Submitted To:

Greater Cairo Air Pollution Management and Climate Change Subproject

Environmental & Social Impact Assessment for the Closure Plan of Abu Zaabal Dumpsite

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Executive Summary

BACKGROUND AND ESIA OBJECTIVES

The Ministry of Environment is implementing a World Bank-funded project to reduce pollution and increase resilience in Greater Cairo.

The project targets two major pollution sources in Greater Cairo: solid waste and vehicle emissions, through six components addressing air quality, waste, transport, communication, M&E, and hazardous waste. Component 2 supports implementation of Solid Waste Management (SWM) master plans tailored to each governorate's needs, including infrastructure, healthcare waste, and capacity building. The Abu Zaabal Dumpsite closure falls under Subcomponent 2.1, aiming to improve waste infrastructure and reduce emissions as part of a broader effort that includes developing new facilities and upgrading existing ones.

This report provides the Environmental and Social Impact Assessment (ESIA) for the closure of the Abu Zaabal Dumpsite in Qalyubia Governorate. The primary purpose of the document is to identify, assess, and propose measures/actions to effectively manage potential direct, indirect, and cumulative environmental and social (E&S) impacts associated with the closure and rehabilitation of the site.

The Environmental and Social Impact Assessment (ESIA) was conducted using a combination of primary and secondary data sources, including desktop research, field site visits, environmental measurements, and stakeholder consultations. The assessment ensures compliance with national regulations and the World Bank (WB) Environmental and Social Framework (ESF).

ABU ZAABAL DUMPSITE CLOSURE DESCRIPTION

Background

Abu Zaabal Dumpsite was originally planned for closure in 2021, but remains in operation due to the absence of a fully functional alternative and the limited capacity of the El Obour landfill, the second waste disposal dumpsite in Qalyubia Governorate. Abu Zaabal Dumpsite is located in Arab El-Olaykat occupying an area of 106 feddans[1]. The dumpsite continues to receive approximately 1,570 tonnes of municipal solid waste (MSW) daily from various areas within the governorate.

[1] Draft Geotechnical investigation Report

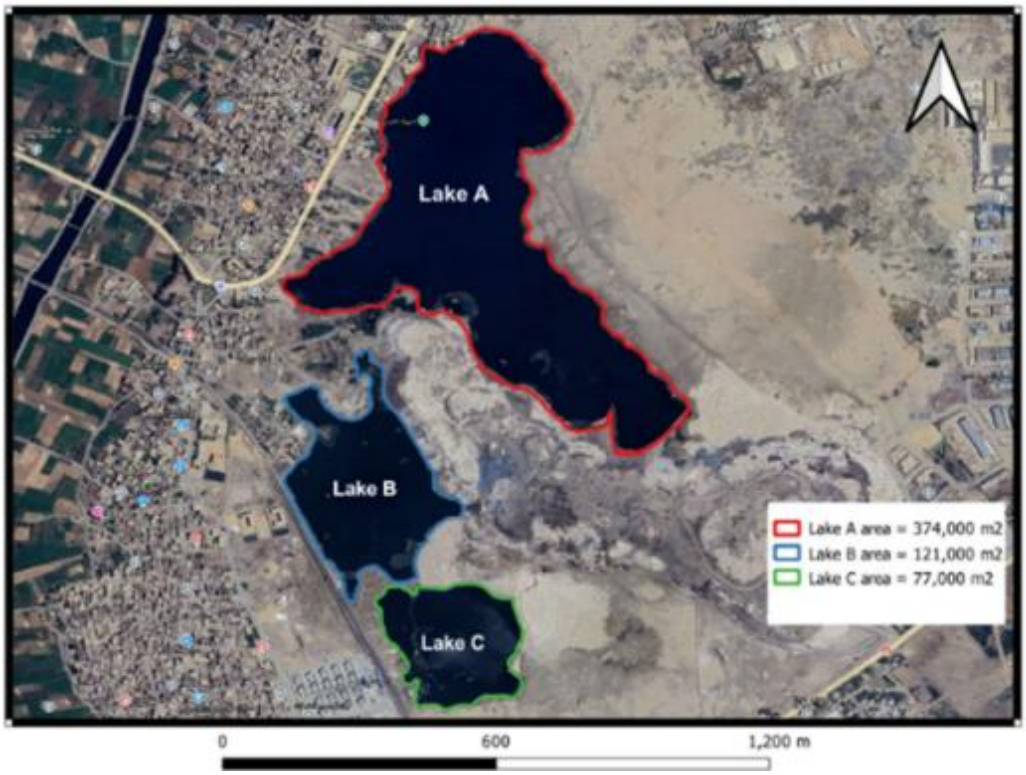
Abu Zaabal Dumpsite in Qalyubia Governorate, Egypt

Abu Zaabal functions as an open dump without containment measures or engineered barriers, and both past and ongoing waste disposal activities were non-compliant with recognized safety and environmental standards.

This has resulted in significant environmental degradation, including contamination of air, soil, surface water, and groundwater in the surrounding area. The site also experiences frequent fires and smoke emissions due to the lack of compaction as shown in the figure below.

Conditions at Abu Zaabal Dumpsite.

Additionally, groundwater, subsurface water, and surface water seepage have resulted in the formation of Arab El-Olaykat lakes, as shown in the below figure.

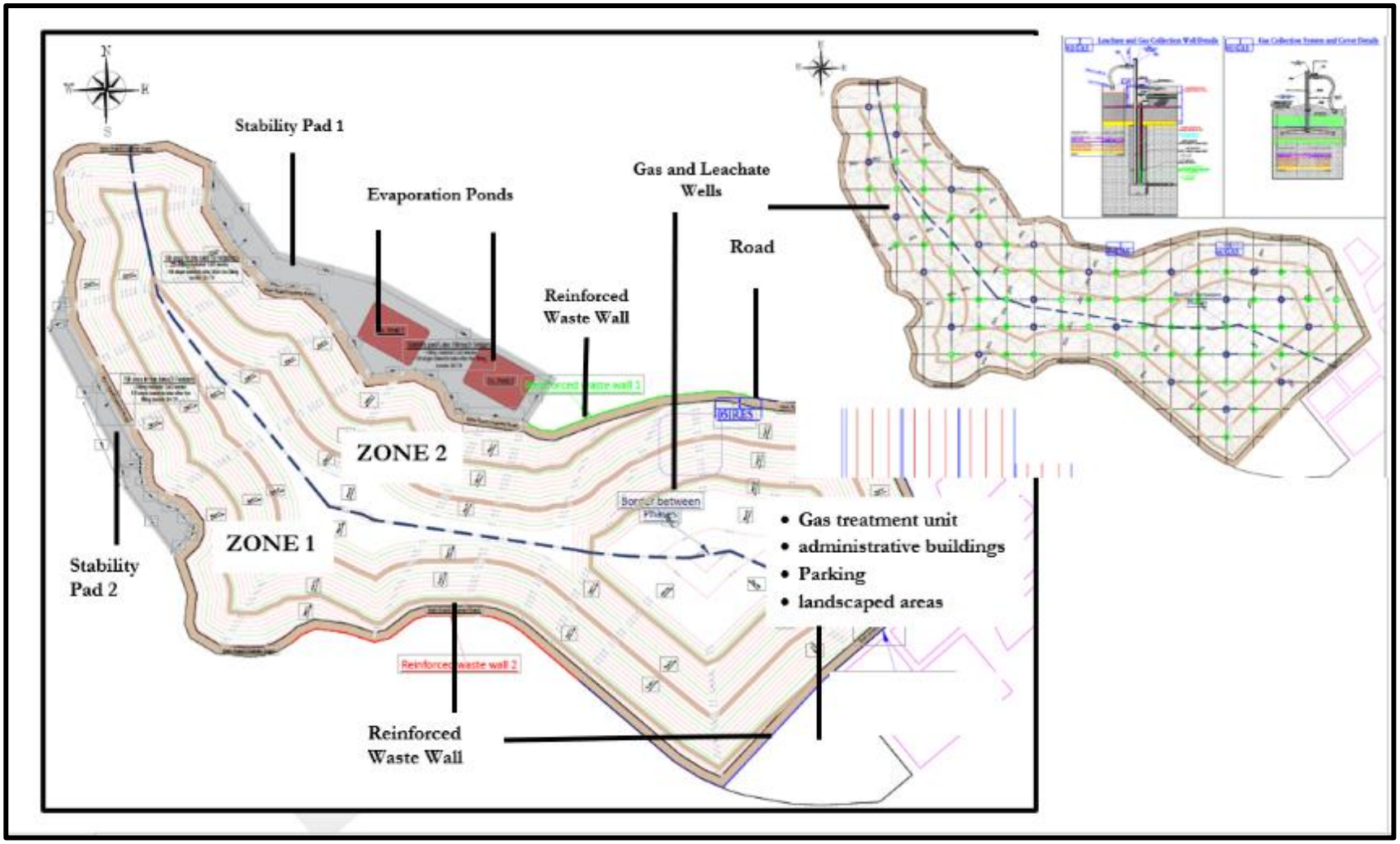


Arab El-Olaykat Lakes

The closure of Abu Zaabal will be carried out alongside the development and commissioning of the first cell of Qalyubia Governorate Sanitary landfill at the 10th of Ramadan Integrated Waste Management Facility (IWMF), ensuring a structured transition and diversion of waste.

The Abu Zaabal Dumpsite will be reshaped and closed in two zones: Zone 1 and Zone 2, to maintain uninterrupted waste disposal operations. Zone 1 will be closed first, with Zone 2 continuing to receive waste; some historical waste from Zone 2 will be transferred to Zone 1, and waste within Zone 1 will be repositioned for proper leveling. The final closed site will feature sloped sides, terraces, and a surrounding service road to support long-term stability, maintenance, and monitoring.

The overall site layout is shown in the figure below.



Abu Zaabal closure Layout

Subproject Components

The following are the subproject components:

1. **Stability Structures:** those include stability pads and reinforced earth walls.

2. **Final Top Cover**: The waste dumpsite will be covered with a final top cover consisting of the following layers from bottom to top: Final Compacted Waste Layer, Separation Layers (Geotextile), Sand Bedding Layer, Gas Drainage Layer (Gravel), High Density Polyethylene (HDPE), and Stormwater Drainage Layer (Gravel).

3. **Landfill Gas Collection and Treatment System**: An active gas collection system will be installed to extract landfill gas and direct it to a treatment unit with two flare units. The system will include 88 gas wells, 23 of which will also be used for leachate extraction through separate piping, with gas managed via northern and southern networks. It consists of horizontal pipes within the gas drainage layer and vertical wells, with gas routed through pipelines to 16 substations for flow regulation before treatment using two high-temperature flares east of the dumpsite.

4. **Leachate Collection and Treatment System**: The leachate management system uses submersible pumps in vertical gas wells to lower leachate levels and improve gas collection. Leachate is transferred through a pipe network to a main collection line and then to two evaporation ponds. These ponds, covering 2 feddans on the stability pad, enable the evaporation of up to 35 m^3 of leachate per day while supporting site stability. The evaporation ponds will be fully lined to contain the leachate and contaminants inside and avoid any leakages and act as contaminant migration to the soil or groundwater

5. **Internal Roads and paved areas**: A surrounding road at slope toe and steps with lighting, drainage, wheel cleaning and signs will serve the purpose of maintenance and body stability. An access road will be constructed to the evaporation ponds area.

6. **Area Facilities**: The project will establish essential area facilities and security components before work begins, including administrative and labor buildings, a guardroom, parking areas, a main gate with fencing, a weighbridge and control room, equipment sheds, an access road, landscaping, and a septic tank.

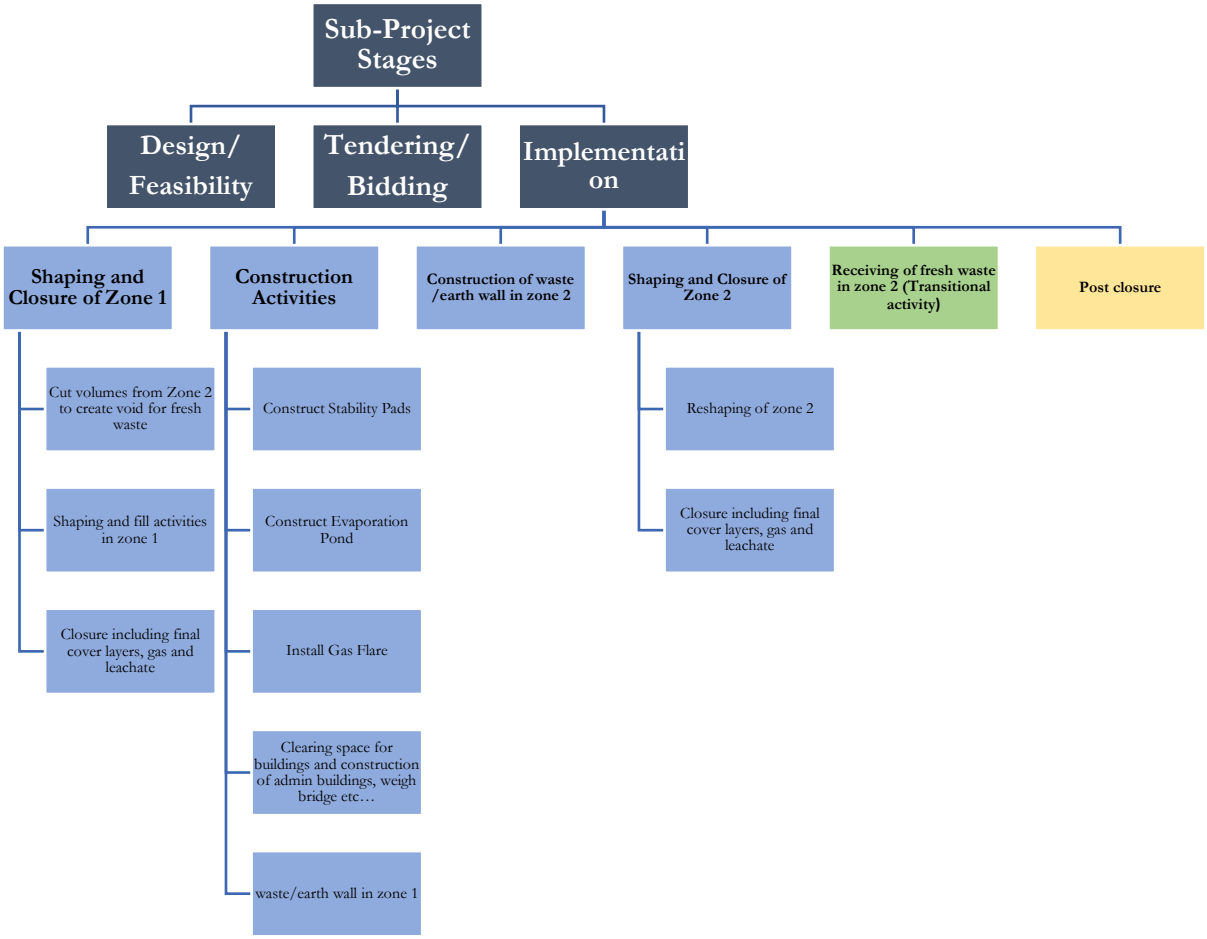
Subproject Phases and Activities

To streamline the assessment, the Consultant categorized project activities into three phases, grouping similar activities together as follows:

1. **Civil works phase:** The civil works phase includes emptying voids in Zone 2 and transferring waste to Zone 1, clearing space for buildings, reshaping the waste body, and constructing stability structures. It also involves installing the final top cover, landfill gas wells, and leachate pipes in both zones. Additional works include building evaporation ponds, installing the gas treatment system, and constructing ancillary infrastructure.

2. **Receiving of fresh waste phase**: Will include the receipt of fresh waste in zone 2.
3. **Post closure phase:** According to the Egyptian Code, no activities are allowed on the waste body of closed/covered landfills for at least 15 years. However, lightweight structures consisting of a single floor may be permitted after the post-closure care period, following the relevant codes.

The phases group similar activities to streamline impact assessment, as they are expected to result in similar impacts. Time overlaps are captured and addressed in the cumulative impact assessment. The activities within each of the phases is summarized in the block diagram below.



Subproject activities

Resources

The following are the expected resources used in the project development:

1. **Equipment:** While the contractor is responsible for selecting suitable equipment, the design consultant recommended a range of machinery for different project phases. For the civil works and fresh waste reception phases, equipment includes bulldozers, excavators, wheel loaders, trucks, compactors, graders, water tanks, drilling rigs, and thermal welding tools. For the post-

closure phase, specialized equipment is required for landfill gas and leachate management, soil and vegetation maintenance, erosion control, environmental monitoring, and infrastructure upkeep.

2. **Labor Force:** Throughout the closure and construction phase of the Abu Zaabal Dumpsite, an estimated number of 150 employees, including engineers, drivers, and laborers, recruited through both direct and indirect employment are expected. The total workforce during the post closure phase is around 12, including landfill manager/site supervisor, environmental engineer, social officer, gas collection and flaring technicians, leachate management technician, ground and cap maintenance crew, health and safety officer and administrative officers. Contractors are encouraged to prioritize hiring locally from Qalyubia. Additionally, the contractor will determine the required number of 8-hour working shifts for the subproject.

Subproject Timeframe

The total implementation time (including the remaining dumpsite operation) is 28 months in total. These are as follows:

- Total duration of civil works in zone 1 spans from Month 1 to Month 24
- Total duration of civil works in zone 2 spans from Month 1 to Month 28
- Receiving of fresh waste phase is in zone 2 and spans from Month 1 to Month 15 overlapping with civil works phase.
- Post closure activities start after full closure and have a duration of 15 years.

LEGAL AND INSTITUTIONAL FRAMEWORK

The Abu Zaabal Dumpsite Closure Subproject will adhere to the National laws and to World Bank Environmental and Social Standards. The sections below provide a summary of applicable laws and standards.

The detailed legal framework is available in the Environmental and Social Management Framework (ESMF) prepared for the Greater Cairo Air Pollution Management and Climate Change Project, which is publicly disclosed on the Bank's website[2].

National Laws, Regulations and Codes

In Egypt, environmental regulations are governed by the Egyptian Environmental Affairs Agency (EEAA), which operates under the Ministry of Environment. The primary legal framework guiding environmental protection is Law No. 4 of 1994 concerning the Protection of the Environment. This law empowers the EEAA to regulate and control various environmental aspects, including air and water quality, waste management, and biodiversity conservation. The Waste Management Law, Law 202 of 2020 and its Executive Regulations, provides precautionary measures for potential release of pollution.

The following are the most relevant laws for the subproject:

[2] https://documents1.worldbank.org/curated/en/739341590759685510/pdf/Environmental-and-Social-Management-Framework-ESMF-Egypt-Greater-Cairo-Air-Pollution-Management-and-Climate-Change-Project-P172548.pdf

- Decrees number 1095/2011, 710/2012, 964/2015, 544/2016, 75/2017, 618/2017 and 1963/2017 for the amendment of the executive regulations of the environmental Law number 4/1994.
- Law number 38 /1967 concerning the general cleanliness and its executive regulations.
- Law No. 48/1982 concerning pollution protection of the River Nile and the water channels and its executive regulation.
- Law 93/1962 regulating the discharge of liquid waste to the public sewage network. The executive regulations of this law as amended by Minister of Housing decree 44/2000.
- Traffic law 66/1973 amended by law 121/2008 and updated in 2018
- Law 94/2003 on establishing the National Council for Human Rights (NCHR)
- Law 137/1981 governing labor relations and the duties of both employee and employer
- Law No. 117 of 1983 Amended by Law No. 12 of 1991 for the Protection of Archaeological Areas and Cultural Heritage
- Law No.44 / year 2000 sets the acceptable limits for using treated wastewater (WW) at three treatment levels, primary, secondary, and tertiary.
- The Egyptian Code of Design Principal and Implementation Conditions for Municipal Solid Waste Management Systems
- Egyptian Labor Law number 12/2003 and Decrees 134/2003 and 126/2003, and the Occupational Safety and Health Convention No. 155 ratified by Egypt. These laws require risk mitigation in workplaces, safety training, PPE provision, emergency response preparedness, and clear delineation of OHS responsibilities. The subproject will comply fully with these standards and integrate them into the OHSP and contractor obligations
- The National Occupational Safety and Health Regulations (Decree 211) and Occupational Safety and Health (OSHA) define the key risks

World Bank Environmental and Social Standards

The World Bank Environmental and Social Framework (ESF)[3] sets out the World Bank's commitment to sustainable development, through a Bank Policy and the ten Environmental and Social Standards (ESS) which are designed to guide borrowers to operate in compliance with good international practices in the key areas of environmental and social issues and impacts. The table below shows the 10 Environmental and Social Standards as stipulated by the WB and indicates their applicability to the Subproject.

[3] http://pubdocs.worldbank.org/en/837721522762050108/Environmental-and-Social-Framework.pdf

Environmental & Social Standard (ESS)	Title of the ESS	Applicability to the Subproject (Y/N)	Justification
ESS 1	Assessment and Management of Environmental and Social Risks and Impacts	Yes	ESS1 is relevant to this subproject due to the environmental and social risks and impacts associated with the activities, including those defined by the Environmental, Health, and Safety (EHS) Guidelines established by the World Bank Group
ESS 2	Labor and Working Conditions	Yes	ESS2 is relevant to this subproject due to the need for workers and health and safety impacts associated with the nature of subproject activities.
ESS 3	Resource Efficiency and Pollution Prevention and Management	Yes	ESS3 is relevant to this subproject due to activities involving consumption of resources and generation of pollution.
ESS 4	Community health, safety and security	Yes	ESS4 is relevant to the subproject due to possible risks and impacts on the community health and safety from subproject activities.
ESS 5	Land Acquisition, Restrictions on Land Use and Involuntary Resettlement	Yes	The land is state owned land. However, ESS 5 is relevant to this subproject due to the provision of alternative job opportunities for waste pickers through the Livelihood Restoration Plan.
ESS 6	Biodiversity Conservation and Sustainable Management of Living Natural Resources	Yes	No natural habitat or natural protectorate property issues, or habitat that include significant biodiversity value have been identified during site visits or desk studies, hence the risk of Subproject activities affecting natural habitats or natural protectorate property is considered minimal.

Environmental & Social Standard (ESS)	Title of the ESS	Applicability to the Subproject (Y/N)	Justification
ESS 7	Indigenous Peoples/Sub-Saharan African Historically Underserved Traditional Local Communities	No	No indigenous people are identified in connection the subproject's boundaries.
ESS 8	Cultural Heritage	Yes	ESS8 might not be relevant to the subproject given there are no archaeological sites in the subproject area. However, in case of finding any objects of cultural value a chance-finds procedure has been developed for the subproject.
ESS 9	Financial Intermediaries	No	Not Applicable
ESS 10	Stakeholder Engagement and Information Disclosure	Yes	ESS10 is relevant to the subproject due to the involvement of various stakeholders and complex implications of the subproject.

ENVIRONMENTAL AND SOCIOECONOMIC BASELINE

Project Area Surroundings

Abu Zaabal Dumpsite is located in Arab El-Olaykat village in Khanka District in Qalyubia Governorate. The site is surrounded by a variety of activities, as follows:

- Residential areas to the East, West and North, with distance less than 500 m.
- Al Akrasha industrial area adjacent to the east (at a 1 km distance), with several industries (covering an area of approximately 100 acres), including a currently non-operating facility for the separation and treatment of municipal waste (Khanka factory).
- A military area owned by the Ministry of Defense to the north (covering an area of approximately 200 acres).

- 13 medical incinerators owned by Ministry of Health. However, not all are currently operational. They fall at a distance less than 500 m.
- 3 artificial lakes resulting from previous mining activities and belonging to the Ministry of Petroleum and Mineral Resources (covering a total area of approximately 140 acres).
- Areas of backfilled lakes created randomly by locals (covering an area of approximately 15 acres).

Environmental Baseline

Climate: Qalyubia Governorate is characterized to have a subtropical desert climate. The majority of rain fall occurs during the months of, January, February, and March. Highest temperatures are recorded in July and August reaching 38 ºC.

Air Quality and Noise: Although spot sampling results showed compliance with National standards as well as the permissible limits of the International Finance Corporation (IFC) general ambient air quality standards, stakeholder interviews revealed recurring air quality issues. Residents reported smoke and emissions from waste fires, particularly in summer, and worsening air conditions when incinerators were offline. Visible smoke from the nearby medical incinerator suggests likely exceedances and uncontrolled air pollution.

Seismology: The subproject lies in the low-impact seismic zone.

Surface waters: The closest surface water receptor to the Abu Zaabal Dumpsite consists of three lakes formed by groundwater seepage and infiltration from the Ismailia Canal into former quarry pits. Water samples were collected upstream and downstream to assess contamination sources. Upstream groundwater showed acceptable pH, Dissolved Oxygen (DO), and low heavy metals, but elevated Total Dissolved Solids (TDS) and Electrical Conductivity (EC) levels. In contrast, Abu Zaabal Lake (downstream) showed significant water quality deterioration, with TDS up to 2,960 mg/L, EC reaching 4,873 µS/cm, and DO dropping to 3.1 mg/L below USEPA freshwater criteria. Chemical Oxygen Demand (COD) and Biological Oxygen Demand (BOD) values exceeded limits, indicating severe organic pollution, while chloride and heavy metals like lead and cadmium were notably higher than upstream levels. These results confirm substantial downstream contamination, likely from industrial or wastewater sources.

Biological Environment: The fauna in the area primarily includes birds, domestic animals, and agricultural pests such as insects, worms, and rodents.

Biodiversity: No protected areas or endangered species (there is no critical or high biodiversity values that might be affected) in the vicinity of the subproject.

Socioeconomic Baseline

Administrative Divisions: Qalyubia Governorate comprises 7 districts, 10 cities, 50 rural neighborhoods, and 147 villages. The Abu Zaabal Dumpsite is located in Arab El-Olaykat, part of Al Khanka City.

Gender Relations and Women's Status: Women face social and workplace restrictions, with limited access to industrial jobs and economic participation mainly in government roles, trade, and select factories.

Vulnerable Groups: Vulnerable groups include residents of nearby social housing, informal waste pickers (including children), and the dumpsite operator, all affected by health, livelihood, and environmental risks.
Health Services and Facilities: Arab El-Olaykat is served by one primary care facility which delivers essential services such as vaccinations, maternal and child healthcare, and basic outpatient care. For emergencies, residents depend on the Arab El-Olaykat Railway Hospital, approximately 1 kilometer away, and Abu Zaabal Hospital, 2-5 kilometers away in the adjacent village.
Water Services: Most households in Al Khanka use public tap water from the Al-Khanka Water Station, though residents report occasional impurities and use filtration at home.
Sanitation Services: About 75% of Al Khanka's population is connected to the sewage network; others rely on septic tanks or open drains, which contribute to odors and insect infestations.
Waste Management: Municipal waste is collected and sent to the Abu Zaabal Dumpsite; a new contract was signed in 2025 to improve local waste collection services.
Road Network and Access: The road network in Arab El-Olaykat and the Al Khanka area supports connectivity to the Abu Zaabal dumpsite but is constrained by poor infrastructure and limited transportation options.

IDENTIFICATION AND ASSESSMENT OF IMPACTS

This chapter addresses potential impacts of all planned subproject activities. Measures to avoid, reduce or compensate potentially significant negative impacts have been suggested in each case.

Overall Positive Impacts of the Subproject

With proper management, the Subproject tends to have a positive environmental & socioeconomic impact.

1. Environmental and Public Health Improvement

Positive impacts include the improvement of public health, environmental conditions and economic sustainability. Key benefits include preventing groundwater contamination, reducing toxic emissions and fire risks, lowering air pollution and odors, and minimizing health issues such as respiratory diseases, while also enhancing community well-being and property values.

2. Implementation of Resource efficiency measures (waste hierarchy)

The Abu Zaabal Dumpsite closure will include the implementation of resource efficiency measures such as use of C&D waste for the stability pads and fresh waste coverage

3. Reduction of GHG Emissions

The dumpsite closure will result in capturing and flaring about 184.7 million m^3 of landfill gas which would have otherwise been released into the environment as methane, a potent greenhouse gas. Flaring then combusts this methane into carbon dioxide and water vapor. Although carbon dioxide is still a greenhouse gas, its global warming potential is significantly lower than that of methane, leading to a net benefit for air quality and climate change mitigation.

4. **Improvement of Quality of water in the lakes**

According to the geotechnical report prepared by the design consultant, geophysical investigations revealed that fluid seepage pathways have formed within the waste body at the site, draining toward the lakes. Although the dumpsite is not the sole source of contamination to the lakes, it is a significant contributor. Installing leachate collection and treatment is expected to improve the water quality in the lakes and the surrounding area.

5. **Restoration of Livability and Property Value**

As outlined in the Local Communities Adjacent to Abu Zaabal Dumpsite baseline subsection, residents who previously left their homes due to the dumpsite's adverse impacts are expected to return after its closure. Additionally, the decline in property values is anticipated to reverse.

6. **Direct Job Opportunities for Skilled and Semi-Skilled Laborers**

The subproject will generate a variety of direct employment opportunities. An estimated total of 150 workers may be required across all phases and activities. Key roles across the subproject components include specialized teams for civil works, fresh waste reception, and post-closure activities. Civil works require drivers, engineers, safety officers, and various skilled trades such as excavation workers, masons, electricians, and civil engineers for reshaping and infrastructure construction. The fresh waste reception phase involves waste handlers, equipment operators, and site supervisors, while the post-closure phase includes environmental technicians, maintenance workers, and security guards to ensure long-term site functionality and compliance.

7. **Indirect Job Opportunities and Supply Chain**

The subproject is expected to generate indirect economic benefits in the surrounding area. These will arise from increased demand for services such as transportation, catering, cleaning, security, and supply of construction materials and equipment. Local drivers, service providers, and vendors will benefit from supporting the workforce and subproject operations.

Negative Impacts of the Subproject

The project is subject to a number of impacts during the different phases of the project, namely, civil works, receival of fresh waste and post closure activities phases.

Environmental Impacts across the different Sub-project Activities

EHS Aspect / Risk	Sensitive Receptors	Pre-Closure Phase (Civil Works)		Fresh Waste Reception Phase (Zone 2)		Post-Closure Phase	
		Source of Impact	Significance-Pre-Closure	Source of Impact	Significance-Fresh Waste	Source of Impact	Significance - Post-Closure
Air Emissions	Communities, workers, ambient air	Equipment dust, exhaust, landfill gas exposure	**Major**	Odors, VOCs, exhaust from waste transport	**Major**	Flaring emissions, leaks from gas system	**Moderate**
Noise and Vibration	Communities, workers	Heavy machinery and waste movement noise	**Major**	Noise from compactors, trucks, waste handling	**Major**	Noise from pumps, blowers (localized)	**Minor**
Soil & Groundwater Contamination	Soil, groundwater, lakes, canal	Waste disturbance, leachate infiltration	**Moderate**	Leachate from fresh waste	**Moderate**	Leachate overflow, liner faults, sludge risks	**Moderate**
Improper Waste Management	Workers, communities, environment	Excavated, construction waste mishandling	**Moderate**	Poor handling, illegal waste, exposure risks	**Major**	Improper sludge handling	**Minor**
Biodiversity – Habitat Loss	Birds, small fauna, communities, farms	Habitat disturbance, scavenger displacement	**Major**	Limited scavenger activity, disruptions	**Major**	Rodents/insects near evaporation ponds	**Major**
Surface Water – Lakes	Lake (low sensitivity)	Sediment/runoff into lake	**Minor**	Leachate seepage to lake	**Moderate**	Long-term sludge/seepage risks	**Moderate**
Surface Water – Ismailia Canal	Ismailia Canal (high sensitivity)	Indirect leachate to canal	**Moderate**	Leachate migration to canal	**Moderate**	Long-term leachate to canal	**Moderate**
Risk to Cover Layers	Workers, landfill integrity	Liner damage during installation	**Major**	Cover damage from access, worker movement	**Major**	Settlement, wear damage to covers	**Major**
Natural Disasters	Workers, infrastructure, environment	Disruption from flooding, heat, seismic activity	**Minor**	Same as civil works	**Minor**	Damage from natural events (low likelihood)	**Minor**

Social Impacts across the different Sub-project Activities

Social Aspect / Impact		Pre-Closure Phase		Fresh Waste Phase		Post-Closure Phase	
	Sensitive Receptors	Source of Impacts	Significance - Pre-Closure	Source of Impacts	Significance - Fresh Waste	Source of Impacts	Significance - Post-Closure
Labour & Working Conditions	Workers	Poor working conditions in waste sector	**Moderate**	Poor working conditions in waste sector	**Moderate**	Poor working conditions in waste sector	**Moderate**
Livelihoods	Waste pickers, operator	Loss of access for waste pickers	**Major**	NA			
Temporary Labour Influx	Workers, local residents	Influx of external workers, potential tensions	**Moderate**	Similar influx risks persist	**Moderate**	N/A	
Road Traffic & Transportation	Workers, roads, residents	Heavy vehicle movement, traffic risks	**Major**	Fresh waste transport traffic impacts	**Major**	Occasional traffic and equipment transport	**Moderate**
SEA/SH	Women, workers, nearby communities	Risk of harassment due to male labor influx	**Moderate**	Risk of harassment due to male labor influx	**Moderate**	N/A	
Public Resources & Utilities	Utilities, industrial & residential users	Electricity, water, sewage use for operations	**Minor**	Electricity demand for systems	**Minor**	Increased long-term electricity demand	**Moderate**
Child Labour	Children	Children may be involved in hazardous roles	**Major**	Risk of child labor in unsafe roles	**Major**	N/A	
Cultural Heritage	Cultural heritage sites	Chance of uncovering archaeological finds	**Minor**	N/A			
Occupational Health & Safety (OHS)	Workers	Exposure to physical, chemical, biological risks	**Major**	Exposure to physical, chemical, biological risks	**Major**	Ongoing OHS risks from systems	**Major**

Community Health & Safety	Nearby communities	Air, water, noise, vector-borne disease risks	**Major**	Health, fire, unauthorized access risks	**Major**	Fire, emissions, safety risks, gas emissions	**Major**

ENVIRONMENTAL & SOCIAL MANAGEMENT & MONITORING PLAN (ESMMP)

The objective of the (ESMMP) is to outline actions for minimizing or eliminating potential negative impacts, as well as to monitor the implementation and performance of mitigation measures. Chapter 8 of this report addresses the ESMMP for different receptors, identifies roles and responsibilities for implementation, as well as the monitoring of mitigations during the construction and operation phases of the project.

Institutional Setup

Effective implementation relies on coordination among several key entities:

- **Main Contractor**: Implements the C-ESMP, appoints one Environmental Specialist, one Social and Gender Specialist, and three OHS Specialists (including a supervisor). Responsible for training, monitoring, recordkeeping, and ensuring subcontractor compliance.
- **Project Coordination Unit (PCU)**: Based within the Ministry of Environment, coordinates subproject implementation, supported by technical consultants throughout design and execution.
- **Supervision Consultant**: Includes environmental, social, and OHS specialists. Oversees contractor compliance, monitors field activities, and reports progress to the PCU.
- **Ministry of Local Development (MoLD)**: Leads Component 2 of the GCCC project and oversees subproject implementation in partnership with Al Qalyubia Governorate.
- **Al Qalyubia Governorate (QG)**: Supervises implementation locally, particularly in the post-closure phase, through the Al Khanka Local Unit and Solid Waste Management Unit (SWMU) E&S Management Team.
- **Environmental Unit within QG**: Reviews EIAs, conducts inspections, and monitors compliance.
- **Waste Management Regulatory Authority (WMRA)**: Ensures compliance with national waste management law and closure standards.

Roles and Responsibilities by Phase

1. **Civil Works Phase**

    - **Main Contractor**: Implements the C-ESMP, provides regular monitoring data, trains staff, and submits monthly ESHS reports.
    - **Supervision Consultant**: Ensures compliance, monitors activities, provides guidance, and submits progress reports to the PCU.
    - **PCU**: Reviews reports, addresses challenges, and ensures alignment with national standards.
    - **TIU (QG, MoLD, WMRA)**: Oversees policy coordination, operator performance, and integration of technical inputs.

2. **Fresh Waste Reception Phase**

    - **Main Contractor**: Implements ESMP measures for waste handling, rejects hazardous waste, ensures OHS compliance, and reports on waste characteristics.

- **Supervision Consultant**: Verifies compliance, monitors waste management, and supports on-site adjustments.
- **PCU & TIU**: Review reports, coordinate responses, and ensure adherence to project goals and safeguard requirements.

3. **Post-Closure Phase**

- **Qalyubia Governorate**: Leads site supervision, monitors leachate and gas systems, and ensures site integrity.
- **MoLD**: Provides strategic oversight, reviews reports, and ensures long-term alignment with GCCC objectives.
- **Contractor (if assigned)**: Carries out maintenance and monitoring under QG and MoLD supervision.

Stakeholder Engagement Activities

Stakeholder engagement is a key component of impact assessment best practices, and a requirement under the WB ESS 10 and the EEAA mandates for subprojects with moderate to high environmental risk and impact. The stakeholder engagement activities for the Abu Zaabal Dumpsite subproject aimed to ensure meaningful participation and address key concerns. The objectives included gathering community feedback, identifying impacts, enhancing subproject design, promoting inclusivity, facilitating collaboration, informing and educating, and ensuring compliance. Engagement activities have been ongoing since March 2024. Stakeholder consultations were primarily carried out through key-informant interviews and focus group discussions. The outcomes of the consultations were shared and deliberated with the design consultant and were incorporated in the final dumpsite closure design. Following the drafting of the ESIA report, a public consultation session was conducted on February 25, 2025.

Grievance Redress Mechanism

A detailed subproject Grievance Redress Mechanism (GRM) was developed in line with WB ESS 10 and communicated to the subproject stakeholders. To ensure the effectiveness and comprehensiveness of the GRM, the following key principles were adopted: accessibility and participation, fairness and justice, responsiveness and effectiveness, privacy and confidentiality, preventing the risk of retaliation, and including channels dealing with grievances related to sexual exploitation and abuse and sexual harassment. The GRM establishes clear timelines for acknowledgment, updates, and final feedback to the complainant.

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Table of Abbreviations

Abbreviation	Description
AF	Additional Finance
AoI	Area of Influence
AQM	Air Quality Management
BSA	Baseline Site Assessment
CAP	Corrective Action Plan
CBO	Community Based Organization
CIA	Cumulative Impact Assessment
CoC	Code of Conduct
CTA	Cairo Transport Authority
EEAA	Egyptian Environmental Affairs Agency
EIA	Environmental Impact Assessment
EPRP	Emergency Preparedness and Response Plan
ESCP	Environmental and Social Commitment Plan
ESIA	Environmental and Social Impact Assessment
ESMF	Environmental and Social Management Framework
ESMMoP	Environmental and Social Management and Monitoring Plan
ESMP	Environmental and Social Management Plan
ESS	Environmental and Social Standards
FGD	Focus Group Discussion
GCA	Greater Cairo Area
GCCC	Greater Cairo Air Pollution Management and Climate Change Project
GEF	Global Environment Facility
GHGs	Greenhouse Gases
GoE	Government of Egypt
GRM	Grievance Redress Mechanism
IFC	International Finance Corporation
IIBP	International Industrial Best Practices
LGU	Local Governmental Units
LMP	Labor Management Procedures
LRP	Livelihood Restoration Plan
M&E	Monitoring and Evaluation
MoE	Ministry of Environment
MoLD	Ministry of Local Development
NGO	Non-governmental Organization
OHS	Occupational Health and Safety
PAD	Subproject Appraisal Document
PAPs	Subproject Affected Persons
PCU	Subproject Coordination Unit
PMP	Pest Management Plan
POM	Subproject Operational Manual
PPE	Personal Protective Equipment
PS	Performance Standard
RAP	Resettlement Action Plan
RF	Resettlement Framework
SEA/ SH	Sexual Exploitation and Abuse and Sexual Harassment
SEP	Stakeholder Engagement Plan
SW	Solid waste

Abbreviation	Description
SWM	Solid Waste Management
TIA	Traffic Impact Assessment
TIUs	Technical Implementation Units
ToR	Terms of Reference
uPOPs	unintended persistent organic pollutants
WB	World Bank
WMP	Waste Management Plan
WMRA	Waste Management Regulatory Authority

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1 Introduction

1.1 Background

The Ministry of Environment is implementing the Greater Cairo Air Pollution Management and Climate Change Project, financed by the World Bank (WB), to reduce air and climate pollution and increase resilience in Greater Cairo (Cairo, Giza, and Qalyubia governorates) in collaboration with various stakeholder ministries and agencies including the Ministry of Local Development (MoLD), Waste Management Regulatory Authority (WMRA), Qalyubia Governorate (QG), and Cairo Transport Authority (CTA). The Environmental and Social Commitment Plan (ESCP), part of the loan and grant agreements, outlines necessary measures and actions such as institutional arrangements, staffing, training, monitoring, reporting, and grievance management, while specifying environmental and social instruments to be adopted under the World Bank's Environmental and Social Standards (ESS). An Environmental and Social Management Framework (ESMF) and a Resettlement Framework (RF) have been prepared for the entire subproject in accordance with both the WB ESS's and national regulations, and an Environmental and Social Impact Assessment (ESIA) was conducted for specific components including the Qalyubia Sanitary Landfill, the shared construction and demolition waste treatment facility, and the general access road. Labor Management Procedures (LMP) and a Stakeholder Engagement Plan (SEP) have also been prepared, with the overall environmental and social risk classification of the subproject being High.

1.2 The Greater Cairo Air Pollution Management and Climate Change Project Components

The Project focuses on two main sources of air pollution: solid waste management and vehicle emissions in GC region. The Project is divided into six main components: Component 1: Enhancing the Air Quality Management (AQM) and Response System; Component 2: Support the Operationalization of Solid Waste Management (SWM) Master Plans in GC; Component 3: Vehicle Emission Reduction; Component 4: Communication and Stakeholders Engagement; Component 5: Subproject Management and Monitoring and Evaluation (M&E); and Component 6: Enhanced E-Waste and HCW management for Reduction of uPOPs.

Component 2 of the subproject focuses on supporting the operationalization of Solid Waste Management (SWM) master plans in Greater Cairo. It aims to improve SWM services in accordance with each Governorate's specific needs. This component has three subcomponents: Subcomponent 2.1 involves waste management infrastructure, Subcomponent 2.2 supports response to the COVID-19 pandemic and improves healthcare waste management, and Subcomponent 2.3 focuses on enabling activities, capacity building, and institutional strengthening.

The Abu Zaabal Dumpsite closure, hereinafter referred to as the sub-project, is part of Subcomponent 2.1, which focuses on improving waste management infrastructure to reduce air pollution and climate emissions. This includes developing the Integrated Waste Management Facility (IWMF) at 10th of Ramadan, rehabilitating dumpsites like Abu Zaabal, establishing

hazardous waste disposal sites, constructing environmentally controlled transfer stations, and upgrading recycling infrastructure.

1.3 ESIA Objectives

This report provides the Environmental and Social Impact Assessment (ESIA) for the closure of the Abu Zaabal Dumpsite in Qalyubia Governorate. The primary purpose of the document is to identify, assess, and propose measures/actions to effectively manage potential direct, indirect, and cumulative environmental and social impacts associated with the closure and rehabilitation of the site. The assessment covers all relevant phases, providing a comprehensive understanding of the site's impact throughout its different phases, namely, closure, interim phase of waste receival and post-closure management described in more detail in section **2**. More specifically, key objectives of this ESIA are as follows:

- Describe the subproject's components and activities relevant to the environmental and social assessments.
- Identify applicable national and international legal requirements and guidelines.
- Assess the baseline status of environmental and social conditions.
- Evaluate potential site-specific direct, indirect and cumulative environmental, social, and health and safety impacts.
- Develop environmental and social management and monitoring plans in compliance with relevant legislation.
- Establish the roles and responsibilities of all parties involved in the subproject's environmental and social management.
- Document key environmental and social concerns raised by stakeholders during public consultation activities.
- Ensure the existence of a Grievance Redress Mechanism (GRM) for lodging and handling complaints.

1.4 ESIA Methodology

The Environmental and Social Impact Assessment (ESIA) was conducted using a combination of primary and secondary data sources, including desktop research, field site visits, environmental measurements, and stakeholder consultations. The assessment ensures compliance with national regulations and the World Bank Environmental and Social Framework (ESF).

1. Data Collection and Baseline Assessment

To establish baseline conditions, the ESIA process incorporated multiple methods:

- Field Surveys & Measurements such as air and noise measurements
- Stakeholder Consultations to engage local communities and relevant stakeholders to assess concerns and gather mitigation recommendations.
- Desktop Study to reviewing reports, legislation, and online resources to evaluate the environmental and socio-economic conditions of the project area, existing solid waste

management systems, and regulatory frameworks, including relevant technical reports created by the technical consultant.

- Site Visits & Field Observations:
    - The initial site visit to **Abu Zaabal Dumpsite** on April 2, 2024, identified key environmental and social concerns.
    - Subsequent specialized visits were conducted to further investigate these findings through targeted measurements and assessments.

2. **Coordination with technical consultant:**

From the early stages of the ESIA, a coordination and communication channel was established with the Technical Advisory Consultant to ensure alignment with:

- Technical design documents.
- Engineering surveys and feasibility studies.
- Environmental and social considerations in line with national and international standards.

3. Impact Assessment & Management covering three key phases:

Project activities were grouped into phases to simplify the assessment, as activities within each phase are expected to have similar impacts.

