ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT (ESIA)

SUMMARY

Project Name : Integrated Water Resources Management of the Nubaria and Ismailia Canals
Country : EGYPT
Environment and Social Categorization: II
Project Code : P-EG-AAC-024

1. INTRODUCTION

The Government of Egypt (GoE) through the Ministry of Water Resources and Irrigation (MWRI)’s Horizontal Expansion Project Sector (HEPS) and financial support of the African Development Bank (AfDB) intends to rehabilitate and modernize the Nubaria and Ismailia canals with the aim of contributing to improved management of water resources in the canals.

Nubaria and Ismailia Canals are two of the major multipurpose canals in the Nile Delta that provide water to approximately one third of the Nile Delta population. The Canals are of immense importance to the regional economy but face a myriad of problems related to poorly functioning infrastructure, seepage and water logging adversely affecting valuable agricultural land, insufficient water conveyance capacity, unauthorized abstractions, and environmental degradation from pollution. It is estimated that about 24-26% of the water is lost from the canals in the form of seepage. This has resulted in the flooding of agricultural land and farms alongside the canals, depriving farmers of their main source of income and livelihood.

To prepare the rehabilitation of the Canals, comprehensive feasibility studies funded by the African Water Facility, were conducted and finalized in 2014. These studies were prepared in parallel with the Environmental and Social Impact Assessments (ESIA).

This ESIA summary is prepared in compliance with national regulations and as per requirements of the AfDB’s Integrated Safeguard System (ISS) and Environmental Assessment Procedures (ESAP). It provides information on project activities; anticipated impacts; measures to be put in place to mitigate identified adverse impacts; and institutional arrangements to facilitate implementation and monitoring of the Environmental and Social Management Plan (ESMP).

2. PROJECT DESCRIPTION AND JUSTIFICATION

2.1 Project description

The Project will comprise mainly canal lining and recalibration; dredging and cleaning to improve hydraulic flow. The Project is composed of 3 components, namely, i) Rehabilitation of Ismailia and Nubaria canals, ii) Capacity building and livelihood improvement, and iii) Project management.

Component 1: Rehabilitation of Ismailia and Nubaria canals. This component seeks to line the most affected sections of the Ismailia (covering 20 km) and Nubairia (covering 10 km) canals with an impervious material to reduce seepage and waterlogging of nearby agricultural lands and properties. The component shall include the following activities; (a) dredging and lining of the Ismailia Canal in the stretch between km 72 and km 92.5 at
Sharqia Governorate for a length of 20.5 km (b) dredging and lining of the Nubaria Canal in the stretch between km 23 and km 33 for a length of 10km (c) environmental management, and (d) consultancy services to supervise, monitor and evaluate project activities and to ensure adherence to socio-economic, environmental safeguard objectives.

Component 2: Capacity Building and Livelihood Improvement. This component will include training and capacity building of different stakeholders including project staffs, farmers, and Water User Association (WUA). The component will include (a) training farmers in climate-smart agriculture practices; (b) training Project Staff on procurement, financing management, M&E, gender mainstreaming in project design, and implementation, and (c) training of WUA on integrated WRM, as well as climate change mitigation and adaptation.

Component 3: Project Management shall focus on strengthening the capacity of the Horizontal Expansion Projects sector (HEPS) (Implementing Agency) on project management, as well as operation and maintenance (O&M). This component shall provide equipment, to support HEPS in carrying out the project management and O&M to ensure project sustainability.

2.2 Project Location

The Nubaria and Ismailia Canals are located in the East Delta and West Delta of the Nile respectively (see Figure 1 below). The project intervention for the Nubaria canal proceeds from the intake at Rayah El Behery to the old navigation lock at Km 100, while the Ismailia canal project location proceeds from its intake on the Nile to its outlet on the Suez Canal. The project area covers Alexandria, El Beheira, Qalioubia, Sharqia and Ismailia Governorates.

Source: ESIA Report (2014), Comprehensive Study and Project Preparation for the Rehabilitation of the Nubaria and Ismailia Canals
2.3 Project justification

The River Nile plays a crucial role in the economy of Egypt, as it is the main source of domestic, industrial and agricultural water supply. However, growing population, economic activities, and climate change risks have increased pressure on the water systems and threaten the ability to meet growing demands.

To address this issue and anticipate the consequences of water scarcity, the Government of Egypt (GoE) developed the National Water Resources Plan for Egypt (NWRP) to promote a comprehensive approach for safeguarding Egypt’s water resources with respect to quantity and quality, and sustainable use. The NWRP has three main pillars, one of which is to make better use of existing resources with the aim of improving the efficiency of the water resources system through a mix of infrastructural and financial incentives or measures. The NWRP is complemented by the government’s Integrated Water Resources Management Plan (IWRMP 2017) to address on a long-term basis, the water control and management systems for irrigation and drainage systems throughout the country. The improvements of the Nubaria and Ismailia canals are major components of the IWRMP.

In that regard, rehabilitation of the canals is critical to improve water distribution to develop agricultural and industrial sectors and facilitate poverty reduction. The objective of the project is to promote a sustainable and efficient water resources management in the Nubaria and Ismailia canals. These canals are performing below optimal requirements and are unable to meet water demands for irrigation and industrial purposes due to operational inefficiency, poor state of infrastructure and water losses from seepage (seepage losses are estimated to vary between 24 and 26% of discharge).

3. POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

3.1 Legal Framework

Environmental Law No.4/1994 is the main legislation governing environmental protection in Egypt. The Environmental Law stipulates that an Environmental Impact Assessment (EIA) should be prepared for projects, which are associated with potential environmental impacts, as a precondition for obtaining a license. The entity responsible for the enforcement of the Environmental Law is the Ministry of State for Environmental Affairs (MSEA) through the Egyptian Environmental Affairs Agency (EEAA). EEAA has issued updated Guidelines for the rules and procedures of undertaking EIAs, in which projects are classified into 3 classes of EIAs according to their expected impacts on the environment, these Classes include A, B, and C ascending respectively from lower to higher impacts on the environment. Class A is equivalent to Category 3 in the African Development Bank’s project impact categorization, Class B is equivalent to Category 2 and Class C is equivalent to Category 1.

