



Environmental and Social Impact Assessment for Gaza Solid Waste Management Project

Executive Summary

January 2012

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ENVIRONMENTAL SOLUTIONS

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Introduction

The status of Solid Waste Management (SWM) in the Gaza Strip (GS) is associated with many environmental, health and social shortcomings. This is attributed to several technical, institutional and financial factors as defined in the National Strategy for Solid Waste Management (NSSWM) in the Palestinian Territory for 2010-2014

Most of the collected solid waste in the GS (1450 tons/day in 2007) is disposed of in three main disposal sites: Johr al Deek Landfill east of Gaza City, Sofa Landfill east of Rafah City, and Deir El Balah Landfill in the Middle Area of GS. The three sites are reaching their maximum capacity, in addition to the fact that the expected amount of solid waste is expected to reach around 3700 tons/day in 2040. Accordingly there is a growing need for establishing an integrated SWM that to adequately handle the growing waste generation rates in GS with minimum impacts on public health and the environment.

Within this context the Gaza Solid Waste Management Project (GSWMP) has been initiated. The goal of the project is to improve SWM in Gaza through taking emergency short-term measures to upgrade existing facilities, and long-term measures to establish new facilities that will enable adequate SWM for a time horizon of 30-40 years implemented in certain stages.

The GSWMP will be carried out by the PNA in cooperation with different international organizations which have expressed interest in supporting the project. The United Nations Development Program (UNDP) is supervising the preparation of the Feasibility Study (FS) and Detailed Design for the short-term and the long-term measures of SWM in GS; the Government of Japan (GoJ) has agreed to finance the short-term measures, while different organizations have expressed their interest to finance long-term measures including the World Bank (WB), the European Union (EU), the AFD, the Islamic Development Bank (IsDB), and GoJ.

The preparation of an independent ESIA including a RAP for the long term measures of GSWMP was announced as a competitive bid in May 2011. The consultancy assignment is funded by AFD and has been awarded to the Joint Venture of EcoConServ Environmental Solutions, Egypt, and Universal Group, Palestine.

The ESIA has used the solid waste management scenario designed within the FS and the conceptual designs of the two landfills and related transfer stations. This ESIA report includes the baseline study for the two landfill sites and related transfer stations and the impact analysis and environmental and social management plan for the Sofa site only.

ESIA Objectives

The ESIA is an instrument that involves examining the project's technical, environmental, socio-cultural, institutional, historical and political context, and stakeholders' views and priorities. It aims to set a mitigation and monitoring plan to tackle the negative environmental and social impacts and defines the institutional responsibilities for implementing these measures. The RAP is regarded as a mitigation policy and action to minimize the negative impact of involuntary land acquisition that might be triggered as part of the project.

This ESIA report has been prepared in accordance with the National Environmental Impact Assessment (EIA) guidelines including the EIA Brochure of the PNA. It also recognizes the international policy and guidelines including the WB Operational Policy/Bank Procedures/Good Practice (OP/BP/GP 4.01), EC directive 85/337 and EC directive 97/11/EC

Secondary data collection involved the review of information in previous reports and studies. Moreover, structured site visits were undertaken to collect primary data directly from stakeholders in order to garner their perceptions about the project's predicted impacts. The most important tools included Structured, Questionnaire, Focus Group Discussions (FGD), Semi Structured Interviews (SSI) and Informal/ Unstructured Interviews as well as public consultations through plenary events.

Current Waste Management Situation

Waste is currently collected and hauled to the three main landfills currently operating in the GS; 1) Johr al Deek (Gaza) Landfill, located in Gaza municipality; 2) Deir El Balah Landfill: located in the east side of Deir Al Balah municipality; and 3) Sofa landfill: located in Khan Younis municipality, east of Rafah municipality which it serves. Both Johr al Deek and Sofa landfill sites are not equipped with soil protection measures which present a potential contamination risk to groundwater resources due to waste leachate percolating through the soil layers in the event of rainwater. In addition to potential groundwater contamination, the existing solid waste management system is characterized by the following deficiencies:

- Air pollution and direct harm to health due to emissions and nuisance from the solid waste at the landfill site. This includes odor generated from the chemical decomposition of the waste, particulate matter (PM) and toxic substances which may result from waste burning and/or spontaneous combustion of the waste.
- Direct harm to health may also result from direct contact with the waste in the absence of personnel protection equipment. This already exists as many scavengers are regularly visiting the landfill sites.
- Nuisance to people and risk on public health due to rats and flyers of random dump sites and accumulation of waste in streets
- Global warming potential due to methane generation from anaerobic degradation of the organic portion of the solid waste in the landfill.
- Contamination of the upper soil layer or wadis due to uncontrolled discharge of rainwater runoff.

What may exaggerate the hazard nature of the above impacts is the co-mixing of hazardous and health care waste with MSW. This is a result of limited control over the site which leads to uncontrolled dumping as well as the absence of waste acceptance criteria and alternatives for hazardous waste treatment.

The current situation is therefore not the most environmentally sound solution to solid waste management in the GS. A sustainable solution with respect to social, environmental and economical impacts is therefore needed for the solid waste management in the GS.

Project Description

The proposed long term measures for the GSWMP includes the construction of two new landfills at Sofa and Johr al Deek, these will use six transfer stations distributed all over the GS. In the period until 2032, it is proposed to use Johr al Deek landfill for the disposal of solid wastes generated from Gaza and North Gaza Governorates and the Sofa landfill for the disposal of solid wastes generated from Rafah, Deir El Balah and Khan Younis Governorates – through three transfer stations; Tel al Sultan, Al Namsawi and Deir El Balah.