- Civil Works Phase – Assessing potential construction-related impacts.
- Fresh Waste Reception Phase – Evaluating operational impacts.
- Post-Closure Phase – Addressing long-term environmental and social implications.

Since the phasing does not reflect exact timing or spatial distribution, potential overlaps between activities across phases are considered in the cumulative impact assessment.

4. Cumulative Impact Assessment

Cumulative Impact Assessment was conducted to examine potential combined effects due to receiving fresh waste and closure works taking place simultaneously

5. Environmental and Social Management and Monitoring Plan

To mitigate risks, an Environmental and Social Management Plan (ESMP) which followed the same phasing introduced above. A monitoring plan was then developed to monitor parameters.

2 Abu Zaabal Dumpsite Closure Description

2.1 Background

Abu Zaabal Dumpsite was originally planned for closure in 2021, but remains in operation due to the absence of a fully functional alternative and the limited capacity of the El Obour landfill, the second waste disposal dumpsite in Qalubia Governorate. Abu Zaabal Dumpsite is located in Arab El-Olaykat occupying an area of 106 feddans.[4]. The dumpsite continues to receive approximately 1,570 tonnes of municipal solid waste (MSW) daily from various areas within the governorate.

Figure *2-1*: Abu Zaabal Dumpsite in Qalyubia Governorate, Egypt

Abu Zaabal functions as an open dump without containment measures or engineered barriers, and both past and ongoing waste disposal activities were non-compliant with recognized safety and environmental standards.

This has resulted in significant environmental degradation, including contamination of air, soil, surface water, and groundwater in the surrounding area. The site also experiences frequent fires and smoke emissions due to the lack of compaction as shown in **Figure 2-2:**.

[4] Draft Geotechnical investigation Report

Figure 2-2: Conditions at Abu Zaabal Dumpsite.

Urban expansion has led to the development of residential and other land uses near the dumpsite, increasing the negative effects on surrounding communities. The baseline environmental assessment in section 4.1 further elaborates on these conditions. Additionally, groundwater, subsurface water, and surface water seepage have resulted in the formation of Arab El-Olaykat lakes, as shown in the accompanying figure.

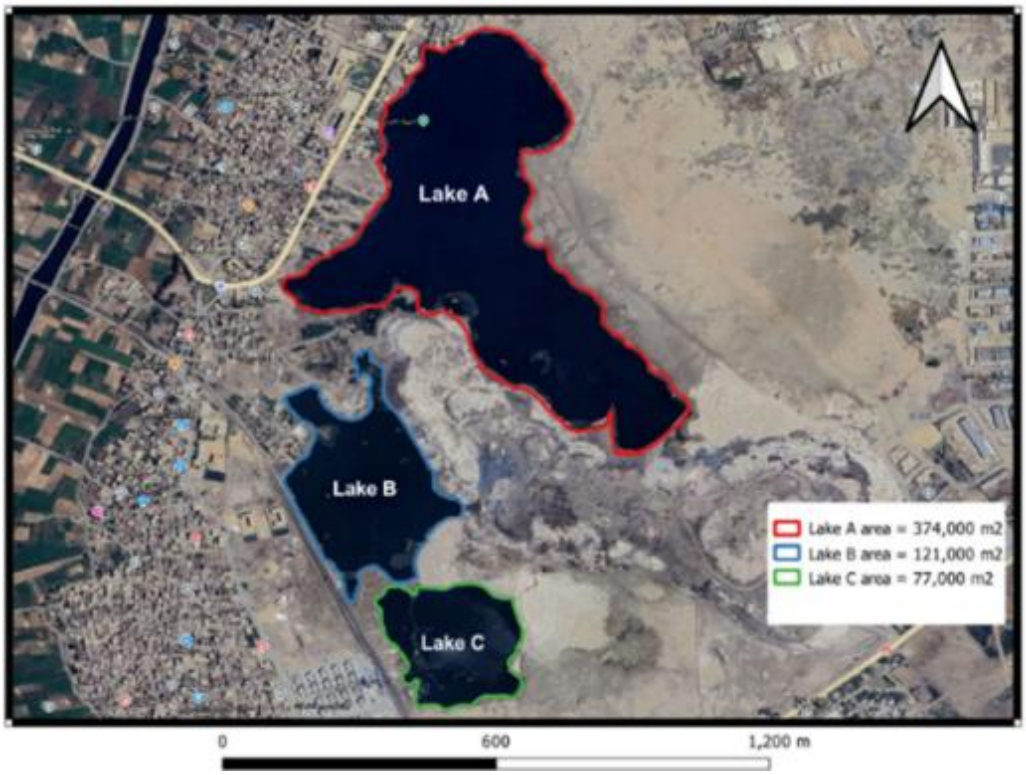


Figure 2-3: Arab El-Olaykat Lakes

The closure of Abu Zaabal will be carried out alongside the development and commissioning of the first cell of Qalubia Governorate Sanitary landfill at 10th of Ramadan IWMF, ensuring a structured transition and diversion of waste.

2.2 Project Layout and Design Concept

To prepare the site for closure, the Abu Zaabal Dumpsite will be reshaped and covered to ensure long-term stability and environmental protection. To achieve this, the site has been divided into two areas, referred to in this document as "Zone 1" and "Zone 2." These zones will be closed one after the other rather than all at once to ensure waste disposal operations continue without disruption. The final waste body, once both phases are closed, will have gradual sloped sides and a service road around its base to facilitate maintenance and monitoring. Terraces will be introduced at different heights to enhance stability and allow for future upkeep.

Zone 1 will be closed first, while Zone 2 will continue to receive waste from Qalyubia Governorate. To create space for fresh municipal solid waste, part of the historical accumulated waste in Zone 2 will be transported to Zone 1. Additionally, some of the existing waste in Zone 1 will be repositioned within the same area to achieve proper leveling. This process ensures a stable surface before the cover layers are applied.

To safely manage landfill gases, an active gas collection system will be installed and connected to a treatment unit. Additionally, two evaporation ponds will be constructed to handle liquid waste (leachate) extracted from the waste body.

Once the final cover is applied, the site will be maintained through regular monitoring and upkeep to ensure environmental safety and long-term stability.

At the site entrance, approximately five feddans will be cleared of waste to accommodate essential facilities, including a gas treatment unit, administrative buildings, parking, and landscaped areas.

The overall site layout is shown in the figure below

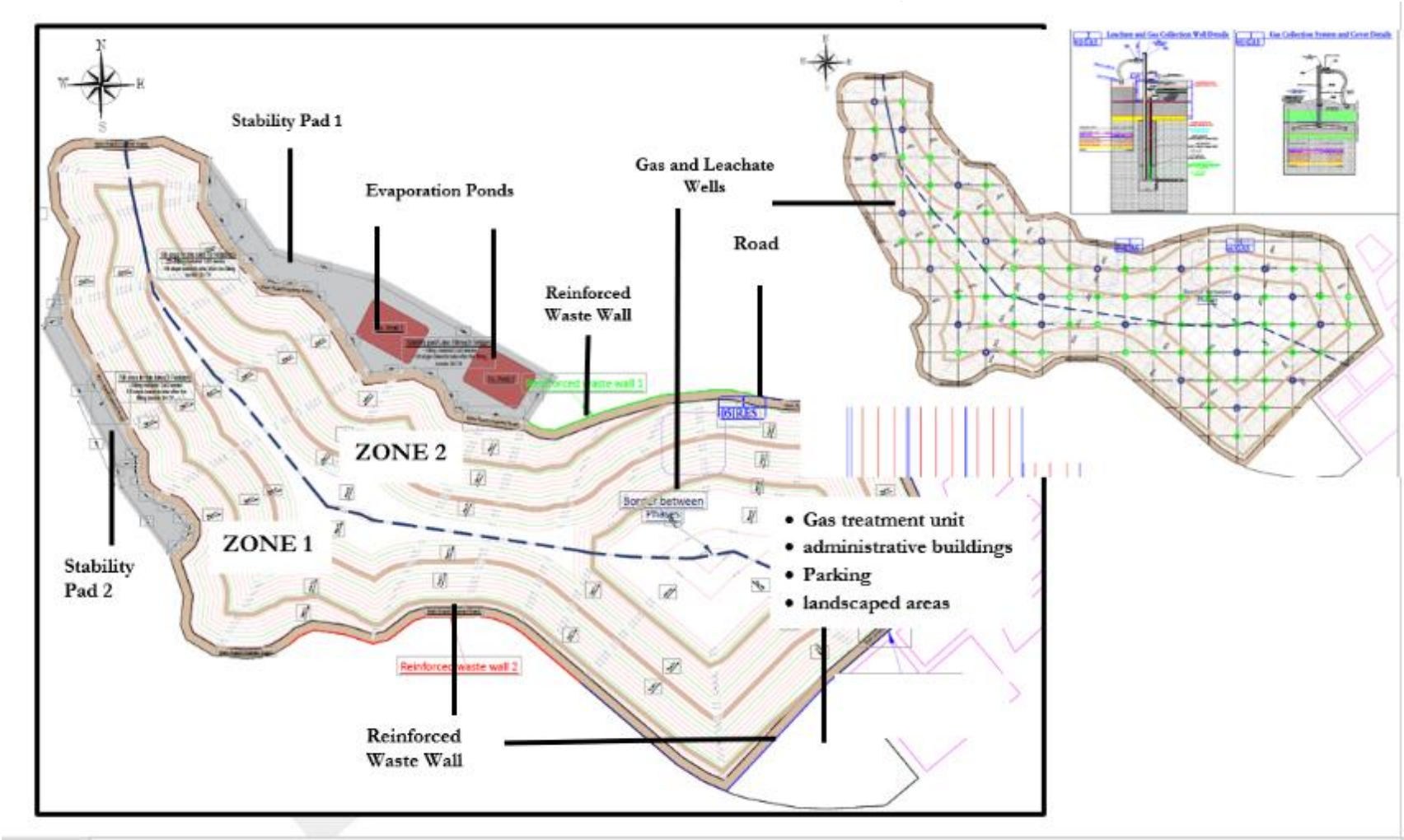


Figure 2-4: Abu Zaabal closure Layout

2.3 Subproject Components

2.3.1 Stability Structures

Ensuring the stability of the dumpsite is essential for its safe closure and long-term environmental integrity. Given the large volume of waste and the varying site conditions, two key stabilization measures will be implemented.

Before construction begins in each zone, a reinforced waste wall will be built around it to support steeper slopes and maintain structural stability. This structure, strengthened with geogrid layers, will help distribute weight evenly, prevent erosion, and ensure the long-term safety of the site.

Additionally, some areas of the dumpsite, particularly where waste was historically disposed of in water bodies, require further stabilization. To prevent ground instability, specific sections of the site will be reinforced with stability pads using rockfill or bulky construction and demolition waste (CDW). as shown in Figure 2-5.

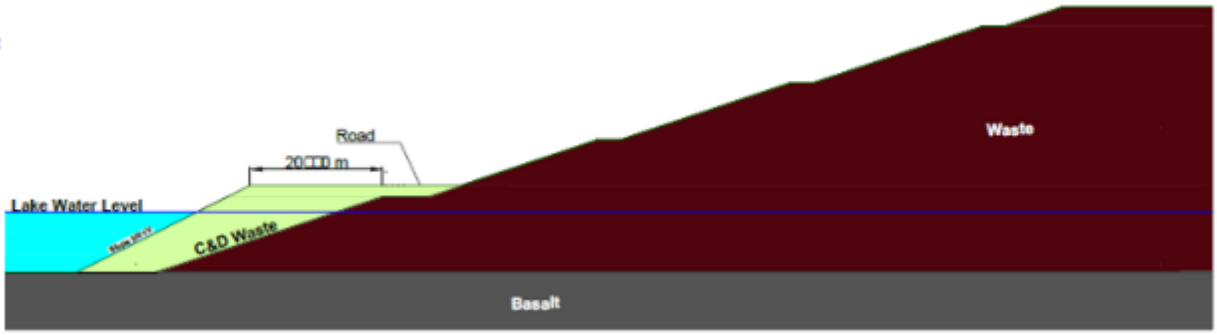


Figure 2-5: Stability pads using C&D waste

2.3.2 Final Top Cover

The waste dumpsite will be covered with a final top cover with layers as follows in order from the bottom up:

- Final Compacted Waste Layer: Provides a stable foundation for the cover system and prevents uneven settlement over time.
- Separation Layers (Geotextile): Placed between various layers to prevent mixing of materials and maintain the integrity of each functional layer.
- Sand Bedding Layer: Protects underlying components and provides a stable base for drainage layers.
- Gas Drainage Layer (Gravel): Allows landfill gases to escape safely, preventing pressure buildup and reducing the risk of explosions or uncontrolled emissions.
- High density polyethylene (HDPE) Layer: Acts as a barrier to prevent rainwater infiltration, reducing the formation of leachate that could contaminate groundwater.

- Stormwater Drainage Layer (Gravel): Facilitates proper water runoff to prevent erosion and control surface water accumulation.

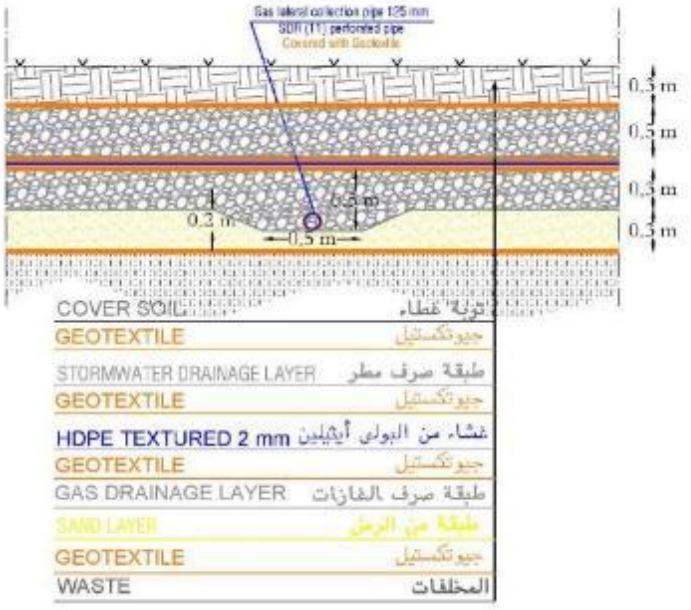


Figure 2-6: Lining layers

2.3.3 Landfill Gas Collection and Treatment System

An active gas collection system will be installed to extract landfill gas and route it to a treatment unit with two flare units. The system includes 88 gas wells, 23 of which will also facilitate leachate extraction through separate piping. Gas collection and treatment will be managed through two separate networks, a northern and a southern line.

The landfill gas management system consists of two collection types: horizontal pipes integrated into the gas drainage layer and combined vertical wells that collect both landfill gas and leachate. Gas is transported through a network of pipes to 16 substations, where flow regulation ensures stable gas quantity. The extracted landfill gas will be treated using two high-temperature flares, installed east of the dumpsite.

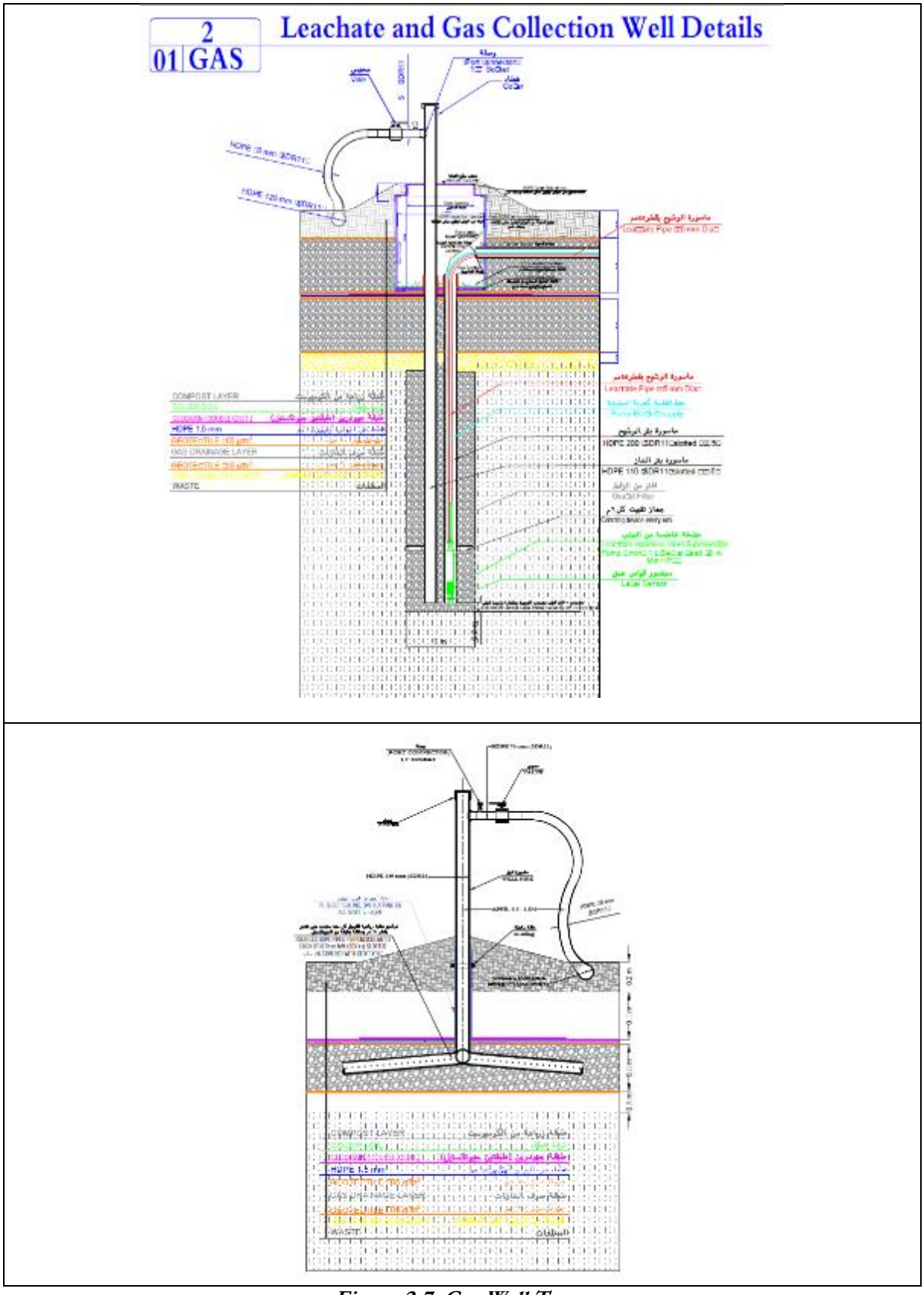


Figure 2-7: Gas Well Types

2.3.4 Leachate Collection and Treatment System

The leachate management system includes submersible pumps installed in vertical gas wells to extract leachate, reducing its level above the lake and improving gas collection efficiency. The extracted leachate is directed through a network of pipes to a main collection line, which transports it to two evaporation ponds. These ponds, covering a total area of 2 feddans, are located over the stability pad to enhance site stability while facilitating the evaporation of up to 35 m³ of leachate per day.

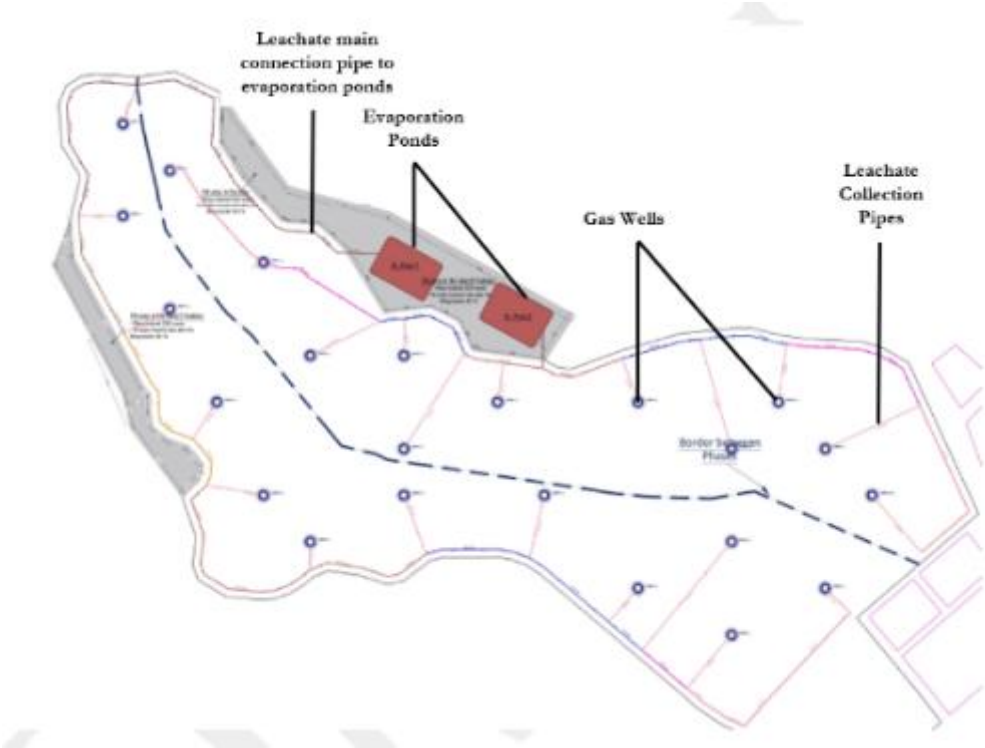


Figure 2-8: Leachate system details with evaporation pond connection

The location of the evaporation ponds is shown in the figure below.

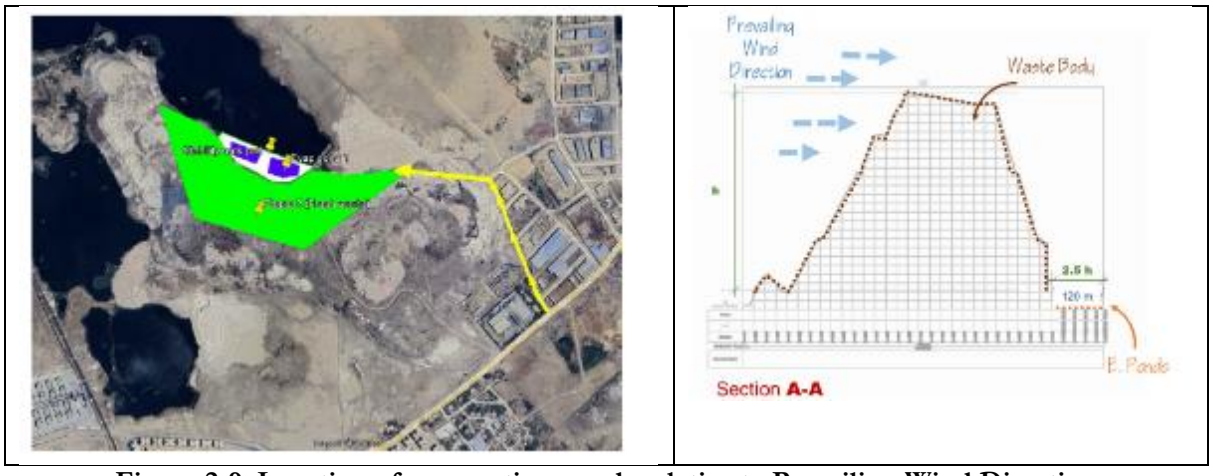


Figure 2-9: Location of evaporation ponds relative to Prevailing Wind Direction

Evaporation ponds will be fully lined to contain the leachate and contaminants inside and avoid any leakages and act as contaminant migration to the soil or groundwater. The lining layers from the bottom up consist of a compacted subgrade, a Geotextile Clay Liner (GCL), a textured HDPE layer for containment, a protective geotextile layer, and a concrete layer for durability and stability lakes as shown in figure Figure 2-10.

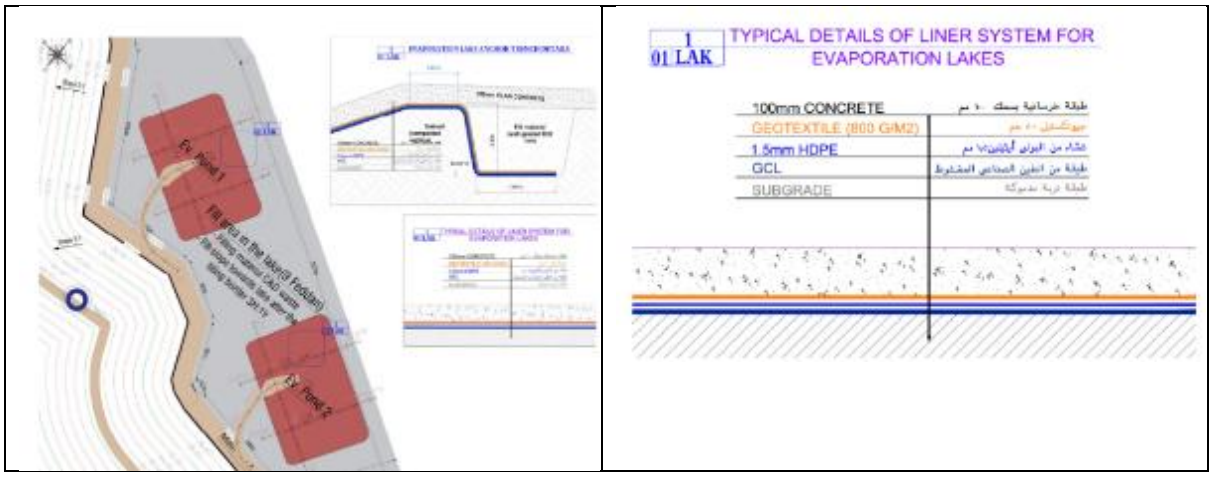


Figure 2-10: Lining Layers

2.3.5 Internal Roads and paved areas

A surrounding road at slope toe and steps with lighting, drainage, wheel cleaning and signs will serve the purpose of maintenance and body stability. An access road will be constructed to the evaporation ponds area.

The site will also have a ramp leading to zone 2 and another leading to zone 1 as illustrated below.

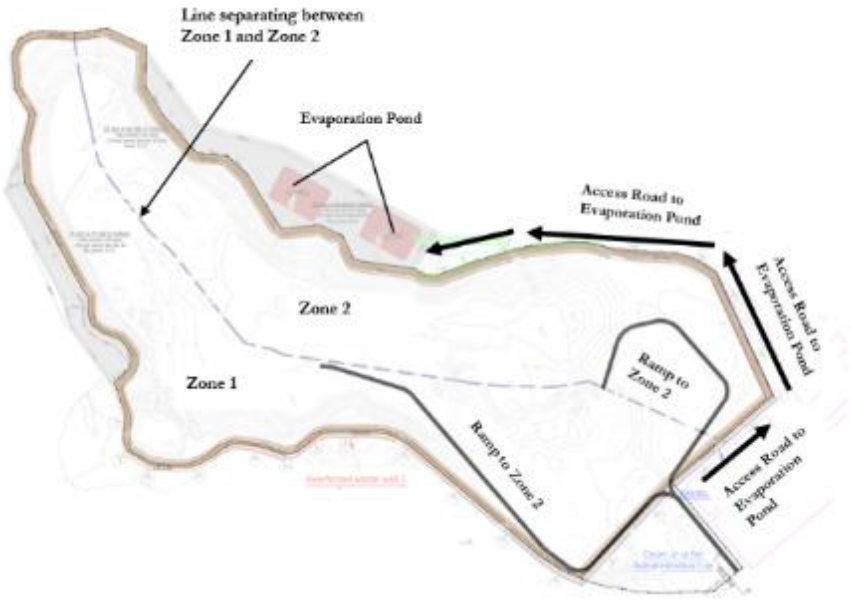


Figure 2-11: Surrounding Road and access ramps leading to zone 1 and zone 2

2.3.6 Area Facilities

The following facilities and security components will be introduced prior to commencement of works:

- Administrative area and labor building
- Guardroom
- Car parking
- Main gate and Fence
- Equipment' parking shed
- Loading vehicles parking
- Weighbridge control room
- Weighbridge
- Landscaping
- Access Road
- Septic tank

2.4 Subproject Phases and Activities

This section summarizes all on-site activities following the completion of the planning, design/feasibility, and tendering stages. These activities were assessed for environmental, social and health and safety impacts.

To streamline the assessment, the Consultant categorized them into three phases, grouping similar activities together as follows:

4. **Civil works phase:**
    a. Emptying of void space from zone 2 and transferring them to zone 1
    b. Clearing space for buildings in zone 1
    c. Reshaping of waste dump body, construction of stability structures (waste wall and stability pads), installation of final top cover, drilling of landfill gas wells and laying of leachate collection pipes in both zone 1 and zone 2
    d. Construction of evaporation ponds
    e. Installation of gas treatment System
    f. Construction of ancillary infrastructure.
5. **Receiving of fresh waste phase**: Will include the receipt of fresh waste in zone 2.
6. **Post closure phase:** According to the Egyptian Code, no activities are allowed on the waste body of closed/covered landfills for at least 15 years. The European Union guidelines specify a post-closure care period of 30 years. In compliance with the Egyptian Code, constructing buildings on the waste body is prohibited. However, lightweight structures consisting of a single floor may be permitted after the post-closure care period, following the relevant codes. Post closure activities will therefore only consist of aftercare activities which will be carried

out using specialized equipment for gas management, leachate control, soil stabilization, vegetation maintenance, and environmental monitoring.

The phases group similar activities to streamline impact assessment, as they are expected to result in similar impacts. The phasing does not consider potential overlaps in timing, where some activities within a single phase may occur at different times and could coincide with activities from other phases. It also does not account for how activities are distributed across different areas of the site.

Time overlaps are captured and addressed in the cumulative impact assessment. The activities within each of the phases is summarized in the block diagram below.

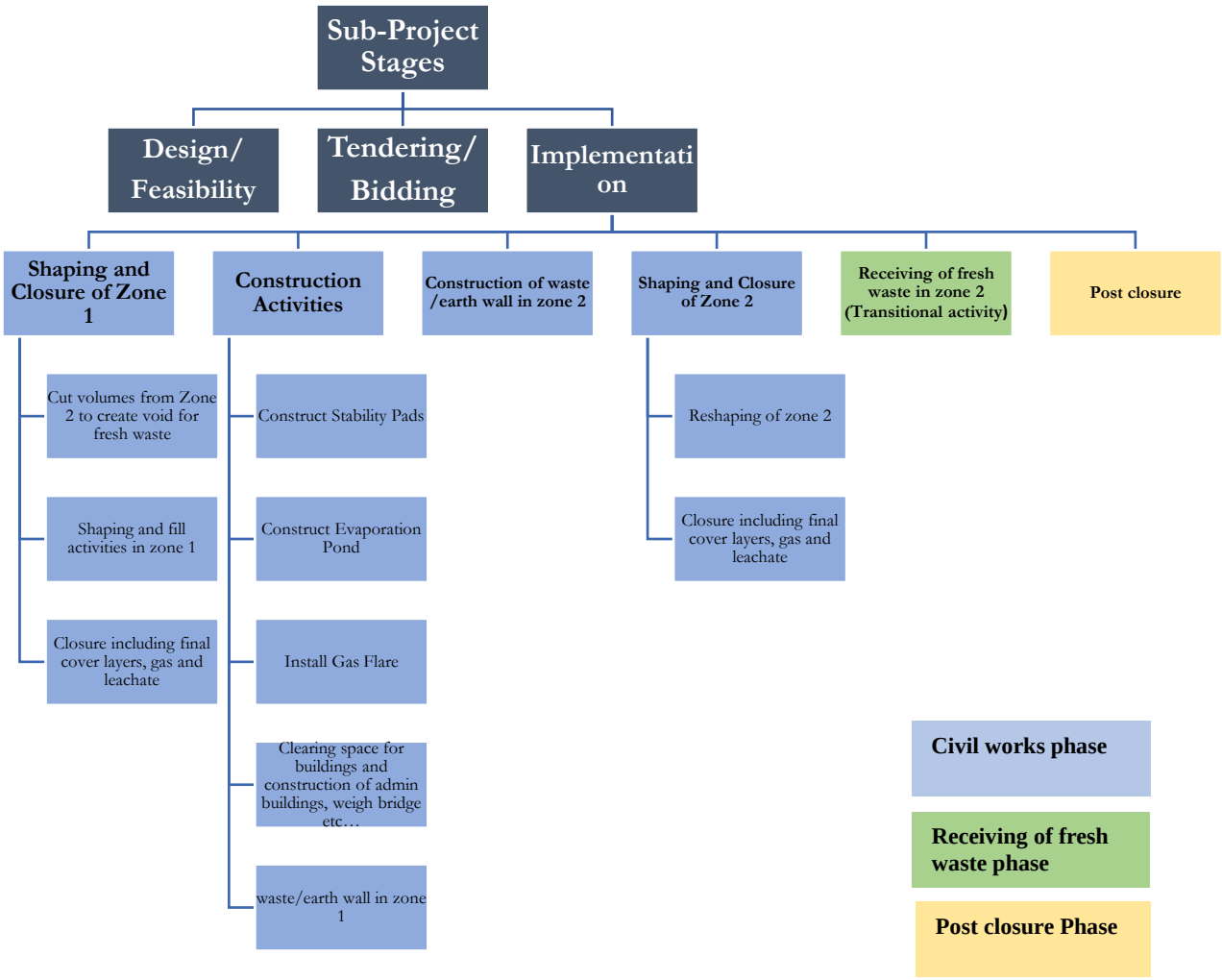


Figure 2-12: Subproject activities

The table below outlines the sub-activities involved in each phase. These sub-activities are considered the potential impact-generating activities, and hence, provide a basis for the impact assessment.

Table2-1: Sub-Activities by phase

Phase	Activities	Sub-Activities
Civil works phase	Emptying of void space from zone 2 and transferring them to zone 1	• Excavation of waste • Hauling of Waste
	Reshaping of waste dump body	• Cutting 334232.40 m3 and filling 1391535.18 m3 of historical waste in zone 1 • Cutting 727057.29 m3 of historical waste from zone 2 and filling 1257263.66 m3 for stability purposes • Hauling waste and relocating • Compaction
	Construction of waste wall	Excavation and installation of geogrid
	Construction of stability pad	Backfilling C&D waste in lake
	Installation of dumpsite final top cover	• Laying of protective layer and levelling • Laying of lining layers
	Installation of landfill gas collection and treatment	• Drilling and installation of landfill gas wells • Placement of gas collection pipes • Connection to the gas extraction system • Sealing and testing of wells for efficiency • Integration with the landfill gas treatment system • Installing Flaring systems or gas-to-energy units • Installing monitoring probes and gas analyzers
	Laying of leachate collection pipes	• Laying of leachate collection pipes in Zone 1 and Zone 2 • Installation of protective layers and drainage materials • Connection to the leachate treatment system • Testing and inspection to ensure proper functionality
	Construction of evaporation ponds	• Excavation of waste • Leveling • Laying of protective layer and levelling • Laying of lining layers
	Installation of gas treatment System	• Land clearing and levelling • Installation of gas treatment system (flaring)

Phase	Activities	Sub-Activities
	Construction of ancillary infrastructure including: • Solar pole • Guardroom building • Administration building • Weighbridge control room • Main gate and Fence • Equipment' parking shed • Loading vehicles parking	• Land clearing and levelling • Soil replacement under foundations and compaction • Concrete pouring for foundations and structural elements • Backfilling with clean sand • Wire mesh for fence • Installing fire alarm • Electric components • Water supply to buildings • Sewage works (utilities) • Finishing • Soil compaction and grading for landscaping • Planting vegetation for erosion control • Creating tree barriers for protection.
	Marginal road	• Clearing debris and leveling the area. • Grading and compacting the natural soil for subgrade preparation • Laying and compacting a layer of granular material for base layer placement. • Spreading and compacting coarse aggregate for durability for surface layer. • Drainage Implementation – Ensuring proper water runoff management. • Checking stability and making necessary adjustments.
	Pest management	Applying pest control according to pest management plan
Receiving of fresh waste phase	Waste disposal activities	• Transport of received waste r at the entry gate till zone 2 (traffic impacts within the site) • Tipping of fresh waste • Spreading fresh waste layers • Adding sand/C&D cover • Spreading water • Compaction • Pest management
Post closure phase	Aftercare activities	Maintenance activities for final cover system, Leachate collection system • Cleaning of evaporation ponds and removal of sludge • Soil and Vegetation Maintenance • Structural Integrity and Erosion Control • Environmental Monitoring • Road and Infrastructure Maintenance • Pest management

2.5 Resources

2.5.1 Equipment

2.5.1.1 Equipment for Civil works and Receiving of Fresh Waste

While it is up to the contractor to choose the equipment needed to perform properly, some of the commonly used equipment include the following

Table2-2: Equipment Recommended by Design Consultant

Item of Equipment	Civil works	Receiving of Fresh waste
Tracked Bulldozer 40 tonnes	2	1
Track backhoe excavator	4	4
Wheel loaders	4	4
Trucks/tipper trucks/Articulated trucks	12	6
Landfill Steel Wheel Compactors [30 tonnes weight]	2	1
Graders with articulated frame motor grader) for shaping of Cut and Fill Works	1	1
Equipment for deploying of synthetic cover	2	2
Drilling equipment completes with accessories to drill gas wells in solid waste	1	1
Wheeled water tanks (for dust abatement and compaction requirements)	2	2
Thermal welding equipment	1	1

- Source: Cowi and Chemonics. Progress of Detailed Design Presentation. 21 Oct. 2024.

2.5.1.2 Equipment for post closure Phase

The following table outlines the key activities, and the equipment required for their implementation.

Table2-3: post closure phase equipment

Activity	Equipment Used
Landfill Gas Management	Gas extraction wells, blowers, flaring systems, gas analyzers
Leachate Management	Leachate pumps, collection tanks, treatment plant equipment, piping and valves
Soil and Vegetation Maintenance	Excavators, dozers, hydro-seeders, mulchers, irrigation systems, tractors, mowers
Structural Integrity & Erosion Control	Compactors, geotextile placement tools, retaining wall construction equipment
Environmental Monitoring	Groundwater sampling pumps, air quality monitoring stations, GPS, drones
Road & Infrastructure Maintenance	Graders, rollers, water trucks, utility vehicles

2.5.1.3 Other Equipment (All phases)

- Insecticide spraying equipment
- Portable lighting equipment
- Firefighting equipment
- Cleaning equipment
- Generators and temporary electrical panels.

2.6 Labor Force

Throughout the closure and construction phase of the Abu Zaabal Dumpsite, an estimated number of 150 employees, including engineers, drivers, and laborers, recruited through both direct and indirect employment are expected.
The total workforce during the post closure phase is around 12, including landfill manager/site supervisor, environmental engineer, social officer, gas collection and flaring technicians, leachate management technician, ground and cap maintenance crew, health and safety officer and administrative officers. This estimate, drawn from experience with similar subprojects, will be finalized once the construction contract is awarded and confirmed in the contractor's documentation. Contractors are encouraged to prioritize hiring locally from Qalyobia. Additionally, the contractor will determine the required number of 8-hour working shifts for the subproject.

2.7 Subproject Timeframe

The total implementation time (including the remaining dumpsite operation) is 28 months in total. These are as follows:

- Total duration of civil works in zone 1 spans from Month 1 to Month 24
- Total duration of civil works in zone 2 spans from Month 1 to Month 28
- Receiving of fresh waste phase is in zone 2 and spans from Month 1 to Month 15 overlapping with civil works phase.
- Post closure activities start after full closure and have a duration of 15 years.

3 Legal and Institutional Framework

3.1 Overview

The Abu Zaabal Dumpsite Closure Subproject will adhere to the National laws and to World Bank Environmental and Social Standards. The sections below provide a summary of applicable laws and standards.

The detailed legal framework is available in the Environmental and Social Management Framework (ESMF) prepared for the Greater Cairo Air Pollution Management and Climate Change Project, which is publicly disclosed on the Bank's website[5].

3.2 National Laws, Regulations and Codes

In Egypt, environmental regulations are governed by the Egyptian Environmental Affairs Agency (EEAA), which operates under the Ministry of Environment. The primary legal framework guiding environmental protection is Law No. 4 of 1994 concerning the Protection of the Environment. This law empowers the EEAA to regulate and control various environmental aspects, including air and water quality, waste management, and biodiversity conservation. The Waste Management Law, Law 202 of 2020 and its Executive Regulations, provides precautionary measures for potential release of pollution.

The following are the most relevant laws for the subproject:

- Decrees number 1095/2011, 710/2012, 964/2015, 544/2016, 75/2017, 618/2017 and 1963/2017 for the amendment of the executive regulations of the environmental Law number 4/1994.
- Law number 38 /1967 concerning the general cleanliness and its executive regulations.
- Law No. 48/1982 concerning pollution protection of the River Nile and the water channels and its executive regulation.
- Law 93/1962 regulating the discharge of liquid waste to the public sewage network. The executive regulations of this law as amended by Minister of Housing decree 44/2000.
- Traffic law 66/1973 amended by law 121/2008 and updated in 2018
- Decrees number 211, 134, and 126 of Law 12/2003 on labour and workforce safety
- Law 94/2003 on establishing the National Council for Human Rights (NCHR)
- Law 137/1981 governing labor relations and the duties of both employee and employer
- Law No. 117 of 1983 Amended by Law No. 12 of 1991 for the Protection of Archaeological Areas and Cultural Heritage
- Law No.44 / year 2000 sets the acceptable limits for using treated wastewater (WW) at three treatment levels, primary, secondary, and tertiary.
- The Egyptian Code of Design Principal and Implementation Conditions for Municipal Solid Waste Management Systems

[5] https://documents1.worldbank.org/curated/en/739341590759685510/pdf/Environmental-and-Social-Management-Framework-ESMF-Egypt-Greater-Cairo-Air-Pollution-Management-and-Climate-Change-Project-P172548.pdf

- Egyptian Labor Law number 12/2003 and Decrees 134/2003 and 126/2003, and the Occupational Safety and Health Convention No. 155 ratified by Egypt. These laws require risk mitigation in workplaces, safety training, PPE provision, emergency response preparedness, and clear delineation of OHS responsibilities. The subproject will comply fully with these standards and integrate them into the OHSP and contractor obligations
- The National Occupational Safety and Health Regulations (Decree 211) and Occupational Safety and Health (OSHA) define the key risks

3.3 World Bank Environmental and Social Standards

The World Bank Environmental and Social Framework (ESF)[6] sets out the World Bank's commitment to sustainable development, through a Bank Policy and the ten Environmental and Social Standards which are designed to guide borrowers to operate in compliance with good international practices in the key areas of environmental and social issues and impacts. The table below shows the 10 E&S standards as stipulated by the WB and indicates their applicability to the Subproject.

Table 3-1 Applicability of WB Environmental and Social Standard (ESS) to the Subproject

Environmental & Social Standard (ESS)	Title of the ESS	Applicability to the Subproject (Y/N)	Justification
ESS 1	Assessment and Management of Environmental and Social Risks and Impacts	Yes	ESS1 is relevant to this subproject due to the environmental and social risks and impacts associated with the activities, including those defined by the Environmental, Health, and Safety (EHS) Guidelines established by the World Bank Group
ESS 2	Labor and Working Conditions	Yes	ESS2 is relevant to this subproject due to the need for workers and health and safety impacts associated with the nature of subproject activities.
ESS 3	Resource Efficiency and Pollution Prevention and Management	Yes	ESS3 is relevant to this subproject due to activities involving consumption of resources and generation of pollution.
ESS 4	Community health, safety and security	Yes	ESS4 is relevant to the subproject due to possible risks and impacts on the community health and safety from subproject activities.
ESS 5	Land Acquisition, Restrictions on Land Use and Involuntary Resettlement	Yes	The land is state owned land. However, ESS 5 is relevant to this subproject due to the provision of alternative job opportunities for waste pickers through the Livelihood Restoration Plan.

[6] http://pubdocs.worldbank.org/en/837721522762050108/Environmental-and-Social-Framework.pdf

Environmental & Social Standard (ESS)	Title of the ESS	Applicability to the Subproject (Y/N)	Justification
ESS 6	Biodiversity Conservation and Sustainable Management of Living Natural Resources	Yes	No natural habitat or natural protectorate property issues, or habitat that include significant biodiversity value have been identified during site visits or desk studies, hence the risk of Subproject activities affecting natural habitats or natural protectorate property is considered minimal.
ESS 7	Indigenous Peoples/Sub-Saharan African Historically Underserved Traditional Local Communities	No	No indigenous people are identified in connection the subproject's boundaries.
ESS 8	Cultural Heritage	Yes	ESS8 might not be relevant to the subproject given there are no archaeological sites in the subproject area. However, in case of finding any objects of cultural value a chance-finds procedure has been developed for the subproject.
ESS 9	Financial Intermediaries	No	Not Applicable
ESS 10	Stakeholder Engagement and Information Disclosure	Yes	ESS10 is relevant to the subproject due to the involvement of various stakeholders and complex implications of the subproject.

3.3.1 EHS Guidelines (World Bank Group)

The Environmental, Health, and Safety (EHS) Guidelines established by the World Bank Group are technical reference documents that provide international best practices for managing environmental, occupational health and safety, and community health risks in various sectors. These guidelines support compliance with the World Bank's environmental and social framework and are used by borrowers and developers to design and implement sustainable and safe projects.

3.3.2 EHS Guidelines for Waste Management Facilities EHS7

The Environmental, Health, and Safety Guidelines for Waste Management Facilities provide comprehensive guidance on managing municipal solid waste and industrial waste. These guidelines cover various aspects, including waste collection and transport, waste receipt, unloading, processing, and storage, as well as landfill disposal, physicochemical and biological treatment, and incineration subprojects. They also address industry-specific waste management activities, such as those related to medical waste, municipal sewage, and cement kilns.

