Helwan South Power Plant 500 kV Electrical Interconnection Project

Environmental and Social Impact Assessment

Executive Summary

FINAL REPORT
Volume – II

May 2013
Project No. 1750

Submitted by:

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<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>CAA</td>
<td>Competent Administrative Authority</td>
</tr>
<tr>
<td>CAPMAS</td>
<td>Central Agency for Public Mobilization and Statistics</td>
</tr>
<tr>
<td>EAAQLs</td>
<td>Egyptian Ambient Air Quality Limits</td>
</tr>
<tr>
<td>EEAA</td>
<td>Egyptian Environmental Affairs Agency</td>
</tr>
<tr>
<td>EEHC</td>
<td>Egyptian Electricity Holding Company</td>
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<tr>
<td>EETC</td>
<td>Egyptian Electricity Transmission Company</td>
</tr>
<tr>
<td>EGSMA</td>
<td>Egyptian Geological Survey and Mining Authority</td>
</tr>
<tr>
<td>EHS</td>
<td>Environmental Health and Safety</td>
</tr>
<tr>
<td>EIA</td>
<td>Environmental Impact Assessment</td>
</tr>
<tr>
<td>EMS</td>
<td>Environmental Management Staff</td>
</tr>
<tr>
<td>ENIT</td>
<td>Egyptian National Institute of Transport</td>
</tr>
<tr>
<td>ESIA</td>
<td>Environmental and Social Impact Assessment</td>
</tr>
<tr>
<td>ESMP</td>
<td>Environmental and Social Management Plan</td>
</tr>
<tr>
<td>EU</td>
<td>Environmental Unit</td>
</tr>
<tr>
<td>EUPS</td>
<td>Egyptian Unified Power System</td>
</tr>
<tr>
<td>FHWA</td>
<td>Federal Highway Administration, (US)</td>
</tr>
<tr>
<td>FM</td>
<td>Finance Manager</td>
</tr>
<tr>
<td>GARBLT</td>
<td>General Authority for Roads, Bridges and Land Transport</td>
</tr>
<tr>
<td>GEP</td>
<td>Good Engineering Practice</td>
</tr>
<tr>
<td>GIS</td>
<td>Gas-Insulated Switchgear</td>
</tr>
</tbody>
</table>
HCM  Highway Capacity Manual
HGVs  Heavy Goods Vehicles
HSE  Health, Safety and Environment
MoEE  Ministry of Electricity & Energy
MWRI  Ministry of Water Resources & Irrigation
MSDSs  Material Safety Data Sheets
NFRA  National Fire Protection Authority
NRIAG  National Research Institute for Astronomy and Geophysics
OSHA  Occupational Safety and Health Administration
PCBs  Polychlorinated Biphenyls
PCDA  Public Consultation and Disclosure Activities
PIU  Project Implementation Unit
RIGW  Research Institute for Ground Water
RoW  Right of Way
S/ST  Substation
HELWAN SOUTH POWER PLANT 500 kV TRANSMISSION LINE AND SUBSTATIONS PROJECT

Environmental and Social Impact Assessment

Executive Summary

1. INTRODUCTION

EETC is a Egyptian State-owned enterprise that is responsible for constructing, operating and maintaining 66-500 kV Transmission electricity grid networks.

The Government of Egypt has identified a number of high voltage electricity transmission projects which are urgent and strategically important for providing constant electricity supply to the Egyptian consumers and reliable operation of the Egyptian electricity grid as a whole. Firstly, the strategy of the electricity grid development is directed towards creation of standard conditions for utilization of the capacity from power supply units currently operating as well as from new power supply generators, either thermal or renewable, the commissioning of which is planned by the Government, optimization of the balance structure of the capacity, providing for frequency and voltage regulation.

Amongst these projects is the construction of the 500 kV overhead transmission line of a total length of 250 km, which interconnects the Helwan South Power Plant and its supporting S/Ss with the national electricity grid.