From 2032 until 2040, waste generated from Gaza and North Gaza Governorates will be transferred to Johr al Deek from which it will be bulk transported to Sofa, so Johr al Deek will be turned to a transfer station with a storage capacity of 30,000 tons and the landfill will be closed. Waste generated from Rafah, Deir El Balah and Khan Younis Governorates will continue to be disposed of at Sofa which will become the only landfill serving the GS.

The amount of solid waste which will be disposed of at Sofa is estimated at around 550 t/day in Year 2011 increasing to 1,200 t/day in Year 2032. In 2040, the amount of solid wastes which will be disposed of at Sofa is estimated at around 3,000 tons/day. The Sofa landfill will be constructed in separate cells, each lasting for 5 years. A base lining system which consists of double layers of 1.5 mm PE-HD and Geo-synthetic clay will be installed. The base lining system in conjunction with the low permeability clayey soil layers detected at the proposed site will provide an effective containment system for waste leachate. A soil cover with a thickness of 10 cm will also be placed and compacted daily on the surface of the waste layer.

The engineering measures recommended to collect the leachate include a drainage layer which will include PE-HD 2/3 perforated pipes embedded in lowest elevation areas of the cells bottom which will have enough inclination to collect the liquid in the pipes then by gravity to a collection pit at the lowest point of each cell, then the leachate will be pumped up to a leachate pond and recycled to active cells. The sanitary landfill includes furthermore a degassing system through 150 vents, each vent will be formed in a hole that will contain broken stone around PE-HD filter pile, and will be gradually raised during the progression of landfill cells. Each vent will cover an area with a radius of about 30 meters, and all the vents will be collected in PE-HD collection pipes that will be located inside the re-cultivation layer and the ring road around the landfill and will end in a gas compression station.

Environmental Baseline Investigation

An surface geological and geophysical investigation of the Sofa site has shown that no major fault type formations have been observed. The geo-morphological study showed that Wadi Gaza is the major wadi in GS, to which 6 sub-basins drain and discharge their water load directly into the Mediterranean Sea. It was observed that the drainage patterns of the 6 sub-basins are at a considerable distance from Sofa.

At the Sofa Landfill area, the water table appeared at depth of 46m and groundwater flow direction is in the N-NW direction. Groundwater vulnerability studies performed

for GS indicate that the proposed site of Sofa for the landfill construction is among the most favorable locations for such purpose within the strip.

No rare, sensitive or endangered fauna or flora species were observed during the visits to the Sofa site, that would be negatively impacted by the construction and operation activities of the landfill. Birds were observed at Sofa, this is an important factor to be considered when assessing the impact on the nearby Rafah airport – which is not functioning at the moment. The baseline investigation has also shown that the proposed site is at a considerable distance from any cultural heritage sites.

Social Baseline Data Investigation

The surface area in Gaza is very limited, with an average land availability of 0.26 dunum per person in 2007. Gaza Strip is a small closed coastal area of a total surface area of 365 Km². By 2007, approximately 1.4 million Palestinians lived in Gaza Strip, of whom almost one million were UN-registered refugees. The current population is estimated to be in excess of 1.5 million. The general unemployment rate in the occupational Palestinian territories (oPt) is considered high with a rate of 23.4% of the labor force. Unemployment rate in Gaza is considered double the rate in the West Bank (37.4% in Gaza against 16.9% in the West Bank in 2010). Literacy level is generally high in Gaza strip reaching around 95% of the population above 15 years of age. Gender discrepancy is not significant except in the groups above 45 years of age.

Social Aspects Related to the Existing SWM systems

In Gaza strip, waste systems are affected by the general political context. In particular, the frequent roadblocks and curfews imposed resulting in the creation of several alternative routes and temporary and emergency disposal sites within urban areas. The location of these transfer stations near residential areas also result in multiple social implications on the local communities including direct negative impacts on health, hygiene and negative visual impacts.

Survey results show the following key results:

- There is a need for higher level of attention to remote and densely populated areas as they lack house to house regular services.
- Local community was relatively satisfied with UNRWA services.
- 80% of the surveyed areas receive their services from the municipalities. Around 17% receive UNRWA services while the rest of the respondents receive the services from other institutions.
- The majority of the interviewed local community members expressed concern and dissatisfaction with the heavy charges for services including SWM
- Service bills are, however, not paid by the majority of the people as they can not afford it
- Key reason for refusing to pay the cost for solid waste services was linked to affordability rather than to poor level of service.
- Half of the survey sample was satisfied by the service and half of it was dissatisfied
- Almost all communities believe that the current system needs to be improved, including those who are satisfied.

- 40% of the survey sample perceived municipalities as suitable institution for system improvements. 31% see that UNRWA can lead the system improvement better while 23% recommended a role for the private sector.
- Results indicated that more than half of the surveyed cases are willing to pay higher cost for improved services. The percentage was the highest in well-off areas.

The Location, Land and Livelihoods Issues of Sofa Landfill

The field observation suggests that more than 80 % of the land around the landfill is uncultivated while round 20% is cultivated with perennial crops which is growing naturally and does not need any care or attention from the owners. The land of the landfill is privately owned by small number of families and is currently not used for any activities. Land owners interviewed during the preparation of the ESIA mentioned that the value of their lands drastically decreased as a result of the waste disposal activities at the dumpsite. Security issue was also perceived to be one of the factors for decreasing land value.