[7] Waste Management Facilities - Final - December 7.doc (ifc.org)

3.3.3 Other Relevant International Standards and Guidelines

1. International Labor Organization (ILO)

Egypt has been a member of the International Labor Organization (ILO) since 1936 and has signed 64 conventions that regulate labor standards and working conditions. In 1988 Egypt ratified the Occupational Safety and Health Convention of 1979 (No. 152)

2. Hazardous Materials and Chemicals

- Convention Concerning Prevention and Control of Occupational Hazards Caused by Carcinogenic Substances and Agents-1974
- Bamako Convention on the Ban of the Import into Africa and the Control of Trans boundary Movement and Management of Hazardous Wastes within Africa-1991
- Amendment to the Basel Convention on the Control of Trans boundary Movements of Hazardous Wastes and Their Disposal-1995
- Stockholm Convention on Persistent Organic Pollutants (POPs)-2002

3. Atmosphere, Air Pollution and Climate Change

- United Nations Framework Convention on Climate Change -1992
- Montreal Protocol on substances that deplete the ozone -1987
- Kyoto Protocol: Calls for Implementing and/or further elaborating policies and measures that result in limitation and/or reduction of GHGs emission-1999
- Paris Agreement under the United Nations Framework Convention on Climate Change-2015

4. Health and Worker Safety

- International Labor Organization Core Labor Standards-1936
- Convention Concerning the Protection of Workers Against Occupational Hazards in the Working Environment due to Air Pollution, Noise and Vibration-1977
- Occupational Safety and Health convention: Convention No. 155 on Occupational Safety and Health provides for the adoption of a coherent national occupational safety and health policy, as well as action to be taken by governments and within enterprises to promote occupational safety and health to improve-1979
- Convention on the Rights of the Child (CRC) -1990

3.3.4 Permitting

3.3.4.1 <u>Egyptian Permitting Procedure</u>

Developers must submit an Environmental Impact Assessment (EIA) study to the Competent Administrative Authority (CAA), which ensures the study complies with the guidelines from the Egyptian Environmental Affairs Agency (EEAA). Upon verification, the CAA forwards the application to the EEAA, which evaluates it within 30 days. If necessary, EEAA may request amendments before approving the report. Approved management plans become legally binding

for the developer. Subprojects are categorized (A-B-C-scoped B) according to the severity of environmental risks and impacts

The CAA for this subproject is the ***Qalyubiya Governorate.*** According to the EEAA, the subproject falls under **Category C**, **Subprojects**, which requires the preparation of a full Environmental and Social Impact Assessment (ESIA) and requires organizing a public consultation meeting.

3.3.4.2 Other Permits

Law 9/2009 and its amendments, requires establishments to keep environmental registers and notify EEAA of non-compliance. There are specific regulations for hazardous waste management and detailed documentation requirements. Various permits are needed for operating a Municipal Solid Waste dumpsite, including approvals for civil defense, construction, and operation. These permits are issued by authorities such as the Civil Defense Authority, EEAA, Industrial Development Authority, and others.

4 Environmental and Socioeconomic Baseline

4.1 Site Location and Adjacent Land Uses

Abu Zaabal Dumpsite is located in Arab El-Olaykat village in Khanka District in Qalyubia Governorate. The site is surrounded by a variety of activities, as follows:

- Residential areas to the East, West and North, with distance less than 500 m.
- Al Akrasha industrial area adjacent to the east (at a 1 km distance), with several industries (covering an area of approximately 100 acres), including a currently non-operating facility for the separation and treatment of municipal waste (Khanka factory).
- A military area owned by the Ministry of Defense to the north (covering an area of approximately 200 acres).
- 13 medical incinerators owned by Ministry of Health. However, not all are currently operational. They fall at a distance less than 500 m.
- 3 artificial lakes resulting from previous mining activities and belonging to the Ministry of Petroleum and Mineral Resources (covering a total area of approximately 140 acres).
- Areas of backfilled lakes created randomly by locals (covering an area of approximately 15 acres).

The map below summarizes the key surrounding land uses and distances from Abu Zaabal Dumpsite site.

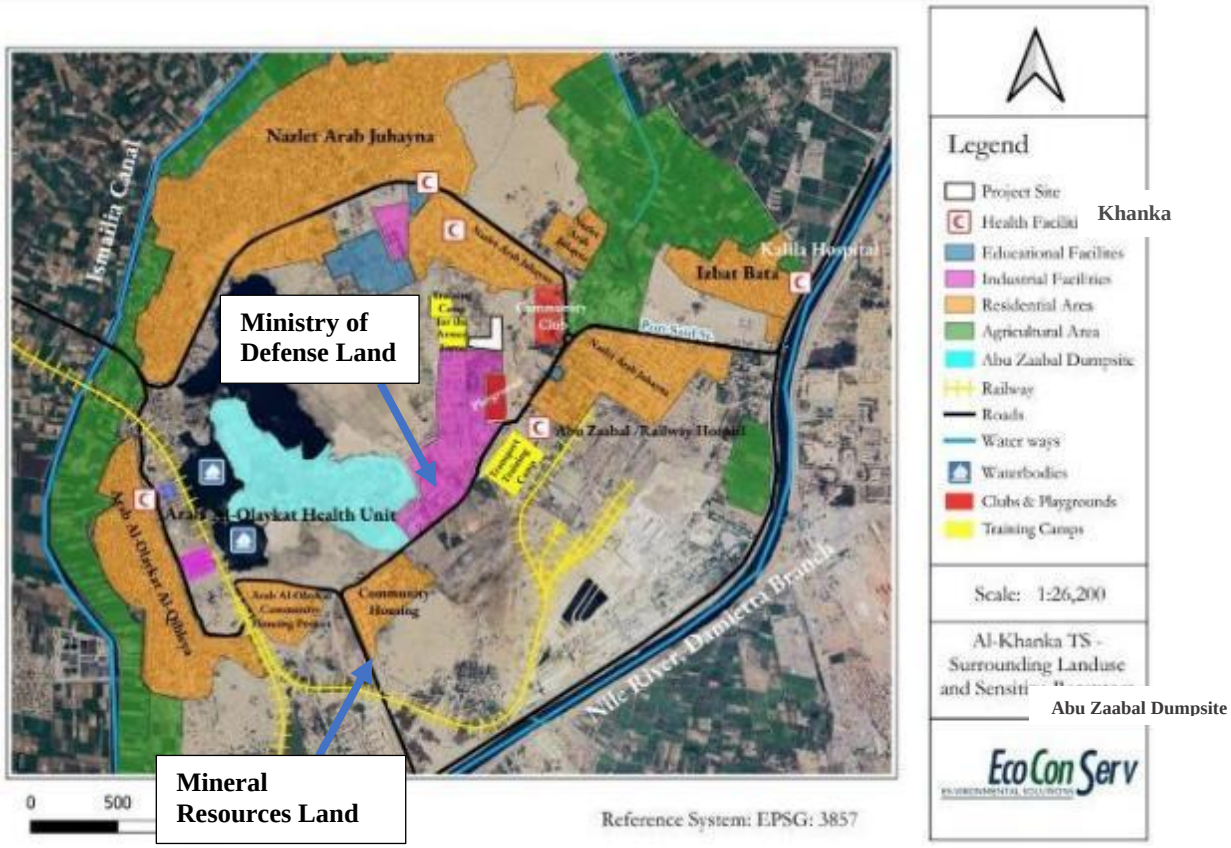


Figure 4-1: Abu Zaabal Dumpsite location and the surrounding areas.

The Consultant identified the sensitive receptors around the subproject site. These are summarized in the Table below. The locations of these are shown in **Figure 4-1**.

Table4-1: Closest Sensitive Receptors within Area of Influence

Receptor Type	Receptor	Distance (m)	Direction from the Site
Agricultural	Nearest Agricultural Area	720	North-East
	Nearest Educational Facility	340	North
Military	Training Camp for the Armed Forces	750	North East
Transport	Railway	170	South-West and South East
	Port Said St.	0-1,400	East
Healthcare facilities	Arab El-Olaykat Health Unit	450	South
	Abu Zaabal Railway Hospital	750	West
	Kalila Hospital	2,500	North- East
Residential	Arab El-Olaykat Al-Qibleya	370	South West
	Community Housing (nearest Residential Community)	170	South-East
	Nazlet Arab Juhayna	300	North and North-East
	Izbat Bata	2,000	North-East
Water Bodies	3 lakes	Adjacent to site	Northern lake South-West South
	Ismailia Channel	750	West
	Nile River, Damietta Branch	1,350	East
Subsurface water	Subsurface depth	The measured GWL ranged between 2.65 m and 4.97 m	Below ground surface (bgs).

4.2 Environmental Baseline

The environmental baseline for a dumpsite refers to the existing environmental conditions and characteristics of the subproject area before the construction and operation of the facility. It serves as a reference point for assessing the potential environmental impacts associated with the facility.

4.2.1 Climate[8]

Meteorological data at the nearest station, Arab El-Olaykat, only a few meters (about 200 m on average) south and west of Abu Zaabal Dumpsite were used to obtain climate data relevant to the sub-project area.

Temperature

The monthly average for the maximum temperature reaches its peak value in July and August (38 °C), and its minimum value in January (21 °C) whereas the monthly average of minimum temperature reaches its highest in July and August (21 °C) and its lowest in February (7 °C).

Table4-2: Average monthly temperatures in Abu Zaabal (based on data from 30 years of observation)

Air Temp.	Month											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Max °C	21	22	25	20	34	37	38	38	35	32	27	22
Min °C	7	7	9	11	15	18	20	21	19	17	13	9
Mean °C	14	14.5	17	15.5	24.5	27.5	29	29.5	27	24.5	20	15.5

Source: Meteoblue

Rainfall

The distribution of rainfall in Egypt shows its maximum values over the Mediterranean coast, with a rapid decrease towards the south. The mean annual precipitation in the last thirty years at the subproject area is 21 mm. The rainfall reaches its maximum value in January (4 mm). Furthermore, it reaches its minimum value in the months of June, July (0 mm).

Table4-3: Average rainfall data in the Subproject Area (based on data from 30 years of observations).

Rainfall	Month												Annual
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(mm/ month)	4	3	3	٢	٢	٠	٠	1	1	1	2	2	21

Source: Meteoblue

[8] Meteoblue (2024). Climate (modelled) 'Qalyubia station'.

Wind Speed

According to Weather Spark meteorological data, the average monthly wind speed ranges between 11 Km/h and 13 Km/h. Dry hot dust-laden which blows mainly from south and southwest, also, Khamasin winds blows occasionally for about 50 days during spring, from the Northeast direction. As per the Wind Rose shown below, the prevailing winds at the subproject area blow from the North-west direction

Table4-4: Average monthly wind speed in the Subproject Area (based on data from 30 years of observations)

Wind Speed	Month											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Max. (km/h)	21	21	23	24	25	26	24	23	23	21	19	18
Min. (km/h)	5	5	5	5	4	4	4	3	3	4	4	5
Mean. (km/h)	12	12	13	13	13	13	12	11	11	11	11	11

Source: Meteoblue

4.2.2 Air Quality

4.2.2.1 Ambient Air

Ambient air quality measurements were made for a period of 24 hours in 4 specific locations, in compliance with Egyptian Environmental Law 4/1994 and its amendments as well as WB General EHS Guidelines. The site-specific air quality measurements were conducted using standard ambient air quality monitoring instruments under the supervision of an experienced specialist. The below table shows the GPS coordinates of the ambient air measurement

Table4-5: Coordinates of Measurement Locations

Measurement Locations	N coordinates	E coordinates
Point 1 (P1)	30°17'7.71"N	31°20'54.29"E
Point 2 (P2)	30°17'17.64"N	31°20'57.76"E
Point 3 (P3)	30°16'33.23"N	31°21'21.36"E
Point 4 (P4)	30°16'44.95"N	31°20'52.93"E

Figure 4-2: Location of the four measurements points

The four measurement points for air and noise quality around the Abu Zaabal Dumpsite were selected to assess the site's ambient baseline conditions.

P1 and P2 are located **downwind and adjacent to the dumpsite**, where pollutant levels are expected to be highest due to prevailing wind patterns. P3 and P4 were selected to assess baseline conditions at close residential areas.

Detailed report of the air quality measurements and the methodology are included in **Appendix 1**

The results of the measured parameters are listed in the table and illustrated in the figure below.

Table4-6: Measurements Results

Time	NO_2	SO_2	CO (mg/m³)	PM2.5	PM_{10}	T.S.P
Point 1	37.3	57.40	3.45	32.4	52.1	65.4
Point 2	43.97	66.78	3.99	35.4	56.1	72.2
Point 3	59.14	87.62	5.03	33.2	50.3	63.7
Point 4	39.81	60.23	3.9	٣٤,٢	٥٢,٦	٦٧,٣
Limit (µg/m³) WB	200-1 hour	125	------	75	150	-----
Limit (µg/m³) National	150	125	10 (mg/m3)	100	150	230

While all recorded results confirmed compliance with applicable ambient air quality standards, the measurements were based on spot sampling. According to interviews with different stakeholders including nearby residents, air emissions and smoke when the wastes disposed in the dumpsite ignite and spread, especially during summer times. In addition, the air quality deteriorates significantly when the incinerators were not operational. However, exceedances of ambient air limits are expected due to the presence of the medical incinerator near the site. This is evident

from visible smoke emissions from the incinerator stack, indicating uncontrolled air pollution as shown in the figure below.

Figure 4-3: Visible stack emissions from medical incinerators

4.2.2.2 Odour

The consultant conducted thorough consultation activities to establish a baseline of odour impacts prior to the subproject's initiation. This effort was essential in understanding the existing conditions and potential concerns of nearby residents. Numerous complaints from residents living in buildings close to the dumpsite have been documented, with many expressing frustrations over the foul odours. These odours, according to the consulted groups are particularly pronounced during the summer months, when warmer temperatures can exacerbate the issue. This was discussed further in Section 9.

4.2.3 Noise & Vibration

Noise levels were measured at the same four air quality measurement locations for a period of 24 hours measurements as per the international standard using type 1 precision noise level meter. The noise measurement locations are the same as in Table4-5.

The results of the measurements of surrounding ambient noise levels were compared to the permissible national limits as well as international limits of WB. The four point of noise measurements were found to be compliant with permissible limits. Detailed report of the noise quality measurements and the methodology are included in **Appendix 1**

Figure 4-4: Ambient Air Quality and Noise Monitoring System

4.2.4 Topography

Located in the eastern region of the Nile Delta, Qalyubia Governorate has a topography that is generally low, gradually descending from south to north. The elevation ranges from approximately 6 meters above sea level (asl) to sea level towards the Mediterranean Sea.

A topographic survey **Appendix 2** was conducted at the dumpsite to establish a baseline for its closure and future monitoring. Chemonics Egypt Consultants completed the survey of the land portion between May 13th and May 18th, 2023. A detailed survey of the entire site was carried out to generate a high-resolution Digital Elevation Model (DEM), capturing the site's surface features, elevations, and internal infrastructure. This data is essential for planning the closure activities, ensuring proper grading, drainage, and stabilization of the site. Additionally, control points were set up across the dumpsite to serve as reference points for post-closure monitoring, including settlement tracking and landfill gas movement. The Figure below shows the contour map of Abu Zaabal Dumpsite.

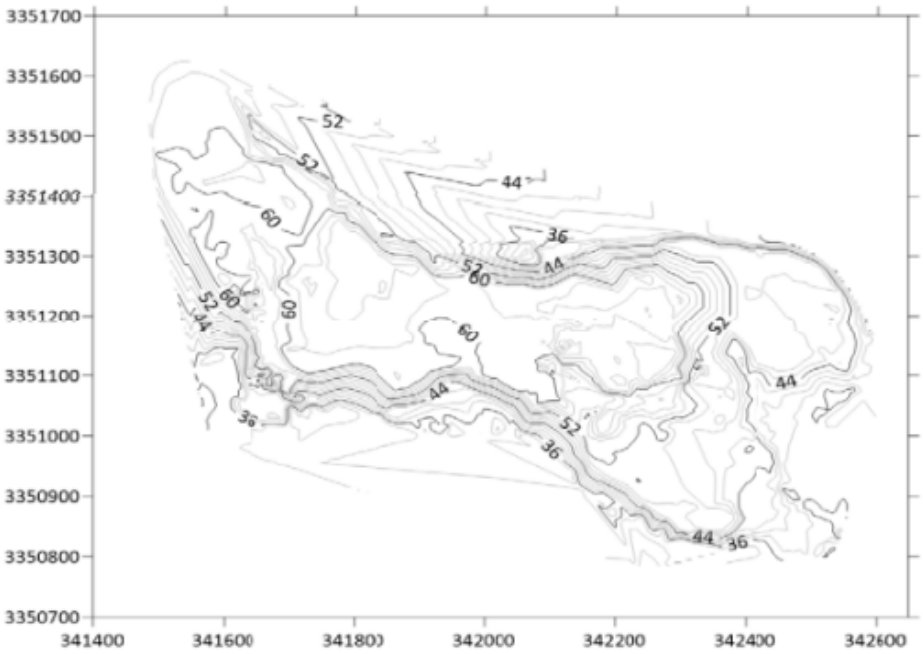


Figure 4-5: Contour Map of Abu Zabaal Dumpsite

4.2.5 Geomorphology

A geotechnical investigation was conducted over 488,180 square meters of the dumpsite to assess its suitability for closure.

The site is primarily covered by Quaternary sediments, with groundwater movement influenced by fractured Oligocene basalt quarries in Abu Zaabal. The main groundwater source, the Quaternary Aquifer, consists of two layers with varying productivity.

The Abu Zaabal lakes are connected to the Ismailia Canal (east of the site) and Belbais Drain (west of the site), which are sources of freshwater. The lakes pose a significant contamination risk on these freshwater sources despite them being more than 1 km away. Formed in fractured rock and hydraulically connected to the aquifer, the Abu Zaabal lakes have been found to be saline, contaminated with sewage, and potentially polluted with industrial wastewater. This underscores a critical environmental issue for the dumpsite closure, necessitating preventive measures to limit further groundwater contamination.

Figure 4-6: Western bank of Abu Zaabal lake showing study area outcrop of basalt rock hill.

Geophysical surveys revealed the landfill's composition and potential environmental concerns. The landfill consists of three main layers:

- Top layer (Soil Type A): dry, loose sand and debris with variable thickness (3.25-19.75 meters).
- Middle layer (Soil Type B): moist, denser sand and debris with variable thickness (1.25-27.5 meters).
- Bottom Layer (Soil Type C) Wet, loose middle lenses: containing organic waste and leachate, with variable thickness (4.25-15.75 meters).

The total estimated landfill volume is 14.5 million cubic meters. Soil Types A, B, and C make up 38%, 55%, and 7% of that volume, respectively.
The survey also identified deep basaltic bedrock and very low-resistivity zones in the northern half of the landfill, which may indicate concentrated leachate flow paths as shown in **Figure 4-7**.

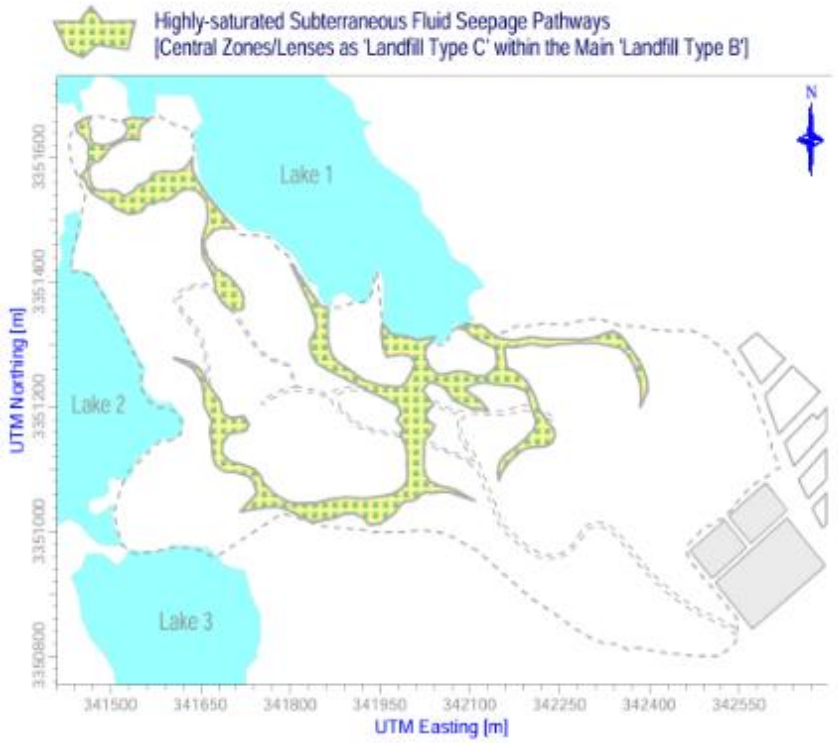


Figure 4-7: Highly-saturated Subterraneous Fluid Seepage Pathways [Central Zones/Lenses as 'Landfill Type C' within

4.2.6 Groundwater

The groundwater level ranges from 31.35 m to 32.03 m, indicating that dewatering will not be required for the planned excavations. While seasonal fluctuations may occur, the investigation confirms that groundwater levels are unlikely to rise above the excavation depth, eliminating the need for groundwater control measures during construction.

A subsurface investigation was conducted to assess groundwater conditions at the site. The detailed report has been included in ***Appendix 11*** Groundwater samples were collected and analyzed for key indicators, including Total Dissolved Solids (TDS), sulfate (SO_4^{2-}), chloride (Cl^-), and pH. The results confirmed contamination, indicating potential risks from leakage and interaction with the underlying aquifer. The results are shown below:

- **Total Dissolved Solids (TDS):** The concentration of TDS in the groundwater samples ranged from 146 ppm to 526 ppm. The upper value exceeds the WHO recommended limit of 500 ppm, indicating potential concerns for drinking water suitability.
- **Chloride (Cl^-):** Chloride concentrations ranged between 53 ppm and 243.8 ppm, falling within the non-aggressive classification.
- **Sulfate (SO_4^{2-}):** Sulfate levels were measured between 24.01 ppm and 34.3 ppm, also classified as non-aggressive.
- **pH:** The measured pH values of the groundwater samples indicate non-aggressive conditions.

Table4-7: Results of Chemical Analyses on Groundwater Samples from the geotechnical engineering report

BH No.	Depth (m)	Elevation (m)	T.D.S ppm	Sulphate as (SO_3) ppm	Chloride as (Cl^-) ppm	Carbonates (CO_3) (ppm)	Total Alkalinity (ppm)	Bicarbonate (HCO_3) (ppm)	pH value
A	3	33.0	526	34.30	243.8	0.0	110.0	110.0	7.84
B	2.75	31.3	500	24.01	106.0	0.0	105.0	105.0	7.33
C	5.5	31.5	146	24.01	53.0	0.0	65.0	65.0	7.16

The ground water (GW) flow direction is towards the north-western direction which agrees with previous studies as shown in the following figure.

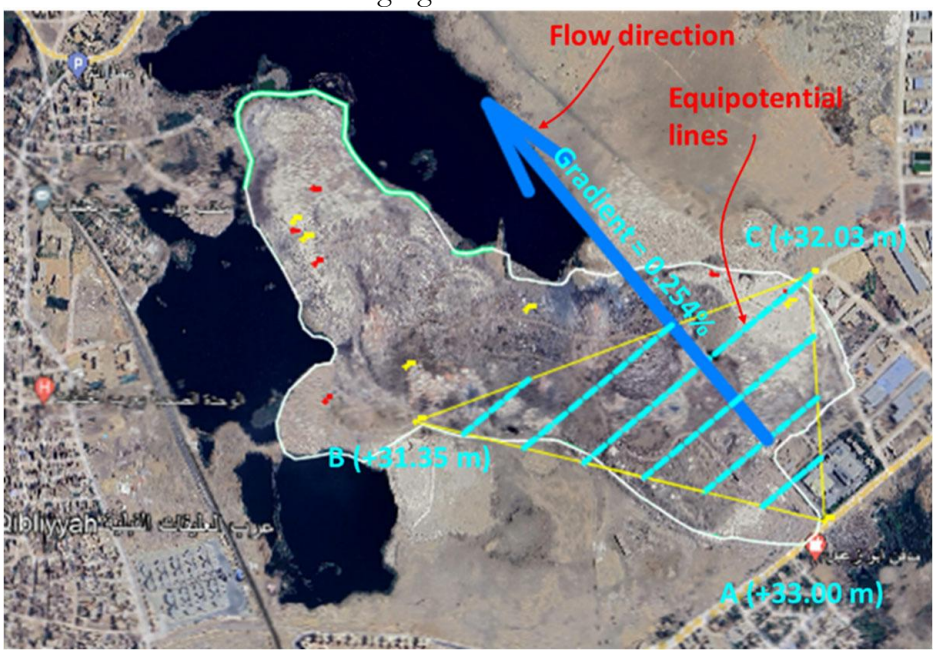


Figure 4-8: Groudwater flow direction

4.2.7 Surface Water

The closest surface water receptor to the Abu Zaabal Dumpsite consists of three lakes formed by groundwater seepage, subsurface water, and surface water infiltration from the Ismailia Canal into large pits created by quarrying and rock mining as shown in Figure 4-9. The lakes cover an area of approximately 600,000 square meters. The depths of the lakes reach 16 m and the northern lake is generally deeper than the southern ones. Slopes under water range from 1:1 to 3:1 (Horizontal: Vertical) which is steep and therefore needs support structure, hence the need for stability pad.
Because the water properties in the lake consist of parameters that are not conventional to leachate, the source of contamination was questionable and is expected to have occurred from other sources.

Figure 4-9: Nearest surface water to Abu Zaabal Dumpsite

To assess the level of contamination and possible sources, groundwater and surface water samples were collected based on flow direction verified through previous research and piezometer levels. By collecting water samples at specific locations, the goal was to compare upstream (before the waste influence) and downstream (where contamination might be present) water quality.

- The groundwater sample from BH-A (upstream) represents water quality before it has interacted with waste.
- The leachate effluent sample from the adjacent lake represents the impact of waste contamination.

The results are shown below.

Table4-8: Results of sampling

Test / Parameters	Unit	Sample 1 Piezometer A measured	Sample 2 Abu Zaabal Lake-measured	Pond Abu Zaabal Lake-previous study	BH-5 Sample-previous study
pH	-	7.34	7.68	7.97	7.21
Temperature	°C	24.6	26.1	25.8	24.2
Electrical Conductivity (EC)	µS/cm	2195	3152	4873	2421
Total Dissolved Solids (TDS)	mg/l	1350	1900	2960	1470
Total Suspended Solids (TSS)	mg/l	8	12	25	10
Turbidity	NTU	2.5	4.1	7.3	2.9
Dissolved Oxygen (DO)	mg/l	5.8	4.2	3.1	6.0
Chemical Oxygen Demand (COD)	mg/l	19	34	56	22

Biological Oxygen Demand (BOD)	mg/l	4.2	6.8	11.2	5.1
Ammonia (NH3)	mg/l	0.12	0.34	0.57	0.15
Nitrate (NO3)	mg/l	4.5	6.7	9.2	5.3
Nitrite (NO2)	mg/l	0.05	0.08	0.14	0.06
Phosphate (PO4)	mg/l	0.09	0.14	0.22	0.10
Sulfate (SO4)	mg/l	110	156	230	125
Chloride (Cl)	mg/l	180	250	370	190
Fluoride (F)	mg/l	0.31	0.45	0.68	0.36
Iron (Fe)	mg/l	0.18	0.25	0.42	0.21
Manganese (Mn)	mg/l	0.04	0.07	0.12	0.05
Zinc (Zn)	mg/l	0.09	0.13	0.21	0.11
Copper (Cu)	mg/l	0.03	0.05	0.08	0.04
Lead (Pb)	mg/l	0.002	0.005	0.009	0.003
Cadmium (Cd)	mg/l	0.0004	0.0008	0.0015	0.0005
Mercury (Hg)	mg/l	<0.0001	<0.0001	0.0002	<0.0001
Arsenic (As)	mg/l	0.001	0.002	0.003	0.001
Aluminum (Al)	mg/l	0.02	0.009	0.24	0.013
Barium (Ba)	mg/l	0.012	0.007	-	-
Boron (B)	mg/l	0.003	0.056	-	-
Cobalt (Co)	mg/l	<0.0001	<0.0001	-	-
Selenium (Se)	mg/l	<0.0001	<0.0001	-	-
Vanadium (V)	mg/l	<0.0001	<0.0001	-	-
Antimony (Sb)	mg/l	<0.0001	<0.0001	-	-
Molybdenum (Mo)	mg/l	<0.0001	<0.0001	-	-
Silver (Ag)	mg/l	<0.0001	<0.0001	-	-
Strontium (Sr)	mg/l	0.134	1.365	-	-
Thallium (Tl)	mg/l	<0.0001	<0.0001	-	-
Uranium (U)	mg/l	<0.0001	<0.0001	-	-

The water quality analysis at upstream and downstream locations, compared with the USEPA National Recommended Water Quality Criteria for freshwater[9], reveals notable contamination downstream, likely resulting from industrial discharge or other sources of pollutants.

Upstream Water Quality:

- **pH**: Upstream samples from Piezometer A (7.34) and BH-5 (7.21) fall within the USEPA acceptable range of 6.5–8.5, indicating no concerns about the water's acidity or alkalinity.
- **TDS**: The TDS levels for Piezometer A (1,350 mg/L) and BH-5 (1,470 mg/L) exceed the **USEPA** secondary standard of 500 mg/L. This suggests a high mineral content, which may be attributed to natural geological influences.

[9] According to WB General EHS Guidelines, Discharges of process wastewater, sanitary wastewater, wastewater from utility operations or stormwater to surface water should not result in contaminant concentrations in excess of local ambient water quality criteria or, in the absence of local criteria, other sources of ambient water quality with reference to US EPA National Recommended Water Quality Criteria

- **EC**: The electrical conductivity (EC) of 2,195 µS/cm (Piezometer A) and 2,421 µS/cm (BH-5) indicates significant ion concentration, though USEPA does not have a specific criterion for EC. These values may still indicate elevated dissolved salts.
- **DO**: Dissolved Oxygen (DO) levels are 5.8 mg/L in Piezometer A and 6.0 mg/L in BH-5, which are within the acceptable range for healthy aquatic ecosystems, aligning with USEPA guidelines of ≥5 mg/L for freshwater.
- **Chloride (Cl^-)**: Chloride levels in Piezometer A (180 mg/L) and BH-5 (190 mg/L) are well below the USEPA secondary maximum contaminant level (SMCL) of 250 mg/L, suggesting minimal contamination from chloride.
- **Sulfate (SO_4^{2-})**: The sulfate concentration in Piezometer A (110 mg/L) and BH-5 (125 mg/L) also falls within the acceptable range of USEPA guidelines, which recommend a limit of 250 mg/L.
- **Heavy Metals**: Lead (0.002–0.003 mg/L), cadmium (0.0004–0.0005 mg/L), mercury (<0.0001 mg/L), and arsenic (0.001 mg/L) are well below the USEPA limits for freshwater aquatic life (e.g., Lead: 0.0031 mg/L, Arsenic: 0.010 mg/L), indicating no significant industrial contamination.

Downstream Water Quality (Abu Zaabal Lake):

- **pH**: The pH values in Abu Zaabal Lake are 7.68 (measured sample) and 7.97 (previous sample), both within the USEPA acceptable range of 6.5–8.5.
- **TDS**: The TDS levels in Abu Zaabal Lake increase significantly, reaching 1,900 mg/L (measured) and 2,960 mg/L (previous). These values far exceed the USEPA secondary standard of 500 mg/L, indicating substantial mineral pollution.
- **EC**: EC values for the lake are much higher, with 3,152 µS/cm (measured) and 4,873 µS/cm (previous), signaling significant pollution from dissolved salts and other ions.
- **DO**: DO levels drop to 4.2 mg/L (measured) and 3.1 mg/L (previous), falling below the USEPA guideline of 5 mg/L, indicating low oxygen availability, which is concerning for aquatic life.
- **COD and BOD**: Chemical Oxygen Demand (COD) is 34 mg/L (measured) and 56 mg/L (previous), while Biological Oxygen Demand (BOD) is 6.8 mg/L (measured) and 11.2 mg/L (previous). Both values significantly exceed USEPA guidelines for freshwater (COD ≤20 mg/L, BOD ≤5 mg/L), suggesting severe organic pollution from industrial or sewage sources.
- **Chloride (Cl^-)**: Chloride levels increase to 250 mg/L (measured) and 370 mg/L (previous), with the latter exceeding the USEPA SMCL of 250 mg/L, indicating contamination likely from wastewater or leachate.
- **Sulfate (SO_4^{2-})**: Sulfate concentrations rise to 156 mg/L (measured) and 230 mg/L (previous), which remain within the USEPA guideline of 250 mg/L.
- **Heavy Metals**: Lead levels in the previous sample are 0.009 mg/L, approaching the USEPA guideline for freshwater aquatic life (0.0031 mg/L), and cadmium (0.0015 mg/L) is higher than upstream levels but still within USEPA limits. Mercury and arsenic remain

below USEPA chronic criteria for aquatic life but show an increasing trend compared to upstream concentrations.

These findings confirm that water quality deteriorates significantly downstream, as indicated by elevated TDS, EC, COD, BOD, and heavy metal levels, along with reduced DO concentrations. While upstream groundwater shows moderate water quality, the downstream lake water shows higher concentrations of contaminants.

4.2.8 Biodiversity

4.2.8.1 Protected Areas and Ecologically Sensitive Areas

Egypt has a total of 30 protected areas, many of which are located along the Mediterranean and Red Seas. Another 14 areas are labelled as "Future Protected Areas". The nearest protected area to the subproject site is Wadi Degla at the south and Qubbit El Hassana from the west, which are not affected by the subproject activities. The distance between the Subproject's location at Abu Zaabal dumpsite and Wadi Degla is around 20 Km to south-west direction While the distance from the second nearest protected area Qubbit ElHassana protected areas is 28 kilometers to the south-west direction. Based on available data, the groundwater flow direction is towards the northwest, indicating that Abu Zaabal lies downstream of these protected areas, and not hydrologically connected to them via groundwater flow.

4.2.8.2 Flora and Fauna Habitat

The study area includes six main habitats:

1. **Canal Banks** – This habitat consists of the water channel itself and the surrounding land, including the sloped embankments and riparian zones.
2. **Cultivated Lands** – These are agricultural fields and citrus orchards. Farming follows Egypt's typical seasonal cropping pattern, with **winter crops** like Egyptian clover (*Trifolium alexandrinum*) and wheat (*Triticum vulgare*), and **summer crops** like maize (*Zea mays*) and rice (*Oryza sativa*). The area is partially surrounded by agricultural fields intersected or adjacent to irrigation and drain ditches. These arable lands are highly productive habitats. In the Nile Delta, land use is intensive, with almost all arable land being either cultivated or developed. Small patches of feral land along canals, roads, and field edges provide refuges for native species.
3. **Waste Lands** – Barren or abandoned areas no longer used for cultivation.
4. **Sandy Plains** – Areas with sandy deposits characterized by low water retention and limited capillary action.
5. **Waste Dump Area** – Includes active and closed sections of the dumpsite, serving as a feeding ground for scavenging species.
6. **Abu Zaabal Wetland (Three Lakes)** – A wetland system of three interconnected lakes supporting various water-dependent species.

Detailed Flora and Fauna Studies are included in the Baseline study in **Appendix 4**. However, the sections below include the conclusions of the biodiversity in the area.

4.2.8.3 Fauna

The fauna in the area primarily includes birds, domestic animals, and agricultural pests such as insects, worms, and rodents.

4.2.8.3.1 Birds

According to literature, the subproject area hosts a variety of avian species, including House Sparrow (Passer domesticus), Cattle Egret (Bubulcus ibis), Graceful Warbler (Prinia gracilis), Hooded Crow (Corvus corone), Yellow Wagtail (Motacilla flava), Common Bulbul (Pycnonotus barbatus), Laughing Dove (Streptopelia senegalensis), Rock Dove (Columba livia), Little Egret (Egretta garzetta), Pied Kingfisher (Ceryle rudis), Kestrel (Falco tinnunculus), Moorhen (Gallinula chloropus), Senegal Coucal (Centropus senegalensis), and Hoopoe (Upupa epops). Additionally, the subproject area lies within an important wintering zone for waterbirds, including the world's largest concentrations of Slender-Billed Gull (Larus genei) and Whiskered Tern (Chlidonias hybrida) (Baha El Din, 1999).

Field observations confirmed the presence of Cattle Egrets which are frequently observed scavenging at the dumpsite. In addition, according to surveys in the subproject areas, Hooded Crows and Slender-Billed Gull are also expected to be scavenging species. Hooded Crows are known for their opportunistic feeding behavior, generally foraging through waste materials, while Cattle Egrets generally feed on insects and small prey attracted to the organic waste. Finally, the Slender-Billed Gull is a species that often exploits human-associated food sources.

Figure 4-10: Cattle Egrets

4.2.8.3.2 Mammals

According to literature, the wider subproject area is home to mammals that either live alongside humans or adapt well to human activity. Common species include the Nile rat (Arvicanthis niloticus), house mouse (Mus musculus), long-eared hedgehog (Hemiechinus auratus), and

Egyptian red fox (Vulpes vulpes). Other species found in the area include the wild cat (Felis sylvestris) and weasel (Mustela nivalis).

However, the main scavenging fauna sighted during the site visits in the subproject sites and nearby areas primarily consists of a few strays' feral dogs.

Figure 4-11: Strays' Feral Dogs

4.2.8.3.3 Reptiles

While none were sighted during the field survey, the study area supports a variety of reptile species, commonly found in different habitats:

- **Lizards & Skinks**:
  - *Ocellated Skink* (*Chalcides ocellatus*) and *Bosc's Lizard* (*Acanthodactylus boskianus*) are frequently observed.
  - The *Common Chameleon* (*Chamaeleo chamaeleon*) is also present.
- **Snakes & Geckos**:
  - The *Turkish Gecko* (*Hemidactylus tarcicus*) is a common sight.
  - The *African Beauty Snake* (*Psammophis sibilans*) is often found near irrigation canals and streams.
- **Amphibians**:
  - The most commonly encountered species is the *Square-marked Toad* (*Bufo regularis*), which is often heard calling in urban gardens.

These reptiles and amphibians contribute to the ecological balance, controlling insect and rodent populations while adapting to both natural and human-modified environments.

According to consultation activities, residents have reported sightings of snakes in the nearby lake, as well as a large number of stray dogs, some of which are known to be rabid.

4.2.8.3.4 Insects and Other Invertebrates Summary

The area hosts a diverse range of insects and other invertebrates, many of which are associated with agricultural lands and water bodies.

- **Common Insects**:
  - *Beetles* (*Tentyrina bohmi*), *Butterflies*, *Dragonflies*, *Dense Flies*
  - *Small Ants* (*Monamorium subopacum*) and *Large Ants* (*Cataglyphis bicolor*)
  - *Wasps* and *Bees*
- **Agricultural Pests and Beneficial Insects**:
  - *Ladybug* (*Coccinella sp.*) – a natural predator of aphids
  - *Mole Cricket* (*Gryllotalpa gryllotalpa*) and *Gryllus bimaculatus Cricket* – common in farmlands
  - *Giant Water Bug* (*Belostoma flumineum*) – found in wetland areas
  - *Garden Snail* (*Helix aspera*) – commonly observed in cultivated lands
- **Aphids**:
  - Eleven different species were recorded, with *Aphis fabae* being the most prevalent, followed by *A. craccivora* and *A. pisum*, particularly in summer.

According to residents, particularly women from the villages of Arab El-Olaykat, a major concern is the overwhelming presence of mosquitoes.

4.2.8.4 Aquatic Ecosystem

4.2.8.4.1 Abu Zaabal Wetland (lakes)

A description of the floristic composition and life form spectrum of the recorded species in Abu Zaabal Wetland (three lakes). It aims also to analyzing the distribution pattern of the plant species and the environmental factors that affect their distribution. Forty stands were selected to represent the apparent variation in the vegetation physiognomy and habitats of these lakes. Sixty-four species (38 annuals and 26 perennials) belonging to 56 genera and 28 families were recorded in Abu Zaabal Wetland. Gramineae (Poaceae) had the highest contribution, followed by Leguminosae (Fabaceae), Amaranthaceae, Chenopodiaceae and Compositae (Asteraceae). Forty-five species (31 annuals and 14 perennials) were terrestrial weeds, 7 species (2 annuals and 5 perennials) natural plants, 6 species (one annual and 5 perennials) aquatic weeds, while other six (5 annuals and one perennial) escaped from cultivations. Life forms of the recorded species indicated the predominance of therophytes, followed by geophytes, helophytes, phanerophytes, hemicryptophytes, chamaephytes and

hydrophytes. Pluriregional taxa were dominated over biregional, and monoregional ones. (Galal *et al*., 2007).

- **Bacterioplankton**

High total bacterial counts (saprophytic and parasitic) and high bacterial indicators of sewage pollution (total and faecal coliforms as well as faecal streptococci) were recorded in summer. The total counts of gram-negative bacteria were also recorded, where *E. coli, Klebsiella pneumonia, Salmonella choleraesuis, Enterobacter aerogenes, Yersinia pseudotuberculosis* and *Citrobacter freundii* were found to be dominant organisms (Rabeh and Azab, 2006).

- **Phytoplankton**

Bacillariophyceae (diatoms), Chlorophyceae (green algae) and Cyanophyceae (blue green algae) constituted main food in fish of plant origin in Abu Zaabal lakes. Diatoms are represented mainly by *Navicula* sp., *Cyclotella* sp., *Achnanthes* sp. and *Cocconies* sp. green algae are represented in fish stomachs mostly by *Scenedesmus* sp., *Ankistrodesmus* net; sp., *Coelastrum* sp. and *Cosmarium* sp., while blue green algae were represented by *Merismopedia* sp., *Oscillatoria* sp., *Anabaena* sp., *Micrcystis* sp. and *Coelospharium* sp. whereas rotifers, molluscanes (bivalves), cladoceranes, ostracods, copepods and animal derivatives constitute the food of animal origin. In occurrence method, diatomes was found to be the most preferable food of plant origin where it occurred in more than 68.0% of the examined fish (Shalloof and Khalifa, 2009).

- **Zooplankton**

The pelagic zooplankton community in Abu Zaabal lakes comprised Rotifera (16%), Protozoa (Ciliophora and Rhizopoda) (18%) and Copepoda (16%). Cladocera were seldom recorded. Hexarthra, Brachionus and Rotaria were the dominant rotifer taxa. Several characteristics—including the community composition, the dominance of small ciliates and nauplii, the abundance of Cyanobacteria, and the absence of macrophytes—indicated that it is a severely eutrophic lake (El-Basset and Taylor, 2007). El-Shabrawy *et al.* (2007) mentioned that rotifers dominated the zooplankton groups forming about 87% of total zooplankton in Abu Zaabal lakes, and *Brachionus plicatlis* proved to be the most dominant species.

4.2.8.4.2 Fresh water ecosystems in Ismailia Canal

The Ismailia Canal **banks** in the study area support diverse vegetation, influenced by water flow and soil conditions.

- **Open Water Plants**:
  - *Phragmites australis* (Common Reed) is both beneficial and problematic. It contributes to silting and obstructs waterways but is also used in construction, paper production, and wastewater treatment.
  - *Eichhornia crassipes* (Water Hyacinth) is Egypt's most invasive aquatic weed, originally introduced as an ornamental plant but now widespread in fresh and brackish waters.

  - Other recorded species include *Azolla filiculoides* (Water Fern), *Ludwigia stolonifera*, and *Ceratophyllum demersum* (submerged aquatic plant).
- **Slopes of Canal Banks**:
  - Moist, muddy banks support hydrophilic plants, categorized as bank retainers, aggressive species, and soil controllers.
  - Common trees and shrubs include *Acacia nilotica*, *Salix mucronata*, *Tamarix nilotica*, and *Pluchea dioscoridis*.
  - Perennial herbs include *Verbena officinalis*, *Oxalis corniculata*, *Phragmites australis*, and *Mentha longifolia*.
  - Annual herbs include *Conyza bonariensis*, *Ranunculus sceleratus*, *Rumex dentatus*, and *Trifolium resupinatum*.

This vegetation plays a crucial role in stabilizing banks, filtering water, and providing habitat for various species.

4.2.9 Natural Hazards

Qalyubia Governorate in Egypt is prone to several natural hazards as follows:

- **Heatwaves:** As an arid region, Qalyubia experiences high temperatures during summer months, which can lead to heatwaves. Prolonged exposure to extreme heat can pose health risks and increase the likelihood of heat-related illnesses.
- **Dust storms:** Similar to sandstorms, dust storms can occur in the governorate, especially during dry periods. These storms can carry fine dust particles, affecting visibility and air quality.
- **Earthquakes:** Qalyubia is located in a region of low to moderate seismic hazard and is not considered a high-risk area for earthquakes. The area experiences scattered seismicity, making it challenging to delineate specific seismic zones. Notable historical earthquakes include events in 1935, 1111, 1259, 1262, 1303, and 1588. The most significant instrumental earthquake occurred in 1992, resulting in extensive damage and casualties in Cairo and surrounding areas.

Dust storms, can disrupt construction schedules and potentially damage infrastructure and investments; in particular, heatwaves may also pose a risk of heat stress to workers.