In addition to the Law 4/1994, there are other specialized laws that govern the environmental and social performance of projects according to the type, location and activities of the project. Examples of such laws include Law 93/1962 for projects that discharge wastewater to a sewage network, Law 38/1967 for General Cleanliness, Law 12/2003, which is the Labor Law, Local Decrees in Governorates that organize land-use issues and Engineering Codes of Practice related to environmental issues, and Law 48/1982 for protection of the River Nile and waterways from pollution. In addition, the Executive Regulation of the Environmental Law provides limits for noise levels in the working environment.
Law 12/1984 for Irrigation and Drainage: This law is the main law for regulating irrigation and drainage. It regulates irrigation and water distribution, use of water, and groundwater management in the Nile Valley and Delta. It controls water rights, sets priorities between users, defines beneficial and harmful water uses and regulates financial aspects and penalties. Ministry of Water Resources and Irrigation (MWRI) is designated to manage and issue permission for all abstractions of water.

The law defines the use and management of public and private sector irrigation and drainage systems including main canals, feeders and drains. The law regulates the use of groundwater and drainage water (construction of wells or the use of drainage water and water umps). It provides the regulations for the development of new land and the price that has to be paid for the irrigation and drainage of land.

Resolution 346/2007 and other laws on expropriation and compensation define and estimate compensations and reimbursements for damages caused to cultivated lands, plants and trees, by land improvement projects and public utilities. It is composed of 3 articles. Compensations are evaluated based on land quality, kind of crops, and age (art. 1). Article 2 abrogates all resolutions, rules, regulations and the like, which are incompatible with the present Resolution.

3.2 Institutional Framework

The Egyptian Environmental Affairs Agency (EEAA) was established to be the competent national authority in environment management. The EEAA is responsible for defining criteria for Environmental Impact assessment for projects and establishments, and validating the acceptability of EIA documents.

The EEAA manages the Environmental Information and Monitoring Program (EIMP). Through this program, the EEAA monitors air quality, water quality for coastal waters, and waste discharges from Nile ships and industrial effluents.

The EEAA also has Regional Branch Offices (RBOs) in Greater Cairo and Sharkia Governorates. The RBO in Suez covers the Governorates of Port Said, Ismailia and Suez. Environmental Management Units have been set up within each Governorates.

Other institutions/ entities concerned with the rehabilitation of the Canals include:

The Ministry of Agriculture and Land Reclamation (MALR) is in charge of agricultural research and extension, land reclamation, agricultural development, fisheries and animals. The Agricultural Research Center comprises 16 institutes and 11 central laboratories and is the scientific body of MALR for all aspects related to agricultural development.

Ministry of Water Resources and Irrigation is responsible for the management of all water resources, including available surface water resources of the Nile system, irrigation water, drainage water and groundwater. It is responsible for providing suitable water to all users. The MWRI formulates national water policies. It operates and maintains the hydraulic structures of the country such as dams, weirs, irrigation and drainage canals etc. It has authority for issuing licenses for domestic and industrial discharges and monitors water quality.

The MWRI manages irrigation, drainage and pump stations, allocating water resources to all users (irrigation, domestic and industrial water supply, navigation) down to the Branch canals. The MWRI is responsible for construction, operation and maintenance of irrigation and drainage networks, as well as collection and disposal of agricultural drainage water. The MWRI manages groundwater, and gives specifications and permits
for drilling groundwater wells. The main MWRI departments relevant to the Project include the (i) Mechanical Engineering Department, (ii) Irrigation Department, (iii) National Water Resource Center (NWRC), and (iv) Egyptian Public Authority for Drainage Projects (EPADP).

**Water User Associations (WUA)** have been implemented over the last decades at *mesqa*¹ level. They allow farmers to manage water rotations, rationalize pumping costs, reduce water abstraction based on a more efficient allocation, and to participate in operation and maintenance (O&M). A number of WUAs have also been established at high levels; these are sometimes referred to as Branch Canal Water User Associations (BCWUA) or Water Boards.

Law 213/1994 enables farmer participation in water management on improved irrigation systems at *mesqa* level and provides a legal basis for the establishment of water user associations and water boards on new lands. However, the legal basis for their empowerment to manage the O&M of irrigation/drainage infrastructure requires amendments to the Water Resources Law 12 of 1984.

**The Irrigation Advisory Services** (under the irrigation department of the MWRI) provide support to the farmers for managing and operating the irrigation system. The Irrigation Advisory Services, assist *mesqa* level water users associations in irrigation management. The WAU are responsible for maintenance of the *mesqas*. They pay a contribution to the Irrigation Advisory Services, which is used to cover operation and maintenance costs of the pumping system. The WUA and Irrigation Advisory Services decide on water allocation together. The MWRI remains responsible for canal operation and maintenance at Branch canal level.

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1 A *mesqa* is a third-level canal, and serves an area of 50 to 200 *feddan*. 

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**The Bank’s Environmental and Social Safeguards Policy**

The African Development Bank’s Integrated Safeguards System provides the framework that promotes the social and environmental sustainability of the Bank’s projects outcomes. The Bank requires borrowers/clients comply with these safeguards requirements during project preparation and implementation.

The Bank’s Integrated Safeguards Policy Statement sets out the basic tenets that guide and underpin the Bank’s approach to environmental safeguards. In addition, the Bank has adopted five Operational Safeguards (OSs), which sets out the Bank’s overarching requirements for borrowers or clients to identify, assess, and manage the potential environmental and social risks and impacts of a project, including climate change issues. Operational Safeguard I requires the preparation of an Environment and Social Impact Assessment (ESIA), which assess the potential environmental and social impacts of the Project. The proposed Project is rated as environmental assessment category “2” and may have limited adverse environmental and social impacts, triggering the following safeguard policies:
<table>
<thead>
<tr>
<th>Safeguard Policies Triggered</th>
<th>Yes</th>
<th>No</th>
<th>TBD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environmental and Social Assessment (OS 1)</td>
<td>X</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The proposed project shall involve civil works / physical interventions on the natural environment; therefore OS 1 is triggered. A detailed ESIA (including ESMP) has been prepared to address all impacts attributed to the construction and operation phases.

