration in industrial areas was 2.31μg/m^3 in 2001, and has dropped to 1.04 μg/m^3. The decreasing tendency in lead concentration levels could be attributed to reduction efforts.

Table 4-8 Annual Lead Concentrations (µg/m^3) at few Locations in Cairo

Location	Type	2001	2002	2003	2004	2005	2006	2007
Giza (Faculty of Agriculture)	Traffic	1.06	1.03	1.02	1.09	1.16	0.67	0.38
6th of October City	Residential	1.01	0.70	0.86	0.85	0.86	0.77	0.27

Source: Egypt State of the Environment Report 2007, EEAA, MSEA

(E) Carbon Monoxide (CO)

Carbon monoxide (CO) is emitted from vehicular emissions, from burning coal or wood in heaters. It is considered one of the most hazardous and toxic air pollutants affecting both human beings and animals. CO reacts with hemoglobin forming carboxyhemoglobin preventing oxygen from combining with hemoglobin, depriving the body from oxygen resulting in suffocation. The Environment Law executive regulation stipulates that the maximum permissible limit of CO exposure for one hour and eight hours is 30 mg/m^3 and 10 mg/m^3 respectively.

Based on the data of monitoring stations, it is noticed that the annual average of CO concentrations during 2005 – 2007 is relatively stable. CO concentrations during an eight-hour exposure have sometimes exceeded permissible limits in different months of the year. However, they did not exceed the permissible limits in one-hour exposure at any time of the year.

(F) Ozone

Ozone is formed in the troposphere as a result of the interaction of pollutants emitted from transportation means or appliances containing hydrocarbons (Freon) used in manufacturing refrigerators, air conditioners, and many other industries. Ozone is considered a hazardous component to human health.

Environment Law executive regulations specify the maximum limit of exposure to surface ozone by one hour and not to exceed 200µg/m^3. Permissible limit during 8 hours should not exceed 120µg/m^3. Not much data have been collected on ozone concentration and for a better understanding on ozone concentrations and impacts it is required to increase the number of ozone monitoring stations.

The monitoring data of Qaha and Giza stations indicate significant increase in ozone concentrations mostly due to high traffic density in these areas being in proximity to road networks and due to weather factor prevailing at that time of the year (summer), leading to increase in the percentage of surface ozone formation.

During monitoring period of 2005 to 2007, the ozone concentration of Giza is less than 80μg/m^3, and has satisfied the limitation of air pollution.

(G) Air Pollution Situation of Abu Rawash WWTP and Sludge Lagoon

There is no data available on air pollution parameter for locations near Abu Rawash WWTP and Sludge Lagoon, and hence the level of air pollution at these locations is unknown. The observation point of Giza described above is located in the central area of Giza Governorate. On the contrary, since Abu Rawash WWTP is situated at the end of development zone and sludge lagoon is located outside the development zone, it is understood that the level of air pollution in these locations is not worse compared to that at Giza monitoring station mentioned above.

(H) Air Pollution Situation of Abu Rawash WWTP and Sludge Lagoon by an Original Pollution Source

The main sources of air pollution in Abu Rawash WWTP area can be considered as the exhaust gas emissions from the car traffic on the desert highway, and the brick kilns that are mentioned as major sources of air pollution in Giza Governorate in current situation. However, the desert highway is about 3 km away from WWTP, and some brick kilns are located in the Rahawy area at a distance of about 14 km from WWTP. Therefore, the air pollution level in the present condition is considered to be low except in terms of the particulates. The pollution related to particulates could be generated not only from these sources but could also depend on climatic conditions such as wind direction, wind force, etc.

Similarly, based on the following reasons it is judged that the level of air pollution in the area of sludge lagoon is not very bad.

- There is no source of air pollution because there only exist few farms (plantation) and residences (cottage) on the outskirts of the sludge lagoon

area.

- Sludge lagoon area is located at a distance of about 8 km from the desert highway, and it is understood that the influence of vehicles running on desert highway will be negligible on air pollution level in lagoon area.

4.1.6 Noise

Based on the results of noise monitoring, the main sources of noise in Egypt have been categorized as follows:

(A) Transportation and Road Noise

It is considered to be the main cause of environmental noise in Egypt. Areas lying along main roads are affected by traffic noise due to the increased number of vehicles; neglect of regular maintenance of vehicles, and poor road pavement. Also, train noise affect those residing beside railways within a distance of 150m, and so does airport noise over urban areas settled around these areas.

(B) Commercial and Human Activity Noise

This category includes the noise produced by shops and all types of commercial facilities and activities, as well as people's daily activities.

(C) Loud Speaker Noise

This type of noise is generated due to use of loud speakers in open area celebrations, weddings, funeral ceremonies, outside mosques, and for commercial propaganda.

For the purpose of noise monitoring in Egypt, 30 stations are installed and of this 18 Stations are installed in the east side of the Nile River (the Cairo center and south zone) in Greater Cairo. The result of noise level measurements by Monitoring Station in Greater Cairo is shown in Table 4-9 below.

Table 4-9 Noise Level measured by Monitoring Stations in Greater Cairo

Area of Monitoring Stations (Name of monitoring station)	Average equivalent noise level (dB)		
	Daytime	Evening	Night
Main Cairo Squares (Opera Square, Ataba Square, Ramsis Square, Roxy Square, Fom El- Khalig Square)	60-80	70-80	65-75
Residential low-traffic suburbs in south Cairo (Aly Mobark School, Foad Galal Primary School, Mokatam District, El-Nasr Company for housing)	65-75	65-75	60-70
Some schools in residential/commercial areas or along a main road in south Cairo (Sakr Qorish School, Fatma El-Zahraa School, Foad Galal Prep School, El-Bahaya School, Ismail El- Abany School)	65-80	65-80	65-90
Average Equivalent noise level L_{day} in residential and commercial areas or along main roads in south Cairo in 2007 (NPC, Maadi Sport for Yakht, Toraa prison, Helwan Metro, Helwan University, Maadi Metro, Cairo House, Automated slaughter, Public Transportation, El-Sayda Zienb Parking, El-Sayda Asha Post office)	70-90	65-90	65-80
Average equivalent noise level L_{day} in industrial areas in south Cairo in 2007 (Masera Shipbuilding Yard, Cairo south power station, Tebbeen Water Plant)	75-90	75-90	70-85
Law Limits	55	50	45

Source: Egypt State of the Environment Report 2007, EEAA, MSEA

From the data presented in Table above, it is noticed that the level of noise in all monitoring stations in Cairo central and southern zone exceeds the limit defined by the Law for town residential areas. Considering the existing level of noise in different parts of the city, it is judged that adequate control measures are not undertaken to bring the noise level within standards.

Data is not available on noise level in the areas of Abu Rawash WWTP and the sludge lagoon, and the measurement survey is not carried out under JICA Study.

In the Abu Rawash WWTP and its neighborhoods, sources of large noise do not exist. The existing main sources of noise in this area include mobile sources (vehicles) on the desert highway and the access road to Abu Rawash WWTP. In the vicinity of Abu Rawash WWTP, on the southwestern side newly developed zone including factory, warehouse, residence, restaurant and business schools is located. Furthermore, in the northern and eastern neighborhoods, a suburban village zone is located from ancient times including residences and small individual stores. A noise source of concern is not located in either of these areas.

In the neighborhoods of the sludge lagoon, only farms (plantation) are distributed, and the area does not include any fixed noise source. Also, the mobile sources of noise (vehicles on the desert highway) are located in the northeast at a distance of 8 km from the sludge lagoon, and it does not cause any nuisance related to noise near the sludge lagoon and its periphery.

4.1.7 Odor

In Egypt, the environmental standard values and regulations related to odor has not been setup or defined. Therefore, in the existing condition neither monitoring stations have been installed nor periodical observation is carried out for odor.

Usually, the odor ingredients which are expected to be generated from wastewater treatment plant or sludge treatment facilities include parameters such as Ammonia, Methyl Mercaptan, Hydrogen Sulfide, Methyl Sulfide, Methyl Disulfide and Trimethylamine (these are the parameters listed in the Offensive Odor Control Law enforcement ordinance in Japan). Especially Hydrogen Sulfide is considered to be the main item that may cause odor problem.

In the existing condition, in the area related to this Study, odor emission has been observed at three locations. Considering this, the odor measurement investigations were conducted at these three locations in this Study. The result of measurement investigation and other gathered information are described below.

- Sludge pump station of the Abu Rawash WWTP
- Sludge Lagoon
- Al Rahawy Drain at Nikla

(A) Sludge Pump Station of the Abu Rawash WWTP

Sample was collected for odor survey analysis at existing sludge pumping station at Abu Rawash WWTP (Figure 4-12), for which details including results are listed below.

Items	Description
Sampling point	Sludge inflow pit and sludge storage tank (refer to Figure 4-12) Sampling Date: 11 and 13 August 2009
Main odor sources	Sludge inflow pit and sludge storage tank (open type facilities)
Results of investigation	Odor Index: 40, 39 Ammonia: 125 μg/m^3, 112 μg/m^3

	Hydrogen sulfide: 2,200 μg/m^3, 1,750 μg/m^3
Remarks	Although odor concentration in the emission from source is high, no odor related to sludge is perceived near the boundary of Abu Rawash WWTP. Odor diffusion into air from source can be reduced by improving the existing open inflow pit structure into closed type facilities.

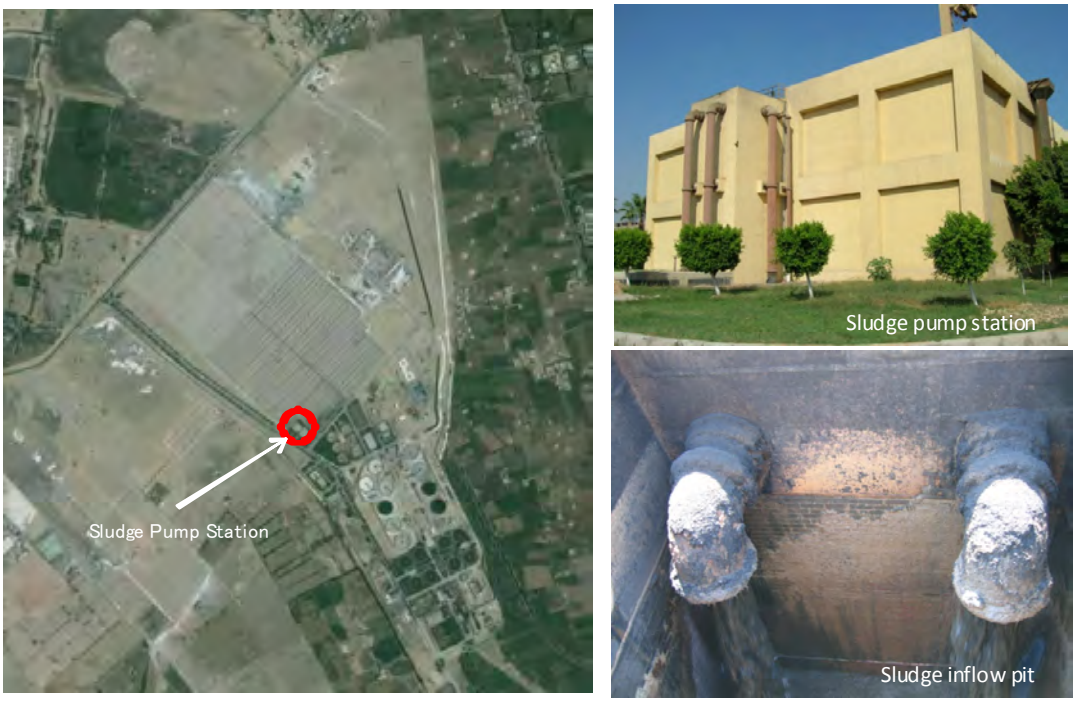


Figure 4-12 Sampling Point of Odor Measurement Survey at Sludge Pump Station

(B) Sludge Lagoon

In the process of drying sludge in lagoons, odor is generated and it can be felt very strong just near the bank of the drying beds in lagoon. However, in cases when the distance to drying beds gets longer, the intensity of odor decreases significantly. The details on sampling points, results of analysis and remarks are presented below.

Items	Description				
Sampling point	Sludge lagoon (refer to Figure 4-13) Sampling Date: 11 and 13 August 2009				
Main odor sources	Sludge lagoon (open type facilities)				
Results of investigation	Sampling Date	Sampling point	Odor Index	NH_3 (μg/m^3)	H_2S (μg/m^3)
	11 August 2009	1-A	37	90	1,480
		1-B	21	36	149
		1-C	13	25	42
	13 August 2009	2-A	37	83	1,370
		2-B	<10	ND	ND

		2-C	<10	ND	ND
Remarks	Local governments in Japan determined the standard values for odor index to be in the range from 10 to 21. Air quality guidelines of EPA: 100 NH_3 µg/m^3 for 24 hr averaging time Air quality guidelines of WHO: 150 H_2S µg/m^3 for 24 hr averaging time				

: Sampling point

Date	Distance	
11 Aug. 2009	1-A～1-B	95 m
	1-B～1-C	215 m
	1-A～1-C	310 m
13 Aug. 2009	2-A～2-B	425 m
	2-B～2-C	325 m
	2-A～2-C	750 m

Figure 4-13 Sampling Point of Odor Measurement Survey at Sludge Lagoon

(C) Al Rahawy Drain at Nikla

As discussed earlier, the effluent from Abu Rawash WWTP is discharged to Barakat drain which passes through series of drains. The effluent receiving drain crosses Al Nasery and Al Baheri canals in the form of siphon at Nikla and finally flows through Al Rahawy drain to Rosetta branch of River Nile.

Items	Description
Sampling point	Bank of Al Rahawy Drain at Nikla (after siphon, refer to Figure 4-14) Sampling Date: 12 Aug. 2009
Main odor sources	Drain water
Results of investigation	Bank of Al Rahawy Drain at Nikla Ammonia: ND Hydrogen sulfide: 0.12 mg/m^3 (=120 H_2S µg/m^3)
Remarks	Due to siphon action and lowering of pressure in the outlet, the hydrogen sulfide which is dissolved in water diffuses out to the air, leading to the occurrence of odor problem. The complaint from residents related to bad odor from drain has occurred.

Figure 4-14 Sampling Point of Odor Survey along Al Rahawy Drain at Nikla

4.1.8 Other Environmental Problems

In the existing condition, presence of large number of harmful insect (fly) in sludge lagoon is expected to be an environmental problem concerning this Project. Although the quantitative level of fly present in the neighborhoods of sludge lagoons cannot be grasped, many flies were observed during the visit to these beds. It is expected that the level of offensive odor concentration will diffuse with longer distances, however, these flies might

migrate and diffuse to longer distances along with the wind and affect living and health environment of the neighboring farm (plantation). When the workers, working at the farm (plantation), were interviewed, their response did not indicate any problem of fly. However, the presence of large number of flies could be very irritating and annoying to the visitors from Cairo who visit either cottages or the golf institution in neighboring areas.

4.2 Biological Environment

4.2.1 Nature Preserve Area in Greater Cairo

Egypt has defined Nature Preserve Areas and Important Bird Areas (IBAs), and nature conservation is positively performed in these zones. The number of zones in the former category is 27 and that in the latter are 34 (Refer to Tables 4-10 and 4-11 and Figures 4-15 and 4-16). El Hassana Dome Protectorate is among this list and is located in Giza Governorate, the same Governorate of Project area in this Study.

El Hassana Dome Protectorate (Type: Geological protected area)

Hassana Dome Protected Area is a museum and specialized scientific institute that helps in studying geology and different geological formations like folds, faults; also they can be compared with similar formations in other places. The existence of fossils collected and arranged in perfect reserved colonies, makes Hassana Dome a perfect area for studying fossils science or the science of paleo life and also the features of the ancient environment and the extent of climate change which took place in the Area, especially the cretaceous period, which characterized this area.

The colonies of coral reefs fossils that characterized this area are the best guiding fossils that refer to the paleo environment, so these marine fossils represent a complete record of the Ancient history.

However, there is sufficient distance between this protected area and Abu Rawash WWTP and sludge lagoon, and the implementation of this project is not expected to have any impact on this area.

Table 4-10 Protectorates Declared in Framework of Law 102 of Year 1983

No.	Protectorates Names	Declaration Date	Area km^2	Governorate	Prime Ministerial Decree
1	Ras Mohamed National Park	1983	850	South Sinai	Decrees 1068/1983 and 2035/1996
2	Zaranik Protectorate	1985	230	North Sinai	Decrees 1429/1985 and 3379/1996
3	Ahrash Protectorate	1985	8	North Sinai	Decrees 1429/1985 and 3379/1996
4	El Omayed Protectorate	1986	700	Matrouh	Decrees 671/1986 and 3276/1996
5	Elba National Park	1986	35,600	Red Sea	Decrees 450/1986 and 642/1995
6	Saluga and Ghazal Protectorate	1986	0.5	Aswan	Decree 928/1986
7	St. Katherine National Park	1988	4,250	South Sinai	Decrees 613/1988 and 940/1996
8	Ashtum El Gamil Protectorate	1988	180	Port Said	Decrees 459/1988 and 2780/1998
9	Lake Qarun Protectorate	1989	250	El Fayoum	Decrees 943/1989 and 2954/1997
10	Wadi El Rayan Protectorate	1989	1,225	El Fayoum	Decrees 943/1989 and 2954/1997
11	Wadi Alaqi Protectorate	1989	30,000	Aswan	Decrees 945/1989 and 2378/1996
12	Wadi El Assuit Protectorate	1989	35	Assuit	Decrees 942/11989 and 710/1997
13	El Hassana Dome Protectorate	1989	1	Giza	Decree 946/1989
14	Petrified Forest Protectorate	1989	7	Cairo	Decree 944/1989
15	Sannur Cave Protectorate	1992	12	Beni Suef	Decrees 1204/1992 and 709/1997
16	Nabaq Protectorate	1992	600	South Sinai	Decrees 1511/1992 and 33/1996
17	Abu Galum Protectorate	1992	500	South Sinai	Decrees 1511/1992 and 33/1996
18	Taba Protectorate	1998	3,595	South Sinai	Decree 316/1998
19	Lake Burullus Protectorate	1998	460	Kafr El Sheikh	Decree 1444/1998
20	Nile Islands Protectorates	1998	160	All Governorates on the Nile	Decree 1969/1998
21	Wadi Digla Protectorate	1999	60	Cairo	Decrees 47/1999 and 3057/1999
22	Swia	2002	7,800	Matrouh	Decree 1219/2002
23	White Desert	2002	3,010	Matrouh	Decree 1220/2002
24	Wadi El-Gemal/Hamata	2003	7,450	Red Sea	Decree 143/2003
25	Red Sea Northern Islands	2006	1,991	Red Sea	Decree 1618/2006
26	El Gulf El Kebeer	2007	48,523	New Valley	Decree 10/2007
27	El-Dababya	2007	1	Qena	Decree 109/2007

Figure 4-15 Location Map of Protectorates of Egypt

Birds are one of the most prominent and visible components of Egypt's biodiversity. The country is blessed with a wide range of habitats each with its own unique bird life. As the only land bridge between Eurasia and Africa, Egypt represents one of the most important migration routes in the world, with hundreds of millions of birds passing through the country every spring and autumn. Many birds, in winter, migrate over to Egyptian wetlands, making them internationally important wintering grounds for water birds. A total of 16 globally threatened species occur in the country, seven of which has particular importance in Egypt.

Egypt has benefited from its bird life since ancient times. The country is vital for many species of birds and shares a global responsibility to conserve them. Therefore important bird areas have been delineated in Egypt (Table 4-11).

However, none of these important bird areas are located near proposed site of either secondary treatment facilities or sludge lagoons and therefore the project implementation is not expected to have any negative impact on important birds.

Table 4-11 Important Bird Areas (IBAs) of Egypt

1. Lake Bardawil	18. Qulan Island
2. Zaranik	19. Zabargad Island
3. El Malaha	20. Siyal Islands
4. Bitter Lakes	21. Rawabel Islands
5. Lake Manzalla	22. Nabaq
6. Lake Burullus	23. Gabel Elba
7. Lake Idku	24. The Abraq Area
8. Lake Maryut	25. St. Katherine
9. Lake Qarun	26. Gabel Maghara
10. Wadi El Rayan	27. Quseima
11. Wadi El Naturn	28. Wadi Gerafi
12. Upper Nile	29. El Qasr Desert
13. Aswan Reservoir	30. Suez
14. Lake Nasser	31. Gabel El Zeit
15. Hurghada Archipelago	32. El Qa Plain
16. Tiran Island	33. Ras Mohammed
17. Wadi Gimal Island	34. Ain Sukhna

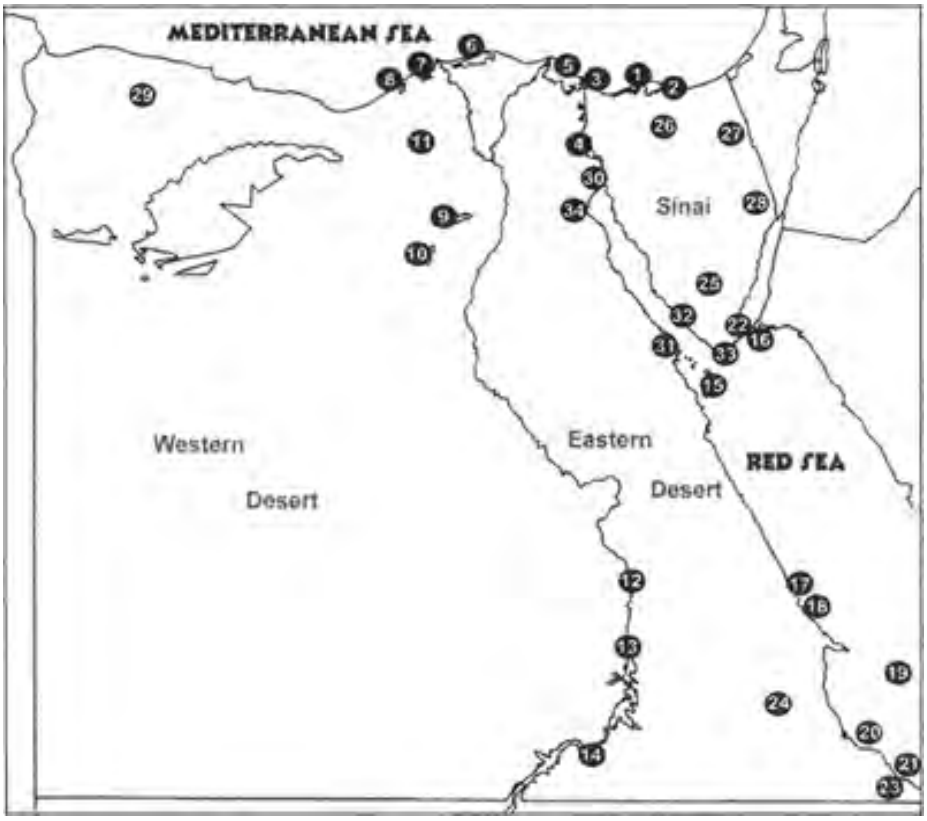


Figure 4-16 Location Map of Important Bird Areas (IBAs) of Egypt

4.2.2 Existing Situation of Flora and Fauna

(A) Abu Rawash WWTP Proposed Site

The secondary treatment facilities proposed in this project is planned to be built within the existing WWTP site. Proposed site for secondary treatment facilities, in the existing condition, is occupied by the old sludge drying beds (not in operation any more), and flora and fauna do not exist in the proposed site. It is proposed that all the sludge drying beds be removed before the construction of the secondary treatment plant. Therefore, it is judged that the construction of proposed secondary treatment facilities at Abu Rawash WWTP shall not have any impact on the flora and fauna at this location.

(B) Effluent Receiving Water Bodies

In the existing condition, the primarily treated effluent from Abu Rawash WWTP is discharged to Barakat drain that subsequently flows to series of public water bodies (agricultural drains). Also, partially treated or untreated wastewater from other areas is discharged to these drains. These drains mainly have the role of draining water from agricultural areas, and the existing environment is not suitable for growth and development of animals and plants. Salient features of these water bodies are described below.

- Since the drain canal has the purpose of draining excess water from agricultural areas promptly as mentioned above, it has either a rectangular or trapezoidal cross-section, and is almost straight.
- Also, the surface of wall is not suitable for growth of plant, and flora hardly exists.
- Similarly, the flow velocity in the drain is rapid, and there is almost no water area suitable for breeding and growth of fishes.
- Moreover, the present drainage canal is extremely polluted, and since dissolved oxygen is very low, it is not suitable as the living environment of fishes.

As mentioned above, the effluent receiving water bodies from Abu Rawash WWTP is not suitable for flora and fauna in the existing condition. Therefore, it is judged that proposed project shall not have negative impact on any flora and fauna in the effluent receiving water bodies.

(C) Sludge Lagoons Site

The sludge lagoons are located in desert area that has a very severe environment for development and growth of usual flora and fauna. Although the fly generated in sludge lagoon is a dominant species with an overwhelming high population at the sludge lagoon site, insects (an ant, a grasshopper, a beetle, etc.) and arthropods (a spider, a scorpion) are also found (Figure 4-17). However, the population of such species is very few. Moreover, although there is the least probability of breeding of birds in this area, birds flying to the sludge lagoon for predation are observed occasionally. Also, some bushes and herbs can be seen growing on the banks of the drying beds, it is expected that such plants will not exist in absence of the sludge lagoons which serves as source of nutrient and moisture for such plants.

In surrounding area of the sludge lagoons, some irrigated agriculture farms do exist that grow fruits and crops such as lemon, olive, corn, tomato, etc. It is understood that these plantation environment have been improved artificially and has positive influence on existence and growth of insect and small animals. Hence, it is assumed that environment suitable for producing plant improves the probability of growth of insect and related organisms that could feed on such plants/crops.

Therefore, the sludge lagoon site is considered to be an artificial favorable environment instead of desert environment, and it is judged that there are no flora and fauna which should be considered to have potential negative impact at the sludge lagoon site.

Figure 4-17 Existing Flora and Fauna at Sludge Lagoons Site

4.3 Socio-economic Environment

4.3.1 Community Structure

Greater Cairo is the center of the political and economic activities in Egypt, and its areal extent consists of Cairo, Giza, Qalyobia, Helwan, 6th October, and Shobra El-Kheima Governorates and New Cities. Proposed sites of secondary treatment and sludge treatment facilities under this project are located in Giza Governorate in the west side of the Nile

River.

Local administration units are described by the Law as the Governorates, Cities, Centers, Districts and Villages. However, these levels differ in different cases. Egypt is divided into 29 *Governorates* and one among them is Giza.

Giza Governorate consists of 21 *Cities* (called *Kism* and *Markaz*), and 2 other Cities (desert area). Abu Rawash WWTP is located in Kurdasa City (Markaz), and sludge lagoon is located in desert area. Moreover, the agricultural drain network which receives the effluent from Abu Rawash WWTP passes from Kurdasa City to Embaba City, and finally discharges to Rosetta branch of Nile River.

The area of Giza Governorate is 13,184 km^2. Of this, cultivated land covers an area of 9.8 thousand feddans (1 feddan = 4,200 square meters), that is equivalent to 0.3% of the total area, and unused area occupies about 80% of the total area. In general, the Nile delta zone is used for dwelling or cultivation purposes, whereas, the western desert area lies almost barren except the new urban development zone.

4.3.2 Population

According to the latest population census conducted in 2006, population in Greater Cairo was 12.4 million. Considering the latest census figures, population projection in Greater Cairo up to 2037 has been carried out in the Master Plan Update. The result of population projection in Master Plan Update has been authorized by HCWW as basis of planning both water supply and wastewater services and is presented in Table 4-12. Population in Greater Cairo is expected to increase from 12.4 million in 2006 to 25.4 million in 2037.

Table 4-12 Projected Population of Greater Cairo

District Name	Population (thousand persons)			
	2007	2017	2027	2037
East and South Nile	7,123	9,615	11,415	13,552
West Nile	4,148	5,684	6,789	8,109
Helwan	854	1,175	1,369	1,596
Shobra El-Kheima	1,176	1,593	1,857	2,165
Total	13,302	18,066	21,430	25,422

4.3.3 Socio-economics of Giza Governorate

The salient features of the socio-economic conditions in Giza Governorate are described below and presented in Table 4-13.

- GDP per capita (per capita gross domestic product) of Giza Governorate is slightly smaller (about 13%) compared to the national average value.
- The labor force (% of total population) is 30.9% which is almost at the same level as national value. When the labor force is compared sector wise, the labor force affiliated to agricultural and industrial sectors are very low and in services sector large ratio of labor force are involved. The trend of these figures in case of Giza Governorate is similar to that of Cairo which indicates that Giza also has characteristics of urban center.
- The ratio of poor person to the total population is 13.1%, and is about 3 times compared to the level in Cairo Governorate. However, the percentage of poor people in Giza is lower when compared to national average (19.6%), and this could be attributed to the fact that economy of Giza Governorate is also influenced by the economy of Greater Cairo.
- The unemployment rate of Egypt is high and has reached to 9.3%, and the figures for Cairo and Giza Governorate are also at similar level as national value.
- It can be judged that the level of public services in terms of electricity and water supply are high in general. However, sufficient services are not offered in sanitation sector and especially the service level is low in rural area. In

Giza Governorate, only 35% of rural households and 92% of urban households have access to sanitation.

