YMCA- Lebanon

Brief Environmental Impact Assessment Report for

WASTEWATER TREATMENT PLANT 2 IN BAKKA TOWN

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1. General Overview and Context

1.1 Introduction

The project goal is the establishment of a Wastewater Treatment Plant (WWTP)- Bakka WWTP/2- in the Western side of Bakka town, Rashaya caza, which will treat the generated domestic wastewater of this part of the town to a secondary level treatment. After this treatment level the effluents will be discharged into the environment.

The Bakka WWTP/2 will serve a population of around 200 people and will have a capacity of processing up to 60 m^3 of raw wastewater everyday. Due to migration from the town, it is expected that the population will remain low, increasing slightly within the next 10 to 20 years. The projected population of this western part of the town for the year 2020 is 600.

YMCA- Lebanon is supporting the Municipality technically and financially for the materialization of this project. The Municipality of Bakka has already established the sewer line that will connect the plant to the houses and the WWTP is to be built by YMCA. The Municipal Council of the town is in charge of the implementation of this project with the supervision of YMCA.

A couple if years ago, YMCA has established Bakka WWTP/1 for the residents of the eastern side of the town, comprising 90% of the population.

1.2 Objectives of the Project:

The project aims at environmentally safe disposal of wastewater, for upgrading the sanitary and health standards of the inhabitants living in Bakka town.

The long-term objectives of wastewater treatment project are to:

- Prevent the spread of diseases,
- Prevent the prevalence of conditions offensive to sight and smell,
- Control the contamination of water resources,
- Prevent and control soil and groundwater pollution.

The specific objectives of the project are to:

- Establish a dependable wastewater treatment plant that is a cost effective alternative to conventional mechanized wastewater treatment and disposal facilities.
- Manage the pathogenic risk inherent in wastewater to meet the effluent discharge standards set by Lebanese Ministry of Environment.
- Eliminate or manage the safe disposal of sludge.

1.3 Importance of the Project for the Local Community:

The state of wastewater management in Bakka town is similar to most of the municipalities of rural Lebanon. People discharge their wastewater in open bottom cesspits or septic tanks. When these overflow, they hire a vacuum truck to empty them. That is, in either way the wastewater is delivered back to nature without any treatment. This creates unhealthy situations and odor problems that cause nuisance to people.

Reasons behind the establishment of WWTP/2

In 2004, with the cooperation of YMCA, the WWTP/1 was established on the eastern side of the town. However, due to the topography of the town, only about 90% of the houses (1000 people) got connected to the sewer lines and to the proposed treatment plant. The connection of the remaining 10% of the households to the WWTP wasn't achieved since it necessitated additional works such as the establishment of a collection pond to store the generated wastewater from these 10% of the houses, an advanced pumping system and a 2500m long pipeline to deliver the wastewater from the pond to the treatment plant. Since all these measures required heavy infrastructural interventions which are costly and environmentally unsound, the houses located on the western side of the town weren't connected to the WWTP and kept on discharging their wastewater in the septic tanks.

However, this created a critical condition to the inhabitants of Bakka town since most of the small springs that supply their drinking water are located on the western side of the town and are being contaminated by the seepages caused by the septic tanks. Therefore, wastewater disposal became the pressing environmental issue in the town, and the local community is keen to have an environmentally sound solution to their problem in order to improve the socio-economic and health standards of the community.

Therefore, this project proposes the establishment of a WWTP on the western side of Bakka town, to serve the remaining 10% of the population. Wastewater will be collected through a sewage network and connected directly to the treatment plant and the treated effluents will be led into a runoff channel, to be discharged in the nature or used for irrigating forest trees. This will eliminate the spread of diseases, prevent risks of contamination of the water spring, and contribute in the preservation of the quality of the environment.

All of the householders of the town are aware of the project and are happy about it, because it will bring a real solution to their wastewater disposal problem, from which they have been suffering for several years.

1.4 Public Hearing in Bakka Village

Representatives of YMCA, IBC Co. (Contractor of the plant) and Experts of MEEA/MECTAT (the EIA study group) have visited the village and met with the Municipal Council and community members and discussed the issue of wastewater treatment plant with them. MEEA/MECTAT experts have spoken with 5 people and

asked if they find the project essential for the village. All of them have expressed their satisfaction and gave their positive views for the establishment of the WWTP. The Municipality has informed the public about the project. Everybody is aware of it and there are no complaints on it, including the proposed site of the WWTP.

2. Project Identification

Project Title:	Wastewater Treatment Plant #2 in Bakka Town.
Location:	Bakka, Rashaya Caza.
Project Site:	Land lot No 1466 in Bakka town
Population:	200 people (projection of 600 people for 2020)
Technology to be used:	Advanced Integrated Wastewater Pond Systems (AIWPS) of IBC Co.
Size of the Plant:	Land area: 1000m^2 Total area of the plant: 500 m^2 Volume of one digester: 235 m^3 Total volume of 2 digesters: 470m^3 Volume of grease trap: 3 m^3
Load processed daily:	60m^3/day of untreated wastewater.
Plant to be built by:	International Business Consultants (IBC)
Plant to be financed by:	Joint partnership between YMCA/USAID and the Municipality
Plant to be managed by:	The Municipality of Bakka
Operation to start in:	After receiving the approval of the Ministry of Environment.

3. Project description

3.1 Location of the WW treatment plant (Bakka WWTP/2)

The WWTP project will be located at a level below Bakka village on the western side of it, and at a distance of about 1000m from the nearest house. The land lot on which the plant is to be built in an abandoned sand quarry, publicly owned. It is the land lot number1466 .This site is sandy on the surface with rocky bottom layers and there is no forest trees when a radius of more than 300m around the site is considered. There is one small forest of about 60 poplar trees, 350m far from the site.

The Project site presents the following characteristics:

- A rocky land area of 1000m^2 is allocated for the construction of the treatment plant.
- The Bakka WWTP/2 will be located at the lowest spot on the western side of the village and about 1000m from the nearest house.
- Wastewater from the 10% of households of the town will reach the plant gravitationally. It is the most suitable point to collect the wastewater from all houses gravitationally. No other site has the required favorable characteristics for Bakka WWTP/2.
- The Municipality has already completed the construction of the sewer network of the town in May 2006.
- The main asphalted road of the town passes 400m away from the proposed site. An agricultural road connects the plant to the main road and it is the responsibility of the Municipality of Bakka to asphalt it.
- 7m deep excavation work is required at the site. Leveling as well as removal of soils will be carried out.
- The effluents of the treatment plant will be discharged into the runoff channel that is located next to the proposed plant site. The quality of the discharged effluents would be suitable for irrigation.

3.2 Description of the Wastewater Treatment Process of the Proposed Project

The wastewater treatment technology to be used is the International Business Consultant's (IBC) Advanced Integrated Wastewater Pond Systems (AIWPS) technology, which consists of a set of anaerobic digesters and an aerobic pond and channel, through which the wastewater flows gravitationally and gets treated by natural processes, with minimum maintenance. AIWPS process provides secondary level treatment to wastewater. It significantly reduces the pathogenic bacteria, BOD, nitrogen, phosphorous, toxic substances and other pollutants found in the wastewater. AIWPS digesters and ponds can be tailored to site-specific conditions with high loading capacities.

Wastewater is conveyed from the western side of Bakka village to the grease and sand trap by a gravity sewer line. An energy dissipater is installed before wastewater reaching to grease and sand trap.

1- Grease and Sand Trap is a two-compartment structure that receives the inflow from the sewage network and passes it through after retaining the grease and the sand. Heavy materials such as sand will sink to the bottom sump and the flow will pass through the submerged pipe connected to the Anaerobic Digester.
2- The Anaerobic Bio Digester (2 digesters) is the main reactor of the WWTP, which retains the sewage for a specified period to allow the growth of anaerobes that multiply in the absence of oxygen. The anaerobe organism digests the organic component of the sewage and produces the biogas, a mixture of methane gas (about 70%), carbon dioxide (about 20%), and other gases. The released biogas will be flared intermittently with an automatic torch.
3- The Aeration Tank, which follows the anaerobic tank, is an open structure that exposes the effluent to light and air. In here the anaerobic microorganisms die and the aerobic bacteria overtake, which further digests and purifies the wastewater. Air and sun help the aerobic process. In this aerobic process the aerobic bacteria produce no odors or methane gas.
4- The effluent wastewater from the aeration tank passes to the Outflow channel, which is the final delivery channel of the secondary level treated wastewater. Wastewater in here is further exposed to air and solar rays before being discharged in the nature through a runoff channel.

Because of the 1000m distance from the closest house and the location of the plant in a valley, the community will not experience odor problems or other sorts of nuisance, when the Bakka WWTP/2 is established and operated.

3.3 Environmental Pollution Issue

The outputs of the plant would be **effluent wastewater**, **gaseous emissions (biogas),** and **oil and sand** from the grease and sand trap.

The effluent wastewater will have the characteristics that comply with the Ministry of Environment Decision 8/1, 2002 and will be safe for discharge in the nature or used in agricultural practices. The **gaseous emissions** (biogas) will be periodically flared and the products would be the natural components of the atmosphere, such as carbon dioxide and water vapor. On the other hand, the **oils and sands** of the grease trap will be properly handled and disposed with the solid waste of the village. Therefore, the wastewater treatment plant will not create water, soil and air pollution problems. It will neither create health or nuisance problems. This implies that the project will not have an impact on the surface and ground water resources. The AIWPS plant will not generate any **sludge** except once in 20 years, which will be dried properly in drying beds next to the project site and used in forestry projects.

3.4 Required Equipment and Construction Work:

Equipment to be used at the wastewater treatment plant:

The plant will not have any electrical or mechanical equipment except its concrete structures.

Required Construction Work:

The plant will be established on a land area of 1000m^2 and will occupy part of land lot nº1466. Required construction work involves the following:

1. Leveling of the ground: Clearing of an area of 500 m^2.
2. Construction of the two chambered grease and sand trap of capacity 3 m^3, with concrete, in an area of 3.3m^2. The chambers are fitted with cast iron manholes.
3. Construction of the 2 concrete digesters of size 235m^3 each that will occupy an area of 144 m^2. The 2 digesters will be connected in series.
4. Constructing a rectangular Aeration Pond (14.5m x 8m) and an open area (length: 64.1m, width: 15m) subdivided into 150 cm wide shallow channels, to provide maximum aeration for the effluent of the bio-digester.
5. Construction of drainage canals to collect incidental runoff (length: 300m, depth: 30 cm, width: 40 cm.
6. Putting a fence around the plant.
7. Putting a main gate at the entrance of the site.
8. Planting trees around the site.
9. Make arrangements against fires.

Maps of Appendix C indicate the details of construction work to be carried out at the site. Proper canalization will be done in order to avoid water flooding, erosion and pollution around the plant. These measures will be completed during the construction of the treatment plant.

3.5 Advantages of the AIWPS Wastewater Treatment Process

- The AIWPS technology is environmentally friendly,
- It is not land intensive,
- No surface or ground water pollution or soil contamination takes place, because the effluent wastewater is treated to the specified standards,
- No air pollution results, provided that the biogas generated will be flared,
- It can be constructed with locally available building material. No high technology is involved.

- The AIWPS system needs the minimum maintenance during its operation,
- The process is based on the dependable biological (anaerobic and aerobic) digestion, replicating the natural phenomena,
- The system has no mechanical or electrical equipment,
- It does not generate noise and odor,
- The AIWPS system operates gravitationally and provides secondary level treated wastewater, which might be used for irrigation or forestation purposes,
- Moreover, the AIWPS plant does not need full time attendance, as it is self-operational.
- The AIWPS process is innovative in the fact that it does not continuously generate sludge, except once for 20 years, when the digester is cleaned.
- Future expansion of the plant capacity can be done easily, by installing additional anaerobic digesters.
- This technology is of particular interest in rural areas, where low cost maintenance is needed.