4.2.10 Other findings related to Current Site Conditions

The following points summarize the findings of the different investigation programs conducted at the site as described in the feasibility report:

- Approximately 14.8 million m3 of waste are disposed of at the site below and above the existing ground surface. Different types of waste are characterized, and the volume of each type is estimated as follows:
  - Type A (dry waste mixed with rubble) around 5.59 million m3
  - Type B (lightly saturated waste mixed with rubble) around 8.2 million m3
  - Type C (heavily saturated waste mixed with rubble) 1.04 million m3

- Waste ranges from burnt/charred (ashes) to undergoing decomposition.
- Gas was encountered in all invasive boreholes, with methane levels exceeding LEL, particularly below 3-4 m in all boreholes.
- Estimated 45 million m3 of gas can still be generated after completing the dumpsite closure in 2027(from LF gas prognosis).
- By tracing the moisture of waste body above and below ground surface, as evident in the geotechnical and geophysical investigations, it is estimated that around 1.95 million m3 of extractible fluids are still entrapped in the waste body, approximately 0.7 million m3 are above the lake level. These fluids are mixtures of leachate generated by the disposed waste as well as groundwater flowing into the disposed waste below ground surface.
  To understand how much of this volume can be practically recovered, the waste mass was categorized into three zones according to moisture content. The upper zone was found to be nearly dry, the middle zone was partially saturated, and the lower zone, located below lake level, was fully saturated and significantly diluted by lake water. The estimation focused on the moisture content that exceeds the field capacity, recognizing that a portion of the leachate remains bound within the waste and cannot be freely drained. As a result, the recovery system was designed to target leachate in the upper zones where extraction is more feasible, while also maintaining a hydraulic gradient that prevents outward migration and reduces environmental risks without relying on physical containment.

4.2.10.1 Landfill gas assessment

Although there are fires inside the dumpsite reducing the organic content in the waste, and although there was no waste compaction resulting in aerobic degradation of the organic waste components, it is expected that the waste still has a bio-degradable content. According to landfill gas assessment, the site is expected to generate a maximum of 774.8 cubic meters of gas per hour in 2025. Over time, a total of 184.7 million cubic meters of gas is projected to be released until 2085.

4.3 Socio-economic Baseline

4.3.1 Administrative Divisions

Based on Egypt's Description by Information 2021, Qalyubia Governorate's population is estimated at 6,217,766 as of January 2024. It consists of 7 local units for districts (Markaz), 10 cities, 2 sub-districts, 50 rural local unit neighborhoods, and 147 satellite villages.

Abu Zaabal Dumpsite is situated in Arab El-Olaykat village in Al Khanka city. The borders of Al Khanka city are as follows:

- Western border: Kafr Hamza Road, Sheben al-Qanater district
- Eastern border: Ismailia Canal (Abu Zaabal village)
- Northern borders: Mashtoul Al Souq district (Al Sharqiyah Governorate)
- Southern border: Abu Zaabal village

4.3.2 Total Area

The total area of Al Khanka city is approximately 21.845 km², with land use distributed as follows: 5.494 km² (25.15%) classified as agricultural land, 12.911 km² (59.1%) designated for residential purposes, and 3.440 km² allocated for other uses. The agricultural land in Al Khanka is primarily used for farming, with a cultivated area of 1,308.20 acres.

The city hosts various government buildings, including schools, Azhar institutes, shops, factories, workshops, and gardens. Al Khanka is home to several prominent families, such as Al-Jamal, Al-Qarsh, and Al-Badrawi. Due to its well-developed infrastructure and availability of essential services, the city attracts residents from neighboring villages that lack such amenities, as well as merchants seeking business opportunities.

4.3.3 Demographic Characteristics

4.3.3.1 Demographic and Social Composition

According to the Al Khanka City Council Information Center (2024), the total population of Al Khanka City is 89,707, with males comprising 50.9% (45,744 individuals). The city has 17,707 households, with an average family size of five.

Al Khanka is considered a predominantly young community, with 43.5% of the population under the age of 15. The economically active age group (15–65 years) makes up 54.9% of the population, while only 1.6% are over the age of 65. A similar demographic pattern applies to the villages within Al Khanka, including Arab El-Olaykat, highlighting that the youthful and growing population characterize the community.

Al Khanka City has a diverse social structure, comprising both civil and tribal communities. Residents of Arab El-Olaykat are considered highly conservative, even by Egyptian standards. The local community upholds the customs and traditions of tribal societies and informal settlements.

4.3.3.2 Local Communities Adjacent to Abu Zaabal Dumpsite

According to the Deputy Governor of Qalyubia Governorate, the communities closest to the Abu Zaabal dumpsite include Arab El-Olaykat Village, the new social housing subproject (specifically residential buildings No. 113 and 59, which overlook the dumpsite), the Abu Zaabal Workshop Housing Subproject, and Al Khanka Markaz, as seen in **Figure 4-12**. Nearby institutions include the administrative building and the healthcare unit of Arab El-Olaykat Village.

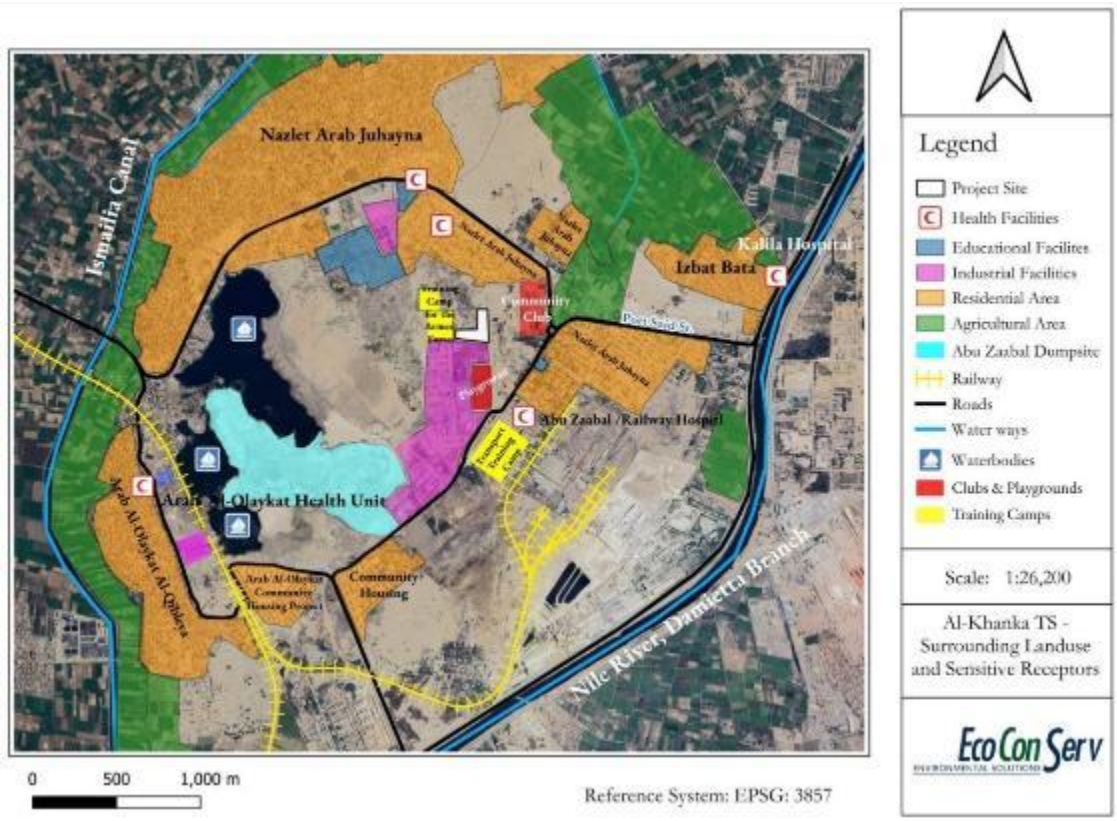


Figure 4-12: Surrounding Community of Abu Zaabal Dumpsite

Consultations with residents of the new social housing subproject (buildings 113 and 59) revealed significant dissatisfaction with the Abu Zaabal dumpsite's operations. Residents are exposed to persistent air pollution due to frequent fire incidents at the dumpsite, as well as strong odors from both the dumpsite and the Al Akrashah industrial area, located 1 km away, where aluminum waste is burned.

Figure 4-13 New Social Housing Subproject Residential Buildings no. 113

These environmental hazards have led to a rise in respiratory diseases, skin conditions, and allergies among the local population. Additionally, the dumpsite attracts large numbers of mosquitoes and

insects, creating further health risks and discomfort for residents. Stray dogs roaming the area pose additional safety risks, particularly for children and young people. Waste collection trucks also frequently transport uncovered garbage, contributing to litter accumulation on village streets.

As living conditions continue to deteriorate, many residents have been forced to leave their homes. Moreover, the proximity to the dumpsite has significantly reduced property values, making it difficult for residents to lease or sell their apartments. Authorities at Qalyubia Governorate have confirmed that the Abu Zaabal dumpsite has directly contributed to this decline in residential property values, further diminishing the overall quality of life for the affected population.

Figure 4-14: Stray dogs observed on-site

Figure 4-15: Cleanliness campaign to encourage residents to return to their homes

Further details on the outcomes of consultations with residents and local authorities, highlighting the impacts of the dumpsite on the community, are available in the ***Outcomes of the Scoping Consultation Activities*** subsection.

4.3.4 Gender Roles and Women's Economic Participation

The economic participation of women in Arab El-Olaykat is shaped by both industrial and social factors. The area is home to numerous factories producing lead, coal, fertilizers, and tiles, yet social customs and traditions often restrict women's employment opportunities. Women are primarily limited to government jobs or specific types of factory work within the village.

Despite improvements in family conditions and increased access to education, women's participation in industrial work remains minimal due

o unsuitable working conditions, such as long hours and the absence of maternity support. Instead, women are more commonly employed in government positions, trade (particularly in vegetables

and clothing), and select industries, including waste recycling factories, chicken slaughterhouses, and clothing factories in the Al Amal Industrial Zone.

Consultations with local women revealed several key challenges. Workplace harassment, financial difficulties, and limited job opportunities were among the most pressing concerns. Many women highlighted that economic hardships have contributed to rising divorce rates in the community. Furthermore, insufficient pensions and financial aid exacerbate their financial instability, making it difficult to meet basic needs. A significant gap also exists in vocational training, as women expressed a need for workshop to develop skills in handicrafts and other income-generating activities.

While most women in the community actively participate in social life and the electoral process and have access to support services, certain groups remain vulnerable. Female-headed households, widows, low-income women, and women relying on daily wage labor face heightened economic and social challenges.

4.3.5 Current Utilizers of the Dumpsite

4.3.5.1 Current Waste Pickers at the Dumpsite

Based on the socio-economic survey conducted at the Abu Zaabal Dumpsite, a total of **56 active waste pickers** work on sorting waste and selling materials to the dumpsite operator. Including the operator, the total number of **Subproject-Affected Persons (PAPs)** reaches **57 individuals**.

- **Demographics of Waste Pickers**

  Gender Distribution:
  - 50 males
    - 14 under 18 years old (below legal working age)
    - 14 married, 3 divorced, and 19 never married
  - 6 females
    - Age breakdown:
      - 3 women aged 59-62 (all widowed)
      - 2 women aged 38-39 (both divorced)
      - 1 woman aged 23 (married)

- **Household Characteristics**
  - The 56 waste pickers belong to 35 households, comprising 173 household members.
  - Gender ratio: 56.6% male / 43.4% female.
  - Age distribution within households:
    - 44.5% are under 18 years old
    - 23.7% are aged 18 to less than 35
    - 27.2% are aged 35 to less than 60

  - 4.6% are 60 years or older

- **Education Levels**
  - 52% have never attended formal education or dropped out.
  - 31% are currently enrolled in school.
  - 12% have completed mid-level schooling.

- **Residence and Household Size**
  - 80% of the waste pickers reside in Arab El-Olaykat Village, while the remaining 20% live in Abu Zaabal Village.
  - Average household size: 4.94 members per family.
  - 60% of households exceed this average, with four families having more than 8 members.

4.3.5.2 Dumpsite Operator

The dumpsite operator is a 32-year-old married man with three young children. He is from Arab El- Olaykat Village, near the dumpsite, and is familiar with the families of the waste pickers and their socio-economic conditions. He has been working at the Abu Zaabal Dumpsite for over 11 years under an official contract with Qalyubia Governorate. In addition to his extensive experience at the site, he owns warehouse for used plastics.

4.3.6 Vulnerable Groups

Based on consultation activities with the local community of Arab El-Olaykat, the primary population affected by the dumpsite, the following vulnerable groups have been identified within the context of the subproject, in alignment with the World Bank's criteria for recognizing vulnerable populations:

1. **Residents of the Social Housing:** Residents of Buildings 113 and 59, located less than 0.5 km from the dumpsite, are directly affected by strong odors, air pollution, and insect infestations due to their close proximity. These environmental hazards contribute to deteriorating living conditions, particularly for individuals with respiratory issues, whose health is further compromised by frequent open burning at the dumpsite.
2. **Existing Waste Pickers at the Dumpsite:**
   a. Based on the socio-economic information detailed in *4.3.5 Current Utilizers of the Dumpsite*, the closure of the dumpsite is expected to further exacerbate the vulnerability of waste pickers. Already operating within the informal sector, these workers endure hazardous conditions, earn below the minimum wage, and are often responsible for supporting large families. With the commencement of closure activities, they will lose access to the site, effectively ending their means of livelihood. Given this critical situation, a **Livelihood Restoration Plan (LRP)** has been developed to facilitate their transition and provide necessary support.

b. **Children Working at the Dumpsite** are considered a highly vulnerable group according to WB ESS 2 due to the severe risks associated with hazardous working conditions, limited access to education, and economic hardship. Waste picking exposes children to toxic substances, sharp objects, and disease-carrying materials, posing serious health and safety risks. Additionally, many children engaged in this work do so out of financial necessity, often contributing to family income at the expense of their education and long-term well-being. This group was also included in the livelihood restoration options outlined in the LRP study.
c. **Current Dumpsite Operator:** While the dumpsite operator is generally less vulnerable than the waste pickers, the closure of the Abu Zaabal Dumpsite may still have a significant impact on his livelihood. Unlike the waste pickers, he has an official contract with Qalyubia Governorate and additional income from owning a warehouse for used plastics, providing him with a relatively more stable financial position. However, the closure will disrupt his primary source of income, requiring him to adapt his economic activities. Although his vulnerability level is lower, the transition may still pose financial challenges that are recommended to be considered within the Livelihood Restoration Plan.

4.3.7 Child Labor

Based on consultations with the local community, child labor is prevalent in Al Khanka City, primarily among boys aged 13 to 18. These children often work as apprentices in workshops and shops or engage in learning crafts to support their families. Younger children, under the age of 13, are commonly found working in blacksmithing or agricultural activities. Girls, however, are generally excluded from these types of labor.

4.3.8 Health Services and Facilities

The healthcare landscape in Arab El-Olaykat, mirrors the challenges of rural Egyptian communities, intensified by environmental pressures from nearby industrial and waste sites, particularly the Abu Zaabal dumpsite. Arab El-Olaykat is served by one primary care facility, the Arab El-Olaykat Family Health Unit, which delivers essential services such as vaccinations, maternal and child healthcare, and basic outpatient care. Aligned with the Egyptian Ministry of Health and Population's rural health network, this unit is constrained by a lack of specialized team or advanced diagnostics, a common limitation in village settings.

4.3.8.1 Nearby Emergency Facilities

For emergencies, residents depend on the Arab El-Olaykat Railway Hospital, approximately 1 kilometer away, and Abu Zaabal Hospital, 2-5 kilometers away in the adjacent village, reachable 5-15 minutes by vehicle. The Railway Hospital manages acute cases like injuries or sudden illnesses, while Abu Zaabal Hospital provides general medical and surgical care. Neither is a fully equipped emergency center, and their ability to handle critical cases requiring intensive care is restricted.

Regionally, Al Khanka Specialized Hospital, about 10 kilometers away in Al Khanka city, serves as the primary hub for comprehensive care. Accessible in roughly 20 minutes by vehicle, it offers inpatient services, general surgery, and some specialties, though high demand across Qalyubia strains its capacity to absorb emergency cases from outlying areas like Arab El Olaykat. For advanced treatment, Benha University Hospital in Banha, 40 kilometers away, is the nearest tertiary care option. Its distance makes it impractical for urgent needs, particularly given the inconsistent availability of ambulance services in rural zones.

4.3.8.2 Abu Zaabal Dumpsite Health Risks

The Abu Zaabal dumpsite, associated with industrial activities in the neighboring area, poses significant health risks that amplify Arab El Olaykat's dependence on limited medical resources. Respiratory ailments, including chronic coughs and infections, are prevalent due to dust emissions and waste contamination, straining local health units which are ill-equipped to manage chronic environmental illnesses.

4.3.8.3 Emergency Response Limitations

Emergency support in Arab El-Olaykat remains limited, particularly for incidents related to dumpsite operations. The nearest acute care facilities, the Railway Hospital and Abu Zaabal Hospital, lack specialized units for treating chemical burns, toxic exposure, or severe respiratory distress, and their capacity to handle such emergencies remains unverified.

For more serious cases, residents often rely on hospitals in Al Khanka. However, this reliance highlights a critical gap in immediate emergency support, especially given the logistical constraints typical of rural settings. Although the redevelopment of El Khanka Hospital for Mental Health (located 9–10 km away) into a general medical complex offers long-term promise, as of March 2025, it has yet to deliver tangible benefits to Arab El-Olaykat or address the village's specific environmental health risks. In light of these challenges, a site-specific emergency response plan is urgently needed.

4.3.9 Solid Waste Management Services

The nearest waste management facility to the subproject area will be Al Khanka Transfer Station, currently under construction in Arab El-Olaykat village. The Abu Zaabal dumpsite is intended for municipal waste disposal, although there are occasional instances of unauthorized waste being disposed of at the site.

Municipal solid waste generation in the area is estimated at 150–200 tons per day, according to the Director of the Solid Waste Management Unit in Qalyubia Governorate. In response to persistent complaints about inadequate waste collection and street litter, the Governorate signed a contract with a cleaning company in March 2025. The aim of this initiative is to improve household waste collection services and enhance overall cleanliness in the area.

4.3.10 Infrastructure

The general infrastructure in Al-Khanka City is largely adequate, with public water and electricity networks covering most areas. Al-Khanka Water Station supplies potable water to the city, though residents report occasional impurities and a chlorine taste during maintenance. Most households use tap water with home filtration. Electricity is widely accessible through a public network.

However, sewage services remain less comprehensive. According to consultations with local governmental units in April 2024, 75% of the city's population is connected to the public sewage network, while 25% of households, mainly in outlying areas, rely on private sewage systems and septic tanks. In unserved areas, wastewater is often discharged into open drains, leading to foul odors and insect infestations.

As the Abu Zaabal Dumpsite Closure Subproject progresses, addressing waste and wastewater management will be essential to mitigating environmental and public health risks (refer to mitigation measures on waste and waste water management).

4.3.11 Road Network and Access

The road network in Arab El-Olaykat and the Al Khanka area supports connectivity to the Abu Zaabal dumpsite but is constrained by poor infrastructure and limited transportation options, impacting socio-economic conditions.

4.3.11.1 Local and Regional Roads

The Khanka-Al-Marj Road, a primary regional route over 10 kilometers from the dumpsite, is partly unpaved with cracks and heavy traffic. Other roads, also over 10 kilometers away, include Al-Khanka Al-Salam Road, a highway with frequent accidents, and Kafr Al-Hamam Road, narrow with cracks, bumps, and no lighting. These roads, averaging 5-8 meters wide, experience peak traffic from 7-8 a.m. and 2-3 p.m. The Abu Zaabal Road, a secondary route from the Cairo-Belbeis Desert Road extends 2-5 kilometers to Abu Zaabal village, followed by 1-2 kilometers of internal, unpaved industrial roads to the dumpsite. These local roads, also 5-8 meters wide, have bumps, cracks, and no lighting.

4.3.11.2 Dumpsite Access Routes

The Abu Zaabal Road, branching from the Cairo-Belbeis Desert Road, is the primary access to the dumpsite. The highway supports heavy vehicles, while the secondary and internal roads accommodate waste and construction trucks despite their narrowness and poor condition. These routes pass near residential areas in Abu Zaabal village, posing risks from traffic and dust. The Ismailia Canal Road, a narrower alternative, is less suitable for trucks and also runs through rural residential zones.

4.3.11.3 Transportation and Socio-Economic Effects

Transportation in Arab El-Olaykat is limited to tuk-tuks and microbuses, which are often inconsistently available. This limitation increases private transport costs, raises the price of goods, and delays students' access to schools, negatively impacting both education and local economic activity.

In addition, poor road conditions and the absence of street lighting further restrict mobility and pose significant safety concerns, particularly as large trucks will be transporting waste to and from the area. These trucks have substantial blind spots and may not see smaller vehicles like tuk-tuks or motorcycles, increasing the risk of accidents, especially on narrow or poorly lit roads.

4.3.11.4 Subproject Implications on Roads and Traffic

Subproject activities will primarily affect the Abu Zaabal Road and internal routes, with truck traffic causing road wear, dust, noise, and congestion during peak hours (7-8 a.m., 2-3 p.m.). Regional roads over 10 kilometers away are unlikely to be directly impacted unless detours occur. On the long-run dumpsite closure may reduce traffic, though construction could temporarily increase use. Impacts are detailed in the subproject's impact assessment.

4.3.12 Cultural Heritage

There are no known cultural heritage sites, archaeological sites, or cemeteries within or near the subproject area.

5 Analysis of Alternatives

This chapter of the ESIA outlines the feasible alternatives considered for the closure and rehabilitation of the Abu Zaabal Dumpsite. It also highlights the key factors behind the selection of the preferred option, including a comparison of the associated environmental impacts. During the development of design options, a primary goal is to achieve a balance between minimizing adverse environmental effects and fulfilling the subproject objectives. As detailed in Section 1 and Section 2, the objectives of the proposed subproject include:

- Eliminating risks to public health and safety.
- Reducing environmental, social and occupational health and safety risks to an acceptable level.
- Implementing a closure plan that gains community approval.
- Adhering to best practice sustainability principles into both the remediation and post-closure phases.

5.1 No Subproject Alternative

This option represents the current baseline situation, with no changes to the environmental impacts from the dumpsite, which are expected to persist for many years. While the organic and inorganic waste in the dumpsite will eventually degrade or be washed out, the timeframe for stabilization is uncertain due to limited knowledge of the waste composition. Stabilization of an uncontrolled dumpsite typically takes at least 50 years, often longer, depending on factors such as waste composition, water flow patterns within the waste body (e.g., through fractures or voids), and the retention of solid matter in certain areas.

Maintaining the dumpsite in its current state poses several risks, including:

- Continued pollution of surface water, groundwater, and soil.
- Ongoing emissions of landfill gas, dust, and odors.
- Potential slope instability, increasing the likelihood of landslides.
- Negative impacts on the nearby residential areas as odour, fire risks, etc

5.2 Improvement of Environmental Conditions /Site Remediation Options

An evaluation of remediation strategies for the Abu Zaabal Dumpsite explored multiple technical solutions to mitigate site-related risks. This assessment employed a qualitative scoring system to compare the viability of each option against specific performance criteria. These are summarized below.

5.2.1 Landfill Mining

One of the strategies, involving the complete excavation and off-site disposal of all waste, was excluded early in the decision-making process. While this method offered potential benefits for groundwater protection, its overall environmental and logistical impacts were deemed unsustainable. Removing approximately **15.575 million** cubic meters of waste according to forecast until end of 2025 would lead to significant emissions of landfill gases release, causing prolonged odor issues and the release of considerable greenhouse gases (GHGs).

In addition, this alternative was rejected from a technical point of view as the waste quality in the dumpsite was found to be unsuitable for waste mining

5.2.2 Implementing Closure Options

The other option was to improve the current environmental conditions resulting from the uncontrolled status by installing landfill cover, gas treatment and leachate treatment. The final chosen option includes cover installation, emptying a volume to receive fresh waste and to use in reshaping of phase 1, installing leachate and gas collection systems, constructing an evaporation pond and installing a flare system.

This option will allow the treatment of 0.185 million m310 of extractible leachate fluids and the collection of 184.7 Million Mm^3 of landfill gas until 2028 preventing its migration to the environment.

5.3 Cover after Reshaping

The design Consultant determined the final cover layers taking into consideration different international standards (EU Landfill Directive, US EPA etc.), the nature of the site and the Egyptian Code for Solid Waste. The cover will include:

- Leveling layers,
- gas drainage layer, a permeable layer, typically gravel, to prevent gas buildup
- geomembrane liners,
- stormwater drainage layer,
- vegetation topsoil for final finish and erosion protection, and
- serration geotextiles between the above layers.

The different options are compared below.

[10] According to Section 7.3 of the latest DD report, quantity of leachate to be extracted from the waste body is approximately 50% of the 0.37 million m^3 due to considerable movement and relocation of waste will occur during the reprofiling of the waste mass

Table5-1: Comparison of Cover Options

Criteria	Sand Cover Only - No LFG Collection	Sealed Capping with Gas Collection	Separation and Reuse of Inert Materials as Cover
Groundwater protection	Minimal protection; leachate can infiltrate groundwater.	High protection**.** Prevents infiltration with sealed capping and drainage systems.	Minimal protection; leachate can infiltrate groundwater.
Surface water protection	**Low protection**: Runoff may carry pollutants into surface water bodies.	**High protection**: Prevents contamination with a sealed cover and controlled drainage.	**Low protection**: Runoff may carry pollutants into surface water bodies
Landfill gas control	**Low control**: No measures to capture or control landfill gas, leading to emissions.	**High control**: Captures gas and prevents migration, reducing greenhouse effects.	**Low control**: No measures to capture or control landfill gas, leading to emissions.
Odour and nuisance impacts	**Low control**: Odors remain unmitigated due to lack of controls.	**High control**: Sealed capping and gas collection minimize odors effectively.	**Low control**: Odors remain unmitigated due to lack of controls.
Visual impact	Offers basic coverage but lacks a landscaped appearance.	Provides a clean, landscaped appearance post-closure.	Offers basic coverage but lacks a landscaped appearance.
Timescale to remediate the site	Quick to implement with minimal preparation.	**Medium**: Longer timeline due to construction of sealed capping and gas collection systems.	**Moderate timeline** to implement with some preparation needed to separate the material
Health and Safety	High risk of exposure to gases, leachate, and other hazards without protective measures.	Effective in reducing risks associated with gas exposure and contamination.	High risk of exposure to gases, leachate, and other hazards without protective measures. In addition, during separation of materials, workers are exposed to many health risks.
Resource Sustainability	**Low, since no reuse**	**Low, since no reuse**	High since inert material will be collected and used as cover, prioritizing reuse in the waste hierarchy.
Cost	Low: Least expensive option with minimal investment.	High: Most expensive due to advanced systems for capping and gas collection.	Medium: Moderate costs for processing and reusing inert materials as cover.

The Sealed Capping with Gas Collection was the chosen option because it offers the maximum environmental and health and safety benefits.

5.4 Leachate containment

5.4.1 Perimeter Cutoff Wall + Vertical Leachate Extraction Wells

This solution contains a slurry trench from the ground surface down to the basalt layer. In parallel the trench will be filled with a bentonite/grout suspension. The suspension hardens within a month and becomes watertight. The waterflow (groundwater and leachate) is minimized and groundwater from upstream cannot easily mix with leachate while leachate cannot easily flow downstream and mix with groundwater.

For leachate collection a certain number of water wells with submerged pumps need to be constructed along the cutoff wall.

This solution results not only in high construction costs but also in high operation costs for the permanent pumping over a longer period of several years (estimated at least 10 years). In addition, the connection of the cutoff wall and the bedrock (basalt) is critical, and a long-term watertight solution is questioned.

5.4.2 Perimeter leachate drain

Instead of a cut-off wall, a perimeter drain is constructed around the landfill. Due to the shallow groundwater table and the continuous recharge from the lakes, the practicality of excavating a trench and dewatering it represent a compromise regarding costs and effectivity in comparison to the cut-off wall.

5.4.3 No Containment

A third option examined the use of leachate pumping without any form of physical containment, relying instead on hydraulic control principles. In this scenario, a leachate collection system consisting of vertical extraction wells was examined to extract leachate from within the waste body, targeting layers located above the lake level. The wells are distributed across the reprofiled surface of the dumpsite, with the lowest extraction points positioned approximately two meters above the lake surface. Rather than aiming to remove the total volume of leachate present, this approach is designed to extract enough to reduce the leachate head, thereby lowering the hydrostatic pressure that would otherwise drive seepage into adjacent surface and groundwater receptors.

To quantify the volume of leachate to be extracted, the existing waste body was subdivided into three vertical zones based on geotechnical and geophysical investigations. The upper zone was characterized as virtually dry, the middle zone (representing the core of the dumpsite) as partially saturated, and the bottom zone, located below lake level, as fully saturated. The average moisture content and corresponding volume of waste in each zone were established from sample analysis,

and the extractible leachate was estimated by calculating the moisture content in excess of the field capacity of the waste material. This allowed for exclusion of the fraction of leachate that remains bound within the waste matrix and cannot be freely drained.

The system was therefore designed to extract only raw leachate located above lake level, deliberately excluding the saturated lower zone where leachate is likely diluted by lake water and less practical to recover. The effectiveness of this method depends on maintaining a leachate level within the waste mass that is lower than the external lake level, creating a neutral or inward hydraulic gradient. In doing so, the risk of outward migration of leachate is minimized through hydraulic balance rather than physical containment. While this approach is cost-efficient and less complex than constructing physical barriers, it requires careful monitoring of leachate levels, adaptive pumping control, and an accurate understanding of the site's hydrogeological dynamics.

The table below provides a comparison of the options.

Table5-2: Comparison between leachate containment options

Environmental /Social/Feasibility Aspect	Scenario A: Perimeter Cutoff Wall + Vertical Leachate Extraction Wells	Scenario B: Perimeter Leachate Drain	Scenario C: Hydraulic Head Control with Vertical Leachate Pumping (No Containment)
Groundwater protection	Moderate to Good: Aims to minimize groundwater contamination by isolating waste, but full containment is not guaranteed due to challenges in achieving a watertight connection with the basalt bedrock which was initially assumed to be non-porous.	Moderate: Reduces leachate flow but less effective than a cutoff wall due to groundwater recharge challenges.	Moderate: Reduces risk of leachate migration by lowering leachate head; effectiveness depends on accurate gradient control and site conditions.
Surface water protection	Good: Designed to prevent leachate from reaching surface water, but performance depends on proper functioning of both wall and pumps.	Moderate: Provides partial protection but relies on continuous drainage, which may not fully control seepage into lakes.	Moderate: Helps limit seepage to surface water by maintaining inward/neutral gradient; does not directly address saturated bottom zone.
Treatment efficiency	High: Actively removes leachate through pumping, provided wall and wells are well maintained.	Moderate: Captures a portion of leachate but effectiveness depends on drainage continuity and groundwater-lake interactions.	Moderate: Targets free leachate above lake level to reduce head; does not extract from saturated zone but minimizes driving pressure.

Traffic, noise, and vibration	High: Construction of the cutoff wall and ongoing leachate pumping operations result in significant noise, vibration, and traffic over several years.	Moderate: Requires construction of a perimeter drain, resulting in temporary noise and traffic, but less disruptive than Scenario A.	Low to Moderate: Localized well installation and periodic pumping result in limited disturbance compared to containment systems.
Visual impact/intrusion	Moderate: Construction and operation of wells and pumps may alter the site's visual appearance.	Moderate: Visible drainage infrastructure may cause some visual impact but less intrusive than Scenario A.	Low: Minimal aboveground infrastructure, with wells less visually intrusive than drainage or containment structures.
Timescale to remediate the site	Long: Construction and ongoing leachate pumping are approximately 10 years.	Moderate: Remediation is quicker than Scenario A but requires ongoing drainage maintenance.	Moderate: Achieves risk reduction relatively quickly by lowering leachate head, but requires ongoing monitoring and adaptive pumping.
Cost	High: Significant costs for construction, operation, and maintenance over a long period.	Moderate: Costs are lower than Scenario A, but excavation and drainage infrastructure still require substantial investment.	Moderate: Lower cost than containment options; avoids structural works but includes well installation, pumping, and monitoring.

Following the evaluation of the site's hydrogeological conditions, waste composition, and leachate distribution, the option of selective leachate extraction through hydraulic head control was chosen as the preferred approach. This decision was based on the understanding that, from an environmental standpoint, it is not necessary to extract all the leachate stored within the waste body. The key objective is to reduce the leachate head to a level that eliminates the hydraulic pressure responsible for driving seepage into adjacent surface and groundwater receptors.

By maintaining an inward or neutral hydraulic gradient, the potential for leachate migration is effectively minimized. The saturated lower zone of the waste body—located below lake level—contains leachate that is already diluted and poses a lower environmental risk. As such, focusing extraction efforts on the upper and partially saturated zones is considered sufficient to achieve the required level of environmental protection.

In contrast, higher-cost containment options do not ensure full isolation, particularly given the technical challenges of securing a watertight connection to the basalt layer. Moreover, these systems require larger construction areas, extended implementation periods, and continuous pumping operations, all of which increase environmental disturbance and cost without guaranteeing superior performance. The selected approach therefore represents a balanced solution that is technically sound, environmentally protective, and economically viable for the conditions present at the Abu Zaabal dumpsite.

5.5 Leachate Treatment Technologies

Depending on the selected leachate collection system, a certain quantity of extractible leachate is expected over the coming years. Leachate treatment options considered were either natural attenuation, leachate evaporation or technical solutions like reverse osmosis.

5.5.1 Natural attenuation

As part of the leachate management evaluation for the Abu Zaabal Dumpsite, natural attenuation was examined as a potential low-intervention alternative. This approach relies on the natural transformation or immobilization of contaminants through physical, chemical, and biological processes occurring within the surrounding lakes. Organic pollutants may degrade into less harmful by-products, such as carbon dioxide and water, while some inorganic compounds may bind to sediments and become less mobile. Considering that a portion of the waste was historically deposited below the groundwater table or beneath the lake water level during earlier disposal phases, it is likely that much of the easily leachable contaminants have already been washed out and that degradation has already progressed to some extent.

In this context, the adjacent lakes act as passive treatment zones, where natural attenuation is already occurring through mechanisms such as dilution, sedimentation, sorption, and anaerobic microbial activity. While these processes contribute to the gradual reduction of contaminant levels, the consultant's assessment identified several technical and environmental limitations that reduce the viability of this option as a primary treatment strategy.

Treatment efficiency is inherently low to moderate and highly dependent on environmental conditions, including temperature, redox potential, and sediment composition. The passive nature of this approach means it cannot be actively controlled or scaled beyond the natural capacity of the lake system. Although it requires no energy input and minimal maintenance — with capital and operating costs limited to environmental monitoring — its effectiveness is unpredictable. Importantly, the approach offers poor protection of groundwater, particularly in areas where waste was deposited below the water table. In such cases, reliance on natural degradation processes alone may be insufficient to prevent continued leachate migration.

Furthermore, there is a high likelihood that certain contaminants, particularly metals such as lead, cadmium, mercury, and arsenic, may accumulate in lake sediments rather than being fully removed from the system. While biodegradable organic compounds (e.g. BOD, COD) may be broken down over time, inorganic contaminants tend to persist. Nutrients such as phosphate and ammonium may also accumulate, increasing the risk of eutrophication. This creates a scenario in which contaminants may continue to seep into nearby lakes, posing ongoing risks to surface water quality and aquatic ecosystems. Over time, these risks may intensify, particularly if sediment-bound contaminants are re-released due to changes in redox conditions or lake disturbance.

For these reasons, the natural attenuation approach was ultimately disregarded as a standalone solution. It does not provide the level of control, reliability, or protection required to meet environmental objectives. While it may contribute to long-term mitigation of historical leachate impacts, it cannot substitute for engineered containment and treatment measures. The consultant concluded that active leachate management remains essential to safeguard groundwater, surface water, and surrounding ecosystems from further degradation.

5.5.1.1 Leachate evaporation

Using leachate evaporation, leachate will be pumped into open ponds with bottom lining systems. Leachate will evaporate and the dried fines need to be dredged/scrapped and disposed at a landfill. In general, leachate evaporation of the entire leachate quantity (1.95 million m^3) is possible for Abu Zaabal Dumpsite due to climate conditions but the size of the evaporation ponds is calculated to have 120,000 m^2 surface (for example 8 evaporation ponds with a surface of 15,000 m^2 each) to evaporate the leachate over 10 years. For this, sufficient space on site is not available unless extra land is provided in the neighborhood of the dumpsite.

It is also possible to reduce the quantity of leachate to be extracted from the waste body to approximately 0.7million m3 to target significant reduction of leachate head instead of complete removal. In case of non-containment, the daily generated volume is 40-50 m3 during 14 years and the operator can control the extracted quantity. Only 2 evaporation ponds with a surface of 5,000 m^2 each will be needed. The bottom of the evaporation pond will be lined with a virtually impermeable liner with several layers and covered with a lean concrete surface.

Assuming that the expected leachate composition falls within the range provided in the design, evaporation ponds are considered an appropriate method to handle leachate provided that sludge is appropriately transported and disposed. The main disadvantage of evaporation ponds is potential nuisance caused by odor. The evaporation ponds are the selected technology for the leachate treatment.

5.5.1.2 Leachate Treatment by Reverse Osmosis

Out of the different possibilities for a technical treatment of leachate, Reverse osmosis (RO) is one of the favored technical solutions. It aims to extract clean water from the aqueous solution of organic and inorganic contaminants that constitute the landfill leachate. The process exploits the natural phenomenon of osmosis whereby, if two aqueous solutions, with different degree of concentration, are separated by a semi-permeable membrane, water from the weakest solution will pass through the membrane to dilute the higher concentration solution on the other side. The process will continue till solutions on both side of the membrane display the same degree of concentration.

With reverse osmosis the process is reversed. Pressure is applied to a water solution, (leachate), against a semipermeable membrane forcing the water molecules to pass through the membrane,

thus forming the clean "permeate". The majority of the solutes or contaminants will be left behind forming the "concentrate". Reverse osmosis is the finest physical separation method known. In contrast to normal filtration where solids are eliminated from a liquid, reverse osmosis succeeds in removing solutes from a solvent. As a technology, RO is well established in wastewater treatment applications.

Advances in membrane technology in the last years have allowed the development of RO systems designed specifically for the treatment of leachate. The retention efficiency is primarily depended upon the molecular weight and polarity of contaminants. Reverse osmosis membranes can result in the retention of more than 98% of large molecules dissolved in leachate. Ions of valance 1 such as Na+, Cl- can also be retained. Most commercially available plants are constructed as two stage plants with contaminant removal rates better than 99.6%. Where unusually high strength leachate is treated or very stringent discharge consents apply, three stage plants can be employed and achieve contaminant removal rates better than 99.98%.

Table 5-3: Comparison between leachate treatment options

Issue	Natural Attenuation	Leachate Evaporation	Reverse Osmosis (RO)
Effectiveness in leachate treatment	Low to moderate: Dependent on natural conditions; does not guarantee full contaminant removal. Persistent contaminants (e.g., metals, nutrients) may remain in sediments.	Medium: Relies on climatic conditions for evaporation and may not fully treat contaminants.	High: Can effectively meet discharge standards using tailored treatment processes.
Space requirements	No additional space needed as it uses existing lakes.	Requires significant space (5,000 m² for each of the two ponds). However, space was available in Abu Zaabal.	Space requirements vary depending on the chosen technology.
Scalability	Limited: Constrained by lake capacity and site-specific conditions.	Scalable depending on available land and climate.	Highly scalable with flexible treatment combinations.
Environmental impact	Potential for long-term sediment contamination and surface water quality risks.	Odor and emissions possible; disposal of dried fines required. Impacts are minimal with proper design.	Tailored systems minimize environmental impacts; sludge management required.
Flexibility	Limited: Not controllable or adjustable once in place.	Limited by climate and land but suitable for Egyptian weather.	High: Can be adapted to various leachate qualities and discharge targets.
Maintenance and operation	Low: Only monitoring is required.	Requires regular monitoring and management of ponds and sludge.	Varies by system but generally requires skilled labor and ongoing management.

Cost	Low: Minimal CAPEX/OPEX for monitoring.	Moderate: Construction and maintenance of ponds.	High: Advanced technology and operational costs.
Treatment efficiency	Low to moderate: Reduces some organics; metals and nutrients may accumulate in sediments and potentially leach back.	Moderate: Reduces volume and concentrates pollutants as dried sludge.	Very high: Up to 99.98% contaminant removal with multi-stage systems.

Leachate evaporation was selected as the preferred treatment option due to its balance of effectiveness, cost-efficiency, and operational feasibility in the context of the Abu Zaabal Dumpsite. Compared to natural attenuation, which is passive, slow, and offers limited control over leachate behavior, evaporation provides an active means of volume reduction with significantly lower environmental risk. Natural attenuation also poses long-term concerns, such as the accumulation of metals and nutrients in lake sediments and the potential for continued contamination of surface and groundwater. In contrast, reverse osmosis (RO) offers the highest treatment efficiency and can achieve contaminant removal rates above 99%, but its complexity, high operational costs, and need for skilled labor make it less suitable given local conditions and long-term resource requirements.

Leachate evaporation, while dependent on climatic conditions, is technically simple, energy-efficient, and well-suited to Egypt's arid environment. The availability of adequate land in a designated location near the dumpsite supports the construction of evaporation ponds. Importantly, the selected location benefits from prevailing wind directions that blow away from nearby sensitive receptors, such as residential areas or public facilities, helping to mitigate the potential nuisance from odors. This makes the method more environmentally and socially acceptable than other options that may result in greater disturbance. Additionally, evaporation ponds allow for controlled leachate extraction over time and involve only moderate capital and operational costs. Taken together, these factors position leachate evaporation as the most practical and cost-effective solution among the options considered.

5.5.2 Leachate Treatment Location

In general, leachate evaporation as well as other treatment solutions can take place elsewhere outside the dumpsite area. Additional transport costs would increase the cost for leachate treatment significantly.

Leachate treatment in a wastewater treatment plant is not recommended without pre-treatment because the biological stage of the wastewater treatment plant is not appropriate.

On the other hand, treatment may occur onsite as in the case of the current design.

Table5-4: Comparison between onsite and offsite treatment options

Issue	Onsite treatment (evaporation ponds)	Offsite Leachate Treatment in WWTP
Effectiveness in leachate treatment	Highly effective: Achieves high contaminant removal rates (>99.6%), suitable for stringent discharge standards.	Medium: Effectiveness depends on the pre-treatment quality and the receiving facility's capabilities.
Space requirements	Requires dedicated on-site space for evaporation ponds	No space required at the dumpsite but relies on infrastructure at external facilities.
Groundwater protection	Prevents leachate from contaminating groundwater through direct on-site treatment.	Relies on external treatment efficiency to protect groundwater. Possible leaks during transportation
Surface water protection	Prevents leachate from entering surface water bodies through immediate on-site treatment.	Transport and external facility management influence effectiveness.
Odour and nuisance impacts	Minimal odors on-site, with concentrated waste handled in a controlled manner.	Odor impacts arise from transport and external handling processes.
Traffic, noise, and vibration	Avoids transport-related disturbances, resulting in minimal traffic, noise, or vibrations.	Transport logistics lead to increased traffic, noise, and vibration over time.
Visual impact/intrusion	Onsite systems require visible infrastructure but are generally compact and localized.	No visible impact on-site, but transport activities may intrude on surrounding areas.
Timescale to remediate the site	Relatively quick to implement and operate after installation.	Delays occur due to transport and external treatment processes.
Sustainability/greenhouse gases	Significantly reduces emissions by minimizing transport and using energy-efficient treatment.	Transport and energy-intensive processes at external facilities result in high emissions.
Cost	High initial investment but lower operational costs in the long term.	High costs due to transport, pre-treatment, and external facility fees.

5.6 Location of Evaporation Ponds

Two locations were assessed for the evaporation ponds. The initially proposed ponds' location was close to the adjacent residential settlement (<150 m).

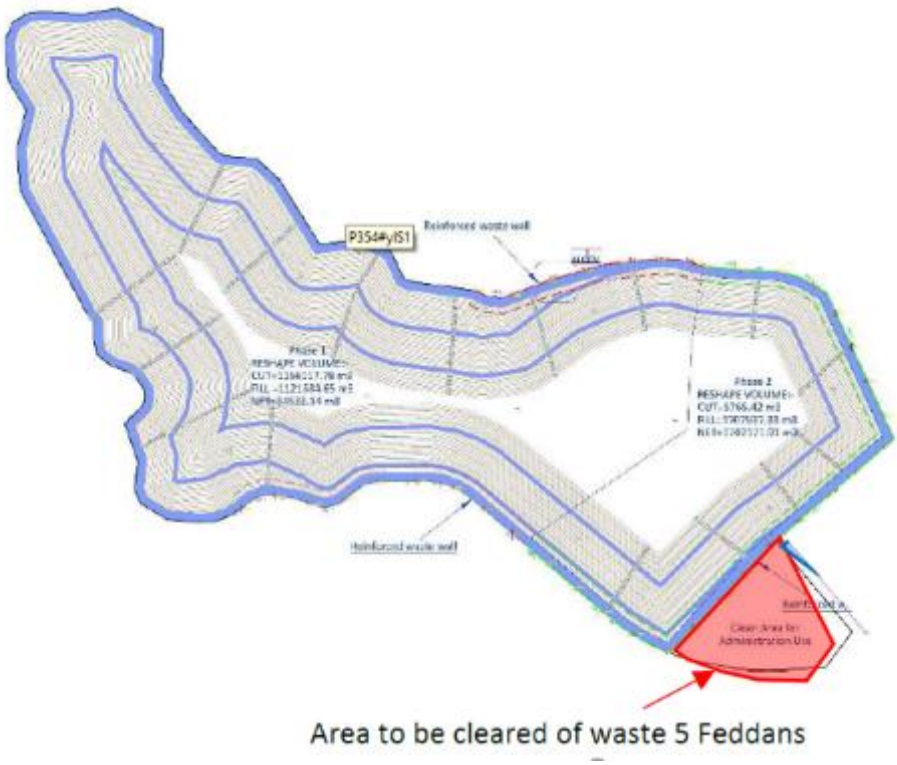


Figure 5-1: Initial proposed location of evaporation ponds

It was raised by various stakeholders that locating the treatment facilities close the entrance, which faces residential settlements to the south of the site, might cause significant inconvenience to the public and potential resistance to the entire subproject. The consultant was urged to find alternative locations within the site boundaries for the potential EP to avoid the transport of odor to the residential settlements. In addition, locating EP close to the entrance in the south will be visible and add to the public inconvenience.