- In terms of communication services (telephone connections) compared to the national level, it is observed that Giza Governorate has good level of services. However, connectivity to internet has not spread yet to wide areas, and diffusion rates are 9.2% and 18.3% in Giza Governorate and Cairo Governorate, respectively.
- The condition of service level in health sector in Giza Governorate is better than the national average.
- In terms of services in education, enrollment ratio in Giza is slightly smaller than the national level. However, the ratio of women who have received higher education and the level of literacy in Giza governorate are higher than the national level.

Table 4-13 Existing Situation of Public Services

Items		Egypt	Cairo Governorate	Giza Governorate
GDP per capita (LE)	2005/06	6,371.7	6,156.5	5,552.0
	%	100	96.6	87.1
Poor persons (Total)	2004/05	13974.1	356.4	1,024.5
Poor persons (of total population %) Actual	2004/05	19.6	4.6	13.1
Labor force (15+) (% of total population)	2005	30.2	33.1	30.9
Percentage of labor force (15+) in Agriculture	2005	30.9	0.2	10.2
Percentage of labor force (15+) in Industry	2005	11.7	21.4	19.5
Percentage of labor force (15+) in Services	2005	57.4	78.4	70.3
Wage earners (as % of labor force 15+)	Total 2006	30.9	37.0	32.5
	Females 2006	10.49	16.2	9.9
Employees in Gov. & public sector (% of total labor force 15+)	Total 2006	14.7	18.3	14.0
	Females 2006	7.1	11.2	6.6
Unemployment rate (%)	Total 2006	9.3	11.0	-
	Females 2005	25.8	25.81	23.55
	Urban 2006	10.9	11.0	10.8
	Rural 2006	8.0	-	7.9

Items		Egypt	Cairo Governorate	Giza Governorate
Households with Electricity (%)	2006	99.3	99.5	99.6
Households with Radio (%)	2004	-	90.9	92.3
Households with Television (%)	2004	-	95.9	93.1
Households with access to Piped water (2006)	Urban	98.8	99.2	99.42
	Rural	92.9	-	96.95
Households with access to Sanitation (2006)	Urban	82.5	98.2	91.8
	Rural	24.3	-	35.1
Telephones per 1000 households	2006	674.6	1173.4	910.0
Number of internet subscribers (per 1000 people)	2004/05 2006	- 75.6	182.7 -	92.1 -
Children dying under age 5 (per 1000 people)	2005		26.6	12.1
Infant mortality (per 1,000 live births)	2005		31.1	13.5
Doctors per 10,000 People MOH	2006	6.5 (2005)	5.3	8.3
Maternal mortality rate (per 1,000,000 live births)	2005	52.9	61.70	43.80
Beds per 10,000 people	Total (2006)	21.5 (2005)	42.8	21.3
	MOH (2006)	11.1 (2005)	10.5	10.4
Health units per 100,000 population	2005	3.8	6.2	5.1
Life expectancy at birth (years)	2006	71.3	71.4	69.1
Population (15+) with secondary or higher education (%) 2006	2006			31.3
Gross enrollment ratios (%) basic education (2005/06)	Total	-	78.2	82.5
	Primary	94.51	83.5	93.8
	Preparatory	88.26	76.8	80.1
	Secondary	70.08	68.0	59.5
Females (15+) with secondary or higher education (%)	2006	22.7	38.0	25.5
Literacy rate (15+)	2006	78.9	88.2	81.4

Source: Egypt Human Development Report 2008, UNDP

4.3.4 Cultural Heritage

The tourist industry is very prosperous in Egypt. The country has several tourist attractions with important historical inheritance. Therefore, in the tourism sector, large revenue is collected.

At present, seven locations are specified as world heritage of Egypt, and the list is shown below.

1. Memphis and its Necropolis - the Pyramid fields from Giza to Dahshur (N29°51' E31°15')
2. Ancient Thebes with its Necropolis (N25°42' E32°35')

3. Nubian monuments from Abu Simbel to Philae (N22°30' E31°50')
4. Islamic (Old) Cairo (N30°6' E31°26')
5. Abu Mena (Monastery near Alexandria) (N30°51' E29°40')
6. St. Katherine's (Monastery and area immediately surrounding it) (N28°34' E34°0')
7. Wadi Al-Hitan (Whale Valley) in the Faiyum Governorate (N30°11' E29°20')

Out of the above list, Memphis and its Necropolis are located in Giza Governorate, and are visited by many tourists. It is one of the most important tourist industry resources in Egypt.

Abu Rawash WWTP is located at a distance of about 12 km from the Memphis and its Necropolis. Therefore, it is judged that implementation of the project shall not cause any negative influence on these heritages. Sludge lagoon is located further 35 km away from Abu Rawash WWTP, and implementation of sludge lagoon extension is not expected to have any negative influence on the tourist industry.

Furthermore, it is judged that there is no possibility of existence of cultural heritages at the location of proposed sites in Abu Rawash WWTP and sludge lagoons due to the following reasons.

- Investigation by specialists was conducted before the start of the primary treatment facility construction in 1980s. From the results of investigation, it was confirmed that there did not exist any cultural heritage in the Abu Rawash WWTP site.
- No remnants relevant to cultural assets had been discovered during two construction works of primary treatment facilities.

4.3.5 Water Utilization (Water available for Potable Supply, Irrigation and Industrial Use)

The effluent receiving water bodies from Barakat Drain to Al Rahawy is managed as an agricultural drain, and water rights is not set up. However, unauthorized water withdrawal from these drains is frequently observed at several locations for agricultural uses. Although the quality of water in these drains is not of satisfactory level for agricultural uses, water is often pumped by neighboring farmers since water can be obtained easily in sufficient amount.

From the field survey it is learnt that water is not withdrawn from the Rosetta Branch as a source of drinking water supply for a distance of about 30km downstream of its confluence with Rahawy.

4.3.6 Transportation (Access Road to Abu Rawash WWTP)

Abu Rawash WWTP is situated about 3km from Cairo Alexandria desert highway to the northeast. From the desert highway, there exists a road through which one can reach Abu Rawash WWTP travelling straight through a distance of about 3 km (Figure 4-18).

Figure 4-18 Access Road to Abu Rawash WWTP

An access road is one of the main roads which connect Abu Rawash area to the desert highway. The width of the road is about 7m, and it is paved road of single-sided one lane. On both sides of the road there exist some establishments such as factory/warehouse, business school, restaurant, residences and mosque, etc.

The water tank trucks which carry water from the private pumping wells (using groundwater as source) located in the vicinity of Abu Rawash WWTP are observed to pass through this road frequently. Also, many large size vehicles carrying materials and products to and from surrounding factories and warehouses pass through it. Although, exact information on number of such large vehicles passing through this road is not available, these vehicles are frequently observed on this road.

However, this area is newly developed zone and the number of permanent residents seems to be still low. Therefore, pedestrian are still very low in number with few small vehicle

users. However, with rapid development, it is expected that the number of pedestrian and vehicles would increase gradually. Therefore, especially during the construction stage, traffic control is required for safe and smooth traffic of the road users.

It would be important to point out here that although the road is paved, the road shoulder and pedestrian walkways are still in the form of sand, and therefore it is anticipated that while large-size trucks pass each other, significant amount of particulate matters will be generated. Moreover, the road has a width of only 7m, and great caution shall be required while large and heavy vehicles are passing each other.

4.3.7 Public Health

Detail information on public health is not available for Study Area and therefore average condition of public health is presented for Egypt. The MDG targets at the reduction of occurrence of diseases such as HIV/AIDS, Malaria, TB, etc. The prevalence of HIV/AIDS in Egypt is very low, with approximately 5,300 cases in 2005, or less than 0.01% of the population. Efforts towards halting and reversing the incidence of TB and malaria have been successful in Egypt. According to data from the Ministry of Health and Population, incidence of new cases of tuberculosis was 24 cases per 100,000 persons in 2006. Prevalence of TB in 2005 was 32 cases per 100,000 persons.

Other major diseases that affect the Egyptian population include Hepatitis C and schistosomiasis (Bilharzia). According to the Ministry of Health and Population, prevalence of intestinal schistosomiasis declined from 14.8 per 100 persons in 1990 to 2.7 in 2000. The prevalence of urinary schistosomiasis declined from 6.6 to 1.9 during the same period.

CHAPTER 5 ANALYSIS OF ALTERNATIVES

5.1 Analysis of Alternatives: With and Without Project

The main purpose of this project is to upgrade the level of treatment at Abu Rawash WWTP from primary to secondary, and to improve the quality of treated effluent thereby resulting into improvement of water pollution level in receiving water bodies. On the implementation of this project, it is expected that the treated effluent quality would be within defined standard for discharges into water bodies (which is assumed to exceed in the existing condition due to only primary level of treatment being practiced). In addition, improved quality of effluent will also result into improvement in water quality of receiving water bodies (network of drains), availability of better quality water for agricultural uses (for those who would like to use it), and mitigation of the odor problem along the drain network that is caused due to odor emission from drains.

In this part, comparative analysis is carried out related to the water quality in receiving water bodies for the cases of with project and without project. For this purpose, first of all, the existing condition of receiving water bodies is described below.

5.1.1 Effluent Receiving Water Bodies

The Wastewater of Abu Rawash WWTP is discharged into Barakat Drain, which flows through a series of drains namely Al Ramal, Muheit, and Al Rahawy, and finally it is flowing into Rosetta Branch of River Nile. The effluent receiving water bodies refers to the section of drain networks including Barakat Drain to Al Rahawy Drain. A schematic diagram of effluent receiving water bodies is presented below in Figure 5-1.

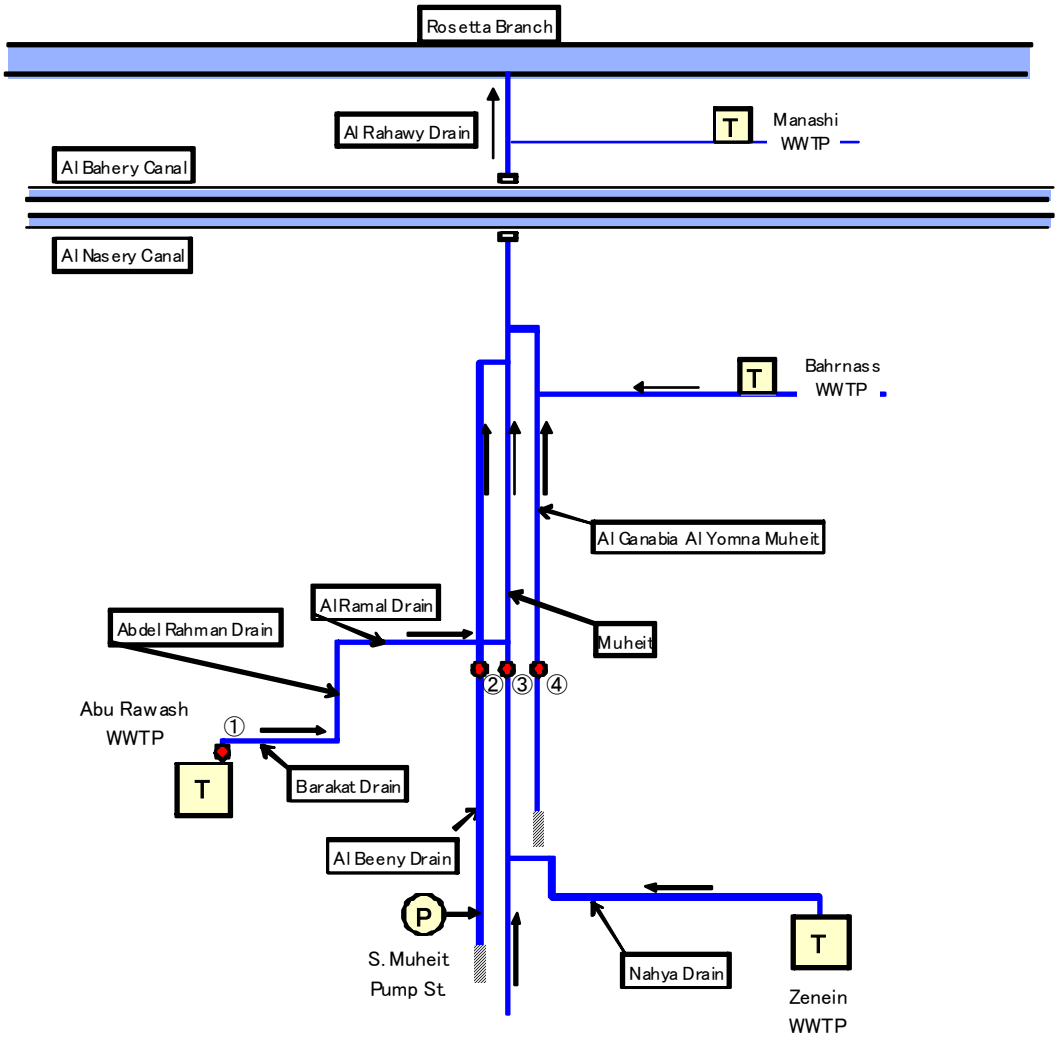


Figure 5-1 Schematic Diagram of Effluent Receiving Water Bodies

5.1.2 Pollution Load Discharged into Effluent Receiving Water Bodies

The discharged pollution load into the effluent receiving water bodies is classified into three regional distributions: from Abu Rawash WWTP, in the upper stream networks, and in catchment area of the effluent receiving water bodies downstream of the Abu Rawash effluent confluence (refer Figure 5-1). The discharged pollution loads for these regions are presented below in Table 5-1. For details regarding this, please refer Appendix 1.

Table 5-1 Discharged Pollution Load into Effluent Receiving Water Bodies

Name of Location		Discharged Pollution Load into the Effluent Receiving Water Bodies (BOD ton/day)		
		Existing	Future (Without Project)	Future (With Project)
1.	Abu Rawash WWTP	99.1	117.6	24.0
2.	Al Beeny	15.6 [1]	0.0	0.0
3.	Muheit	8.8	8.8	8.8
4.	Al Ganabia Al Yomna	1.7	1.7	1.7
Sub-total of Upper Stream (②, ③, ④)		26.1	10.5	10.5
-	Catchment area of the effluent receiving water bodies	0.0 [2]	1.2	1.2
Total		125.2	129.3	35.7
		100%	103%	29%

Note:

1. It is presumed that all pollution loads is due to overflow from the South Muheit Pump Station.
2. The septic tank with leaching system is used in this area for discharging human waste and domestic wastewater, and it is assumed that only little of pollution load is discharged into drain networks.

The existing regional distribution ratio of discharged pollution load is shown in Figure 5-2. According to this figure, the pollution load from the sewerage facilities (Abu Rawash WWTP and South Muheit Pump Station) contributes about 92% of the total pollution load discharges in the drain networks, and hence is expected to have significant impact on the water quality in the drain networks.

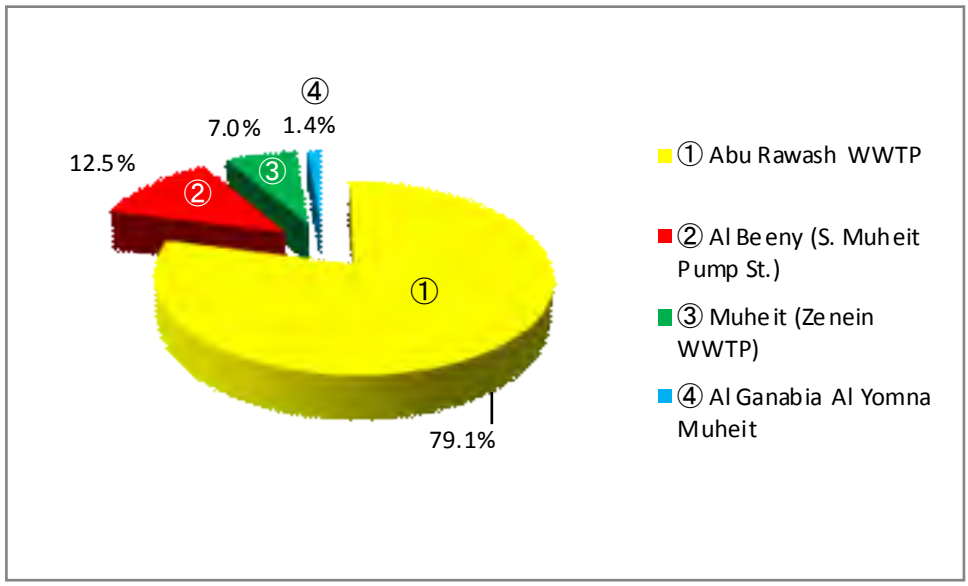
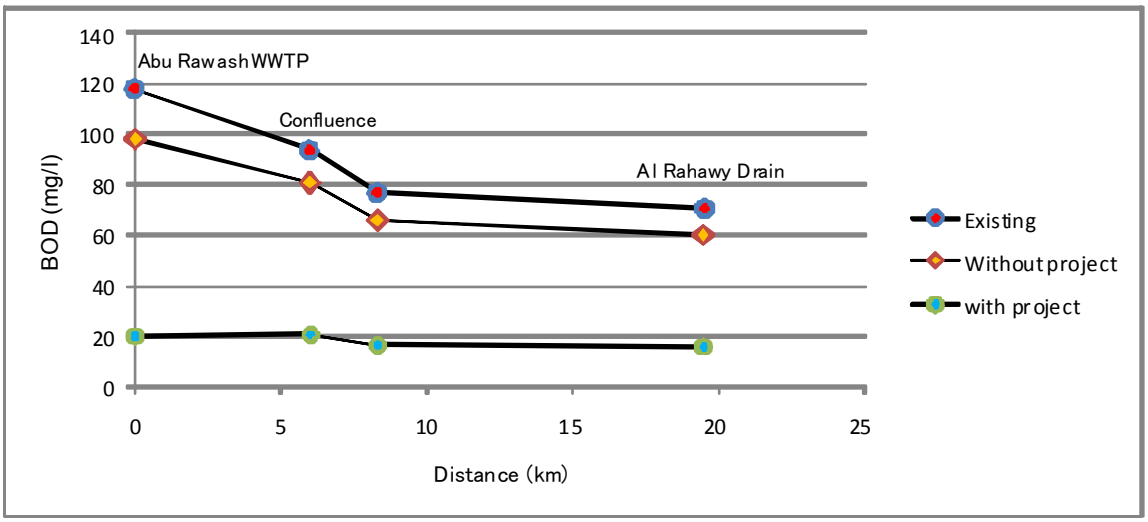


Figure 5-2 Distribution Ratio of Discharged Pollution Load (Existing)

5.1.3 Approximate Water Quality Simulation

Since, sufficient data is not available, very accurate water quality simulation is difficult. Therefore, approximate estimates of water quality in terms of BOD load has been carried out based on the available information. Results obtained from water quality survey by JICA Study Team have been used for simulation purposes. Since, it is difficult to clarify the actual purification and dilution action in the drain, the rate of decrease used in this section is an apparent rate of change of water quality. The results of approximately simulated water quality in the effluent water bodies are shown in Figure 5-3.



Notes:

Existing: Total wastewater volume is 850,000 m^3/day, (of this primary treatment is carried out for approximately 450,000 m^3/day)
Without project: Total wastewater volume is 1,200,000 m^3/day (Primary treatment)
With project: Total wastewater volume is 1,200,000 m3/day (Secondary treatment)
For details, refer to Appendix 1.

Figure 5-3 Approximate BOD Levels based on Simulation

It can be seen in plot in Figure 5-3 that the BOD level in case of Without Project is lower than Existing case. This is attributed to the reason that in the existing condition, although the total inflow to Abu Rawash WWTP is about 850,000 m^3/day, only half of it is primarily treated and the remaining is discharged untreated along with the effluent. However, in case of Without Project, the total flow of 1.2 million m^3/day shall be treated to the primary level and hence BOD level would be lower in this case.

5.1.4 Discharged Pollution Load into Rosetta Branch

The discharged pollution load into the Rosetta Branch is calculated using the values of discharged pollution load into the effluent receiving water bodies and the rate of decrease. The estimated pollution load is shown in Table 5-2.

Table 5-2 Discharged Pollution Load (BOD) into Rosetta Branch

(ton/day)

Items		Existing	Without Project	With Project
Discharged Pollution Load from Sewerage Facilities	Abu Rawash WWTP	99.1	117.6	24.0
	S. Muheit pump St.	15.6	-	-
	Masina & Bahrnass WWTP	-	1.2	1.2
	Sub-total	114.7	118.8	25.2
Discharged Pollution Load into the Rosetta Branch		107.1 100 %	108.4 101 %	28.9 27 %

Notes:
Existing: Total wastewater volume is 850,000 m^3/day, (Primary treatment is carried out for approximately 450,000m^3/day)
Without project: Total wastewater volume is 1,200,000 m^3/day (Primary treatment)
With project: Total wastewater volume is 1,200,000 m^3/day (Secondary treatment)
For details, refer to Appendix 1.

Based on the result of above analysis, it is expected that following improvements will result upon the implementation of secondary treatment facilities at Abu Rawash WWTP.

- It is estimated that implementation of project will effect reduction of the discharged pollution load from Abu Rawash WWTP into the water bodies by about 80% in case of future estimates.
- It is estimated that, after implementation of the project, the discharged pollution loads into the Rosetta Branch reduces to 29 ton/day as BOD compared to 107 ton/day in case of present load and 108 ton/day in case of the future load if the project is not implemented.
- The existing and future BOD levels in the case of without-project implementation are estimated as 71 mg/l and 60 mg/l, and estimated level of BOD in case of the with-project situation is 16 mg/l.
- Through the implementation of this project, the treated effluent quality level would satisfy the water quality standard of the maximum limits for re-use of treated effluent (2nd group water treated secondarily: Decree No.44 of 2000) and the effluent limits for treated discharges into water bodies (Decree No.8 of 1983).

– Moreover, since dissolved oxygen shall be recovered by water quality improvement (reduction of BOD level), the mitigation of odor problem in Nikla and native habitat of the drains are also expected.

The results discussed above are summarized in the following Table.

Table 5-3 Results of Analysis of Alternatives: With and Without Project

Items	Present Situation	Future Situation	
		Without Project	With Project
Discharged Pollution Load into the Rosetta Branch (BOD)	107 ton/day	108 ton/day	29 ton/day
Water Quality in Al Rahawy drain (BOD)	71 mg/l	60 mg/l	16 mg/l
Comparison to water quality standard of the maximum limits for re-use of treated effluent (Decree No.44 of 2000)	Exceeds the standard	Exceeds the standard	Within the standard
Comparison to effluent limits for treated discharges into water bodies (Decree No.8 of 1983)	Exceeds the standard	Exceeds the standard	Within the standard
Odor problem in Nikla	Continues	Continues	Resolves

5.2 Analysis of Alternatives: Others

In the project planning part of Volume I, analysis of alternatives have been carried out. Several types of processes are used for secondary treatment of wastewater. However, in this project, the primary treatment facilities are already constructed at Abu Rawash WWTP and full use of existing primary facilities shall be made. Therefore, the process of secondary treatment that could be applied narrows down to activated sludge process. The summary of this analysis is presented below.

5.2.1 Alternative Techniques for Wastewater Treatment

In the project planning, six alternatives of biological treatment process were examined, and, based on the result of comparison the conventional activated sludge process (CASP) was adopted. Examination of alternatives is summarized in Table 5-4.

The merits and reasons to select the application of CASP for secondary treatment are as follows.

- Required effluent standard can be achieved since more than 90% of removal efficiencies of BOD and SS are expected.
- Sewage treatment facilities with a total capacity of 2.0 million m^3/day can be accommodated within the existing WWTP site.
- Other large-scale WWTPs in Greater Cairo also apply CASP and operation and maintenance technology is well established in Egypt.
- It is possible to design larger capacity for one series, which leads to higher efficiency and economy of scale and easy operation.
- Utilization of the existing and ongoing primary treatment facilities is possible to reduce pollution load prior to secondary treatment.

Table 5-4 Alternatives of Biological Treatment Process

Alternatives	Explanation
Conventional activated sludge process (CASP)	CASP is a suspended growth aerobic process. It requires primary clarification prior to biological treatment. Detention period in aeration tank is maintained usually 4-6 hours. Activated sludge and liquid are separated in secondary clarification after aeration tank.
Oxidation ditch process (ODP)	ODP is a suspended growth aerobic process and lower BOD-SS loading operation comparing CASP. It does not require primary clarification. Detention period of aeration tank is maintained usually 14-28 hours. It is mainly applicable to small scale plants.
Extended aeration process (EAP)	EAP is a suspended growth aerobic process and lower BOD-SS loading operation comparing CASP. It does not require primary clarification. Detention period of aeration tank is maintained usually 12-14 hours. Solid retention time is longer than CASP.
Sequential batch reactor process (SBRP)	SBRP is an aerobic process where raw sewage is treated in batches. It does not require primary clarification. Operation takes place in cycle order and biological process and sedimentation take place in one reactor. It is mainly applicable to small scale plants.
Aeration lagoon process (ALP)	ALP is a completely mixed aerobic biological reactor without recycling. Overflow of aerated lagoon is sent to sedimentation basin. Since detention period is 3-4 days, lagoons require a very large area. Operation is simple but power consumption is high.
Waste stabilization pond process (WSPP)	WSPP treats sewage in a series of ponds. After screening sewage is fed to an anaerobic pond for initial pretreatment and then enters to an aerobic pond. WSPP requires a very large area and it is normally used for small capacity plants.

5.2.2 Alternative Techniques for Aeration Method

Removal of pollution load in activated sludge process is carried out by the action of microbes that are present in activated sludge. Activated sludge removes pollution load by absorption, ingestion, oxidization and elaboration in the presence of appropriate amount of oxygen. Therefore, aeration device that supplies oxygen to activated sludge and mixes wastewater and activated sludge, is vital for sewage treatment.

In diffuser method, airlift function is used by injecting air supplied from blowers in shape of fine bubbles into sewage in order to supply oxygen and mixing at the same time. On the

other hand, mechanical mixing method makes use of the pumping function and mixing function by rotating blades in sewage in order to supply oxygen.

Aeration device consumes significant portion of total electricity used in sewage treatment. In addition, its role is vital in activated sludge process. Therefore, aeration method should be selected considering all factors regarding the efficiency of dissolving oxygen, economical aspect, operation and maintenance, etc. In Egypt, mixing type of mechanical aeration device has been common so far due to factors such as easy maintenance and low initial cost. Fine bubble diffuser device was initially introduced to aeration facilities of Stage 2 of Al-Gabal Al-Asfer WWTP, which has been operative since 2006. In this Project, the application of ultra fine bubble diffuser device, which is more effective than fine bubble diffuser device, is considered. The candidates considered for comparison of aeration method are shown below and the comparison of aeration method is described in the following paragraphs (Refer Volume I for details).

	Options of Aeration Method
Case 1	Fine bubble diffuser device (Spiral flow type)
Case 2	Fine bubble diffuser device (Whole area differed type)
Case 3	Ultra fine bubble diffuser device (Whole area differed type)
Case 4	Mechanical aeration device (Mixing type)
Case 5	Mechanical aeration device (Submerged aeration type)

Case 3 Ultra fine bubble diffuser device (Whole area differed type) is recommended due to the following factors.

- It is most effective in terms of energy saving due to its high efficiency in dissolving oxygen.
- It can be utilized for relatively longer time due to its non-clogging feature by adequate operation.
- It has high level of flexibility for various operations due to its feature of wide operational range of air flow.
- It is the most economical in term of life cycle cost since it requires the lowest O&M cost due to its high efficiency.

CHAPTER 6 IMPACT IDENTIFICATION AND MITIGATION MEASURES

6.1 Overall Impact Identification

The first step in EIA is to identify potentially significant impacts due to implementation of proposed project components. The various aspects considered in impact identification of the project are as follows:

- Project components
- Project stages
- Impact generating activities
- Type of impact

A matrix table has been used to identify the overall impacts. The matrix thus identifies the environmental factors likely to be affected, and the activities responsible for this. The matrix for construction stage is shown in Tables 6-1 and that for operation stage is presented in Table 6-2. For various activities, the scoping includes identification of impact on social, natural and pollution parameters. The ○ in Tables indicates that the development scheme is foreseen to have some impact on that particular environmental element. Details on impacts of such elements are discussed in the next Section.

Table 6-1 Scoping Matrix for Project Components (Construction Stage)

Activities \ Environmental Elements	Affected parameters																								
	Social Environment									Natural Environment								Pollution							
	Resettlement	Economic Activity	Traffic/Public Facilities	Split of Communities	Cultural Properties	Water Right/Right of Common	Public Health Condition	Solid Waste	Hazard (Risk)	Topography and Geology	Soil Erosion	Groundwater	Hydrological Situation	Coastal Zone	Flora and Fauna	Meteorology	Landscape	Air Pollution	Water Pollution	Soil Contamination	Noise and Vibration	Ground Subsidence	Offensive Odor	Others
Construction: Secondary Treatment Plant																									
Whole construction work					○										○		○	○			○				
Carrying in and out of materials/construction waste			○				○											○			○				
Disposal of construction waste and soil								○																	
Work by heavy construction equipments																		○			○				
Construction laborers' lodgings									○																
Construction: Effluent Channel																									
Whole construction work			○															○			○				
Construction: Sludge Lagoon																									
Whole construction work			○												○			○			○				

Note: ○: Indicate that the development scheme is foreseen to have some impact on the environmental element.