<table>
<thead>
<tr>
<th>Involuntary Resettlement: Land Acquisition, Population Displacement and Compensation (OS 2)</th>
<th>X</th>
</tr>
</thead>
</table>

Involuntary resettlement is unlikely to occur since the works will be carried out on existing canal system. However, an inventory of potential legal and illegal farmers engaged in micro-scale agriculture along the banks of the 20km stretch of the Ismailia Canal and 10 km of the Nubaria canal shall be determined by the MWRI district offices. These will be compensated as per Egyptian policies but not resettled. OS.2 is therefore not triggered at this stage but measures and procedures are outlined in the MWRI’s RFP and ESMP to address compensation.

<table>
<thead>
<tr>
<th>Biodiversity and Ecosystems Services (OS 3)</th>
<th>X</th>
</tr>
</thead>
</table>

The project infrastructures involve rehabilitation of exiting canal systems. It is not anticipated that new greenfield areas currently not under cultivation will be opened up. Therefore, OS.3 is not triggered.

<table>
<thead>
<tr>
<th>Pollution Prevention and Control, Hazardous Materials and Resources Efficiency (OS 4)</th>
<th>X</th>
</tr>
</thead>
</table>

OS 4 is triggered since sediments excavated during dredging works may be contaminated with agricultural and industrial effluents and risk polluting drinking water sources hence mitigation measures will be required in the ESMP.

<table>
<thead>
<tr>
<th>Labour Conditions, Health and Safety (OS 5)</th>
<th>X</th>
</tr>
</thead>
</table>

OS.5 is triggered since the contractors shall employ staff or workers during project implementation.

4. DESCRIPTION OF PROJECT ENVIRONMENT

4.1 Climate

The climate is arid, with a mean temperature of 21.8°C, and average temperatures ranging from 13.6°C in January to 28.4°C in July. The average rainfall is less than 10 mm/year. Relative humidity varies from 43% in May to 62% in January. Evapotranspiration varies between 2.5 mm/day (December) and 8.6 mm/day (June).

Geology and Typology

Ismailia canal is located on the Southeastern edge of the Nile Delta, where different geological formations merge. At about Km 70, the canal lies in the old lands, or historically cultivated fluviatile Nile Delta deposits, before it branches off to the East and follows a depression to Ismailia Governorate. After Km 115 and until Ismailia, the canal lies in sandy desert formations. The left bank of the canal near Abu Zaabl has a different geology, with tertiary Pliocene-Miocene sands and gravels, but also very locally impervious basaltic rocks (location or former quarries).
Nubaria canal lies on the Southwestern edge of the Nile Delta. The canal lies in a flat region, slightly sloping upwards to the Western Desert. The Mediterranean coastal area is higher than the land behind it. The canal starts at an altitude of about 40 m A.S.L and it ends in Lake Maryut approximately 2 m below sea level. After Km 100, the land is below sea level.

4.2 Hydrogeology

Nubaria Canal: There are three hydrogeological zones in Nubaria canal area:

- **Zone C**: The Nile Delta aquifer is confined by the clay cap, and much reduced in thickness due to intrusion of salt seawater.

- **Zone B**: The aquifer is covered with clay cap. In this area, two groundwater reservoirs exits; a sub-soil water table in the semi-pervious clay and silt, and the deeper Nile Delta reservoir. In the southern part of Zone B, the sub soil water table is reportedly higher than the piezometric head of the groundwater, and there is recharge of groundwater from the subsoil. In the northern part, nearer to the coast, there is reportedly upward seepage of groundwater to the subsoil.

- **Zone A**: In this area there is no more clay and silt cap. The aquifer is phreatic, and gradually thinner and less productive. The soils are sandy and poor desert soils.

Ismailia Canal: The two hydrogeological zones of the Ismailia Canal include:

- **Zone B**: A cap of silt and clay covers the aquifer. In this area, there are two groundwater reservoirs: a sub-soil water table in the semi-pervious clay and silt, and the deeper Nile Delta reservoir.

- **Zone A**: In this area there is no more clay and silt cap. The aquifer is phreatic, and gradually thinner and less productive. The soils are sandy and poor desert soils.

4.3 Ecology

The aquatic habitats of the canals do not support a rich aquatic ecology. Water velocities are low, temperatures are high, and the canals indirectly receive domestic and agricultural effluents. These factors produce a eutrophic aquatic environment, which is dominated by aquatic weeds and catfish. The bottom of the canal consists of a sandy/silty substratum with a deposit of bottom sediment that does not form a suitable substratum for the rich development of benthic or fish species.

Due to the combination of average water quality and poor substratum, the aquatic ecology of the canals are currently poor.

Terrestrial Ecology: The Project area consists of desert land, urban area and intensively cultivated area, and limited natural vegetation. The agricultural landscape is dominated by non-native species. Only the native *Pistia stratiotes* and *Nymphaea lotus* can be found along the canals, drains, and roads. Two endemic plant species are found: *Sonchus macrocarpus* (endemic to the Nile Delta) and *Zygophyllum aegyptium* (restricted to Egypt and Libya).

There are no Protected Areas, neither in the direct vicinity of the canal, nor in the command area of the canal.
4.4 Socio-Economic Profile

The socio-economic profile of project areas (Ismailia and Nubaria) is summarized in table below.