However, the only need is to do testing for the final effluents and report any changes that might be caused by external factors.

4. Description of the Surrounding Environment of the Project

The village of Bakka is located in the Caza of Rashaya, at 85km from Beirut, at an elevation of 1450m above the sea level. The lands of the western part of the town are sandy on the surface and rocky in the bottom layers and are devoid from natural vegetation. There are no agricultural plantations around the site. Only a small poplar forest is located above the level of the site, at a distance of 350m. Photograph 1 shows the location of the site.

The main road of the village passes 400m away from the site. An agricultural road connects the proposed project site to the main road. The Municipality will be involved in asphalting it.

4.1 Topography

- The project area (Rashaya Caza) lies in the eastern side of Lebanon. It is a plateau with relatively plain areas, with some low altitude hills. The elevation of the lands of Bakka village rages from 1400m to 1500m from the sea level. The village center is at 1450m from sea level. The proposed project site is 1000m from the nearest house of the village..
- The village lies on a ridge and 90% of the houses are located on the south-eastern side of the ridge and 10% on its western side
- The WWTP/2 of Bakka village will be located in this western slope, where the wastewater of 10% of the households can be collected gravitationally.

- The other 90% of the houses of the village lie on the South-eastern side of the ridge. The wastewater from these houses is connected to the main sewers and a treatment plant established in 2005.

4.2 Water issues

- Municipal piped water network exists in Bakka, with house to house connection.
- Households of Bakka get their main water supply from an artesian well located at 1.5km north-west of the village, at the bottom of the valley, more than 300m below the level of the village. Water is pumped once per two days and an average of 2000 liters are supplied to each family per two days.
- The average water consumption rate in the village is about 80 l/person/day.
  There are no permanent surface water sources in the project area except a couple of small springs that are located at 1200m from the site, from which villagers obtain their drinking water. At the proposed location, there is a very small water stream that dries during summer and it is located 10m far from the point where the final effluent is discharged. Its water is usually used for agricultural activities. The effluents of the plant will be discharged in a runoff channel which will make it available for agricultural irrigation.
- On the South-Eastern side of the proposed site, there is a shallow water pond of size about one hectare where surface runoff is gathered in the winter season. This pond dries in May and remains dry for more than 7 months/year. Water of this pond is not used for any purpose, even for irrigation or for domestic animals.
- Due to the lack of irrigation water, rain fed agriculture is practiced in the area. Most of the farms of the project area are very small, with shallow soil, where just barley and wheat can be grown.

4.3 Wastewater management

- In Bakka, domestic wastewater is disposed through septic tanks or cesspits, which often do not comply with health standards. Frequent leakages and overflows from these septic tanks create unhealthy situations, particularly during the rainy season, when the septic tanks overflow. This is the main public health concern of the project area.

- Wastewater collection for the 90% of houses in the village is done througha newly established sewage network, that is connected to the wastewater treatment plant # 1.

- The remaining 10% of the houses will be connected to the proposed WWTP/2 where the generated wastewater will be treated. The sewer lines connecting the houses to the WWTP are already established. It is expected that the treatment plant will operate soon and eliminate the spread of diseases, which will contribute in the improvement of the health standards of the community and help in the preservation of the quality of the environment.

4.4 Climate

- Bakka is at an altitude of 1450 m from the sea level. Its **climate** is Mediterranean, with 7 to 8 dry months and relatively wet winters of 4-5 months duration. In winter months the village faces freezing conditions during January, February and March.
- The prevailing wind direction in the area is from West to East. Some northerly also overtakes the area.
- Annual average rainfall in the area ranges from 600-800 mm, which is confined to winter months (November-April). During the remaining period the weather is completely dry. During the last decade the climate has been dryer and rainfall has been scarcer. But the past two years were relatively better.
- Average high temperature for summer months does not exceeds 30^{o}C and average low temperature in winter months often drops below 0^{o}C, somedays even reaching -10 ^{o}C.

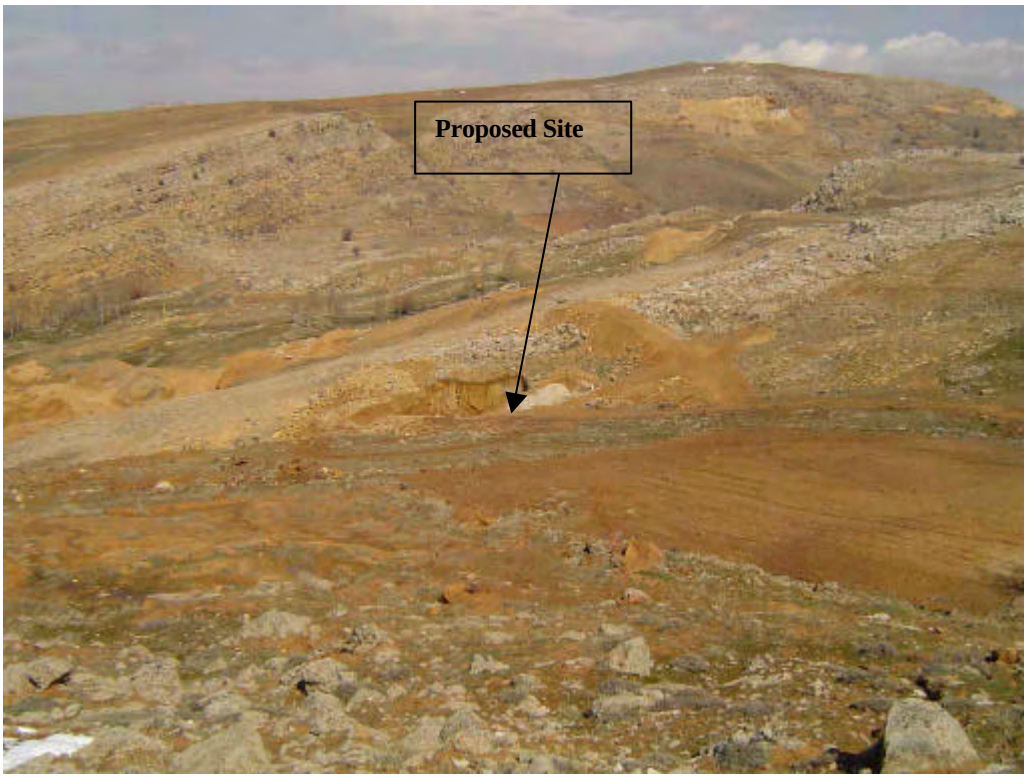
4.5 Air quality

- Given the fact that there are no industries, no large-scale agricultural projects and no heavy car traffic in the project area, the air quality in the village and in the area is fairly good. However, occasional burning of solid waste at the dumpsite produces air pollutants.

4.6 Soils

Soils of the project area are highly eroded. They are red in color derived from calcareous parent rock material. Due to the absence of the vegetative cover, soils are prone to severe rain and wind erosion. At the project site the soil cover is very thin and sandy, with underbed rocks very near to the site. There is also soil of volcanic origin. (photograph 1)

The flora of the project area is very poor. There is no vegetation at and around the site, only a small Poplar forest of a few hundred trees 350m far. The wildlife in the project area is scarce due to the absence of plant cover and scarcity of soil and water.
There are no sensitive areas near the project site, such as natural forests, wetlands, springs and rivers.



Photograph 1: Location of the site

5. Likely Significant Environmental Effects of the Project and Their Mitigation

The environmental effects of the project will be insignificant. This will be manifested by minor soil erosion caused by runoff from the site and minor visual inconvenience due to the physical existence of the plant. But the digesters of the plant will be constructed partially below ground level and they will not be observed from far.

Establishment of the WWTP/2 will have positive environmental impacts, even if minimum maintenance is applied. It is unlikely that it will pollute the surface waters, the soil, or contaminate the aquifers in the area. However, if the WWTP/2 is not established, the household will connect their septic tanks to the newly established sewage network and the untreated wastewater will be discharged into the nature and this will exert negative effects on the local environment, causing health problems and contamination of surface waters.

Impacts of the project on the environment will consist of four sources namely:

5.1 Site Specific Factors:

The choice of the site is based on the fact that it is the convenient low spot of the village where wastewater from all the houses of the western side of the town can reach gravitationally.

It will be built at the place of an abandoned quarry, 1000m from the last house of the village and about 1.2km from the main artesian well of the town.

The effluent will be discharged in an open runoff channel, where it will be further purified by natural factors, such as sun, soil, bacteria and other microorganisms. After that, no environmental hazards might occur.

5.2 Process-Technology Related Effects:

The AIWPS technology of IBC is an environmentally friendly and low-cost technology, which can be applicable in rural areas where skilled labor is not available.

Compared to other similar wastewater treatment technologies, it is dependable, because of absence of mechanical equipments, which often can go out of order. The system operates by natural gravitational flow. Water pumping requirements are minimal in the plant. On the other hand, the sludge is kept in the anaerobic digesters for 20 years. There are no odorous gas emissions from the plant. The generated biogas inside of the two digesters are periodically flared with an automatic torch.

These features make the treatment system easily applicable in the rural areas without significant environmental impacts.

However, there is a chance of mosquito breeding in the open aeration tanks of the plant. This might create nuisance to the people, but since mosquito do not travel for more than 500m, the chance of mosquito reaching the village is very low.

5.3 Effects Created During Construction and Earth Moving:

During the construction phase of the project, soil disturbance will take place and if this soil is not utilized for landscaping, during the wet season soil erosion will result at the site. On the other hand, if the excavated rocks and soil are haphazardly dumped this will create unsightly views at the project site or in the project area. However, since the site is an old quarry, minimal excavation work is required.

5.4 Effects Created During the Operation of the Treatment Plant:

No significant environmental effects will take place during the operation of the plant. A proper drainage system for the runoff will be implemented at the site. Also measures will be taken to buffer shock flows, such as accidental entry of rainwater runoff into the sewage network and then to the WWTP/2.

The accumulated biogas in the anaerobic digesters will be released periodically and ignited by an automatic torch. This will eliminate the methane gas (a greenhouse gas) emissions to the atmosphere. But there is a low probability that the relief valve of the digester might be clogged and the pressure in the anaerobic chamber increase and this

may disrupt the system, or if the automatic torch does not function, a lot of greenhouse gases can be released into the atmosphere.

5.5 Mitigation Measures:

The main mitigation means will concentrate on careful designing and use of locally available construction material, constructing drainage channels for rainwater runoff, launching tree planting around the plant, awareness raising of the community for minimizing biowaste introduction in their kitchen sinks.

The caretaker of the plant (IBC) will practice good housekeeping measures, which will lead into the containment of any incidental pollutant release, proper maintenance of drainage system around the plant, optimized wastewater treatment operation and any other related measures that will mitigate the side effects of the overall operation. The sand and grease from the grease and sand trap will be properly stored and disposed periodically with the municipal solid waste.

6. Effects on Biological, Physical, Social and Economical Environment

6.1 Human Beings

Impacts

The residents of Bakka town will experience net positive environmental benefits from the project. The public health of the town will be upgraded due to improved standard of wastewater management. Income opportunities will be created for local people during the construction and operational phases. With a clean environment, eco-tourism and other projects can be developed in the village.

However, the workers of the plant might experience negative health impacts, particularly during the removal and collection of greases.

Mitigation

Municipal staff responsible for the treatment plant will be trained for applying safety measures. Also adequate protective clothing will be provided to them.