Table 6-2 Scoping Matrix for Project Components (Operation Stage)

Activities \ Environmental Elements	Affected parameters																							
	Social Environment									Natural Environment								Pollution						
	Resettlement	Economic Activity	Traffic/Public Facilities	Split of Communities	Cultural Properties	Water Right/Right of Common	Public Health Condition	Solid Waste	Hazard (Risk)	Topography and Geology	Soil Erosion	Groundwater	Hydrological Situation	Coastal Zone	Flora and Fauna	Meteorology	Landscape	Air Pollution	Water Pollution	Soil Contamination	Noise and Vibration	Ground Subsidence	Offensive Odor	Others
Operation: Secondary Treatment Plant																								
Wastewater treatment works																					○			
Treated wastewater disposal							○		○				○						○					
Sludge transportation works																							○	
Operation: Sludge Lagoon																								
Sludge treatment works (sludge drying process)																							○	○
Sludge re-use works									○															

Note: ○: Indicate that the development scheme is foreseen to have some impact on the environmental element.

6.2 Foreseeable Adverse Impacts of Project at Construction and Operation Stages

The environmental parameters for which adverse impacts are anticipated have been analyzed in detail in this Section. The cells, which fall at the junction of the activity and affected parameter in Tables 6-1 and 6-2, have been graded as A, B, C and D in terms of level of impacts. (Tables 6-3)

The adverse impacts have been classified under two categories, namely construction stage and operation stage. Impacts during construction stage may be regarded as temporary or short-term whereas those during operation stage are likely to have long-term effects. The environmental impacts have been discussed separately for the construction stage and the operation stage.

At the construction stage, impacts could be in terms of noise, vibration, increased traffic, dust and solid waste disposal. All these impacts could be mitigated through proper mitigation management at construction stage.

During the operation stage of WWTP, major impacts could be in the form of presence of heavy metals in treated effluent and sludge. Also, the odor and flies problems are expected near the sludge lagoons. These impacts can also be mitigated through monitoring and implementing countermeasures.

Table 6-3 Foreseeable Adverse Impacts of Project Components (Construction Stage)

Activities	Foreseeable Adverse Impacts	Affected Objects	Grade of Adverse Impacts
Construction of Secondary Treatment Plant, Effluent Channel and Sludge Lagoon (Whole construction work, Use of heavy construction equipments)	<Cultural Properties> Damage to cultural properties	Egyptian people (Estate assets), Objects of cultural importance, Social environment in surrounding areas	− Investigation by specialists was conducted during the first stage of the primary treatment facilities construction (in the 1980s). The result of the investigation reflected that cultural properties do not exist in project site. − The presence of cultural assets was not discovered during construction (Phases 1 and 2) of the primary treatment facilities. **Grade of Adverse Impacts: C or D** **Influence period : Extended Period**
	<Flora and Fauna> Degradation of ecosystem and biodiversity	Natural environment in Project Area	<Abu Rawash WWTP> − The proposed construction site for secondary treatment facilities is located in the area of existing Abu Rawash WWTP. Presently, there exists old sludge treatment facilities that are no more in operation, and it is proposed that after dismantling these old facilities, the secondary treatment facilities should be constructed. Therefore, it is judged that there is no flora and fauna at proposed construction site that need consideration (Refer Figure 6-1). <Sludge Lagoon> − The extension of sludge lagoon is proposed at the site of existing sludge lagoon (Figure 3-2). − This zone is located in desert area, and the natural environment of this location is peculiar to a desert. During field visits, very few species of flora and fauna were observed in this area. − This site is already secured for construction of additional lagoons when needed in future, and precious species of the flora and fauna which should be conserved do not exist in this area. − As mentioned above, it is judged that sludge lagoon construction is possible without serious impact on the flora and fauna existing in its neighbourhoods. **Grade of Adverse Impacts: C or D** **Influence period : Extended Period**

Activities	Foreseeable Adverse Impacts	Affected Objects	Grade of Adverse Impacts
	<Landscape> Degradation of landscape	People in the neighbourhoods of Abu Rawash WWTP	- The height of proposed secondary treatment facilities is lower than the existing structures (Primary settling tank), and the height of main structures is less than 2m. Therefore, it is not visible from outside of the wastewater treatment site. Even in cases when it is visible, it is not expected to cause any feeling of oppression. **Grade of Adverse Impacts: C or D** **Influence period : Extended Period**
	<Air Pollution> Deterioration of air pollution level	People in the neighbourhoods of Abu Rawash WWTP	- Generation of the particulates and exhaust gases accompanying construction activities are expected that would be generated from the heavy construction equipments and vehicles used for the construction works. **Grade of Adverse Impacts: C or D** **Influence period : Construction period**
	<Noise and Vibration> Generation of noise and vibration	People in the neighbourhoods of Abu Rawash WWTP	- Generation of noise and vibration accompanying constructions which are generated from the heavy equipments and vehicles used for the construction works are expected. **Grade of Adverse Impacts: C or D** **Influence period : Construction period**
Carrying in and out of materials/ construction waste	<Traffic/Public Facilities> <Public Health Condition> <Air Pollution> <Noise and Vibration> Environment deterioration in terms of the above-mentioned item	In particular, people in the neighbourhoods of the road.	- The vehicles going to the WWTP can use the access road of about 3 km almost travelling straight from the desert highway (Refer to Figure 6-2). - This access road is one of the main roads that connect Abu Rawash area to the desert highway. The width of the road is about 7m, and it is paved road of single-sided one lane. Few establishments located along this access road include factory/warehouse, business school, restaurant, residences and mosque. - The water tank trucks which carry pumped water from groundwater wells located in the neighborhoods of the WWTP pass through this road frequently. In addition, large-sized vehicles carrying products/goods from surrounding factory and warehouse also pass through this road. Although the data on exact number of such vehicles is not available, these vehicles are frequently observed on this road. - This area is newly developed and the number of residents, pedestrians and vehicles users in this area is still low. - It would be important to point out here that although the road is paved, the road

Activities	Foreseeable Adverse Impacts	Affected Objects	Grade of Adverse Impacts
			shoulder and pedestrian walkways are still in the form of sand, and therefore it is anticipated that while large-size trucks pass each other, significant amount of particulate matters will be generated. Moreover, since the width of the road is only about 7m, large-sized vehicles need to be careful while crossing each other. - Therefore, carrying-in/out of vehicles can result into possible adverse impacts on health, air pollution level (by exhaust gas), and noise and vibration along the access road. **Grade of Adverse Impacts: C** **Influence period : Construction period**
Construction labourers' lodgings	<Hazard (Risk)> Deterioration of public safety and health environment	Residents around the site of labourers' lodgings	- Only labourers' specific environment may give local resident sense of incongruity, or may generate problem in terms of safety or health depending on the case. **Grade of Adverse Impacts: C or D** **Influence period : Construction period**

Note:

A: Indicates that the development scheme is foreseen to have strong impact on the environmental element.
B: Indicates that the development scheme is foreseen to have some impact on the environmental element.
C: Indicates the impact is not quite sure but minor impact is expected.
D: Indicates the impact is foreseen to have no impact.

Table 6-4 Foreseeable Adverse Impacts of Project Components (Operation Stage)

Activities	Foreseeable Adverse Impacts	Affected Objects	Grade of Adverse Impacts
Operation of Secondary Treatment Facilities (Wastewater treatment works, Treated wastewater disposal and Sludge transportation works)	<Noise and Vibration> Generation of noise and vibration	Residents in the neighbourhoods of Abu Rawash WWTP	− In the operation of secondary treatment facilities, the blower for aeration is usually the biggest source of noise. − To control the noise level, it is proposed to install blower in a building. − Hence, it is expected that significant level of noise shall not be emitted in the surrounding area. **Grade of Adverse Impacts: D** **Influence period : Operation period**
	<Water Pollution> <Public Health Condition> Environment deterioration in terms of the above-mentioned item	Residents in the neighbourhoods of the effluent receiving water bodies	− In this project, if suitable operation management is carried out, it is possible to satisfy the discharge standard from WWTP and the standards for re-use of drain water for agricultural purposes. − Before discharging treated effluent, chlorination shall be carried out for disinfecting the pathogenic bacteria. − Moreover, it is expected that through the introduction of secondary treatment, the water quality problem in the drainage networks and the odor problem at Nikla village shall also improve. − In the usual operation situation, it is expected that negative influence on water quality environment shall not be caused. − It is possible that in case of abnormal circumstances due to accident or power failure, significant level of influence might be caused and this point is mentioned later. − Another problem is expected to be in the form of excess or too little residual chlorine due to inappropriate addition of chlorine for chlorination. − Excess amount of residual chlorine in treated effluent is expected to have negative influence on existing ecosystem in drainage networks. This could also result into generation of hazardous chlorine compounds. − On the other hand, too little addition could cause health problem. − The above impacts could be solved through proper operation and management.

Activities	Foreseeable Adverse Impacts	Affected Objects	Grade of Adverse Impacts
			Grade of Adverse Impacts: D **Influence period : Operation period**
	<Hazard (Risk)> Contamination of heavy metals and toxic substances	The object which could suffer damage has a very wide range.	− Many cases of water withdrawal from the drain for agricultural uses are observed along drains receiving treated effluent from WWTP. − Usually the risks from wastewater could be in the form of presence of heavy metals and toxic substances resulting into abnormal water quality. − When the heavy metal or toxic substance is mixed with wastewater, this will also result into presence of these substances in treated effluent because these elements are not treated through WWTP. − When treated effluent is reused for agricultural uses, it might result into contamination of crops or farmland. − The discharge of heavy metals or other toxic substances in wastewater and finally to other water bodies could result into accumulation of such substances in ecosystem and related problems could be caused. − In the process of wastewater treatment, there is a tendency of gradual accumulation of heavy metals in sludge, and this could result into secondary contamination in case of sludge reuse. For example, if sludge is used for agricultural purposes, such metals might accumulate in human being body through intake of these crops. − Moreover, as an extreme example, the presence of such toxic substance might cause unusual pH and influence the process of activated sludge negatively. − In principle, it is necessary to manage sewerage system properly so that heavy metals and toxic substances do not mix in wastewater. − Although it is expected that there is very little risk due to heavy metals or toxic substances in the existing condition of the project area, the measures against prevention in the form of monitoring of industrial effluents is required. **Grade of Adverse Impacts: D** **Influence period : Operation period**
	<Hydrological Situation> Generating of flood	Residents in the neighbourhoods of the effluent receiving water	− There is necessity of examining whether the effluent receiving water bodies has sufficient carrying capacity to take care of volume of effluent discharged from this project.

Activities	Foreseeable Adverse Impacts	Affected Objects	Grade of Adverse Impacts
		bodies	− The network of drainage canal receiving water from Abu Rawash WWTP has three siphons for crossing canals and this portion becomes a bottleneck especially. Therefore, examination of this portion is required. − In this Study, examination has been carried out for sufficiency of the existing effluent channels and drains in terms of its capacity and it is judged that these drains are sufficient for carrying the flow of 1.2 million m^3/day. **Grade of Adverse Impacts: D** **Influence period : Operation period**
	<Offensive Odor> Deterioration of the living environment by offensive odor	People in the neighbourhoods of Abu Rawash WWTP	− The major source of odor emission in Abu Rawash WWTP is the sludge inflow pit and storage tank of the sludge pump station. − Since the sludge inflow pit and storage tank are open at the top and no odor control measures have been performed, the odor is intense in existing condition. − Therefore, it is assumed that the measures for odor control at WWTP are not difficult. **Grade of Adverse Impacts: D** **Influence period : Operation period**
Operation of Sludge Lagoon (Sludge treatment works, Sludge re-use works)	<Offensive Odor> Deterioration of the living environment by offensive odor	People in the neighbourhoods of sludge lagoon	− At the sludge lagoon, a strong odor emits during the period until sludge dries. − From the results of an investigation carried out by JICA Study Team, it is reflected that odor concentration and distance from source are inversely proportional. − Moreover, the result of odor survey and analysis indicated that odor level is within the guidelines (Japan, US EPA, WHO). (Investigation was carried out in August 2009) − However, during winter south and southwesterly wind may cause odor to move in the direction of adjoining plantation area. − Presently, there are very few permanent residents in this area, and with rapid development in the region, the number of permanent residents is expected to increase. Hence, the possibility of occurrence of odor problem cannot be denied in future. − Therefore, there is necessity of working on the measures against odor. **Grade of Adverse Impacts: C or D** **Influence period : Operation period**
	<Others>	People in the	− In addition to the odor problem near the sludge lagoon, generation of noxious insect

Activities	Foreseeable Adverse Impacts	Affected Objects	Grade of Adverse Impacts
	Deterioration of the living environment by noxious insect (fly)	neighbourhoods of sludge lagoon	(fly) can be a potential problem. - The odor is reduced by diffusion. However, under the influence of wind, the fly may diffuse to far distances. - Although a fly normally puffs up a feeling of repulsion only, it may have contact with eyes or mouth and may cause the illness of eyes and other related health problems. - For flies, it is important to establish a monitoring system that can be used for evaluation of the effect of implemented control measures also. **Grade of Adverse Impacts: C or D** **Influence period : Operation period**
	<Hazard (Risk)> Contamination of heavy metals	A wide range of objects may suffer damage.	- At present, dried sludge is used as agricultural fertilizer and soil conditioner in desert land. - Based on the available data it is observed that the heavy metal concentration contained in sludge satisfies the agricultural use guideline. - However, there is a risk of increased heavy metal concentration in future, and suitable monitoring organization needs to be developed. **Grade of Adverse Impacts: D** **Influence period : Operation period**

Note:

A: Indicates that the development scheme is foreseen to have strong impact on the environmental element.
B: Indicates that the development scheme is foreseen to have some impact on the environmental element.
C: Indicates the impact is not quite sure but minor impact is expected.
D: Indicates the impact is foreseen to have no impact.

Figure 6-1 Proposed Site for Construction of Secondary Treatment Facilities

Figure 6-2 Access Road from Desert Highway to Abu Rawash WWTP

Figure 6-3 Proposed Location of Effluent Channel from WWTP to Barakat

6.3 Mitigation Measures for Adverse Impacts during Construction and Operation Stages

The impacts have been discussed in detail in the previous Section. Major impacts are not expected either at construction stage or operation stage and only minor impacts are envisaged. These impacts could be mitigated or minimized through measures undertaken during construction and operation stages of the proposed Project. These measures have been discussed in detail in this Section and presented in the following Table.

Table 6-5 Mitigation Measures for Potential Adverse Impacts (Construction Stage)

Activities	Foreseeable Adverse Impacts	Mitigation Measures
Construction of Secondary Treatment Facilities, Effluent Channel and Sludge Lagoon (Whole construction work, Work by heavy construction equipments)	<Cultural Properties> Disappearance of and damage to cultural properties	From the background of the projects undertaken at Abu Rawash WWTP site in past and based on its location being very far from places of cultural importance and historical heritage, it is judged that there are no cultural assets in the area of proposed site. However, during implementation of construction stage the following important points should be put into practice while undertaking construction activities: - In order to centralize all the information about cultural properties, a person in charge shall be stationed in the site office. - When carrying out digging works, the workers should be advised to be careful about occurrence of anything concerning cultural assets or an unknown thing. In case of occurrence of such assets, the person in charge should be contacted immediately before continuing with digging works. In addition, the workers should be advised to care for such occurrence in addition to digging works. - When any such unknown thing/assets appear in course of digging, it should be reported immediately to the specialist and opinion should be received. - If required, the establishment of system for periodic information collection should be proposed.
	<Flora and Fauna> Degradation of ecosystem and biodiversity	Based on the existing situation of the proposed site, it is expected that there will be no influence of project activities on the flora and fauna, and biodiversity in the project area. However, it is advisable to collect information related to flora and fauna, that the worker notices during construction stage and record should be maintained. Information collection system can be established if needed, for this purpose.
	<Landscape> Degradation of landscape	It is judged from facilities planning that no major change in landscape is expected to occur by any structure proposed under this Project. However, to collect the complaints from residents and to make it reflected in the project, installation of information desk and including a person in charge at construction stage is proposed. When there are complaint and request from the residents concerning irritating landscape, the establishment of vegetation zone around facilities is considered to be the most suitable countermeasure. .
	<Air Pollution> Deterioration of air pollution	Since construction site is isolated from the housing zones and residential areas, it is expected that construction activities shall not cause any direct influence on residents in terms of air pollution. However, the following countermeasures are proposed in order to mitigate or minimize influences on neighboring people, and on workers of construction site.

Activities	Foreseeable Adverse Impacts	Mitigation Measures
		− Dust control through water sprinkling at the construction sites. − Preventive maintenance of construction machineries and vehicles to meet emission standards. Regular maintenance of vehicles and equipment should be carried out. − Attentive operation and speed restrictions of construction vehicles and equipment with sufficient effects on mitigation of adverse impacts.
	<Noise and Vibration> Generation of noise and vibration	It is judged that serious influence shall not be caused in terms of noise and vibration from the construction site on housing zone being far from construction site. However, it is proposed to implement certain measures in order to mitigate or minimize such impacts: - Announcement should be made to the residents about construction schedule, daily time schedule and the contents of construction. - Construction activities should be strictly prohibited at night in the residential areas (for example, between 7:00PM and 5:00AM). - The equipment to be utilized in the construction of the project should be fitted with vibration isolators.
Carrying in and out of materials/ construction waste	<Traffic/Public Facilities> <Public Health Condition> <Air Pollution> <Noise and Vibration> Environment deterioration in terms of the above-mentioned item	The impacts in this case are applicable to the neighborhoods of 3-km access road to Abu Rawash WWTP. These effects could be mitigated or minimized by the following countermeasures: - The announcement and public notification concerning the construction contents and its schedule before the construction. - Watchman or traffic control staff deployed at the site to control the traffic and scheduled transport of construction material. - Although the access road is about 7m in width, large-size vehicles need to be operated and are frequently observed on the access road. Therefore it is important to manage traffic especially during day time when vehicles related to construction sites will increase the traffic frequency on this road. - The road shoulder of existing access road has sand and passing of heavy construction vehicles is expected to disperse particulates easily. To reduce this negative impact, water sprinkling should be considered if needed. - The vehicles carrying construction material should be covered to avoid falling and spilling of materials. If required, periodic cleaning of the street should be carried out. (Vehicles carrying construction material and residual soil should be covered with tarpaulin or canvas sheet to avoid spilling.) - Arrangement of an information desk and deployment of a responsible person. - Attentive operation and speed restrictions of vehicles with sufficient effects on mitigation of adverse impacts. - Preventive maintenance of construction machineries and vehicles to meet emission standards.

Activities	Foreseeable Adverse Impacts	Mitigation Measures
Construction laborers' lodgings construction	<Hazard (Risk)> Environment deterioration in terms of public health and safety	Priority should be given to engage local laborers as much as possible during construction stage. This will eliminate the need to build large-scale construction laborers' lodgings around Abu Rawash WWTP. Moreover, it will be easier to control problems created (problem with neighboring residents, etc.) by the laborers from overseas.

Table 6-6 Mitigation Measures for Potential Adverse Impacts (Operation Stage)

Activities	Foreseeable Adverse Impacts	Mitigation Measures
Operation of Secondary Treatment Facilities (Wastewater treatment works, Treated wastewater disposal and Sludge transportation works)	<Noise and Vibration> Generation of noise and vibration	During operation of secondary treatment facilities at WWTP, the components that are possible to generate significant level of noise include blower used for aeration and generator used at the time of power failure. Countermeasures are itemized below to control the noise level from the above two facilities. - A blower shall be installed in a building in order to control noise level going out in open air. In Japan, the noise problem is mitigated by the same method. - A silencer shall be installed in the exhaust port of generator and control of noise and vibration (especially low frequency wave) shall be considered. A generator is installed as an emergency equipment to be used during power failure only, and hours of its use are normally short.
	<Water Pollution> <Public Health Condition> Environment deterioration about the above-mentioned item	Usually, the wastewater treatment plant is performing disinfection from sanitary viewpoint and in case when treated effluent is to be reused. In Abu Rawash WWTP also, disinfection is planned to be performed. The most common agent used for disinfection is chlorine. It is very important to add appropriate amount of chlorine in order to manage the residual chlorine within desired limit. An excess of residual chlorine can have negative impact on biological environment of effluent receiving water bodies and very low level of residual chlorine in effluent could cause presence of pathogens that are not yet killed. Therefore, sufficient technical training of operation and maintenance staff related to chlorination is required and monitoring of residual chlorine in effluent shall be carried out.
	<Hazard (Risk)> Contamination of heavy metals and toxic substances	The countermeasure for control of flow of heavy metals and toxic substances into sewerage system is to stop the flow from main sources. The main causes of inflow of heavy metals and toxic substances are through effluent from industrial sources. Therefore, before discharging industrial effluent into the sewerage system, appropriate treatment is required to remove such substances from effluents. For this purpose, it is required to establish a monitoring system for industrial effluents discharged into Abu Rawash sewerage system. Furthermore, the industries discharging into Abu Rawash sewerage system should be regulated to carry out proper treatment of effluents before discharging into sewerage system. The details are described in the section of monitoring.
Operation of Sludge	<Offensive Odor>	As explained earlier related to existing sludge treatment process in case of Abu Rawash, generated sludge is

Activities	Foreseeable Adverse Impacts	Mitigation Measures
Lagoon (Sludge treatment works, Sludge re-use works)	Deterioration of the living environment by offensive odor	dried using the sludge lagoons located in the desert area about 35 km away from WWTP. Since dehydration of sludge is performed in the open type sludge lagoon, the emitted odor from sludge lagoons spreads in surrounding environment. Under this Study, odor measurement investigation in sludge lagoon was conducted in August 2009. From the results of investigation carried out by JICA Study Team, it is reflected that odor concentration is inversely proportional to the distance from source. Also, the result of odor survey and analysis indicated that odor level is within the guidelines (Japan, US EPA, WHO). (There is no guidelines/standard concerning odor in Egypt.) Therefore, the possibility of occurrence of serious influence in terms of bad smell in the neighborhoods of sludge lagoon is very low. However, the possibility that the degree of influence will change with the difference in climatic condition can be considered. Therefore, the measure against bad smell is described below. - In order to mitigate influence of odor, the operation plan of the sludge lagoon shall be prepared based on the climate condition. - Reduction of odor emission can also be carried out by spraying of Calcium Hydroxide or deodorant. The following items are considered as prospective countermeasures in the long run. - Use of the sludge lagoon which generates adverse impact should be suspended, and the location should be moved to such a place that would not cause negative impacts. - The use of mechanical dehydration should be adopted in order to reduce the time required for dehydration, to reduce area required for sludge drying process, and finally to reduce the level of odor emission significantly. - The sludge treatment facility proposed at Abu Rawash WWTP should be constructed in future that would also result into reduced amount of sludge, in addition to other advantages mentioned above.
	<Others> Deterioration of the living environment by noxious insect (fly)	At the site of existing sludge lagoon, in addition to the odor problem, noxious insect (fly) is also observed. The complaints from residents related to fly has not been received. However, following countermeasures are suggested for mitigating the impact of noxious flies. - At present, since the information on adverse impacts (complaint from residents) about fly is not received, it is necessary to continue and perform monitoring and information collection. - Through the monitoring, the selection of lagoon for which fly reduction is needed and the determination of time at which flies should be killed can be made.

Activities	Foreseeable Adverse Impacts	Mitigation Measures
		- An insecticide shall be applied if necessary. However, the application of insecticide should be tried to keep at minimum as this might also lead to other negative impacts on neighboring environment and in long run resistant variety of flies could be generated.
	<Hazard (Risk)> Contamination of heavy metals	In present condition also, dried sludge is used as fertilizer and soil conditioner in desert land, it is necessary to eliminate the risk of heavy metal and toxic substance mixing in sludge. According to the available data on heavy metal concentration in sludge (JETRO report), the level of heavy metals is within the standard defined for restricted agricultural reuse. Therefore, as a measure to mitigate negative influence, surveillance and periodic monitoring of the heavy metal concentration in sludge should be carried out. Also, monitoring should be undertaken for control of heavy metals discharges along with industrial effluents into sewerage system.

CHAPTER 7 ENVIRONMENTAL MANAGEMENT PLAN

7.1 Risk Analysis and Mitigation Plan

During the operation stage, attention should be paid to the following aspects as Risk Analysis.

(A) Power Supply

In the wastewater treatment plant, starting with pumps for pumping of wastewater, aeration in the aeration tank, control panels and many instruments are working by electricity. If power failure occurs, the instruments will stop, and a serious obstacle occurs in the wastewater treatment plant. When especially lift pump of wastewater stops, there is a possibility that the overflow from the lift pump station may occur, and it will have large adverse influence on environment.

The following items are included in this facilities planning as countermeasures to the power failure.

- Provision should be made to receive transmitted electricity from two power transmission systems. When one power transmission system stops, the plan is made so that it may change to the power transmission system of another side immediately.
- In case of failure of both power transmission systems, the provision should be made to receive power from electric generator facilities.

It is expected that by considering these measures during facilities planning, and through the provision of these facilities, negative impacts in case of power failure on the wastewater treatment process and on environment could be avoided or at least mitigated.

(B) Electrical and Mechanical Equipment Failure

Operational disruption due to electrical and mechanical equipment failures can be avoided by the provision of spare parts and stand-by facilities available at site. Operation and maintenance instructions and manuals for emergency should be provided at the time of training of the operation staff in the wastewater treatment plants.

(C) Chlorine Gas Leakage

In Abu Rawash WWTP, treated wastewater is planned to perform disinfection using chlorine gas in order to discharge to drains. Usually, even after treatment with secondary treatment facilities the effluents contain many bacteria including pathogenic bacteria, and disinfection is required from sanitary viewpoint when discharging treated effluent to water bodies. There are several types of disinfection methods, however, chlorination is most commonly used for disinfection and in case of Abu Rawash WWTP also chlorine gas is planned to be adopted. Therefore, it is necessary to always store sufficient quantity of the chlorine gas that could be used for disinfection. However, chlorine gas is extremely lethal and generates a stimulus and inflammation on respiratory organs even in case of inhalation in low concentration (Table 7-1).

Table 7-1 Effects of Chlorine Gas Inhalation on Human Beings

Exposure concentration	Poisoning action
1-3 ppm	Inhaling of this level causes generation of slight membrane stimulus condition.
30 ppm	Immediately after inhaling, it causes chest pain, vomiting, and breathing difficulty.
40 – 60 ppm	It causes pneumonia, and accumulation of fluid in the lungs.
1,000 ppm	It causes fatality within several minutes.

In Abu Rawash WWTP, the chlorine gas of 6 ton/day is required to be stored always. In facilities planning, in consideration of safety, it should be considered to equip the storage structure such that chlorine gas does not leak outside of the storage room even in case of leakage from gas cylinder and safety should be ensured.

Furthermore, during the project implementation an emergency measure plan shall be prepared including management manuals, such as a protective garment, a washing shower, and measures to be undertaken immediately after inhaling, related to the operators working in this area.

(D) Heavy Metals and Toxic Substances (Surveillance and Management of Industrial Wastewater)

Usually, the source of the heavy metal and toxic substance which flows into the sewerage is

industrial effluent. Therefore, if management of industrial wastewater is put into practice, it is expected that inflow of the heavy metal and toxic substance into the sewerage system exceeding the standard can be controlled. For this purpose, the following countermeasures shall be required.

(i) Database on Factory and Production Activities

Database should be prepared for all the industries in the service area of WWTP including the following main items:

- The list of factories which use heavy metal and toxic substance
- Information on all used raw materials in industries
- Information on manufacturing process and drainage system in workshops and industries
- Information related to onsite wastewater treatment plant in industries

(ii) Implementation and Reporting of Water Quality Analysis

A periodical water quality analysis of effluents and the reporting of the result should be made compulsory for the industries discharging effluent into sewerage networks. Moreover, the sewerage administrator should be allowed to carry out investigation in such industries related to industrial wastewater management practiced by such industries.

(iii) Administrative Guidance for Industrial Wastewater

Provision should also be made for administrative guidance on industrial wastewater management including following main items:

- Administrative guidance for wastewater treatment (Drainage system division for every manufacturing process, application of the optimal disposal method, promotion of installation of onsite treatment plant, transparency of responsibility for wastewater management, etc.)
- Administrative guidance including water utilization and manufacturing process management (positive introduction of the Cleaner Production, administrator for wastewater installation and implementation of the training program, promotion of transfer to the industrial zone (industrial city) and related financial support, etc.)

(iv) Consolidation of the Legal System concerning Execution of the above-mentioned Item

- Legal positioning for information collection, factory entry investigation and others should be clarified, and the organization responsible for performing these activities should be established, if already not existing.
- Establishment of the legal enforcement (stoppage of a production activity, penal regulations, etc. should be included) for those industries that are not practicing appropriate management of industrial wastewater.

In order to carry out proper monitoring and management of the industrial wastewater and to judge its effect, it is required to prepare plan and take steps not only by the sewerage company but also by other Agencies of MOHUUD, MSEA, and EEAA. Establishment of the organization concerning the industrial wastewater by a wide range of governmental organizations and implementation of the above-mentioned item are proposed.