The Location, Land and Livelihoods Issues of Johr al Deek Landfill

Johr al Deek, located at the eastern border line adjacent to Israel borders. The location is already used as a landfill and the high risk of the landfill was a key issue for various workers and users of the landfill. Since access to the landfill will likely be restricted as part of the short term activities of GSWMP, the impact on the groups of waste pickers, particularly those who are working as full timers and whose livelihoods is fully reliant on this business should be carefully considered.

Workers in SWM in Gaza Strip

Under the current situation in Gaza with the high levels of poverty and unemployment, such jobs currently attract high qualified young university graduates as a source of income, even on short term basis. It also attracts large number of urban poor who try to find a day-to-day living from informal segregation of valuable recyclables.

Formal workers:

They work under different formal organizations including the municipalities, UNRWA. The work mode of these organizations varies between temporary and permanent work. Permanent municipalities' workers are contracted on fixed term. Additionally, the municipalities hire temporary workers for shorter term. Some of the formal workers are working in temporary projects. In some cases they are contracted by international institution such as COOPI who runs cash for work programme.

Informal Sector Involvement in the SWM Sector:

The informal sector is becoming increasingly involved in the sector. The informal sector can be mainly divided into three groups.

- A) Waste pickers who work in the main landfill or in the temporary waste storage sites for recovering recyclables.

- B) Street pickers who collect the recyclables from the waste bags in front houses and from the containers before they are emptied.
- C) Informal traders who purchase the sorted recyclables from the previous groups and sell them to the industry for recycling.

Potential Environmental and Social Impacts of the Project

Impacts during construction and operation phase:

Impacts of Spoil Storage (medium to high significance):

The spoil that will be generated from excavation of the landfill to the design depth (20 meters) is considered large quantity of soil that will occupy large area for storage. It was estimated that the soil requirements for landfill operations (daily cover and side embankments) will only consume less than half of the excavated soil. Also a temporary land will need to be used for storing the spoil that will be used for landfill operations in Cells 4 and 5 after filling of the other cells. The following mitigation measures and monitoring activities are recommended for controlling this impact:

Mitigation Measures:

- In case there are no sufficient areas adjacent to the landfill, the depth and height of the landfill should be changed to safeguard against such impacts .
- The area allocated for spoil storage should be selected.
- Ensure that the height of the spoil will not cause unaccepted visual impacts to adjacent areas

Monitoring Activities:

- Amounts of excavated soil and the amount of soil used in landfill operations
- Keep track of the end uses of the soil and the methods of transportation.

Affecting air quality by dust emissions of construction works (medium significance):

Dust emissions will negatively impact ambient air quality, particularly during the initial phases of construction of the landfill, and to a much less extent during the construction of transfer stations. Residential areas or other occupied buildings are not in the immediate vicinity of the site, the impact will not therefore be strongly felt by nearby inhabitants. However, users of nearby roads and scattered farm houses visitors may experience some disturbances due to dust generation. The following mitigation measures and monitoring activities are recommended for controlling this impact:

Mitigation Measures:

- Placing wind break trees at the outer perimeter of the cell.
- Storing spoils that will be reused as close as possible from the active cells
- Pavement of the access road and ring road
- Ensure effective vehicle wheels washing

Monitoring Activities:

- Ambient Particulate Matter at the site borders.

- Complaints from neighboring residents to both the landfill and the transfer stations.

Noise Impacts (medium significance):

Construction and operation works include noisy activities related to machine operation in addition to the noise generated from the trucks entering or leaving the site. Because the nearest receptors are relatively far, the noise impacts are not expected to be major, as most of the machinery noise will be effectively attenuated by this distance, especially when excavation and filling works are deep below ground level. Construction noise at the transfer stations is not expected to exceed that of a conventional concrete building, and during operation the noise of the extra traffic and compactors is not expected to be significant. The following mitigation measures and monitoring activities are recommended for controlling this impact:

Mitigation Measures:

- Key noisy equipment should be selected with adequate silencers;
- Optimize the use of machines and noisy equipment (i.e. switching off when idle);
- Use acoustic barriers as needed
- Construction and landfilling work should be stopped at night-time.
- Planting of a wind break trees where appropriate to act as a noise buffer

Monitoring Activities:

- Ambient noise at the nearest residential areas from landfill.
- Complaints from neighboring residents to both the landfill and the transfer stations.

Odors Impacts (medium significance):

The impact of odors is normally considered a mere annoyance, as foul smells can rarely harm health directly. However, due to the nature of landfills, the odors produced can potentially be quite powerful. The nearest residential cluster to the proposed Sofa Long Term landfill was found at around 1600m from the nearest active cell and the nearest farm house is located at a distance of 700-800 m from the nearest active Cell. Because the existing site, at sofa is being used for waste disposal without covering, the potential odor impacts of the project are not likely to significantly increase the cumulative odors in the area especially with the application of the daily cover in the new landfill operations. This also applies for the related transfer stations which are currently being used as open waste area, and will be more controlled through the project. The following mitigation measures and monitoring activities are recommended for controlling this impact:

Mitigation Measures:

- Adhere to the landfill design measures regarding waste progression and waste cover.
- In case of receiving complaints cover application should be improved
- Implement the transfer stations design measures of unloading through a hopper.
- Additional containers should be present at the transfer station site

Monitoring Activities:

- Complaints from neighboring residents to both the landfill and the transfer stations.