6.2 Nuisance (Odor, Noise, Vermin and Fire)

Impacts

There will not be odor, noise and vermin problems at the plant that can affect the residents. Even the worker(s) will not be affected by the odor. However, there is the possibility of mosquito breeding in the open aeration tank of the plant and also in the water pond, where the effluent will be discharged, which can cause nuisance to the people during the summer months.

The plant will not attract flies, rodents and other animals. Occurrence of fire is not possible unless the biogas release valves do not function properly and create explosive situations.

Mitigation

- Fire extinguishing equipment will be installed at the treatment plant. Actually, the treated effluents of the plant will be used in case of fire. Also chemical fire extinguishers will be made available at the project site.
- Usually mosquitoes do not travel more than 500m from their breeding sites. This will minimize the occurrence of nuisance for the residents.

6.3 Water

Impacts

In general, the existence of the WWTP will have a positive impact on the surface and ground water quality of the area because it will eliminate the existing septic tanks in the western part of the village, which cause pollution and create health problems. However, the discharge of treated effluents from the plant to the runoff channel will have some slight impacts, particularly during the wet season, extending from November to April. In addition, the water stream located in the vicinity of the plant may be contaminated if effluents do not meet the standards. During the dry season the discharged water can be used for irrigation of forest trees, or used by farmers.

If the removed grease from the grease trap is dumped haphazardly at the plant site it will impact the surface waters, particularly during the wet season when the rains carry them down into the valley.

Mitigation

- With continuous sampling and laboratory tests the performance of the plant will be optimized.
- The water stream at the site is not permanent and it dries during summer months.
- The greasy material from the grease trap will be regularly removed and stored in proper barrels and then collected and disposed with the municipal solid waste.
- Awareness campaign will be launched for the residents in order to reduce the introduction of grease and used cooking oil in their kitchen sinks.

6.4 Air

Impacts

Air pollution will result during the excavation and construction phase. Dusty conditions will occur. Also vehicular emissions will take place. But this will occur for a period of 2 to 3 months. During the operational phase of the plant no such conditions will result. Gaseous and particulate emissions will have their impacts on the natural vegetation.

If flaring of biogas does not take place, methane gas will be released into the atmosphere, which is a powerful greenhouse gas and it will have negative impact on the global climate.

Mitigation

- During the construction phase water will be sprayed in order to minimize dust emission at the site and along the earthen road.
- Unnecessary vehicular trips will be controlled.

- Automatic torch will be installed at the site for flaring the generated biogas.

6.5 Climate

Impacts

The existence of the WWTP will not have any negative effect on the microclimate of the area. This will be improved against the climate extremities (wind and storms), by planting trees in the neighborhood of the plant. Greenhouse gases, such as methane gas, will be produced in the bio-digesters of the plant and if released, this will have negative impact on the climate.

Mitigation

- Trees will be planted around the plant and on the nearby public lands , which will improve the local climate. These will be irrigated with the effluent wastewater.
- Produced biogas will be flared automatically.

6.6 Soil

Impacts

Sandy soil and rocks will be excavated during the construction phase of the treatment plant. If it coincides with the rainy season, this will cause soil erosion at the site. However, since the site is already dug, minimal excavation work is required.

The use of treated wastewater for irrigation will improve the fertility of agricultural lands of the area. But when unsatisfactorily treated effluents are released, these might contaminate the soils.

If the grease and sludge (once in 20 years) are not properly handled and managed they can contaminate the nearby soils and create unsightly conditions.

Mitigation

- The staff of the plant will be trained for proper management of greases, to avoid soil contamination.
- Periodic tests will be done to assure the quality of effluent wastewater, to avoid partially treated wastewater to reach the soils.
- Excavated soil and rocks at the site will be utilized for landscaping.

6.7 Landscape

Impact

The bio-digesters of the WWTP/2 will be constructed underground at a distance of at least 1000m far from the nearest house. The WWTP will be the only structure in the area. But since the digesters are going to be partially burried inside the abandoned

quarry, they will be hidden by the surrounding natural fence of trees, which will surround it. Therefore, the visual impact on the project would be positive.

Mitigation

- The bio-digesters of the plant will be constructed below ground level.
- The roofs (domes) and external walls of the plant will be painted in a color that matches with the landscape.
- Trees will be planted around the site and along the road to beautify the landscape. The effluent wastewater of the plant will be utilized for growing trees.

6.8 Flora

Impact

The project area is an arid environment and poor of vegetative cover. Trees will be planted around the WWTP. This will become a positive impact.

Mitigation

- The Municipality will organize tree-planting campaigns at the site and in the project area, which will be irrigated with the treated wastewater from the WWTP/2.

6.9 Fauna

Impacts

The fauna in the project area is very limited. It consists of some birds, rodents, snakes and turtles. During the construction phase of the plant these animals will be disturbed and their habitat affected. The physical existence of the plant might scare the birds.

Effluents of the WWTP will have some minor impact on the soil microorganisms, particularly in the immediate vicinity of the water pond, where it will be discharged. In dry season the plant effluents can become a water source for the wild animals and birds.

Mitigation

- Various mitigation measures such as tree planting, proper drainage of runoff, reduction of the number of trips and working time of vehicles on site and others are already mentioned under different headings. All of these measures will contribute in the mitigation of the impact on the species that are found at the vicinity of the plant.
- Tree planting will enhance biodiversity at the site. Trees will attract many bird species and other animal species, which will become a positive impact.

6.10 Sensitive areas

There are no sensitive areas near the project site, such as natural forests, wetlands, springs and rivers, except the Poplar forest and the very small seasonal spring . However, since the forest is located at 350m above the site, there is no possibility for the effluents to reach it.

Mitigation

Various mitigation measures that are already mentioned previously, under different headings, all of them will contribute in the mitigation. The automatic torch for kindling the biogas will be properly maintained, as well as the release valves.

6.11 Cultural Heritage

There are no archeological sites or monuments in the project area that can be affected by the project.

The project will not have interference with the traditions and customs of the people.

6.1- Summary Table of Effects on Biological, Physical and Socio-Economical Environment

Description						Evaluation	
Impacts on	***Impact number***	***Character***	***Magnitude***	***Duration***	***Consequences***	***Significance***	***Certainty***
Human beings	6.1	Positive	All of the people except the staff of the plant	Permanent	Improvement of public health	Significant	High
Nuisance (odor, fire, noise & vermin)	6.2	No effect on the population but minor inconvenience at the working environment	At the plant	Permanent	Health threat to workers	Significant	Very low
Water	6.3	Surface water pollution	Thiny water stream at the vicinity of plant	Wet season only	Contamination of watercourse with new microorganisms	Slight	Low
Air	6.4	Production of gases	At the plant	Intermittent	Damage to climate	Slight	Low
Climate	6.5	Negative	Not known	Intermittent	Not known	Very slight	Very low
Soil	6.6	Soil erosion and disturbance	Vicinity of the plant	Construction phase and wet season	Loss of soil and visual impact	Slight	Low

Description						Evaluation	
Impacts on	***Impact number***	***Character***	***Magnitude***	***Duration***	***Consequences***	***Significance***	***Certainty***
Landscape	6.7	Loss of solitude and visibility of structure	At the plant site	Long term	Contrast with the surrounding landscape	Very slight	Very low
Flora	6.8	Positive, due to planting of trees	Around the plant	Permanent	Improvement of degraded arid lands	Significant	High
Fauna	6.9	Attractive to species due to tree planting at the site	Around the plant	Long term	Enrichment with various species	Significant	High
Sensitive areas	6.10	None, except natural runoff course	Next to the plant	Long term	Runoff water contamination	Slight	Low
Cultural heritage	6.11	None	---	---	None	---	---

Impact Evaluation Checklist:

The ***Impact rating*** is calculated as follows:
Five questions are asked. A YES answer is valued as 1 and a NO answer is valued as 0. Calculation of the value (between 0 and 5) is done and it is called the ***Impact rating***.

Questions that are asked:

1- Is the aspect associated with any legislation, regulations, authorizations or codes of practice? Or does the identified aspect involve the use of any hazardous, restricted or special substance?
2- Is the aspect of concern to stakeholders? I.e.
   - Employees
   - Neighbors
   - Shareholders
   - Local community
3- Is the identified aspect or impact clearly associated with any of the more serious global environmental issues?
4- Is the aspect identified is quantifiable, is the amount of use significant?
5- Is the aspect identified is quantifiable, is the amount or frequency of use significant?

Severity Rating Matrix

Rating	**Severity**
1	No or minor environmental effect
2	Slight environmental effect
3	Moderate environmental effect
4	Serious environmental effect
5	Disastrous environmental effect

In the **Significance Factor** column, multiplying the **impact** and **severity ratings** will indicate the **Significance** of the aspect.

The Significance test will generate a result between 0 and 25 for each of the identified aspects or impacts tested. Any aspect or impact with a value greater than or equal to 8 is '**notable**' and any aspect or impact with a value greater than or equal to 12 is '**significant**'.

Process step	Aspect or impact identified	Impact Description	Direct or indirect	Impact rating	Severity rating	Significance factor	Mitigation Measures
Excavation	Dust and stones	Contribute to air pollution directly and indirectly as synergists or carriers of other pollutants. Can affect human health and local ecosystem. The blown out stone pieces from dynamiting operation poses risks to humans.	Direct	1	2	**2**	Spraying water during the excavation phase. Dynamite use to be controled by experts, to eliminate accidents and apply all necessary safety measures.
Excavation	Vehicle emissions	Emissions of VOCs, NOx, SOx, CO_2 and particulate matter to atmosphere and thus contribute to air pollution, greenhouse gas production and global warming.	Direct	2	2	**4**	Reducing number of trips and frequency of operation of the vehicles.
Excavation	Soil disturbance	Heavy machinery used will cause soil compaction and disturbance.	Direct	1	3	**3**	Limiting the excavation area.
Excavation	Disposal of excavated material	The excavated material will be used for landscaping.	Direct	0	1	**0**	This is a positive impact.
Excavation	Noise	Excessive or prolonged exposure to noise (typically more than 8 hrs above 85-90 decibels) leads to hearing loss, which is not the case here. This will affect the workers on site.	Direct	1	2	**2**	Reduction of the frequency of operation.
Concrete surfaces	Erosion	Structures and covering the surface with concrete can cause additional discharges of runoff, which promotes soil erosion.	Direct	1	3	**3**	Proper channeling for a sound drainage systems at the site.
Building the treatment plant	Use of power equipment	Combustion of fuel leads to emission of VOCs, NOx, SOx, CO2 and thus air pollution, acidification, greenhouse gas production and global warming.	Direct	1	3	**3**	Minimize the frequency of operation of the equipment and vehicles, and use of filters for the exhaust.