<table>
<thead>
<tr>
<th>Nubaira Canals</th>
<th>Ismailia Canals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Region</td>
<td>Alexandria,</td>
</tr>
<tr>
<td>Population</td>
<td>1,250,000 inhabitants live in the area irrigated by the Nubaria Canal</td>
</tr>
<tr>
<td>Water Seepage</td>
<td>An average loss of 550 million m3/year.</td>
</tr>
<tr>
<td>Economic Activities:</td>
<td>Oil, textile and chemical Industries</td>
</tr>
<tr>
<td>Irrigation system</td>
<td>Nubaria canal currently serves 1,060,000 feddan of irrigated agricultural land, which is about 13% of Egypt’s cultivated area.</td>
</tr>
<tr>
<td></td>
<td>746,140 feddan are managed under surface irrigation and 335, 504 feddan under modern irrigation.</td>
</tr>
<tr>
<td>Crops</td>
<td>Winter Crops: Wheat, barley, local beans, clover, garlic, onion, flax, sugar beet and winter vegetables like tomatoes, strawberries, cucumber, zucchini, lettuce, cantaloupe and green fodders. Summer Crops: Yellow Maize, summer melet, sugar cane, peanuts, sesame, onion, rice and cotton, as well as vegetables (green peas, green beans).</td>
</tr>
<tr>
<td>Sanitation (% population of governorates with access to sanitation.)</td>
<td>90%</td>
</tr>
</tbody>
</table>

4.5 Settlements along Canal Banks

Small-scale agricultural activities are observed along the banks of the Canals. According to the Irrigation Law 12/84, all land up to 20 m from the Canal belongs to the MWRI. It can be rented to other users. Farmers are required to pay taxes as rent for occupation of the canal banks. The standard practice and in line with MWRI’s Resettlement Policy Framework (RPF), particularly when the MWRI performs routine maintenance works on the canals, farmers-legally (rented from MWRI) or illegally engaged in micro-scale agriculture or other small-scale activities - are compensated in the events of any impacts on their crops based on a rate that is fixed by law.
The MWRI Districts have inventories of the land that is farmed on the canal banks. The area covered by this type of agriculture is, however variable with time, since the Canal Banks are regularly reshaped or occupied by workers for maintenance works.

5. ALTERNATIVE SOLUTIONS

5.1 No Project Option

In the assessment of the —no project alternative, the social and environmental impacts of the project are compared to the impacts that would occur if the project were not implemented.

The pre-feasibility studies show that - in the current situation without project- the Canals do not cover the water needs, especially for agriculture, as well as for drinking water supply and industries, where interruptions are observed. Water demand in the future will increase because of population growth and economic development. In case of non-execution of the Project, the water deficits in the area will increase, with a negative impact on agricultural incomes, employment, local development health, and water supply in touristic areas.

Firstly, the —no project alternative means that the Canal will continue to be operated ad hoc, without measurement or control of the quantities of water that are delivered. This situation prevents proper assessment of water delivery, and therefore prevents the development of better water management. More so, the absence of water control causes water losses and inequities in water distribution among different users of the canals system.

Secondly, the —no project alternative means that the Canal hydraulic structures will further deteriorate. Many structures are currently heavily deteriorated, and further deterioration may result in management challenges in the future.

Finally, the economic analysis has shown that with the water gains from lining only, the project has a positive economic rate of return. This means that not lining the Canal amounts to losing money in the future.

The negative environmental and social impacts of the project are mainly due to the underwater dredging and excavations. They cause potential negative impacts on water quality, and potential disruptions of water supply. However, these impacts are temporary, and can be mitigated.

5.2 Canal Lining Technologies

Potential alternative canal lining technologies envisaged during pre-feasibility studies are compared below.

- Alternative C1 involves laying clay mattresses in sections of the canal that are completely dewatered,
- Alternative C2 involves laying plates underwater
- Alternative C3 involves laying a geo-membrane under dry or wet conditions (C3d or C3w)
- Alternative C4 involves pumping clay/cement into a frame, under water.
<table>
<thead>
<tr>
<th>ALTERNATIVE</th>
<th>C1</th>
<th>C2</th>
<th>C3W</th>
<th>C3D</th>
<th>C4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description</td>
<td>Clay, sheet pile curtains, dry</td>
<td>Clay, plate technology, wet</td>
<td>Geo-membrane technology, wet</td>
<td>Geo-membrane technology, dry</td>
<td>Soil, earth lining clay/cement, wet</td>
</tr>
<tr>
<td>Impact on continuity of water supply during works</td>
<td>Minor impact</td>
<td>Moderate impact</td>
<td>Complete disruption</td>
<td>Moderate impact</td>
<td>Complete disruption</td>
</tr>
<tr>
<td>ERR (%)</td>
<td>16%</td>
<td>22%</td>
<td>34%</td>
<td>34%</td>
<td>21%</td>
</tr>
<tr>
<td>Average water saving (BCM/year)</td>
<td>0.47</td>
<td>0.67</td>
<td>0.67</td>
<td>0.67</td>
<td>0.54</td>
</tr>
<tr>
<td>Volume of excavations</td>
<td>12.6</td>
<td>10.5</td>
<td>10.5</td>
<td>10.5</td>
<td>10.5</td>
</tr>
<tr>
<td>Source of materials</td>
<td>Local Material</td>
<td>Natural clay</td>
<td>Geo-membrane</td>
<td>Geo-membrane</td>
<td>Clay and concrete</td>
</tr>
<tr>
<td>Duration of the works (years)</td>
<td>10</td>
<td>10</td>
<td>3</td>
<td>4</td>
<td>10</td>
</tr>
<tr>
<td>Required limitation of flow velocity</td>
<td>No limitation</td>
<td>Probably some limitation necessary</td>
<td>&lt; 0.15</td>
<td>Total limitation</td>
<td>Probably some limitation necessary</td>
</tr>
<tr>
<td>Impact on water supply due to required reduction of flow velocity during works</td>
<td>None</td>
<td>Moderate (mitigation possible)</td>
<td>Moderate (mitigation possible)</td>
<td>Probably unacceptable</td>
<td>Moderate (mitigation possible)</td>
</tr>
<tr>
<td>Impact on water turbidity</td>
<td>Moderate (can be mitigated)</td>
<td>High due to underwater excavations and clay laying underwater – can be mitigated</td>
<td>Low because geo-membrane is laid as against clay</td>
<td>Moderate</td>
<td>High due to underwater excavations and clay laying underwater – can be mitigated</td>
</tr>
<tr>
<td>Development of new technologies and training</td>
<td>Cofferdam techniques</td>
<td>Will require technology transfer</td>
<td>Unknown</td>
<td>Unknown</td>
<td>Technology well-known in Egypt</td>
</tr>
</tbody>
</table>

*Source: ESIA Report*

The canal lining technique will be determined during the construction phase based on defined selection criteria. Three lining techniques including Geo-Membrane, Geo-Synthetic Textile and Geo-Synthetic Clay are being tested on a pilot basis. The most favorable option will be selected from an environmental and socio-economic point of view.
6. POTENTIAL IMPACTS

6.1 Potential Positive Impacts

6.1.1 Potential Positive Impacts during construction phase

**Employment and Income:** The construction phase has some positive socio-economic impacts, as it will provide employment plus economic opportunities for dredging companies and ancillary activities (including provision of fuel, chemicals and materials, maintenance, and transport).