7.2 Environmental Mitigation Plan

In the following Table, countermeasures are proposed against the adverse impacts, discussed in the previous Chapter, that should be undertaken by implementing agency.

Table 7-2 Mitigation Plan for Adverse Impacts

Phase	Adverse Impacts	Main Countermeasures
Construction Phase	Whole construction work, Work by heavy construction equipments	< Cultural Properties and Flora/Fauna> – Related organization to be set up in Construction Management team and a person in charge shall be appointed. – If required, cooperation shall be requested from a specialist. < Landscape> Required measure will be undertaken if there is a request from residents. <Air Pollution> – Dust control through water sprinkling – Preventive maintenance of construction machineries and vehicles – Attentive operation and speed restrictions of construction vehicles and equipment <Noise and Vibration> – Announcement of construction schedule and contents – Attentive operation and speed restrictions of construction vehicles

Phase	Adverse Impacts	Main Countermeasures
		and equipment
	Carrying in and out of materials/ construction waste	– Announcement and public notification concerning the construction contents and its schedule – Assigning of watchman or traffic control staff – Implementation of water sprinkling – Covering the loading platform of vehicles – Arrangement of an information desk and deployment of responsible person. – Attentive operation and speed restrictions of vehicles – Preventive maintenance of construction machineries and vehicles
	Construction laborers' lodgings	Selection of suitable constructor
Operation Phase	Operation work of wastewater treatment	<Water Pollution and Public Health Condition> Suitable operation management
	Operation work of sludge treatment	< Odor > – Operation plan of the sludge lagoon should be considered based on climate condition. – Reduction of odor emission by spraying of Calcium Hydroxide or deodorant. < Deterioration of the living environment by noxious insect (fly)> Spraying of insecticide

It is recommended to establish a staff structure within the implementing agency that should be responsible for implementing these measures against potential negative impacts (except monitoring) considering the following points:

- In case of the adverse impacts during construction stage, a building constructor shall carry out the measures on the basis of directions of CAPW which is responsible for construction management.
- CAPW shall be responsible for making decision on important issues.
- During the operation stage, GWWC shall carry out mitigation measures against negative impacts.
- For monitoring, it is discussed in detail below.

7.3 Environmental Plan

When performing Environmental and Social Impact Assessment and evaluating the effect, it

is also important to carry out monitoring in order to grasp the information on any new negative influence due to these activities. The monitoring plans, the person in charge for implementation, and needed technical education and training are described below in this Section.

7.3.1 Monitoring Program

It is proposed to undertake following monitoring plans related to the negative impacts that has been described in previous Chapter. The monitoring plan is categorized under construction stage and operation stage. For preparing the monitoring plan, it is considered that during construction stage influence will be short duration and therefore it is important to have measurement result immediately rather than caring for the level of accuracy and accordingly measurement methods should be selected. However, in the operation stage it is required to evaluate the level of influence and make any judgment based on environmental standards. Also, it is required to find out if any new negative impact has come up during operation stage. Therefore, measuring method is selected considering sufficiency in terms of accuracy and its simplicity in use. In case when new influence is expected in future, the measuring method should be improved based on the need of new impacts and desired accuracy or measured parameters. Monitoring programs for construction and operation stages are described below.

(A) Construction Stage

On the access road and the construction site (site boundary is included), the particulates are measured that are generated by operation of vehicles carrying materials in/out and heavy construction machines. For the purpose of monitoring, it is understood that in terms of air quality, generation of particulates is the most significant item, and therefore it is judged that the level of particulates along the access road and at construction site should be measured with a portable particulate measurement instrument. In order to control the level of particulates in air, watering shall be carried out and measurement shall again be carried out in order to evaluate the effect. Furthermore, when a complaint window is established and complaints are received from residents related to particulates in air due to project activities, the measurement result should be referred and the water frequency should be reconsidered (such as the road shoulder, pavement of a setback portion, construction of crossing turnout, etc.).

On the access road and construction site (site boundary is included), the noise generated by operation of vehicles carrying materials in/out of construction site and due to use of heavy construction machines should be measured using a portable noise level meter. When complaints are received from residents, the measurement result should be referred, and sound insulating wall should be installed. Also, the reduction of operating speed of vehicles and sound reductions measures should be considered.

Monitoring program for construction stage is summarized in Table 7-3.

Table 7-3 Monitoring Program for Construction Stage

Object		Monitoring Point	Parameters	Frequency
Air Pollution	Air quality	Access road and Construction site	Particulates	Arbitrary number of times during the construction period
Noise	Noise	Access road and Construction site	Noise (maximum level)	Arbitrary number of times during the construction period

(B) Operation Stage

Periodical water quality measurement of inflow wastewater and treated effluent should be performed. This measurement shall be carried out in order to obtain basic data to evaluate whether the project components satisfy the expected effect (pollution load reduction) of wastewater treatment plant, the sewage disposal plant emission standard, and the reuse standard (water reuse for agriculture) of treated water. The parameter to be measured more frequently for regular operation of wastewater treatment shall be selected separately.

The level of noise shall be measured on the exterior of the blower facilities, and at border line of WWTP. Although, it is judged that there is no influence on the neighborhoods, especially measurement of sound level at night is recommended.

The monitoring for odor shall be carried out as indicated in the Table 7-4 below. However, when the standard concerning bad smell is set up in future, the measurement parameters should be changed accordingly.

The sludge lagoon is basically an excavated pond with only embankment protected against infiltration. Therefore, it is possible that part of moisture (water) from accumulated sludge in pond infiltrates into ground. It is reported that groundwater level in the sludge lagoon site is more than 100 m below ground, and is considered to be fossil aquifer. Hence, there is minimum possibility that the infiltrated water reaches groundwater level, and result into groundwater contamination. However, for safety against groundwater contamination, it is advisable to monitor groundwater quality in the neighborhoods.

Now, in the surrounding plantation area, tube well (depth of about 150 m) is used for irrigation of plants using groundwater sources. For monitoring purposes, in order to judge the possibility of groundwater contamination, water quality survey in the wells of neighboring plantation is proposed. Based on the result of monitoring, the situation of water quality changes shall be grasped and judgment on occurrence of serious groundwater contamination shall be made. Countermeasures should be applied when groundwater contamination is observed.

The investigation about fly shall be carried out by installation of fly trap and measuring the number of flies trapped. The observation points shall be in the central part of sludge lagoons and at the boundary of the sludge lagoon site. The measurement should also be carried out by installing a trap in a surrounding plantation. Moreover, when the insecticide shall be sprinkled, the number of flies should be grasped using a fixed point observation in order to assess the effect of insecticide. The relationship (or tendency) of the number of flies obtained by the above-mentioned observation, scattering condition, seasonal variation, climate condition, and the information from people living in the neighborhoods on number of flies shall also be collected. Based on the result of monitoring examinations, the "fly control manual" should be prepared including the frequency of insecticide application and the reduction of applied amount as much as possible. More appropriate operation management of sludge lagoon shall be performed using this manual.

Based on collected information on sludge quality, in existing condition, heavy metals of dried sludge is within standard defined for limited agricultural applications. However, monitoring should be carried out for parameters listed in Table 7-4 below for dried sludge to ensure safe application of dried sludge in future also.

Monitoring program required at operation stage is summarized in Table 7-4.

Table 7-4 Monitoring Program for Operation Stage

Object		Monitoring Point	Parameters	Frequency
Water Pollution	Water quality (Influent and Treated Wastewater)	Inlet/Outlet	pH, Temperature, BOD_5, COD_{Cr}, Total Suspended Solids (TSS), Total Coliforms, Fecal Coliforms, Total Dissolved Solids (TDS)	Daily measurement should be carried out for those parameters that are important for normal operation of wastewater treatment process.
			Oils and grease, Number of enteric nematode cells or eggs, Sodium Adsorption Ratio, Chlorides, Bromides, Cadmium (Cd), Lead (Pb), Copper (Cu), Nickel (Ni), Zinc (Zn), Arsenic (As), Chromium (Cr), Molybdenum (Mo), Manganese (Mn), Iron (Fe), Cobalt (Co)	Four times a year
Noise	Noise	The exterior of the blower facilities WWTP Site boundary	Noise (maximum level)	Four times a year
Odor	Odor	Sludge pump station of Abu Rawash WWTP and site boundary Sludge lagoon and site boundary	<Precise measurement> Olfactory measurement Hydrogen sulfide Ammonia <Simplified measurement> Hydrogen sulfide	Two times a year for precision measurement Once every month for simplified measurement
Groundwater Contamination	Water quality (Well water)	Irrigation well for plantation in the surrounding area of sludge lagoon	pH, Temperature, BOD_5, COD_{Cr}, Total Suspended Solids (TSS), Total Coliforms, Fecal Coliforms, Total Dissolved Solids (TDS), Oils and grease, Number of enteric nematode cells or eggs, Sodium Adsorption Ratio, Chlorides, Bromides, Cadmium (Cd), Lead (Pb), Copper (Cu), Nickel (Ni), Zinc (Zn), Arsenic (As), Chromium (Cr), Molybdenum (Mo), Manganese (Mn), Iron (Fe), Cobalt (Co)	Two times a year
Noxious insect (fly)	Number of individuals	Sludge lagoon and site boundary	Number of individuals measurement by a fly trap	The accumulated number of trapped flies should be counted once every month

Object		Monitoring Point	Parameters	Frequency
Dried Sludge	Sludge Quality	Dried sludge from sludge lagoon	Zinc, Copper, Nickel, Cadmium, Lead, Mercury, Chromium, Molybdenum, Selenium, Arsenic	Two times a year
Meteorological observation	Meteorological observation	Sludge lagoon	Temperature, rainfall, moisture content, wind speed, wind direction, duration of sunshine, evapotranspiration, etc.	Daily measurement

7.3.2 Institutional Setup

The fundamental information about the organization that should carry out monitoring activities is itemized below.

- The constructor shall carry out monitoring during construction stage, and shall report to CAPW.
- WWTP laboratory shall carry out monitoring during operation stage in principle.
- However, in case when WWTP laboratory cannot carry out monitoring activities, the Central laboratory of Giza Water and Wastewater Company (GWWC) should be assigned this responsibility.
- In addition, for the parameters that are difficult to be measured by the Central laboratory of GWWC, a suitable organization should be requested. (For example, odor measurement can be requested to the EEAA.)

Monitoring Management Group

Proposed monitoring plans directly related to the sewerage system are classified under the construction and operation stages. Mainly, the following items are related to monitoring plan.

- Monitoring of water quality in the receiving water bodies
- Monitoring of water utilization from the receiving water bodies

- Monitoring (Surveillance) of the factory effluent discharged into public water bodies and sewerage system
- Other monitoring, such as living and hygienic environments in surrounding area of Abu Rawash WWTP and biological environment in the receiving water bodies

Establishment of an administrative unit is required in order to carry out the above monitoring. This unit is called Monitoring Management Group (MMG) in this report. As shown in Figure 7-1, the MMG consists of organizations relevant to sewerage system, organizations which take charge of environmental management, organizations which manage the water bodies, and local administrative organizations and residents. It is proposed to have proper coordination among these agencies for effective monitoring. Moreover, collected information on monitoring should be compiled in the form of a database that can be accessed by all related organizations whenever needed.

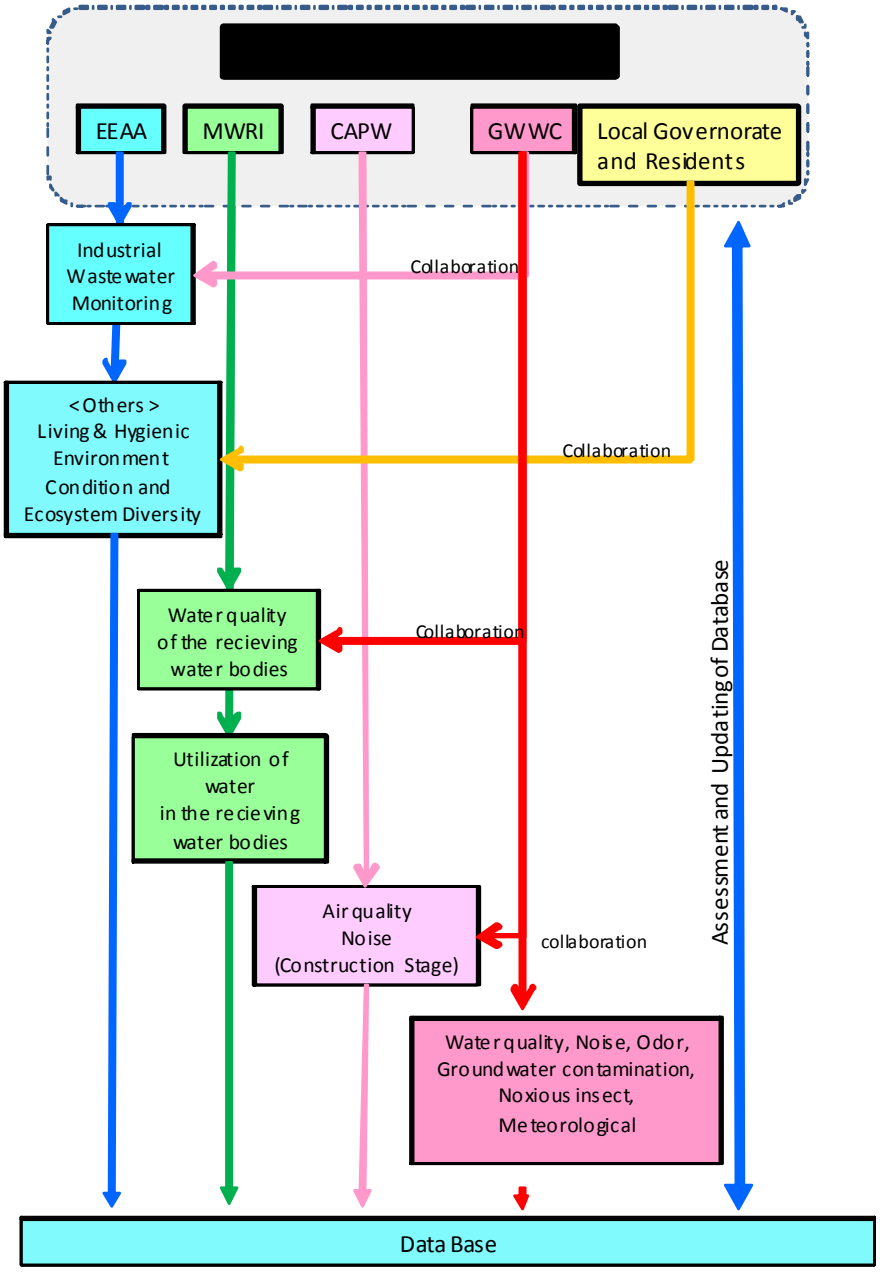


Figure 7-1 Outline of Monitoring Management Group

7.3.3 Occupational Health and Safety Measures

During the construction and operation stage of the project, consideration should be given to workplace air quality, ambient temperature and humidity, noise limits, specific conditions on working in confined place, and general conditions on health and safety. The work involves working at high places and guidance on care to be taken while working in such places should be provided to workers. General health and safety practices should be

followed by workers on site.

The following mitigation and management measures should be adopted to ensure that the health and safety of staff and any visitors at the site is not affected negatively during construction and operation stages:

- development and implementation of an Operational Health and Safety Plan with appropriate training
- provision of training in use of protection equipment and chemical handling (chlorine)
- clear marking of work site hazards and training in recognition of hazard symbols
- development of site emergency response plans
- all personnel working or standing close to noisy areas or equipment will be required to wear noise protectors; and
- potable drinking water should be made available at working site.

CHAPTER 8 PUBLIC CONSULTATION

8.1 General

Public consultation is essential to take into account views and interests of all project stakeholders such as Governmental Agencies, local NGOs, local residents, etc., in accordance with the environmental guidelines, procedures and safeguard policies before implementation of Project starts. Under this Study, public consultation is carried out according to the EEAA requirements and JBIC guidelines. EEAA Guidelines require coordination with other government agencies involved in the EIA, obtaining views of local people and affected groups. Based on the JBIC Guidelines, this project is categorized as B and public consultation is not required. However, considering EEAA requirements as a part of full EIA preparation, public consultation is carried out once under this Study. Accordingly, CAPW with assistance from JICA Study Team organized a Public Consultation on 19th December 2009 to solicit the views of all stakeholders concerned or likely to be concerned with the Abu Rawash WWTP Improvement Project. Public consultation was organized smoothly and effectively with the assistance of two local consultants including a Social Development/Gender Consultant and an Environment/Sustainable development consultant along with the experts of JICA Study Team.

This Chapter summarizes on the selection of participants, contents of stakeholder meeting, list of participants, and main points discussed in the meeting held under public consultation activity.

8.2 Participants of Stakeholders Meeting

Participants were invited from a wide range of stakeholders including the project developers/sponsors, competent ministries and local authorities, local council, parliamentarians, private sector NGOs/CBOs, researchers, local communities, the media and other interested parties. The total number of participants was more than 50, in addition to CAPW senior managers and members of JICA Study Team. Abu Rawash WWTP General Director, other managers, technicians and staff also participated in the consultation. Their views related to conditions of service were also solicited as well as their interaction with other stakeholders served in clarifying aspects that could not possibly be known to outsiders. A complete list of participants is provided in Appendix 3 of this Report. The participants were categorized into three focus groups as described below.

8.2.1 Focus Group I

This group included the staff working at the WWTP in managerial, technical, administrative, and secretarial functions. Altogether 18 staff-members, selected randomly, were invited to the public consultation to contribute with their views and suggestions regarding work conditions at the Abu Rawash WWTP and other related issues. Their participation was also deliberately intended to have them benefit from listening to experts' views as well as to sensitize them on the implications of the activities taking place during the construction and operational phases of the project on the people living in the vicinity of the plant. Another purpose of their participation in this consultation was to answer possible questions raised from the floor by other stakeholders.

8.2.2 Focus Group II

The participants under this category included researchers and experts, and concerned governmental agencies (environment, health, water supply and sanitation, irrigation, agriculture, food safety). Focus group II included 22 participants listed in Appendix 3. The role of participants in this group was to provide the views of researchers and experts in related fields as well as to reflect views of representatives of other sectors directly concerned with the project's activities such as environment, health, agriculture, irrigation and food safety.

8.2.3 Focus Group III

This category mainly comprised the Abu Rawash Community Group, represented by: the local Arab Bedouins living very close to the WWTP in Ezab Arab Abu Rawash; the local community living in Abu Rawash Village formed of elected representatives; National Democratic Party (the ruling party) representatives; school headmasters, local council workers, workers in WWTP who reside in the neighborhood, Representatives of the NGO Nahdet El Mansouria for Development; and Representatives of owners of farms near the WWTP. Focus group III included altogether 20 participants listed in Appendix 3.

8.3 Discussions in Stakeholders Meeting

The public consultation was held on the premises of the Abu Rawash WWTP on 19th

December 2009 during 0930 – 1630 hrs. The agenda of the meeting is provided in Appendix 3. Also, all the details on meeting are described in Appendix 3. The meeting included Plenary Session I, Working group sessions, and Plenary Session II. The plenary session I initially started with the introductory speech by Eng. Zeinab Mounir (CAPW) giving an overview of the project in stages. Introduction was followed by the presentation of the JICA Study Team briefing the audience on the proposed improvement project. A visit to the site of Abu Rawash WWTP was also included in plenary session I. It was followed by the Working Group Sessions. As indicated earlier, the participants were divided into three focus groups for this purpose. Focus Group I (WWTP Staff), II (Experts) and III (community) were provided with questionnaires to guide them in their deliberations and to fill up on individual basis. The form filled up by Group I members was compiled by the consultant. Group II and Group III selected a moderator and a rapporteur. Discussions were smooth and interactive. Members of the current WWTP project team and CAPW officials were represented in each group to clarify issues, as warranted. Their reports were read by their respective rapporteur in the Plenary Session II. The meeting ended with the concluding remarks by CAPW.

8.3.1 Main Points Discussed

Strong technical justifications for upgrading the level of treatment in case of Abu Rawash WWTP from primary to secondary were presented. In the meeting, unanimous agreement was obtained regarding the importance and priority of the proposed project. It was observed that no one is against the improvement of Abu Rawash WWTP as proposed in this Study.

There was no resistance about the positive impact of the proposed project with regard to reducing health hazards, allowing certain cultivations, especially fish farming, reducing water pollution along drainage networks, etc. However, the possibility of inconvenience to people living in the neighborhoods of WWTP during construction stage in the form of high vehicle traffic, increased dust in air, noise, etc. were raised. Also, during the operation stage, the occurrence of negative impacts such as bad odor, increased insects, etc. were raised during the meeting. Mitigation measures for these negative impacts have been described and discussed in detail in this Report. Also, monitoring for these impacts has been proposed.

Another important issue pointed out by the community and agreed by all participants is Abu Rawash WWTP serves the Giza and 6th October communities whereas the Abu Rawash community itself lacks drinking water supply and sanitation system. An integrated approach to the development of the area was considered to be part of the Corporate Social

Responsibility incumbent on the Government with the understanding that such development could not be in the hands of CAPW or the Ministry of Housing alone, but that the latter could play a critical role in mobilizing action to this effect.

It was also suggested to raise the awareness of farmers who use treated effluent or raw wastewater for irrigating crops assuming it to be more fertile in order to avoid health hazards due to fruits, vegetables and other crops grown by such farmers.

Attention was also drawn towards the establishment of improved sludge treatment facilities as soon as possible and to avoid long term use of sludge lagoons. The JICA Study Team has also recommended in the same direction.

8.3.2 Conclusions and Recommendations

General

1. The project for upgrading of the wastewater treatment level at Abu Rawash WWTP from primary to secondary should have a high national priority as the treated wastewater passes through six governorates until it reaches its final destination the Rosetta Branch of the River Nile and the level of pollution after only primary treatment remains quite high and unsafe.
2. The views and recommendations suggested by the participants of the Public Consultation should be given special consideration. This will create trust between the community and governmental agencies that will help conclude the "social contract" Egypt's President is committed to.
3. Besides benefitting from experts' and technical advice as well as learning about the possible impact the construction and the operation phases of the project may have on the neighboring inhabitants, the Public Consultation provided an opportunity to the community to express their demands before the municipality. As some of such demands are outside the scope of the project or CAPW, the principles of Corporate Social Responsibility (CSR) may incite the authority to bring up demands to competent parties, as relevant.

Specific

1. Safe disposal of sludge to avoid any environmental and health hazards
2. Minimizing disruption that could be caused to the community and identified as:

- Noise, odors, insects and rodents. Studying the effect of use of repellents was suggested as it is believed to restrict migration of insects to the neighborhoods.
- Safe and continuous disposal of waste from construction works.
- Heavy traffic caused by trucks especially during construction works that is to last for a number of years may cause accidents especially that roads are not well paved.
- As the location of the plant over a sizeable area is obstructing the mobility of people between the Desert Road (South) and the Abu Rawash district (north), CAPW was urged to construct a pathway (road) within its premises that would facilitate movement of the community.
- The health hazards caused from using primarily treated wastewater and drain water for agricultural purposes require a consolidated action by the Ministry of Irrigation, the Ministry of Agriculture, NGOs and farmers. For this purpose a public awareness program is important.

3. Considering solving the transportation problem from which the current staff seem to suffer
4. Extending training to administrative staff and not restricting it to the technical category. Gender sensitization is also recommended.
5. Giving priority to employment of the population residing in the neighborhood
6. Promoting an integrated area development program as part of Social Corporate Responsibility that includes providing the community access to safe drinking water supply and an adequate sanitation system that connects to the public sewage network, and mobilizing action towards building schools, hospitals and other basic services in collaboration with other competent parties.

Mitigation measures for most of the raises issues have already been included in this Report. Also, monitoring of parameters to check the severity of negative impacts have been formulated and proposed.

CHAPTER 9 CONCLUSION

9.1 Important Items in the Environmental Impact Consideration

For the proposed project components in this Study, the main points that need consideration while carrying out environmental impact assessment include any occurrence of resettlement, presence of any source of secondary contamination such as heavy metals or toxic substances, and damage or loss of cultural assets or historical heritage.

(A) Occurrence of Resettlement

Proposed sites for construction of secondary treatment facilities and sludge lagoons under this project is situated in the land owned by HCWW and is reserved for the extension of Abu Rawash WWTP and sludge lagoons, respectively. Therefore, it is not necessary to acquire any new land and hence resettlement will not occur.

(B) Occurrence of the Secondary Contamination Source (occurrence of the new contamination source such as heavy metal and toxic substances in the wastewater)

The heavy metal concentration in the wastewater that flows into the Abu Rawash WWTP is lower than the quality standards defined for effluent from WWTP and for reuse of treated wastewater, and it is judged that the effluents from wastewater treatment plant cannot become a new contamination source. Moreover, through the implementation of monitoring plan it would be possible to recognize any new contamination at early stage, and it would also be possible to implement needed effective countermeasures.

(C) Damage and Loss of Cultural Assets and Historical Heritage

The locations proposed for construction of secondary treatment facilities and sludge treatment is very far from the sites of cultural assets and historical heritages. Therefore, the implementation of projects proposed under this Study is not expected to cause any negative impact on such important structures.

Also, the sites proposed for the facilities under this project are within the boundary of existing Abu Rawash WWTP and sludge lagoons. At the site of existing Abu Rawash WWTP, during the construction work performed so far (for old and new primary treatment

facilities), no structure relevant to cultural assets and historical heritages have been discovered yet. Therefore, it is judged that the possibility of damage and loss of the cultural assets and historical heritages by the implementation of this project is minimal.

In conclusion, it is judged that the project activities are not going to cause any significant problem that are detrimental to biological and social environment. Rather, it is expected that upon the improvement of wastewater treatment level at Abu Rawash WWTP, the water quality of effluent from Abu Rawash WWTP shall improve contributing to the improvement of water quality in effluent receiving water bodies.

According to the Egyptian EIA regulation, this project is categorized as "Black" considering the scale of project (objective population is more than 1 million). However, considering the regulations of JBIC Guidelines, it is judged that the project is under Category-B.

9.2 Items that Need Careful Examination

Although any major problem is not expected due to project components, there are some items that require careful examination during the construction and operation stages of the project implementation and are described below in brief.

(A) Construction Stage

The adverse impacts during the construction stage are temporary and the influence is limited to the construction period. In particular, the attention is required towards the influence of traffic due to heavy vehicles carrying construction materials in and out of the construction site. The construction of the primary treatment facilities (800,000m^3/day) is being undertaken now, and any serious problem concerning the traffic mentioned above is not reported. However, "arrangement of traffic control staff", "sprinkling of water on the road", etc. which are already described under the countermeasures against the environmental adverse impacts should be carried out appropriately. Also, the countermeasures for mitigation and elimination of other environmental adverse impacts, such as noise generation, and solid waste disposal that may occur during construction stage, should also be undertaken as suggested.

(B) Operation Stage

During the operation stage, adverse impacts such as generation of odor from sludge lagoon and increase in number of flies could be expected and attention should be paid towards mitigation of these problems. At present, no serious influence is experienced in the neighborhoods of sludge lagoons related to these impacts. However, with the rapid development of the surrounding areas, it is possible that impacts might influence living environment. Therefore, appropriate monitoring should be carried out and based on the degree of influence, decision should be made on suitable countermeasures and early implementation of countermeasures is recommended.

9.3 Positive Impacts of Project

In addition to negative impacts, the implementation of this project is expected to have several positive impacts on biological and social environment directly or indirectly in long run. The following beneficial impacts are expected as outcome of this project implementation:

- Upon application of secondary level of treatment at Abu Rawash WWTP, the treated effluent will satisfy the water quality standards defined for discharge to water bodies and for reuse of treated wastewater.
- This is expected to have impact in the form of gradual improvement of water quality in effluent receiving water bodies and consequently odor problem in Nikla Village is also expected to reduce or eliminate.
- Furthermore, the treated water amounting 1,200,000 m^3/day with BOD level of 20 mg/l or less could be considered as new source of water. The reuse of this water for the green project could be potentially considered in future.

From the above mentioned points, it is concluded that suggested countermeasures should be undertaken to mitigate potential adverse impacts due to implementation of this project. With the mitigation of adverse impacts, this project is expected to have potential benefits in terms of improved water quality of effluents and improvement of living environment in the neighborhoods of effluent receiving water bodies. Hence, it is recommended to undertake this project in the interest of environment and living conditions of the residents in the area.

APPENDIX – 1

Water Quality Survey

Water Quality Survey

(1) Outline of Water Quality Survey

The water quality survey consists of three parts including water quality survey-1, 2 and 3. Objectives of the water quality survey-1 is to investigate water quality of raw and treated wastewater at the Abu Rawash wastewater treatment plant, and in the receiving channel from the Abu Rawash WWTP to the confluence of Rosetta Branch. The water quality survey-2 is carried out in order to obtain the basic data that is required for judging whether the treated wastewater of the Abu Rawash WWTP meets the water quality standard for irrigation. The water quality survey-3 is carried out in order to obtain the basic data that is required for analysis of water pollution system in the effluent receiving water bodies. Simple flow calculation was carried out for the three locations in the area of the upper streams of the drain networks (Items 6, 7 and 8 in Table 1)

This water quality survey was carried out on 10th and 12th August 2009. The works of sampling and analysis was undertaken by the Water Pollution Research Department of the National Research Center. Throughout the sample collection, the experts of JICA Study Team supervised the works. The outline of survey contents and results of survey analysis are described below. The water sampling locations and analysis parameters are shown in the following Tables and Figure. The results of the water quality survey are shown in the following Tables.