Landfill Gas Impacts (medium significance):

The disposal of solid waste in an anaerobic environment causes decomposition of the organic components of the waste to produce landfill gas. Landfill gas mainly composed of methane, carbon dioxide and other minor constituents including Non-Methane Organic Carbons (NMOC) or Volatile Organic Carbons (VOC), ammonia and hydrogen sulfide. The expected ultimate amount of landfill gas that will be produced at Sofa landfill is 9.68 million tons (which is estimated by 6,917 million m³). According to the preliminary design of the landfill there will be a degassing system in the landfill that will end in a gas compression station, in which the gas will be either flared or used in power generation. This degassing system is believed to minimize the migration of landfill gas to the atmosphere or through the soil to the groundwater. The following mitigation measures and monitoring activities are recommended for controlling this impact:

Mitigation Measures:

- Adhere to the design requirements for the degassing system
- Adhere to the design requirements for the base lining system and final cover

Monitoring Activities:

- Keep records of collected gas through the degassing system
- Analyze composition of the landfill gas against main components.
- Analyze ambient air quality at the landfill borders
- Analyze the acidity and hardness of groundwater taken from monitoring wells

Leachate and Surface Water Impacts (medium significance):

The leachate is generally characterized by its strong organic load, containing heavy metals and toxic hydrocarbons, its acidic nature and offensive smell. The expected yearly amounts of leachate will gradually increase from about 27,000 m³/year to a maximum of about 280,000 m³/year. The preliminary design includes a leachate collection and recycling system through a leachate pond next to a wastewater treatment plant. These engineering measures are believed to be sufficient for controlling the generated leachate according to the best available technologies. The odor of the collection pond will be gradually attenuated in proportion with the distance from the pond, especially when the leachate recirculation and the regular clean up of settled sludge in the pond is maintained at an adequate rate. The risk of contaminating groundwater is low because of the low soil permeability and the relatively large depth of groundwater table. The following mitigation measures and monitoring activities are recommended for controlling this impact:

Mitigation Measures:

- Adhere to the design requirements for leachate collection and management
- Adhere to the design requirements for the leachate collection pond and pumping station so that to minimize retention time and implement effective removal of sludge.
- Surrounded the leachate pond with wind break trees
- Adequately maintain pump station and piping system.
- Coordinate with the WWTP discharging of leachate and sludge if needed.

- Prevent rain water from reaching the waste at transfer stations and composting plant
- Take prompt actions to confront any detected groundwater pollution at the site.

Monitoring Activities:

- Leachate pumped amounts
- leachate chemical analysis
- Groundwater chemical analysis.
- Amounts of sludge removed from leachate pond

Impacts on Birds and on Gaza Airport (medium significance):

Generally, the habitats of the migrant birds include wetlands, lakes, riverbanks, vegetative cover along coastline, forests, etc. Since none of these features exist around the proposed landfill site, there will be a very limited population of migrant birds in this area. However, landfills can become preferable food sources for birds and will attract both migrant and local birds. The environmental impacts that could be associated with attracting birds on the landfill site are minimum because there are no collision risks with objects, such as high tension lines, and there are no rare and endangered species in the area. However, the risk factor that may arise is the nearby (about 4.5 km away) Gaza International Airport, which is currently not operating, but in case the airport will become operating there may be some risks on the aviation safety. The following mitigation measures and monitoring activities are recommended for controlling this impact:

Mitigation Measures:

- Obtaining the Approval of the Palestinian Civil Aviation Authority.
- Implemented any conditions that may be included in this approval

Monitoring Activities:

- Complaints and correspondence with the Palestinian Civil Aviation Authority

Risks of Receiving Hazardous Waste (medium significance):

There are different types of hazardous wastes that are currently mixed with domestic waste; the most common are healthcare waste, which is commonly found in garbage bins and dumpsites, and hazardous construction waste, such as asbestos and contaminated rubble with different chemicals, such as PAHs. It is well defined in the project objectives that it deals with domestic non-hazardous wastes, but the fact that there are no sufficient places currently available which receives hazardous waste raises the risk of receiving such waste at Sofa landfill. The following mitigation measures and monitoring activities are recommended for controlling this impact:

Mitigation Measures:

- MLDF should negotiate for initiating a hazardous waste management project
- Train project staff on handling the types of hazardous waste that could be received
- In case the Long Term landfill will start operation before having a hazardous waste facility in Gaza, a special cell for hazardous waste disposal should be established

- Asbestos waste should be wetted once admitted in the landfill and immediately covered
- Flammable and explosive waste should be strictly forbidden from admission
- Provide staff with adequate PPE
- Prepare a documented emergency response plan to any spills or fires

Monitoring Activities:

- Amounts of hazardous waste received in the landfill
- Amounts of flammable and explosive wastes that have been refused from admission
- Topographic survey of the special cell and estimation of the amount of received waste
- Health records for the project staff.

Risks on Public Health and Hygiene (medium significance):

Potential impacts on the health and hygiene of both the general public and on-site workers exists as a result of the nature of the waste. Waste sorters at the recycling plant, in addition to regular staff in the landfill and transfer stations, are in direct contact with the waste and accordingly are exposed to unhygienic conditions. The situation at the existing uncontrolled disposal site is associated with resident populations of vermin which are factors for increasing nuisances to humans and the spread of disease, and disrupting the natural ecosystem. The adoption of high standards for the new landfill, through compaction and daily coverage, will limit the potential for the development of resident populations of vermin and pests. The following mitigation measures and monitoring activities are recommended for controlling this impact:

Mitigation Measures:

- Provide health and safety training for the staff and provide them with hygiene measures
- Unauthorized entrance to the landfill site should be prevented
- Adhere to the design measures for compaction, waste filling and waste cover.
- Adequate application of non-hazardous pesticides if needed.