**Positive Impacts during Operation Phase**

The project is expected to generate positive socio-economic impacts as the rehabilitation of the canals will increase agricultural productivity and enhance farmers’ livelihoods. Specifically, the project will lead to (i) improved water supply for irrigation, (ii) increased crop productivity and production that will result in higher yields and revenue for farmers, (iii) improved efficiency of irrigation systems as well as equity and reliability of water distribution among users, and (iv) increased irrigated area and stabilized water table levels.

The main benefit of the project is the improved water supply for irrigation. The agro-economic study prepared during the pre-feasibility phase showed that crop yields could increase by 15% on average if sufficient water is available for irrigation at the right timing, and farm revenues by 35%. In the command area of the Canals, incomes of poor farmer households could increase from an average 6,000 to 8,300 Egyptian Pounds and incomes from non-poor households from an average 16,000 to 18,300 Egyptian Pounds.

**Impact on Water Quality:** It is expected that the Project will not bring significant changes in water quality. Water quality may slightly improve due to the additional flow that is saved from seepage. The removal of canal sediment, which is potentially contaminated with ancient industrial contamination, may also remove a potential pollution source.

6.2 Potential Negative Impacts

6.2.1 Negative Impacts during construction phase

The construction phase has potential negative impacts associated with engineering works, among which the most significant being the risk of increased turbidity and pollution, risk of inappropriate handling of excavated materials and construction waste and risk attributed to the lining technology adopted.

**Risk on Water Quality:** Dredging and underwater excavations may have negative impacts on water quality and on aquatic ecosystems including cause sediment suspension and potential increases in turbidity that may impair water quality. In addition, sediments may contain pollutants that are relatively stable in anaerobic conditions under water, which may be mobilized again in the water column, with a toxic effect on drinking water and on fish.

The proposed programme of works will not disturb the canals more than current routine dredging operations. However, the risk assessment has shown that turbidity is likely to increase moderately during the works, with an effect on relatively long distance along the canals.
**Risk of Excavated and Dredged Materials:** The disposal of contaminated sediment or excavated material on land or on Canal banks may contaminate the soils, pose a hazard for people in case of contact, and contaminate the groundwater or the canal water by leaching of contaminated effluents.

**Risk of Canal Lining Techniques/Materials:** The lining works may have an additional impact on water quality depending on the material of the technique. The use of concrete in the lining process, for example, may release concrete milk into the water system during civil works. Three canal lining techniques including Geo-synthetic Textile mattress, Geo-synthetic Clay and Geo-membrane are being tested to evaluavable technical feasibility, durability, and least social and environment costs.

**Risk on Canal Bank activities:** No case of land acquisition or involuntary resettlement is anticipated from the proposed project interventions. However, the civil works may require the destruction, or temporary disturbance of micro-scale agriculture field and small shops along the canal banks. The works may also require temporary occupation of land for storage of machinery and excavated materials.

**Other impacts during construction**

*Erosion:* Building traffic of trucks and machinery on the Canal banks may create gullies and erode canal banks or erode unhardened access roads.

*Hazardous materials and Accidental spills:* Hazardous materials such as oils and fuel for machinery and cement may be used during the construction phase. If stored and handled inappropriately or if spilled, these materials may pollute soils and canal waters.

*Liquid effluents* from preparation of concrete, sediment dewatering and wastewater from portable toilets or offices may contaminate the canal waters.

*Dust and air emissions:* The use of machinery and the construction traffic will generate emissions of fumes and dust.

6.2.2 Impacts during operation phase

**Impact on hydrology (groundwater levels):** After rehabilitation, water levels are expected to rise in the downstream reaches of the canals. In the current situation, water levels sometimes fall below the intake value for some of the intakes. The future scenario should lower this risk. It is recommended to put in place a system where users, mainly the drinking water companies and the industries on the Canal, communicate the physical characteristics of their intakes to the Canal operators, and receive a warning if water levels fall.

**Impact on Ecosystems:** The lining will create an artificial canal bed locally. However, the quality of river bottom habitats is currently poor, such that this impact is not deemed significant.

6.2.3 Impact of the Environment on the Project

**Climate Change:** Climate change will intensify extreme events such as drought and flood, and change the precipitation and temperature patterns. These impacts will not only cause adverse effects on rain fed agriculture, but also water shortage and flood damage to agricultural areas that are developed for irrigation and drainage. Climate change will have several effects on the Nile Delta. The impact of climate change on the hydrology of the Nile is still uncertain, but many studies predict a decrease in yearly flows. Climate change will also lead to higher temperatures in Egypt, and will induce a higher water demand from crops.
The project has been classified as Category 2 according to the Bank’s Climate Safeguards System. This implies that the proposed project could be at risk from climate change and further review is therefore required to consider broad climate trends and identify practical risk management and adaptation measures that should be integrated into the project design and implementation plans. The major climate risks related to this project include: i) Impact of severe weather conditions; ii) Water resource availability for irrigation; and iii) Cropping and irrigation technologies and systems.

**Environmental Degradation:** Environmental degradation in the area of the Project could lead to deterioration of the Canal water quality, thereby preventing the use of the Canal water. Programs and measures for water quality management, improved sanitation and solid waste management are already being implemented, and should help improve the environmental situation in the area. Therefore, the situation is expected to improve rather than to deteriorate. However, a fast pace of environmental improvement will have to be sustained in order to balance population growth.