Process steps	Aspect or impact identified	Impact Description	Direct or indirect	Impact rating	Severity rating	Significance factor	Mitigation Measures
Building the treatment plant	Noise	Excess noise at the construction site cause disturbance for the scarce wildlife	Direct	3	4	**12**	Minimize the unnecessary use of vehicles and power equipment.
Grease and sand trap	Soil and Water Pollution	Risk of soil and water pollution from removed grease.	Direct	2	3	**6**	Proper storage in barrels and its disposal with municipal solid waste.
Discharge of effluents during the operation of the wastewater treatment plant	Soil and Water Pollution	Below standard treatment leads into soil and water resources contamination.	Direct	3	4	**12**	Regular lab test to assure proper performance of the plant. Avoidance of accidental runoff water intrusion from the manholes of sewage network. Awareness for reducing the amounts of used oil and grease intrusion from kitchens.
Final effluent discharge	Water quality	If the final effluent contains certain bacteria like salmonella, it poses a risk to contaminate the food chain and the groundwater.	Direct	3	3	**9**	Regular testing of the effluent wastewater to ensure better quality.
Effluent use	Health Impacts	Risk of transmission of disease to farmers using wastewater for irrigation.	Direct	2	3	**6**	Instructing the farmers and the Municipality to plant forest trees.
Waste grease and sand Transportation	Transport emissions	Emissions of VOCs, NOx, SOx, CO_2 and particulate matter to atmosphere and thus contribute to air pollution, greenhouse gas production and global warming.	Direct	1	3	**3**	Planning a schedule to collect maximum load of grease and sand trap wastes in a minimum number of trips.
Collection of grease wastes with solid waste	Health Impacts	Risk of injury or transmission of disease to workers collecting the grease trap wastes.	Direct	2	3	**6**	Proper training of workers, and use of proper storage tanks and protective clothing.
Aeration Area	Health Impacts	Risk of mosquito breeding in the open channels that can cause nuisance to villagers.	Direct	2	3	**6**	Monitor the proliferation of mosquito and use eco enzymes for controlling them.

Process steps	Aspect or impact identified	Impact Description	Direct or indirect	Impact rating	Severity rating	Significance factor	Mitigation Measures
Release of biogas	Emissions	High risk of greenhouse gas production and global warming.	Direct	2	3	**6**	Monitoring the proper functioning of the automatic torch.
Release of biogas	Risk of fire	Potential for accidental occurrence of fire in and around the plant, which in turn causes air pollution and loss of biodiversity.	Direct	2	4	**8**	Keeping fire extinguishers on site. Training of workers for proper handling and for behavior in emergency cases.
Sludge accumulation and cleaning of the digester	Soil and water Pollution	Risk of contamination of soil and water resources when once in 20 years the digester is cleaned.	Direct	2	3	**6**	Making arrangements for proper drying of sludge in earthen beds at the site of the plant. The operation to be done during the dry season.

7. Analysis of the Alternatives to the Project

Alternatives to the project are analyzed in terms of factors related to the ***sites*** and ***technologies*** that are available, by taking into account their environmental gains and soundness. Alternatives are described at three levels namely:

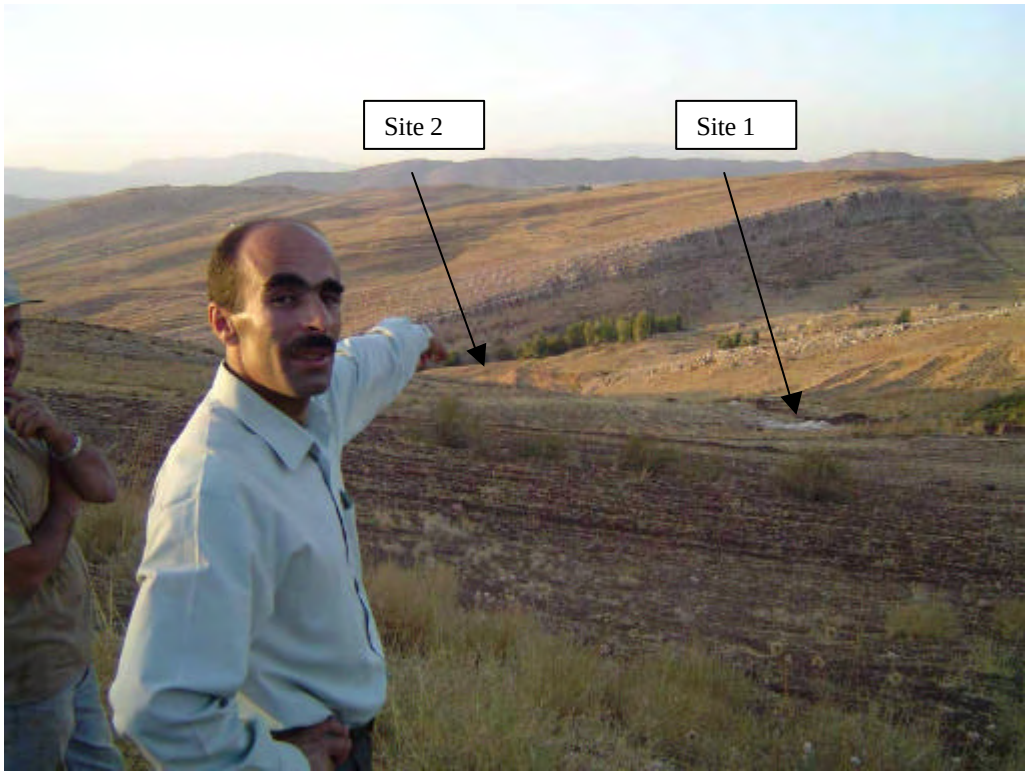
- **Alternative locations** for the project site.
- **Level of wastewater treatment required**, based on the requirements of MoE Decision 8/1, 2002.
- **Alternative processes of small-scale wastewater treatment** technologies, compatible with AIWPS wastewater treatment process.

7.1 Alternative Locations:

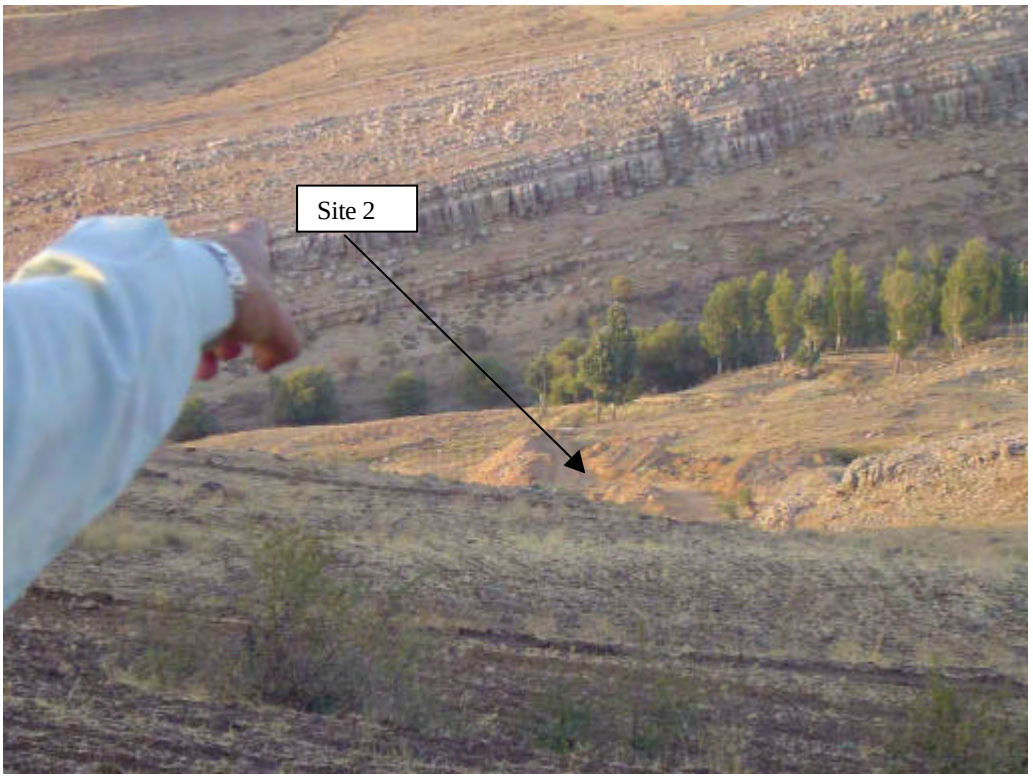
The proposed WWTP site (land lot no. 1466) which is on the western side of Bakka, is the most convenient location for establishing the wastewater treatment plant. (site 1 on the photograph 2). No other spot can gather all wastewater effluents gravitationally from all of the houses located on this side of the village. The land, on which the plant is to be built on, is an abandoned sand quarry, publicly owned. It is at a distance of more than 1000m far from the nearest house.

The **alternative site** (site 2) (land lot no. 1467) is an also a sand quarry, 350m further from the actual proposed site. However its sandy soil is not stable to withstand the WWTP structure. In addition to that, the quarry is privately owned and requires additional funds to be bought.

Therefore, the present site (site 1) with an area of 1000m^2 is ideally placed for the implementation of the project. Photographs 3 and 4 give a clear idea on the characteristics of the 2 sites.



Photograph 2: Alternative locations



Photograph 3: Location of the alternative site (site 2)

Photograph 4: Location of the proposed site (Site1)

7.2 Technological alternatives of Wastewater Disposal:

The level of wastewater treatment depends on the financial means of the communities and municipalities and the availability of technical skills. The higher we go in the levels of treatment, i.e., from *Primary* to *Secondary*, to *Tertiary* or *Advanced* levels, costlier would be the operation. For the rural areas of Lebanon it is always preferable to adopt simple and environmentally sound technologies that require minimum maintenance. The **secondary level** treatment can attain the effluent standards that are set by MoE Decision 8/1, 2002.

7.3 Alternative wastewater processes comparable with AIWPS process:

AIWPS is the most favorable wastewater treatment technology for the project area. Many types of wastewater treatment technologies are practiced worldwide. Here below two innovative small-scale wastewater treatment technologies are described that achieve similar effluent characteristics as **AIWPS** process does, but which are not convenient for the project site.

7.3.1- Alternative 1: *EMCO Extended Aeration Waste Treatment Plant with Hopper-Type Clarifier*

The **first Alternative** is the technology provided by the EMCO group of companies. The prefabricated EMCO AEROBIC waste treatment plants with hopper-type clarifier are engineered specially for small-scale wastewater treatment processes. This is a mechanical process and it requires electricity for operation.

In the Extended Aeration process, raw sewage enters the plant and is broken up into finer particles for more efficient biological digestion. It is then mixed with living organisms in the aeration tank before passing in clarifier or settling tank. The accumulated sludge is constantly pumped back into the aeration tank for further digestion in the aeration tank.

The clarified effluent flows from the settling tank into a chlorine contact tank where it is brought into contact with chlorine in solution. The treated effluent is then discharged from the plant for final disposal.

7.3.2- Alternative 2: *POLYTECH Bio-Process for Wastewater Treatment*

The **second alternative** for the proposed wastewater treatment plant at Bakka is the **Bio-Process** System developed by POLYTECH Agro-Environment Technologies Company of Lebanon.

The **Polytech Bio-process** is composed of four rectangular or circular shaped concrete or steel tanks, coated with epoxy to prevent corrosion and oxidation (rust). It operates through gravitational flow. The bio-products Balsam and Polyzymes are the basic enzymes that enable the process to be simple and effective.

The Process:

1. First the main sewer system is connected to the controlled bio treatment screen system.
2. The screened water pass to the bio treatment compartment, the bio-reactor.
3. The sewage overflow to the grinder compartment for further mixing and grinding the inorganic solid wastes, below 2.5 cm size.
4. The sewage continuously flows in through a 4 inch heavy duty plastic pipe to the bottom of the bio-reactor.
5. The bio-reactor is equipped with a floating air blower giving very fine bubbles.
6. The treated sewage in the Bio-reactor overflow to the first settling tank through a V weir, passing homogeneous water slowly between the tank wall and a plastic lamella, without turbulence and turbidity.
7. From the first settling tank the water continue overflowing to the third and fourth tank (clarifier) through V weir and lamella.
8. The treated water in the clarifier is overflown through a V weir to a gutter surrounding the lower base of the tank.
9. The collected water (final effluent) in the gutter is flown through a pipe by gravity, to be used in irrigation or discharged in nature, free of malodor and feacal coliforms. The bio-product Balsam kills 98% of all pathogens. These results comply with the Decision 8/1, 2002 of Ministry of Environment.