EEHC / EETC is seeking financial assistance from the WB for the construction and operation of this Transmission Line and Substations. This project uses the savings of US$180 million from the ongoing $600 million Ain Sokhna project (IBRD loan 76330) to the Arab Republic of Egypt (Borrower) to upgrade the national transmission grid. The savings would help finance (i) two 750 MVA, 500/220kV, Zahraa El-Maadi GIS Substation; (ii) a 500 kV double circuit OHTL South Helwan/ Zahraa El-Maadi with about 100km length; (iii) 500 kV, double circuit OHTL from South Helwan with 150km length, crossing one circuit from the existing 500 kV, OHTL Samalaut/ Assuit at Assuit Site; (iv) opening the under construction 500 kV, OHTL Tebbeen/ El-Sokhna P.P. and extend it in/out with length 2x 30km to Zahraa El-Maadi; (v) 2x 165 MVAR, 500kV, switchable line shunt reactor one in Assuit S.S. and the other in South Helwan Power Project and (vi) Connecting three existing 220 kV lines (Ain Siraf/ Tora (2x7 km), Cairo east/ Basateen (2x5 km), Katamia/ Tebeen (15 km)) to Zahraa el- Maadi SS. The funding of the expansion of the savings will enable the new Helwan south power plant and the Ain Sokhna power plant as well as other generation plants added to the grid to effectively evacuate their energy into the grid. The proposed project is designated as a Category (B) project under the WB and as a Category (B) project under the Egyptian environmental regulations. Although it does not require a full EIA, but only a screening Form "B", a full Environmental and Social Impact Assessment has been conducted. Financing from WB is conditional upon obtaining the environmental clearance from the Egyptian regulatory authorities and the WB.
Figure-1, Figure-2, Figure-3 and Figure-4 depict the electrical networks of Cairo, Giza, Beni-Sueif and the El-Minya Governorates and the proposed re-enforcement by the year 2015.

The proposed transmission lines will re-enforce the existing network and allow the evacuation of the power generated at the Helwan South area to the Egyptian electricity national grid. It will also help address concerns about the security of electricity supply within the Upper Egypt region, where the demand is rising. At the same time, grid re-inforcement has the potential to deliver an additional Hundreds MW from new power plants.

The construction of the proposed transmission line and associated S/Ss is anticipated to yield a number of tangible benefits to the electricity system and EEHC, that include:

- **Improved stability of the system** - The reliability of the grid will be significantly improved as additional redundancy will be built into the network that will reduce the need for power cuts in the event of the unplanned breakdown of a major piece of equipment.

- **Optimised supply of power to Upper Egypt** - From being able to exploit all the potential generating capacity established in Helwan South.

- **Increased energy efficiency** - Through increased higher levels of energy efficiency in the transmission system.

- **Transfer and dispersion of skills** - To the power generation complex of Egypt from implementing projects of this nature and associated income for contractors and sub-contractors.

**Project Overview**

The Helwan South Power Plant 500 kV Electrical Interconnection Project is an integral part of the Egyptian Electricity Sector's on-going program to enhance transmission capacity for meeting the ever increasing demand for electricity generation. The project includes evacuation of the generated electricity at the Helwan South to the National Unified Power Grid (NUPG) via interconnecting Overhead Transmission Lines (OTL) and supporting Substations. These interconnecting transmission lines and supporting substations will connect the electricity users and consumers to the National Electricity Network.
Figure 1

Electrical Network of the Cairo Governorate Region, 2015
Figure-2

Electrical Network of the Giza Governorate Region, 2015
Figure-3

Electrical Network of the Beni-Suef Governorate Region, 2015

Source: Egyptian Electricity Holding Company (EEHC): Geographic Information Center, 2010
Figure-4

*Electrical Network of the El-Minya Governorate Region, 2015*

• Scope of the ESIA

This ESIA covers the main areas that might be affected by the construction and operation of the proposed transmission and substations project. Specifically, this includes studying environment and social impacts due to and on:

• The project sites, i.e. areas within the domain of the proposed sites;

• Areas immediately bordering and in the vicinity of the proposed sites (i.e. surrounding environment and the community);

• Terrestrial and aquatic ecosystems that might be affected (i.e. farmlands, desert lands, ecology, geology, water bodies, including ground water, .. etc);

• Any other areas that might be affected by the proposed project.
2. POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

2.1 PROJECT PERMITTING

The key permits required for the construction and operation of the proposed Transmission Line and Substations are set out in Table-1. These permits set out and regulate the standards to which the Transmission Line and Substations must be designed, constructed and operated.

Table-1

<table>
<thead>
<tr>
<th>Permit</th>
<th>Permitting Authority</th>
<th>Relevant Legislation</th>
<th>Role of Permit</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction Permit (for constructing substations and transmission line)</td>
<td>Regulatory Body</td>
<td>Presidential Decree of the Arab Republic of Egypt, No. 326/1997, to Establish the Regulatory Body for Electricity Utility and Consumer Protection</td>
<td>Authorization to construct the Transmission Line and Substations project</td>
<td>[Secured]</td>
</tr>
</tbody>
</table>
In addition, a number of subsidiary permits will be required related to connection to, and use of, existing services and infrastructure.