### 6.3 Cumulative Impacts

Cumulative impacts are those resulting from the combined action of activities related to the project itself and related actions and/or projects or in the same impact area. At this stage and from available information, no significant negative cumulative impacts have been identified. The proposed rehabilitation works and other interventions planned as part of the Project do not have significant irreversible impacts. Hence, the project interventions are unlikely to contribute to cumulative impacts in the project area. All negative impacts will be addressed in the site-specific EIAs and ESMPs to be developed during the design and implementation stages of the project.

### 7. ENHANCEMENT AND MITIGATION MEASURES

The main measures for preventing, mitigating or compensating potential negative impacts of the projects can be summarized as follows: (i) Creation of a Canal Committee and a program for information and coordination and early warning of all water users along the Canal, (ii) Measures for limiting the impacts of dredging and lining operations on water quality, by preventing re-suspension and by protecting drinking water intakes, (iii) An emergency plan for water supply, (iv) Measures for disposing of the excavated and dredged material in an appropriate way, (v) Measures for limiting nuisances and pollution from construction and rehabilitation works, (vi) Compensation programme in line with the MWRI’s RFP for illegal settlers along the canal banks, and (vii) An Environmental Monitoring Programme, including monitoring of water quality, groundwater levels, fish tissue, and local impacts of construction works (noise, air quality, effluent quality). The required organization and costs for implementing these measures are described in the ESMP.

**Water quality:** Specific measures shall be implemented to limit turbidity levels in the canal, including the use of dredging methods that cause less disturbance to the sediment, use of silt screens to avert dispersal of suspended matter during civil works, and protecting drinking water intakes with solid screens. Importantly, a monitoring system will be established to monitor water quality during construction works.

**Adaptation to Climate Change:** To address the risks of climate change, the project will implement adequate adaptation measures in line with the Egyptian National Strategy for Adaptation to Climate Change and Disaster Risk Reduction including, enhancing water efficiency through improving the optimization of the canals, and
promoting awareness and training of farmers and water users association on water management and climate smart agricultural practices. These measures will be evaluated in accordance with the Bank’s Adaptation Review and Evaluation Procedures (AREP), valued and included in the Project design and the Environmental and Social Management Plan (ESMP).

Mitigation and enhancement of major impacts during pre-construction, construction and operation phases of the Project are detailed in table below:
### Proposed enhancement/mitigation, monitoring of the potential environmental and social impacts of the IWRMNIC Project

<table>
<thead>
<tr>
<th>Anticipated Environmental and Social Impacts</th>
<th>Proposed Action/Measures and Objective of Management Measures</th>
<th>Monitoring and Reporting Indicators</th>
<th>Frequency of Monitoring (Timing)</th>
<th>Implementation Plan and Institutional Responsibilities</th>
<th>Cost Estimates (US$)</th>
</tr>
</thead>
</table>
| **Pre-construction (Planning/Design) Phase** | Compliance with National environmental land and all applicable AfDB Environment and Social Safeguards Policies | - Identify and assess the environmental and social impacts and risks including those related to gender, climate change and vulnerability  
- Determine compensation requirements, based on inventory of agricultural and small-scale activities along the banks of Nubaria and Ismailia canals.  
- ESIA and ESMPs prepared for each canal  
- Construction ESMP  
- Prepare abbreviated resettlement action plan (ARAP) | Once | MWRI, HEPS, Contractor | |
<p>| Risk of Canal lining techniques | - Evaluation of lining technique to select technology based on technical feasibility, economic viability and environmental impact | Appropriate Canal lining technique retained | Once | MWRI-HEPS | <strong>150,000</strong> |
| Environment and Social Safeguards Training | Safeguards training including AfDB operational safeguards for all Governorate Environmental Management Unit (EMU) officers and MWE project implementing unit (PIU) | PIU staff and Governorate’s EMU staff trained | Once | MWRI | <strong>50,000</strong> |</p>
<table>
<thead>
<tr>
<th>Anticipated Environmental and Social Impacts</th>
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<th>Cost Estimates (US$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Community mobilization and consultation</td>
<td>Prepare and implement a stakeholder engagement plan, inform all communities affected by the project implementation schedule and their right to compensation if any</td>
<td>No of farmers/community groups engaged and sensitized</td>
<td>Once-Before commencement of construction</td>
<td>MWRI, HEPS, Contractor</td>
<td>10,000</td>
</tr>
</tbody>
</table>