The Bio-Process System operates gravitationally. It does not produce and sludge. The Balsam/Polyzyme bio-products are added by the automatic dosing system, which inactivate the anaerobic bacteria and suppress odor generation by 95%. These bio-products also kill the coliform bacteria and sterilize the final effluent. They also dissolve the organic matter in wastewater, including tissue paper, and eliminate the accumulation of sludge. The limited quantity of settled sludge in the three settling tanks are periodically pumped and reinserted in the first tank, in the bio-reactor. The system does not need continuous aeration. The automatic air blowers are operated only once in a while.

The Bio-Process System operates with minimum maintenance. A part time attendant can daily check the dosing system and operate the pumps and the blowers for a couple of hours.

7.3.3- Comparison of Technological Alternatives:

The **summary matrix** for the characteristics and advantages of the three small-scale wastewater treatment processes are presented here below. The favorable conditions are graded on a scale from 1 to 5. Five being the highest favorable condition.

Functions	Wastewater Treatment Technologies/ Processes		
	AIWPS	***EMCO***	***POLYTECH***
Compactness	4	4	5
Reduced odors	4	4	4
Less Electricity supply need	5	2	4
Local level maintainability	5	2	4
Low operational cost	5	2	3
Speed of treatment process	3	4	3
Quality of effluent	4	4	4
Convenience and aesthetics	4	4	4
Life time of the system	5	3	4
Environment friendliness of the technology	5	4	5
Effective performance in cold weather	4	4	3
Total Grades	48	37	43

The total grades indicate that, with 48 points the AIWPS process presents an advantage over the other two small-scale wastewater treatment processes. Actually its low maintenance and low operational cost features make it more attractive for this project site.

7.3.4 The Most Preferred Alternative to the Project:

Taking the three levels of alternatives (site, suitability of technologies and wastewater treatment processes) that were discussed here above, it is obvious that the AIWPS wastewater treatment process presents an advantage over the other two processes, for this particular project and site. This advantage is in terms of capital and operational cost, siting and appropriateness of the technology. For other geographic locations and scale of operation the other two processes might present additional advantages.

8. Environmental Management Plan

An environmental management plan should be applied for the WWTP/2 of Bakka during its construction and operational phases.

Possible impacts of the project are already identified in Section 6 of this report as well as their mitigation measures. These mitigation measures should be applied in all the phases of the project. Proper training of employees should be conducted and protective cloths should be provided to them. In the project area, awareness campaigns should be launched with local people and the Municipality for water consumption rate reduction, reduction of grease and waste oil dumping in their kitchen sinks, as well as the reduction of the use of chemical detergents. This will improve the efficiency of the wastewater treatment plant.

Records of technical failures or complaints or any problems that occur on site in the coming years should be kept properly. Good housekeeping should be practiced and periodical maintenance of equipment should be done.

A local man should be designated by the Municipality to follow up the operation on part time basis. He should be in charge of supervision and reporting.

Testing of wastewater quality should be done on a regular basis, in order to detect any failure in the system and assure the quality of effluents.

The overall costs of mitigation measures will be about 5% of the total project cost. This cost will come either from the project budget or the running costs. However, the Municipality will shoulder the cost related to awareness raising activities and will secure the tree seedlings for afforestation programs.

Most of the mitigation measures proposed in section 6 are inter-related. For instance, planting of trees will reduce soil erosion, will improve the landscape, will improve the air quality and reduce the noise. Grown up trees will hide the structures and act as a natural fence and a shelterbelt against winds and odors.

It is essential that an environmental consultant prepare annual environmental assessments for the WWTP operation and project site.

8.1 Program to Reduce the Significant Negative Effects of the Project

Impact	Mitigation Measures	Phase of the Project	Party Responsible for Implementation	Environmental Effects of Mitigation Measure	Additional Costs Involved
1. Water pollution problems	- The grease and oil removed from the grease and sand trap will be stored in barrels and periodically collected with the solid waste of the town.	- Operational	- IBC- Municipality of Bakka	- Positive	- Included in operational costs.
	- Properly treated effluent wastewater will be discharged in the runoff channel next to the WWTP or used for irrigating forest trees.	- Operational	- IBC	- Positive	- Included in operational cost.
	- Forest trees will be planted around the WWTP, improving the scenery and creating biologic diversity at the site.	- Operational	- IBC- Municipality of Bakka	- Positive	- Included in operational cost.
2. Soil erosion and pollution	- Earth moving operations will be carried out during the rainless season, to avoid soil erosion.	- Construction	- IBC	- Positive	- Included in project cost
	- Excavated soils and rocks will be used for landscaping and establishing terraces at the project site.	- Construction	- IBC	- Positive	- Included in project cost
	- Rain runoff from the plants' open surfaces will be channeled properly into the nearby runoff channel in order to avoid soil erosion.	- Construction and operational	- IBC	- Positive	- Included in projects cost and running cost
3. Nuisance ? Odors ? Litter ? Noise ? Vermin	- Plant attendant will be trained for proper maintenance and operation of the plant, including elimination of odors, vermins and mosquito.	- Operational	- IBC	- Positive	- Included in project cost
	- Fencing and planting trees around the site.	- Construction and operational	- IBC- Municipality of Bakka	- Positive	- Included in running cost

Impact	Mitigation Measures	Phase of the Project	Party Responsible for Implementation	Environmental Effects of Mitigation Measure	Additional Costs Involved
4. Fires	- Arrangements will be made to use the plant effluents for controlling fires at the site.	- Construction	- IBC	- Positive	- Included in project budget
	- Fire extinguishers will be made available at various corners of the plant.	- Construction and operational	- IBC	- Positive	- Included in project budget
5. Health of staff	- Provision of training and safety clothing.	- Operational	- IBC	- Positive	- Included in project running cost
6. Air pollution	- The generated biogas from the bio-digestion process will be intermittantly flared with an automatic torch in order to avoid the release of greenhouse gases in the atmosphere.	- Operational	- IBC	- Positive	- Included in project budget
	- Dusty conditions will be minimized by paving the vacant areas at the site.	- Construction	- IBC	- Positive	- Included in project budget
7. Landscape disturbance	- The concrete structures of the plant will be painted with colors matching the landscape. Water based paints will be utilized rather than solvent based.	- Construction	- IBC	- Positive	- Included in project budget
	- Proper landscaping will be done at the site. The excavated soil and rocks will be used for ladscaping. Also trees will be planted in the project area.	- Construction	- IBC- Municipality of Bakka	- Positive	- Included in project budget

8.2 Supervision and Monitoring Programs

Monitoring of the operation of the wastewater treatment plant would be performed by doing **regular periodic checks** at the site and **laboratory tests** for the effluents, to assess the environmental standards of the plant operations and to ensure compliance with environmental safety requirements. The specific objectives of monitoring activities are:

- To establish baseline data on the quality of effluents and other outputs.
- To detect contamination and environmental degradation.
- To satisfy regulatory obligations.
- To improve understanding of anaerobic digestion processes for better management.

Monitoring and supervision of the plant operation will be carried out regularly so that acceptable environmental standards are maintained at the plant. Monitoring will identify possible inadequacy and suggest remedial actions before serious and detrimental environmental effects are allowed to develop.

Monitoring activities will cover the issues of emissions (biogas), effluents, grease and oil, noise, vermin proliferation and odors that are resulted at the plant site. It will ensure that all of these outputs are within the safe limit and that they do not have environmental effects on all environmental aspects that were discussed in Section 8. It will also ensure that measures are taken to mitigate the incidental release of such wastes in case of accidents or abnormal conditions.

The monitoring program of the plant will cover the following main aspects of the operations:

- Verification of environmental impact predictions
- Evaluation of mitigation measures
- Adherence to the designs and processes of the plant
- Compliance with the environmental standards
- Preparation of annual environmental reports on the operation

Therefore, the monitoring activities at the WWTP/2 will concentrate on: good housekeeping, awareness raising, limiting exposure of operating personnel to toxic substances, effluent testing, maintenance of equipment, proper management of the grease and oil waste, sludge disposal once in 20 years, and extent of soil erosion problems and biodiversity loss (or gain) around the project site.
The same technician that takes care of Bakka WWTP/1 will take care of Bakka WWTP/2.
The monitoring means of specific activities, their parameters, frequencies and recording system is summarized in the following monitoring scheme for the project:

Monitoring Scheme for Wastewater Treatment Plant in Bakka village

Domain	Monitor for/ Parameter	Frequency	By	Record	Reviewer
1- <u>Amenity:</u> site and environs: Main access road, whole site and working area Safety measures	- Tidiness, cleanliness - Safety	Daily Yearly	Attendant Attendant	Record book Action list and report	Representative of the Municipality Representative of Municipalit
2- Nuisance	Odor and vermin control	Quarterly	Attendant	Action list and report	Representative of Municipalities
3- <u>Water:</u> Run-off from site **Effluent water**	Quality flow Quality flow	Yearly **Monthly**	Provincial health department **Municipality and IBC**	Test report **Lab test reports**	MOE MOE
4- <u>Soil:</u> Soil erosion outside the site	Turbidity of runoff water	Yearly	MOE expert	Reports	Municipality MOE
5- Habitat survey	Ecosystem	One year later	Ecologist	Report	MOE
6- Periodic assessment	Environmental parameters	Yearly	Consultant	Report	MOE

Based on the records of the monitoring scheme, the **Annual Environmental Report** of the plant operations will be prepared and presented to Ministry of Environment. The Municipality in cooperation with IBC Co. will prepare this report.

The typical contents of the Annual Environmental Report will include the following sections:

1. Executive summary
2. Introduction
3. Quantities of wastewater treated and outputs that resulted (effluents, grease and oil, sand, sludge, biogas)
4. Environmental activities for the year under review
5. Environmental problems encountered (accident records and other major events during the year and their management)
6. Monitoring results against expected environmental quality standards
7. Conclusion

Monitoring is the shared responsibility of Ministry of Environment and the Municipal Council of Bakka village. Therefore, responsibility for ensuring appropriate monitoring lies with Ministry of Environment. It has the right to verify at any time that the Municipality has gathered adequate monitoring data as specified in the monitoring scheme.

After a couple of years the wastewater treatment process will be optimized by the IBC Co. and then some of the monitoring activities will be deleted, such as monitoring of soil erosion, ecosystem study, and doing laboratory tests for the effluents. This is because no significant variations will take place (after 2 years of operation) around the site and in the composition of the influent wastewater. However, the remaining monitoring activities will be continued according to the monitoring scheme. Cost of supervision and monitoring program will be covered from the operational budget of the Municipality and IBC Company. For the first two years, when experts' fees are involved, this might become a burden for the Municipality. At least $1000 needed for each year. But the monitoring fees after two years will not add up to $500 per year. In the long run these monitoring activities will bring far greater environmental, health, economic and social benefits for the community of the project area.

8.3 Administration and Institutional Capacity Building:

Adequate management of the wastewater treatment plant and the sewage network entails the cooperation of all parties in the village. The parties who are going to be involved and play roles during the project implementation and operation include the following:

- Municipal Council of the Bakka village
- YMCA Lebanon
- Local population of the village
- IBC Company
- Ministry of Environment

The role of parties pertains to their substantial contributions for effective management of wastewater in the project area, including effective operation of the plant. In this regard the parties will shoulder the following tasks:

- Municipality: It will be in charge of launching an awareness campaign for reducing waste dumping at domestic level. It will be responsible for the daily affairs of the plant. It will keep the records of the lab tests of the effluents and the records of the grease and oil waste generated at the plant. It will pay the salaries of the part time staff of the plant. The Municipality will shoulder the cost related to the arrangement of tree seedlings that will be planted in the project area.