Table-1 Number of Sampling Location

Survey	Sampling Location	
Survey-1	1	Abu Rawash WWTP (Raw wastewater)
	2	Abu Rawash WWTP (Primary treated wastewater)
	3	Barakat Drain (Discharged wastewater from WWTP)
	4	Muheit Drain (midpoint of this drain)
Survey-2	5	Al Rahawy Drain
Survey-3	6	Al Beeny Drain (upper stream)
	7	Muheit Drain (upper stream)
	8	Al Ganabia Al Yomna Muheit Drain (upper stream)
	9	Muheit Drain (endpoint of this drain)

Table 2 Parameter of Water Quality Analysis

Survey	No.	Parameters	Remarks
Survey-1	1	pH	These parameters are set up based on Decree No.8 of 1983 (Effluent limits for treated discharges into water bodies).
	2	Temperature	
	3	BOD_5	
	4	COD_{Cr} (Dichromate)	
	5	Total Suspended Solids (TSS)	
	6	Total Dissolved Solid (TDS)	
	7	Total Coliforms	
	8	Total Heavy Metal	
Survey-2	1	BOD_5	These parameters are set up based on Decree No.44 of 2000 (Maximum limits for re-use of treated effluent)
	2	COD_{Cr} (Dichromate)	
	3	Total Suspended Solids (TSS)	
	4	Oils and grease	
	5	Number of enteric nematode cells or eggs	
	6	Fecal Coliforms	
	7	Total Dissolved Solids (TDS)	
	8	Sodium Adsorption Ratio	
	9	Chlorides	
	10	Bromides	
	11	Cadmium (Cd)	
	12	Lead (Pb)	
	13	Copper (Cu)	
	14	Nickel(Ni)	
	15	Zinc (Zn)	
	16	Arsenic (As)	
	17	Chromium (Cr)	
	18	Molybdenum(Mo)	
	19	Magnesium（Mg）	
	20	Iron (Fe)	
	21	Cobalt (Co)	
Survey-3	1	BOD_5	
	2	Total Suspended Solids (TSS)	
	3	Total Volatile Suspended Solids (TVS)	
	4	pH	

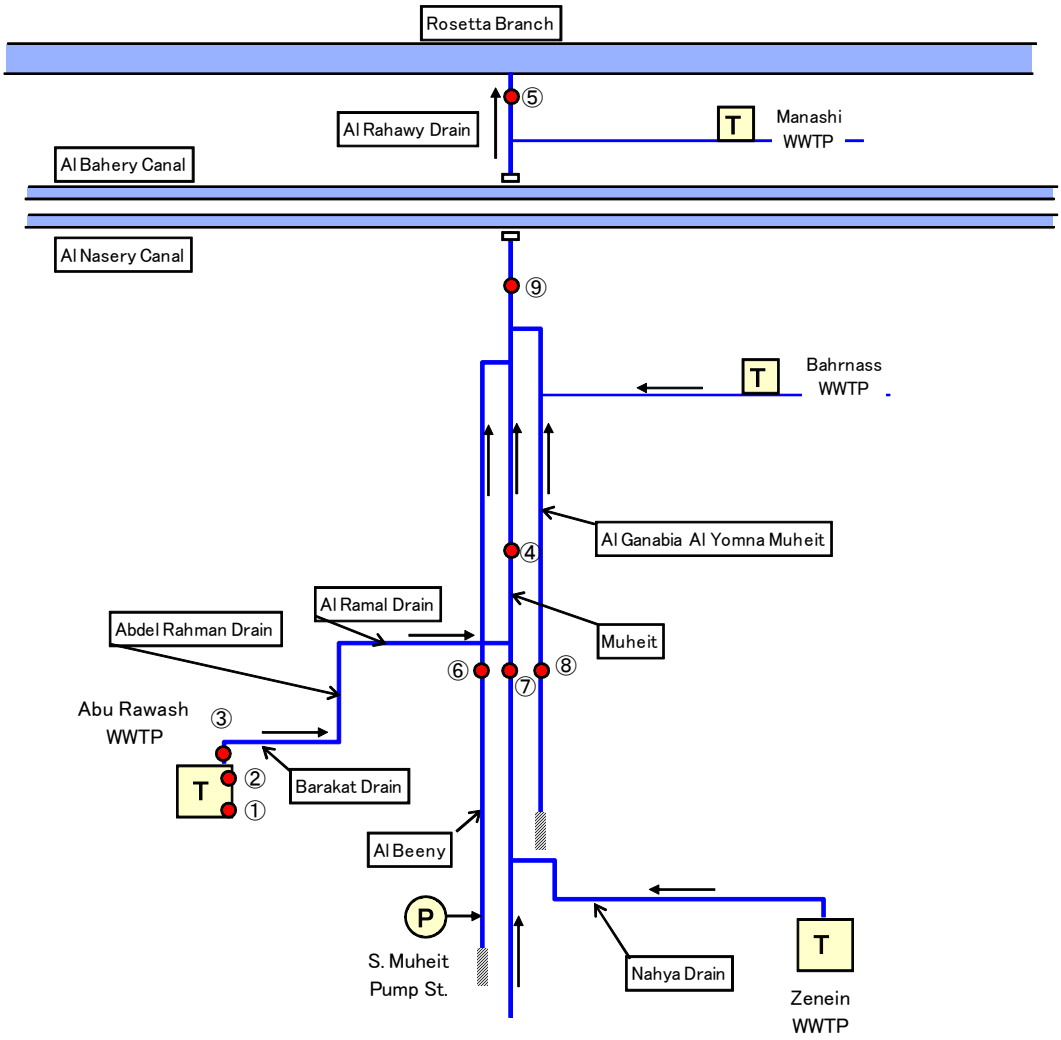


Figure 1　Sampling Location

Table-3 Results of Water Quality Survey (Abu Rawash WWTP and Drains: 10 August 2009)

Parameters	Unit	Sampling Point					Standard -A	Standard -B
		No.1	No.2	No.3	No.4	No.5		
pH	-	7.5	7.4	7.5	7.5	7.6	-	6 - 9
Temperature	°C	27	28	30	30	30	-	35
COD_{Cr}	mg/l	437	175	239	143	168	80	80
BOD_5	mg/l	162	108	111	98	99	40	60
Total Suspended Solids (TSS)	mg/l	160	48	86	48	52	40	50
Volatile Suspended Solids (VSS)	mg/l	148	48	83	48	30	-	-
Total Dissolved Solids (TDS)	mg/l	532	524	530	715	653	2,000	2,000
Volatile Dissolved Solids (VDS)	mg/l	180	144	140	185	140	-	-
Sodium (Na)	mg/l	75	85	80	150	125	-	-
Sodium Adsorption Ratio	%	-	-	-	-	7.7	20	-
Chlorides	mg/l	-	-	-	-	118	300	-
Bromides (Br)	mg/l	-	-	-	-	<0.05	3	-
Manganese (Mn)	mg/l	-	-	-	-	**0.3**	0.2	-
Oils and grease	mg/l	-	-	-	-	18	10	-
Cadmium (Cd)	mg/l	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	-
Lead (Pb)	mg/l	<0.01	<0.01	<0.01	<0.01	0.2	5	-
Copper (Cu)	mg/l	<0.01	<0.01	<0.01	<0.01	<0.01	0.2	-
Nickel(Ni)	mg/l	<0.01	<0.01	<0.01	<0.01	<0.01	0.2	-
Zinc (Zn)	mg/l	<0.05	<0.05	<0.05	<0.05	0.1	2	-
Arsenic (As)	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	N.A.	-
Chromium (Cr)	mg/l	<0.01	<0.01	<0.01	<0.01	<0.01	N.A.	-
Molybdenum(Mo)	mg/l	-	-	-	-	<0.005	0.01	-
Iron (Fe)	mg/l	-	-	-	-	1.3	5	-
Cobalt (Co)	mg/l	<0.01	<0.01	<0.01	<0.01	<0.01	0.05	-
Total Coliform	MPN/100 ml	1.5×10^9	1.5×10^5	7.5×10^4	9.3×10^3	2.3×10^3	1,000	5,000
Number of enteric nematode cells or eggs	Ova/l	-	-	-	-	0.0	1	-
Total Heavy Metal	mg/l	<0.1	<0.1	<0.1	<0.1	-	-	1

Standard-A: Decree No.44 of 2000 (Maximum limits for re-use of treated effluent: 2nd group water treated secondarily)
Standard-B: Decree No.8 of 1983 (Effluent limits for treated discharges into water bodies)

Table-3 Results of Water Quality Survey (Abu Rawash WWTP and Drains: 12 August 2009) (Continued)

Parameters	Unit	Sampling Point					Standard -A	Standard -B
		No.1	No.2	No.3	No.4	No.5		
pH	-	7.1	7.1	7.1	7.2	7.3	-	6 - 9
Temperature	^{o}C	23	25	27	29	29	-	35
COD_{Cr}	mg/l	185	167	212	116	105	80	80
BOD_5	mg/l	102	87	125	55	42	40	60
Total Suspended Solids (TSS)	mg/l	109	67	101	49	75	40	50
Volatile Suspended Solids (VSS)	mg/l	94	67	93	42	66	-	-
Total Dissolved Solids (TDS)	mg/l	429	403	423	557	523	2,000	2,000
Volatile Dissolved Solids (VDS)	mg/l	74	72	114	100	397	-	-
Sodium (Na)	mg/l	85	90	90	180	170	-	-
Sodium Adsorption Ratio	%	-	-	-	-	10.3	20	-
Chlorides	mg/l	-	-	-	-	120	300	-
Bromides (Br)	mg/l	-	-	-	-	<0.05	3	-
Manganese (Mn)	mg/l	-	-	-	-	0.1	0.2	-
Oils and grease	mg/l	-	-	-	-	21	10	-
Cadmium (Cd)	mg/l	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	-
Lead (Pb)	mg/l	<0.01	<0.01	<0.01	<0.01	<0.01	5	-
Copper (Cu)	mg/l	<0.01	<0.01	<0.01	<0.01	<0.01	0.2	-
Nickel(Ni)	mg/l	<0.01	<0.01	<0.01	<0.01	<0.01	0.2	-
Zinc (Zn)	mg/l	<0.05	<0.05	<0.05	<0.05	<0.05	2	-
Arsenic (As)	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	N.A.	-
Chromium (Cr)	mg/l	<0.01	<0.01	<0.01	<0.01	<0.01	N.A.	-
Molybdenum(Mo)	mg/l	-	-	-	-	<0.005	0.01	-
Iron (Fe)	mg/l	-	-	-	-	0.7	5	-
Cobalt (Co)	mg/l	<0.01	<0.01	<0.01	<0.01	<0.01	0.05	-
Total Coliform	MPN/100 ml	7.5×10^8	2.3×10^5	2.0×10^4	2.1×10^3	9.0×10^2	1,000	5,000
Number of enteric nematode cells or eggs	Ova/l	-	-	-	-	0.0	1	-
Total Heavy Metal	mg/l	<0.1	<0.1	<0.1	<0.1	-	-	1

Standard-A: Decree No.44 of 2000 (Maximum limits for re-use of treated effluent: 2nd group water treated secondarily)
Standard-B: Decree No.8 of 1983 (Effluent limits for treated discharges into water bodies)

Table-3 Results of Water Quality Survey (Drains: 8, 10 and 12 August 2009) (Continued)

Sampling Point	Date of Sampling	Water Quality Parameters					Flow (1,000 m^3/day)
		pH	TSS (mg/l)	TVS (mg/l)	TVS (%)	BOD (mg/l)	
No. 6	10/8/2009	6.9	59	46	78	125	112
	12/8/2009	6.9	60	46	77	131	-
No. 7	10/8/2009	7.3	25	13	52	<60	353
	12/8/2009	7.3	22	12	55	<60	-
	24/8/2009	7.2	22	15	67	25	-
No. 8	10/8/2009	7.0	62	20	32	<60	79
	12/8/2009	7.4	30	15	50	<60	-
	24/8/2009	7.5	45	21	46	21	-
No. 9	10/8/2009	7.0	82	50	61	165	-
	12/8/2009	7.0	70	53	76	102	-
No. 4	10/8/2009	-	-	-	-	-	1,430

Sampling and Analysis: Abu Rawash WWTP Laboratory (Giza Water and Wastewater Company)

(2) Salient Features from Results of Water Quality Survey

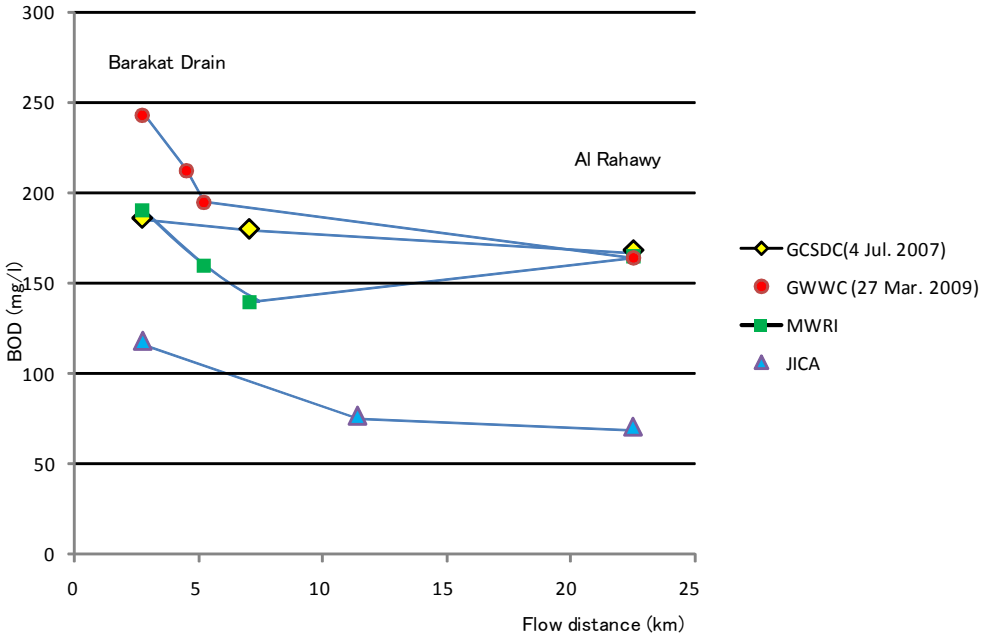
Based on the water quality survey result mentioned above and the information collected from the field investigation, the main points grasped are described below.

i) Water Pollution Situation of the Effluent Receiving Water Bodies

The following points became clear from the results of the water quality survey and the field investigation.

- The quality parameters of treated water from WWTP, that are exceeding the effluent standards, are COD_{Cr}, BOD_5, TSS and Total coliform group.
- Six items including COD_{Cr}, BOD_5, TSS, manganese, oil & grease, and Total coliform group are exceeding the water quality standards defined for reuse of treated wastewater.
- However, it is expected that the level of above-mentioned water quality parameters shall be improved by implementation of the secondary treatment facilities project at Abu Rawash WWTP.
- It is assumed that high level of manganese may be due to high level of BOD and hence lower DO in effluent. The quality of treated water shall be improved by the secondary treatment facilities project, and thereby dissolved oxygen concentration shall increase, and it is expected that manganese concentration shall decrease.

The water quality data collected in past and during this survey are presented in Figure 2 and Table 4. It is judged from Figure 2 that the water quality of drains is not good from viewpoints of agricultural use and sanitation. Moreover, it has also been learnt that bad smell problem has occurred in the neighborhoods of Nikla village along Al Rahawy Drain, and this may be attributed to odor emissions from polluted water in drains (See Appendix 2 for details). The odor problem is also expected to be mitigated by the implementation of secondary treatment facilities project at Abu Rawash WWTP.



Sources:

- Data-1: Greater Cairo Sanitary Drainage Company (4 July 2007)
- Data-2: Giza Water and Wastewater Company (27 March 2009)
- Data-3: Ministry of Water Resources and Irrigation (unknown)
- Data-4: JICA (10 and 12 August 2009)

Figure 2 Present Water Quality Situation of the Effluent Receiving Water Bodies (BOD)

Table 4 Present Water Quality Situation of the Effluent Receiving Water Bodies (BOD)

Unit: mg/l

Location	Data-1	Data-2	Data-3	Data-4
Starting point of Barakat drain	186 [1]	243	190	118
Front of the cottage in Barakat drain		212		
End point of Barakat drain		195	160	
Al Ramal Drain	180		140	
Muheit				77
End point of Al Rahawy drain	168	164	165	71

Notes:

1. Average value of inflow wastewater and primary treated wastewater

The water quality (BOD_5) of Rosetta Branch is presented in Table 5, and it is observed from the data that the quality of river water at the upstream of its confluence with Al Rahawy is better. However, the BOD level downstream of the confluence increases indicating deterioration in water quality, even though the large variation in data obtained from two sources is not clear.

Table 5 Present Water Quality Situation of Rosetta Branch (BOD)

Sampling point	Giza Water and Wastewater Company (27 March 2009)	Ministry of Water Resources and Irrigation (unknown)
Rosetta Branch (before confluence)	4 mg/l	10 mg/l
Rosetta Branch (after confluence)	81 mg/l	16 mg/l

ii) Effluent Receiving Water Bodies and its Water Pollution Mechanism

The water pollution mechanism of the existing water pollution conditions in drain networks (mentioned above) is described below.

The wastewater of Abu Rawash WWTP is discharged into Barakat Drain, flows through Al Ramal Drain, Muheit Drain and Al Rahawy Drain, and is finally discharged into Rosetta Branch. The effluent receiving water bodies refers to stretch of drains from Barakat Drain to Al Rahawy Drain (Refer Figure 1).

The effluent receiving water bodies is not a natural waterway but the drainage canals built as agricultural drainage canal. The salient features of these drainage canals are described below.

- The drainage canal is an artificial drainage canal of almost straight and fixed form. Therefore, stagnation of flow is not observed due to the meanders in canals.
- Although the flow velocity of the drainage canal changes with form and structures, the average flow velocity is 0.9 m/sec (Barakat drain) to 0.6 m/sec (Muheit).
- The duration required by water to flow from Abu Rawash WWTP to Rosetta Branch is 0.4 day in general, when calculated using the above-mentioned flow velocity. It is observed that the water flows from source to Rosetta branch within a relatively short time.

The pollution load which flows into the effluent receiving water bodies can be classified into three regional distributions including the Abu Rawash WWTP, the upper stream networks, and catchment area downstream of the Abu Rawash contribution point (Refer Figure 3). The outline of regional distribution is described below.

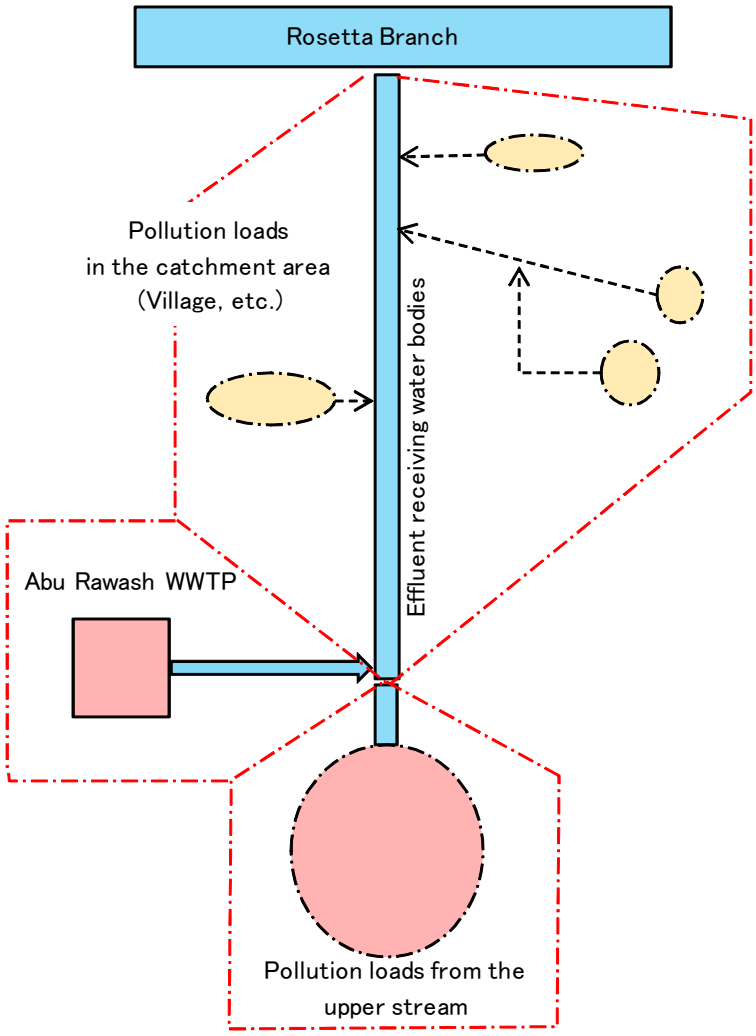


Figure 3 Regional Distribution of Pollution Load which Flows into the Effluent Receiving Water Bodies

Pollution Load from Abu Rawash WWTP

The wastewater discharged from Abu Rawash WWTP is approximately 840,000 m^3/day (the observed value on August 10, 2009). About 50% of wastewater receives primary treatment, and the remaining wastewater is discharged without treatment into Barakat drain. The discharging point is starting point of Barakat Drain, which is Location No. 3 among the sampling point of the above mentioned Water Quality Survey (Figure 1).

Pollution Load from the Upper Stream Networks

The pollution load from the upstream stretches of drain networks is flowing in through the following three drains.

- Al Beeny Drain
- Muheit Drain
- Al Ganabia Al Yomna Muheit Drain

Al Beeny Drain: Along this drain, South Muheit Pump Station is located and some wastewater is discharged presently into Al Beeny Drain as overflow on temporary basis (Refer Figure 4). This overflow is an urgent countermeasure against the shortage of treatment capacity at Abu Rawash WWTP. Since the amount of overflowing wastewater at the pump station is not measured, the information on overflowing amount is not available. In addition, land reforms are also undertaken at the upstream of this drain, and a high level of pollution load results from overflow at the pump station.

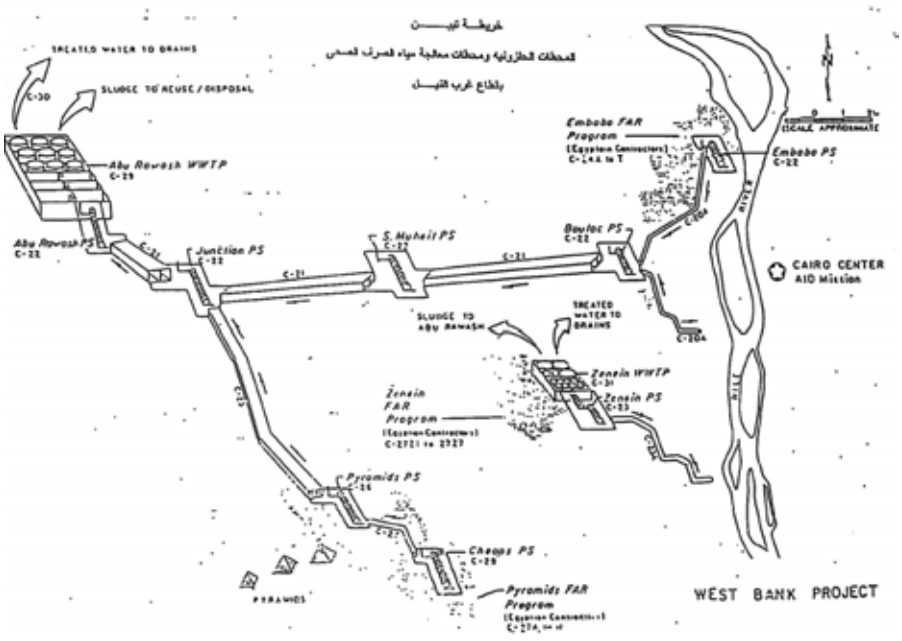


Figure 4 Location of the South Muheit Pump Station

Muheit Drain: The main sources of pollution load into this drain include effluent from Zenein WWTP, the domestic and commercial wastewater from unsewered area in its catchment, and

factories. Although the amount of discharge from Zenein WWTP is as large as 343,000 m^3/day (as monthly average in June 2009), the quality of treated water is good (BOD level of 14 mg/l as monthly average in June 2009). The treated wastewater of Zenein WWTP is flowing into Muheit Drain through Nahya Drain.

The wastewater from domestic and commercial establishments in unsewered area is also large pollution source. This area has few factories due to positive policy of industries relocation to industrial City of the 6th October Governorate. At present, there exist five factories listed in the following Table, and it is reported that discharge amount of wastewater from these industries is approximately 1,200 m^3/day. Although, quality of effluent from these factories is unknown, it is presumed that the influence is not very significant judging from the existing situation of drain water quality.

Table 6 List of Factories in Muheit Drain and its Branches

Factory	Discharge Drain	Discharge Wastewater Volume (m^3/day)	Remarks
Crispy	Harrania Drain	500	Closedown
Drying onion	Harrania Drain	120	
Aromatic	Muheit Drain (Maryutia)	536	
Oil and Soap	Public network	500	
Slaughter	Public network	80	
Total	-	1,236	Except "Crispy"

Source: EEAA

Al Ganabia Al Yomna Muheit Drain: The upstream section of this drainage canal has not received large amount of wastewater from unsewered area. Therefore, the water pollution has not deteriorated to serious level.

Pollution Load from the Catchment Area of the Effluent Receiving Water Bodies

There are two wastewater treatment plants and 11 villages located in this catchment area; however, there is no large-scale factory (Refer Figure 5). The information on wastewater disposal practices and sewerage system of villages is summarized in the following Table.

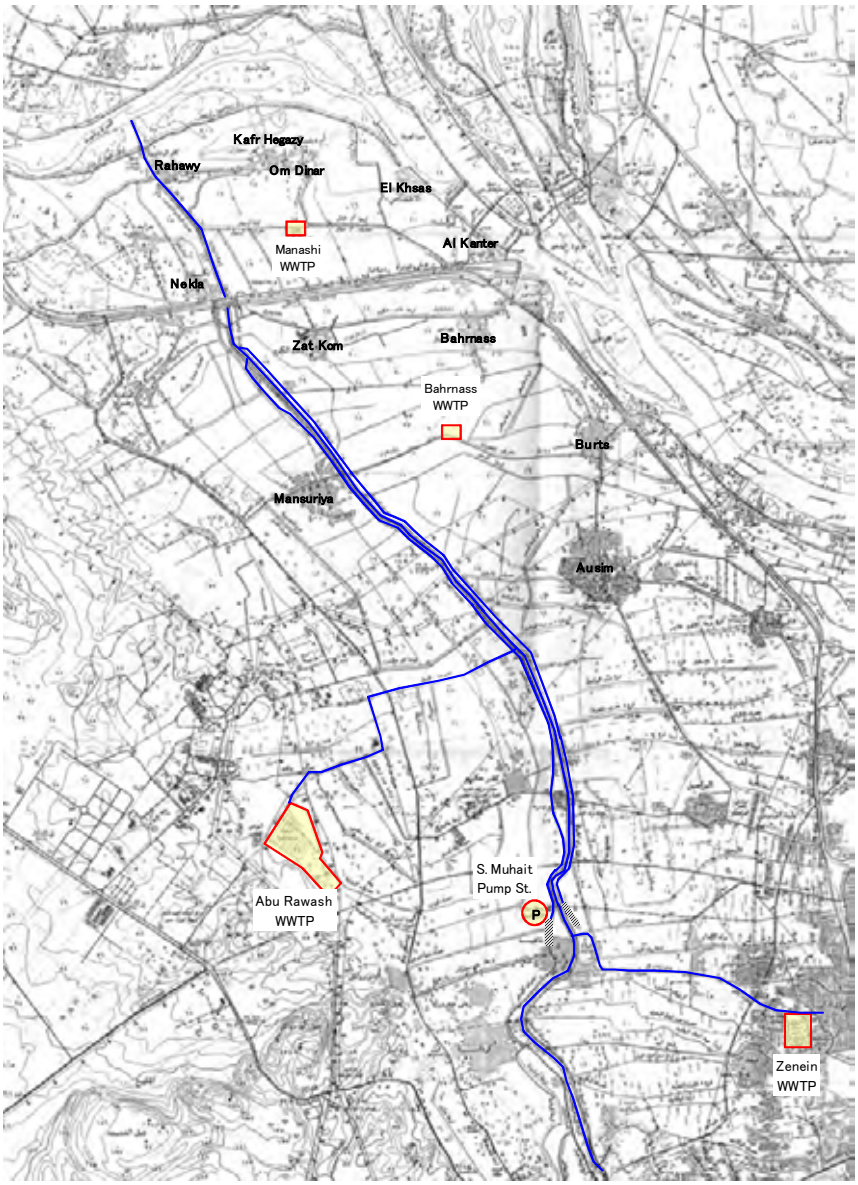


Figure 5 Outline of the Catchment Area in Effluent Receiving Water Bodies

Table 7 Situation of Wastewater Disposal and Sewerage System

Name of Village	Present Situation (2009)	Future Situation (2017)	WWTP
Kafr Hegazy	On-site treatment	Sewerage system	Manashi WWTP
Rahawy	On-site treatment	Sewerage system	
Om Dinar	On-site treatment	Sewerage system	
El Khsas	On-site treatment	Sewerage system	
Al Kanter	On-site treatment	Sewerage system	
Nikla	On-site treatment	Sewerage system	
Zat Kom	Sewerage system	Sewerage system	Bahrnass WWTP

Name of Village	Present Situation (2009)	Future Situation (2017)	WWTP
Bahrnass	Sewerage system	Sewerage system	
Burts	On-site treatment (50%) + Sewerage system (50%)	Sewerage system	
Mansuriya	Sewerage system	Sewerage system	Abu Rawash WWTP
Ausim	Sewerage system	Sewerage system	Abu Rawash WWTP

The septic tank with leaching pit is used for on-site treatment, and some wastewater from on-site treatment facilities is discharged into drains. In the field survey, the drainage canals from villages were checked whenever possible, and the outflow of wastewater was not observed in most of the cases. Hence, it is presumed that a large part of disposed wastewater infiltrates into the ground through leaching system.