2.2 EGYPTIAN LAND LEGISLATION

The Egyptian Constitution recognizes three main types of ownership. Article 29 of the 1971 Constitution provides that “Ownership shall be under the supervision of the people and the protection of the State. There are three kinds of ownership: public ownership, co-operative ownership and private ownership”.

In accordance with Article 34 of the Constitution: “Private ownership shall be safeguarded and may not be placed under sequestration except in the cases defined by law and in accordance with a judicial decision. It may not be expropriated except for the general good and against a fair compensation as defined by law. The right of inheritance shall be guaranteed in it.” According to this article, it is understood that procedures for private property expropriation are considered to be exceptional. The competent jurisdiction shall be entitled to take cognizance of the lawsuits raised by individuals against the administration for appropriate compensations.

2.2.1 Land Tenure

There are three main forms of land ownership in Egypt:

a) Public or State land\(^1\) (in Arabic *Amlak Amiriya*), which is divided into the State’s public domain that cannot be alienated and the State’s private domain, which can be alienated generally through sale, lease, *Takhsiss* (i.e. transfer of ownership conditional on meeting certain criteria, such as keeping the land use unchanged and paying the remaining installments of the land price) or through *Haq Intifaa*.

b) Private land (in Arabic *Mulk horr*), which may be alienated/transferred freely, and

c) *Waqf* land (land held as a trust/endowment for religious or charitable purposes), which is often subject to covenants on transfer or use, and which is typically transferred through leasehold or usufruct.

In addition, there are some areas in Sinai and in the northern coast with implicitly recognized *customary rights* to land to the benefit of Bedouins. In these areas, someone wishing to acquire land often has to make two payments, first to the Bedouin claimant(s) for the right of use and then to the State to regularize and register their land tenure/ownership and be able to obtain services.

It is important to note that the Civil Code (No. 131 of 1948) recognizes *Hiyaza* (i.e. possession of immovable/movable property without ownership) as a legitimate channel to acquire ownership of the property in question through adverse

---

\(^1\) The large majority of land in Egypt is public or State-owned desert land that is for the most part undeveloped (estimated to be 90-95% of the national territory).
possession, provided that the *Hiyaza* has been “peaceful, unchallenged and uninterrupted” for a period of 15 years. By Law, ownership through adverse possession does not, however, apply to State lands.

### 2.2.2 Egyptian Civil Code

Within the framework of the Constitution, *the Civil Code, in articles 802-805 concerning private property*, has recognized the private ownership right. Article 802 has stated that the owner, pursuant to the law, has the sole right of using and/or disposing his property. In Article 803, land ownership has been defined as land with all things above and below it and pursuant to the law, the property of the surface may be separated from the property of what is above or below it.

Then, Article 805 provides that “No one may be deprived of his property except in cases prescribed by law and this would take place with an equitable compensation.”

### 2.2.3 Expropriation of Ownership for Public Interest (Law 10/1990)

Although, the constitution prohibits the expropriation of private property except for public interest against compensation determined pursuant to the law, Law 10 of 1990 concerning the Expropriation of Ownership for Public Interest was issued to reflect this constitutional mandate. In addition, expropriation of property is further regulated by Law 59 of 1979 concerning the Establishment of New Urban Communities and Law 3 of 1982 concerning Urban Planning.

The term “public interest” in the context of expropriation has been defined in Article 2 of Law 10/1990. The Article specifies the acts that are considered for public interest. These include:

- Constructing, widening, improving, or extending roads, streets, or squares, or the construction of new districts.
- Water supply and sewage projects, irrigation and drainages projects.
- Energy projects.
- Construction or improvement of bridges, cross roads for railway and tunnels.
- Transportation and telecommunication projects.
- Urban planning purposes and improvements to public utilities.
- Other acts considered as acts for public interests mentioned in other laws.

The law further stated that expropriation can be exercised only with respect to:

---

1. The Ministry of Local Administration estimates that 15.7 million Egyptians (22.3% of the population) live in 1,105 informal or squatter settlements, called *aswāʿiyat*, including unlawful urbanization of agricultural lands, unplanned/unauthorized land subdivisions, and squatting on public or privately-owned lands.
• Real property and not movable property. The term real property means, "Anything that is fixed in its space affirmed therein, which may not be moved without being damaged." Accordingly, real property includes only land (whether agricultural or vacant, whether in urban or rural areas) and buildings above this land.

• Real property belonging to private persons (individuals or corporate) or to State private property.