- YMCA: During the planning and construction phase YMCA will cover the equipment and material cost and provide technical assistance. This will include the expert fees, coordination with official bodies and experts, and negotiations with suppliers and contractors. YMCA will also cooperate with the local community in launching awareness and tree planting campaigns in the area.

- Local community: Local NGO's, students and women will cooperate in promoting environmental awareness and cooperate during tree planting campaigns. The Municipality will coordinate these activities.

- Ministry of Environment (MoE): will monitor the overall performance of the wastewater treatment plant and ensure that environmental standards are kept at acceptable level. MOE will also assist in launching the awareness campaign.

- Staff: The part time attendant of the plant will be trained on the proper cleaning and storage of the waste grease and oil from the grease and sand trap. He will be also trained in taking samples from the plant effluents for laboratory testing. IBC Co. will do the training. These trainings will be carried out during the first month of operation of the plant. It would be ideal that the attendant of Bakka WWTP-1 takes care of Bakka WWTP/2.

- IBC Co.: It will make sure that the plant is designed and constructed properly. It will also make sure that the plant operates normally. During the first two years it would be in charge of good housekeeping, management of produced biogas, elimination of odor and control of vermin and mosquito proliferation at the plant.

The Municipality will select the part time attendant. The attendant will be able to do the following tasks:

- Remove and store the waste grease and accumulated sand.
- Take proper samples from the effluent of WWTP and deliver it to the laboratory.
- Record keeping on the amounts of grease removed and reporting to the Municipality on accidents and malfunctioning of the plant.
- Establishing a pilot tree nursery at the plant site and irrigate it with effluent wastewater.
- Good housekeeping at the plant site.

Division of Responsibilities During the Operational Phase

Activity	Party Responsible	Executing Party	Duration
Supervision of plant operation	- Municipality	-Designated representative of the Municipality	Throughout operation
Data keeping: - Recording of inputs/outputs of the plant	- Municipality	Attendant and designated Representative of the Municipality	Throughout operation
Awareness campaigns	- Municipality and YMCA	- YMCA staff and Municipality	First year of operation
Launching of tree planting campaigns	Municipality	Local community and Municipality	3 years
Good housekeeping at the plant: - Reparations - Gardening	Municipality	- Attendant	Throughout operation
Planning for improvement and emergency response plan	- Municipality - YMCA and - IBC	Municipality and IBC technicians	One year

9. Summary of Benefits, Reduction of Negative Environmental Effects and Prior Preparations for the Implementation of the WWTP/2

9.1 Net Benefits that Justify the Implementation of the Proposed Wastewater Treatment Project:

The establishment of the small-size wastewater treatment plant in Bakka village will bring net ecological, economic, social and health benefits. The plant will achieve secondary level treatment for the influent wastewater of domestic origin.

The overall benefits of the project would be the following:

1. Ecological Benefits will be obtained by:
   - Turning the dangerous wastewater into a safe effluent that complies with the standards of MoE for safe discharge in nature.
   - Preventing the occurrence of water pollution and nuisance, which is caused by the current septic tanks.
2. Economic Development will be attained by:
   - Realizing an appropriate, dependable and affordable wastewater treatment technology, which can be replicated by other municipalities.
   - Encouraging ecotourism in the project area.

3. Social and Health Benefits will be materialized by:
   - Improving the health and living standards of the inhabitants.
   - Preventing the spread of diseases, which is caused by current practices.

9.2 Briefing on the Means to Reduce the Likely Negative Side Effects:

The project will have net positive environmental effects. It will convert the domestic wastewater into a safe effluent, to be discharged in nature. However, some side effects will take place, which will be mitigated during the construction and operational phases of the treatment plant.

The likely effects and mitigation measures are summarized in the table of Section 6.1.

The environmental effects of the project will be manifested by minor soil erosion caused by runoff, visual inconvenience due to the physical existence of the plant, and some nuisance.

The main mitigation means will concentrate on careful designing and use of locally available construction material, launching tree planting campaigns, construction of proper drainage system, training of staff (part time attendant), awareness raising of the community towards adequate reduction measures of organic waste load entering in the sewage network.

The Municipality and YMCA-Lebanon will take care of awareness. The Municipality will organize annual tree planting campaigns. Students and households will participate in these campaigns. The attendant of the plant will practice good housekeeping measures, which will lead into the containment of any incidental pollutant release, proper maintenance of drainage system, optimized plant operation and any other related measures that will mitigate the side effects of the overall operation.

9.3 Prior Preparations to Follow-up the Monitoring:

- Already at YMCA-Lebanon a team of technicians and experts are available for launching of awareness campaigns. They have also contacts with laboratories that do analysis for the effluents.
- Already the Municipality is well positioned to secure tree seedlings and organize tree-planting campaigns.

The budget is secured for the establishment of the treatment plant and its running costs, including the proper training of the staff. USAID, through YMCA, is the main party that finances the establishment of the wastewater treatment plant. The Municipality of Bakka has already established the sewer network in the town.

10. Contingency Plan

Contingency and emergency plans were tackled in the design consideration of the Bakka WWTP/2, which will be always updated by IBC Co., the WWTP attendant and the Municipality. IBC Co. will train the attendant for emergency actions and the attendant and the Municipality will take care of the plant.
However, IBC Co. assumes all of the responsibility for complying with the national effluent standards, provided that the influent wastewater complies with the limits set by MOE. In this case, the BOD level of influent wastewater is estimated to be 240 mgl. The basic measures for management of emergency situations will be as follows:
In the first place, the annual emergency response plans will be revised by and proper instructions will be given regularly to the Municipality and plant attendant.

- In case of fires in the forests around the plant, the effluent wastewater will be utilized, which will be available all the time. Also fire extinguishers will be available.
- Proper drainage channels will drain the uncontaminated rain runoff from the surfaces of the WWTP to the valley.
- The vent for generated gases form the anaerobic digestion in the primary tank will be checked periodically to assure the release via the 3m long pipe.
- In case of structural failures caused by an earthquake to the sewerage network and to the WWTP, the spilled wastewater will be channeled properly to the runoff watercourse and the concrete structures will be repaired within a short time. Canalization at the site will take care of this incident automatically.

Additional environmental practices at the WWTP and the project area will include awareness campaigns will be carried out by the Municipality in order to raise the awareness of the households in reducing the discharge of waste matter in the wastewater stream. This will particularly emphasize the reduction of organic wastes

intrusion through the kitchen sinks. It will also include campaigns on using proper screens to trap the particulate matter, in order not to overburden the BOD load of the WWTP.

11. Benefits that Justify the Implementation of the WWTP

The establishment of the WWTP/2 in Bakka will bring net ecological, economic, social and health benefits for the town and its inhabitants. It will achieve a secondary level treatment for the wastewater generated at household level.

The overall benefits of the project would be the following:

1- Ecological benefits will be obtained by:
- Turning the dangerous wastewater, that is currently being disposed into leaking septic tanks to a safe effluent that complies with the standards of MOE for safe discharge in nature or use for irrigation.
- Preventing the occurrence of water resources contamination and nuisance, which is caused by the current septic tanks overflow in the town of Bakka.
- Increasing water availability by using the effluents for afforestation projects..

2- Economic development will be attained by:
- Realizing an appropriate, dependable and affordable wastewater treatment technology, which can be replicated by other municipalities in the region.
- Encouraging ecotourism in the project area.
- Saving the costs spent on emptying septic tanks .
- Saving the cost of excavating and building septic tanks under new buildings.
- Saving the cost spent on reinforcing building structures when soil becomes unstable due to septic tanks overflow.

3- Social and health benefits will be materialized by:
- Improving the health and living standards of the inhabitants, and
- Preventing the spread of diseases and mosquitoes.

4-Touristic benefits will be attained by:
- Protecting touristic areas from the overflow of wastewater odors and flies.
- Improving the aesthetic status of the town.

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ANNEXES

Annex -1: Public Hearing in Bakka

Annex -2: Related Documents

Annex- 2.1: Documents Related to the Design of the WWTP
Annex- 2.2: Maps of the Project Area
Annex- 2.3: Legal documents

Annex3: List of Individuals and Institutions Involved in the Preparation of the EIA Report

Annex-1: Public Hearing in Bakka

Public Hearing in Bakka Town

The issue of wastewater treatment and disposal has become the priority concern of the Municipal Council of Bakka Town and they have concluded that the best solution would be installing a sewerage network and a second WWTP for the village. They have asked the support of YMCA Lebanon. Upon positive response from YMCA cooperation has been established for solving their wastewater problem.

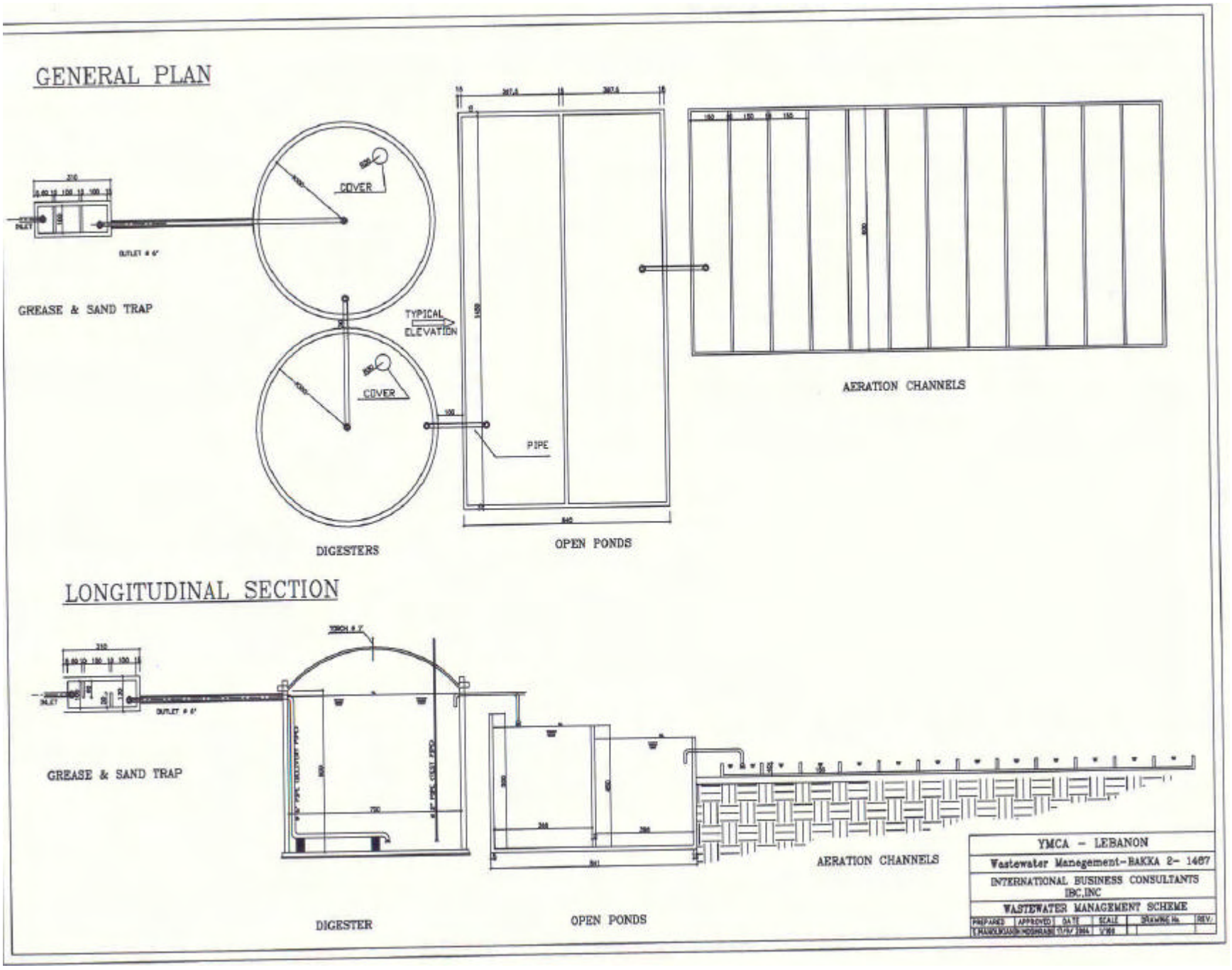
There are no groups that are disadvantaged by the project. Everybody welcomed the project without objection. There are no houses or farms in the vicinity of the proposed WWTP site. The nearest house is more than 1km far from the plant.