Although the construction of Manashi WWTP (Figure 6) has already been completed, actual operation has not yet started. (There is also information that operation of 10,000 m^3/day has started out of planned capacity of 50,000 m^3/day.)

Figure 6 Outline of Manashi WWTP

The Bahrnass WWTP has already started operating. However, the construction of sewer networks in Burts village is in progress and only about 50% has been completed.

Figure 7 Outline of Bahrnass WWTP

As mentioned above, construction of two wastewater treatment systems is in progress and is expected to be completed by 2017. These two wastewater treatment plants use the oxidation ditch method of treatment, and also have sludge drying beds.

Based on the water survey result, the pollution load in case of the effluent receiving water bodies is calculated. The calculation result is described below.

iii) Discharged Pollution Load into the Effluent Receiving Water Bodies

The discharged pollution load into the effluent receiving water bodies is classified into three regional distributions comprising Abu Rawash WWTP, the upper stream networks, and catchment area of the effluent receiving water bodies downstream of Abu Rawash WWTP contribution point (Refer Figure 3). The discharged pollution load is presented below in Table.

Table 8 Discharged Pollution Load into the Effluent Receiving Water Bodies

Name of Location		Discharged Pollution Load into the Effluent Receiving Water Bodies (BOD ton/day)		
		Existing	Future (without project)	Future (with project)
①	Abu Rawash WWTP	99.1	117.6	24.0
②	Al Beeny	15.6 [1)]	0	0.0
③	Muheit	8.8	8.8	8.8
④	Al Ganabia Al Yomna Muheit	1.7	1.7	1.7
Sub-total of Upper Stream		26.1	10.5	10.5
-	Catchment area of the effluent receiving water bodies	0.0 [2)]	1.2	1.2
Total		125.2	129.3	35.7
		100%	103%	29%

Note:
1) It is presumed that all pollution loads is overflowed from the South Muheit Pump Station.
2) The septic tank with leaching system in which many of human waste and domestic wastewater treatment are used, and it is thought that the most part of pollution load is not discharged into Drain.

The existing regional distribution ratio of discharged pollution load is shown in Figure 8. According to this Figure, the pollution load from the sewerage facilities (Abu Rawash WWTP and South Muheit Pump Station) occupies about 92% and it is assumed that pollutants from these sources has major influence on water quality in effluent receiving water bodies.

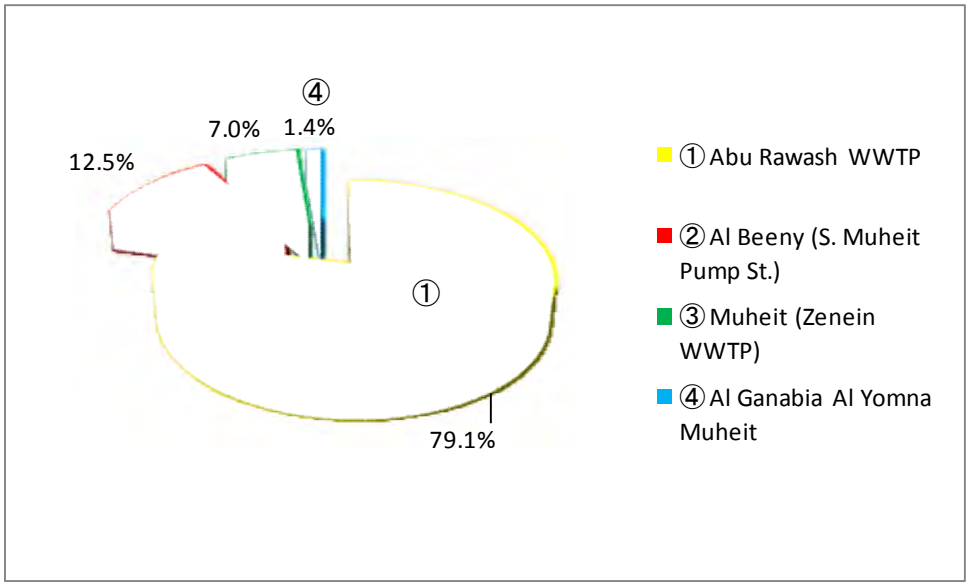
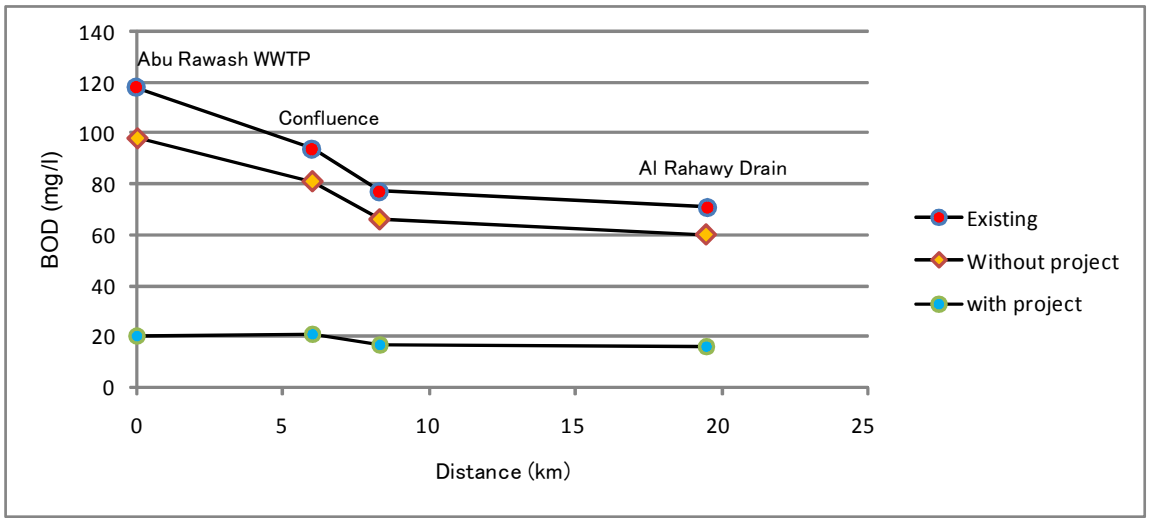


Figure 8 Regional Distribution ratio of the Discharged Pollution Load (Existing)

iv) Approximate Water Quality Simulation

Since, sufficient data is not available, very accurate water quality simulation is difficult. Therefore, approximate estimates of water quality in terms of BOD load has been carried out based on the available information. Results obtained from water quality survey by JICA Study Team have been used for simulation purposes. Since, it is difficult to clarify the actual purification and dilution action in the drain, the rate of decrease used in this section is an apparent rate of change of water quality. The results of approximately simulated water quality in the effluent water bodies are shown in Figure 9.



Notes:

Existing: Total wastewater volume is 850,000 m^3/day, (of this primary treatment is carried out for approximately 450,000 m^3/day)
Without project: Total wastewater volume is 1,200,000 m^3/day (Primary treatment)
With project: Total wastewater volume is 1,200,000 m3/day (Secondary treatment)
For details, refer to Appendix 1.

Figure 9 Approximately Simulated BOD Levels in Effluent Receiving Water Bodies

v) The Discharged Pollution Load into the Rosetta Branch

The discharged pollution load into the Rosetta Branch is calculated using the values of discharged pollution load into the effluent receiving water bodies and the rate of decrease. The estimated pollution load is shown in Table 9.

Table 9 Discharged pollution Load into the Rosetta Branch

Unit: BOD-ton/day

Items		Existing	Without Project	With Project
Discharged Pollution Load from Sewerage Facilities	Abu Rawash WWTP	99.1	117.6	24.0
	S. Muheit pump St.	15.6	0.0	0.0
	Masina & Bahrnass WWTP	0.0	1.2	1.2
	Sub-total	114.7	118.8	25.2
Discharged Pollution Load into the Rosetta Branch		107.1 100 %	108.4 101 %	28.9 27 %

Based on the result of above analysis, it is expected that following improvements will result upon the implementation of secondary treatment facilities at Abu Rawash WWTP.

– It is estimated that implementation of project will effect reduction of the discharged pollution load into the water bodies by 70% compared to the present pollution load and

by 80% compared to future load.

- It is estimated that, after implementation of the project, the discharged pollution loads into the Rosetta Branch reduces to 29 ton/day as BOD compared to 107 ton/day in case of present load and 108 ton/day in case of the future load if the project is not implemented.
- The existing and future BOD levels in the case of without-project implementation are estimated as 71 mg/l and 60 mg/l, and estimated level of BOD in case of the with-project situation is 16 mg/l.
- Through the implementation of this project, the treated effluent quality level would satisfy the water quality standard of the maximum limits for re-use of treated effluent (2nd group water treated secondarily: Decree No.44 of 2000) and the effluent limits for treated discharges into water bodies (Decree No.8 of 1983).
- Moreover, since dissolved oxygen shall be recovered by water quality improvement (reduction of BOD level), the mitigation of odor problem in Nikla and native habitat of the drains are also expected.

Table 10 Approximate Water Quality Simulation for Effluent Receiving Water Bodies (Existing Condition)

Point	Flow (1,000m3/day)	BOD (mg/l)	Pollution Load [7] (ton/day)	Reduction Ratio	Remarks
A	840 [1]	118	99.1		
B	122 [2]	128	15.6		
C	353 [2]	25	8.8		
D	1,315 [3]	94 [5]	123.5 [8]		
E	1,430 [2]	77	110.1	0.819 [10]	
F	79 [2]	21	1.7		
G	1,509 [4]	74 [6]	111.8 [9]		
H	1,509 [4]	71	107.1	0.959 [11]	

1) Flow is calculated by pump capacity and operation hours.
2) Flow measurement
3) Flow-D= Flow (A+B+C)
4) Flow-G=Flow (E+F)
5) BOD-D =Pollution Load (A+B+C) / Flow-D
6) BOD-G =Pollution Load (E+F) / Flow-G
7) Pollution Load =Flow × BOD
8) Pollution Load-D =Pollution Load (A+B+C)
9) Pollution Load-G =Pollution Load (E+F)
10) Reduction ratio-E =Pollution Load-E / Pollution Load-D
11) Reduction ratio-H =Pollution Load-H / Pollution Load-G

Table 11 Approximately Simulated Water Quality of the Effluent Receiving Water Bodies

(Future Condition: without Project)

Point	Flow (1,000m3/day)	BOD (mg/l)	Pollution Load (ton/day)	Reduction Ratio	Remarks
A	1,200[1)]	98 [4)]	117.6		
B	0 [2)]	-	0.0		
C	353	25	8.8		
D	1,553	81 [5)]	126.4		
E	1,668	66 [5)]	110.1	0.819	
F	79	21	1.7		
-	60 [3)]	20 [6)]	1.2		
G	1,807	63 [5)]	113.0		
H	1,807	60 [5)]	108.4	0.959	

1) Flow is planned wastewater volume in the Abu Rawash WWTP.
2) No over flow from pump station
3) Two wastewater treatment plants (Manashi and Bahrnass WWTP)
4) Water quality of treated wastewater in terms of BOD level is assumed as 98 mg/l according to the results of JICA Water Quality Survey (Primary treatment).
5) Estimated water quality
6) Water quality of treated wastewater is assumed to be 20 mg/l (Secondary treatment) in terms of BOD level.

Table 12 Approximately Simulated Water Quality of the Effluent Receiving Water Bodies

(Future Condition: with Project)

Point	Flow (1,000m3/day)	BOD (mg/l)	Pollution Load (ton/day)	Reduction Ratio	Remarks
A	1,200[1)]	20 [4)]	24.0		
B	0 [2)]	-	0.0		
C	353	25	8.8		
D	1,553	21 [5)]	32.8		
E	1,668	17 [5)]	28.4	0.819	
F	79	21	1.7		
-	60 [3)]	20 [4)]	1.2		
G	1,807	17 [5)]	31.3		
H	1,807	16 [5)]	28.9	0.959	

1) Flow is planned wastewater volume.
2) No overflow from pump station
3) Two wastewater treatment plants (Manashi and Bahrnass WWTP)
4) Water quality of treated wastewater (in terms of BOD level) is assumed to be 20 mg/l (Secondary treatment).
5) Estimated water quality

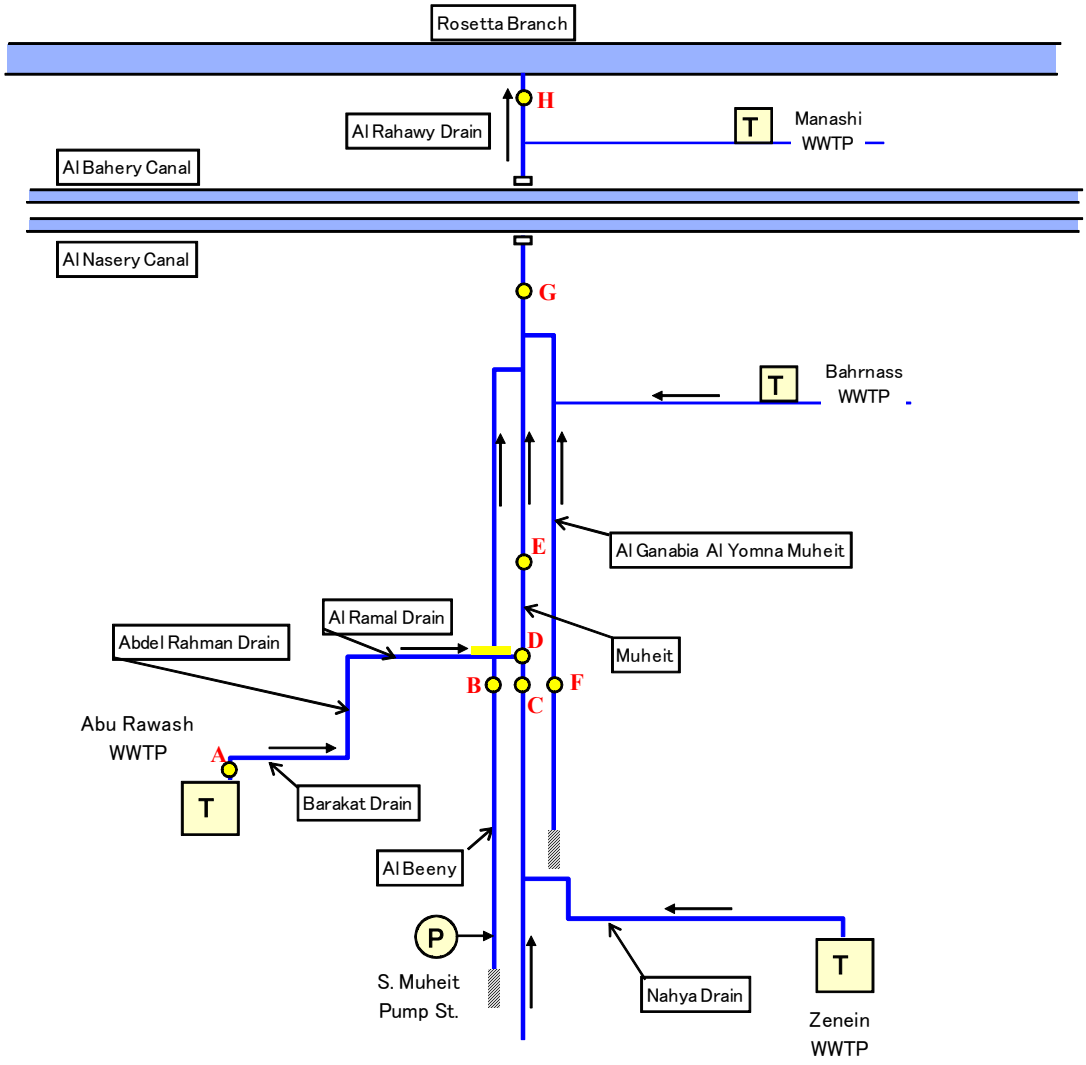


Figure 10 Calculation Point of Rough Water Quality Simulation

APPENDIX – 2

Odor Measurement Survey

Odor Measurement Survey

(1) Outline of Odor Measurement Survey

Purpose of Survey

In Egypt, the environmental standard values and regulations related to odor has not been setup or defined. Therefore, in the existing condition neither monitoring stations have been installed nor periodical observation is carried out for odor. Also, information on the existing level of odor emission is neither available for Abu Rawash WWTP nor for sludge lagoons in desert. Therefore, to gather relevant basic data, odor measurement survey has been carried out under this Study.

Contents of Survey

The survey under this Study included olfactory measurement, concentration of Ammonia and Hydrogen Sulfide, and meteorological observation such as weather, temperature, wind speed and wind direction. The target facilities for odor investigation included the sludge pumping station in the Abu Rawash WWTP and the sludge lagoon. Number of air sampling points was four and the sampling and measurements were conducted on 11th and 13th August 2009. The air sampling and analysis works were carried out by the Air Pollution and Noise Monitoring Department (Central Laboratory) of the Egyptian Environmental Affairs Agency (EEAA). Throughout the sampling period, expert of JICA Study Team supervised the activities.

Air Sampling Point

The description on locations where air sampling was undertaken and the reasons to select these locations are explained below.

- Sludge Pumping Station: one point

  An air sampling point was selected near the sludge inflow pit and the sludge storage tank (Figure 1) because the odor was observed to be the most intense in its neighborhoods. In past, when sludge dewatering beds were in operation, there were some complaints from the

residents living in the surrounding areas. However, no complaints have been received after suspension of its operation. Moreover, the level of odor at the boundary of Abu Rawash WWTP was observed to be very weak during the field survey. Considering these factors, the idea of selection of air sampling location at the boundary of WWTP was dropped.

Figure 1 Location of Sludge Pumping Station

- Sludge Lagoon: three points

Near the sludge lagoons, three sampling locations were selected on the leeward side, one of them on the bank of the sludge lagoon and the other two locations at a distance from the sludge lagoons. The locations at distance were decided in order to determine the relationship of distance with the odor concentrations. The sampling points selected for odor measurement and air sampling are illustrated in Figure 2.

● : Sampling point

Date	Distance	
11 Aug. 2009	1-A～1-B	95 m
	1-B～1-C	215 m
	1-A～1-C	310 m
13 Aug. 2009	2-A～2-B	425 m
	2-B～2-C	325 m
	2-A～2-C	750 m

Figure 2　Air Sampling Locations near Sludge Lagoon

Results of Odor Measurement Survey

The results of odor measurement survey for the cases of the sludge pumping station and the sludge lagoons are presented below in Table.

Table 1 Results of Odor Measurement Survey

(Sludge Pump Station)

Date	Meteorological Data				Odor Index	Ammonia (μ g/m^3)	Hydrogen Sulfide (μ g/m^3)
	Wind Direction	Wind Speed (m/sec.)	Temp. (^{o}C)	Relative Humidity (%)			
11th August 2009	N	1.05	33.5	29.5	40	125	2,198
13th August 2009	NW	1.55	38.5	20.5	39	112	1,752

(Sludge Lagoon)

Date	Sample	Meteorological Data				Odor Index	Ammonia (μ g/m^3)	Hydrogen Sulfide (μ g/m^3)
		Wind Direction	Wind Speed (m/sec.)	Temp. (^{o}C)	Relative Humidity (%)			
11th August 2009	A	NW	2.73	36.7	26.4	37	90	1,481
	B	NW	2.18	36.3	24.5	21	36	149
	C	NW	1.29	39.4	38.0	13	25	42
13th August 2009	A	N	1.69	33.7	32.1	37	83	1,369
	B	N	2.80	33.9	26.5	<10	BMDL	BMDL
	C	N	2.67	36.8	22.1	<10	BMDL	BMDL

*BMDL: Below Method Detection Limit, MDL for concentration of ammonia in air is 20 μ g/m^3 and for hydrogen sulfide is 2.2 μ g/m^3.

Sludge pumping station in the Abu Rawash WWTP

Existing sludge inflow pit and the sludge storage tank are open type without any cover at the top. Especially the structure of sludge inflow pit is favorable to emission of high level of odor concentration to the environment. However, as shown in Figure 1, the present facilities position is very far from the housing zone, and has not resulted in significant level of odor problem for the residents. It is expected that through the application of enclosed type facility, the odor emission in open air could be controlled. Therefore, it is judged that it is possible to maintain the odor concentration at relatively lower level at the Abu Rawash WWTP boundary.

Sludge Lagoon

The odor index at the bank of the sludge lagoons is 37, and is relatively a high value. It is observed from the results that the intensity of odor decreases as the distance of sampling location from the source increases. The relationship between the odor index and distance is illustrated in Figure 3.

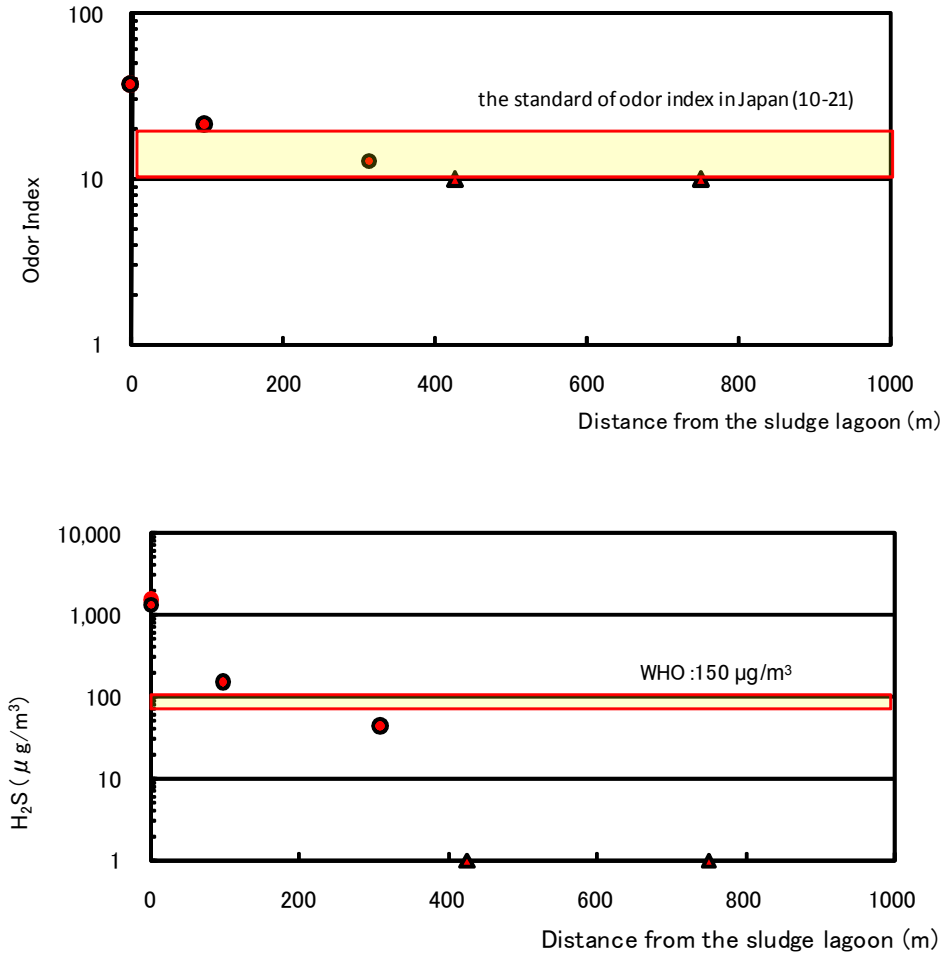


Figure 3 Relationship of Odor Index/Concentration and Distance from Source

As already described in the main report also, there is no standard defined for offensive odor control in the Egyptian regulation. For reference purposes in this Study, the standards of the odor control in foreign countries are considered as described below.

- Local governments in Japan have determined the standards values for odor indices from 10 to 21.
- The guidelines value of ammonia in ambient air is determined as 100 μg/m^3 (as the time-weighted average for 24 hours) by the US Environmental Protection Agency (EPA).
- The World Health Organization (WHO) proposes 150μg/m^3 (24 hours averaging time) of hydrogen sulfide as the air quality guideline value for Europe.

At the sludge lagoon, a strong odor emits during the period until sludge dries. The climatic conditions (mainly wind, solar radiation, duration of sunshine, etc.) influence odor level to great extent. However, it is expected that through the application of 200 m buffer zone around the site, the influence of offensive odor on neighborhoods can be minimized. Moreover, in existing condition, the surrounding area of sludge lagoon is mainly occupied by plantation and very few permanent residents are there in this area and thereby the odor problem has still not occurred. Based on the response of some laborers at the plantation sites, it is observed that odor is not a problem in the neighborhoods yet.

However, during winter south and southwesterly wind may cause odor to move in the direction of adjoining plantation area. Therefore, odor monitoring should be carried out based on the climate conditions. It is recommended that necessary details on area of influence and level of odor should be grasped. Based on the collected information, the countermeasures against odor problems should be considered.

(2) The odor problem in Nikla Village

In Nikla village near the underpass (for crossing irrigation canals of Al Bahery and Al Nasery) at the beginning of Al Rahawy drain (Figure 4), the offensive odor has occurred from the drainage canal, and in few cases complaints have been received from nearby residents.

The JICA team carried out an odor measurement survey by simple method using detecting tube. From results of the survey, hydrogen sulfide was detected at level of 0.12 ppm and ammonia was less than the detection limit on the Al Rahawy drain bank. This odor emission is attributed to the factor that the dissolved hydrogen sulfide in drain water is released by the physical influence of the siphon. The drainage canal water was sampled at the upstream of the siphon, and the concentration of the hydrogen sulfide in collected sample was measured. The measurement method included agitation of the collected sample and then measuring emitted level of hydrogen sulfide, as illustrated in Figure 5. As a result, the hydrogen sulfide concentration which converted to the gaseous phase was observed as 0.06 – 0.04 ppm. It is judged that the hypothesis mentioned above could be fully explained from this result, and if secondary level of treatment is carried out at Abu Rawash WWTP, and if the water quality of drains is improved, this will result into mitigation of offensive odor problem at Nikla.

Table 2 Results of Hydrogen Sulfide Measurement (Nikla Village)

Sample	Hydrogen Sulfide (ppm)
Al Rahawy drain bank in Nikla Village d/s of Siphon	0.12
Drain water at the upstream of Siphon	0.06 – 0.04

Figure 4 Location of Air Sampling in Nikla Village

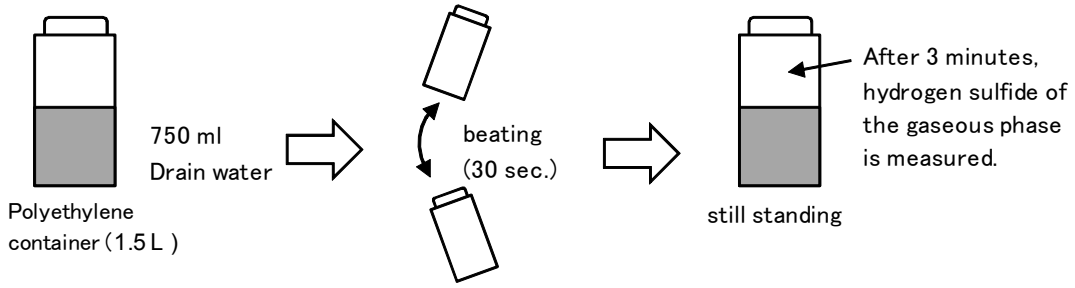


Figure 5 Measurement Method of Hydrogen Sulfide in Drain Water

(3) Others (generation of noxious insect)

In addition to the odor problem near the sludge lagoon, generation of noxious insect (fly) can be a potential problem. When the workers, working at the farm (plantation), were interviewed, their response did not indicate any serious problem of fly in the surrounding areas. However, the information related to fly (the distribution situation of fly, the number of individuals, etc.) is not available and not collected in the existing condition. In future, it is advisable to gather the information on problems due to fly through monitoring. In case when the problem occurs, it is necessary to grasp the information on contents and regional distribution, and it is necessary to take required countermeasures to mitigate this problem.