**Construction Phase**

<table>
<thead>
<tr>
<th>Land Use, Resettlement, and Compensation</th>
<th>The Contractor will define their land use requirements for installing machinery, equipment, offices, for access roads, for preparing materials and for disposal of excavated material.</th>
<th>Once</th>
<th>Contractor (MWRI (PIU safeguard experts) and respective Governorate Environmental Officers)</th>
<th>Provided in contractor bids</th>
</tr>
</thead>
</table>
| Loss of vegetation                      | -Clearing of vegetation should be done only where necessary.  
-At least 50% of any indigenous trees removed during clearing will be replaced.                                                                 | Area re-vegetated or restored.  
Conservation of at least 50% of indigenous trees.  | Contractor (MWRI (PIU safeguard experts) and respective Governorate Environmental Officers) | Provided in contractor bids |
| Erosion, Air quality, Hazardous Material and Waste Management, Dust, Traffic and Sanitation, | Measures identified in construction ESMP | Measures implemented | Daily monitoring | Contractor, Supervising Consultant (MWRI (PIU safeguard experts) and respective Governorate Environmental Officers) | Provided in contractor bids |
| Sediment suspension                     | Appropriate dredging techniques  
Use of silt screens | Water pollution prevention measures in place | Weekly | Contractor, Supervising Consultant (MWRI -NWRC, (PIU safeguard experts) and | Provided in contractor bids |
<table>
<thead>
<tr>
<th>Anticipated Environmental and Social Impacts</th>
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</tr>
</thead>
</table>
| Handling of excavated material and sediments from dredging | - Sediment sampling and risk assessment  
- Dewatering of sediment  
- Confinement of contaminated sediment. | Excavated material disposed as quality of sediments | Monthly | Contractor, Supervising Consultant (MWRI, PIU safeguard experts, Ministry of Health) and respective Governorate Environmental Officers | Provided in Contractor bids |
| Occupational Health and Safety | - Develop, implement and disseminate occupational health and safety guidelines  
- First aid kits to be available on site for use by the workers,  
- Provide Personal Protective Equipment (PPE) to employees.  
- Sensitize community about ongoing works through notice boards, reflective liners and detours | - OHS guideline in place (% of contractor staff aware of OHS measures and trained  
- Documented qualifications of first aider and safety officer  
- PPE usage | Monthly | Contractor, Supervising Consultant | Provided in Contractor bids |
<p>| Water quality | Monitoring of all parameters to ensure compliance with Egyptian standards | Water quality parameters in compliance with standards | Daily and weekly measurements | Contractor, MWRI-NWRC (Egyptian Research Institute and Laboratory), PIU safeguard expert and respective Governorate Environmental Officers | 200,000 |
| Employment Opportunities | - Implementing clear and transparent procedures for | Number of local communities’ | Three month interval | Contractor (MWRI (PIU safeguard experts) and | Provided in Contractor bids |</p>
<table>
<thead>
<tr>
<th>Anticipated Environmental and Social Impacts</th>
<th>Proposed Action/Measures and Objective of Management Measures</th>
<th>Monitoring and Reporting Indicators</th>
<th>Frequency of Monitoring (Timing)</th>
<th>Implementation Plan and Institutional Responsibilities</th>
<th>Cost Estimates (US$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recruitment of labour and sourcing of goods and services will enhance the positive impact. Preference will be given to residents of local communities, in the case of unskilled labour, and preference given to local suppliers in the case of goods and services.</td>
<td>employed and/or procured as part of project interventions.</td>
<td>respective Governorate Environmental Officers</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Impact on aquatic ecology (fish)</td>
<td>Monitoring</td>
<td>Fish tissues monitored</td>
<td>Every 3 months</td>
<td>Contractor, MWRI-NWRC (Egyptian Research Institute and Laboratory), PIU safeguard expert and respective Governorate Environmental Officers</td>
<td>40,000</td>
</tr>
<tr>
<td>Impact on water supply</td>
<td>Emergency plan to guarantee water supply for basic needs</td>
<td>Emergency plan developed</td>
<td>Once</td>
<td>MWRI-HEPS, Governorates</td>
<td></td>
</tr>
<tr>
<td><strong>Operation and Maintenance Phase</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Improved water for productive uses</td>
<td>-This positive impact will be enhanced by developing strengthening Water User Associations and training on water conservation and efficiency</td>
<td>Water User Association strengthened Training on water conservation and water use efficiency</td>
<td>Annually</td>
<td>Governorates MWRI, WUA</td>
<td>Included in project design</td>
</tr>
<tr>
<td>Anticipated Environmental and Social Impacts</td>
<td>Proposed Action/Measures and Objective of Management Measures</td>
<td>Monitoring and Reporting Indicators</td>
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<td>Cost Estimates (US$)</td>
</tr>
<tr>
<td>---------------------------------------------</td>
<td>---------------------------------------------------------------</td>
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<td>------------------------------------------------------</td>
<td>----------------------</td>
</tr>
</tbody>
</table>
| Degradation of land due to poor agronomic practices | - Sensitize farmers on adoption of improved irrigation/agriculture technologies.  
- Promote soil conservation practices and climate smart agricultural practices | - Number of farmers trained in improved agronomic practices | Quarterly | MWRI, Governorates’ Ministry of Agriculture | Included in project design |
| Impact on Groundwater and Hydrology | Groundwater Monitoring | Weekly | MWRI-NWRC, Governorate’s Environmental Officers | | 50,000 |
| | | | | | 500,000 |
8. ESMP IMPLEMENTATION AND MONITORING PROGRAM

The overall responsibility of the environmental and social monitoring will lie with the Ministry of Water Resources and Irrigation (MWRI) - Horizontal Expansion Projects Sector (Project Executing Agency). HEPS, in liaison with technical personnel at the respective Governorates’ EMU, EEAA (the overall national authority on the environment), National Water Research Centre (Institute responsible for monitoring), Ministry of Agriculture and Land Reclamation (MALR), Ministry of Health, Ministry of Housing, Local Councils, Farmers’ Organization and Water Users Association will undertake regular environmental, social, safety and health inspections.

A Canal Management Committee will be established during the project design (and continue on to the operation phase) comprising the above stakeholders (and headed by the MWRI) to undertake annual environmental and social monitoring of project implementation. A Technical Commission will be formed under the Canal Committee to include technical staff respective ministries, local authorities and representatives of water users. The Technical Canal Commission will oversee implementation of environmental and social measures throughout the project lifetime.

In accordance with the Contract provisions, the Contractor(s) will be accountable for the implementation of the mitigation measures during the construction and initial operation phases. The Contractor(s) must prepare Construction ESMP (CESMP) and include in their schedule of works, all proposed mitigation measures. The Contractor(s) must have designated personnel to monitor environmental, safety and health matters during construction works, and report regularly to MWRI-HEPS/PIU. The CESMP will be reviewed and approved by the supervising consulting engineer and the respective PIU Environmental Safeguard Specialist. At project completion, the Contractors will prepare a final environmental completion and decommissioning report to be approved by the supervising consultant, MWRI-HEPS and EEAA.

Supervising Consulting Expert/Technical Assistance. An environmental expert (consulting firm) shall be appointed as part of the project to provide advice on the implementation and monitoring of environmental and social measures. Before construction, the supervising consultant will review the works contract and document environmental and social requirements, road safety, and quality assurance systems and plan the supervision functions to ensure that works are implemented while protecting the social and environment aspects. During the construction phase, the supervising consultant: (a) Monitors implementation of the Contractor ESMP and (b) prepares monthly and quarterly environment and social compliance reports, which are submitted to the PIU for consideration, as well as annual environment and social audit reports submitted to the EEAA. The Quarterly Reports and the Annual Report certified by the EEAA shall be made available to the Bank for review.

Egyptian Environmental Affairs Agency (EEAA) will be responsible for the review, comment and overall approval of the ESIA/ESMPs reports for the project activities. Once approved, EEAA will issue Conditional Approval Certificates for the ESIA for the proposed construction and operation of the canals.