Monitoring Activities:

- Type, quantity, date, location and method of application for all pesticides
- Complaints from neighboring residents to both the landfill and the transfer stations.

Visual Impacts (Low significance):

The solid waste accumulation is an unfavorable seen, especially when it is with large quantities as the case in landfills, transfer stations and composting/recycling plants. The operation of landfills, transfer stations and composting/recycling plants is also associated with litter dispersion by wind which adds to the negative visual impacts. The waste scene in the landfill and transfer stations is expected to be hidied by the deep excavations, surrounding embankments and large containers in the transfer stations. Currently considerable visual impacts are caused by the existing landfill which is about 15-meter high and uncovered, therefore overall impact of the Short Term measures is expected to be positive, even though the landfill height will increase. If the new landfill operations are

added to the existing Short Term hill the additional impact on the area is expected to be minor. The following mitigation measures and monitoring activities are recommended for controlling this impact:

Mitigation Measures:

- Active cells should be surrounded by a movable fence screen.
- Provide adequate fence and roof for the composting/recycling plants

Monitoring Activities:

- Complaints from neighboring residents to both the landfill and the transfer stations.

Affecting Air Quality by Exhaust (Low significance):

Local air quality can be negatively affected by vehicle exhaust emissions from vehicles and machines operating at the site. Overall, the potential impact of vehicle emissions resulting from the landfill and transfer stations-related traffic is not expected to increase as compared with the current situation. The following mitigation measures and monitoring activities are recommended for controlling this impact:

Mitigation Measures:

- All vehicles and heavy equipment working in the project should be adequately maintained.

Monitoring Activities:

- CO₂ emission rate of all vehicles.

Impacts of Construction and Operation Waste Other than Excavation Soil (Low significance):

These wastes includes non-hazardous waste such as construction debris, packaging waste, scrap wood, metals, garbage and sewage in addition to some limited amounts of hazardous waste such as used oils, empty paints containers and contaminated cloth. The following mitigation measures and monitoring activities are recommended for controlling this impact:

Mitigation Measures:

- hazardous waste should be separated from other wastes
- Other solid wastes to be collected from different areas of the site
- Sewage and wheels washing water should be collected from cesspits and sent to the WWTP.

Monitoring Activities:

- Amounts of hazardous waste generated at the site
- Amounts of collected sewage and wheels washing water

Risks of Unforeseen Exceeding of Landfill Capacity (Low significance):

Some of the assumptions that were basis of the calculations for estimating the landfill capacity may not be materialized during the actual implementation of the project. A

scenario for changing these assumptions, to more pessimistic assumptions, led to earlier filling date than the design date (end of year 2040). The following mitigation measures and monitoring activities are recommended for controlling this impact:

Mitigation Measures:

- Start studying expanding the Sofa site in due time.

Monitoring Activities:

- A topographic survey for the landfill site to identify the used area and waste height.

Risks of Damaging Chance-Find Antiquity Objects (Low significance):

The possibilities for such chance-finds are not high but still exist. The following mitigation measures and monitoring activities are recommended for controlling this impact:

Mitigation Measures:

- In the case of chance-finds and the Ministry of Tourism and Antiquities should be contacted to handle the site.

Monitoring Activities:

- Type, location, photographs and the followed procedures for handling chance-finds

Impacts on Flora and Non-Avian Fauna (Low significance):

The fauna species using the existing uncovered landfill for feeding or sheltering may be affected by the controlled operation of the waste disposal. The site restoration after decommissioning, including any baffles and vegetative screens, will create a variety of new habitats. No further mitigation measures are required.

Impacts during the Decommissioning Phase:

Impacts Landfill Gas (Medium significance):

The generation of landfill gas will continue after the landfill decommissioning. Although the proposed degassing system is believed to be sufficient in controlling the impacts, a new risk will be associated with the decommissioning phase as there are possibilities that the site will become un-manned. The following mitigation measures and monitoring activities are recommended for controlling this impact:

Mitigation Measures:

- Take necessary measures to continue monitoring activities after decommissioning.
- Take prompt actions to confront any gas leakages.

Monitoring Activities:

- Keep records of collected gas through the degassing system

- Analyze composition of the landfill gas against main components on annual basis.
- Analyze ambient air quality at the landfill borders on annual basis
- Analyze the acidity and hardness of groundwater

Impacts of Leachate and Surface Water (Medium significance):

There will remain two main leachate issues after decommissioning of the landfill: the amount of leachate that will remain in the leachate pond after closure of Cell 5 and the amount of leachate that will remain inside the landfill body after closure. Accordingly there will still be amounts of leachate collected in the first one or two years after the last cell closure and the recirculation will not be possible, therefore, all collected amounts should be discharged to the adjacent WWTP. The surface water runoff will be in relatively high amounts in which an adequate area should be identified for collection and effective evaporation. The following mitigation measures and monitoring activities are recommended for controlling this impact:

Mitigation Measures:

- Identify adequate area for surface water collection.
- Continue leachate collection and pumping after decommissioning.
- Take necessary measures to continue monitoring activities after decommissioning.
- Take prompt actions to confront any detected groundwater pollution at the site.