A fly not only gives displeasure, but could also cause diseases through the contact with eyes and mouth. An insecticide shall be applied if necessary. However, the application of insecticide should be kept at minimum as this might also lead to other negative impacts on neighboring environment and in long run resistant variety of flies could be generated. It is suggested that monitoring procedures be prepared considering these factors and level of fly problems. The photograph of the trap used in Japan for fly monitoring is shown in Figure 6 for reference.

Figure 6　Trap Investigation Instrument for Fly

APPENDIX – 3

Records of Public Consultation
(Stakeholders Meeting)

PUBLIC CONSULTATION/STAKEHOLDERS MEETING
ABU RAWASH WWTP,
SATURDAY, 19 DECEMBER 2009

I. Introduction

The Abu Rawash Wastewater Treatment Plant (WWTP) is located on the west bank of the River Nile in Greater Cairo. It serves a population exceeding 5 million inhabitants from Giza and the fast growing region of 6th October. It is considered one of the most important projects carried out by the Construction Authority for Potable Water and Wastewater (CAPW). The treatment capacity of the Abu Rawash WWTP is - as in 2009 - 400,000 m^3/day. However, the current inflow to this WWTP has reached almost 1,000,000 m^3/day and the flow exceeding treatment capacity is discharged to Barakat drain – that ultimately pours into the Rosetta Branch of the Nile - without any treatment. To address this problem, CAPW began working on the extension of the plant in 2006 to increase its primary treatment capacity by an additional 800,000 m^3/day. The extension is expected to be completed by end January 2009. However, the level of treatment continues to be primary. As a result, the effluent will not be able to meet the standards required by Decree No.8/1983 and its effects on water pollution will not be addressed.

CAPW is about to start to improve the efficiency of the plant by upgrading wastewater treatment from primary to secondary treatment to reduce pollution of the drainage system. This project is expected to have direct positive effects on the environment and public health as well as it has the potential of resulting in substantive socio-economic added value.

The feasibility study of the improvement project has included an Environmental and Social Impact Assessment (ESIA) that was concluded in October 2009 with support from JICA[1]. The study was to be complemented by a Public Consultation. Both initiatives constitute prerequisites for approving projects as part of Corporate Social Responsibility (CSR) to be assumed by competent parties with the aim to prevent foreseeable problems or negative effects that could arise from the proposed project as well as to maximize on positive effects by taking the

[1] Source: Preparatory Study for Abu Rawash Wastewater Treatment Plant Improvement in Cairo, Arab Republic of Egypt, Interim Report Volume II: Environmental and Social Impact Assessment of Abu Rawash WWTP Project, October 2009, by JICA Study Team, (Tokyo Engineering Consultants, Ltd.)

views/suggestions of stakeholders from their diverse perspectives. Accordingly, CAPW with assistance from JICA Study Team, have organized a Public Consultation on 19 December 2009 to solicit the views of all stakeholders concerned or likely to be concerned with the Abu Rawash WWTP Improvement Project.

A team of two consultants: a Social Development/Gender Consultant and an Environment/Sustainable development consultant were recruited by JICA upon consultation with CAPW to manage the public consultation based on which this report is presented.

II. Participants

Participants were invited from a wide range of stakeholders including the project developers/sponsors, competent ministries and local authorities, local council, parliamentarians, private sector NGOs/CBOs, researchers, local communities, the media and other interested parties.

The total number of participants was more than 50, in addition to CAPW senior managers and members of JICA Study Team who participated in observers' capacity. Abu Rawash WWTP General Director, other managers, technicians and staff have also participated in the consultation. Their views related to conditions of service were also solicited as well as their interaction with other stakeholders served in clarifying aspects that could not possibly be known to outsiders.

The full list of participants is provided in Annex I of this part together with affiliation and contact details.

III. Conduct of Business

The public consultation, which took place on the premises of the Abu Rawash WWTP, was moderated by Dr. Emad Adly, Consultant. It started with an introduction by Eng. Zeinab Mounir, CAPW Deputy Chair and Head, Central Department of Projects. She gave an overview of the project in its various stages (past, ongoing and proposed). Eng. Mounir's statement was followed by a presentation by Professor Dr. Ahmed Hossam El Din on behalf of the JICA Study Team. Dr. Hossam El Din briefed the audience on the proposed improvement project. An actual visit of the site followed before a plenary session took place. The agenda of the meeting is provided as Annex II of this report.

Three working groups were formed, as follows:

1. Focus Group I: Staff working at the Plant in different managerial, technical, administrative and secretarial functions selected at random.
2. Focus Group II: Researchers and experts, concerned governmental agencies (environment, health, water supply and sanitation, irrigation, agriculture, food safety)
3. Focus Group III: The Abu Rawash Community Group, represented by: The local Arab Bedouins living very close to the sewage station in Ezab Arab Abu Rawash; The local community living in Abu Rawash Village formed of elected representatives; National Democratic Party (the ruling party) representatives; school headmasters, local council workers, workers in WWTP who reside in the neighborhood, Representatives of the NGO Nahdet El Mansouria for Development; and, Representatives of owners of farms near the WWTP.

The staff of the plant (Focus Group I) were distributed a questionnaire that they were asked to complete on individual basis, in order to prevent inhibition as well as to protect wish for confidentiality. Completed forms were compiled and summarized by the consultant.

Focus Group II (Experts) and Focus Group III (community) were provided another questionnaire to guide them in their deliberations. Each of Group II and Group III selected a moderator and a rapporteur. Discussions were smooth and interactive. Members of the current WWTP project team and CAPW officials were represented in each group to clarify issues, as warranted. Their reports were read by their respective rapporteur in the final plenary session

The questionnaire for Focus Group I, and the one to guide Focus Group II and III were developed by the consultants and are provided in Annex III and Annex IV

The Public Consultation started at 10.00 a.m. and adjourned at 4.30p.m., including coffee and lunch breaks that also served for networking purposes and were kindly hosted by the current project management.

IV. Summary of discussions

A. Plenary Session

The Plenary Session was facilitated by the consultant recruited by the JICA Study Team. Welcoming and introductory notes started by expressing special thanks to the Ministry of Water Resources & Irrigation, the Ministry of State for Environmental Affairs, the Holding Company for Drinking Water and Wastewater, the Arab Contractors Company, and to all participants who included high level officials representing health, agriculture and food safety, research centers, parliamentarians and local council representatives, NGOs, members of the community (including the Bedouin cohorts), the private sector, members of the staff for their responding to the invitation. The participants were briefed on the purpose of the meeting and the agenda (Annex II) was agreed upon.

Eng. Zeinab Mounir made a presentation on behalf of CAPW in which she explained the overall strategy of the Authority and the objectives of the Abu Rawash project. Specifically, she advised the audience that increasing the capacity to treat wastewater from 400,000 m^3/day as per actual capacity to 1.2 million m3/day is underway as per ongoing extension project which is due to be operational by January 2010. The ongoing extension was to try to cope with the rapid population expansion in the region being served by Abu Rawash WWTP. Further needs for expanding the plant's capacity will depend on the rate of population increase in the region.

The improvement project presented for discussion in this meeting is to develop and upgrade the plant to attain secondary treatment level with a capacity of 1.2 million m^3/day through upgrading the processing units that already exist. Upgrading to secondary level of wastewater quality is expected to take 5 years from starting the project until it becomes operational. Treating the sludge has already started. The Gabal El Asfar WWTP offers an excellent example. Eng. Mounir made it very clear to the audience that getting them involved and discussing the impact of the different aspects of the project is an essential prerequisite before launching the project.

Dr. Ahmed Hossam, representing ECG, the consulting firm which assisted the JICA Study Team in preparing the project's environmental impact assessment, made a presentation to highlight the results of the Environmental and Social Impact Assessment part of the Report on "Preparatory Study for Abu Rawash Wastewater Treatment Plant Improvement in Cairo". The consultant

presented a number of positive impacts and anticipated side effects of the project especially during the execution phase.

The two presentations by CAPW and the JICA Study Team delivered in the first plenary session were useful in creating awareness among the audience, especially the Abu Rawash community, about the important role played by the plant. From 2006, CAPW had started to expand the existing primary treatment capacity of the plant from 400m^3/day of wastewater to 1.2 million m^3/day. This proved to be a necessity to cope with the ever increasing size of the population of a previously desert region and which reached more than 5 million inhabitants. The extension project is expected to be operational in January 2010.

Strong technical justifications for upgrading the primary treatment of wastewater to secondary treatment were presented. Agreement regarding the importance and priority to be given to the project was unanimous. However, as part of Corporate Social Responsibility and to fulfill the objectives from this Public Consultation, participants were invited to provide their views and suggestions to avoid or mitigate any side effects that may arise during the construction and operational phases of the proposed improvement project. Participants were also invited to come up with suggestions to maximize the benefits – social – economical – technical or otherwise – that could be part of the project, or that could be recommended to other competent parties for their consideration. The facilitator of the meeting provided enough time to all those who asked for the floor. The remarks and responses came from a number of participants representing the various and diverse stakeholders. The level of active participation was high and demonstrated interest and eagerness in sharing views and comments which reflected unprecedented trust in that their views will be taken seriously by competent authorities. At this point, it may be important to note that in the case viable recommendations are not acted upon, or at least justifiable explanations to why they are not pursued, this will cause an important backlash and political distrust.

Summary of views, suggestions and recommendations made by the various stakeholders in interaction with explanations from competent parties responsible for the project follow:

— There was no questioning about the positive impact of the proposed project with regards to reducing health hazards, allowing certain cultivations, especially fish farming, reducing water pollution which deteriorates along its northern path through new polluting drainage (Al Rahawy) up to discharging in the Rosetta Branch of the River Nile through “Nikla”

which adds solid waste from households and industrial pollutants thus increasing the level of Ammonia to high health risk levels.

— However, the improvement aspect of the project – that is upgrading wastewater treatment from primary to secondary treatment of the whole 1.2M cubic meters requires five years before it becomes operational. While the project extension or upgrading take place on the land that belong to the authorities concerned does not mean appropriating or buying more land, this project will cause a number of inconveniences for the community especially during the long construction phase, such as high trafficking of trucks, possible bad smell, insects and rodents.

— Another important issue raised by the community and agreed by all participants that it was not equitable that the Abu Rawash Plant serves the Giza and 6th October communities when the Abu Rawash community itself was lacking drinking water supply and sanitation system. An integrated approach to the development of the area was considered to be part of the Corporate Social Responsibility incumbent on the Government with the understanding that such development could not be in the hands of CAPW or the Ministry of Housing alone, but that the latter could play a critical role in mobilizing action to this effect.

— Abu Rawash plant deals with about 800,000 cubic meters daily half of this volume is primary treated and the rest is a bypass. In the meantime the plant is not solely responsible for water pollution in the region. The effluent of the plant is later mixed with wastewater from households and agriculture wastewater in Al Rahawy drainage until it reaches Nikla. So the rate of Ammonia (an indicator of water pollution) is very high, hence the urgency of the need to upgrade water quality using the same model of El Gabal El Asfar.

— The treatment deals with the organic aspect while there is still a problem with the heavy metals present in the sewage reaching the plant. This matter has to be investigated during the treatment.

— Al Rahawy drainage is 74 km long and contains 3.5 million m^3 of agricultural, illegal raw wastewater and a high level of contamination. This could be organic and/or chemical. This means that even with the secondary treatment, still some chemicals remain dissolved in the effluent water which is used for irrigation by the farmers in the areas around the drainage. In some areas, there are cases of farmers using the raw sewage to use in their lands believing

that this would help the fertilization of their land. Educating the farmers in this area is therefore necessary and the law must be enforced.

— The project is a turning point, converting the plant from primary to secondary treatment is a very good step but the project must include the best method for the sludge disposal. This method must be effective because the sludge is dangerous on the environment, the soil and the groundwater in the area.

— Though the priority of the proposed project is uncontested, a question about operating and maintenance costs was raised and whether citizens would be willing to contribute so that they feel ownership of the project and thus preserve it.

— Egypt is suffering from water scarcity with the continuous population increase. The water share per capita has declined from 5000 cubic meters some decades ago to less than 800 cubic meters nowadays. In addition the volume of wastewater is increasing everyday as a result of the population increase. For these reasons, the drainage of water without treatment is a crime, but the secondary treatment is not the best solution because still it has a negative impact on the cultivation of crops that are needed. In Egypt the argument that the treated wastewater for wood forests is not considered to be logic as water is needed to grow food crops to achieve food safety standards. For this reason, the tertiary treatment is the best option for the environment and food safety.

— The project must be an integrated development project for the region to improve the quality of life and support the livelihoods.
— The oxidation pools for sludge must be lined by Polyethylene so that it does not contaminate the groundwater. It can be used in the cultivation of forest trees in desert regions, or burning it in the cement producing plants.

— The project could also adopt an operation of aerating the treated wastewater in Barakat drainage in order to upgrade the quality of treated water especially after it is mixed from other illegal raw sources of sewage and wastewater produced along the drainage.

— The community in this area has suffered from lack access of sanitation. They need to live without smelling the bad odor and with the soil of their lands is not polluted. In fact some of the population in this area has left their homes because of these problems.

— The project should take into consideration the unemployed residents with jobs created during the implementation.

— The area is becoming attractive to tourists. This also shows the importance of the project and the need to have a clean environment. This means the project should include other aspects to improve the environment and develop comprehensively the whole area.

— The project will make the area suffer again from the demolishing and building operations which will cause inconveniences to the residents for some more years.

— A question was raised as to whether the Barakat drainage after this project is finished will be safe for agricultural use.

— The households in this area are injecting their wastewater through the septic tanks 20 to 30 meters deep into the ground which has a severe negative impact on the quality of ground water. Stakeholders need to know how this project will deal with this dangerous situation.

— There was a general feeling among the participants that such consultation is something new for them and they never had or heard about similar process with any of the big projects implemented in the country.

CAPW (Eng. Zeinab Mounir) Response:

— The maximum capacity of this plant could go up to 2 million cubic meters. In this project the target of this 5 years action plan is to upgrade it to 1.2 million cubic meters. However as a result to anticipated population increase in the area, an extension of the plant capacity in the coming 5 years action plan is foreseen.
— There is already a process to treat the sludge.
— The Egyptian Code for the secondary treatment of the wastewater is (20-20). But in the upgrading of the Abu Rawash plant, the effluent water will be treated at (8 / 8) which is better than required by the Egyptian Code. The same case is happening with the Gabal El Asfar plant.

Some other reactions were made by some of the representatives of the Holding Company, CAPW and ECG the Consulting Firm:

— Primary treatment of wastewater is not sufficient. It is the reason for most of the health problems we are facing in the different communities all over the country.

— The consultant presentation showed the importance and the positive impacts of the project but did not explain the sustainability in terms of the operations and maintenance costs.

— Cost of wastewater treatment plants is very high compared with the drinking water plant. The ratio is something like 1 to 7. This project is estimated to cost about 2.4 billion Egyptian Pounds and will be run with the BOT system for 20 years. The project will consider the treatment of the sludge.

— All stakeholders are keen about the safety and the improvement of the livelihoods in the area.

— There was a unanimous agreement about the importance to raise the wastewater quality to secondary standard, but worried about its deteriorating again after mixing with drains.

— On behalf of CAPW, Eng. Zeinab Mounir thanked the participants for their valuable contribution with ideas and suggestions and promised that their recommendations will be taken seriously.

— One of the participants also took the floor and thanked the organizers and declared it was his first time to attend such a consultation to involve the communities in designing a big project like this one in Abu Rawash.

B. Focus Group I: Staff of Abu Rawash WWTP

There are 100 staff working at Abu Rawash WWTP per shift plus about 20 consultants. In addition, there are temporary staff hired by the subcontractor during construction phases,. The new project is to generate employment for about 500 staff during the construction phase on a temporary basis, but which is to last about five years followed by 150 permanent staff in the operational phase[2]. Job creation is therefore one of the added values of the proposed improvement project.

Eighteen staff members, selected at random, were invited to the Public Consultation to contribute with their views and suggestions regarding work conditions at the Abu Rawash WWTP and other related issues. Their participation was also deliberately intended to have them benefit from listening to experts' views as well as to sensitize them on the implications of the activities taking place during the construction and operational phases of the project on the people living in the vicinity of the plant. Another purpose from their participation in this consultation was for them to be able to answer possible questions raised from the floor by other stakeholders.

1) Data on staff who completed the questionnaires

They are, in alphabetical order:

1. Abdel Monem Mahmoud Abdel Moez
2. Ahmed Mohamed Hassan
3. Ezzat Safwat Mohamed Aly
4. Kamal Youssef El Gohary
5. Magdy Moris Tawfik
6. Mahassen Mahmoud Ibrahim
7. Mahmoud Hanafi Mahmoud Abou Hadid
8. Mohamed Bayoumi Farag
9. Mostafa Ahmed Hafez
10. Samir Ahmed Marzouk

[2] Source: Eng. Abdel Wahab, Deputy Director, Extension Project at Abu Rawash WWTP

The following is a collective summary of their responses compiled by Consultant

- The majority are in their forties, with two of them above 60 years of age.
- The duration of their service ranges between 18 years to two years
- All participating staff who completed the questionnaire are married and with children
- They hold diverse jobs at different levels: mechanical engineering, technical, managerial, administrative and clerical jobs
- Those occupying senior technical positions are holders of a Bachelor's degree in an engineering-related field, those in senior administrative positions are holders of a BA degree. More junior staff are either holders of diplomas or other certificates at school leaving level.

2) About conditions of service

- Their answers indicate that they have all been recruited on a competitive basis through normal recruitment channels based on their educational background and/or work experience
- They believe that the jobs they occupy match their qualifications except for one or two who think that they deserve career advancement.
- Technical staff acknowledge having received on the job, in-house and/or special training.
- Administrative staff do not seem to have been offered training
- The majority consider having competitive salaries as compared to that of their peers in similar functions elsewhere. The more senior among them view that salaries are not adequate and not commensurate with the experience they have acquired on the job.
- According to answers, conditions of work for staff within WWTP seem to be generally satisfactory.
- Suggestion was made to create awareness among employees about rights and obligations as well as about health protection and safety and to establish bidding rules and regulations to this effect
- The general complaint seems to be about transportation.

3) Technical views

- Staff believe that starting upgrading the treatment of water to the secondary level as soon as possible is a must. They see the improvement of the quality of the treated wastewater as a national project as it would reduce the pollution of the water farmers use for irrigation.

General awareness about proper use of such water by environmental and food security standards was also seen as most important.

- Treating sludge so that it can have multiple uses was strongly recommended.
- One respondent[3] learned from the internet that certain bacteria can be an effective ingredient for water treatment?
- One respondent[4] took the initiative of making some modifications to the design of some mechanical operations.
- One respondent[5] made some modifications to the electric operating board for the lifting pumps. He suggests to use pipes to transport wastewater instead of feeding the Barakat drain so that farmers do not use it for agriculture.
- Health awareness is believed to be necessary for staff working in the station.
- Creating landfills to dispose of trash coming out of the plant is a must as this is causing problems to the neighborhood.
- Staff should be made better aware of the results of the many studies and research conducted on water treatment, and applied as applicable

4) About Gender

- In answer to gender-related questions, most participants' responses indicate that they perceive women as good for clerical, secretarial or office work only.
- Some see that the only jobs not suitable for women are those related to security functions and night shifts.
- Some see the location of the plant and the nature of work as hardship with regards to women
- None believes that there is a glass ceiling inhibiting women from accessing any job and that all jobs are open for both genders: The senior consultant of the whole project is a woman engineer.
- One respondent sees that the most important criterion for occupying any post is qualification, irrespective of gender.
- The majority of respondents do not perceive having a woman as a direct supervisor.
- Women are considered to be safe in the premises and not subject to harassment.

5) About Impact of WWTP

[3] Mr. Ahmed Mohamed Hassan
[4] Mr. Samir Mohamed Marzouk
[5] Mr. Abdel Moez Mahmoud

- All participants are aware of the important social and environmental impact WWTP has at the national scale.
- WWTP is seen by participants as a job-creating enterprise as well as an opportunity to upgrade living conditions in the neighborhood. It is also seen as an opportunity for related industries and small business enterprises to develop in the neighborhood.
- All participants are aware that primary treatment of wastewater is not enough and that secondary treatment is a must.
- Treated sludge can be used as fertilizer, as well as it can generate electricity by applying biogas techniques.
- Participants are aware of the positive effects that the development of the plant can have on the neighborhood – for which an integrated approach is recommended. They are also aware of the possible side effects that require mitigation such as bad smell, noise, insects, excess of traffic during construction phases.
- The meaning of corporate social responsibility is not fully grasped.

C. Focus Group II: Experts, Researchers and Competent Parties

Moderator: Dr. Fatma Attia Abdel Rahman, Water Research Centre, Ministry of Irrigation

Rapporteur: Eng. Abdel Wahab Hilmy, Deputy Director, Abu Rawash WWTP Extension Project

Focus Group II was to provide the views of researchers and experts in related fields as well as to reflect views of representatives of other sectors directly concerned with the project's activities such as environment, health, agriculture, irrigation and food safety. Focus Group II included the following participants in alphabetical order:

1. Abdel Wawab Hilmy (Deputy Director of Abu Rawash current extension project, Group Rapporteur)
2. Abdul Mohsen Abdel Baki
3. Ahmed Hossam El-Din
4. Ahmed Mohammed Hassan
5. Alaa Abdel-Hamid
6. Ali Shehata
7. Ezzat Safwat Mohammed Ali
8. Fatma Abdel-Hamid
9. Fatma Abdel Rahman Attia (Water Research Centre, Ministry of Irrigation, Group Moderator)
10. George Meshreky Abdel-Malek
11. Hanafi Mohamed Hanafi
12. Hussein Mansour (Head, Food Safety Organization)
13. Ibrahim Shawady
14. Magdi Tawfik Morris
15. Mahmoud Ibrahim
16. Mahmoud Rabea
17. Manal Mohammed Selim
18. Mohammed Ismail
19. Oliva Hassan El-Safae
20. Ragaa Gouda
21. Samir Seif

22. Zeinab Mounir (CAPW)

General View

The proposed project of upgrading wastewater treatment from primary to secondary level is unanimously seen as a national environmental and socio-economic priority. Important issues and recommendations were raised by participants under (1) below. Reaction/answers by CAPW and project management also follows under (2) below.

1) Issues raised and recommendations by the group:

- How to deal with noise - dust - the movement of equipment during preparatory stages of the project - car exhaust - increased rates of accidents - flies - mosquitoes.
- Though the wastewater plant is located in Abu Rawash, it is serving other regions (Giza and 6th October Governorate, or the West Bank of the River Nile). This is while the Abu Rawash region itself is deprived of drinking water supply and a sanitary system. The group recommends that the legitimate request of inhabitants to be supplied with an adequate drinking water supply and sanitary system is met in parallel with the establishment of an undertaking as big as the Abu Rawash project.
- A proper waste disposal system needs to be put in place especially to get rid of the trash that results from the construction works and affects neighboring areas
- Priority to provide opportunities for employment to the neighboring population to meet staffing needs during the construction and operational phases of the project should be part of the project's strategy.
- Studying and addressing problems that may affect the status of current staff in case private companies take over the plant management.
- Citizens need to be informed as to whether there is a possibility of increasing tariff to be borne by them for the cost of improving treatment of wastewater per cubic meter.
- There is a need to identify/study the safe and optimal use of wastewater after secondary treatment.
- The project should consider building fermentation tanks to convert the sludge to Methane gas that may cover up to 70% of the plant's electricity.
- Ventilation of the drainage system is a must so that the wastewater discharged into the Rosetta Branch of the River Nile becomes totally clean and free from pollutants.

2) Response from CAPW and Abu Rawash Project Management

— Expediting the process leading to improving the quality of wastewater to secondary treatment is a major priority for CAPW, while undertaking primary treatment of wastewater at double its current capacity is currently underway.
— The feasibility of improving wastewater treatment to tertiary level characteristics will also be studied.
— The wastewater treated at secondary level can be used to grow certain types of crops only as allowed according to certain specifications set by the Ministry of Irrigation. This would save on scarce water resources currently used for irrigation, especially that people are currently suffering from shortages of drinking water supplies.
— The upgrading of wastewater quality to secondary treatment level will reduce environmental pollution and contamination of agricultural land. This is because people are currently using wastewater treated at primary level only to irrigate their lands. This is extremely dangerous because of its direct threat to human health. Farmers, however, lack sufficient awareness about such danger.
— Improving the quality of wastewater gains importance as it discharges in drains that pass through six governorates until it reaches the Rosetta Branch of the River Nile.

3) Follow up on recommendations:

— Private contractors that will be entrusted with any phase of the project will be required to give priority to the qualifying residents. This will save on transportation cost of staff and will also upgrade the quality of life in the neighborhood. Furthermore, contractors will be responsible for conducting ongoing training programs to benefit existing and potential staff and upgrade their skills to match that of the contractors.
— With regards to the noise and road accidents rates and the transportation of equipment a private road is being planned to reach the station. However, participants' attention was drawn to the fact that the bulk of the traffic takes place within the large premises of the plant which is surrounded by a fence, thus minimizing external disturbance.
— Ensuring the use of repellents against creeping and flying insects is a routine daily activity within the plant. Planting green belts of *Gazwarina* and *Neem* trees to absorb odors and to fight mosquitoes is planned.
— CAPW will study the feasibility of providing the Abu Rawash region with drinking water supply and sanitation.
— In cooperation with the Ministry of Irrigation CAPW will also study the best solution for safe use of wastewater treated at secondary level.

— The general plan of the project includes allocating a whole area for building sludge fermentation tanks to produce Methane gas to generate a main part of the electricity required to operate the plant.
— CAPW will also study the possibility to design a system to ventilate the drains discharging into the Rosetta Branch to improve water quality.
— The query regarding the possibility of raising tariff per cubic meter of treated water was considered outside the scope of the consultation. It is a public policy issue that falls under the jurisdiction of the Ministry of Finance.

D. Focus Group III: Abu Rawash Community

Moderator: Mr. Ashraf Farouk, farm owner

Rapporteur: Mrs. Inas Omar, member of NGO Nahdet El Mansouria for Development.

The Abu Rawash Community Group was represented by the following groups:

- The local Arab Bedouins living very close to the sewage station in Ezab Arab Abu Rawash.
- The local community living in Abu Rawash Village formed of elected representatives, National Democratic Party representatives, school headmasters, local council workers, low level workers in the station,
- Representatives of the NGO Nahdet El Mansouria for Development
- Representatives of owners of farms near the sewage station.

Focus Group III included the following participants, in alphabetical order:

1. Abdel-Gawad Kazzafy Ghoul (contractor)
2. Affaf Topgui (resident)
3. Ali El-Akbawi (member of the Popular Council of Abu Rawash)
4. Amr Abdel-Rahman
5. Ashraf Farouk (farmer and group moderator)
6. Attiyah Abd El-Aziz El-Ghoul (lawyer - resident)
7. Enas Mahmoud Omar (NGO Nahdet El Mansouria for Development – resident, and group rapporteur)
8. Jamal Ali Abdel-Al, (President of the Popular Council of Abu Rawash)
9. Helmi El-Sayed Helmi (Member of the local center for Kerdassa)
10. Mahmoud Abdel Moez Abdel Moez (deputy director of the treatment plant in Abu Rawash)
11. Mohamed Abdel-Halim Kazaz (Director of the Supreme Council of Antiquities Center and member of the Popular Council of Abu Rawash)
12. Mohamed Gamal Akbawi (National Democratic Party secretary of Abu Rawash, the local council member of Kerdassa)
13. Mohamed Juma
14. Mohamed Mongi Manna (contractor, resident)
15. Mona Mohamed Baligh (resident)
16. Mordi Ibrahim Gul (contractor)

17. Mustafa Ahmed Hafez (Abu Rawash plant maintenance manager)
18. Rizk Kazzafy Ghoul, (resident)
19. Sherif El mehelmy, (resident)
20. Tamer Shafiq Mohammed Khalid, (Director of the Al-Sheta villas -Mounsouria)

The discussion showed the following:

1) General Views

The proposed project of upgrading wastewater treatment from primary to secondary level is seen as a national environmental and socio-economic priority. It will also benefit the community and pathway of the treated wastewater to its final destination: The Rosetta branch of the River Nile.

The group, however, strongly stated the following arguments that provide their views on the negative and positive aspects of the project, as well as their recommendations for improvement (points 2, 3, and 4 below).

2) Problems that are expected to be faced during the execution of the project and generally from the existence of the station and the works in it.

- The community is affected adversely by strong odors emanating from the station.
- Increased amounts of rodents, flies and mosquitoes
- Adverse conditions on health.
- Trucks working in the construction inside the station were destroying the roads.
- Rubbish and earthwork produced by the works were being dumped on the sides of the roads or in the irrigation canals and not transported to proper dumping areas.
- The street leading from Abu Rawash and the ezab (small agglomerations) around it, to the desert road ran through the sewage station and was now closed thus adding one hour of time for people to reach the desert road and beyond.
- Although the area was being used for treating the effluent from the whole of the urban west bank of the River Nile in Greater Cairo, the area itself had no benefited from that work.

— Primary treated sewage and non treated sewage was being let into the waste canals and farmers were using this polluted water to irrigate their edible crops, thus producing polluted food crops.
— Sub soil water was also being polluted from that effluent.