The Project Implementation Unit (PIU) established under HEPS of the MWRI will coordinate the activities of all institutions. The PIU shall have 1 environmental and social safeguard specialist(s) (recruited or appointed by the MWRI) who will monitor and manage the implementation of the ESMP. The functions of the specialists will include working with consultants and reviewing reports as well as ensuring that safeguard
decisions are adequately mainstreamed. They will also participate in monitoring and evaluation exercises.

The Environmental Management Units for Governorates in Ismailia, Sharqia and Alexandria will participate in the monitoring and enforcement of the environmental regulations, provision of extension services, mobilization of communities, sensitization and capacity building activities. Each Governorate will designate a Project Support Officer (PSO) among its staff, who will support the implementation and technical supervision of the Project, including sensitization of farmers, training, and monitoring and evaluation in the respective governorates. An identified district environment officer will be responsible for ensuring the compliance of all the project’s components in line with relevant regulations and conditions during construction and the operation of the canals.

Using the environmental monitoring indicators (Table above) adopted, the supervisory and regular monitoring team will seek to measure the project’s progress, in a manner that highlights the various objectives in line with national goals and the Bank’s Integrated Safeguards System (ISS). An annual monitoring report will be submitted to the MWRI and the African Development Bank for review.

9. PUBLIC CONSULTATIONS AND DISCLOSURE

In compliance with the requirements of the EEAA and the AfDB, consultations were undertaken as part of the preparatory studies and ESIA process. Various stakeholders were consulted during the pre-feasibility phase, including representatives from EEAA, MALR, commercial and smallholder farmers, drinking water companies, industries and water users associations. The consultations were aimed at introducing the project and its objectives, and understand the expectations of stakeholders. Generally, all consulted stakeholders had positive expectations from the project.

Stakeholders were consulted on four levels, continuous consultation of individual stakeholders during the project, consultation of communities during the socio-economic baseline studies; and consultation on social and environmental issues during two stakeholder meetings, consultation on the draft ESIA through a public hearing in June 2014.

Consultations showed that stakeholders in water management have high expectations from the project. All agree that it is important to improve the supply of water from the Canal. Water quality is a concern in the area, as the current poor quality prevents drainage water reuse, and poor water quality has a negative impact on crop yields. Some participants expect that a higher level of coordination is possible between different organizations involved in water management.

The most critical issues coming out of stakeholder consultations focused on canal dredging methods, participation of local councils, risk management, compensation, access to navigation, improving canal water quality, water pollution and citizen capacity building to increase sustainability.

Consultations and community participation is proposed to continue with regards to risk and mitigation management, including engagement with the community during implementation as follows: (i) Consultation meeting at all governorates at the start of construction activities; (ii) Consultation meeting at all governorates during construction activities; (iii) Consultation meeting at completion of the construction. Consultations are will continue into project implementation with various stakeholders.
10. Estimated Costs

The cost for implementing the environmental and social impact mitigation measures, monitoring/supervision and capacity building is estimated at USD 0.62 million. These costs will be directly integrated into the main project budget. It is expected that the proposed ESMP budget may change depending on the work plan.

Table 3: Estimated cost breakdown for the Implementation of the ESMP

<table>
<thead>
<tr>
<th>No.</th>
<th>Activity</th>
<th>Timeframe</th>
<th>Cost (US$)</th>
<th>Responsibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>Set up of Canal Committee and Technical Commission</td>
<td>Project Design Phase</td>
<td>40,000</td>
<td>MWRI-HEPS</td>
</tr>
<tr>
<td>02</td>
<td>Mitigation Measures</td>
<td>Construction and Operation phase</td>
<td>500,000</td>
<td>Contractors, MWRI-HEPS, Governorates</td>
</tr>
<tr>
<td></td>
<td><strong>ESMP Monitoring</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Regular supervisions</td>
<td>Entire project period until hand-</td>
<td>Integrated in Project</td>
<td>MWRI-HEPS, Governorates</td>
</tr>
<tr>
<td></td>
<td>• Control missions</td>
<td>Over and Annually during project</td>
<td>Integrated in Project</td>
<td>MWRI-HEPS, EEAA &amp; AfDB</td>
</tr>
<tr>
<td>03</td>
<td>Capacity Development to address ESMP implementation capacity gaps at the</td>
<td>Prior to project works</td>
<td>50,000</td>
<td>MWRI-HEPS, Governorates</td>
</tr>
<tr>
<td></td>
<td>Governorates and PIU</td>
<td></td>
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<tr>
<td></td>
<td>Total</td>
<td></td>
<td>590,000</td>
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<tr>
<td></td>
<td>5% mark-up</td>
<td></td>
<td>29,500</td>
<td></td>
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<tr>
<td></td>
<td>Grand Total</td>
<td></td>
<td><strong>619,500</strong></td>
<td></td>
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</tbody>
</table>
11. CONCLUSION

The Integrated Water Resources Management for the Nubaria and Ismailia Canals Project will bring immense benefit to population within the catchment of the canals through improved water supply and increased irrigated area that will enhance agricultural productivity and create opportunities for improved incomes of farmers. It is expected that improved efficiency of the irrigation canals would in the long-term support the socio-economic development of Egypt. The project will improve the control of water along the canals for equitable distribution to over 1 million feddan of irrigated land while meeting the priority needs for domestic, industrial, navigation and environment purposes.

The primary beneficiaries will be farming households in the catchment of the Nubaria and Ismailia canals (including the Sharqia and Ismailia governorates), whose agricultural fields had been continually waterlogged and properties damaged due to increased groundwater levels resulting from the canal seepage. The project interventions will therefore reduce damage to communities’ assets and properties and improve soil quality for agricultural purposes.

The anticipated environmental and social impacts of the project are localized and site specific and can be mitigated during by the application of mitigation measures specified in this Environmental and Social Management Plan. The ESMP will provide the mechanism to guide the assessment and mitigation of potential adverse environmental and social impacts of the project activities.

The project is environmentally and socially feasible for implementation provided the recommended mitigation and monitoring measures are implemented, and the proposed implementation arrangements are upheld.