The second location is further North and located away from the residential areas. While the second option will result in a higher investment, it mitigates nuisances that may arise from the operational phase. Accordingly, the second location was selected.

Figure 5-2: The Selected Location of the Evaporation Ponds

5.7 Gas collection and treatment

Several options regarding the collection and treatment of landfill gas (LFG) were assessed for Abu Zaabal Dumpsite. A closure of the dumpsite without any LFG collection system should be excluded as it will cause uncontrolled gas emission with an increased risk of fire and in worst case gas explosions. In addition, since the main aim of the subproject is to mitigate air pollution and address climate change and since methane is one of the main components of the landfill gas and responsible for the "Greenhouse gas" effect, LFG collection and treatment / utilization should be one of the main goals of the dumpsite closure.

5.7.1 Landfill gas collection and venting

Gas collected in the gas wells or the horizontal gas drainage is led to the atmosphere untreated at defined points at the dumpsite. It reduces the health and safety risks but there is no reduction of the greenhouse effect.

5.7.2 Landfill gas collection and flaring

Gas collection and treatment in high-temperature flares is state of the art for large dumpsites as well as sanitary landfills for household waste. The gas is burned at temperatures of more than 1,000° Celsius. Beside the flare, the gas blower, and the operating system which is usually stored in sea-containers, several other installations such as connection pipes between the gas collection system and the flare, gas-substations and gas condensate traps are needed. For optimizing the gas flow and maintenance of the plant regular supervision is needed.

5.7.3 Collection with gas utilization

Electricity can be used at the dumpsite itself (for operating a leachate treatment plant, pumping systems or similar), for supporting commercial or private activities in the surrounding of the dumpsite or it can be supplied to the public network.

All these options depend on the distance between the gas utilization plant and the user, respectively the transfer point to the network. Before starting the detailed design of the gas utilization plant, the willingness of the electricity authorities to receive electricity should be confirmed.

The quantity of landfill gas produced in the dumpsite will decrease over the years which is why several smaller gas engines would be installed instead of only one. When gas production depletes, a number of the gas engines can be decommissioned and moved to another landfill.

Table5-5: Gas treatment options

Issue	Landfill Gas Collection and Venting	Landfill Gas Collection and Flaring	Collection with Gas Utilization
Effectiveness in gas management	Low: Reduces health and safety risks but does not address greenhouse gas emissions.	Medium: Effectively reduces greenhouse gases through flaring but does not provide energy recovery.	High: Reduces greenhouse gas emissions and allows for energy recovery through electricity production.
Environmental impact	Venting releases untreated landfill gas directly into the atmosphere, contributing to climate change.	Burning gas reduces its environmental impact but still emits CO2.	Produces renewable energy, reducing the site's carbon footprint significantly.
Greenhouse & Climate gases	No reduction in greenhouse gas emissions; methane is directly released into the atmosphere.	Methane is converted to CO2, significantly reducing greenhouse gas potency.	Methane is captured and utilized, providing both environmental and economic benefits.
Energy recovery potential	No energy recovery or economic benefit.	No energy recovery, but potential exists for future gas utilization.	Produces electricity for on-site use, surrounding areas, or the public network, depending on infrastructure.
Cost	Minimal installation and operational costs.	Higher installation and operational costs due to flaring system infrastructure.	Significant investment in gas engines, infrastructure, and operational management. However, possible to create income through carbon credits .

The Landfill Gas Collection and Flaring was chosen for its effectiveness in reducing methane emissions, lower costs, and simpler operation compared to gas utilization. While venting would release methane gas into the atmosphere, flaring minimizes environmental impact by converting methane into less harmful emissions with lower greenhouse gas effect. Flaring also helps control odors and air pollutants. Gas utilization was not feasible due to inconsistent gas yields and high investment costs., making flaring the most practical and efficient choice for the site.

5.8 Implementation Scenarios

The following four implementation scenarios were compared and analyzed (Illustrated in Figure 5-4):

- Scenario A: Two phases with daily generated waste reception to the east
- Scenario B: Two phases with daily generated waste reception to the north
- Scenario C: One phase without receiving daily generated waste
- Scenario D: Two phases with daily generated waste reception to the middle

5.8.1 Scenario A

Under this scenario:

- An area of 5 Feddans (light green) will be recovered for landscape purposes, expanding to 8 acres after clearing the garage and medical incinerator area.
- The implementation is divided into two phases:
  - The first phase on the northwest side (dark green): will be closed immediately.
  - The second phase on the east side: waste will be received for two years until the construction of the disposal cell on the tenth of Ramadan.
- This alternative is the least costly because it has a smaller volume of waste disposed of within the site.
- The reclaimed area will not be utilized until after 30 months.

5.8.2 Scenario B

Under this scenario:

- An area of 5 Feddans (light green) will be recovered for landscape purposes, expanding to 8 acres after clearing the garage and medical incinerator area.
- The implementation is divided into two phases:
  - The first phase on the east side (dark green): will be closed immediately.
  - The second phase on the northwest side (red): daily generated waste will be received for two years until the construction of the initial cell in the landfill site at the Tenth of Ramadan.

- There is an additional cost for implementing this alternative, which involves transporting a quantity of waste from the northwest side to the relatively lower east side to clear space for disposing the daily generated waste for two years.
- The reclaimed area will not be utilized until after 28 months.

5.8.3 Scenario C

Under this scenario:

- An area of 20 Feddans (light green) will be recovered for landscape use, expanding to 23 acres after recovering the garage and medical incinerator areas.
- The implementation is in a single phase, where 20 Feddans will be reclaimed, covering the rest of the site.
- The daily generated waste will be transferred to the Tenth of Ramadan site, assuming the completion of the cell in terms of design and implementation within 6 months.
- This alternative requires transporting waste outside the site, increasing the subproject cost. However, it reduces the cover cost, making it less expensive than Scenario B.
- This is the fastest closure scenario, and the reclaimed area can be available after 24 months.

5.8.4 Scenario D

T**he selected scenario is D**, under this scenario:

- The area of 5 Feddans (similar to previous options) will be recovered as a buffer and for landscape purposes in the future,
- The implementation is divided into two phases (Figure 5-3):
  - The first zone on the southern side: will be closed immediately after emptying the area for zone 2.
  - The second zone on the northern side: daily generated waste will be received for two years until the construction of the initial cell in the landfill site at the Tenth of Ramadan.

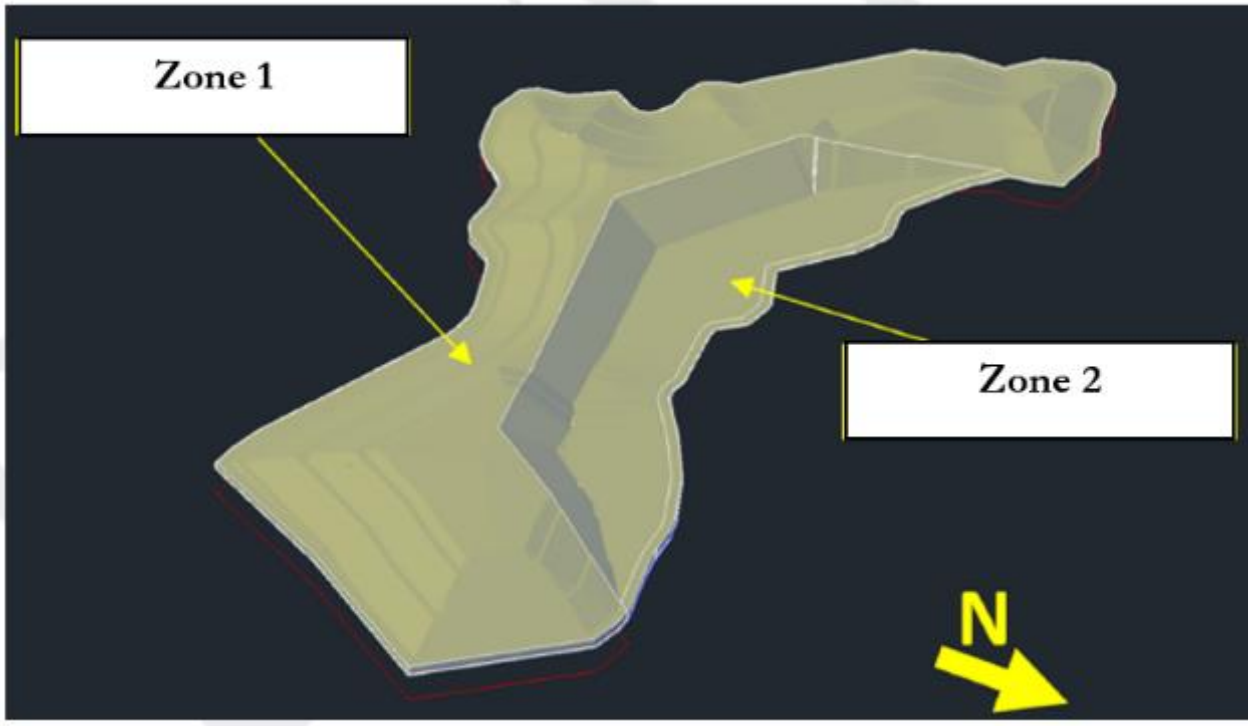


Figure 5-3: Location of the Proposed Zone 1 and Zone 2 in Scenario D (Selected Scenario)

- There is an additional cost for implementing this alternative, which involves transporting a quantity of waste (app. 600,000 m3) from the northern side to the relatively lower east side to clear space for disposing the daily generated waste for two years.
- The reclaimed area will not be utilized until after 32 months.

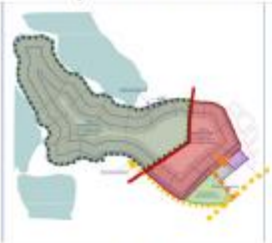
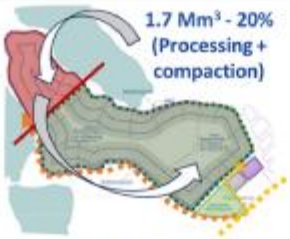
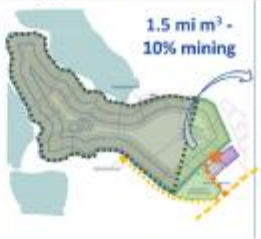
Scenario A: Two phases with daily generated waste reception to the east	Scenario B: Two phases with daily generated waste reception to the north	Scenario C: One phase without receiving daily generated waste	Scenario D: Two phases with daily generated waste reception to the middle
			
21,011,000 USD	26,311,000 USD	24,500,000 USD	22,711,000 USD
8 Feddans of clear flat area (immediate 5 feddans and future 3 feddans)	8 Feddans of clear flat area (immediate 5 feddans and future 3 feddans)	23 Feddans of clear flat area (immediate 20 feddans and future 3 feddans)	8 Feddans of clear flat area (immediate 5 feddans and future 3 feddans)
30 months	28 months	24 months	32 months
Will receive daily generated for two years	Will receive daily generated for two years	No daily generated of waste	Will receive daily generated for two years

Figure 5-4: The Proposed Implementation Scenarios

The Scenario D was selected to relocate the waste receiving area further from residential zones. By positioning the daily waste reception at the center, the design utilizes the waste mass height as

a wind barrier to reduce air and odor emissions. Additionally, with residential areas upwind of the facility, prevailing winds carry odors and emissions away, minimizing exposure to unpleasant smells and potential air pollutants while also reducing mosquito-related concerns.

6 Identification and Assessment of Impacts

This chapter addresses potential impacts (positive vs. negative, direct vs. indirect, short-term vs. long-term, avoidable vs. unavoidable, reversible vs. irreversible) of all planned subproject activities. Measures to avoid, reduce or compensate potentially significant negative impacts have been suggested in each case.

The subproject's available documents have been reviewed and analyzed to identify the potential environmental and social impact. The main sources of data that the impact assessment relies on is Chemonics Feasibility Study Report.

6.1 Overall Positive Impacts of the Subproject

With proper management, the Subproject tends to have a positive environmental & socioeconomic impact.

1. **Environmental and Public Health Improvement**

Positive impacts include the improvement of public health, environmental conditions and economic sustainability. The closure of Abu Zaabal Dumpsite improves overall public health in Qalyubia Governorate, particularly in Arab El-Olaykat by:

- Preventing leachate contamination of groundwater and surface water, ensuring safer drinking water.
- Reducing unplanned waste burning and the emission of toxic and hazardous gases.
- Minimizing fire risks caused by open-air waste burning.
- Controlling dumpsite exposure to wind, reducing odors and improving community well-being.
- Lowering airborne pollutants, leading to fewer respiratory issues such as asthma, bronchitis, and allergies.
- Mitigating long-term health and environmental hazards, including poor air quality, odors, harmful gases, and disease-carrying pests, while enhancing local aesthetics and property values.

2. **Implementation of Resource efficiency measures (waste hierarchy)**

The Abu Zaabal Dumpsite closure will include the implementation of resource efficiency measures such as use of C&D waste for the stability pads and fresh waste coverage

3. **Reduction of GHG Emissions**

The dumpsite closure will result in capturing and flaring about 184.7 million m^3 of landfill gas which would have otherwise been released into the environment as methane, a potent greenhouse gas. Flaring then combusts this methane into carbon dioxide and water vapor. Although carbon dioxide is still a greenhouse gas, its global warming potential is significantly lower than that of methane, leading to a net benefit for air quality and climate change mitigation.

4. **Improvement of Quality of water in the lakes**

According to the geotechnical report prepared by the design consultant, geophysical investigations revealed that fluid seepage pathways have formed within the waste body at the site, draining toward the lakes. Although the dumpsite is not the sole source of contamination to the lakes, it is a significant contributor. Installing leachate collection and treatment is expected to improve the water quality in the lakes and the surrounding area.

5. **Restoration of Livability and Property Value**

As outlined in the Local Communities Adjacent to Abu Zaabal Dumpsite baseline subsection, residents who previously left their homes due to the dumpsite's adverse impacts are expected to return after its closure. Additionally, the decline in property values is anticipated to reverse.

- **Direct Job Opportunities for Skilled and Semi-Skilled Laborers**

The site closure subproject will generate a variety of direct employment opportunities, requiring both skilled and semi-skilled laborers. The number and type of workers depend on factors such as subproject activities, the nature of the tasks, and the subproject timeline. An estimated total of 150 workers may be required across all phases and activities. Below is a breakdown of key roles organized by subproject component.

1. **Civil Works Activities**
   a. **Reshaping and closure of Zone 1**, necessitates specialized skills and oversight to ensure efficiency and regulatory compliance:
      - **Drivers**: Trained to operate specialized construction machinery, including bulldozers, compactors, and excavators.
      - **Engineers**: Responsible for overseeing and ensuring the proper execution of reshaping activities.
      - **OHS Safety Officers**: Tasked with monitoring compliance with occupational health and safety regulations during reshaping and closure.

   b. **Construction of Key Infrastructure**

Significant construction activities will support the subproject, creating diverse opportunities for skilled tradespeople and laborers across key infrastructure development. These activities encompass the construction of evaporation ponds, stability pads, an administrative building, and a waste/earth wall. The following roles will be required:

- **Excavation Workers**: Perform digging and shaping for various structures.
- **Lining Installation Workers**: Install protective linings to ensure functionality, particularly for ponds.
- **Structural Reinforcement Workers**: Strengthen structures for long-term durability.
- **Earthworks Personnel**: Conduct groundwork and leveling for construction bases.
- **Compacting Workers**: Compact soil or materials to create stable foundations.
- **Reinforcement Workers**: Reinforce structural components to enhance integrity.
- **Masons**: Handle structural work such as bricklaying and blockwork.

- **Carpenters**: Construct wooden frameworks and complete interior woodworking.
- **Electricians**: Install and maintain electrical systems.
- **Plumbers**: Set up plumbing systems for water supply and drainage.
- **Civil Engineers**: Design and supervise construction to ensure durability and structural integrity.
- **Bricklayers**: Build wall structures using bricks or similar materials.
- **Concrete Specialists**: Mix, pour, and finish concrete elements for robust construction.

2. **Receival of Fresh Waste (Zone 2)** will require:

- **Waste Handlers**: Manage the intake and sorting of incoming fresh waste.
- **Equipment Operators**: Skilled in operating compactors and dozers to process waste efficiently.
- **Site Supervisors**: Oversee daily operations and ensure compliance with waste management regulations.

3. **Post-Closure**

After the closure and construction phases, ongoing roles will be required to monitor, maintain, and manage the site and its infrastructure, ensuring long-term functionality and environmental compliance.

- **Environmental Technicians**: Conduct regular monitoring of air, water, and soil quality around the site, including evaporation ponds and waste/earth walls.
- **Maintenance Workers**: Perform routine upkeep of infrastructure, such as repairing linings in evaporation ponds, reinforcing stability pads, or fixing structural issues in the administrative building and waste/earth wall.
- **Security Guards**: Patrol the site to prevent unauthorized access and ensure safety of the closed areas.

6. **Indirect Job Opportunities and Supply Chain**

During the closure, construction and operation phases of the subproject, a number of indirect benefits are expected to be sensed in the targeted areas due to the need for more supporting services to the workers and contractors at the subproject site. Economic activity in the subproject area will be increased through the following supply chain:

- Implementation of works and provision of supplies related to construction, operation and closure of the site and ancillary facilities;
- Provision of transportation, freight and storage services to the subproject;
- Drivers and mini-bus owners will benefit from the transportation of the workers;
- Provision of food supplies, catering, and cleaning services;
- Provision of construction & auxiliary materials, accessories, engineering, installation and spare parts; and
- Security personnel.

6.2 Negative Impacts of the Subproject

The project is subject to a number of impacts during the different phases of the project, namely, civil works, receival of fresh waste and post closure activities phases.

Table6-1: Environmental Impacts across the different Sub-project Activities

EHS Aspect/Impact/Risk	Sensitive Receptors										Activity		
											Pre-Closure		Post-Closure
	Workers	Aesthetics	Communities/Industries/Health Facilities/Educational Facilities	Agricultural land	Ambient Air /Noise Quality	Surface Water	Ground Water & Soil	Infrastructure- Roads & Landscape	Biodiversity	Risk to Asset/Investment	Civil Works in Zone 1 and Zone 2	Fresh Waste in Zone 2	
Air Emissions	✔		✔		✔						• Dust from equipment movement and waste movement stirs up dust and waste from soil and waste mass disturbance. • Exhaust gasses from vehicles/trucks, namely, carbon dioxide (CO_2), nitrogen oxides (NO_x) and Sulphur dioxide (SO_2) and particulate matter (PM). • Landfill gas migration, airborne contaminants and odour emissions as a result of exposing the top layers The magnitude of the impact is considered High, the spatial extent is **High** as it is close to the sensitive receptors and the duration as **Low** as it only lasts for **28 months**. The receptor sensitivity is considered **High.** The overall impact significance is considered **MAJOR**.	• Foul-smelling gases/odor and particulate matter into the air. as a result of compounds such as ammonia (NH3), hydrogen sulfide (H2S), and other volatile organic compounds (VOCs). [11] • Trucks, compactors and equipment exhaust are as in civil works phase The magnitude of the impact is considered High, the spatial extent is **High** as it is close to the sensitive receptors and the duration as **Low** as it only lasts for **28 months**. The receptor sensitivity is considered **High** The overall impact significance is considered **MAJOR**.	• Unpleasant odors from the evaporation ponds • Methane emissions as a result of incomplete combustion of flared landfill gas or leakage of gasses as a result of improper capture. • Maintenance equipment exhaust are as in civil works phase The magnitude of the impact is considered Medium, the spatial extent is **Low** as the facilities were located far from sensitive receptors and the duration as **High** as continues for more than 15 years. The receptor sensitivity is High. The overall impact significance is considered **MODERATE**.
Noise and Vibration	✔		✔		✔						• Heavy equipment & vehicle engine noise • Heavy equipment & vehicle movement (tire and breaking noise) • Loading and unloading of waste moved and construction materials.	• Noise from truck and equipment engines, tires, and braking due to waste transport, placement, and compaction activities. • Loading and unloading of fresh waste activities	• Maintenance equipment engine noise • Pumps used for pumping leachate • Blowers for gas treatment

[11] The strength of these odours depends on factors such as the amount of odorous waste, the degree of degradation of organic materials, and the organic content in the waste. These are exacerbated by factors such as meteorological conditions, local topography, and waste composition.

EHS Aspect/Impact/Risk	Sensitive Receptors										Activity		
											Pre-Closure		Post-Closure
	Workers	Aesthetics	Communities/Industries/Health Facilities/Educational Facilities	Agricultural land	Ambient Air /Noise Quality	Surface Water	Ground Water & Soil	Infrastructure- Roads & Landscape	Biodiversity	Risk to Asset/Investment	Civil Works in Zone 1 and Zone 2	Fresh Waste in Zone 2	
											The magnitude of the impact is considered High, the spatial extent is **High** as it is close to the sensitive receptors and the duration as **Low** as it only lasts for **28 months**. The receptor sensitivity is considered **High.** The overall impact significance is considered **MAJOR**	The magnitude of the impact is considered High , the spatial extent is **High** as it is close to the sensitive receptors and the duration as **Low** as it only lasts for **28 months**. The receptor sensitivity is considered **High.** The overall impact significance is considered **MAJOR**	The magnitude of the impact is considered Low, the spatial extent is **Low** as the evaporation ponds were located further within the site further from the sensitive receptors with the waste mass height acting as an acoustic barrier. The gas blowers on the other hand are within an enclosed body also resulting in low magnitude. The duration as H**igh** as the phase continues for over 15 years. The receptor sensitivity is considered **High.** The overall impact significance is considered **MINOR**
Soil and Groundwater Contamination			✔			✔	✔	✔			• Waste movement and installation activities may disturb soil layers, increasing the risk of groundwater contamination from leachate • Heavy-duty vehicles and equipment used for waste movement and transportation may contribute to soil erosion, road damage, and landscape disruption. • Improper waste management can lead to the leaching of additional contaminants into groundwater through soil. • Any breaks in installation of cover liner during installation can result in leachate migration, potentially contaminating the soil and groundwater and resulting in a continuation/worsening of the baseline situation.	• Same impacts as in civil works phasing. • Leachate generation from decomposing waste can infiltrate the soil and groundwater, increasing pollution levels. The magnitude of the impact is High. Sensitivity of the receptor is low. The overall impact significance is assessed as **MODERATE**.	• Improper leachate management, including possible overflows can infiltrate the soil and groundwater, increasing pollution levels. • Risk of leachate leaks to soil and groundwater as a result of faults in insulation layers Soil and ground water contamination risks can particularly affect downstream areas such as the lakes and the surface waters such as Ismailya Canal.. The magnitude of the impact is Low. Sensitivity of the receptor (lakes) is low. The Ismailya Canal is at 750 m and can also be affected.

EHS Aspect/Impact/Risk	Sensitive Receptors										Activity		
											Pre-Closure		Post-Closure
	Workers	Aesthetics	Communities/Industries/Health Facilities/Educational Facilities	Agricultural land	Ambient Air /Noise Quality	Surface Water	Ground Water & Soil	Infrastructure- Roads & Landscape	Biodiversity	Risk to Asset/Investment	Civil Works in Zone 1 and Zone 2	Fresh Waste in Zone 2	
											• Groundwater quality could be affected directly by accidental oil spills and improper waste management during pre-construction activities The magnitude of the impact is High. Both soil and groundwater in the area are considered to have low sensitivity based on groundwater sampling results, which confirmed the presence of pollutants commonly associated with landfill leachate in the sand and gravel layers beneath the site. While contamination is present and not solely attributed to the subproject activities, the subsurface water receptor is highly vulnerable due to its shallow depth (2.65–4.97 m) and the existing pathway for leachate infiltration into the underlying aquifer system. Consequently, the overall impact is assessed as **MODERATE**.		The overall impact significance is assessed as **MODERATE**.
Improper waste Management	✔	✔	✔	✔			✔	✔			The main sources of waste are non-hazardous waste, hazardous waste and construction waste (construction waste/excavated waste), wastewater and subsurface water. Improper waste management from excavated waste, construction waste, and domestic waste can: • Leach through the soil into the groundwater and contribute to the layer's contamination. • Cause aesthetic annoyance and hygiene situation deterioration on site. • Result in additional mosquitos and pests.	• Improper management of fresh waste received in zone 2 • Smuggling of improper waste types can lead to handling of inappropriate types of waste without having proper PPEs, leading to OHS chemical exposure risk or explosion risks as discussed in dedicated OHS impacts below. The magnitude of the impact is considered **High.** Workers are highly sensitive receptors and are considered of High	• Improper management of sludge generated in the evaporation ponds The magnitude of the impact is considered **low.** Groundwater and soil are considered the main receptors and are of Low sensitivity. The overall impact significance is therefore **MINOR**.

EHS Aspect/Impact/Risk	Sensitive Receptors										Activity		
											Pre-Closure		Post-Closure
	Workers	Aesthetics	Communities/Industries/Health Facilities/Educational Facilities	Agricultural land	Ambient Air /Noise Quality	Surface Water	Ground Water & Soil	Infrastructure- Roads & Landscape	Biodiversity	Risk to Asset/Investment	Civil Works in Zone 1 and Zone 2	Fresh Waste in Zone 2	
											The magnitude of the impact is considered **Moderate.** While groundwater sensitivity is low, other receptors are considered of **High** sensitivity. The overall impact significance is therefore **MODERATE**.	sensitivity. The overall impact significance is therefore **MAJOR**.	
Biodiversity- Loss of Habitats	✔		✔	✔					✔		During the closure phase, active waste disposal will cease, and site preparation activities such as waste compaction, capping, and potential grading will take place. This will have the following impacts: ○ Scavenging Birds such as Hooded Crows and Cattle Egrets will experience changes in foraging behavior due to the reduction in available food sources. Hooded Crows are expected to seek alternative feeding grounds in urban areas, agricultural fields, and other waste sites, potentially increasing competition with other scavengers. Cattle Egrets may temporarily forage in the area if soil disturbance exposes invertebrates but will eventually shift to agricultural fields or wetlands once their primary food source is depleted. ○ The movement of waste may also displace insects, rodents, rats, reptiles and possibly snakes to surrounding areas. The magnitude of the impact is considered **High.** Surrounding communities and agricultural areas are the main sensitive receptors and are considered of	Since fresh waste will continue to be accepted in zone 2 within the site before full closure, scavenging opportunities will persist within the zone but with possible disruptions. The magnitude of the impact is considered **High.** Workers are the main sensitive receptors and are considered **High** sensitivity. The overall impact significance is therefore **MAJOR**	During the post closure phase, active waste disposal will cease in both zones, and scavenging birds would have already been gone. However, there may still be a risk of attracting displaced insects, rodents, reptiles, including rats and possibly snakes and particularly around the evaporation ponds. The magnitude of the impact is considered **High.** Both workers and close communities are the main sensitive receptors and are considered of **High** sensitivity. The overall impact significance is therefore **MAJOR**

EHS Aspect/Impact/Risk	Sensitive Receptors										Activity		
											Pre-Closure		Post-Closure
	Workers	Aesthetics	Communities/Industries/Health Facilities/Educational Facilities	Agricultural land	Ambient Air /Noise Quality	Surface Water	Ground Water & Soil	Infrastructure- Roads & Landscape	Biodiversity	Risk to Asset/Investment	Civil Works in Zone 1 and Zone 2	Fresh Waste in Zone 2	
											High sensitivity. The overall impact significance is therefore **MAJOR**		
Surface Water - Lakes						✔	✔		✔		• Sediment disturbance may degrade water quality, impact aquatic life, and resuspend nutrients, potentially enhancing eutrophication. This could increase blue-green algae growth, reduce oxygen levels, and contribute to algal blooms. However, as no fish are present, the risk of fish mortality is not a concern. • Disturbance may reduce the abundance of key species, including phytoplankton and zooplankton, affecting the food chain. • Dumping of waste in the lake as a result of improper management can disrupt lake aquatic ecosystems. Main source of waste in this phase is accumulated waste that is moved and construction waste. • Indirect impact as a result of leaching of contaminated groundwater While the lake may be affected by the different phases, it is not considered a sensitive receptor due to its low biodiversity value, aquatic ecosystem, and heavy contamination, which prevent it from serving as a freshwater source. The magnitude of the impacts is high, low-term in duration, the spatial extent is high due to the close proximity. However, due to the low sensitivity of	• Indirect leachate Seepage into the Lake: Fresh waste decomposition produces leachate rich in organic matter, heavy metals, and pathogens. If not properly managed, leachate can infiltrate groundwater or surface waters, severely impacting lake quality. • Increase in Bacterial Contamination: Higher levels of E. coli, Salmonella, and other harmful bacteria in water due to leachate contamination • Inadequate waste management can disrupt lake aquatic ecosystems. Main source of waste in this phase is fresh waste that is received to zone 2. The magnitude of the impacts is high, medium-term in duration, the spatial extent is high due to the close proximity. However, due to the low sensitivity of the receptor, the overall significance is assessed as **MODERATE**.	Same impacts due to improper waste management of leachate. Main waste during this phase is sludge which is exclusive to this phase. The magnitude of the impacts is high, long-term in duration, the spatial extent is high due to the close proximity. However, due to the low sensitivity of the receptor, the overall significance is assessed as **MODERATE**.

EHS Aspect/Impact/Risk	Sensitive Receptors										Activity		
											Pre-Closure		Post-Closure
	Workers	Aesthetics	Communities/Industries/Health Facilities/Educational Facilities	Agricultural land	Ambient Air /Noise Quality	Surface Water	Ground Water & Soil	Infrastructure- Roads & Landscape	Biodiversity	Risk to Asset/Investment	Civil Works in Zone 1 and Zone 2	Fresh Waste in Zone 2	
											the receptor, the overall significance is assessed as **MINOR**.		
Surface Water – Ismaailya Canal and other fresh water sources						✔	✔		✔		• Dumping of waste in the lake as a result of improper management can disrupt lake aquatic ecosystems. • Indirect impact as a result of leaching of contaminated groundwater The Ismailiya canal is considered a fresh water source, a main source of irrigation water and hosts aquatic life The magnitude of the impacts is medium, low-term in duration, the spatial extent is low. However, due to the high sensitivity of the receptor, the overall significance is assessed as **MODERATE**.	Same impacts as in civil works phase but waste handled is fresh waste. The magnitude of the impacts is medium, low-term in duration, the spatial extent is low. However, due to the high sensitivity of the receptor, the overall significance is assessed as **MODERATE**.	Same impacts due to improper waste management of leachate. Main waste during this phase is sludge which is exclusive to this phase. The magnitude of the impacts is medium, long-term in duration, the spatial extent is high due to the close proximity. However, due to the low sensitivity of the receptor, the overall significance is assessed as **MODERATE**. •
Risk of Damage to cover layers						✔	✔			✔	Risk of damage to landfill cover layers as a result of improper handling during installation The magnitude of the impacts is high, low-term in duration. The receptors are of high sensitivity and the overall significance is assessed as **MAJOR**.	Zone 2 operations will continue after and during the installation of the cover layers of zone 1. Since workers will have access to the whole site, this increases risk of damage to landfill geosynthetic cover layers in Zone 1 from worker behavior/movement, potentially causing punctures, tears, or displacement. The magnitude of the impacts is high, low-term in duration. The receptors are of high sensitivity and the overall significance is assessed as **MAJOR**.	• Risk of damage to landfill cover as a result of settlement that can be caused by excessive pumping, natural degradation of waste • Risk of damage to landfill cover as a result of equipment pressure The magnitude of the impacts is high, long-term in duration. The receptors are of high sensitivity and the overall significance is assessed as **MAJOR**.

EHS Aspect/Impact/Risk	Sensitive Receptors										Activity		
											Pre-Closure		Post-Closure
	Workers	Aesthetics	Communities/Industries/Health Facilities/Educational Facilities	Agricultural land	Ambient Air /Noise Quality	Surface Water	Ground Water & Soil	Infrastructure- Roads & Landscape	Biodiversity	Risk to Asset/Investment	Civil Works in Zone 1 and Zone 2	Fresh Waste in Zone 2	
Natural Disasters- Earthquakes, sandstorms, extreme heat waves and Flooding			✔			✔	✔			✔	Earthquakes and Flooding may disrupt the construction schedule and pose risks of injuries or fatalities to workers The baseline assessment indicates that the project site is in a seismically inactive area with no recorded earthquake activity. Additionally, flood risks are not expected to be significant, as hydrological studies confirm that the site is in an arid region with minimal rainfall therefore, the overall significance is assessed as **MINOR**.	• Same impacts as in the Civil works phase • Odors as a result of flooding Same assessment as in civil works phase. The overall significance is assessed as **MINOR**.	• Overflowing of leachate as a result of flooding events. • Damage to sub-project infrastructure and components in case of earthquake event resulting in loss of investment and possible soil/groundwater /surface water contamination ndary Same assessment as in civil works phase. The overall significance is assessed as **MINOR**.

Table6-2: Social Impacts across the different subproject phases

EHS Aspect/Impact/Risk	Sensitive Receptors					Phase		
						Pre-Closure		Post-Closure
	Workers	Nearby Residential Areas	Roads and Public Infrastructure	Healthcare Facilities	Industrial Area	Civil Works in Zone 1 and Zone 2	Fresh Waste in Zone 2	

Labour & Working Conditions	✔					• Prevalent practices in the waste management sector expose workers to challenging working conditions. These include:
						  ○ Low wages, lack of insurance coverage, informal employment without contracts, and undefined working hours leading to unpaid overtime hours.
						  ○ These factors increase worker vulnerability and exposure to risks.
						
						The magnitude of the impacts is moderate, short-term in duration and localized to the study area. Given the Moderate sensitivity of the receptors the overall significance is assessed as **MODERATE**.		

Livelihoods	✔					• At the start of the subproject, site access will be permanently restricted. • Waste pickers who currently collect waste at the dumpsite will be prohibited from entering. • The contractor will hire their own workers to manage on-site activities. • This decision will significantly impact the livelihoods of 56 individuals and the current site operator. • Waste pickers and their families, who rely on site access for income, will be particularly affected (refer to "*Current Utilizers of the Dumpsite*" subsection in the socio-economic baseline) The magnitude of the impacts is high, long-term in duration, and localized to the study area. Due to the high sensitivity of the receptors, the overall significance is assessed as **MAJOR**.	NA	NA
Temporary Labour Influx	✔	✔	✔	✔		• The contractor will recruit an estimated total of 150 skilled and unskilled workers for the different activities. • While the contractor may prioritize hiring labour from the local community when suitable skills are available, workers from other regions or governorates may be employed if local expertise is insufficient. • This temporary labour influx, though moderate in scale, could have certain effects on the subproject area, including: - **Increased risk of social conflict** between local residents and incoming workers. - **Potential for illicit behavior and crime**, stemming from the integration of non-local workers into the community. - **Pressure on Local Services:** A sudden increase in population may strain existing infrastructure, such as water supply, housing or healthcare services. The magnitude of the impacts is moderate, short-term in duration and localized to the study area. Given the medium sensitivity of the receptors the overall significance is assessed as **MODERATE**.		NA

EHS Aspect/Impact/Risk	Sensitive Receptors					Phase		
						Pre-Closure		Post-Closure
	Workers	Nearby Residential Areas	Roads and Public Infrastructure	Healthcare Facilities	Industrial Area	Civil Works in Zone 1 and Zone 2	Fresh Waste in Zone 2	
Road Traffic & Transportation		✔	✔		✔	The activities in this phase, including waste transfer and civil works, will generate significant movement of heavy vehicles **both on-site and off-site** the subproject site, leading to various impacts: • Potential surge in **on-site** traffic from frequent heavy vehicle movement during waste transfer from **Zone 2 to Zone 1** and civil works, raising dust, noise, and accident risks near workers and machinery due to blind spots and lack of pedestrian zones. • Possible **off-site** road congestion and wear from transporting heavy machinery and trucks to and from the site, disrupting traffic flow and contributing to road wear. • Increased safety hazards for pedestrians and other road users due to intense vehicle activity, spills, or reckless driving along access routes • Poor road conditions and lack of street lighting restrict mobility and pose safety risks, especially as large waste trucks with blind spots may not see smaller vehicles like tuk-tuks or motorcycles on narrow, dark roads (refer to "*Road Network and Access"* subsection in the socioeconomic baseline). • Risk of noise and vibration disturbances from heavy transport affecting nearby residents' quality of life. The magnitude of the impacts is high, short-term in duration and run on a regional scale. Given the high sensitivity of the receptors the overall significance is assessed as **MAJOR**.	• Potential increase in traffic congestion on roads leading to the dumpsite (refer to "*Road Network and Access"* subsection in the socioeconomic baseline) due to frequent waste transport vehicles operating during fresh waste receival • • Potential surge in **on-site** traffic from frequent heavy vehicle movement during fresh waste transport, raising dust, noise, and accident risks near workers and machinery due to blind spots and lack of pedestrian zones. • Risk of road degradation or damage from heavy trucks carrying waste • Possible safety hazards for road users from spills, reckless driving, or overloaded vehicles tied to waste delivery • Potential disruption to local access and mobility if waste receival schedules or traffic volumes overwhelm existing road capacity. • Poor road conditions and lack of street lighting restrict mobility and pose safety risks, especially as large waste trucks with blind spots may not see smaller vehicles like tuk-tuks or motorcycles on narrow, dark roads The magnitude of these impacts is high, short-term in duration and run on a regional scale. Given the high sensitivity of the receptors the overall significance is assessed as **MAJOR**.	• Transportation of equipment, materials for leachate management or monitoring systems, will be required at a low frequency. • Monitoring and other site management activities are likely to occur on a monthly basis, resulting in only occasional traffic disruptions. The magnitude of these impacts is moderate, long-term in duration and run on a regional scale. Given the high sensitivity of the receptors the overall significance is assessed as **MODERATE**.
SEA/SH	✔	✔				• Potential SEA/SH at subproject sites threatens workers and local communities, especially women • Influx of male laborers may disrupt social dynamics, raising women's vulnerability to harassment and abuse • SEA/SH incidents could create an unsafe work environment at the dumpsite (women likely in admin roles only), cutting morale and productivity, and risking turnover, or legal/financial consequences • Nearby communities (e.g., Arab El-Olaykat and Arab Juhayna, 500m–2.5km away) may lose trust if SEA/SH is mishandled, fueling opposition and subproject delays The magnitude of the impacts is moderate, short-term in duration, and run on a regional level. Given the medium sensitivity of the receptor, the overall significance of the impact is assessed as **MODERATE**.		NA

EHS Aspect/Impact/Risk	Sensitive Receptors					Phase		
						Pre-Closure		Post-Closure
	Workers	Nearby Residential Areas	Roads and Public Infrastructure	Healthcare Facilities	Industrial Area	Civil Works in Zone 1 and Zone 2	Fresh Waste in Zone 2	
Public Resources & Utilities		✔	✔		✔	• The anticipated electricity consumption is expected to stay within standard parameters, mainly supporting the administrative building and site lighting. • For heavy equipment or machinery requiring electrical supply (such as welders or drillers), it will likely be generated by backup generators. • Water usage will be minimal, primarily limited to housekeeping and drinking needs for the workforce. • Likewise, sewage generation will consist mainly of typical domestic and workforce-related waste. The magnitude of the impacts is low, short-term in duration, and run on a regional level. Given the low sensitivity of the receptor, the overall significance of the impact is assessed as **MINOR**.		• Increased power demand from ongoing operation of leachate extraction systems in Zone 1 and Zone 2, plus the evaporation pond, throughout the aftercare phase could strain the local electrical grid. • Potential risk of shortages or outages disrupting nearby industrial zones, commercial activities, and residential areas, particularly during peak periods, if the infrastructure can't sustain the added load over time The magnitude of the impact is moderate, long-term in duration, and run on a regional level. Given the medium sensitivity of the receptor, the overall significance of the impact is assessed as **MODERATE**.
Child Labour	✔					• Child labour is common in Qalyubia Governorate's construction industry • Contractors, subcontractors, and suppliers may involve children in civil works activities, violating Labour Law No. 12/2003, which prohibits employing those under 18 in hazardous conditions • Elevated risk emerges as children work in hazardous roles, such as drivers, laborers, or on tasks like reshaping, excavation, and system installations, both on-site at the dumpsite and off-site during transportation • Limited contractor supervision during off-site activities and complex on-site operations increases the potential for these dangerous and inappropriate tasks. The magnitude of the impacts is high, short-term in duration and localized to the study area. Given the high sensitivity of the receptors the overall significance is assessed as **MAJOR**.	• Potential for children to be exposed to hazards like toxic materials, biological risks, and heavy lifting if employed as drivers or waste handlers in unsafe, unsuitable roles during fresh waste receival • Elevated risk during off-site transportation of fresh waste, where limited contractor oversight could enable such exploitation. The magnitude of the impacts is high, short-term in duration and localized to the study area. Given the high sensitivity of the receptors the overall significance is assessed as **MAJOR**.	NA
Cultural Heritage						• Deep excavation and ground-disturbing activities may uncover underground archaeological finds or cultural artifacts.	NA	NA

EHS Aspect/Impact/Risk	Sensitive Receptors					Phase		
						Pre-Closure		Post-Closure
	Workers	Nearby Residential Areas	Roads and Public Infrastructure	Healthcare Facilities	Industrial Area	Civil Works in Zone 1 and Zone 2	Fresh Waste in Zone 2	
						The magnitude of the impacts is low, short-term in duration, and localized to the study area. Given the low sensitivity of the receptor, the overall significance of the impact is assessed as **MINOR**.		
Occupational Health & Safety (OHS)	✔			✔		• Workers at the Abu Zaabal Dumpsite may face various OHS risks. • In addition to the OHS risks outlined below, failure to adhere to OHS standards exposes the subproject to legal risks, including non-compliance with national laws and safety regulations as outlined in Section 3.2 of this report (Article 217, Law 12/2003). • The Occupational Health & Safety Administration (OSHA)[12] define the key risks, and the following are those applicable: **1. Physical Hazards:** - Sharp objects: Exposed sharp objects, such as metal scraps or broken glass, can cause cuts and lacerations. - Heavy equipment: Operation of heavy machinery, like bulldozers or excavators, can lead to crushing or pinning injuries. - Unstable terrain: Uneven or unstable ground can cause slips, trips, and falls from height on solid terrain or in the adjacent lake involving the risk of drowning. **2. Chemical Hazards:** - Toxic gases: Decomposition of waste can release toxic gases, such as methane, hydrogen sulfide, or volatile organic compounds (VOCs). - Chemical contamination: Exposure to contaminated soil, water, or air can occur through skin contact, inhalation, or ingestion. - Pesticide or herbicide exposure: Workers may be exposed to pesticides or herbicides used to control vegetation during closure activities. - Fire and Explosion Risk: Methane accumulation in landfill gas systems poses a severe fire and explosion risk. - Confined space risks: Landfill gas and leachate systems pose confined space risks, such as asphyxiation, toxic gas exposure (e.g., methane, hydrogen sulfide), and entrapment. - Unauthorized waste access: Hazardous, medical, or industrial waste may be illegally disposed of at the site **3. Biological Hazards:** - Vector-borne diseases: Mosquitoes, rodents, venomous reptiles or other pests can spread diseases like malaria, dengue fever, or leptospirosis. - Infections: Exposure to contaminated waste can lead to infections, such as tetanus or bacterial infections. **4. Psychological Hazards:** - Stress and fatigue: Workers may experience stress and fatigue due to the physical demands of closure activities. - Trauma: Exposure to hazardous or disturbing situations can lead to psychological trauma. - Risk of Delayed Medical Access: There is a risk of delayed access to the hospital in the event of an emergency, as well as the potential unavailability of required services at the nearest hospital. **5. Environmental Hazards:** - Air pollution: Closure activities can generate dust, particulate matter, or other airborne pollutants. - Water pollution: Leachate or contaminated water can enter nearby waterways, posing environmental and health risks. - Soil contamination: Closure activities can disturb or spread contaminated soil, leading to long-term environmental damage. The magnitude of the impacts is high, long-term in duration and localized to the study area. Given the high sensitivity of the receptors the overall significance is assessed as **MAJOR**.		