3) Positive aspects that are expected to be generated by the project:

The project, although in its construction phase, negatives may arise, is also an opportunity for the local community. As the project will cost 2.4 Billion Egyptian Pounds, it is only fitting that the project should recognize its social responsibility towards the community it is located in. This responsibility should be translated into providing much needed services for the community like schools, health services, sewage system, clean drinking water system, a system to safely and responsibly collect and dispose of garbage, paving of streets and lighting them, skills training for employment, etc. These services are all sadly below requirements. A preliminary amount of LE 200 million should be set as part of the cost of the construction towards providing the needed services to the community. This amount would be well spent and add benefit to the project as it could be advertised thus embellishing its public image.

In addition to the expected benefit that should come from the project outlined above, other benefits would be:

— Work and training opportunities for young people of the community in the project itself.
— Work opportunities for the contractors of the community in the project itself.
— More and cleaner produced water that could be used in irrigating some crops safely like cotton, jute, bananas, citrus fruits.
— A better road system, properly maintained, with direct access to the desert road.
— Secondary treatment would lessen odors
— Proper disposal of sludge and surface material would lessen mosquitoes and flies.

4) Recommendations:

The actions needed from the project are the following:

— Open a road either inside or adjacent to the station to facilitate reaching the desert road.
— Fast and safe disposal of sludge and surface material

— Daily spraying against insects
— Monitoring of levels of odor gasses to prevent them from polluting the air.
— Continuous monitoring of the state of the roads
— Continuous monitoring to assure that no earthwork is dumped in the area.
— Priority for workers of the area to fill the jobs in constructing and running the station.
— Priority for contractors from the area to work as sub-contractors in their different fields.
— Allocation of a sum of LE 200 million for the upgrading of services in the Abu Rawash area.
— Secondary treatment should be considered as the first step towards tertiary treatment.
— Forming a committee between the station and residents to respond to residents' complaints and to assure that the above points are met.

Finally, although this is the first time that the community has been involved in a public consultation about work that will affect their daily lives, their question remains:

— Will the points expressed by the community be worked on and taken into consideration in the planning of the project, or has this just been a meeting to write a report and do nothing about it?

E. Main Conclusions and Recommendations

General

1. The viability of Upgrading the wastewater treatment from primary to secondary treatment should take high national priority as the treated wastewater passes through six governorates until it reaches its final destination at the Rosetta Branch of the River Nile and the level of pollution obtained after primary treatment remains quite high and unsafe.

2. All viable views and recommendations suggested by the participants of the Public Consultation and which are reflected under the summaries of the Plenary and working sessions of the three focus groups provided in this report should be given special consideration. This is because the caliber of expertise was high and the interventions by government, people and community' representatives were legitimate and pertinent. Furthermore, it will create new bonding trusts between the community and governmental agencies that will help conclude the "social contract" Egypt's President is committed to.

3. Besides benefitting from experts' and technical advice as well as learning about the possible impact the construction and the operational phases of the project may have on the neighboring inhabitants, the Public Consultation was taking as an opportunity by the community to express their demands from the municipality. As some of such demands are outside the scope of the project or CAPW, the principles of Corporate Social Responsibility (CSR) may incite the authority to bring up demands to competent parties, as relevant.

Specific

1. Safe disposal of sludge to avoid any environmental and health hazards
2. Minimizing disruption that could be caused to the community and identified as:
   - Noise, odours, insects and rodents. Studying the effect of use of repellents was suggested as it is believed to help migration of insects to the neighbourhoods.
   - Safe and continuous disposal of trash from construction works.

- Heavy trafficking by trucks especially during construction works that is to last for a number of years may cause accidents especially that roads are not well paved
- As the location of the plant over a sizeable area is obstructing the mobility of people between the Desert Road (South) and the Abu Rawash district (north), CAPW was urged to construct a pathway (road) within its premises that would facilitate movement of the community.
- The health hazards caused from using wastewater treated at primary level further polluted after mixing with drainage water for agricultural purposes require a consolidated action by the Ministry of Irrigation, the Ministry of Agriculture, NGOs and farmers. For this a sensitization and awareness creation programme also proposing alternatives is a must

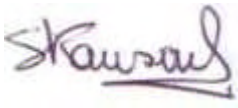
3. Considering solving the transportation problem from which the current staff seem to suffer
4. Extending training to administrative staff and not restricting it to the technical category. Gender sensitization is also recommended
5. Giving priority for employment to the population residing in the neighbourhood
6. Promoting an integrated area development programme as part of Social Corporate Responsibility that includes accessing the community with safe drinking water supply and an adequate sanitation system that links with the public sewage network, and mobilizing action towards building schools, hospitals and other basic services in collaboration with other competent parties.

The community would react positively and will meet what is required from them as citizens when they realize that their views are taken seriously.

Signed by:

Dr. Emad Adly (Environment) **Date_24 December 2009**

Signed by:



Mrs. Seheir Kansouh (social/gender) **Date_24 December 2009**

Annex I

Draft List of Participants

م	الإسم Name	الوظيفة Affiliation
1.	م. سمر يوسف Eng. Samar Yousef	جماعة المهندسين الاستشاريين Engineering Consulting Group
2.	د. احمد حسام الدين Dr. Ahmed Hossam El Din	جماعة المهندسين الاستشاريين Engineering Consulting Group
3.	م. أحمد طارق عبد المنعم Eng. Ahmed Tarek Abdel Monem	جماعة المهندسين الاستشاريين Engineering Consulting Group
4.	م. محاسن محمود ابراهيم Eng. Mahassen Mahmoud Ibrahim	من العاملين في الاستشاري Consulting Staff
5.	سوميه حسن Somaya Hassan	مهندسة
6.	م. عزت صفوت محمد علي Eng. Ezzat Safwat Mohamed /aly	مهندس – استشاري
7.	م. مجدي موريس توفيق Eng. Magdy Moris Tewfik	مهندس (استشاري المالك)
8.	م. أحمد محمد حسن Eng. Ahmed Mohamed Hassan	مدير إداري (استشاري المالك)
9.	د. سامح محمد عبد الجواد Dr.Sameh Mohamed AbdelGawad	مكتب مصر للاستشارات
10.	Ahmed Mohamed Hassan حسن محمد أحمد	الاستشاري
11.	م. سمية مرزوق Eng. Somaya Marzouk	الاستشاري
12.	م. عزت صفوت محمد Eng. Ezzat Safwat Mohamed	مهندس- الاستشاري
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14.	م. عفاف الطوبجي Eng. Affaf El Tobgy	مدير إداري شريك- AIT Consultant – Abu Rawash Community
15.	Eng. El Sayed Abdel Maksoud المقصود عبد السيد . م	رئيس قطاع- الشركة القابضة لمياه الشرب والصرف الصحي
16.	م. حنفي محمد حنفي Eng. Hanafy Mohamed Hanafy	الشركة القابضة لمياه الشرب والصرف الصحي
17.	م. عبد المحسن عبد الباقي	الشركة القابضة لمياه الشرب والصرف

	Eng. Abdel Mohsen Abdel Bak'ee	الصحي
18.	د. ضياء الدين القوصي Dr. Riad El Qousy	المركز القومي لبحوث المياه
19.	م. محمد سميح محمد سامي Eng. Mohamed Sameeh M. Samy	مدير عام- وزارة الموارد المائية والري
20.	م. جورج مشرقي عبد الملك Eng. George Meshreky Abdel Malek	رئيس الإدارة المركزية لمتابعة وتقييم اداء صيانة الصرف- وزارة الموارد المائية
21.	د. فاطمة عبد الرحمن عطية Dr. Fatma Abdel Rahman Attia	مركز بحوث المياه- وزارة الري Water Research Centre, Ministry of Irrigation
22.	منى محمد بليغ Mona Baligh	من سكان المنصورية Mansouria community
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24.	م.مصطفى أحمد حافظ Eng.Mostafa Ahmed Hafez	مدير الصيانة بمحطة معالجة أبو رواش
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35.	جمال علي عبد العال Mr. Gamal Aly Abdel Aal	رئيس المجلس الشعبي المحلي بابو رواش
36.	م. مصطفى احمد حافظ Eng. Mostafa Ahmed Hafez	مدير الصيانة بمحطة أبو رواش
37.	م. محمود ربيع	وكيل وزارة الري والموارد المائية

	Eng. Mahmoud Rabee	
أمين عام جهاز شئون البيئة Secretary General, Head of the Sector for Branches Affairs Ministry of State for Environmental Affairs	د. م. علي عبد الرحيم ابو سديرة **Dr. Eng. Ali Abdel Rahim Abou Sedira**	**38.**
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مقاول **Contractor**	منجي محمد مناع **Mr. Mongy Mohamed Manae**	**43.**
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كيميائية – مستشار وزارة الصحة	رجاء جودة يوسف **Mrs.Ragaa Gouda Youssef**	**46.**
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من سكان ابو رواش محامي **Abu Rawash community – Lawyer**	أ. عطية عبد العزيز الغول **Mr. Attia AbdelAziz El Ghoul**	**48.**
كيميائي بالشركة القابضة لمياه الشرب- ابو رواش	ك. محمد محمود اسماعيل **Mr. Mohamed Mahmoud Ismail**	**49.**
من سكان المنطقة **NGO member Mansouria community**	إينـاس محمود عمر **Inas Mahmoud Omar**	**50.**
عضو مجلس محلي 6 اكتوبر **Local Council 6th October**	عمرو عبد الرحمن طايع **Amr Abdel Rahman Tayee**	**51.**
من سكان المنطقة **Abu Rawash community**	علاء الدين عبد الحميد **Alaa El Din Abdel Hamid**	**52.**
من سكان المنطقة **Abu Rawash community**	شريف المهيلمي **Sherif El Meheilmy**	**53.**
إيه في سي زيروكس مدير عام شركة **Abu Rawash community and Director Xerox**	أشرف فاروق **Ashraf Farouk**	**54.**
مدير عام إدارة المشروعات – المقاولون العرب **Arab Contractors**	هشام مختار الحارونى **Hesham Mokhtar El Harouny**	**55.**
صاحب شركة – عضو مجلس محلي كرداسة	حلمي سيد حلمي	**56.**

Local Council - Kerdasa	**Helmy Sayed Helmy**	
أ.د. مندسة المطرية **Professor of Engineering – Mataria**	د. مصطفى عشماوي **Dr. Mostafa Ashmawy**	**57.**
رئيس قطاع الصرف الصحي بشركة الجيزة	م. شحاته علي درة **Eng. Shehata Aly Dorra**	**58.**
وزارة الصحة **Ministry of Health**	الفت حسين الشافعي **Olfat Hussein El Shafei**	**59.**
The Arab Office for Youth and Environment (NGO)	**Elham Afifi**	**60.**
Head for Central Department of Projects – CAPW	**Eng. Zeinab Mounir**	**61.**
CAPW	**Eng. Nihad Anwar**	**62.**
CAPW and Deputy Project Director Abu Rawash Extension Project	**Eng. Ihab Helmy (Abdel Wahab)**	**63.**
CAPW Office Manager	**Mrs. Karima Hussien**	**64.**
	Mr. Mohamed Abdel Wahab	**65.**
سكرتارية **Secretariat**	ماهيتاب محمد **Mrs. Mahitap Mohamed**	**66.**
سكرتارية **Secretariat**	عمرو عبد الباقي **Mr. Amr Abdel Baky**	**67.**
Team leader –JICA study team	**Masafumi Miyamoto**	**68.**
E/A - JICA study team	**Masahito Kawachi**	**69.**
Environment and Sustainable Development Consultant JICA Study Team	**Emad Adly**	**70.**
Social and Gender Consultant, JICA Study Team	**Seheir Kansouh**	**71.**

Annex II

Public Consultation/Stakeholders Meeting

Abu Rawash WWTP, Saturday 19 December 2009

Final Agenda

9:30-10:00 Registration

PLENARY SESSION I

10:00-10:30 Welcome and Introduction (by CAPW, Ministry of Housing, Utilities and Urban Development)

10:30-11:10 Presentation (by JICA Study Team)

- The Proposed Improvement Project
- Result of the Environmental Impact Assessment (EIA)

11:10-11:40 Site Visit of the Plant

11:40-12:00 Coffee Break

WORKING GROUPS SESSION

12:00-12:15 Modality of work – *by Consultants*

12:15-13:45 Three Working Groups – *session moderated by Consultants*
Focus Group I – Staff (males and females) of Abu Rawash WWTP
Focus Group II – Experts, researchers, other authorities and ministries, etc.
Focus Group III – Abu Rawash Community, Local councils, NGOs, etc.

PLENARY SESSION II

13:45-15:30 Report by *rapporteur* of each of the three working groups, collective findings and recommendations – *session moderated by consultants*
Concluding Remarks - *by Eng. Zeinab Mounir, Head, Central Department of Projects, CAPW*

LUNCH

15:30-16:30

Annex III

Public Consultation/Stakeholders Meeting
Abu Rawash WWTP,
Saturday, 19 December 2009

Questionnaire for Focus Group I
Abu Rawash WWTP Staff
(Translation from Arabic)

Modality of work:

Forms will be completed individually and collected for compilation by the consultants. Views and suggestions will be included in the Public Consultation report.

1. <u>Personal information</u>

Name: **Age:**
Social Status (tick as appropriate): ☐ **Single** ☐ **Married** ☐ **Divorced** ☐ **Widow**
Children: **Number:** ☐ **Age (of each):**
Academic background:
Prior experience:

2. <u>Job-related questions</u>

Date of entry in WWTP:
Current Job:
The staff of WWTP are
How did you come to know about this job?
Did it match your qualifications, or was it just to earn your living?

When you compare your benefits with those of your peers with same qualifications in the country, do you feel you have:

☐ ***Better conditions*** ☐ ***same*** ☐ ***lower***

In what way?

Do you think you are overqualified for this job? If yes, *in what way*

Did you get training through WWTP? Abroad? In Egypt? On the Job?

Whom are you reporting to? (state his/her function only. No need for name)

How many persons are reporting to you (if applicable):
☐ Technical ☐ Administrative ☐ Clerical

How many men and how many women occupy positions similar to yours in WWTP:

Did you introduce any innovation or taken an initiative that added value to the work? If yes, please explain in what way and if acknowledged by management.

Any special constraint: ☐ Transportation? ☐ Condition of work? ☐ Other?
Please explain:

2. <u>Gender-Related Questions:</u>

Do you feel that working conditions and attitudes differ when the staff is a man or a woman? If so, please explain

Do you feel that there are jobs in WWTP that in your own view are not suitable for women. If so which ones and why?

Do you have any problem dealing with your male colleagues such as their possibly adopting a patriarchal attitude? If so, in which way?

Do you have an objection having a female supervisor? If so why?

Is there a "glass ceiling" for women in your enterprise? In this case what strategy do you think is needed to facilitate women's <u>*increased access*</u> to senior positions?

3. <u>General awareness</u>

What is your perception of WWTP's accomplishment?

- **In a national context**
- **As a plant (such as creating jobs, related industries)**
- **For the surrounding communities**

Have you an idea of what "corporate social and environmental responsibility" is all about? Are you fully acquainted with your rights and obligations?

You are hopefully aware that an improvement phase of Abu Rawash WWTP is now being considered. Do you feel there is a need to introduce legislations, internal regulations, mode of operation that will improve the status of employees and remove any discrimination against women? ***If so, please explain***

Do you have any technical view on WWTP operations that you would wish to raise to Management?

Annex IV

Public Consultation/Stakeholders Meeting
Abu Rawash WWTP,
Saturday 19 December 2009

Questionnaire for
Focus Group II (Community) and III (Experts)
(Translation from Arabic)

Modality of work:

1) Please select a chair for the working group and a rapporteur who will present the group's report to the plenary session
2) Each working group is to attempt at providing their collective views with regards to the following:

1. Positive impact expected of the project and possible optimization measures (economical, social, environmental)

Possible area of gain	**Identify**	**Suggested optimization measure**	**Responsibility**
Increase work opportunities			
Contribute to energy saving			
Improve land productivity, soil fertility, fish farming			
Increase agricultural intensification rate			
Improve health and minimize disease			
Improve water quality by reducing wastewater feeding the			

drainage system			
Economic gains resulting from all above			
Other			

2. Negative or adverse effects expected to result from the implementation of the project and suggestions for reducing/mitigating such effects

Activity	**Adverse Effects**	**Suggested Mitigation Measures**	**Responsibility**

3. Mitigation

Impact	**Suggested Mitigation Measures**	**Responsibility**

4. Role of various stakeholders in optimizing impact of project and minimizing its possible side effects

Impact	**Role of Local Council**	**Role of NGOs**	**Role of Private Sector**	**Role of Women**	**Media and Others**

APPENDIX – 4

List of References

No.	Title of the Document	Source
1	West Bank Project, Mitigation Interim Report, Sep. 1996	CAPW
2	GWWC Organization Chart, Staff Nos., Training Program	GWWC
3	A Study of the Effect of Releasing Excess Water from Sub-Rasheed Branch on Rahawy Main Drain	MWRI
4	West Bank Project, Operating Data and Design Criteria Review, Sep. 1996	CAPW
5	Greater Cairo Wastewater Project, Sludge Management Study, Appendices	CDM
6	Greater Cairo Wastewater Project, Sludge Management Study, Comments on Draft Final Report, Oct. 1990	CDM
7	West Bank Project, West Bank Strategic Plan Concept Report, May 1993	CDM
8	National Water Resources Plan 2017	MWRI
9	Cross Sections of Drains, Major Wastewater Sources	MWRI
10	Drain System on West Bank (Arabic)	MWRI
11	Egypt State of the Environment Report 2007	EEAA
12	Egypt State of the Environment Report 2008 (Arabic)	EEAA
13	Environmental Assessment Alexandria Wastewater Project Phase II, June 1997	ECG
14	Environmental Assessment and Screening Report, Gabal El Asfer Wastewater Treatment Plant Extension Project - Stage 2 Phase 2	CAPW
15	METAP Study: Wastewater Project for Greater Cairo's West Bank Area	JICA, Cairo Office
16	Sixth of October and Sheikh Zayed Cities Water and Wastewater Final Pre Feasibility Study, April 2002	ECG
17	West Bank Sludge Handling Facilities, Report on Comparison of Mechanical Dewatering and Trucking Versus Sludge Pumping and Disposal Schemes	CDM
18	Environmental Assessment, East Bank Wastewater Project, Stage II	CAPW
19	AbuRawash-WQ-2007	Giza WS Co
20	AbuRawash-WQ-2008	Giza WS Co

21	AbuRawash-WQ-2009	Giza WS Co
22	DrainWQuality-20090307sampling	
23	The Gabal Al Asfer WWTP Stage 2 Phase 2: Public Consultation	CAPW
24	Zenein Wastewater Treatment Plant, Process Description	Giza WS Co
25	Gulf of El Zayt 220 Mwe Wind Power Plant Project, Environmental and Social Impact Assessment Report	JICA, Cairo Office

APPENDIX – 5

Check List of Environmental Considerations

Environmental Checklist: 19. Sewage and Wastewater Treatment （1）

Category	Environmental Item	Main Check Items	Confirmation of Environmental Considerations
1 Permits and Explanation	(1) EIA and Environmental Permits	① Has EIA report been officially completed? ② Has EIA report been approved by authorities of the host country's government? ③ Has EIA report been unconditionally approved? If conditions are imposed on the approval of EIA reports, are the conditions satisfied? ④ In addition to the above approvals, have other required environmental permits been obtained from the appropriate regulatory authorities of the host country's government?	① According to EEAA guidelines, this project is categorized as Black for which full EIA is required. Preparation of EIA report has been carried out under this Study. Upon completion of this study, CAPW shall be required to submit the EIA Report to EEAA for its approval. ② ③ No. The CAPW shall be required to submit Letter of intent along with three copies of EIA report to get approval from EEAA. The CAPW shall obtain the approval letter from EEAA before implementation starts. ④ No other environmental permits are required to obtain from other regulatory authorities.
	(2) Explanation to the Public	① Are contents of the project and the potential impacts adequately explained to the public based on appropriate procedures, including information disclosure? Is understanding obtained from the public? ② Are proper responses made to comments from the public and regulatory authorities?	① According to EEAA guidelines, public consultation it to be carried out once under this study to explain potential impacts of project to the public and other stakeholders and to obtain their understanding on the project. ② In the public consultation meeting, proper responses shall be made to the comments of all participants.
2 Mitigation Measures	(1) Water Quality	① Do pollutants, such as SS, BOD, COD, pH contained in treated effluent from a sewage treatment plant comply with the country's effluent standards?	① Yes. Proposed project includes provisions of secondary treatment facilities that has been designed considering Egyptian Standards of effluent limits. This will contribute to improvement of water quality in receiving water bodies.
	(2) Wastes	① Are wastes, such as sludges generated by the facility operations properly treated and disposed of in accordance with the country's standards?	① At present, the sludge generated at Abu Rawash WWTP along with sludge received from Zenein WWTP is pumped to a sludge lagoon in desert about 35 km away from WWTP (50 km away from the city) and also the WWTP is about 15 km away from the urban centers. Based on CAPW priorities, sludge lagoons will be extended to treat additional sludge. It is expected that in future stages, sludge treatment facilities of the required capacity would be constructed.
	(3) Soil Contamination	① If wastes, such as sludges are suspected to contain heavy metals, are adequate measures taken to prevent contamination of soil and groundwater by leachates from the wastes?	① Major part of influent to this WWTP is domestic wastewater at present and based on result of water quality survey undertaken in this study, level of heavy metals in wastewater inflow to WWTP are within standards. Also, based on data obtained from GWWC, heavy metals level in dried sludge are within standards. However, in future it is possible that industrial effluents be discharged to the sewerage networks. Therefore, monitoring is needed for effluent quality from industrial units discharging to sewerage networks.
	(4) Noise and Vibration	① Do noise and vibrations generated from the facilities, such as sludge treatment facilities and pumping stations comply with the country's standards?	① Pumps and other noise causing instruments for the proposed facilities shall be located in concrete rooms and proper care should be taken to limit the amount of generated noises. Also, during construction stage, mitigation measures should be undertaken to maintain the noise level within defined limits.
	(5) Odor	① Are adequate control measures taken for odor sources, such as sludge treatment facilities?	① At present sludge from WWTP is pumped to sludge lagoon in desert 35 km away from WWTP (50 km away from the city centers). The result of odor survey carried out in this study indicated that odor level is within guidelines of WHO, Japan, US EPA. However, periodic monitoring should be carried out in this respect.

Environmental Checklist: 19. Sewage and Wastewater Treatment （2）

Category	Environmental Item	Main Check Items	Confirmation of Environmental Considerations
3 Natural Environment	(1) Protected Areas	① Is the project site located in protected areas designated by the country's laws or international treaties and conventions? Is there a possibility that the project will affect the protected areas?	①No, project area is not a protected one, and project will not affect protected areas.
	(2) Ecosystem	① Does the project site and discharge area encompass primeval forests, tropical rain forests, ecologically valuable habitats (e.g., coral reefs, mangroves, or tidal flats)? ② Does the project site encompass the protected habitats of endangered species designated by the country's laws or international treaties and conventions? ③ If significant ecological impacts are anticipated, are adequate protection measures taken to reduce the impacts on the ecosystem? ④ Is there a possibility that the project will adversely affect aquatic environments, such as rivers? Are adequate measures taken to reduce the impacts on aquatic environments, such as aquatic organisms?	①,② Project area does not contain any kind of ecologically valuable habitats and does not encompass the protected habitats of endangered species. ③ Significant negative ecological impacts are not anticipated. Yes, authorities carry on periodical and non periodical auditing as to take proper action with any environmental law violation(s). ④ The treated effluent from Abu Rawash WWTP is finally discharged to Rosetta branch of River Nile through a series of drains. The implementation of project will improve water quality of River Nile by abatement of pollution load in the treated effluents using secondary level of treatment at this WWTP (at present only primary level of treatment is available).
4 Social Environment	(1) Resettlement	① Is involuntary resettlement caused by project implementation? If involuntary resettlement is caused, are efforts made to minimize the impacts caused by the resettlement? ② Is adequate explanation on relocation and compensation given to affected persons prior to resettlement? ③ Is the resettlement plan, including proper compensation, restoration of livelihoods and living standards developed based on socioeconomic studies on resettlement? ④ Does the resettlement plan pay particular attention to vulnerable groups or persons, including women, children, the elderly, people below the poverty line, ethnic minorities, and indigenous peoples? ⑤ Are agreements with the affected persons obtained prior to resettlement? ⑥ Is the organizational framework established to properly implement resettlement? Are the capacity and budget secured to implement the plan? ⑦ Is a plan developed to monitor the impacts of resettlement?	①,②,③,④,⑤,⑥,⑦ The proposed area for construction of secondary treatment facilities and sludge lagoon extension is located within the premises of existing Abu Rawash WWTP and sludge lagoons in desert, respectively. The proposed area is owned by HCWW. Therefore, no resettlement is expected due to project implementation.
	(2) Living and Livelihood	① Is there a possibility that changes in land uses and water uses due to the project will adversely affect the living conditions of inhabitants? ② Is there a possibility that the project will adversely affect the living conditions of inhabitants? Are adequate measures considered to reduce the impacts, if necessary?	① Changes in land use and water use will not affect adversely on living conditions of inhabitant. Rather, it will have positive impacts on their living conditions. ② The project is also expected to have positive impacts on financial conditions of the inhabitants during construction phase.
	(3) Heritage	① Is there a possibility that the project will damage the local archeological, historical, cultural, and religious heritage sites? Are adequate measures considered to protect these sites in accordance with the country's laws?	① There is no possibility that the proposed projects will damage any local archeological, historical, cultural, and religious heritage sites. Egyptian laws are defined for protected areas (Law 102) and for protecting areas of cultural heritage (Law 17) and adequate measures should be considered during construction phase.

Environmental Checklist: 19. Sewage and Wastewater Treatment (3)

Category	Environmental Item	Main Check Items	Confirmation of Environmental Considerations
4 Social Environment	(4) Landscape	① Is there a possibility that the project will adversely affect the local landscape? Are necessary measures taken?	① The proposed project will not have adverse effects on local landscape as area is located in the campus of existing WWTP and sludge lagoon. Also, the WWTP could have a provision of green belt around it when there are several complaints and request from the residents.
	(5) Ethnic Minorities and Indigenous Peoples	① Does the project comply with the country's laws for rights of ethnic minorities and indigenous peoples? ② Are considerations given to reduce the impacts on culture and lifestyle of ethnic minorities and indigenous peoples?	①,② Ethnic minorities and indigenous people are not settled in the project area and no serious impacts of project activities are expected on culture and lifestyle of ethnic minorities and indigenous people.
5 Others	(1) Impacts during Construction	① Are adequate measures considered to reduce impacts during construction (e.g., noise, vibrations, turbid water, dust, exhaust gases, and wastes)? ② If construction activities adversely affect the natural environment (ecosystem), are adequate measures considered to reduce impacts? ③ If construction activities adversely affect the social environment, are adequate measures considered to reduce impacts? ④ If necessary, is health and safety education (e.g., traffic safety, public health) provided for project personnel, including workers?	①,②,③,④ Serious impacts on the natural, and social environment are not anticipated. During the construction phase, appropriate technologies should be considered to reduce impacts due to noise, vibrations, turbid water, dust, exhaust gases and wastes and mitigation measures should be adopted. Also, measures of traffic safety and public health should be considered for project personnel during construction stage.
	(2) Monitoring	① Does the proponent develop and implement monitoring program for the environmental items that are considered to have potential impacts? ② Are the items, methods and frequencies included in the monitoring program judged to be appropriate? ③ Does the proponent establish an adequate monitoring framework (organization, personnel, equipment, and adequate budget to sustain the monitoring framework)? ④ Are any regulatory requirements pertaining to the monitoring report system identified, such as the format and frequency of reports from the proponent to the regulatory authorities?	① Suitable operation of sewerage system shall contribute to improvement of natural and social environments. Monitoring of operation of the system is important and the GWWC is carrying out operation and management of existing facilities at Abu Rawash appropriately including monitoring of effluent quality. In Decree 8 of 1983, rules are also stated related to monitoring of effluent quality periodically for establishments that have been provided license to discharge into water bodies. ② Yes, according to local regulations and standards. ③ Yes, CAPW and GWWC have adequately defined monitoring frameworks. The GWWC submits monthly report on O&M to CAPW. ④ As mentioned in the EIA's approval, preparing an environmental record is a mandatory as to be checked in any periodical or non periodical environmental audit.
6 Note	Note on Using Environmental Checklist	① If necessary, the impacts to transboundary or global issues should be confirmed (e.g., the project includes factors that may cause problems, such as transboundary waste treatment, acid rain, destruction of the ozone layer, or global warming).	① There is no expected impact towards boundary or global issues.

1) Regarding the term "Country's Standards" mentioned in the above table, in the event that environmental standards in the country where the project is located diverge significantly from international standards, appropriate environmental considerations are made, if necessary.
In cases where local environmental regulations are yet to be established in some areas, considerations should be made based on comparisons with appropriate standards of other countries (including Japan' experience).
2) Environmental checklist provides general environmental items to be checked. It may be necessary to add or delete an item taking into account the characteristics of the project and the particular circumstances of the country and locality in which it is located.