Monitoring Activities:

- Leachate pumped amounts
- leachate chemicals analysis
- Groundwater chemical analysis
- Amounts of sludge removed

Visual Impacts (Low Significance):

Obstruction of the landscape with new hills will be the main visual impacts. The visual impacts of the new hills that will be developed by the project are expected to affect only few houses in the adjacent areas. However, in all cases the view of the hills will only be a minor addition to the existing Short Term hill. Furthermore, the more distance from the landfill site the less will be the visual impact. The following mitigation measures and monitoring activities are recommended for controlling this impact:

Mitigation Measures:

- Carry out and maintain plantation of the final covered landfill cells

Monitoring Activities:

- Keep records of the green areas planted over the final cover of the landfill

Stability Impacts (Low Significance):

The landfill site is generally stable as there is no major fault type formation with medium seismic activity, accordingly the stability risks are classified as low. The following

mitigation measures and monitoring activities are recommended for controlling this impact:

Mitigation Measures:

- Adhere to the detailed design measures for the heights and slopes protection

Social Impacts and Proposed Mitigation Measures

Impacts during Construction

Creation of temporary job opportunities

The construction phase of the various components of the project will involve creation of a variety of short-term jobs that will result in improvement for the economic conditions of people including the poor with low and medium skills, in addition to highly qualified professionals in engineering and other professions. This have positive temporary impact of high significance on the livelihoods of local people.

Inconvenience to local communities

The construction process will involve site works including movement of heavy vehicles, transferring construction material and influx of high number of construction workers to the construction site. This significance of this impact is expected to have low significance in the site of the landfill due to the low population density of the site. The significance of this impact from the construction of the transfer stations will be of higher significance due to relative proximity to residential areas.

Mitigation measures

- Establishing community-based monitoring committees to follow up and report feedback of the communities.
- Communicate information about the hours of construction with the local population
- Establishing and enforcing a clear complaints system and ensure complaints are well and promptly addressed.
- Full restriction from access to the site by any other group outside the construction team.

Resettlement Impacts

Involuntary resettlement (IR) resulting from development projects will, if unmitigated, give rise to difficult economic, social, and environmental risks that may lead to a variety of unacceptable impacts.

A) Impact on the livelihoods of the informal waste pickers

- **Complete loss of sources of income**

Complete loss of sources of income for the informal workers in Sofa Landfill and complete loss of sources of income for the informal workers in the temporary waste storage sites and transfer stations.

Impact Significance:

Negative impact of high significance

- **Partial loss of sources of income**

Partial loss of income will be encountered by the informal sector groups who give visits to the landfills and TSs on part time basis to make an additional income.

Impact Significance:

Negative impact of moderate significance.

Mitigation measures

- **ARAP was prepared for the waste pickers in Sofa landfill site**
- **Scenario (A) The integration scenario**

The integration scenario of the informal sector involves structured interventions to ensure minimizing of the negative impacts of cutting the income of these groups through working to integrate the individuals who are capable to maintain work in waste sorting and recycling within the formal Municipality and non-municipality systems.

Scenario (A) 1- Transition Assistance

- Provide technical assistance and capacity building in recycling related fields
- Providing cash and in-kind temporary assistance to assist the targeted families during the construction period of the facilities.

Scenario (A) 2- Provision of Job opportunities

- Hire the appropriate individuals of waste pickers by the municipality and other programmes to work in SWM related fields. This should include formalizing the waste pickers employment conditions and measures should be considered to give them priority in benefiting from the job opportunities.

Scenario (B) The non-integration scenario

For the cases where the integration scenarios will not be applicable, it is still recommended to consider other kinds of measures in order to empower the affected groups and their families. This could be attained by allowing the affected groups to benefit from running donors and national programmes. Some programmes may help **eligible families especially those with working children in establishing businesses by making small soft loans available. This may include the “Deprived families Economic Empowerment Program” (DEEP), UNICEF and other organizations.** Benefit from these running programmes include the provision of capacity development programmes in various areas like vocational training programmes or other fields and facilitate access of the informal sector groups and their families particularly women to micro-grants and sources of finance for improving livelihoods.

B) Impacts of loss of privately owned land

The land that will be acquired as part of the project is of marginal nature. Its value is generally low. This impact could be classified as an impact of moderate significance. The compensation plan as part of the ARAP will minimize the impact the impact to minor.

Mitigation measures

An abbreviated Resettlement Plan has been prepared and will be implemented in order to ensure a fair economic compensation for the affected landowners through a consultative and mutually agreeable process.

Impacts on cultural heritage

The closest cultural site of significance is located around 2 kilometers away from the site of Rafah (Sofa) landfill. This is also applicable to the sites of the two existing TSs that will be rehabilitated as part of the project.

Impact Significance:

This impact is classified as an impact of low significance but enhancement measure will be suggested within the social management plan in order to minimize any potential impacts on the cultural heritage.

Mitigation measures

- Monitoring of site excavations
- In case of finding information or signs about archeological sites or in cases of incidental finds the concerned agency, namely, the Ministry of Tourism and Antiquities should be informed and reporting should be made immediately to these agencies.
- Inclusion of clear terms and conditions within the contracts to regulate the issue of accidental finds.

Impacts during Operation**Reduction of the negative health and safety impact**

The project is expected to result in more efficient and hygiene waste management that will be positively reflected on the health of the informal sector groups; workers; local communities (as general); neighboring communities to the landfill; and neighboring communities to the existing waste storage sites;

Impact Significance:

The reduction of the negative health and safety impact resulting from the current poor collection and disposal practices of solid waste is one important positive impact of high value to the local communities who will be the main receptors of these benefits. The impact could be classified as a positive impact of high significance.

Creation of Job Opportunities

The operation of the different investment components including the newly introduced sites (including landfills and transfer stations) of the project will require additional human resources of various backgrounds and qualifications

Impact Significance:

This is considered as positive impact of high significance to the local communities. Moreover, integrating the informal waste pickers within the formal system would also be a positive socioeconomic impact of high significance.