All of the householders of the town are happy about the project, because this will bring a real solution to their wastewater disposal problem. Households currently discharge their wastewater in open bottom septic tanks, which often overflow and create unsanitary conditions in the town and create breeding sites for mosquitoes and exert tensions among neighbors.

MEEA/MECTAT expert visited the Project site with YMCA and IBC Co. representatives and assessed the local conditions at the proposed site. They met with the Mayor of Bakka, Municipal council members and some citizens and discussed with them issues related to the WWTP and the local environmental issues. No objection or criticism was raised on the project. On the contrary, most of them have welcomed and praised the project.

Annex-2: Related Legal Documents

Annex- 2.1: Documents Related to the Design of the Wastewater Treatment Plant


GENERAL PLAN
COVER
COVER
TYPICAL ELEVATION
PIPE
GREASE & SAND TRAP
DIGESTERS
OPEN PONDS
AERATION CHANNELS
LONGITUDINAL SECTION
GREASE & SAND TRAP
DIGESTER
OPEN PONDS
AERATION CHANNELS
YMCA – LEBANON
Wastewater Manegement-BAKKA 2- 1467
INTERNATIONAL BUSINESS CONSULTANTS IBC,INC
WASTEWATER MANAGEMENT SCHEME

Annex- 2.2: Maps of the Project Area


1466
1467

Annex-2.3: Legal Documents

الجمهورية اللبنانية
مديرية الشؤون العقارية

افادة عقارية

JSARKIS

امانة السجل العقاري في زحلة — رقم الطلب : ٥٨١

بناء على الطلب المقدم من : ياسر جليل — بتاريخ ٢٠٠٦-٠٦-٢٤

و لدى مراجعة قيود السجل العقاري اعطيت هذه الإفادة : الشايلة

العقار : ١٤٦٦ — المنطقة العقارية : بكا — المحلة : عبد الهادي

النوع الشرعي للعقار : أميري — مساحة العقار/القسم (م٢) :

المرجع في السجل اليومي		محتويات و وصف العقار و الحقوق العينية و الوقوعات
الرقم	التاريخ	
		وصف العقار : ارض بعل مستقرية مهملة. نوع العقار : أرض غير مبنية.
		١ - حق إنتفاع او إرتفاق : لهذا العقار حق الانتفاع بالمرور على العقار رقم ١٣٧٧. نوع الانتفاع او الارتفاق: مرور العقار(ات) المستفع(ة): - ١٤٦٦ العقار(ات) المرتفق(ة): - ١٣٧٧

المرجع في السجل اليومي		الملكية - التصرف		الحصة
الرقم	التاريخ	نوع الحق خلاصة العقود	اسماء المالكين	سهم
		اساس الملكية (ملكية، تصرف، قرار قائمقامي) : بموجب قرار القائمقامي الصادر بتاريخ ١٦ / ٧ / ١٩٩٦.	الجمهورية اللبنانية (أميري)	٢٤٠٠

استوفي الرسم بموجب لصق تمغة على الطلب

هذا ما تم تسجيله على الصحيفة العقارية حتى تاريخه أعلاه

زحلة في ٢٠٠٦-٠٦-٢٤

٢٠٠٦-٠٦-٢٤ ٠٩:٠٢:١٨

صفحة ١ من ١

الجمهورية اللبنانية
وزارة الداخلية والبلديات
محافظة : البقاع
بلديـــة : بكـــا
قضـــاء : راشيا

بكا في : ٢٠ / ٧ / ٢٠٠٩

جانب السادة جمعية الشبان المسيحية المحترمين .

المرجع : بلدية بكا قضاء راشيا

الموضوع : تخصيص عقار لإنشاء بركة تكرير للصرف الصحي للجهة الغربية من البلدة .

تفيد بلدية بكا أنه تم الاتفاق بين البلدية والاهالي علي تخصيص العقار رقم 1466 من منطقة بكا العقارية وهو عقار جمهوري لإنشاء بركة الصرف الصحي .

مرفق هذا الكتاب افادة عقارية وخارطة مساحة للعقار .

وتفضلوا بقبول الأحترام

رئيس بلدية بكا
ياسر سعود خليل

عقد اتفاق

فريق أول : جمعية الشبان المسيحية الممثلة بشخص مديرها العام **السيد غسان الصياح**

فريق ثاني :رئيس **بلدية بكا** الممثلة بشخص رئيسها **السيد ياسر خليل** .

لما كانت جمعية الشبان المسيحية في لبنان تقوم بتنفيذ برنامج الممارسات والسياسات البيئية المستدامة لمعالجة وادارة مشاكل النفايات المنزلية الصلبة والسائلة بتمويل من الوكالة الأميركية للتنمية الدولية،ولما كان المشروع يشمل في قسم منه موضوع معالجة المياه المبتذلة ضمن اطار تحسين الأوضاع البيئية في المناطق الريفية .

ولما كان هذا البرنامج يقوم على مبدأ التعاون والشراكة مع المجتمعات المحلية،ومنها البلديات ،ولما كانت بلدة بكا في قضاء راشيا، ضمن القرى التي يشملها البرنامج وبحاجة الى التخلص من مشكلة الصرف الصحي التي تؤثر بشكل كبير على بيئتها ،قد تم الاتفاق على ما يلي :

أولا: تعتبر مقدمة هذا العقد جزءاً لا يتجزأ منه.

ثانياً: ينفذ الفريقان ما تم الاتفاق عليه في هذا العقد .

ثالثاً: يلتزم الفريقان بتأمين المساهمات من اجل التعاون لإنجاز المشروع.

رابعاً : ينفذ مشروع **صرف صحي** في بلدة **بكا**، قضاء **راشيا** ، محافظة **البقاع** وذلك وفقاً للطلب المقدم من الفريق الثاني، والدراسات والخرائط المرفقة والمقدمة من اللجنة المختصة والتي هي جزء لا يتجزأ من هذا العقد، وذلك على مرحلتين :

١. بناء محطة لمعالجة المياه المبتذلة للمرحلة الثانية المقلب الغربي للبلدة.
٢. تمديد شبكة صرف صحي بطول ٢٠٠٠ متر من قساطل PVC قطر ٢٠ سم والريكارات اللازمة.

خامسا ":اتفق الفريقان على البدء بتنفيذ التمديدات للشبكة بينما يتم تحضير الدراسات لتنفيذ محطة التكرير.

سادسا " :اتفق الفريقان على المباشرة بأعمال تمديد شبكة صرف صحي بطول ٢٠٠٠ متر من قساطل PVC قطر ٢٠ سم والريكارات اللازمة .أما الأعمال المطلوبة فهي :

- حفر خندق للمجارير بعمق يتراوح بين(١ م– ٢ م) حسب الخرائط المرفقة بعرض ٦٠ سم بطول أجمالي ٤٤٧٠ متر.
- تركيب قساطل بلاستيك من نوعية ذات مواصفات معتمدة في وزارة الموارد ومجلس الإنماء والأعمار بقطر داخلي ٨ انش بطول٢٠٠٠ متر .

رئيس بلدية بكا
ياسر سعيد خليل

- إنشاء ريكارات من الباطون المسلح ٨٠سم × ٨٠سم ضو وارتفاع يتراوح بين(١٠٠- ٢٠٠) سم حسب شقلات الخرائط وبسماكة لجدرانه لا تقل عن ٢٠سم مع قاعدة وغطاء مستدير قطر ٦٠ سم ويبلغ عدد الريكارات ٧٠ ريكار.
- ردم بمادة ناعمة تحت وحول القساطل لكي تغمرها بسماكة ٣٢٠ على الأقل من فوقها .
- إعادة ردم الخندق بالمواد المحفورة مع حدلها بواسطة 'Compactor' خاص للخنادق وترك الخندق بارتفاع يقل عن مستوى الطريق بـ ٢٥ سم.
- وضع بايسكورس بسماكة ٢٥ سم وحدله بشكل جيد ليصبح اقل ارتفاعاً من الزفت بفارق ٧ إلى ١٠سم.

سادساً : يتعهد الفريق الأول بتقديم المواد المطلوبة لتنفيذ الأعمال المذكورة أعلاه :

* تامين وتقديم قسطل PVC قطر ٨ أنش ،طول ٦ متر	عدد ٣٣٤
* غطاء ريكار درجة A مع قاعدة فونت،قطر ٦٠سم	٧٠ غطاء
* ٩٠% من كامل تكاليف محطة تكرير المياه المبتذلة	(٦٠ متر مكعب يوميا)

سابعاً: يتم تسليم المواد المذكورة أعلاه على دفعات وحسب تقدم الأعمال .

ثامناً: يتعهد الفريق الثاني بالتالي :

* ترابة سوداء لبنانية	١٠٥٠ شوال
* بحص كسارة	١٨٠ متر مكعب
* رمل جبلي	١٠٠ متر مكعب
* حديد قياسات متنوعة	٤ طن
* تامين وتقديم بودرة للردم	٦٠٠ متر مكعب
* تامين وتقديم باسكورس	٦٠٠ متر مكعب

* القيام بأعمال الحفر اللازم بطول ٢٠٠٠ متر ، عمق وسطي ١,٥٠ متر ،عرض وسطي ٦٠ سم .
* تامين اليد العاملة المختصة لتركيب القساطل وتنفيذ الريكارات وذلك ضمن المواصفات المطلوبة والخرائط المرفقة ربطا والأرض اللازمة لانشاء محطة التكرير بموجب كتاب مرفق ومصدق من البلدية.
* تنفيذ أعمال الردم بالبودرة وأعادة الردم بالمواد المحفورة وفقا للمذكور أعلاه .
* تنفيذ أعمال الباسكورس لأعادة الطريق على ما كانت عليه قبل الحفر .
* الاشراف الكامل على تنفيذ الأعمال .
* تحمل مسؤولية العمال وجميع المستخدمين من قبله وكل ما يلحق بهم من ضرر أو اصابات أثناء العمل .

تاسعا :اتفق الفريقان على ان يقوم الفريق الثاني بتقديم عقد خطي موقع من البلدية والمتعهد الذي يرسو عليه كامل أعمال الحفر وتركيب القساطل مع اعادة الردم،حسب المواصفات والخرائط المقدمة من الفريق الأول مع ضرورة تأكيد أن هذا العقد نهائي ولا رجوع عنه نظرا لارتباط حق الغير به .(مرفق ربطا نسخة للعقد الموقع بين البلدية والمتعهد) .

رئيس بلدية بحمدون
ياسر سعيد خليل

عاشراً : يباشر الفريق الثاني بتنفيذ الاتفاق اعتباراً من تاريخ استلام المواد على ان يتم إنهاء العمل بالمشروع في مدة أقصاها اثنا عشرة شهرا .