• State public property may not be expropriated; rather the concerned administrative parties would enter into an agreement with respect to such property either by divesting the property in question from its public characterization or by re-appropriating the said property to another public use or entity.

2.2.4 Transfer of Ownership and Compensation

Compensation assessment: Property expropriation shall only be made against a fair compensation in accordance to constitutional provisions. The legislator has put forth some principles which should be taken into consideration with regards to compensation assessment:

I. The compensation assessment for property expropriation shall not include structures, plants / crops, improvements / additions, or tenant agreements if it has been proved that the aforementioned acts were performed in order to acquire higher compensation.

II. If the compensation amount for the un-expropriated part, in projects other than urban planning, increases or decreases (due to activities causing general public benefit), the increase or decrease in amount should be taken into consideration so that the amount to be added or reduced shall not exceed 50% of the compensation value of the expropriated property (Article 19: Law No. 577 of 1954).

III. If the value of the property subject to expropriation for the upgrading or re-planning of districts / cities is increased as a result of the implementation of a public benefit project, the increase in value shall not be calculated in the compensation assessment if the property expropriation is performed within 5 years from the date of implementation in the previous project (Article 20: Law No. 477 of 1954).

IV. For real estate subject to improvement due to public benefit works (district/city replanning and upgrading projects), the owners shall be obliged to pay for the improvements, provided that the payment does not exceed 50% of the actual expenses for establishing or expanding the street or square which resulted in the improvement. This provision shall also be applicable if only part of the property within the district/city re-planning/upgrading projects is expropriated, and the authority in charge has deemed that that keeping part of the real estate by the owner does not conflict with the purpose of the intended
project. The assessment of the aforementioned charges made by the authority in charge of organizing affairs shall not be subject to any appeal (Law No. 577 of 1954).

2.2.5 Valuation and Compensation Methods

Determination of the valuation methods and compensation to be given to PAPs is made at two separate levels:

- The first is made by the Expropriating Entity in order to meet the requirement that the estimated compensation amount is deposited with ESA prior to proceeding with the remaining formalities as described in the preceding section.

- The second level is a review of that estimated compensation by the Compensation Estimation Committee within ESA.

The first level, as stated in Article 6 of Law 10/1990, requires the Minister of Public Works and Water Resources to form a Committee within each governorate to be charged with the determination of compensation (this contradict with Article 47 of Law 3, 1982 which authorized the concerned Governor to formulate this committee).

The second level is conducted by ESA. The Compensation Estimation Committee within ESA makes a final administrative determination of the compensation to be granted to property owners and rights' holders after having received a consultative report from the General Department for Appraisal within ESA.

The following rules concerning the determination of the compensation for expropriation of ownership are worth noting:

- Should the value of the un-expropriated part of the expropriated property increase or decrease due to the public interest works in projects other than zoning projects within cities, such decrease or increase shall be taken into consideration when determining the compensation amount.

- Compensation is determined in accordance with Article (20) of Law 10/1990 on the basis of prevailing prices at the date of issuance of the expropriation decree in question. The committee and the courts would look to expert opinion in determining the prevailing prices, taking into account prices stated in recorded contracts.

- Should the value of the expropriated property increase due to prior public interest works in a previous project, such increase shall not be calculated in determining the compensation value if expropriation is exercised within 5 years from the date of executing the previous public interest project.
• Compensation under Law 3/1982 can be in one of two ways: (i) taking the value of the property; or (ii) postponing the taking of such value in full or in part until all or part of the area in question is sold. In such event, the owner or holder of rights deserves compensation equal to the said value in proportion to the total value of the properties in question together with one-half of the difference between the two values after deducting the costs of executing the project.

2.2.6 Crop Compensations:

The valuation of crop compensations areas are measured by field surveys during implementation for measuring lengths of affected areas along the transmission line or pipeline layouts and calculating the area based on a width of 10m. for collector pipes and 5m. for the lateral pipes. The affected area is then multiplied by the applicable unit rate depending on the type of crop to reach the crop compensation amount.

Unit rates for crop compensations based on the crop type are updated and issued in consecutive Ministerial decrees related to this matter and issued by the Minister of Water Resources and Irrigation. These updates are prepared by specialized committees established with representation from MWRI's relevant departments, including EPADP, as well as participation of the MALR. Recent practice has been to issue updates of these crop compensation unit rates every three years or as needed depending on major occurrences such as repeated farmer requests.
3. ANALYSIS OF ALTERNATIVES

3.1 CURRENT SITUATION ("NO ACTION" OPTION)

The no action alternative will result in lack of power evacuation and transmission to load centers, and consequently in the demand for electricity exceeding supply, with an increasing deficit as demand increases in future years. A lack of a secure and reliable electricity generation and supply system has significant social and economic implications, since it will:

- constrain existing and future economic development and investment through lack of energy resources to meet industrial and social demand;
- restrict socio-economic development through lack of electricity supply, or poor reliability and shortages in electricity supply for domestic users, community and other public facilities and public services;
- inhibit provision of social services, including public health and poverty eradication.