Stimulation for economic growth in the area

The infrastructure improvement is expected to encourage introduction of economic activities including industrial and commercial activities. The development of the area, despite security limitations, will help in creating several job opportunities to the local population and the population from other places.

Impact Significance:

This impact is considered to be a positive socioeconomic impact of moderate significance to the local communities and the local economy.

Traffic Impact

From the Landfill

The current bad conditions and high traffic load of Salah El Dein road accompanied by the bad conditions of the trucks make regular transportation of waste to the final disposal sites a big challenge. The risk on the safety of the road users' is one of the key impacts that should be considered.

From the Transfer Stations

It is generally expected that the access of the vehicles to the transfer stations will result in increased pressure on both side and main roads with the cities/villages where the transfer stations will be located.

Impact Significance:

It is expected that a rehabilitation plan will be implemented for Salah El Dein Road before 2021. The impact of the landfill on traffic load and safety could be classified as moderate negative impact.

Mitigation Measures

For the landfill

- Implementation for the project of Rehabilitating Salah El Dein Road
- After operation, restrict transport trucks travel to the hours outside the rush hours.
- Strict monitoring to the road accidents as part of the monitoring plan
- Regular information sharing about the times of travel of the transport vehicles with the communities and establishments located by the road.

For the Transfer Stations

- Selecting appropriate model of means of waste transport including small trucks that can easily maneuver in narrow streets.
- Arrange the times of transporting waste to and from the TS to avoid traffic rush hours.
- Assist local communities in establishing community-based monitoring committees in order to follow up and report feedback on the management system and impacts on the communities to the PMU

Higher cost to beneficiary communities particularly the poor

The operation of the long term activities will require significantly higher revenues for SWM in order to maintain and sustain the system. The economic interests of the local population, particularly the poor, should be taken into consideration before proposing any fees system that may overload them economically.

Impact Significance:

From a socially sensitive perspective, and particularly within the poverty conditions in Gaza, the project impact that hits the poor economically should be classified as negative impact of high significance.

Mitigation measures

There is a need to tailor socially sensitive programmes for the fees charging system related to SWM to ensure that poor communities are benefiting, not overloaded financially. Mitigation measures include:

- Municipalities and JSC to maintain mechanisms to target poor families
- Awareness raising and building local communities' knowledge about issues related SWM
- More efficient management systems for waste including raising the profile and strengthening the recyclables market and encouraging community based initiative in segregation at source.

Depressing property values***From the Landfill***

The establishment of the landfill in the proposed site of Sofa where the current final unmanaged disposal site locates is expected to result in certain economic implications for the land and assets value within the site.

From the Transfer Stations

The impacts on land and assets in the neighborhood of the current waste storage sites that will be rehabilitated in Al Namsawi and Tal El Sultan is not expected to be of high negative significance.

Impact Significance:

For the landfill, the negative effect on the prices of land and property as a result of the establishment of the landfill is considered as an impact of low significance. For the transfer stations, the impact could be classified as an impact of moderate significance assuming that strict management measures will be applied in the site.

Mitigation Measures

- Apply strict measures and best practices in managing the sites. This involves full adherence to the mitigation measures mentioned as part of the environmental management and monitoring plan
- Establishing community- based monitoring committees in order to follow up and report feedback on the management system and impacts on the communities to the PMU and conduct regular community survey and consultation activities to measure local communities' feedbacks about the sites management.

Impacts on the social and economic activities

From the landfill

The only social and economic activities that could be affected are the limited grazing activities within the area as well as the limited farming activities. However, this is expected to be an impact of minor significance since the area around the landfill is still an open area for grazing and no restrictions will be imposed on them.

From the Transfer Stations

The neighborhood of the TSs is expected to encounter some limitations for the social and economic activities as a result of the location of the TSs with all the associated waste-related activities and the potential odour and visual impact.

Impact Significance:

The impact from the landfill is expected to be an impact of low significance. The impact related to social and economic activities resulting from the establishment of the TSs could be classified as an impact of moderate significance.

Mitigation Measures

- Full adherence to the management practices will help in reducing the negative impacts on the surrounding social and economic activities.
- Establishing community- based monitoring committees in order to follow up and report feedback on the management system and impacts on the communities to the PMU and conduct regular community surveys and consultation to monitor the project impact on social and economic activities.

Additional recommendations to maximize the social benefits of the project

- Raising the Profile of SWM
- Awareness raising
- Ensuring the benefits are granted to the Local population
- Reducing potential occurrence of work accidents
- Improving the Primary and Secondary Collection systems
- Enhancing Working Conditions of the workers in the SWM sector
- Training and Capacity Development

Analysis of Alternatives

No Project Alternative

The objectives of the GSWMP is basically to improve the environmental and public health conditions in Gaza strip, accordingly it is expected, by definition, that the environmental and social benefits will outweigh the impacts. All the negative impacts are mainly site-specific and could be managed/minimized through implementing the proposed mitigation measures. Comparing the benefits to the impacts in a strategic level, it could be concluded that the “no project alternative” is not supported from the environmental and social perspective.

Alternatives of Integrated Waste Management Scenarios

The Feasibility Study of the project has studied five alternative locations for the landfill; in which three of them were excluded because they are less than 500 meters from existing houses; this exclusion is totally supported by the ESIA team.

Three different scenarios were presented for using the two remaining sites: Johr El Deek and Sofa, these scenarios introduced different distribution of waste volumes between the two sites. A final clear preference from the environmental and social perspective between scenarios could not be ascertained, but the more usage of Sofa site with available area in Johr Al Deek to receive waste in emergencies may be slightly preferable from the environmental and social perspective as Sofa site seems to be less sensitive from the environmental and social perspective.