حادي عشر :في حال مخالفة الفريق الثاني لأي من الشروط المذكورة في هذا العقد، يحق للفريق الأول إلغـاء هـذه الاتفاقية وذلك بموجب كتاب خطي موجه للفريق الثاني، دون أي التزامات وفي أي مرحلة من مراحل العمل.

حرر هذا العقد على نسختين بيد كل فريق نسخة .

بيروت في ٢٠٠٤/٧/٢٣

مدير عام جمعية الشبان المسيحية
غسان فارس الصباح

جمعية الشبان المسيحية
YOUNG MEN'S CHRISTIAN ASSOCIATION
BEIRUT - LEBANON

رئيس بلدية بكا
ياسر خليل

رئيس البلدية بكفيا
ياسر سعيد خليل

اتفاق تلزيم

مشروع محطة تكرير للصرف الصحي في بلدة بكا.

الفريق الأول: جمعية الشبان المسيحية – لبنان YMCA الممثلة بمديرها العام السيد غسان الصياح– ومتخذة محل إقامة لها سن الفيل، حرش ثابت، دلتا سنتر – الطابق الثالث.

الفريق الثاني: شركة IBCممثلة برئيسها المهندس حمزة مغربي متخذة محل إقامة لها في بيروت – كورنيش المزرعة بناية وقف الروم الطابق الثاني – ص. ب. ٦٣٠٠/١٤ بيروت – لبنان .

الفريق الثالث: بلدية بكا –قضاء راشيا ممثلة برئيسها ياسر خليل.

تم الاتفاق بالرضى والقبول المتبادل بين الأطراف على ما يلي:

التزم الفريق الثاني بتنفيذ ما يلي:

- وضع دراسة ومخطط وتصميم هندسي لتركيب محطة التكرير الثانية وموقع المفاعل اللاهوائي وملحقاته.
- تأمين اليد العاملة والمهندسين والمواد اللازمة لإنشاء محطة التكرير للمياه المبتذلة في بلدة بكا والقادرة على خدمة البلدة بقدرة استيعابية يومية: ٦٠ متر مكعب.
- وصل محطة التكرير بشبكة المجارير، على أن تطابق مواصفات المياه المكررة المواصفات المطلوبة من وزارة البيئة اللبنانية في موضوع رمي المياه المكررة في المياه السطحية وذلك حسب تعليمات وشروط الفريق الأول والمذكورة في دفتر الشروط الأساسي المرفق.
- يقوم الفريق الثاني بتنفيذ الأشغال المنوه عنها على مسؤوليته وفق الأصول الهندسية بموجب العرض المرفق والموقع بين الإطراف الثلاثة.
- اتفق الأطراف الثلاثة على أن تكون كلفة إنشاء محطة التكرير مبلغ مقطوع قدره ٣٨،٥٠٠ $ / ثمانية وثلاثون ألف وخمسمائة دولار أمريكي شاملا الكلفة والضرائب والرسوم والضريبة على القيمة المضافة بحسب الملحق المرفق.

يتعهد الفريق الثاني بإنهاء كافة أعمال الحفر والبناء العائدة لمحطة التكرير خلال مهلة ستة أشهر من استلام الموقع وتكون مسؤولية العمال في الورشة على عاتقه.

- يسدد المبلغ المذكور أعلاه ($٣٨،٥٠٠)من قبل الفريق الأول والثالث على الشكل التالي:
- ١٠ % من قيمة العقد فور تسليم الخرائط التنفيذية للمشروع وفي مهلة لا تتعدى الشهر.

- ١٠ % عند الموافقة على الخرائط من قبل YMCA جمعية الشبان المسيحية والبدء بتجهيز الموقع.
- ١٠ % عند انتهاء أعمال الحفر.
- ٣٠ % عند صب الركائز والأساسات بالباطون المسلح.
- ٤٠ % عند إنهاء الأعمال الإنشائية لمحطة التكرير بالكامل.

يتم توقيف ٢٠% على كل دفعة لحين استلام المشروع بالكامل .

يتم استلام المشروع عند الحصول على المواصفات المذكورة للمياه المكررة في دفتر الشروط الأساسي للمشروع (المرفق ربطا) بموجب فحصين مخبريين من مختبر الجامعة الأميركية في بيروت عندئذ تدفع التوقيفات دون قيد أو شرط. أما في حال عدم الحصول على مواصفات للمياه المكررة بحسب المطلوب بسبب ارتفاع المعدلات المذكورة للمياه الداخلة بحسب دفتر الشروط فان التوقيفات تدفع إذا كانت نسبة تخفيف كل مكون من المكونات بنفس النسبة المذكورة في دفتر الشروط على أن يتعهد الفريق الثاني متابعة تحسين المياه المكررة لتناسب المواصفات المذكورة في دفتر الشروط والموافق عليها من الفرقاء كافة.

يتعهد الفريق الثاني بتشغيل وصيانة محطة التكرير لمدة سنة مجانا بعد دفع التوقيفات له.

يتعهد الفريق الثالث بتوقيع عقد تشغيل وصيانة سنوي مع الفريق الثاني على أن يشمل الفحوصات المخبرية التالية (BOD+COD+PH+TDS+TSS) للمياه المكررة والذي يتحمل الفريق الثاني كامل المسؤولية عن نوعية المياه المكررة أما في حال عدم توقيع عقد الصيانة والتشغيل المذكور عندها تتحمل البلدية كافة المسؤولية عن المياه المكررة الناتجة عن محطة التكرير.

يتعهد الفريق الثالث دفع مبلغ ٣،٥٠٠ $ ~~خمسة الأف ومايتي~~ ثلاثة آلاف وخمسمائة دولار أميركي من قيمة العقد لإنشاء محطة التكرير.

على الشكل التالي: ٧٥٠ $ + ٧٥٠$ + ١٠٠٠ $ + ١٠٠٠ $ حسب برنامج الدفعات المذكورة سابقا وتكون البلدية قد سددت مساهمتها عند صب الركائز والأساسات.

حرر هذا العقد على ثلاث نسخ بيد كل فريق نسخة بتاريخ ٣٠ آب ٢٠٠٤.

الفريق الأول	الفريق الثاني	الفريق الثالث
مدير عام جمعية الشبان المسيحية	رئيس شركة IBC	رئيس بلدية بكا
غسان فارس الصياح	جورج [illegible]	ياسر خليل

جمعية الشبان المسيحية
بيروت - لبنان
YOUNG MEN'S CHRISTIAN ASSOCIATION
BEIRUT - LEBANON

INTERNATIONAL BUSINESS CONSULTANTS
CORPORATE
SEAL
LEBANON

Annex-3: List of Individuals and Institutions Involved in the Preparation of the EIA Report

List of Individuals and Institutions Involved in the Preparation of the EIA Report

The Environment Impact Assessment study of the project and the preparation of the EIA Report have been carried out by the Middle East Engineers and Architects (MEEA) Ltd., Consulting Environmental Engineers, based in Beirut since 1979.

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Experience of MEEA Ltd. In EIA Process

MEEA Ltd. – Consulting Environmental Engineers- has long experience in a wide range of environmental issues. The specific Experience that pertains to the EIA process are summarized here below:

- Conduction of the first *EIA Training Workshop*, for Ministry of Environment Lebanon (Capacity 21 Project), in June 1995. This was the first EIA workshop ever held in Lebanon, implemented jointly with Grontmij Consulting Engineers, our Dutch partners.
- Participation in the presentations of the *EIA Training Workshop II*, organized by the Capacity 21 Project of Ministry of Environment and implemented by CEMP of UK, in February 1996.
- MEEA prepared for the Ministry of Environment the *EIA Manual: Basic Procedures for EIA in Lebanon* in 1997, which describes the EIA Process in Lebanon.
- Since 1995, MEEA Ltd. Has evaluated some EIA reports prepared by other consultants.
- Since 1996, MEEA experts have participated in several consultations on EIA process organized by Ministry of Environment.
- Representatives of MEEA Ltd. Participated in three EIA Training Workshops on specific topics organized by UPP/MOE, sponsored by UN-METAP project and conducted by AUB professors, December 2000 – January 2001.
- During 2000-2005, MEEA Ltd. Conducted 7 EIA studies and prepared the EIA Reports for solid waste treatment plants. Five of these were done for YMCA, for SW treatment plants in Akkar El-Attika, Mais El-Jabal, Bint Jbail, Nabatiyeh Al-Faouka, Maarakeh, Arab Saleem and Rashaya. Another EIA Repo The densified material will be used as raw material for producing poles, park benches, etc rt was prepared for the Municipality of Tourza, related to establishing a solid waste material recycling facility.
- During March-June 2004, MEEA prepared 4 EIA reports on wastewater treatment plants projects for YMCA.
- During 2005, MEEA prepared 7 EIA reports on wastewater and solid waste treatment plants as well as the EIA of a slaughterhouse. These were done for YMCA and various municipalities.

Since 1997, MEEA Ltd. Is pre-qualified with Council for Development and Reconstruction (CDR) for doing environmental studies.

List of EIA Studies Conducted by MEEA Ltd.

Type of project	Town Served	Date	Client	Remarks
Municipal Solid waste Treatment Plant	Akkar El Atika	January 2001	YMCA	Approved by MOE
Municipal Solid waste Treatment Plant	Bint Jbeil and Neighboring towns	February 2001	YMCA	Approved by MOE
Municipal Solid waste Treatment Plant	Mais El Jabal	March 2001	YMCA	Approved by MOE
Municipal Solid waste Treatment Plant	Nabatiyeh	March 2002	YMCA	Approved by MOE
Municipal Solid waste Treatment Plant	Maarakeh	May 2002	YMCA	Approved by MOE
Municipal Solid waste Treatment Plant	Tourza	December 2003	Municipality of Tourza	Approved by MOE
Wastewater Treatment Plant	Snayyah	March 2004	YMCA	Approved by MOE
Wastewater Treatment Plant	Wadi Jezzine	April 2004	YMCA	Approved by MOE
Wastewater Treatment Plant	Aychiyeh	May 2004	YMCA	Approved by MOE
Wastewater Treatment Plant	Bakka	June 2004	YMCA	Approved by MOE
Wastewater Treatment Plant	Ghobbatiyeh	October 2004	YMCA	Approved by MOE
Municipal Solid waste Treatment Plant	Rashaya	December 2004	YMCA	Approved by MOE
Municipal Solid waste Treatment Plant	Arab Saleem	April 2005	YMCA	Approved by MOE
Municipal Solid waste Treatment Plant	Sour (Tyr)	May 2005	YMCA	Approved by MOE
Municipal Solid waste Treatment Plant	Al-Menieh (Tripoli)	May 2005	Municipality Al-Menieh	Approved by MOE
Municipal Solid waste Treatment Plant	Bednayel	May 205	Municipality of Bednayel	To be reviewed by MOE
Wastewater Treatment Plant	Al-Houch	August 2005	YMCA	Being reviewed by MoE
Wastewater Treatment Plant	Haitoura (Jezzine)	October 2005	YMCA	Being reviewed by MoE
Wastewater Treatment Plant	Rashaya	November 2005	YMCA	To be presented to MoE
Municipal Solid waste Treatment Plant	Aytaroun	January`2006	Municipality of Aytaroun	To be presented to MoE
Success Rate of Presented EIA Studies: 100%				

MEEA Team that conducted the EIA studies

1- **Boghos Ghougassian:** MS in Environmental Science Engineering. Columbia University, NY, 1976.
2- **Lea Kai:** MS in Environmental technology- Faculty of Engineering and Architecture, American University of Beirut, Lebanon, 2005.
3- **Janine Maalouf:** BS in Geology. American University of Beirut, Lebanon, 2004.