"No Action" Option means, also, loss of all project benefits, which may be summarized as follows:

**Improvement in electricity supply reliability**

The reliability of the grid operation will be significantly improved as additional redundancy will be built into the network to minimise the need to reduce system demand in the event of the unplanned breakdown of a major piece of equipment.

Similarly the strengthening of the transmission connection between eastern Nile power generation and the rest of the network will minimise the risk of system instability occurring after an unplanned fault in the eastern section of the network.

**Improving security of supply**

There are concerns about the security of electricity supply within the Upper Egypt region. Grid re-inforcement has the potential to deliver an additional power from Helwan South electricity generation to the Upper Egypt region.

**Enhanced prospects for economic development in the Upper Egypt region**

Reliable energy supplies are a critical success factor in maintaining the continued economic development. Any loss of confidence in the security of power could have a significant impact on investor confidence and economic growth.

**Enhanced prospects for transmission equipment manufacturers and employees**

Egypt has a manufacturing base in the provision of both transformers and reactors for substations, tower steel and line conductors for overhead lines along with construction and commissioning skills. Although the project will be subject to international competitive tendering, it is probable that Egypt's relatively low cost base and familiarity with local conditions should assist the domestic industry in
winning a proportion of the estimated millions of USDs worth of project work with the associated direct and indirect economic benefits.

As a result, the “no action” option is not a viable or acceptable alternative to the proposed project.

3.2 ALTERNATIVE ROUTES FOR THE TRANSMISSION LINE

The line Route for the Helwan South / Samallout OHTL 500kV (of around 150 km length) starts at Samallout 500 kV substation on a desert land then goes through agricultural area until the Nile River. When it crosses the Nile it goes towards the North through desert lands till Helwan South Power Plant.

When the transmission line crosses the Nile, it goes close to an asphalt road through the desert lands till Helwan South Power Plant. The desert segment of the entire transmission line route is approximately 88% of the total length of the interconnecting lines, which will pass through uninhabited uncultivated state-owned desert land, while the remaining (about 30-32 km), which is around 12% of the total length of the entire interconnecting lines lies on cultivated lands at Samallout area.

The Samallout 500/220/132/66/33 KV substation is located at the desert edge, west of Nile River, this substation will be expanded to house new equipment associated with the construction and operation of new transmission lines.

The Helwan South substation will be located on the most southern part of Giza Governorate. Helwan South substation is about 7.5 km to the south of the El-Kureimat power plant and about 100 km south of Cairo. The area is free of encumbrance and on an uncultivated uninhabited desert lands. The site of the substations and the entire route of transmission line are accessible through the regional road from Cairo to El-Minya.

Three alternative routes for the Nile crossing of the OHTL were studied. The study resulted in recommending the 3rd alignment, as the best option. There are three proposed routes in the green area at Samallout route segment, where:

- The first passes near some housing blocks and crosses the Nile River at 600 m width.
- The second passes through mining area located at the eastern side of the Nile River and constitutes a source of pollution, which may adversely affect the line insulators, in addition to crossing the Nile River at 900m width.
- The third passes far from the mining area, avoiding housing blocks and crosses the Nile River at its narrowest width, 600 m distance.

Figure-5 shows the Transmission Line alternative routes for the 500 kV OHTL crossing the Nile river from Samallout. Figure-6 depicts the selected route segment of 500 kV Samallout / River Nile Bank (Route 3) and its intersection with other TLs at Samallout area.
Figure-5

The Three Alternative Routes to the Samllout / Eastern Nile Bank Segment
Figure-6

Intersection of Samllout / River Nile Bank Segment 500 kV TL with other TLs at the Samallout Area
4. DESCRIPTION OF THE PROPOSED PROJECT

4.1 INTRODUCTION

The Helwan South power project will be connected to the Egyptian Unified Power System (EPS) at Zahraa El-Maady, east of Cairo City, Cairo Governorate in the North and at Samallout, El-Minya Governorate in the Southwest, which are both owned and operated by the Egyptian Electricity Transmission Company (EETC), an affiliate company to the Egyptian Electricity Holding Company (EEHC), via connecting transmission lines of a total length of around 250 km, in addition to 30 km for connecting the underconstruction 500 kV, OHTL Tebben/ Al Ain El-Sokhna P.P. to Zahraa El-Maadi S.S.