Alternatives of Landfill Height and Depth

An ideal situation will be to have an optimum depth and height for the landfill that will make no, or few, excess soil than what is needed in landfill operations. This will ensure the benefits of using minimum land areas for the project operations. If there are limitations on the landfill height, due to security reasons, a sufficient area should be allocated for storing the extra spoil. If such area could be made available, the landfill could have, alternatively, less depth and this area could be used as another landfill cell that will compensate the less landfill capacity.

Alternatives of Gas Management

There are two alternatives for the handling of collected landfill gas: to flare it, or to use it for power generation. The decision about utilization of the landfill gas in power generation, although preferred from the environmental perspective, should be based on an economic feasibility study considering the amounts of gas that will be collected. In all cases during the first years of operation, when the gas recovery will not be feasible for its small quantity, it should be thermally destructed through flaring.

Institutional Set-up for managing the ESMP

Environmental and Social Management Plan

The PMU shall include an Environmental Manager (PMU-EM) who will have the overall responsibility for implementing the ESMP and shall report directly to the PMU Director. During the construction phase the Engineering Consultant (EC) of the project, who will supervise construction work, will make sure that the mitigation measures during the construction phase are implemented by the contractor.

Efficient implementation for the social management plan should involve tailored efforts for maximizing the positive social impacts and ensuring that they are reaching the local communities and minimizing the negative impacts that may hit the poor and vulnerable groups. The potentially-affected groups (particularly waste pickers, land owners and communities near the proposed facilities) should be consulted along the process in order to ensure that their views are considered and that suitable measures are in place to eliminate the severity of negative impacts. Efficient consultations with stakeholders and high level of participation are seen as a prerequisite for a successful ESMP. It is strongly

recommended to appoint a Social Development Officer (SDO) within the PMU. The SDO should be leading the various participatory activities.

Each of the two JSC managers (JSCM) of the landfill sites will generally be responsible for implementing mitigation measures and monitoring activities during operation and decommissioning phase. The two JSCMs will supervise the ESMP measures at the two sites in addition to the correspondent transfer stations and the composting/recycling plant at Sofa site, they will report to the PMU-FM. During the decommissioning phase the two JSCM should provide the resources sufficient of timely implementing monitoring activities.

The specific roles and responsibilities of the SDO planned to be appointed under the PMU include:

- Establish dialogue with project affected groups, including local communities in the TS and landfills sites, landowners and waste pickers
- ensure the project is implemented in a socially sensitive manner that consider the interests of these groups.
- Monitor the project performance and report challenges and propose measures to improve project performance.
- Design and implement awareness raising campaigns
- Facilitate the formation of various community based mechanisms including community-based monitoring committee and social committee as part of implantation of the ARAP.
- Close facilitation for the execution of the ARAP and ensuring that compensations are reaching the PAPs.
- Maintain databases and efficient records for the PAPs as part of the ARAP
- Prepare quarterly progress reports and raise it to the PMU and report to the World Bank where applicable.

Moreover, the implementation of the ESMP involves other community-based mechanisms to assist the SDO in reaching local communities and to facilitate access to information and feedbacks, it is suggested to benefit from existing mechanisms like the "Districts Committees" by involving them and activating their roles wherever applicable. It is suggested to form 4 voluntary Community- Based Monitoring committees with the main responsibilities of:

- Facilitate the PMU and the SDO access to the local communities
- Conduct various surveys and consultation activities as part of engaging local communities in monitoring the project various phases and assessing various impacts.
- Assist in the delivery of awareness raising campaigns

ESMP Budget

Because the project is basically an environmental project the distinction between the budget for engineering works and environmental safeguard measures is difficult because ultimately the whole project will have clear environmental and social benefits. It has been assumed that the recommended mitigation measures and monitoring activities are

included in the project budget except for the following items, presented in the Table below, that may be considered distinct from the pure engineering components of the project.

It is worth noting that it has been assumed that Sofa Landfill will have an equipped laboratory to carry out leachate, groundwater, gas and noise monitoring activities recommended in the ESMP as part of the project budget.

Table 0-1: Proposed Budget for the ESMP

Item	Budget (US \$)
Salary of the PMU-EM in 6 years	72,000
Salary for the SDO in 6 years	72,000
Capacity Development for the SDO	10,000
Training courses on Hygiene and Hazardous Waste Management for project staff	20,000
Contracting consulting firm for carrying out environmental/social audit for the project performance and recommending improvement measures (3 audits in 6 years)	150,000
Allowance for contracting experts in some needed ESMP measures, such as pesticides consultant, groundwater expert, energy expert, safety expert ... etc.	80,000
Consultancy services (strategy for raising SWM profile in GS and strategies for developing financial instruments)	200,000
Designing and implementing awareness raising campaigns	40,000
Transition assistance for the waste pickers of Al Namsawi and Tal El Sultan	126,420 ¹
ARAP for landowners*	8,826,500 ²
ARAP for waste pickers in Sofa landfill*	40,000
	9,636,920

¹ This was calculated on the basis of :

- A) **Cash Assistance:** 21 waste picker x USD 230/ month (as transition allowance) x 24 month (transition period) = USD 115,920
- B) **Capacity development (hands on training):** 21 waste picker x USD 500/training = USD 10,500

² This figure was suggested by the ARAP against calculating not only the areas needed for the project but the actual areas owned by landowners who showed interest in selling to the project. Securing additional land is recommended from environmental and social point of view.