[12] https://www.osha.gov/

EHS Aspect/Impact/Risk	Sensitive Receptors					Phase		
						Pre-Closure		Post-Closure
	Workers	Nearby Residential Areas	Roads and Public Infrastructure	Healthcare Facilities	Industrial Area	Civil Works in Zone 1 and Zone 2	Fresh Waste in Zone 2	
Community Health & Safety		✔	✔	✔		The surrounding residential communities, Arab El-Olaykat and Arab Juhayna (500m–2.5km from the dumpsite), face the highest vulnerability to the community health and safety risks highlighted below: **1. Health Risks:** - Air pollution: Closure activities can generate dust, particulate matter, or other airborne pollutants, exacerbating respiratory issues. - Water pollution: Leachate or contaminated water can enter nearby waterways, posing health risks to communities relying on these water sources. - Vector-borne diseases: Disturbed or displaced pests, like mosquitoes or rodents, can spread diseases. **2. Environmental Risks:** - Soil contamination: Closure activities can disturb or spread contaminated soil, which could leach to groundwater resulting in in possible groundwater contamination. - Disturbance of Species habitats: Closure activities can harm or destroy nearby ecosystems, affecting the natural ecosystems and causing the migration of species to nearby communities. This includes domestic animals, and agricultural pests such as insects, worms, and rodents. - Closure activities can cause noise, vibrations, and other disturbances, disrupting community life. **3. Safety Risks:** - Traffic hazards: Increased traffic from closure activities can pose safety risks to pedestrians, cyclists, and motorists. - Social tensions: An influx of workers may create competition for local resources or employment opportunities, leading to social friction. - Explosive or toxic materials: Disturbed or uncovered hazardous materials can pose explosion or toxicity risks. - Fire risks: Closure activities can generate heat, sparks, or flames, potentially igniting fires. - Unauthorized Site Access: There is a risk that unauthorized individuals could access the site, leading to potential safety concerns. The magnitude of the impacts is high, short-term in duration and run on a regional level. Given the high sensitivity of the receptors the overall significance is assessed as **MAJOR**.		Post closure, the following impacts reflect the reduced intensity of activities - **Temporary Nuisance**: Low-frequency site activities, including occasional equipment use and vehicular movement for maintenance, could inconvenience local residents. - **Unauthorized Site Access**: With less frequent activity on-site, there is a risk that unauthorized individuals could access the site, leading to potential safety concerns. - **Fire and Electrical Hazards**: Risks associated with the operation of leachate pumps and electrical equipment persist. - **Exposure to Gas Emissions** Risk of malfunctioning of gas collection, transport and treatment leading to exposure to gas leaks. The magnitude of the impacts is high, long-term in duration and run on a regional level. Given the high sensitivity of the receptors the overall significance is assessed as **MAJOR**.

7 Assessment of Cumulative Impacts and Mitigations

7.1 Existing and Future activities expected in the subproject Area

To determine the impacts potential, the identified projects were evaluated according to the following:

- Spatial Proximity and overlaps of areas of influence
- Temporal Overlap of construction and operational schedules
- Shared Receptors: Sensitive receptors falling within the shared area of influence

Contributing aspects which may give rise to cumulative impacts were identified in table (7-2) .i.

7.1.1 Abu Zaabal Overlapping Phases

T This chapter assesses cumulative impacts from the overlapping phases and activities.

7.1.2 Medical Incinerators

The medical waste incineration complex covers 4,000 square meters and includes 13 incinerators for medical waste disposal and it handles medical waste from both public and private sectors. Nine specialized vehicles are designated for the daily transport of waste. The project is expected to contribute to traffic movement, incineration emissions, and cumulative impacts on air quality and waste management while also posing a risk of unauthorized waste disposal.

7.1.3 Industrial Area

The Abu Zaabal Dumpsite is located in an industrial area surrounded by factories; accordingly, the subproject (dumpsite closure) activities along with the industrial area's activities will contribute to combined environmental effects in the area such as air and noise pollution, and soil contamination. In addition, the well-being of workers in the area will be affected due to odor, noise, visual blight, and the potential health risks. Surrounding Roads

The civil works during the closure activities of Abu Zaabal Dumpsite will require movement of heavy trucks and machinery in the area, in addition to fresh waste receiving phase where an increased volume of trucks transporting waste to the dumpsite. This will result in increased traffic in combination with the existing traffic in the area including industrial and residential traffic. Cumulative impacts resulting from combined traffic will result in congestion, air pollution, and noise, and road safety impacts affecting the surrounding road network, integrity of the roads structures and nearby communities.

7.2 Identification and Description of Cumulative Impacts

7.2.1 Cumulative Impacts in Months 1-24

The combined implementation of civil works in Zones 1 and 2 of Abu Zaabal, the reception of fresh waste in Zone 2, the operation of the road network and the ongoing operation of both medical incinerators and the nearby industrial area will result in a range of cumulative environmental and social impacts. These are summarized below.

7.2.1.1 Air Quality

During months 1-24, air quality in the project area is expected to deteriorate due to overlapping emission sources. Dust from civil works in Zone 1 and fresh waste receiving in Zone 2, will contribute to short-term particulate emissions. The reception of fresh waste in Zone 2 adds odorous emissions and organic dust, while the operation of medical incinerators introduces hazardous pollutants such as dioxins, furans, and heavy metals. Additionally, emissions from industrial processes and increased vehicular traffic related to road operation further elevate background concentrations of nitrogen oxides (NOx), sulfur oxides (SOx), and particulate matter (PM). The combined impact of these sources will result in degradation of air quality with implications for both public health and environmental receptors.

7.2.1.2 Soil and Land Degradation

The reception of fresh waste in Zone 2 presents a risk of soil contamination through leachate infiltration, particularly where containment systems are not fully developed through potential spills or improper solid waste handling. Over time, the combined physical disturbance and chemical loading may reduce soil fertility and limit future land-use options.

7.2.1.3 Water Resources

Groundwater and surface water in the area may face contamination risks due to leachate generated from the decomposition of fresh waste received in Zone 2 infiltrating groundwater if not properly managed. Industrial area discharges, if inadequately treated/disposed, may introduce chemical pollutants into groundwater that could seep into water channels. Construction activities in the two Abu Zaabal zones may also affect drainage patterns and increase sedimentation in nearby water bodies. Together, these pressures increase the likelihood of water resource degradation, especially in the absence of coordinated containment and treatment systems.

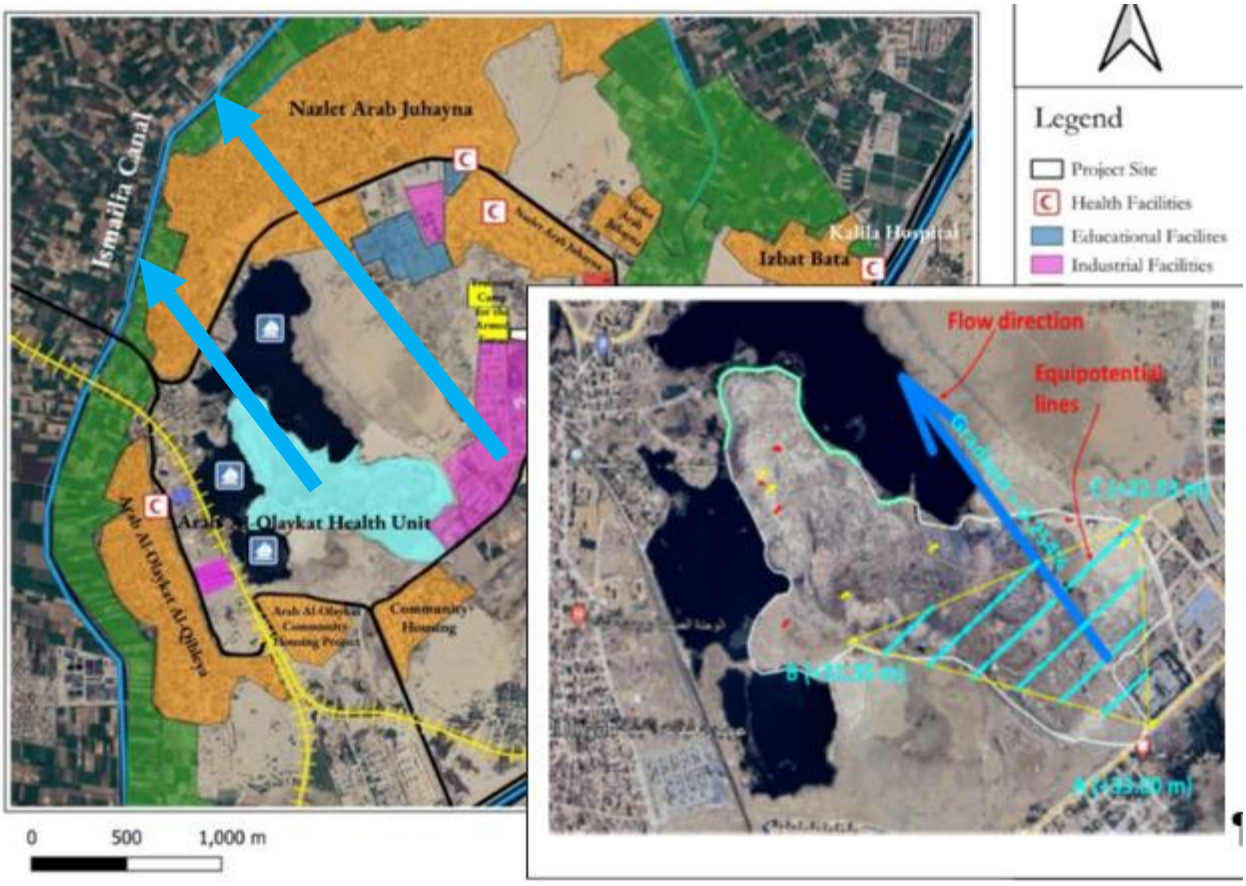


Figure 7-1: Water flow lines showing cumulative impacts on downstream water body

7.2.1.4 Noise and Vibration

Civil works in Zone 1 and Zone 2, are major contributors to elevated noise levels during parallel activities. Road operation will bring continuous traffic noise, especially from heavy trucks transporting waste and industrial inputs. The operation of industrial facilities and medical incinerators adds to the acoustic burden through mechanical and equipment noise. Collectively, these activities are likely to raise background noise levels, potentially exceeding regulatory limits and causing disruption to nearby communities and sensitive receptors.

7.2.1.5 Occupational and Community Health and Safety

Occupational safety risks may accumulate due to overlapping high-risk activities (excavation, gas well installation, leachate handling) occurring in tandem across Zones 1 and 2. If unaddressed, this could strain emergency preparedness or result in cascading incidents.

The cumulative health risks are significant due to combined exposure to multiple stressors. Emissions from medical incinerators, together with industrial pollutants and dust from construction activities, increase the likelihood of respiratory issues and long-term toxic exposure. The handling of fresh waste in Zone 2 may attract disease vectors and generate bioaerosols, contributing to localized health concerns, and possibly vector borne diseases. Road operation increases the risk of traffic accidents, particularly in areas where construction or waste transport intersects with public roadways. Without mitigation measures, these hazards pose a notable threat to community health and occupational safety.

7.2.1.6 Traffic and Infrastructure Pressure

Road infrastructure will face considerable strain due to cumulative traffic loads from the subproject activities and other activities identified and introduced in Section 7.1. Waste trucks servicing Zone 2, trucks transporting construction material for use in zone 1 along with vehicles servicing the medical incinerators and industrial area, will increase congestion, noise, and vehicle emissions. Civil works-related machinery and deliveries will further exacerbate traffic conditions. The combined use of limited roadway capacity may lead to higher accident rates, reduced road lifespan, and restricted mobility for local residents and emergency services. The Abu Zaabal Road, branching from the Cairo-Belbeis Desert Road, and the primary access to the dumpsite is the main road that will be affected.

7.2.1.7 Overall Quality of Life

The combined visual, noise, and odor impacts from civil works, waste reception, incineration, and industrial operations are likely to reduce the overall quality of life for nearby communities. Public perception of the area may shift negatively due to the presence of multiple pollution sources and waste-related infrastructure. Community stress and resistance may arise, particularly if cumulative effects are not transparently addressed or adequately mitigated.

7.2.2 Cumulative Impacts in Months 24-28

When Zone 1 is closed, the remaining impacts from zone 2 civil works and other contributing sources continues but the cumulative impact significance will be reduced. This is primarily because of directing the fresh waste in Zone 2 to the 1st cell of the sanitary landfill in 10RIWMF and the reduction of zone 1 activities.

7.2.3 Cumulative Impacts in Months 28-onwards

Cumulative impacts during this period will arise from all previously mentioned cumulative impacts combined with aftercare activities described in the post closure phase in Section 6.2 .

7.3 Assessment of Significance of Cumulative Impacts

Table 7-1: Cumulative impacts which considered from the combination of phases

Month assessed	Abu Zaabal Phase Contributing to Impact		Adjacent subproject overlapping activity/phase	Valued Environmental and Social Components (VECs)								
	Zone 1	Zone 2		Air	Noise & Vibration	Waste Generation	Ground water	surface water	Traffic	Pests, Rodents & Venomous snakes	Community Health & Safety	Public Resources and
1-24	Civil Works	Civil Works & Receiving of Fresh waste	NA	VH	VH	VH	VH	VH	VH	VH	VH	VH
24-28	NA	Civil Works	NA	M-H	M-H	M-H	M-H	M-H	M-H	M-H	M-H	M-H
28 - Onwards	Post closure	Post closure	NA	L-M	L	L-M	L-M	L-M	IN	L-M	L-M	IN
1-24	Civil Works	Civil Works & Receiving of Fresh waste	Road Operation	VH	VH	IN	IN	IN	VH	IN	IN	IN
24-28	NA	Civil Works	Road Operation	M-H	M-H	IN	IN	IN	M-H	IN	IN	IN
28 - Onwards	Post closure	Post closure	Road Operation	L-M	L	IN	IN	IN	IN	IN	IN	IN
1-24	Civil Works	Civil Works & Receiving of Fresh waste	Medical Incinerators Industrial Area Operation	VH							VH	

24-28	NA	Civil Works	Medical Incinerators Industrial Area Operation	H							H	
28 - Onwards	Post closure	Post closure	Medical Incinerators Industrial Area Operation	H							H	

VH	Very High
H	High
M-H	Medium-High
L-M	Low to Medium

7.4 Mitigation Measures

The main mitigation measure that needs to be implemented to manage cumulative impacts during the dumpsite civil works, receiving of fresh waste and aftercare activities is to maintain communication between Contractor's Project Management and the Governorate to ensure coordinated combined works logistics and schedules.

Aspect	Mitigation Measures
Air Emissions	• Coordinate and synchronize with the Governorate between activities occurring within common area of influence for maximum gains and minimal impacts. • Given the open and exposed conditions of the site, wind-driven dust emissions are largely uncontrollable. However, activities can be planned to avoid periods of high wind or dust storm occurrences as much as possible. Although exhaust emissions from diesel-fueled equipment and vehicles are inherent to operations, their effects may be reduced through actions such as applying dust control measures, restricting the operation of heavy machinery, managing vehicle speeds, and ensuring that personnel are equipped with protective gear. Overall, the expected residual impacts are minor and of limited duration. • Monitoring program to be implemented by Governorate at sensitive receptors
Soil and Land Degradation	• Each of the individual projects discussed in section 7.1 will implement its prevention and mitigation measures as set out in construction management plans. • Coordinate and synchronize between activities occurring within common area of influence for maximum gains and minimal impacts
Water Resources	• Each of the individual projects will implement its prevention and mitigation measures as set out in construction management plans where applicable. • Coordinate and synchronize between activities occurring within common area of influence for maximum gains and minimal impacts.
Noise and Vibration	• Coordinate and synchronize with the Governorate between activities occurring within common area of influence for maximum gains and minimal impacts. • Each of the individual projects will implement its site-specific mitigations as set out in construction management plans where applicable. • Abu Zaabal Dumpsite will implement the mitigations discussed in Section 8 • Avoid simultaneous operation of high-noise machines by carrying out modelling exercise to assess noise of the exact equipment at sensitive receptors. The cumulative impacts of the project at a given time should not exceed the legal limits at the sensitive receptors. Since the noise level may be exceeded on site, workers need to be provided by suitable earmuffs for the noise level. • Install temporary noise barriers or acoustic enclosures near sensitive areas • Schedule noisy activities during daytime hours

Occupational and Community Health and Safety	• Phased application of OHS' mitigation measures—including dedicated emergency teams, fatigue monitoring systems, and confined space entry control. • Provide clear signage, fencing, and controlled access to construction zones • Maintain hygiene and waste control around waste handling and industrial sites • Conduct community awareness campaigns on construction schedules and safety practices
Traffic & Infrastructure	• Implement a traffic management plan that is coordinated with the Governorate • Each of the individual projects, including the subproject of Abu Zaabal should implement its mitigation measures

8 Environmental & Social Management & Monitoring Plan

8.1 Institutional Setup

The successful implementation of the ESIA hinges on the collaboration of various entities and organizations responsible for overseeing mitigation and monitoring efforts. Based on the Institutional Capacity Assessment, the proposed institutional framework for subproject implementation and supervision consists of the following key entities with their primary responsibilities:

1. **Main Contractor:** The contractor is responsible for implementing the Environmental and Social (E&S) Management Policy. This includes establishing the necessary organizational structure and resources, including appointing one Environmental Specialist, one Social and Gender Specialist, and three Occupational Health and Safety (OHS) specialists, one of whom will serve as a supervisor (qualifications detailed in ***Appendix 10***). The contractor must provide regular performance monitoring indicators and ensure employees receive appropriate training. Additionally, they must develop a comprehensive Contractor Environmental and Social Management Plan (C-ESMP), based on the ESMP in this ESIA, which will apply to subcontractors and suppliers, and oversee the effective implementation of all required measures.
2. **The Project Coordination Unit (PCU):** The PCU, established within the Ministry of Environment (MOE), coordinates all aspects of subproject implementation. It is supported by environmental and social consultants who provide technical assistance throughout the subproject stages, including studies, design, preparation of specifications and tender documents, and supervision of infrastructure facilities.
3. **Supervision Consultant:** The Supervision Consultant team, encompassing Environmental, Social and Gender, and OHS specialists, oversees and ensures the quality and compliance of subproject implementation. They provide expert technical guidance, monitor construction activities, review contractor performance, ensure adherence to design specifications and standards, and report progress to the PCU, facilitating effective supervision of infrastructure facilities throughout the subproject duration.

Technical Implementation Unit (TIU):

4. **Ministry of Local Development (MoLD):** The MoLD leads Component 2 of the GCCC project, titled "Support the Operationalization of Solid Waste Management (SWM) Master Plans in Greater Cairo (GC)," which encompasses the closure and rehabilitation of the Abu Zaabal Dumpsite. The MoLD partners with Al-Qalyubia Governorate to supervise subproject

implementation, ensuring local authorities are equipped with the necessary support to carry out plans efficiently.

5. **Al Qalyubia Governorate:** Al Qalyubia Governorate (QG) collaborates with the MoLD to oversee subproject implementation, ensuring effective execution of plans at the local level. It provides support and coordination to local units, including the Al Khanka Local Unit and SWMU E&S Management Team, which operate under its authority to monitor and evaluate operator performance as part of the Technical Implementation Unit (TIU). QG will be responsible for for monitoring impacts during the aftercare phase
    a. **Al Khanka Local Unit and SWMU E&S Management Team:** Operating under the Al-Qalyubia Governorate, this team is tasked with monitoring and evaluating operator performance, assisted by environmental and social specialists. They play a supervisory role as part of the Technical Implementation Unit (TIU).
    b. **Environmental Unit with the Governorate:** This unit reviews Environmental Impact Assessments (EIAs) for subprojects, conducts site inspections, monitors environmental aspects, and updates the environmental register.
6. **Waste Management Regulatory Authority (WMRA):** The Waste Management Regulatory Authority (WMRA) ensures that closure activities comply with national and local waste management laws, environmental regulations, and standards. This involves enforcing guidelines for safe closure, including leachate management, gas emissions control, and site rehabilitation.

An assessment of the current capacity of the proposed entities that will manage the ESMPs and proposed capacity building can be found in ***Appendix 5.***

8.2 Roles and Responsibilities

Below are the delineated Roles and Responsibilities corresponding to each subproject activity:

Civil Works

1. **ESMP Implementation: Main Contractor**

- Implement the Contractor Environmental and Social Management Plan (based on the ESMP in this ESIA)
- Set up the necessary organization and resources
- Appoint Environmental, Social and Gender, and OHS experts
- Provide regular monitoring indicators,
- Provide training and capacity building for employees and workers to enhance their understanding and adherence to environmental and social standards.
- Draft and enforce a comprehensive Contractor Environmental and Social Management Plan, applicable to subcontractors and suppliers, and ensure effective implementation of all measures.

- Maintain detailed records of ESMP activities, including monitoring data, incident reports, and compliance updates, and submit monthly ESHS reports to Supervision Consultant

2. **ESMP Supervision: Supervision Consultant**

- Appoint Environmental, Social and Gender, OHS specialists (according to **Appendix 10**)
- Oversees the implementation of the Environmental and Social Management Plan (ESMP) during the civil works phase, including site preparation, earthworks, capping, drainage installation, and rehabilitation.
- Ensures compliance with environmental and social standards across all activities.
- Monitors the execution of civil works to confirm adherence to design specifications and subproject timelines.
- Assesses contractor performance to maintain quality and efficiency.
- Provides technical guidance to address challenges and ensure safety and environmental integrity.
- Delivers monthly ESHS progress reports to the Subproject Coordination Unit (PCU).

3. **ESMP Oversight: PCU and TIU**

→ **PCU:**

- Liaises with the Supervision Consultant and other stakeholders to oversee progress and address implementation challenges.
- Receives and reviews regular progress reports from the Supervision Consultant to monitor compliance with subproject goals and timelines.
- Facilitates technical assistance from environmental and social consultants to support supervision and ensure adherence to environmental and social standards during the civil works.
- Ensures integration of national policies and subproject specifications into the execution of infrastructure-related activities at the dumpsite.

→ **TIU (QG, MoLD and WMRA):**

- Exercises overarching authority and strategic oversight for the civil works phase of the dumpsite closure
- Leads coordination between national policies and local implementation, ensuring alignment with Component 2 of the GCCC Subproject
- Regulates and enforces waste management standards, ensuring compliance with legal, technical, and environmental requirements throughout the civil works phase.
- Directs local-level execution by monitoring operator performance, to ensure operational efficiency and adherence to subproject objectives.
- Approves key decisions, timelines, and resource allocations, maintaining accountability across all implementing entities, including the PCU and Supervision Consultant.

- Oversees the integration of technical inputs from consultants and ensures the civil works align with broader environmental and infrastructural goals for the GCCC project.

4. **Reporting:**

- **Main Contractor:** Submits monthly progress updates, compliance reports (including E&S Progress reports), and details of executed activities to the Supervision Consultant, highlighting performance metrics, challenges, and adherence to specifications.
- **Supervision Consultant:** Compiles and reviews the Contractor's reports, assesses compliance with the Environmental and Social Management Plan (ESMP) and subproject standards, and prepares comprehensive progress reports for submission to both the PCU and the TIU.
- **PCU/TIU:** The PCU receives and evaluates the Supervision Consultant's reports to monitor subproject advancement and ensure alignment with objectives, while the TIU, reviews these reports to enforce strategic oversight, approve key decisions, and ensure integration with broader waste management goals.

Fresh Waste

1. **ESMP Implementation: Main Contractor**
    - Implements the Environmental and Social Management Plan (ESMP) during the receival of fresh waste phase, ensuring all activities comply with environmental and social safeguards.
    - Conducts on-site monitoring of the types of waste received, identifying and categorizing incoming materials, and rejecting hazardous material to ensure proper handling and disposal as per subproject specifications.
    - Maintains records of waste quantities and characteristics, reporting findings to the Supervision Consultant for oversight and verification.
    - Applies mitigation measures outlined in the ESMP to address potential environmental and social impacts, such as odor, leachate, or community disturbances, arising from waste receival.
    - Ensures worker safety and adherence to occupational health standards during waste handling and processing activities.
2. **ESMP Supervision: Supervision Consultant**
    - Oversees the implementation of the ESMP during the receival of fresh waste phase, ensuring the Main Contractor's activities comply with environmental and social safeguards.
    - Monitors the Main Contractor's on-site waste management practices, verifying the identification, categorization, and rejection of hazardous materials to ensure adherence to subproject specifications.
    - Reviews and validates the Main Contractor's records of waste quantities and characteristics, ensuring accuracy and consistency for reporting purposes.

- Assesses the effectiveness of mitigation measures applied by the Main Contractor to address environmental and social impacts, such as odor, leachate, or community disturbances, arising from waste receival.
- Ensures the Main Contractor maintains worker safety and complies with occupational health standards during waste handling and processing activities.
- Provides technical guidance and support to the Main Contractor and on-site environmental and social specialists to address real-time compliance issues, recommending adjustments to operations as needed.
- Prepares and submits detailed progress and compliance reports to the PCU and the TIU for oversight and decision-making.

3. **ESMP Oversight: PCU and TIU**

→ PCU:

- Liaises with the Supervision Consultant and other stakeholders to oversee progress and address implementation challenges.
- Receives and reviews regular progress reports from the Supervision Consultant to monitor compliance with subproject goals and timelines.
- Facilitates technical assistance from environmental and social consultants to support supervision and ensure adherence to environmental and social standards.
- Ensures integration of national policies and subproject specifications into the execution of fresh waste receival activities at the dumpsite.

→ TIU (QG, MoLD and WMRA):

- Oversees the waste management system prior to the receival of fresh waste at the dumpsite, ensuring effective coordination of waste collection, transport, and categorization processes within the governorate.
- Supervises the transportation process, verifying that vehicles and logistics comply with safety, environmental, and subproject-specific standards to prevent spillage, emissions, or contamination en route.
- Ensures the identification and preliminary sorting of waste types (e.g., organic, inorganic, hazardous) at collection points or transfer stations, establishing a systematic approach to filter out hazardous materials before delivery to the dumpsite.
- Coordinates with the Solid Waste Management Unit (SWMU) and Al Khanka Local Unit to deploy environmental and social specialists for on-the-ground supervision of collection and transport activities.
- Provides feedback and directives to the Main Contractor and Supervision Consultant to align dumpsite waste handling with the ESMP and broader subproject goals.

- Reports findings and system performance metrics to support strategic oversight and decision-making.

4. **Reporting** follows the same approach as the Civil Works activity.

Post-Closure: The post-closure period may extend for approximately 15 years, with supervision under the responsibility of the Governorate, which may assign a contractor if needed.

1. **ESMP Supervision: Qalyubia Governorate**

- Supervises the post-closure phase of the dumpsite, ensuring ongoing compliance with environmental standards, site stability, and community safety after rehabilitation activities are completed.
- Monitors the site for issues such as leachate management, gas emissions, and coordinating with the SWMU and Al Khanka Local Unit for local-level oversight.
- Conducts regular inspections and engages environmental specialists to assess the long-term integrity of the closed dumpsite and its surrounding areas.

2. **ESMP Oversight: MoLD**

- Provides high-level oversight, ensuring the post-closure phase aligns with national waste management policies and the objectives of Component 2 of the GCCC Subproject.
- Reviews reports from the Governorate and evaluates the effectiveness of post-closure measures, maintaining strategic control over the subproject's long-term outcomes.

3. **Contractor (TBC):** A Contractor may be assigned, to be confirmed, to perform specific post-closure tasks such as site maintenance, monitoring, or remedial actions, under the supervision of the Governorate and direction of the MoLD.

8.3 Environmental and Social Management Plans (ESMP)

Table8-1: ESMP

Receptor / EHS Aspect	Impact	Impact Significance	Mitigation Measures	Relevant WB ESS	Means of supervision	Residual Impact	Responsibility		Est. Cost (EGP)
							Implementation	Supervision	
Civil Works Phase									
Air Emissions	• Dust from equipment movement & soil and waste mass disturbance. • Exhaust gasses from vehicles/trucks • Landfill gas migration and airborne contaminants from accumulated waste movement/exposure of layers • Odor emissions	**MAJOR**	The Contractor will include within his C-ESMP an Air Quality Management Plan which would include but is not limited to the following: • Ensuring equipment is in good working conditions and that emissions are withing acceptable limits • Speed limits • Dust suppression using water in and around work areas. • Covering construction materials and moved waste during transportation, using designated storage areas, regulating vehicle speed, and implementing preventive maintenance for vehicles and equipment. • Providing workers with PPEs such as masks • Keep site roads well maintained and use dust suppressing methods to minimize dust from vehicle movements. • Create buffer zones by planting trees and using wind breakers • Implement air monitoring according to monitoring plan. • Deploy a portable device for continuous measurement of on-site gas flow rates. • Install landfill gas monitoring wells and probes for regular assessment of gas migration.	ESS1 ESS2 ESS3	• Site inspection • Air Quality Measurements according to monitoring plan • Review the equipment, maintenance records. • Review the grievance log	**MODERATE**	Construction contractor	• Al Khanka Local Unit, Environmental unit • Qaluybia Governorate PCU • Supervision Consultant • GCCC PCU	Contractor's cost
Noise and Vibration	• Heavy equipment & vehicle engine noise • Equipment tire and breaking noise • Noise from loading and unloading of waste and construction materials These activities can lead to noise nuisances impacting dump ecosystem and surrounding communities/residents.	**MAJOR**	The Contractor will include within his C-ESMP a Noise and Vibration Management Plan which would include but is not limited to the following: • Keep site roads in good condition to minimize noise and vibrations from vehicle movements. • Create buffer zones around the site. • Choose equipment with low noise emission levels.	ESS1 ESS2 ESS3 ESS4	• Site inspection/equipment inspection • Measurements according to monitoring plan • Review the equipment maintenance records.	**MODERATE**	Construction contractor	• Al Khanka Local Unit, Environmental unit • Qaluybia Governorate PCU • Supervision Consultant • GCCC PCU	Contractor's cost

Receptor / EHS Aspect	Impact	Impact Significance	Mitigation Measures	Relevant WB ESS	Means of supervision	Residual Impact	Responsibility		Est. Cost (EGP)
							Implementation	Supervision	
	Additionally, prolonged exposure to noise can pose health risks to workers		• Follow manufacturers' recommended maintenance schedules for engine and mechanical parts, including tire pressure to adhere to permissible limits. • Schedule civil works activities during appropriate daytime hours. • Provide earmuffs/protective hearing equipment for all workers. • Turn off equipment when not in use to reduce the cumulative noise. • Place noise generating sources (e.g., generators) as far as possible from sensitive receptors. • Inform local residents of planned works, noise levels, and contact details for complaints.		• Review the grievance log				
Soil and Groundwater	• Excavation and waste movement activities can lead to soil disturbance and erosion, affecting land stability and increasing the risk of unintended leachate release and migration of landfill gas which may compromise air quality as a secondary impact and pose health and safety risks for workers. • Improperly handled materials, chemicals, excavated waste, construction/municipal waste and sewage can leach into soil and surface water contamination, that could reach groundwater resources and cause indirect contamination.	**MODERATE**	The Contractor will prepare a C-ESMP that would include but is not limited to the following: • Restrict heavy machinery to designated paths to reduce soil compaction and minimize damage. • Soil erosion control measures, such as the use of silt fences, can be implemented to prevent soil erosion. • Proper management of waste, such as segregating hazardous waste, implementing good management practices, and properly disposing of waste. In addition, waste management measures will be carried out. • Speed limits to be indicated on site • Visual inspection to observe any leachate outbreaks • Monitoring of methane • Implement waste management measures in this management plan	ESS1 ESS3	• Site inspection • Methane monitoring using handheld methane detectors for surface emission checks, perimeter air sampling • Review the equipment, maintenance records. • Review the complaints log	**MINOR**	Construction contractor	• Al Khanka Local Unit, Environmental unit • Qaluybia Governorate PCU • Supervision Consultant • GCCC PCU	Contractor's cost
Improper waste Management	The main waste sources include non-hazardous (including construction debris, packaging), hazardous, wastewater, and subsurface water. Risks include improper waste management /illegal dumping which may contaminate surface waters, groundwater, degrade site hygiene, and attract pests posing health risks to workers and community.	**MODERATE**	The Contractor will prepare a C-ESMP comprising a Waste Management Plan (WMP) and Hazardous Waste and Material Management Plan (HAZMAT) that would include but is not limited to the following: • Collect and transport excavated waste to the designated disposal area for use in shaping Zone 1 or haul it to Zone 2 for disposal.	ESS1 ESS2 ESS3	• Site inspection • Waste logs • Review the equipment, maintenance records. • Review the grievance log	**MINOR**	Construction contractor	• Al Khanka Local Unit, Solid waste management unit (SWMU) • Qaluybia Governorate PCU	Contractor's cost

Receptor / EHS Aspect	Impact	Impact Significance	Mitigation Measures	Relevant WB ESS	Means of supervision	Residual Impact	Responsibility		Est. Cost (EGP)
							Implementation	Supervision	
			• Ensure proper washing and maintenance of trucks to avoid spills. • Conduct awareness campaigns and training to prevent oil spills. • Provide collection tanks for wastewater and regularly remove and dispose of sewage/septage. • All workers will follow infection control protocols including on-site hygiene stations, pest control measures, waste classification training, and PPE use. These precautions are especially critical during excavation and capping activities. **For non-hazardous solid waste:** • Segregate construction waste at the source and promote recycling and reuse. • Provide adequate storage areas to prevent littering and illegal dumping. • Dispose of non-hazardous waste in compliance with regulations. **For hazardous solid waste:** • Identify, segregate, handle, and transport hazardous waste properly. • Store hazardous waste securely in designated areas and conduct regular inspections. • Dispose of hazardous waste at authorized facilities and have an emergency response plan. • Train workers on hazardous waste management and safety measures. **For wastewater:** • Authorized contractor for proper disposal to closes wastewater treatment plant. • Use impermeable materials for tanks and maintain equipment to prevent leaks. Train workers on proper waste handling and monitor water quality.				• Supervision Consultant • GCCC PCU	
Biodiversity-Habitat modification/loss	• During closure activities, waste disposal will stop, leading to changes in scavenger behavior, including birds, rats, venomous reptiles, insects, and mosquitoes. In the case of scavenger birds, the most abundant in the dump, namely, Hooded Crows and	**MAJOR**	The contractor C-ESMP will include but is not limited to the following for scavenger behavior shifts during civil works phase: • Regular site monitoring should be implemented to prevent vector proliferation and minimize health hazards. • Prepare pest management plan including integrated pest management (IPM) **and**	ESS1 ESS 3 ESS 4 ESS 6	• Site inspection • Waste logs • Review the grievance log • Surveys of scavenger populations	**MODERATE**	Construction contractor	• Al Khanka Local Unit, Solid waste management unit (SWMU) • Qaluybia Governorate PCU	Contractor's cost

Receptor / EHS Aspect	Impact	Impact Significance	Mitigation Measures	Relevant WB ESS	Means of supervision	Residual Impact	Responsibility		Est. Cost (EGP)
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	Cattle Egrets may move to urban and agricultural areas in search of alternative feeding grounds, which could cause disturbances to nearby communities. • The movement of waste may also displace insects, rodents, and reptiles, increasing competition among scavengers and creating potential impacts to close communities. These may include snakes which were reported close to the lakes.		integrated vector management (IVM) in line with ESS1 to address management of pests and rodents. The plan should include but is not limited to: o Encourages the use of biological or environmentally friendly alternatives to control pests. o Requires measures to prevent contamination of soil, water, and non-target species from pesticide use. • Ensures safe handling, storage, and disposal of pesticides to avoid environmental and health risks through non-toxic control methods. • Worker safety protocols including protective gear and training for workers on handling potential encounters with displaced pests and rodents, including snakes and rodents. • Inform nearby communities about potential increases in scavenger activity and advise on waste management practices to prevent attraction. • Conduct regular surveys of scavenger populations and adjust mitigation measures based on observed impacts.					• Supervision Consultant • GCCC PCU	
Surface Water – Three Lakes	Sediment disturbance during the construction of the stability pads may degrade water quality by resuspending nutrients, increasing the risk of eutrophication and blue-green algal blooms, which can reduce oxygen levels. This may also lead to the loss of aquatic habitat, impacting key species like phytoplankton and zooplankton and disrupting the food chain and ecosystem. In addition, contaminated sediments and excavated material may leach contaminants into the soils and cause groundwater contamination.	**MINOR**	The C-ESMP will include measures to protect surface water, and will include but is not limited to: • Implement silt curtains or turbidity barriers to contain disturbed sediments. • Ensure proper waste management measures • Ensure proper containment, removal, and disposal of any dredged contaminated material in designated areas as discussed in waste management impact. • Use low-impact construction techniques to minimize sediment disturbance.	ESS1 ESS3	• Site inspection	**INSIGNIFICANT**	Construction contractor	• Al Khanka Local Unit, Environmental unit • Qaluybia Governorate PCU • Supervision Consultant • GCCC PCU	Contractor's cost
Surface Water – Ismaailya Canal and other fresh water sources	Freshwater canals may be impacted by improper waste management, including illegal dumping and the indirect leaching of contaminants	**MODERATE**	The C-ESMP will include, within the waste management plan, measures to protect surface water, and will include but is not limited to: • Adhering to soil and groundwater mitigation measures	**ESS1** **ESS3**	• Site inspection	**MINOR**	Construction contractor	• Al Khanka Local Unit, Environmental unit	Contractor's cost

Receptor / EHS Aspect	Impact	Impact Significance	Mitigation Measures	Relevant WB ESS	Means of supervision	Residual Impact	Responsibility		Est. Cost (EGP)
							Implementation	Supervision	
	from leaks through soil and groundwater Improper drainage can cause rainwater to percolate through waste materials, generating leachate that may carry pollutants, including heavy metals, organic contaminants, and pathogens, into surrounding water bodies, leading to leachate runoff.		• Waste management measures will be implemented. • Covering material transporting trucks. • Dust management measures will be implemented • Periodic equipment and machinery inspections will help minimize spills and leaks. • A drainage system will be designed to collect rainwater from the site and discharge it to the public networks to prevent contamination of adjacent surface water bodies.					• Qaluybia Governorate PCU • Supervision Consultant • GCCC PCU	
Risk to asset /investment (landfill cover)	Potential risk of damage to cover from rough or sharp surfaces during phase activities	**MAJOR**	• Adhere to the layers design which include the use of protective layers (e.g., geotextiles) above liners to prevent punctures. • Ensure proper handling and installation of liners to avoid mechanical damage. • Conduct regular inspections and immediate repairs of any identified damage. • Restrict movement of heavy equipment over liner areas. • Train workers on best practices for liner protection.	ESS1 ESS2 ESS3	• Site inspection and monitoring • Training Records	**MODERATE**	The Designer Contractor	• Al Khanka Local Unit, Environmental unit • Qaluybia Governorate PCU • Supervision Consultant • GCCC PCU • (SWMU)	Should be included in operator budget
Waste Mass Stability	Heavy duty vehicles movement, cutting and filling in waste during the civil works may cause instability in the waste mass and consequent slope failure.	**MAJOR**	• The design has taken relevant factors into consideration by incorporating phased excavation, slope reinforcement, terracing, and stability pads to maintain stability. In addition, leachate and gas management were designed. Additionally, slope stability models were conducted to assess potential risks and implement necessary measures to prevent slope failure during civil works. • The contractor will continuously monitor for signs of instability, such as cracks or ground movement, and adjust construction activities accordingly.	ESS1 ESS2 ESS3	• Site inspection and monitoring • Training Records	**MODERATE**	The Designer Contractor	• Al Khanka Local Unit, Environmental unit • Qaluybia Governorate PCU • Supervision Consultant • GCCC PCU • (SWMU)	Should be included in operator budget
Natural Disasters	Earthquake and flooding may disrupt the construction schedule and pose risks of injuries or fatalities. The project is not in an active earthquake zone and flooding is not expected.	**MINOR**	Develop and implement an Emergency Preparedness and Response Plan (EPRP) that includes protocols for seismic and flood events. This should cover early warning systems, safe evacuation routes, worker training, regular drills, and reinforcement of temporary structures. Additionally, schedule construction activities outside of high-risk seasons where	ESS1 ESS2 ESS3	• Training Records • Weather conditions • Emergency Preparedness and Response Plan (EPRP)	**INSIGNIFICANT**	Contractor	• Al Khanka Local Unit, Environmental unit • Qaluybia Governorate PCU	Should be included in operator budget

Receptor / EHS Aspect	Impact	Impact Significance	Mitigation Measures	Relevant WB ESS	Means of supervision	Residual Impact	Responsibility		Est. Cost (EGP)
							Implementation	Supervision	
			feasible and ensure all temporary and permanent structures comply with relevant seismic and flood-resistant design standards.					• Supervision Consultant • GCCC PCU • (SWMU)	
Labor and Working Conditions	• Low wages • Lack of insurance coverage • Informal employment without contracts • Undefined working hours leading to unpaid overtime hours. • Lack of workers' facilities (e.g., rest areas, restrooms…)	**MODERATE**	• Formalize contracts with fair wages, insurance, and legal compliance. • Enforce transparent, non-discriminatory recruitment practices. • Provide written details of employment terms, rights, hours, pay, and benefits. • Ensure timely wage payments and compliance with rest, leave, and family leave laws. • Issue written notice and severance details upon contract termination. • Uphold equal opportunity in recruitment, pay, training, promotion, and discipline. • Ensure safe working conditions with protective equipment and training. • Offer confidential grievance mechanisms for workers. • Audit labor practices regularly for legal and standard compliance. • Prohibit forced labor, child labor, and exploitation. • Install and maintain clean, functional restrooms with adequate water supply and waste disposal. • Provide safe, potable drinking water stations across the worksite. • Designate shaded or indoor rest areas protected from weather extremes **Worker Accommodation Standards** • Develop an Accommodation Management Plan per IFC standards if laborers are accommodated. • Ensure accommodations provide safe, clean, well-ventilated living spaces with clean water, sanitation, first aid, and essential amenities. • Conduct regular inspections using a checklist, maintain an accommodation log, and establish a grievance mechanism. • Require workers to adhere to a Code of Conduct.	**ESS 1** **ESS 2**	• Field investigations • Review the complaint log • Review the subproject CoC • Review consultation activities report and training reports	**Minor**	Contractor Contractor Social Specialist	• Al Khanka Local Unit, • Labour bureau • Environmental and waste management officers in QG, WMRA • Social specialist in QG • Supervision consultant • GCCC PCU	Contractor's cost
Livelihoods	• Permanent site access restriction enforced at subproject start.	**MAJOR**	• Livelihood Restoration Plan (LRP) developed and set for implementation before civil works activities begin.	ESS1 ESS5 ESS 10	• Consultant to be hired to	**Moderate**	Consultant to be hired to implement the	• MoLD • QG	GCCC Subproject Cost

Receptor / EHS Aspect	Impact	Impact Significance	Mitigation Measures	Relevant WB ESS	Means of supervision	Residual Impact	Responsibility		Est. Cost (EGP)
							Implementation	Supervision	
	• Waste pickers barred from entering the site. • Contractor to use own workers for all on-site tasks. • Restriction impacts site operator and 56 informal sector individuals, including waste pickers and families, dependent on site for income.		• Plan offers alternative opportunities and support to offset livelihood disruption. • Includes livelihood restoration options, skill-building programs, and interventions to sustain affected families' subsistence.		implement the LRP. • Monitoring of LRP implementation to continue for at least one-year post-relocation of waste pickers to new livelihoods.		LRP before civil works activities at Abu Zaabal dumpsite begins.	• PCU • WMRA	
Temporary Labour Influx	• Contractor to recruit an estimated total of 150 skilled and unskilled temporary workers for this subproject activity. • Temporary labor influx may impact subproject areas, including: - Increased illicit behavior and social tension. - Health risks from disease transmission and strain on local health services. - Strain on local resources, such as housing.	**MODERATE**	• Contractors to screen workers' criminal records to reduce risks. • Implement and train workers on a Code of Conduct (part of contractor's contract), covering community respect, SEA/SH mitigation, safety, substance abuse bans, and environmental care. • Ensure all workers receive Code of Conduct training. • Require subcontractors to sign the Code of Conduct. • Conduct Code of Conduct induction biweekly for recurring workers and newcomers before work starts. • Provide induction training to new and rehired laborers. • Enforce penalties for Code of Conduct violations. • Offer workers training and awareness on SEA/SH issues. • Ensure adequate worker housing as part of livelihood support • Verify effective implementation of a Grievance Redress Mechanism (GRM) to log community complaints. • Operate GRM fully, including anonymous reporting channels. • Inform local populations of subproject commitments and measures via consultations.	ESS1 ESS2 ESS4	• Field investigations • Review the complaint log. • Review the subproject CoC • Review consultation activities report and training reports	**Minor**	Contractor Contractor Social Specialist	• Khanka Local Unit, • Labour bureau • Environmental and waste management officers in QG, WMRA • Social specialist in QG • Supervision consultant • GCCC PCU	Contractor's cost