The scope of the project is as follows:

i. A 2x750 MVA, 500/220 kV Zahraa El-Maadi Substation.

ii. A 100 km, 500 kV double circuit transmission line connecting South Helwan and Zahraa El-Maadi substations;

iii. A 150 km, 500 kV double circuit transmission line connecting Helwan South substation to Samalaut and Assuit substations by an in-and-out connection at Samalaut substation to the existing 500 kV Samalaut-Assuit transmission line.

iv. A 30 km, 500 kV double circuit transmission line connecting Zahraa El-Maadi substation by an in-and-out connection to the 500 kV transmission line connecting Tebbeen and El-Sokhna substations. The 500 kV transmission line connecting Tebbeen and El-Sokhna substations is under construction and is financed by EETC; and

v. Two 165 MVAR, 500kV switchable line shunt reactors each to be installed at Assuit and South Helwan substations.

vi. Connecting three existing 220 kV lines (Ain Sira/ Tora (2x7 km), Cairo East/ Basateen (2x5 km), Katamia/ Tebeen (15 km)) to Zahraa El-Maadi SS.

It is not foreseen that any of the activities of the transmission line project, or its attachments, would result in involuntary resettlement, particularly with most of the routing pathways of the main electrical transmission lines (around 88% of its routing pathway) are located within uninhabited uncultivated State-owned desert lands with a very limited pieces of land to be occupied by transmission towers' footings against fair compensation and no alternative proposed routing is envisaged as shown clear in the map of the surveyed routes.

Most importantly, no involuntary resettlement is foreseen due to any activity of the transmission line project between Samallout and the River Nile (the agricultural land) because nobody is inhabited on the green cultivated areas, but in the villages discreted all around. Only crop compensation may be associated with the project activities within this part of the line route.

The current status with regard to transmission lines, substations and access roads is given in the following sections.
4.2 PROJECT LOCATION

In order to evacuate the electrical energy generated at the Dayer El-Maymoun, Helwan South into the 500 kV backbone network, EEIC is planning to interconnect the Helwan South at Zahraa El-Maady, east of Cairo City, Cairo Governorate in the North and to Samallout substation at the Nile valley in the Southwest, via installing 500 kV parallel lines of 250 km total length, approximately.

The southern part of the line Route starts at Samallout 500 kV S/ST on a desert land, then goes through agricultural area until the Nile river. When it crosses the Nile it goes to the north direction through desert lands till Helwan South power project. The northern part of the line Route starts at Zahraa El-Maadi 500kV S/ST, east of Cairo City on a desert lands, then goes through desert lands to the south direction till Helwan South power project.

When the transmission line crosses the Nile, it goes close to an asphalt road through the desert lands till Helwan South and continues to the north till Zahraa El-Maady close to an asphalt road through the desert lands, too. The desert segment of the transmission line route is approximately 88% of the total length of the line, while the remaining 12% lies on cultivated lands at Samallout area.

Concerning the transmission line, only small pieces of land for the transmission line's towers' footings all along the route will be acquired.

The land requirements are likely to be limited. No land acquisition is associated with around 88% of the entire route as it passes through uninhabited, uncultivated, State-owned desert land. The same as for the 30 km in/out that connects the 500 kV, TL Tebbin/ El-Sokhna P.P. to Zahraa El-Maadi S/S where the entire connection line passes through a desert land. Also, the three existing 220 kV lines (Ain Siraf/Tora (2x7 km), Cairo East/Bassatin (2x5 km), Kattamia/Tebbin (15 km) that will be connected to Zahraa El-Maadi S/S are all pass through a desert land (see Figures 7 "B & C").

Only in the cultivated area of Markaz Samallout, along the remaining 12% of the route, small pieces (of area around 14x14 m² each) of the agricultural (of total accumulated area of around 3.1 Feddans) land will be occupied by TL towers' footings. For these footings, fair land acquisition compensation and crop compensation system will be applied.

A Resettlement Policy Framework (RPF) has been prepared to accompany this ESIA for framing the legislative conditions and procedures related to any resettlement that may be resulted from this project. If any resettlement exists, a Resettlement Action Plan (RAP) will be prepared and submitted to the W.B. before the construction of the transmission line starts. For this, a full survey of Project Affected Persons (PAPs) would be conducted as soon as the project's specific location is determined and its land requirement is known.
It must be emphasized that no civil work will start unless land expropriation is completed and compensation is paid (land expropriation is a per-construction phase activity).

The indicative geographical co-ordinates outlining the main routes of the transmission line are provided in Tables-2 and-3. also, Figures-7 through-9 give an illustration for the project routes.

**Table-2**

_Helwan South/ Zahraa Al-Maadi 500 kV OHTL Primary Route_

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Table 3

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Figure-7 (A)

Map of Egypt Illustrating Panoramic View for the Helwan South / Zahraa El-Maadi - Helwan South / Samallout 500 kV Transmission Line
Figure-7(B)

Interconnection of Zahraa El-Maady Substation
Current Situation
Figure-7(C)

Interconnection of Zahraa El-Maady Substation
Target Situation
Figure-8

_Satellite Map Depicting the Northern End of the Helwan South/Zahraa Al-Maadi - Helwan South/Samallout 500 kV Transmission Line_
Figure-9

The nearest villages to the TL route in the Samallout segment are shown in Figure 4-7 and can be identified as follows:

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<th>Direction</th>
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4.3 TRANSMISSION LINE DESIGN

4.3.1 Scope of Work

The technical specifications detail the scope of work will include:

- Soil investigation.
- Calculation and design of Towers:
  - Terminal Towers and Angle Towers.
  - Suspension Towers.
  - Calculation and Design of Foundations.
  - Calculation and Design of Earthing.
- Determination of all equipment and fitting:
  - Insulator strings.
  - Earth-wires (optical fiber), conductors and fittings.
  - Accessories as spacers, dampers, clamps, warning signs, etc.
- Sag and tension calculation.
- Line route profile.
- Supply of all equipment.
- Construction of line:
  - Site preparation.
  - Foundation.
  - Tower assembling.
  - Line stringing.
  - Testing and commissioning.
  - Site cleaning.

4.3.2 Electrical Design

The line electrical characteristics are assumed as follows:

- Nominal voltage of a three-phase system: 500 kV.
- Highest voltage of a three-phase system: 550 kV.
- System design short circuit current: 40 kA.
- Lightning impulse voltage withstand 1.2/50 μs (peak): 1550 kV.
- Rated frequency: 50 Hz.
- Maximum operating conductor temperature: 80 °C.
4.3.3 Right Of Way (ROW)

For the 500 kV AC transmission line, the right of way will be 25 m wide for each side.

4.3.4 Towers

Lattice steel self supporting double circuit towers should be used. The 500 kV tower shape will be designed for vertical arrangement, as illustrated in Figure-10.

The positioning of the conductors and of the earth-wires on the tower shall be determined considering the following clearances:
- Clearance to ground and obstacles.
- The clearances between tower's live and earthed parts.
- The clearances between the conductors and between conductors and earth-wires in mid-span and still air.
- The earth-wire's shade protection angle.
- Clearances between conductors at structures.

4.3.5 Insulators

The suspension and tension insulator string units shall be of ceramic or toughened glass type.

Within the coastal area (40 km from the Red Sea Coast) and the agricultural/one al Samallout S/St (32 Ion length). The anti fog type is recommended.

The earth-wire should be OPGW. It shall be a slotted core structure or steel tube construction for 24 optical fibers.

The OPGW will be designed and comply with the IEC standard which should be observed in the design, construction and manufacture.

The optical fiber earthwire shall be of design and construction as to ensure long service with high economy and low maintenance costs. It shall be suitable in every respect for continuous operation at nominal parameters as well as in transient operating conditions, under the climatic conditions peculiar to the site.

The OPGW fiber optic system (24 fibers) will support the communication service between the Wind Farm 500 KV S/ST and Samallout 500 KV S/ST and will be integrated with the existing National Energy Control Center [NECC] telecommunication network.

For the rest of the line (almost 208 km) located in desert area, we may use open profile type. Open profile type unit have less leakage path compared to the anti fog type. So, to decrease the pollution, it is suggested to increase the leakage path. Hence, it is preferable to use anti fog type in the desert area too.
Figure-10

Typical Tower Design for the Samallout/ Suez Gulf Double Circuit 500 kV OHTL

500 kV Line Outlines
Of Suspension Double Circuit
Tower with Double Earth Wire
The anti fog type is recommended for all the line.

4.3.6 Conductor and Earth-wires

Line Conductor

The line conductors for the coastal area will be AAAC 506 mm² while the rest of the line will be (ACSR) 490/65 mm² with characteristics given in the ESIA Report.