Receptor / EHS Aspect	Impact	Impact Significance	Mitigation Measures	Relevant WB ESS	Means of supervision	Residual Impact	Responsibility		Est. Cost (EGP)
							Implementation	Supervision	
			• Adopt the PCU's grievance mechanism, with attention to SEA/SH components.						
Road Traffic and Transportation	Heavy vehicle movement on-site and off-site will increase during this phase, causing: • On-site traffic surge, dust, noise, and accident risks near workers and machinery. • Off-site road congestion, wear, and traffic disruption from machinery transport. • Higher safety risks for pedestrians and road users from spills or reckless driving. • Noise and vibration disturbances affecting nearby residents' quality of life (residents of 113, 59 buildings)	**MAJOR**	Contractor to develop a Traffic Management Plan, including: 1. **Off-Site Traffic Mitigation Measures:** • Schedule construction during off-peak hours. • Provide advance notice of road closures. • Use signage and barriers to guide traffic. • Coordinate with transportation authorities. • Optimize logistics to minimize trips. • Monitor and adjust traffic conditions. • Ensure compliance with safety regulations. • Maintain vehicles with approved parts to prevent accidents. • Train drivers on road safety. • Conduct periodic driver drug testing. • Hold community meetings to share traffic plan details. • Establish a community grievance mechanism for road-related concerns. **On-Site Traffic Mitigation Measures:** • Contractor to include in the Traffic Management Plan: • Designate specific routes for heavy vehicle movement. • Install dust and noise control measures (e.g., water spraying, mufflers). • Use trained flagmen to manage vehicle and worker interactions. • Limit vehicle speeds and enforce safety zones near workers. • Schedule high-traffic activities to avoid peak worker presence. • Regularly inspect and maintain on-site roads and pathways. • Provide workers with safety training on vehicle hazards. • Traffic and Transport Safety Plan will be implemented to minimize incidents involving vehicles and machinery. It will include pedestrian walkways, reversing alarms, speed controls, designated vehicle	ESS1 ESS4 ESS10	• Field investigations • Reviewing the subproject Traffic Management Plan • Review the complaint log • Review consultations reports (MoM)	**Moderate**	Contractor HSE supervisor	• Khanka Local Unit, • Solid Waste Management unit (SWMU) • Social specialist in QG • Environmental and waste management officers in QG, and WMRA • Supervision consultant • GCCC PCU	Contractor's cost

Receptor / EHS Aspect	Impact	Impact Significance	Mitigation Measures	Relevant WB ESS	Means of supervision	Residual Impact	Responsibility		Est. Cost (EGP)
							Implementation	Supervision	
			routes, signage, and night-time driving protocols. All drivers will undergo safety training and assessment. • Transportation safety practices while commuting from/to the site • Vehicle safety requirement for contractors and their subcontractors.						
SEA/SH	• SEA/SH risks at subproject sites endanger workers and locals, particularly women. • Male labor influx may increase harassment risks and disrupt social dynamics. • SEA/SH incidents could degrade workplace safety, morale, and productivity, risking turnover and legal issues. • Mishandled SEA/SH may erode trust in nearby communities (e.g., Arab El-Olaykat, Arab Juhayna, 500m–2.5km away), sparking opposition and delays.	**MODERATE**	• Enforce a Code of Conduct with zero-tolerance for SEA/SH, supported by mandatory training on community respect and penalties for violations. • Contractor to deliver SEA/SH awareness training, accessible to all genders. • Fully implement the PCU's gender-sensitive grievance mechanism with anonymous channels at the site level. • Conduct ongoing, culturally appropriate consultations with women and girls.	ESS2 ESS4 ESS10	• Field investigations • Review the complaint log • Review the subproject CoC • Review awareness sessions/ trainings reports • Review consultation activities reports	**Minor**	Contractor Contractor Social Specialist	• Khanka Local Unit, • Solid Waste Management unit (SWMU) • Social specialist in QG • Supervision consultant • GCCC PCU •	Contractor's cost
Public Resources & Utilities	• Electricity use to remain standard, powering admin building and site lighting. • Heavy equipment (e.g., welders, drillers) to rely on backup generators. • Water use to be minimal, mainly for housekeeping and drinking. • Sewage to consist chiefly of domestic and workforce waste	**MINOR**	• The contractor shall coordinate with relevant authorities (electricity, water, wastewater, and telecom) to obtain infrastructure maps and prevent damage. • If underground utilities are damaged, the contractor must follow standard procedures: immediate repair, notifying affected parties, and documenting the incident. • **Electricity Consumption**: Ensure efficient use in the administrative building and site lighting. Coordinate with the electricity authority to confirm capacity and prevent overloading. • **Water Supply**: Minimize usage through conservation measures. Verify potable water connections to prevent disruptions. • **Sewage Generation**: Ensure proper wastewater disposal by confirming sewage system capacity with relevant authorities to avoid overflows or blockages.	ESS1	• Field investigations • Review MoMs • Review reports of accidents	**Insignificant**	Contractor	• Khanka Local Unit, • Solid Waste Management unit (SWMU) • Social specialist in QG • Water and wastewater company • Egyptian Electricity Transmission Co. • Supervision consultant • GCCC PCU	Contractor's cost

Receptor / EHS Aspect	Impact	Impact Significance	Mitigation Measures	Relevant WB ESS	Means of supervision	Residual Impact	Responsibility		Est. Cost (EGP)
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Child Labor	• Child labor is prevalent in Qalyubia Governorate's construction sector. • Contractors, subcontractors, and suppliers may illegally employ children under 18 in hazardous civil works, breaching Labour Law No. 12/2003. • Children face risks in dangerous roles (e.g., drivers, laborers) during on-site dumpsite tasks and off-site transport. • Weak supervision off-site and complex on-site operations heighten these risks.	**MAJOR**	• Security to check IDs and inspect vehicles at the gate, barring workers under 18 from entry. • Contractor to keep laborers' ID copies and enforce age compliance in contracts with subcontractors, suppliers, and service providers. • Maintain daily attendance records to confirm no workers under 18 are on-site. • Suppliers to adopt a clear anti-child-labor policy. • Add contract appendix banning child labor, with penalties: - Escort children off-site, cover return costs, and pay daily wage. - Social officer to ensure safe return home. - Fine contractors for violations. • Share a unified anti-child-labor recruiting policy with contractors and subcontractors. • Enforce strict obligations, penalties, and gate controls to uphold zero-tolerance for child labor • Include provisions in subcontractor contracts that explicitly prohibit child labor and require adherence to relevant laws and regulations.	ESS2	• Field investigations • Reviewing the daily statements of workers' registration • Reviewing employment contracts • Reviewing the ID of all workers on site. • Penalty system and the course of actions enforced in cases of non-compliance	**Moderate**	Contractor HSE contractor specialist Contractor Social Specialist	• Khanka Local Unit, • Solid Waste Management unit (SWMU) • Social specialist in QG • Labour Bureau • Supervision consultant • GCCC PCU	Contractor's cost
Cultural Heritage	Deep excavation and ground-disturbing activities may uncover underground archaeological finds or cultural artifacts.	**MINOR**	The Chance Find Procedure to be followed ***Appendix 7.***	ESS 8	• Field investigations • Review of incident reports	**Insignificant**	Construction contractor	• Khanka Local Unit, • Solid Waste Management unit (SWMU) • Social specialist in QG	Contractor's cost
Occupational Health & Safety	• Failure to follow OHS standards poses risks to workers and legal non-compliance (Article 217, Law 12/2003). Key hazards include: **Physical Hazards** • Sharp objects (metal scraps, glass) can cause cuts and lacerations.	**MAJOR**	**1. OHS Management** • Develop and implement a comprehensive Occupational Health and Safety Plan (OHSP), aligned with Egyptian Labor Law 12/2003, World Bank ESS2, IFC Performance Standards, ISO 45001:2018, and OSHA regulations. • Conduct a Hazard Identification and Risk Assessment (HIRA), including Task-Based	ESS2	• Conduct field investigations to monitor on-site compliance. • Review subproject plans, documents, and risk	**Moderate**	Contractor HSE contractor supervisor	• Khanka Local Unit, • Solid Waste Management unit (SWMU) • Environmental and waste management officers in QG, and WMRA	Contractor's cost

Receptor / EHS Aspect	Impact	Impact Significance	Mitigation Measures	Relevant WB ESS	Means of supervision	Residual Impact	Responsibility		Est. Cost (EGP)
							Implementation	Supervision	
	• Heavy equipment (bulldozers, excavators) may lead to crushing injuries. • Unstable terrain increases the risk of slips, falls, and drowning. **Chemical Hazards** • Toxic gases (methane, hydrogen sulfide, VOCs) pose inhalation risks. • Chemical contamination can occur through skin contact, inhalation, or ingestion. • Pesticides and herbicides used for vegetation control may cause exposure risks. **Biological Hazards** • Vector-borne diseases from mosquitoes, rodents, or venomous reptiles include malaria, dengue, and leptospirosis. • Infections such as tetanus and bacterial illnesses can result from contact with contaminated waste. **Psychological Hazards** • Stress and fatigue may arise from physically demanding tasks. • Exposure to hazardous or disturbing conditions can cause psychological trauma. **Environmental Hazards** • Air pollution from dust and particulates can affect respiratory health. • Water pollution may result from leachate contamination. • Soil contamination can spread pollutants, leading to long-term environmental damage. **Ergonomic Hazards:** • Ergonomic hazards due to manual labor-intensive activities		Risk Assessments, and maintain an updated risk register. • Provide worker training on site-specific hazards, job hazard analysis, permit-to-work (PTW) systems, fall hazards (on the first day), chemical handling, storage, disposal, heat stress prevention, and emergency response • Assign adequate OHS supervisors to enforce safety protocols through daily toolbox talks, site inspections, and compliance monitoring per Egyptian laws. • Monitor safety performance indicators (Lost Time Injury Frequency rate (LTIFR) and Total Recordable Injury Frequency, (TRIF) in real time and establish a near-miss tracking system. • Ensure workers undergo medical check-ups per Egyptian laws and WBG requirements, with drivers and equipment operators passing drug tests. • Maintain daily attendance records for accident verification and provide insurance for all types of workers, including casual workers and workers hired by contractor and subcontractors, for work-related injuries, fatalities, and third-party liabilities. • Enforce strict penalties to prevent child labor and establish a worker grievance mechanism. **2. Risk Assessment and Mitigation** • Perform a Quantitative Risk Assessment (QRA) to confirm As Low As Reasonably Practicable (ALARP) risk levels • Conduct a Fire Explosion Risk Assessment (FERA) to evaluate methane buildup and ignition sources, with continuous methane monitoring and real-time gas detection systems. • Implement emergency shutdown procedures for landfill gas extraction systems and lockout-tagout (LOTO) safety systems for gas treatment infrastructure. **3. PPE Standards**		assessments, including Hazard Identification and Risk Assessment (HIRA) and Job Safety Analysis (JSA). • Examine incident, accident, and near-miss reports to identify trends and corrective actions. • Verify training logs to ensure workers receive required safety and hazard-specific training. • Monitor daily attendance sheets to track worker presence for accident verification. • Assess penalties imposed on the contractor for non-compliance with safety protocols. • Confirm the adequacy of OHS supervisors assigned to the site. • Check drug test records for			• Social specialist in QG • Labour Bureau • Supervision consultant • GCCC PCU	

Receptor / EHS Aspect	Impact	Impact Significance	Mitigation Measures	Relevant WB ESS	Means of supervision	Residual Impact	Responsibility		Est. Cost (EGP)
							Implementation	Supervision	

	that cloud result musculoskeletal injuries.		• Provide task-specific PPE:
			  ○ Landfill/excavation workers: N95 masks, heavy-duty gloves, steel-toe boots, high-visibility vests, safety goggles.
			  ○ Leachate/gas system operators: chemical-resistant gloves, gas detectors, flame-resistant clothing, self-contained breathing apparatus (SCBA).
			  ○ Heavy machinery operators: hearing protection, impact-resistant helmets, safety goggles.
			  ○ General waste handlers: cut-resistant gloves, safety goggles, disposable coveralls.
			  ○ Chemical handlers: gloves, masks, goggles, respirators.
			• Introduce heat stress PPE (cooling vests, breathable clothing) and face masks during dust storms.
			• Provide task-specific PPE (Annex 16): PPE requirements will be tailored to specific job risks as identified in the HIRAs and JSAs.
			• Workers engaged in leachate handling will be equipped with chemical-resistant suits, nitrile gloves, face shields, and waterproof boots.
			• Workers engaged in gas well drilling will utilize flame-resistant coveralls, safety harnesses, and respiratory protection.
			4. Confined Space Safety
			• Develop a Confined Space Entry Program:
			  ○ Conduct atmospheric testing before entry, monitoring oxygen (O_2), methane (CH_4), and hydrogen sulfide (H_2S) levels to ensure compliance with occupational exposure limits (OEL) and methane below its lower explosive limit (LEL).
					drivers and equipment operators.
					• Review the grievance log to address worker concerns and ensure resolution.
					• Evaluate daily site inspection reports to ensure consistent safety oversight.				

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							Implementation	Supervision	
			○ Implement emergency retrieval systems, rescue procedures, and real-time worker tracking. ○ Equip personnel with PPE and gas detection devices. • Enforce LOTO procedures to prevent hazardous gas releases. • Confined space entry procedures will be rigorously applied to any tasks involving gas wells, leachate tanks, or underground piping. • Entry will only be permitted following pre-entry atmospheric testing, with trained rescue teams on standby equipped with Self-Contained Breathing Apparatus (SCBA). (Annex 14) **5. Fire, Chemical, and Pathogen Risk Mitigation** • Ensure firefighting tools are available and conduct regular fire drills and hazardous material spill simulations. • Install engineering controls (ventilation systems, isolation barriers) to reduce chemical exposure, with administrative controls (training on handling, storage, disposal) and emergency measures (eye wash stations). • Promote pathogen prevention through regular handwashing, hand sanitizers, frequent cleaning of common areas, health screenings, vaccinations, and workspace design for distancing and ventilation. **6. Heat Stress & Fatigue Management** • Implement a Heat Stress Management Plan: ○ Mandate hydration breaks with accessible drinking water stations. ○ Provide shaded, ventilated rest areas and adjust schedules to avoid peak heat hours. ○ Develop a specific program for Ramadan hours. • Establish a fatigue management system for heavy machinery operators:					

Receptor / EHS Aspect	Impact	Impact Significance	Mitigation Measures	Relevant WB ESS	Means of supervision	Residual Impact	Responsibility		Est. Cost (EGP)
							Implementation	Supervision	
			○ Enforce shift rotations and use real-time biometric tracking to monitor fatigue. **7. Emergency Preparedness & Response** • Expand the Emergency Response Plan (ERP) with evacuation maps, alarm systems, and response procedures. • Conduct regular emergency drills for gas leaks, fires, and chemical spills. Emergency Response Plan (ERP), annexed to this ESIA (Annex 14 Section 11), outlines comprehensive protocols for evacuation, fire response, gas leakage, and medical emergencies. It includes evacuation route maps, multilingual training programs, lockout/tagout (LOTO) procedures, and simulation drills based on scenario-specific risk profiles. • Identify the nearest hospital that provides emergency medical services EMS. • Conduct physical assessment from the site to the identified hospital to assess the estimated time taken by the ambulance to reach the site. • Conduct regular emergency drills for gas leaks, fires, and chemical spills or other high-risk applications took place onsite • Emergency response awareness to be indulged into the site safety induction session. **8. Ergonomic Hazards:** • Ergonomic risk assessments will be conducted for all manual labor-intensive activities. Workers will be trained in proper lifting techniques, use of mechanical aids, and job rotation to minimize fatigue and reduce musculoskeletal injuries. • **Instability of the waste mass, excavation near steep slopes**Controlled access					

Receptor / EHS Aspect	Impact	Impact Significance	Mitigation Measures	Relevant WB ESS	Means of supervision	Residual Impact	Responsibility		Est. Cost (EGP)
							Implementation	Supervision	
			• Only trained personnel will undertake excavation work, supervised by safety spotters • Daily visual inspections of slope integrity and deformation will be carried out to prevent incidents **9. Transport and Traffic Safety** • Inspect vehicles before site access, ensuring they are guarded and insulated against electrical hazards. • Equip heavy vehicles with blind spot over-shoulder techniques and reverse alarm systems. • Designate pedestrian-safe zones within landfill operations. • Enforce driver rest periods, shift rotations, a night driving program, and defensive driving training with competency certificates. • Identify intersection points early and apply mitigation measures. .						
Community Health & Safety	The residential communities of **Arab El-Olaykat and Arab Juhayna** (500m–2.5km from the dumpsite) are the most vulnerable to the following risks: **Health Risks** • **Air Pollution:** Dust and airborne pollutants from closure activities may worsen respiratory conditions. • **Water Pollution:** Leachate contamination of nearby water sources poses health hazards. • **Vector-Borne Diseases:** Disturbed pests (mosquitoes, rodents) may spread diseases. **Environmental Risks** • **Soil Contamination:** Disruption of contaminated soil may lead to groundwater pollution. • **Habitat Disturbance:** Closure activities may displace wildlife	**MAJOR**	• Share community health and safety information regularly as per the Stakeholder Engagement Plan (SEP). • Conduct awareness campaigns in collaboration with community-based organizations. • Develop and implement a Traffic Management Plan covering route, truck movements, worker transport, and potential road closures. • Ensure consistent and adequate illumination surrounding the subproject site for security, even if work shifts will be limited to daytime • Fence the construction site and station security personnel to prevent unauthorized access. • Ensure security guards are unarmed and trained in human rights and the Code of Conduct for effective communication with workers and communities.	ESS1 ESS4 ESS10	• Review of stakeholder engagement activities and log. • Review the reports related to awareness raising • Field visit to oversee the site arrangements • Notifications shared with the community • Review of the grievance mechanism • Training sessions documents related to security guard trainings	**Moderate**	Contractor HSE Specialist Social Specialist	• Khanka Local Unit, • Solid Waste Management unit (SWMU) • Social specialist in QG • Supervision consultant • GCCC PCU	Contractor's cost

Receptor / EHS Aspect	Impact	Impact Significance	Mitigation Measures	Relevant WB ESS	Means of supervision	Residual Impact	Responsibility		Est. Cost (EGP)
							Implementation	Supervision	
	(snakes, lizards, insects) into nearby communities. • **Noise and Vibrations:** Construction activities may disrupt daily life. **Safety Risks** • **Traffic Hazards:** Increased vehicle movement may endanger pedestrians and motorists. • **Social Tensions:** Influx of workers may strain local resources and employment opportunities. • **Hazardous Materials:** Exposure to disturbed toxic or explosive substances poses risks. • **Fire Risks:** Sparks or heat from closure activities could ignite fires.		• Notify nearby residents in advance of heavy equipment transport. • Establish and promote an accessible grievance mechanism for community complaints. • Regularly apply safe pest control measures (e.g. traps, rodenticides, insecticides). • Erect fencing or buffer zones to prevent movement of displaced animals toward communities. • Survey the site for active nests, burrows, or dens; relocate non-dangerous species in coordination with environmental authorities if necessary. 14 samples (Annex 14)						
Receiving of Fresh Waste									
Common impacts with the Civil Works activities; therefore, the same mitigation measures apply for: **Noise and Vibration, surface waters (lakes and canal), Waste mass stability, Natural Disasters, Risk to asset /investment (landfill cover), Labour and Working Conditions, Temporary Labour Influx, SEA/SH, Public Resources and Utilities, OHS[13], Community Health & Safety**									
Air Emissions	• Common impacts with the Civil Works activities • Foul-smelling gases/odor and particulate matter during fresh waste receipt and handling as a result of compounds such as ammonia (NH3), hydrogen sulfide (H2S), and other volatile organic compounds (VOCs). [14]	**MAJOR**	• Common mitigation measures with the Civil Works activities • Design measures for Zone 2: The area designated for freshly generated waste during closure implementation will be positioned away from the southern entrance to minimize odor-related disturbances. • Additionally, the Contractor's C-ESMP will include but is not limited to: o to reduce odours from fresh waste disposed in zone 2 operation, it is necessary that the waste is properly	ESS1 ESS2 ESS3	• Site inspection • Review the equipment, maintenance records. • Review the grievance log	**MODERATE**	• Designer • HSE supervisor	• Khanka Local Unit, Environmental unit • Qaluybia Governorate PCU • Supervision Consultant	Contractor's cost

[13] Note; Full Occupational Health and Safety Management Plan (OHSP)- (Annex 14), addresses risks associated with excavation, gas system installation, and post-closure monitoring. This includes task-based PPE guidance (Annex 16), emergency response protocols (Annex 12), fire/explosion risk control, biohazard prevention, and thermal stress management. Annexes also include templates for HIRA- (Annex 13), JSA (Annex 14), PTW, and confined space rescue procedures. (Annex 15)

[14] The strength of these odours depends on factors such as the amount of odorous waste, the degree of degradation of organic materials, and the organic content in the waste. These are exacerbated by factors such as meteorological conditions, local topography, and waste composition.

Receptor / EHS Aspect	Impact	Impact Significance	Mitigation Measures	Relevant WB ESS	Means of supervision	Residual Impact	Responsibility		Est. Cost (EGP)
							Implementation	Supervision	
			compacted and daily cover is applied. • Providing workers with PPEs such as masks						
Soil and Groundwater Contamination	• Ccommon impacts with the Civil Works activities • Leachate generation from decomposing waste can infiltrate the soil and groundwater, increasing pollution levels if improperly managed.	**MODERATE**	• Common mitigation measures with the Civil Works activities • Leachate collection and treatment was taken into consideration in the design.	ESS1 ESS2 ESS3	• Site inspection • Review the equipment, maintenance records. • Review the grievance log	**MINOR**	• Designer • HSE supervisor	• Khanka Local Unit, Environmental unit • Qaluybia Governorate PCU • Supervision Consultant	Contractor's cost
Improper Waste management	• Common impacts with the Civil Works activities • Improper management of fresh waste received in zone 2 can result in leaching of contaminants to soil and groundwater. • Smuggling of inadequate waste types into the site can lead to exposure to OHS risks or explosion risks as discussed in dedicated OHS impacts below.	**MAJOR**	• Common mitigation measures with the Civil Works activities • Inspection of vehicle entering site and maintaining records of types and weights before permitting their access to the site. The contractor/operator will specifically adhere to the **Operational Manual – Operation Procedures**, particularly **Section 3.2 on Waste Reception**. Specifically, the **Zone 2 waste receipt operator** shall ensure that only waste permitted for disposal at the site is accepted and that all waste is controlled and registered before admittance. • GPS trackers to be installed to waste trucks to monitor them avoiding illegal dumping in unauthorized areas. • Awareness to governorate • MOUs to be established between Governorate and Ministries to ensure mutual understanding and accountability • SOP's to be included to the Contractor's Contract	ESS1 ESS2 ESS3	• Site inspection • Maintain waste records • Review the grievance log	**MODERATE**	Construction contractor	• Khanka Local Unit, Solid waste management unit (SWMU)	Contractor's cost
Biodiversity-Habitat Creation	• Common impacts with the Civil Works activities • As fresh waste will continue to be accepted in Zone 2 before full closure, scavenging opportunities	**MAJOR**	• Common mitigation measures with the Civil Works activities • Ensure proper compaction of deposited waste and the application of daily cover in accordance with the designated waste	ESS1 ESS 3 ESS 4 ESS 6	• Site inspection • Waste logs • Review the grievance log	**MODERATE**	Construction contractor	• Al Khanka Local Unit, Solid waste management unit (SWMU)	Contractor's cost

Receptor / EHS Aspect	Impact	Impact Significance	Mitigation Measures	Relevant WB ESS	Means of supervision	Residual Impact	Responsibility		Est. Cost (EGP)
							Implementation	Supervision	
	will persist but may face occasional disruptions. • The presence of fresh waste and possible waste piling may create an ideal breeding ground for disease vectors/insects, rats, mosquitoes, possibly venomous reptiles/snakes posing potential health risks to workers and nearby communities.		filling plan and in line with best practices and the operation manual to avoid the attraction of vermin, disease vectors/insects, rats, mosquitoes, venomous reptiles/snakes, and scavenging birds		• Surveys of scavenger populations			• Qaluybia Governorate PCU • Supervision Consultant • GCCC PCU	
Road Traffic and Transportation	• **Increased traffic volume:** Surge in on-site traffic from frequent heavy vehicle movement during fresh waste transport, raising dust, noise, and accident risks near workers and machinery due to blind spots and lack of pedestrian zones. • **Increased Traffic Congestion**: Frequent waste transport vehicles may lead to higher traffic volumes on roads leading to the dumpsite, causing delays and disruptions. • **Road Damage**: Heavy trucks carrying waste can contribute to road wear, leading to degradation, potholes, and structural damage over time. • **Safety Hazards**: Spills, reckless driving, or overloaded waste vehicles pose risks to pedestrians, cyclists, and other road users. • **Disruptions to Local Mobility**: If waste delivery schedules and vehicle numbers exceed road capacity, local residents and businesses may experience restricted access and mobility challenges.	**MAJOR**	**Onsite Measures:** • Implement a traffic management plan to regulate waste transport schedules, ensuring staggered truck movements to reduce congestion. • Designate specific entry and exit points for waste trucks to streamline movement and prevent bottlenecks. • Enforce weight limits for trucks to prevent overloading, reducing road damage and improving stability. • Impose strict speed limits (approx. 10-15 km/h) within the dumpsite, with warning signs and trained personnel monitoring compliance. • Equip the site with spill containment kits and emergency response protocols to handle accidental waste spills or vehicle breakdowns. • Conduct regular inspections and maintenance of onsite access roads to repair damage caused by heavy trucks. • Provide designated parking areas for waste transport vehicles to prevent obstruction of internal roads. **Offsite Measures:** • Identify and communicate alternative routes for local commuters to minimize congestion on main access roads. • Notify nearby residents and businesses in advance about peak truck movement hours to help them plan accordingly. • Collaborate with local authorities to monitor and regulate truck drivers' adherence to traffic laws, including speed limits and load restrictions.	ESS1 ESS4 ESS10	• Field investigations • Reviewing the subproject Traffic Management Plan • Review the complaint log • Review consultations reports (MoM)	**Moderate**	Contractor HSE supervisor	• Khanka Local Unit, • Solid Waste Management unit (SWMU) • Social specialist in QG • Environmental and waste management officers in QG, and WMRA • Supervision consultant • GCCC PCU	Contractor's cost

Receptor / EHS Aspect	Impact	Impact Significance	Mitigation Measures	Relevant WB ESS	Means of supervision	Residual Impact	Responsibility		Est. Cost (EGP)
							Implementation	Supervision	
			• Install road signs, speed bumps, and pedestrian crossings near affected areas to enhance safety for all road users. • Coordinate with local municipalities to ensure periodic road maintenance and repairs in areas affected by heavy truck movement. • Establish a complaint mechanism for community members to report traffic-related concerns or safety hazards.						
Child Labour	• Children risk exposure to hazards (toxic materials, biological risks, heavy lifting) if employed as drivers or waste handlers during fresh waste receival. • Limited oversight during off-site waste transport heightens exploitation risks.	**MAJOR**	• Ban children under 18 from all roles, especially hazardous ones like driving or waste handling. • Check IDs at site entry and during off-site transport to exclude children. • Train contractor supervisors on preventing child labor and spotting hazards (e.g., toxic materials, biological risks, heavy lifting). • Ensure strict oversight of fresh waste receival and transport with daily logs. • Impose penalties (e.g., fines, termination) on contractors for child exploitation. • Set up an anonymous reporting system for child labor concerns. • Include provisions in subcontractor contracts that explicitly prohibit child labor and require adherence to relevant laws and regulations.	ESS2	• Field investigations • Reviewing the daily statements of workers' registration • Reviewing employment contracts • Reviewing the ID of all workers on site. • Penalty system and the course of actions enforced in cases of non-compliance	**MODERATE**	Contractor HSE contractor specialist Contractor Social Specialist	• Khanka Local Unit, • Solid Waste Management unit (SWMU) • Social specialist in QG • Labour Bureau • Supervision consultant • GCCC PCU	Contractor's cost
Post-Closure Phase									
Common impacts with the Civil Works & Fresh Waste activities; therefore, the same mitigation measures apply for: **Waste Management, Natural Disasters Labour and Working Conditions, and OHS**									
Air Emissions	• Maintenance equipment exhaust impacts are as in civil works phase • Unpleasant odors from the evaporation ponds • Methane emissions as a result of incomplete combustion of flared landfill gas or leakage of gasses as a result of improper capture. • Methane emissions from decomposing waste	**MODERATE**	• Same mitigation measures as civil works phase for maintenance equipment emissions. • Ensure the integrity and effectiveness of the final cover layer • Odor impacts from evaporation ponds on sensitive receptors were mitigated during the design phase and are expected to be minimal. The site's location, the waste mass serving as a wind barrier, and the location of sensitive receptors upwind from the evaporation pond all contribute to reducing potential impacts. • Conduct regular air quality monitoring according to monitoring plan • Engage with local communities to address any concerns related to air quality and keep them	ESS1 ESS2 ESS3	• Site inspection • Review the equipment, maintenance records. • Review the grievance log	**MINOR**	QG "Potential" contractor	• Khanka Local Unit, • Solid Waste Management unit (SWMU) • Environmental specialist in QG	Contractor's cost

Receptor / EHS Aspect	Impact	Impact Significance	Mitigation Measures	Relevant WB ESS	Means of supervision	Residual Impact	Responsibility		Est. Cost (EGP)
							Implementation	Supervision	
			informed about the aftercare operation activities and grievance mechanism.						
Noise and Vibration	• Maintenance equipment engine noise • Pumps used for pumping leachate • Blowers for gas treatment	**MINOR**	• Maintain machinery in good working conditions to minimize noise generation and ensure that they do not exceed permissible limits; • Construct a buffer zone between the site and the external environment or locate facilities away from sensitive receptors • Select equipment that has low noise emission levels; • Follow the manufacturers' recommended maintenance schedule • Aftercare operations should be carried out at proper times during daytime. • Earmuffs/protective hearing equipment shall be made available to all workers if necessary. • The Project should develop and implement a grievance procedure in the event of any noise complaints being received. • HSE/Environmental Specialist will continuously check the site and nearby sensitive receptors for noise related impacts and timely solutions will be made.	ESS1 ESS2 ESS3	• Site inspection • Review the equipment, maintenance records. • Review the grievance log	**INSIGNIFICANT**	QG "Potential" contractor	• Khanka Local Unit, • Solid Waste Management unit (SWMU) • Environmental specialist in QG	Contractor's cost
Soil and Groundwater	Overflowing/Leaks from the evaporation ponds Overflow from evaporation pond as a result of significant rainfall events and waves generated by wind or as a result of excess leachate reaching the pond.	**MODERATE**	• Design has taken heavy storm conditions and historical and projected weather conditions. • Maintaining a freeboard of at least 0.5 m in evaporation ponds provides safeguard against overflow •	ESS1 ESS2 ESS3	• Weather monitoring • Review the equipment, maintenance records. • Review the grievance log	**INSIGNIFICANT**	QG "Potential" contractor	• Designer • Khanka Local Unit, • Solid Waste Management unit (SWMU)	Design budget Contractor cost
Biodiversity-Habitat modification	If evaporation ponds retain water, they may temporarily attract insects.	**MAJOR**	Common mitigations with the Civil Works activities	ESS1 ESS3 ESS6	• Site inspection • Review the grievance log	**MODERATE**	QG "Potential" contractor	• Khanka Local Unit, • Solid Waste Management unit (SWMU) • Environmental specialist in QG	Contractor's cost
Risk to asset /investment (landfill cover)	• Potential risk of damage to cover from rough or sharp surfaces during phase activities • Potential damage of equipment as a result of the high level of salts in leachate	**MAJOR**	• Monitor and record all leachate levels from all leachate sumps on the Premises on a weekly basis and ensure that leachate levels do not exceed design head above the liner in any location;	ESS1 ESS2 ESS3	• Site inspection and monitoring • Review the equipment, maintenance records.	**MODERATE**	QG "Potential" contractor	• Designer • Khanka Local Unit, • Solid Waste Management unit (SWMU)	Should be included in operator budget

Receptor / EHS Aspect	Impact	Impact Significance	Mitigation Measures	Relevant WB ESS	Means of supervision	Residual Impact	Responsibility		Est. Cost (EGP)
							Implementation	Supervision	
	• Risk of damage to landfill cover as a result of settlement that can be caused by excessive pumping, natural degradation of waste		• Due to the generally high level of salts in leachate all equipment has to be prepared to these corrosive environments.						
Road Traffic and Transportation	• Equipment and materials for leachate management and monitoring will be transported infrequently. • Monthly monitoring and site management activities will cause minimal traffic disruptions.	**Moderate**	**On-Site Measures:** • Schedule transportation of equipment and materials during off-peak hours to minimize disruptions. • Ensure proper route planning to avoid unnecessary traffic within the site. • Maintain clear signage and designated parking areas for monitoring vehicles. **Off-Site Measures:** • Coordinate transport schedules with local authorities to prevent congestion on surrounding roads. • Notify nearby communities in advance of any planned large-equipment transport to minimize disruptions. • Conduct periodic road condition assessments to address any potential wear from transport activities.	ESS1 ESS4 ESS10	• Field investigations • Reviewing the subproject Traffic Management Plan • Review the complaint log • Review consultations reports (MoM)	**Minor**	QG "Potential" contractor	• Khanka Local Unit, • Solid Waste Management unit (SWMU) • Social specialist in QG	Contractor's cost
Public Resources and Utilities	• Higher power demand from leachate systems in Zones 1 and 2, and evaporation ponds, during aftercare may strain the local grid. • Risk of shortages or outages affecting nearby industrial, commercial, and residential areas during peak times if infrastructure falters.	**Moderate**	• Assess and upgrade local grid capacity to handle increased power demand from leachate systems and evaporation pond. • Install energy-efficient equipment and backup generators to reduce grid reliance and ensure continuous operation. • Schedule high-demand operations during off-peak hours to minimize strain on the grid. • Monitor power usage and coordinate with local utilities to prevent shortages or outages. • Implement an emergency response plan for power disruptions affecting nearby areas.	ESS1	• Field investigations • Review MoMs • Review reports of accidents	**Minor**	QG "Potential" contractor	• Khanka Local Unit, • Solid Waste Management unit (SWMU) • Social specialist in QG	Contractor's cost
Community Health & Safety	• **Unauthorized Access**: Reduced site activity increases risks of unauthorized entry and safety issues. • **Fire and Electrical Hazards**: Ongoing risks from leachate pumps and electrical equipment operation. • **Gas Emission Exposure**: Malfunctioning gas collection or treatment systems may lead to gas leaks.	**Major**	• Install and maintain secure fencing, signage, and periodic security patrols to deter entry. • Regularly inspect and service leachate pumps and electrical equipment, with emergency shut-off systems in place. • Routinely monitor and maintain gas collection, transport, and treatment systems, with leak detection alarms and repair protocols.	ESS1 ESS4 ESS10	• Review of stakeholder engagement activities and log. • Review the reports related to awareness raising • Field visit to oversee the site arrangements	**Moderate**	QG "Potential" contractor	• Khanka Local Unit, • Solid Waste Management unit (SWMU) • Social specialist in QG	Contractor's cost

Receptor / EHS Aspect	Impact	Impact Significance	Mitigation Measures	Relevant WB ESS	Means of supervision	Residual Impact	Responsibility		Est. Cost (EGP)
							Implementation	Supervision	
					• Notifications shared with the community • Review of the grievance mechanism • Training sessions documents related to security guard trainings				

8.4 Environmental and Social Monitoring Plans (ESMoP)

Table8-2: ESMoP

Receptor / EHS Aspect	Monitoring Indicators	Responsibility of Monitoring	Frequency	Location	Method & Target	Est. Cost (EGP)
Air Quality- Ambient Air Quality	• Number of complaints related to air quality • Equipment performance and maintenance records • Emissions visibility (black smoke, dust for example) • Compliance of ambient air quality (PM10), SO2, CO and NOx with WB EHS and national limits • Evidence of covering trucks and loose/friable materials. • Weather conditions	Contractors and sub-contractors supervised by Al Khanka Local Unit and Solid Waste Management Unit (SWMU)	**During Construction and Fresh Waste receiving** • Air quality monitoring before start of the work to capture any increase in pollutant levels. The monitoring needs to capture times when the neighboring incinerators are fully operational for comparison purposes. • Monthly measurements of air quality and LFG or as soon as receiving a complaint • Daily visual inspection will be carried out continuously	**During Construction and Fresh Waste** • Ambient air monitoring needs to be carried out on site in both Zone 1 and Zone 2 and in selected baseline locations (spots measured in baseline) • Exhaust from equipment entering the site and during operation on site	• Compliance of air quality with the regulatory standards and WB standards of PM10, SO2 , CO , NOx • Methane, total carbon hydrates, carbon dioxide, hydrogen sulphate, nitrogen oxides, carbon monoxide and ammonia.	Contractor Management Cost

Receptor / EHS Aspect	Monitoring Indicators	Responsibility of Monitoring	Frequency	Location	Method & Target	Est. Cost (EGP)
Air Quality- Landfill Gas	Landfill Gas leaks	Contractors and sub-contractors supervised by Al Khanka Local Unit and Solid Waste Management Unit (SWMU)	**All Phases** Continuous monitoring	**All Phases** • Monitoring of LFG should take place both within the waste to identify the quantity /quality of gas generated, and outside of the waste to assess whether gas is escaping in an uncontrolled manner. • Will be carried out 20x20m grid in zone 1 and zone 2 • Along the dumpsite border to make sure that no gas is escaping to neighborhood areas. **Post Closure** Gas vents	• Instrumental monitoring for presence of CH4, CO2, NH3, H2S and VOCs in ambient air using Gas flow meters /analyzer • Gas odors detection during regular site inspection	Contractor Management Cost
Air Quality- Odor Emissions	• H2S in ambient air • Number of complaints related to odor. • Soil top cover	Contractors and sub-contractors supervised by Al Khanka Local Unit and Solid Waste Management Unit (SWMU)	**All phases** Annual for H2S Upon receipt of complaint	**All phases** Zone 1 and zone 2 Sensitive receptors as in baseline	collection of samples and analysis of H2S in ambient air	Contractor Management Cost
Noise and Vibration	• Number of complaints related to noise level. • Ambient noise will be monitored during the project construction phase • Equipment performance and maintenance	Contractors and sub-contractors supervised by Al Khanka Local Unit and Solid Waste Management Unit (SWMU)	**Civil works and Receiving of Fresh waste** - Monthly during civil works or as soon as receiving a complaint	**Civil works and Receiving of Fresh waste** • Same locations as baseline measurement locations • Site perimeter	• Site observation • Measuring ambient noise • Maintenance logs • Complaints log	Contractor Management Cost

Receptor / EHS Aspect	Monitoring Indicators	Responsibility of Monitoring	Frequency	Location	Method & Target	Est. Cost (EGP)
Soil and Groundwater	• Observation of accumulation of hazardous materials/waste • Evidence of fuel spills and lubricants • Soil erosion • Leachate outbreaks • Levels of certain parameters[15]	Contractors and sub-contractors supervised by Al Khanka Local Unit and Solid Waste Management Unit (SWMU)	**All phases** Daily	**All phases** Zone 1 and Zone 2 Project Site Area of influence	• Compliance of test samples with regulatory standards • Site observation with photos documentation • Groundwater Measurements results that shows compliance with WB General EHS standards which refer to the US EPA National Recommended Water Quality Criteria: pH Level, Soil Moisture Content, Heavy Metals (e.g., Lead, Cadmium, Mercury), Organic Compounds (e.g., Benzene, Toluene, Ethylbenzene, Xylenes - BTEX): may originate from waste materials, Nutrients and Fertilizers: Nitrogen (N), Phosphorus (P), Potassium (K), Ammonium and Nitrate Concentrations: especially if there is a potential for leaching into groundwater.	Contractor Management Cost
Waste	• Contracts with waste management contractors • Disposal receipts of some waste • Waste register • Waste logs • Cleanliness of the areas where work will take place. • Ensure burial of all waste • Records of the types and quantities of waste generated and amounts	Contractors and sub-contractors supervised by Al Khanka Local Unit and Solid Waste Management Unit (SWMU)	**All Phases** Daily visual inspection will be carried out continuously	**All phases** On-site and area of influence	• Site inspection with photos documentation • Documentation of any waste accumulating/ disposal in or outside the project site • Records review	Included in Contractor Management Cost
Biodiversity- Habitat modification/loss	• Mosquitos • Stray animals • Scavenging birds • Reptiles/snakes	Contractors and sub-contractors supervised by Al Khanka Local Unit and Solid Waste Management Unit (SWMU	**All Phases** Daily visual inspection will be carried out continuously	**All phases** On-site and area of influence	• Visual inspection • Grievances • Records review	
Surface Water – Three Lakes	• Evidence of fuel spills and lubricants • Leachate leaks • Waste accumulations • PH, temperature, conductivity, chloride, sodium, hardness, iron, color, dissolved oxygen, BOD5, COD, TSS, TDS, NH3-N, chromium, oil & grease, arsenic, cadmium, lead, mercury, total coliforms, faecal coliforms.	Contractors and sub-contractors supervised by Al Khanka Local Unit and Solid Waste Management Unit (SWMU)	**All Phases** • Daily visual inspection will be carried out continuously • Annual monitoring	**All Phases** Upstream and downstream of the Abu Zaabal closing Dumpsite location	• Compliance of test samples with regulatory standards • Site observation with photos documentation • Test water samples for any contamination (VOC, COD, BOD, etc) that resulted from project activities Measurements results that shows compliance with the regulatory standards of the EEAA and WB standards: • Heavy Metals: lead, mercury, cadmium, and chromium. • pH Levels: Extreme pH levels can affect the solubility of certain contaminants. • BOD (Biochemical Oxygen Demand): High BOD levels indicate the presence of biodegradable contaminants. • COD (Chemical Oxygen Demand): It provides an overall indication of water quality. • Nutrients: Monitor levels of nutrients such as nitrogen and phosphorus, which can originate from organic waste and fertilizers. • Leachate Quality: Analyze leachate from the waste management facility, as it can be a direct indicator of potential groundwater contamination. • Groundwater Level: to understand variations and potential impacts on contamination. • Turbidity: High turbidity levels may indicate the presence of contaminants. • Conductivity: Changes in conductivity can indicate contamination.	Included in Contractor Management Cost

[15] pH Level, Soil Moisture Content which can influence the transport of contaminants, Heavy Metals (e.g., Lead, Cadmium, Mercury) which pose risks to human health and the environment., Organic Compounds (e.g., Benzene, Toluene, Ethylbenzene, Xylenes - BTEX): may originate from waste materials, Nutrients and Fertilizers: Nitrogen (N), Phosphorus (P), Potassium (K): Assess the levels of nutrients and fertilizers, which can impact soil fertilityAmmonium and Nitrate Concentrations: especially if there is a potential for leaching into groundwater.

Receptor / EHS Aspect	Monitoring Indicators	Responsibility of Monitoring	Frequency	Location	Method & Target	Est. Cost (EGP)
Risk to asset /investment (landfill cover)	- Cracks or leaks in lining layers - Leachate outbreaks - Gas odors	Contractors and sub-contractors supervised by Al Khanka Local Unit and Solid Waste Management Unit (SWMU)	**All phases** Daily	**All Phases** Waste mass	Visual inspection and walkthrough	Included in Contractor Management Cost
Waste Mass Stability	- Cracks on surface of the waste body or landfill cover - Bulging or slumping of side slopes - Tilted or displaced structures, fencing, or drainage components - Seepage or leachate breakouts along the slope	Contractors and sub-contractors supervised by Al Khanka Local Unit and Solid Waste Management Unit (SWMU)	**All phases** Daily	**All Phases** Waste mass	- Visual inspection and walkthrough	Included in Contractor Management Cost
Unauthorized Waste Types Entry	- Waste register - Waste logs - Records of the types and quantities of waste generated and amounts	Contractors and sub-contractors supervised by Al Khanka Local Unit and Solid Waste Management Unit (SWMU	**Receiving of Fresh waste phase**	**Entrance**	- Visual inspection	Included in Contractor Management Cost
Local Community: **Socio-Economic Opportunities**	- Number of people employed from the local community. - Employment selection criteria - Number of community grievances related to employment.	Al Khanka Local Unit and Solid Waste Management Unit (SWMU), QG Supervision Consultant GCCC PCU	**Civil Works and Fresh Waste Phases:** Quarterly	Subproject site (Zone 1 & 2)	- Field investigations - Review employment contracts - Reviewing the lists that show local employment - Grievance log - Workers' attendance sheet - Stakeholder consultations documentation	No additional costs
Local Community: **Temporary Labour Influx**	- Availability of the code of conduct - Total number and % of signed code of conduct by workers - Penalties and disciplinary action taken against violations of the code of conduct - Number of grievances received related to labour influx issues - Documentation of corrective measures adopted - Frequency of CoC induction sessions - Number and % of new workers receiving induction training before starting work - Number and % of workers receiving SEA/SH training - Number of consultation activities conducted with local communities	Al Khanka Local Unit and Solid Waste Management Unit (SWMU), QG Supervision Consultant GCCC PCU	**Civil Works and Fresh Waste Phases:** Monthly	Subproject site (Zone 1 & 2)	- Lists of workers trained on CoC - Disciplinary actions taken - Review of Grievance log - Review of MoM of engagement activities with women - Biweekly CoC training - CoC training attendance sheet - Field visits and observations on compliance with CoC	No additional costs

Receptor / EHS Aspect	Monitoring Indicators	Responsibility of Monitoring	Frequency	Location	Method & Target	Est. Cost (EGP)
Local Community: **Road and Traffic Flow**	- Vehicle safety inspections are available - Installed signage for speed limits and construction vehicles - Grievances raised about the traffic system by the communities surrounding the site - % Of drivers undergoing periodic drug and alcohol testing - Number of positive drug test results and subsequent actions taken	Al Khanka Local Unit and Solid Waste Management Unit (SWMU), QG Supervision Consultant GCCC PCU	**All Phases:** Monthly	Subproject site (Zone 1 & 2)	- Site inspection with photo documentation - Monthly reports and grievance log - Review Grievance log - Review the Accident log (if applicable)	Included in Contractor's costs
Local Community: **SEA/SH**	- The monitoring of workers' compliance with the Code of Conduct when interacting with the surrounding communities to avoid behaviors such as GBV. - Number of complaints raised due to GBV - Documentation of corrective measures adopted - % Of workers trained on the Code of Conduct and SEA/SH - % of workers who signed the Code of Conduct acknowledging zero tolerance for SEA/SH. - Number of reported violations of the Code of Conduct related to SEA/SH. - Number of penalties applied for SEA/SH-related violations. - Number of consultations conducted with surrounding community members especially women and girls.	Al Khanka Local Unit and Solid Waste Management Unit (SWMU), QG Supervision Consultant GCCC PCU	**Civil Works and Fresh Waste Phases:** Monthly	Subproject site (Zone 1 & 2)	- Review Grievance log - Site observation - Review signed worker code of conduct - Review of MoM of engagement activities with women - Training attendance sheet	No additional costs
Local Community: **Child Labor**	- Workforce database (incl. IDs) - Grievance log - Number of penalties applied for child labor violations - Number of awareness sessions conducted for contractors and workers	Al Khanka Local Unit and Solid Waste Management Unit (SWMU), QG Supervision Consultant GCCC PCU	**Civil Works and Fresh Waste Phases:** Quarterly	Subproject site (Zone 1 & 2)	- Verifying contracts - Inspection of complaints - Inspection of Human Resources Policy - Inspection of employment contracts - Grievance log Review - Labor registry and ID review	No additional costs

Receptor / EHS Aspect	Monitoring Indicators	Responsibility of Monitoring	Frequency	Location	Method & Target	Est. Cost (EGP)
Local Community: **Community Health and Safety**	- Dusts and gas emissions samples around the site - Training records for driving, transportation of hazardous substances, and emergency response - Number of traffic-related accidents. - Number of health complaints for communicable diseases - Number of community complaints related to driver behavior. - Existence of an emergency response plan - Number of complaints on GBV and driving behavior - Number of information-sharing sessions conducted per month as per the SEP.	Contractors and sub-contractors supervised by Al Khanka Local Unit and Solid Waste Management Unit (SWMU)	**All Phases:** Monthly	Subproject site (Zone 1 & 2)	- Review reports of the results of dust samples and gaseous emissions around the site - Review records of training on driving behavior, hazardous materials transportation, and emergency response - Review truck maintenance program monitoring reports - Review the complaints log and the procedures taken to resolve complaints and pending complaints. - Review and update the emergency response plan, if necessary.	Included in Contractor's costs
Workforce: **Labor and Working Conditions**	- Number of working conditions related grievances - Number of workplace accidents or injuries - Availability and use of personal protective equipment (PPE) - Frequency of safety training and drills - Presence of hazardous working conditions (e.g., exposure to chemicals, noise, or extreme temperatures) - Access to clean water, sanitation, and hygiene facilities - Percentage of workers with formal written contracts - Compliance with legal hiring and termination procedures - Turnover rates or absenteeism - Coverage under social security or health insurance programs - Compliance with minimum wage laws - Timeliness of wage payments (e.g., delays or withheld payments) - Availability of rest breaks and days off and access to accommodation	Contractors and sub-contractors supervised by Al Khanka Local Unit and Solid Waste Management Unit (SWMU)	**All Phases:** Monthly	Subproject site (Zone 1 & 2)	- Monthly inspections of workers' facilities condition and cleanliness - First-aid kits quarterly audit for stock levels, ensuring 100% are fully stocked and checked on schedule. - Monthly emergency communication systems check, aiming for 100% functionality - Workers' grievance log (<5/month) - Workers' attendance log - Safety training and drills log - 0% wage delays - 100% PPE use	Included in Contractor's costs

Receptor / EHS Aspect	Monitoring Indicators	Responsibility of Monitoring	Frequency	Location	Method & Target	Est. Cost (EGP)
Workforce: **OHS**	- Development and implementation of a health and safety plan - Routine safety inspection report - Periodic medical examinations and record of health complaints - Records of inspections of available fire extinguishers and functional fire-abatement system - Records of fire drills and audits - Trainings performed and recorded - Number of accidents/ injuries/near-misses - PPE used by workers - Available and regularly sufficient first aid kits for mentioned hazards - Availability of insurance policies schemes and their validity	Al Khanka Local Unit and Solid Waste Management Unit (SWMU), QG Supervision Consultant GCCC PCU	**All Phases:** Monthly	Subproject site (Zone 1 & 2)	- Monitoring of exposure to contaminant dust, vapors, and gases - Regular safety inspection program - Health surveillance program to examine workers before entering the workplace for any signs of infection, along with proper health monitoring during operation - Monitoring of noise - Regular reporting of any accidents. - Regular check on the workers' attendance sheet - Fire drills should be done regularly and external audits - Regular inspection and maintenance of electric equipment, plugs, and wires. - Daily check of toilet and workers' camps cleanliness and follow up on continuous disinfection of the rest areas as well as the presence of clean potable water - Check that the health insurance covers all workers on the site, including work injuries. - In addition to environmental indicators, the ESMoP will monitor OHS compliance through monthly safety audits, incident tracking, PPE usage observations, confined space entry logs, and heat illness reporting. Contractors will be held accountable for meeting OHS KPIs defined in the contract.	Included in Construction costs

9 Stakeholder Engagement Activities

9.1 Introduction

Stakeholder engagement is a key component of impact assessment best practices and a requirement under the World Bank's Environmental and Social Standard 10. In Egypt, the EEAA also mandates stakeholder engagement for subprojects with moderate to high environmental risk and impact, ensuring transparency and public participation. Public consultation is required for specific subproject categories, allowing affected communities to provide feedback. Stakeholder identification must include local authorities, NGOs, and vulnerable groups to ensure inclusivity. Information disclosure is a fundamental requirement, with ESIA reports made accessible before subproject approvals. Consultation methods should be culturally appropriate and may include public meetings, surveys, and focus group discussions. The entire consultation process must be documented in the ESIA report, outlining stakeholder concerns and how they were addressed. Additionally, subprojects must establish a grievance mechanism to ensure stakeholders can raise concerns transparently. EEAA evaluates compliance with these requirements during subproject approval, and failure to meet engagement standards can result in delays or rejection.

The subproject owner is committed to a technically and culturally appropriate consultation process that is inclusive and aligns with international best practices. Engagement activities have been ongoing since **March 2024**, reinforcing the subproject's commitment to transparency and participation. Effective stakeholder engagement fosters a strong and responsive relationship between the subproject owner and stakeholders, which is essential for successfully managing environmental and social impacts. This process involves stakeholder identification, planning, information disclosure, consultation, grievance mechanisms, and ongoing reporting, with the level of engagement tailored to the subproject's risks, scale, and stakeholder interest.

This chapter aims to:

- Summarize international legal and policy requirements for stakeholder engagement.
- Identify stakeholders affected or interested in the subproject.
- Outline engagement efforts to date and explain how stakeholder input has shaped the subproject.

9.2 Objectives

The stakeholder engagement activities for the Abu Zaabal Dumpsite subproject aimed to ensure meaningful participation and address key concerns. The objectives included:

- **Gathering Community Feedback**: Collecting opinions, concerns, and suggestions from local residents and stakeholders.
- **Identifying Impacts**: Understanding the subproject's social, environmental, and economic effects on the community.
- **Enhancing Subproject Design**: Integrating stakeholder insights to better meet local needs and minimize negative impacts.
- **Promoting Inclusivity**: Ensuring diverse voices, including marginalized groups, are heard in decision-making.
- **Facilitating Collaboration**: Encouraging cooperation between the subproject team, local authorities, and community members.
- **Informing and Educating**: Providing stakeholders with accurate information about the subproject's objectives and expected outcomes.
- **Ensuring Compliance**: Meeting all legal and regulatory requirements related to environmental and social safeguards.

9.3 Stakeholder Identification and Analysis

The first step in the stakeholder engagement process is stakeholder identification, which involves determining the various categories of stakeholders and their needs or interests in the subproject. According to the **World Bank's ESS 10**, stakeholders include:

- **Primary Stakeholders**: Individuals or groups directly affected or likely to be affected by the subproject.
- **Secondary Stakeholders**: Those who have influence over or an interest in the subproject but are not necessarily directly impacted.

Effective stakeholder engagement requires identifying stakeholder representatives, who play a key role in both providing valuable insights into the subproject's potential impacts and serving as communication channels to share information and collect feedback. This inclusive approach ensures that diverse stakeholder groups are engaged at different levels to meet the study's objectives. The following stakeholder groups have been identified:

- Deputy Governor of Qalyubia,
- Director of the Solid Waste Management Unit in Qalyubia Governorate,
- Director of Community Communication Department for Qalyubia Governorate,
- Officials of Al Khanka City Council,
- Officials in Arab El-Olaykat and Abu Zaabal Local Units,

- Officials in Arab El-Olaykat and Abu Zaabal Health units, Health Administration in Al Khanka,
- NGOs in Arab El-Olaykat, Abu Zaabal Villages,
- Residents in the nearest residential areas to the subproject site in Arab El-Olaykat villages: Residences 113 and Residences 59 in Arab El-Olaykat.
- Officials at Youth Center of Abu Zaabal and Arab El-Olaykat Villages,
- Community leaders in Arab El-Olaykat.
- Waste pickers utilizing Abu Zaabal dumpsite

9.4 Consultation Methodology & Activities Undertaken

The Consultant's study team carried out field visits to the Abu Zaabal Dumpsite subproject site, accompanied by the PCU team and governorate representatives, in April, May, and October, 2024. During these visits, the consultant actively engaged with the community, capturing numerous photos of the subproject site and its surroundings, and conducting multiple interviews with local residents. Stakeholder consultations were primarily carried out through Key-Informant Interviews (KII) and Focus Group Discussions (FGDs). The diversity of community representation was ensured by including males, females, the elderly, and community leaders. The identification of relevant stakeholders for the subproject considered two main factors: the geographical proximity of potential stakeholders to the subproject area and their level of influence on or by the subproject. The consultation-specific surveying tools designed for each stakeholder group are provided in **Appendix 8**. The table below provides a summarized overview of the stakeholder categories engaged, the consultation methods employed, the number of females and males involved, and the dates of the consultations:

Table9-1: Summarized Overview of the Consultation Activities Conducted in the Subproject Area

Stakeholder	Number		Method	Date
	Males	Females		
Deputy Governor of Qalyubia	-	1	KII	April 1, 2024
Official of the Solid Waste Management Unit in Qalyubia Governorate	1	-	KII	April 1, 2024
Community Engagement Officer in Qalyubia Governorate	-	1	KII	April 1, 2024
Officials of the Khanka City Council (Information Center employees)	1	3	KII	April 29, 2024
Officials in Arab El-Olaykat local unit (Information Center employee)	1		KII	April 30, 2024
Officials at the Youth Center of Abu Zaabal and Arab El-Olaykat Villages	2	-	KII	April 28-30, 2024
Al-Olaykat and Abu Zaabal Health Units and Health Administration in Khanka	3-Deputy	2-Deputy	KII	April 28-30, 2024

Stakeholder	Number		Method	Date
	Males	Females		
Arab El-Olaykat Local Community Development Association, Abu Zaabal	3	-	KII	April 28, 2024 & May 1, 2024
Potential Affected Communities in Arab El-Olaykat villages, Residences 113, Residences 59 in Arab El-Olaykat	16	15	3 FGDs	May 1, 2024 May 8, 2024 October 29, 2024
Community leaders in Arab El-Olaykat	١	-	KII	May 1, 2024
The informal sector- male waste sorters at Abu Zaabal dumpsite	6	-	FGD	May 8, 2024
Total:	35	21		

9.4.1 Outcomes of the Scoping Consultation Activities

All consultation activities conducted were documented with lists of participants and photo documentation in order to guarantee an appropriate level of transparency (***Appendix 9***). The following table presents the stakeholder engagement activities conducted by the Consultant during the site visits and the main outcomes obtained.

Stakeholder	Consultation Outcomes
Deputy Governor of Qalyubia Governorate	**Nearby Communities and Facilities**: - Closest communities: Arab El-Olaykat village, new social housing buildings (113 and 59), Abu Zaabal workshop housing. - Facilities: Local unit and health unit in Arab El-Olaykat village, part of Al Khanka Center. **Naming Clarification**: - Dumpsite named Abu Zaabal but located in Arab El-Olaykat village, not Abu Zaabal village. **Recommendations**: - Conduct awareness campaigns in Arab El-Olaykat about closure process and impacts. - Implement environmental measures: air quality monitoring, dust suppression. - Prioritize proper waste treatment and rehabilitation to prevent long-term environmental hazards.
Director of Solid Waste Management Unit, Qalyubia Governorate	**Dumpsite Overview**: - Size: 127 acres, established 1997, operates 24/7. - Serves Qalyubia Governorate, processes 2000 tons/day. - Underground waste: ~15 million tons across 7 rows, divided into terraces, covered with soil. **Infrastructure and Safety**: - No onsite emergency plan or firefighting equipment; fire extinguishers 2 km away. - No sewage system (undrained trench); water from Khanka station, electricity from public network. - Waste vehicles (20-35 tons) weighed; 22 government workers rotate 12-hour shifts, earn ~3200 EGP/month. - Emergency medical care: Arab El-Olaykat Railway Hospital (1 km), Abu Zaabal Hospital (2 km), Al Khanka Hospital, or Arab El-Olaykat health unit. No onsite first aid kit. **Workforce**: - ~56 waste sorters from Arab El-Olaykat, including children (16-17) and 6 women, earn ~150 EGP/day. - Contractor leases landfill for 100,000 EGP/month. **Environmental and Safety Measures**: - Nearby environmental monitoring station; spontaneous combustion covered immediately.

	- 13 medical incinerators managed by Health Directorate. **Grievance Mechanism**: - Channels: Government portal, citizen service centers, municipal councils, local units, WhatsApp (e.g., Benha Complaints Group), social media (e.g., Facebook). - Complaints (odor, smoke, flies, insects) trigger soil covering. - Monitoring: Follow-up committees verify complaints within 48 hours, forward to relevant authorities. - Complaints recorded; Cabinet publishes national complaint statistics. **Post-Closure Plan**: - Site covered with soil/sand for 15 years, leachate collected.
Director of Community Communication Department, Qalyubia Governorate	**Communication with Authorities**: - Continuous engagement with Social Solidarity, local NGOs, local units, youth centers, health units, Ministry of Health. **Community Engagement**: - Methods: Meetings at governorate, targeted areas, Local Community Development Associations, Youth Center in Abu Zaabal, Youth Community Participation in Khanka Center. - Frequency: As-needed or in response to emerging issues. - Complaint follow-up via WhatsApp for rapid resolution and Deputy Governor updates.
Deputy of Khanka City Council	**Closure Urgency**: - Emphasized need to close dumpsite due to severe community impact. **Environmental Concerns**: - Adjacent lakes contain saline groundwater, unsuitable for fishery. **Affected Areas**: - Residential buildings in Arab El-Olaykat, Abu Zaabal workshop housing, social housing (buildings 113 and 59) impacted by wind direction. **Dumpsite Details**: - 127 acres, established 1997, operates 24/7, serves Qalyubia Governorate. **Waste Disposal Transition**: - Waste redirected to 10th of Ramadan Integrated Waste Management Facility until closure.
Head of Local Unit, Abu Zaabal Village	**Closure Necessity**: - Dumpsite (1.5 km, ~15 min from village) causes foul odors, pollution from Al-Akrasha industrial city, diseases (respiratory, cardiovascular, liver, kidney failure, cancer, skin diseases, allergies). **Healthcare Limitations**: - Local facilities limited to child vaccinations, dental services; residents seek treatment at Central Khanka Hospital or Chest Hospital near Al-Marj Al-Jadeedah. **Community Actions**: - Frequent insecticide use, spraying with health unit substance mixed with gasoline to combat mosquitoes, flies, insects.

	Waste Management Improvements: - March 2025: Contractor hired for waste collection, street sweeping, garbage container emptying.
Head of Local Unit, Arab El-Olaykat	**Transportation Challenges**: - Unpaved, narrow roads (e.g., Abu Zaabal–Shabin Al-Qanater, Shabin Al-Qanater, Kafr Hamza) with potholes, poor construction, no street lighting, frequent accidents. - Main transport: Uncovered pickup trucks, unsuitable for elderly/sick. **Healthcare Limitations**: - Health unit offers family planning, child vaccinations, no ambulance. - Nearest hospitals: Khanka Specialized Hospital (9 km, ~30 min), Benha University Hospital (40 km). **Closure Benefits**: - Reduced diseases, foul odors, improved lake cleanliness, fewer respiratory/allergic illnesses. **Worker Accommodation**: - Vacant units in buildings 113 and 59 suggested but not feasible (designated as social housing). **Community Information Needs**: - Residents seek closure timeline, future development plans, waste removal/covering details. **Communication Suggestions**: - Use community seminars, local gatherings, mosque announcements, youth centers, health facilities, local associations. **Additional Concerns**: - Uncovered waste vehicles litter roads; stray dogs pose risks; medical waste sorted for resale; expired food resold; drug activity with harmful fumes. - Lake (90 acres, formed by quarrying) polluted by waste seepage, causing fish mortality.
Officials at Local Health Unit, Arab El-Olaykat	**Health Impacts**: - Diseases: Respiratory (pneumonia, chest diseases), skin conditions, typhoid fever, worms, gastroenteritis, colds, stomach infections. - Foul odors attract flies, mosquitoes, stray dogs. **Health Unit Actions**: - Summer street spraying for mosquitoes, periodic waste bin sanitization. **Worker Risks**: - Medical incinerator fumes, dumpsite smoke cause allergies. - Sorting injuries (glass, syringes) risk hepatitis C, B, viral hepatitis, HIV; unsafe medical waste disposal leads to resale of syringes. **Closure Benefits**: - Eliminate health risks, pollution; enable safe living environment. - Potential for public parks, recreational areas, improved aesthetics. - Reduced disease incidence, lower medical costs. **Community Education**:

	- Nursing teams conduct seminars on hygiene, child cleanliness, disease prevention, waste disposal.
Officials at Health Administration, Al Khanka Center	**Environmental Health Monitoring**: - Event-based site receives complaints about viral/bacterial disease increases, forwards to health/local units for street spraying. **Waste Accumulation Response**: - Local units issue fines (500-5000 EGP), escalate repeat offenses to public prosecutor. **Closure Urgency**: - Dumpsite (30m above ground, not 60m underground) emits odors; workers lack protective equipment, increasing disease risk.
Youth Center, Abu Zaabal Village	**Waste Management Issues**: - No official municipal waste collection; unofficial contractors charge 30 EGP/month, use local unit containers. - Delays lead to littered streets; residents dump waste in Ismailia Canal without penalties. **Closure and Rehabilitation Proposals**: - Close dumpsite via burial or transfer to 10th of Ramadan Facility after treatment. - National subproject: Build barrier wall, clean water bodies, create lake with recreational zones, playgrounds, green initiatives. **Community Engagement**: - Raise awareness about closure, gather revitalization input via local development association, religious institutions, authorities, community leaders. **Safety Concerns**: - Drug users/dealers around dumpsite pose nighttime safety risks.
Local Community Development Association, Abu Zaabal Village	**Waste Management**: - Contractor collects waste for 30 EGP/month; informal collectors charge 5 EGP/day, dispose improperly, causing pollution. - Lack of citizen participation in official services leads to street littering. **Improvements**: - Contracts with civil society organizations for equipment, monitoring, penalties, and record-keeping. - Residents report waste accumulation; authorities dispatch vehicles/loaders for cleanup. **Closure Impacts**: - Imminent closure (date undisclosed) expected to reduce pollution, informal waste practices, and enable area development. - Challenges: Increased transport costs, adverse impact on waste pickers' livelihoods. **Awareness Plans**: - Campaigns with local associations in Arab El-Olaykat, Kafr Abian, community leaders, mosque imams to promote subproject benefits.

	Information Needs: - Seek clarification on closure timeline, alternatives, transport costs, civil society contracts, post-closure subprojects.
Community Leader	**Rehabilitation Suggestions**: - Cover waste with clay, plant trees (camphor, fax, acacia, palm, gasoline) for timber investment. - Install artificial turf (like Al Azhar Park). - Construct Road connecting Abu Zaabal residences to Arab El-Olaykat. - Clean, pave, prepare road for use. - Clear lake of snakes, insects, repurpose as natural waterbody. - Close and remove hazardous medical incinerators.
FGD with Male Waste Sorters at Abu Zaabal Dumpsite	**Workforce Profile**: - ~60 workers (6 women, 10 children, aged 20-40), all from Arab El-Olaykat. - Inherited job, no formal training; work 6 AM-7 PM, fewer on Fridays; children work after school or full-time in summer. **Closure Awareness**: - Aware of closure decision, unconcerned due to long implementation timeline. - Fear losing sole income; unwilling to leave village or change profession. - Willing to work during rehabilitation or at Khanka transfer station as sorters. **Work Details**: - Sort plastic, paper, cardboard, jute; earn 120-150 EGP/day, higher during holidays/Ramadan. - Receive regular wages from contractor; no other income sources. **Risks**: - Injuries from sharp/contaminated items (glass, syringes, nails) cause income loss. - Work as a team, lack alternative skills.
FGD with Women from Arab El-Olaykat Village	**Social Housing Issues**: - Increased mosquitoes, snakes in lake, rabid stray dogs; unsafe for children. - ~20,000 residents in 24 units each in buildings 113 and 59. **Waste Management**: - No contractor; residents dump waste in bins, lake, canals, roads due to insufficient bins. **Closure and Rehabilitation Demands**: - Close landfill, rehabilitate into green spaces with cafes, restaurants, recreational facilities (like Al-Azhar Park). - Purify lake as natural waterbody. **Health and Safety Concerns**: - Recurring fires cause evacuations; garbage litters streets, attracts insects. - Many households abandoned due to unlivable conditions. **Requests**: - International-standard waste management.

	- Action from Ministries of Housing, Environment, Health, Education. - Relocate landfill outside Al Khanka Center.

9.4.1.1 Collaborative Redesign to Address Community Concerns

The outcomes of the consultations were shared and deliberated with the Design Consultant, governorate representatives, and the Subproject Implementation Unit through multiple meetings and extensive back-and-forth discussions. These exchanges involved studying various options to identify the best possible compromise in the design. As a result, the closure plan, including its timeline and phases, was revised to address the needs of residents and the local community while mitigating concerns about the dumpsite's ongoing negative impacts. This collaborative process culminated in a final closure design that situates the evaporation pond at the greatest distance from residential buildings. Additionally, the partial closure phase was prioritized for areas closest to residents to alleviate some of the current adverse effects. Meanwhile, the section designated to continue receiving waste for the next two years was strategically positioned farther from residential buildings, adjacent to the evaporation pond.

Subsequently, a Focus Group Discussion (FGD) was conducted on 29 October, 2024 with local residents in the nearest residential areas to the subproject site in Arab El-Olaykat villages (Residences 113 and Residences 59 in Arab El-Olaykat) to share updates, disclose detailed information about the revised closure design, and outline the expected timeline for implementation. The session had a balanced turnout, with 16 attendees representing a diverse mix of genders, ages, and community roles, including both youth and elderly residents, as well as the elder leader of the community.

During the discussion, there was an initial misunderstanding among participants regarding the necessity of closing the dumpsite in multiple phases. In response, the consultant provided a clear and simplified explanation of the technical aspects and rationale behind the phased approach, emphasizing that it was designed for the long-term benefit of the community. The consultant reassured the residents that every effort was being made to prioritize their well-being and address their concerns effectively.

Participants were actively engaged throughout the session, asking questions and offering feedback. While the overall response was largely positive, attendees re

terated the urgency of closing the dumpsite as quickly as possible to mitigate its ongoing negative impacts.

1. Consultations Conclusions and Recommendations:

- First and foremost, given the residents' urgent and repeated requests to close the dumpsite, it is recommended to expedite the closure plans to alleviate the negative impacts on the community as soon as possible.

To address citizens' concerns and improve transparency, it is recommended to provide clear and timely updates regarding the Abu Zaabal Dumpsite. Specifically, communicate the expected closure date, outline the forthcoming development plans for the area, and clarify whether the waste piles will be removed or covered with alternative materials. This approach will help manage public expectations and foster trust within the community.

- Following the closure of the dumpsite, it is crucial to incorporate the community's suggestions for the rehabilitation of the subproject area. The community has offered valuable insights and recommendations that could significantly contribute to the successful redevelopment of the land. Engaging with these suggestions will not only help address local concerns but also ensure that the rehabilitation process aligns with the needs and preferences of those directly affected.
- The informal waste sorters currently working at the dumpsite have already been considered as part of the Livelihood Restoration Plan (LRP). Advance notice of the closure
- ate has been incorporated to allow them to plan for their future employment. Additionally, measures to mitigate the potential negative impacts of the dumpsite closure on their livelihoods have been addressed within the LRP to ensure a smoother transition.
- It was evident that adherence to Personal Protective Equipment (PPE) protocols is often insufficient. Accordingly, The GCCC/PCU has procured personal protective equipment (PPE) for distribution to the workers at the Abu Zaabal dumpsite and coordinated with the Qalyubia Governorate and the Occupational Health and Safety (OHS) Office of the Manpower Directorate in the Khanka local unit to deliver an OHS training session.

  The training session was conducted on January 9, 2025, at the Arab El Okaylat local unit and aimed to enhance workers' knowledge and skills in the following areas:
  - Identifying types of risks associated with the Abu Zaabal dumpsite.
  - Safely handling hazardous waste.
  - Proper use of personal protective equipment.

  However, in the upcoming phases of the dumpsite closure subproject, it is critical to enforce strict measures to ensure proper PPE usage for contractors' workers. This includes implementing rigorous monitoring systems to track compliance and establishing clear penalties for violations. By reinforcing these practices, we can enhance safety for all workers and participants involved in the subproject, mitigating health risks and ensuring a safer working environment.

9.4.2 Public Consultation Event

Following the drafting of the ESIA report, a public consultation session was conducted on February 25, 2025, at the hall of the Railway Club in Arab El- Olaykat in the Qalyubia Governorate. This session engaged key authorities and subproject stakeholders, ensuring a comprehensive representation of all relevant parties involved. The process was conducted in full compliance with both national regulations and the standards set by the World Bank for development subprojects.

9.4.3 Announcing the Sessions

The sessions were announced through the following:

- An advertisement in Al Gomhuria newspaper on February 12th, 2025
- Letter invitations and faxes to key stakeholders involved in the subproject were sent two weeks before the event
- In-person invitations via the Director of Community Communication Department for Qalyubia Governorate

Figure 9-1: Public Consultation Newspaper Advertisement

9.4.4 Session Objectives

- **Introduce the Subproject to Stakeholders:** Provide a comprehensive overview of the subproject's goals, scope, and expected outcomes to ensure that all stakeholders have a clear understanding of the subproject's context and relevance.
- **Present the Methodology for the ESIA Study:** Outline the approach and methods used in conducting the ESIA, including data collection methods, analytical processes, and evaluation criteria.
- **Discuss Key Findings and Conclusions:** Share the main results of the ESIA study, highlighting significant environmental and social impacts, as well as the conclusions drawn from the assessment. This includes discussing potential risks, benefits, and mitigation measures.
- **Engage Stakeholders for Feedback:** Offer stakeholders an opportunity to review and provide feedback on the scope of work, key issues identified, and any additional concerns they may have. This allows for an open dialogue and ensures that all relevant perspectives and concerns are addressed.

9.4.5 Participants' Description

The list of attendees included the Deputy Governor of Qalyubia, the Abu Zaabal Dumpsite Manager, representatives from the Egyptian Environmental Affairs Agency (EEAA), officials from relevant governmental bodies, and community members from the subproject area. The photo documentation and the full participants list can be found respectively in **Appendices 12, 13**.

The session was moderated by:

- Deputy Governor of Qalyubia
- Director of the Community Communication Department for Qalyubia Governorate
- Abu Zaabal Dumpsite Manager
- A representative from the GCCC PCU
- The study team from the Environmental and Social (E&S) Consultant, comprising two Senior Social Specialists, an Environmental Management Specialist
- Two Engineers from the Design Consultant "Chemonics Egypt"

9.4.6 Discussion Summary

The public consultation commenced with a welcoming address by the E&S Consultant, the representative from the GCCC PCU, and the Director of the Community Communication Department for Qalyubia Governorate. The subproject's objectives were then introduced, emphasizing its significance in improving waste management in Qalyubia Governorate and addressing the community's repeated requests to close the dumpsite due to its severe negative impacts on their quality of life. The E&S Consultant underscored the study's commitment to complying with

environmental standards, aligning with national laws, EEAA requirements, and international guidelines.

Following the opening remarks, the Design Consultant provided an overview of the subproject, outlining its objectives, development pathways, and a brief technical presentation on the dumpsite closure methodology and subproject timeline. The E&S Consultant then elaborated on the methodology used to prepare the ESIA study, identifying the key positive and negative impacts across different subproject phases. The presentation also detailed the recommended mitigation measures to prevent or minimize adverse effects, along with the responsible entities for their implementation. Additionally, a monitoring plan was introduced to assess the effectiveness of these mitigation strategies. Finally, the team presented the stakeholder engagement activities methodology and the specific engagement efforts undertaken throughout the ESIA process and how their outcomes were integrated into the study.

Several community members and adjacent facility users raised concerns regarding fire risk, truck movement safety, and air pollution exposure. In response, the ESIA team emphasized the development of robust OHS and emergency response systems, including traffic control plans, reverse alarms for vehicles, pedestrian segregation zones, and fire safety provisions around flare systems.

9.4.7 Q&A Segment

Following the presentations, an open discussion took place where attendees were allowed to provide feedback on the ESIA study and issues related to the subproject. A summary of the main points raised are presented below:

Table9-2: Outcomes of Public Consultation Discussion Segment

Representative	Contribution	Response	Reference in ESIA Document
Head of Solid Waste Managment in Al Khanka City	1. How can the existing lakes be utilized for the subproject? 2. Can the current buildup of waste be transferred and repurposed?	E&S Consultant response: 1. The potential for utilizing the existing lakes could be explored at a later stage, following the closure and rehabilitation of the dumpsite. Moreover, utilizing the existing lakes is out of the subproject scope. 2. This is not feasible for repurposing as stable material, as the accumulated waste has not yet reached the post-decomposition refuse stage and may still pose risks like leachate	Out of scope of this ESIA

		production. However, it is more stable than fresh waste.	
Female Resident of Arab Jenena	1. The resident complained that expired food products are being brought to the dumpsite and then sold in nearby markets, posing health risks to the community. 2. Is there a cleaning contractor planned to start working?	Deputy Governor response: 1. The dumpsite's management falls under the Governorate's supervision. Past incidents have indeed been recorded, prompting an immediate response from the Governor, including measures to prevent the entry of prohibited or violating products into the dumpsite. The management team has been replaced with personnel who possess a deeper understanding of the site's operations. Security has also been strengthened, with the number of personnel increased to four, including night shifts to ensure full coverage of the site. The dumpsite now accepts only municipal waste that meets criteria aligned with the Environmental Law. 2. Yes, the Governorate has been working to identify a suitable candidate. A contractor, Cairo Service, has been selected and will begin work in the villages of Al Khanka, Arab El-Olaykat, and Abu Zaabal.	This was addressed in unauthorized smuggling of inappropriate types of impacts both in section 6.2 and 0
EEAA representative	1. What is the gas treatment system? 2. What is the leachate treatment system, and how is it designed to	The Design Consultant response: The locations of the evaporation ponds were carefully selected, taking into account a safe distance from residential buildings and their	1. Gas treatment system was covered in Section 2.3.3 2. Leachate treatment

	avoid impacting groundwater? 3. How will the negative impacts of the evaporation ponds be mitigated?	placement opposite the prevailing wind direction to minimize potential impacts. The leachate treatment system involves pumps located underground, positioned above the groundwater level. These pumps are designed to exclusively extract leachate, preventing any interaction with or contamination of groundwater. The E&S Consultant response: The ESIA provides detailed information on the gas treatment system, including its operational aspects and environmental considerations, alongside specifics on the leachate treatment system, considerations for groundwater impacts, and full mitigation measures for the negative environmental and social impacts of the evaporation ponds.	system was covered in Section 2.3.4 3. Negative impacts include insects, pests and snakes and OHS impacts from falls which has been covered in Section 8.4
Head of Solid Waste Management in the Directorate of Health	What is the status of the medical waste incinerator on-site within the subproject plans?	The Design Consultant response: The on-site medical waste incinerator will temporarily remain in its current state and will not be included in the dumpsite closure activities. It is scheduled to be relocated to the 10th of Ramadan facility at a later stage. The study of the E&S impacts of these incinerators will be considered in the HCWM study of Al Qalyubia Governorate	Incinerators were described in several parts, including baseline in adjacent land uses in section 4.1 ,in Section 4.2.2.1 which describes the expected exhaust released from the exhaust, and in Cumulative impacts Sections 7.1.2, 7.2.1, 7.2.2, 7.2.3, 7.3
Female resident of 113 Residencies	The resident mentioned being forced to move due to unbearable pollution levels	The E&S Consultant response:	Baseline quality of lake water in 4.2.7

	caused by proximity to the dumpsite, suggesting significant environmental and possibly safety concerns in the area. ○ What is the status of the 3 lakes next to the dumpsite within the subproject plans?	The condition of the lakes is expected to improve following the closure and rehabilitation of the dumpsite, as leachate previously spilled into them.	&Positive Impacts Section 6.1,

9.5 Proposed Grievance Mechanism

An effective grievance redressal mechanism and its implementation are crucial for achieving subproject objectives, enhancing the quality of subproject activities and results, and guiding the management of force and defense procedures. Additionally, individuals who wish to file complaints or raise concerns will only do so if they are confident that their grievances will be addressed in an effective, respectful, impartial, and courteous manner, without fear of retaliation.

The PCU has developed a detailed Grievance Mechanism and enclosed it to the Stakeholder Engagement Plan as follows:

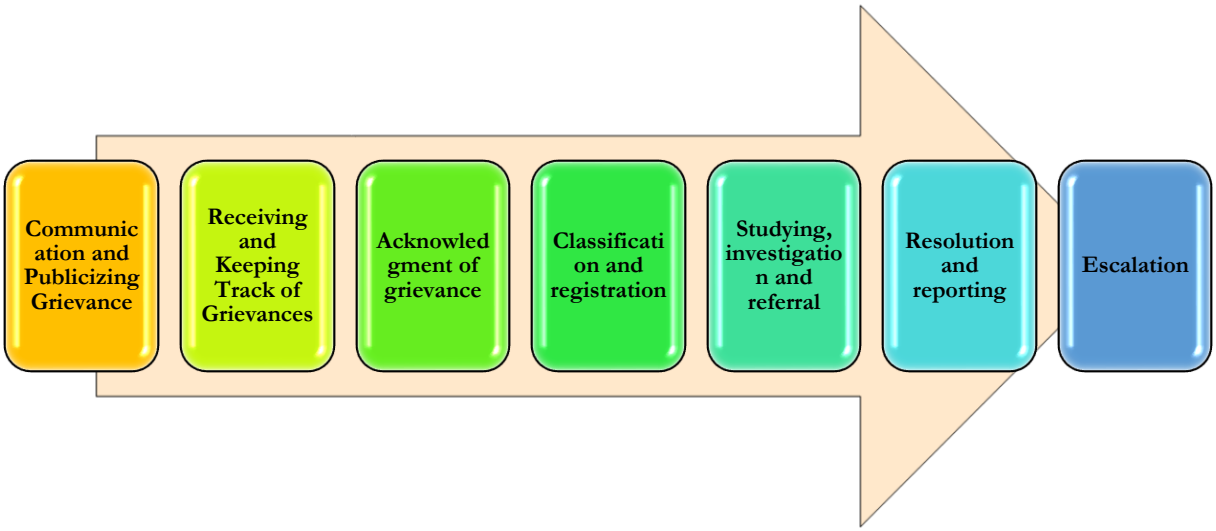

Table9-3: GRM Steps

General enquiries about the Abu Zaabal Dumpsite are managed by Citizens Service Department of QG through the following channels:

- WhatsApp:٠١٢٧٣١٣٣٩١٧ - ٠١١٢٩٩٤٧١٦٢

- Email: Khdmetmwatnen@gmail.com
- In case of any appeal, the complaint should be sent to the PCU for appeal

The Subproject grievance mechanism is operational as per the link: (https://www.eeaa.gov.eg/Subproject/127/Details) and based on an agreement between the GCCC Subproject and the QG, the Citizens Service Department will be responsible for the implementation of the GM.[16] Additionally, the grievance mechanism has been set up and maintained in line with the WB ESS10.

The aggrieved person should be informed that they can take the case to court if needed. However, they should be encouraged to register their grievance with the grievance mechanism (GM) before opening a court case.

9.5.1 Grievance Management Process

The grievance management process outlined in the figure below describes the steps complaints follow, from receipt and registration to resolution. The GM will establish clear timelines for acknowledgment, updates, and final feedback to the complainant. To enhance accountability, these timelines will be widely communicated to subproject stakeholders. The timeframe for resolving a complaint shall not exceed 30 days from the time it is received. If the issue remains unresolved after 30 days, the complainant will be provided with an update on the status of the grievance and an estimated timeline for its resolution.

[16] *Error! Reference source not found.* sheds light on the GM procedures in full compliance with the GM framework developed b y GCCC and approved by the WB.

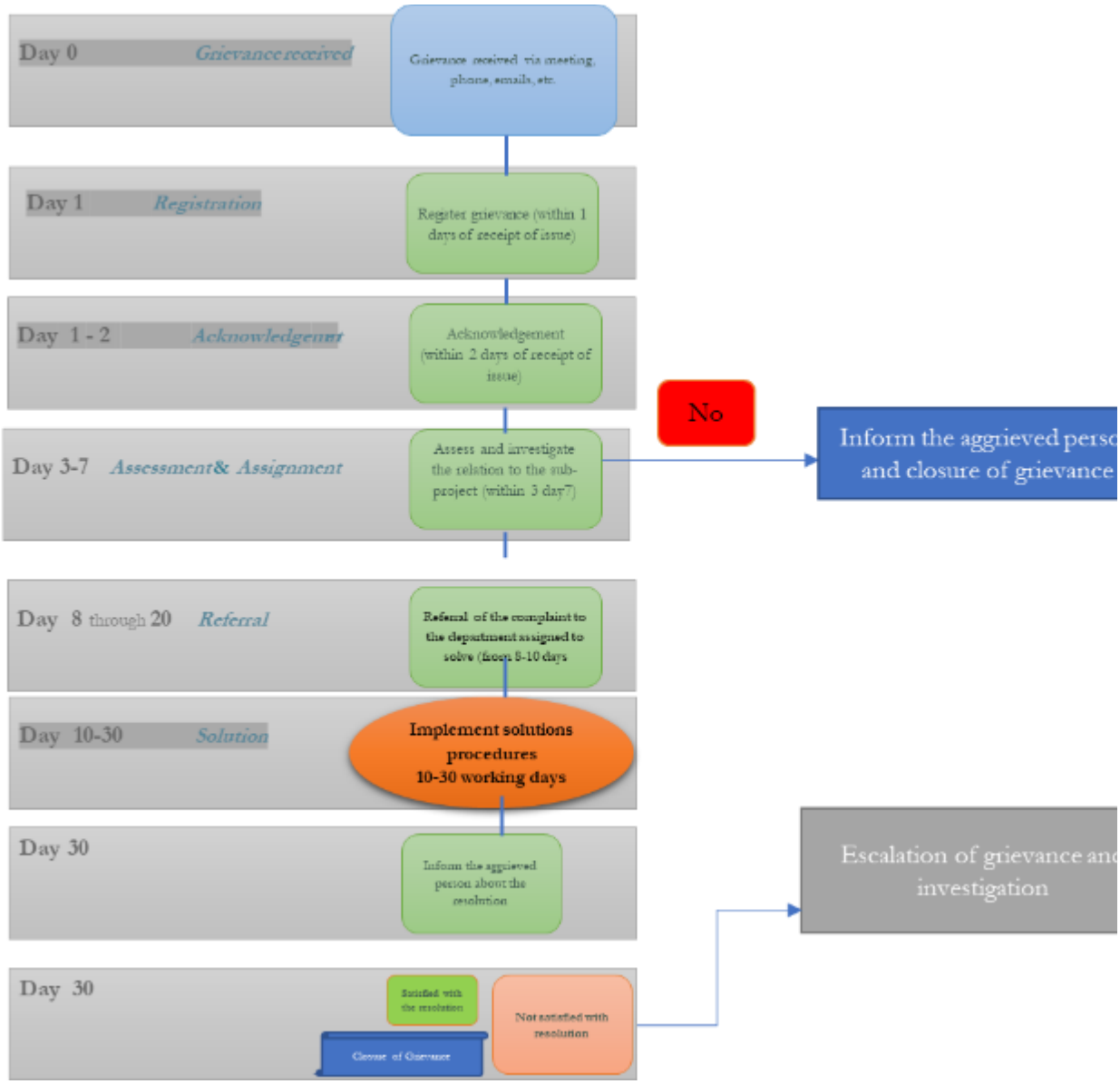

Figure 9-2: Timeline of the GRM

9.5.2 Grievances Mechanism Principles

To ensure the Grievance Redress Mechanism (GRM) is effective and comprehensive, the following key principles are adopted:

1. **Accessibility and Participation**

All information about the grievance and complaints mechanism must be easily accessible to stakeholders in a clear, simple, and consistent manner. The GRM should be tailored to accommodate the cultural backgrounds and educational levels of all stakeholders, particularly those directly or

indirectly affected by the subproject, including vulnerable groups. It should provide diverse methods, channels, and tools that enable anyone to file a complaint, seek resolution, or raise concerns effortlessly and without obstacles.

2. **Fairness and Justice**

Grievances and complaints must be handled impartially, with an appropriate level of confidentiality, and in line with established compensation standards. The GRM should earn the trust and respect of stakeholders and authorities by addressing all submitted complaints equitably and diligently, following transparent, well-defined, and publicly accessible procedures. Effective and ongoing communication between subproject representatives and the community regarding the complaint's status and resolution steps is essential.

3. **Responsiveness and Effectiveness**

Those responsible for managing the GRM must treat complaints with seriousness and adhere to the agreed-upon timelines for resolution outlined in this guide. Complaints should be prioritized, and complainants must be kept informed of progress throughout the process, including the expected timeframe for resolution and closure.

4. **Privacy and Confidentiality**

The GRM must offer secure and private channels for submitting complaints, and those managing the process must respect the rights and privacy of complainants. This includes accommodating individuals who wish to remain anonymous and safeguarding the confidentiality of information gathered during investigations. The grievance process, particularly for complaints involving sexual or gender-based violence, must ensure that collected information is used solely to address and resolve the issue at hand.

5. **Preventing the Risk of Retaliation**

Individuals who submit complaints through the GRM must not face retaliation, intimidation, or discrimination that could deter them from exercising their right to file a grievance. The GRM is obligated to prioritize the safety of participants, which can be achieved by adhering to the aforementioned principles, especially confidentiality. Complainants have the right to expect courteous and respectful handling of their concerns. If the GRM identifies a risk of retaliation, it must refrain from sharing any information with external parties that could reveal the complainant's identity, unless the complainant explicitly consents to such disclosure.

9.5.3 Grievances related to SEA/SH

The World Bank's approach to addressing sexual exploitation, abuse, and harassment in its financed subprojects includes a grievance mechanism for handling allegations. To effectively mitigate risks associated with various subproject activities, clear procedures must be established within the grievance and complaints handling mechanism for dealing with such grievances. These procedures should align with the World Bank's "Good Practice Note on Sexual Exploitation, Abuse and Harassment in the Financing of Investment Subprojects Involving Major Civil Works." Special attention should be given

to the SEA/SH in cooperation with the National Council for Women [17] as they are the entrusted entity that provides direct services as well as referral to survivors of SEA/SH.

The National Council for Women will receive subproject-related claims through the following channels:

- **Complaint Office Branches in Governorates:** Direct communication
- **Toll-Free Hotline:** 15115 (Available 12 hours daily, from 9 AM to 9 PM)
- **Fax:** Main Branch 0223490066- 68
- **Email:** complain.office.2001@gmail.com
- **Social Media:** National Council for Women's official page: https://www.facebook.com/ncwegyptpage

[17] The **Egyptian National Council for Women (NCW)** is an independent government body dedicated to promoting women's rights and empowerment in Egypt. It was established in 2000 and is affiliated with the President of the Republic. The NCW works to ensure that Egyptian women have equal opportunities in all aspects of life, including politics, economics, social, and cultural spheres.

10 Appendices

Appendix 1: Air and Noise quality measurements

Appendix 2: Topographic survey

Appendix 3: Geotechnical engineering report

Appendix 4: Detailed Flora and Fauna Studies are included in the Baseline study

Appendix 5: Capacity Assessment of Proposed Institution

Appendix 6: Impact Assessment Methodology

Appendix 7: Chance Find Procedure

Appendix 8: Surveying Tools

Appendix 9: Stakeholder Consultations Photo Documentation

Appendix 10: Contractor and Supervision Consultant Team Qualifications

Appendix 11: Groundwater and Surface water samples laboratory analysis for Abu Zabaal Dumpsite

Appendix 12: Public Consultation Photo Documentation

Appendix 13: Public Consultation Participants List

Appendix 14: Occupational Health and Safety Management Plan (OHSP)

Appendix15: Site-specific Traffic and Transport Safety Plan (outline)

Appendix 16: Terms of Reference for Construction Environmental and Social Management Plan

Appendix 17: Quantitative Risk Assessment Outline (If required During Operation Phase)

Appendices could be found in the following link:
https://drive.google.com/drive/folders/1ZMS5_FTUhjRBc15k12nEoUGPKGy4pBkN