Earth-wires

All towers shall be equipped with two earthwires (G1 & G2) at tower top as follows:
- One classic earthwire.
- One optical ground wire (OPGW) with 24 fibers.

Composite fiber optic overhead ground wire (OPGW) shall be used to serve dual function as optical fiber communication link and shielding wire.

4.3.7 Steel Towers and Foundations

EETC already have its own towers design. The towers are lattice steel window type designed to carry 3 phase conductors, one earth wires and one OPGW.

Applicable Standards are as follows:

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<td>Deutshes Institute Fuer Normung (German Standards)</td>
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4.3.8 Construction

It is assumed that the construction materials will be stored at the construction contractor’s premises or at EETC’s maintenance stations.

The construction is expected to take place by carrying the tower materials to each tower base by lorry and assembling the towers on site. Work is expected to take place at several construction locations at the same time. The construction teams at each location would consist of four or five crews of 5-10 people, working one after another, with each crew responsible for one of the following: preparing the RoW,
laying the foundations for the towers, assembling the towers on the ground, erecting of the towers and installing the wires and testing and commissioning the line.

**Preparing the RoW**

Once the negotiations for land acquisition and easements are complete, the construction phase will define the right of way on the ground using marker posts in open countryside or by marking vegetations that need to be cleared.

RoW will constitute 25 m at each of the two sides of the transmission line which represent, also, the protection zone along the line route. Additional space will also be made as necessary for the construction and erection of the towers. The preparation of the RoW in cultivated areas will be managed in close co-operation with the El-Minya Governorate.

The provision of access roads to the construction sites is a key feature of these preparatory works. The selection of the access routes will be discussed and agreed with Local Councils and Governorate's authorities. It is expected that the RoW, existing roads, tracks or croplands will be used wherever possible, upgraded as necessary and re-instated to their former condition at the end of the construction phase. Special provision may have to be made for constructing roads into wetland areas.

**Construction of Foundations**

There shall be two basic types of reinforced concrete foundations used: pad, chimney, and piles. The pad & chimney foundations are normally used in firm dry ground. In a typical installation, a hole from 2x2 m to 2.7 x 2.7 m is dug down to approximately 3 - 5m deep. The earth that is removed is carefully separated to preserve the topsoil and the foundation is strengthened with cross-bars. The subsoil is then backfilled into the hole and compressed to strengthen the foundation and the topsoil is laid on top and reseeded with appropriate vegetation.

Pile foundations are used on wetter ground and are expected to be the more common type of foundation in cultivated lands. Piles are driven into the ground with 2-4 piles at each corner and covered with a reinforced concrete beams. None of the foundation types results in a solid concrete platform on the surface, as the foundations are laid under each supporting point of the tower, so that only about 50 cm of concrete foundation is above the ground level. Connections for raising and securing the towers are provided at each corner of foundation through bolted joints.

**Assembly, Erection and Raising of Towers**

The towers shall be erected on the foundations not less than 14 days / 21 days after concreting or till such time that the concrete has acquired sufficient strength.
For the convenience of assembling the tower parts during erection operations, each member is marked at the factory to correspond with a number shown in the erection drawing. Any damage to the steel and injuring of galvanizing shall be avoided. No member shall be subjected to any undue over stress during erection.

There are three main methods of erection of steel transmission towers which are described as below:

a) Built up method.

This method consists of erecting the towers member by member. The tower members are first set out and kept on the ground serially according to erection sequence to avoid time loss due to searching for them as and when required.

b) Section Method:

The major sections of the tower are assembled on the ground and the same are erected as units. Either a mobile crane or a derrick / gin pole is used. The derrick/ gin pole used is approximately 10m long and is held in place by means of guys on the side of the tower to be erected.

Sometimes, one whole face of the tower is assembled on the ground, hoisted and supported in position. The opposite face is similarly assembled and hoisted and then the bracing angles connecting these two faces are fitted.

c) Ground Assembly Method:

This method consists of assembling the tower on the ground, and erecting it as a complete unit. This method is not useful when the towers are large and heavy and the foundations are located in arable land where assembling and erecting complete towers would cause damage to large areas or in hilly terrain where the assembly of complete tower on sloping ground may not be possible and it may be difficult to get the crane into position to raise the complete tower. This method is only adopted where the availability of good approach roads to tower location exists.

Special Crossing (i.e. Nile Crossing)

The Nile crossing tower is a suspension tower, with average height of 150 meter, its span is 850 meter and excavation is 30 x 30 m₂.

Wiring

Tension and suspension sets of insulators for wires and wire ropes are assembled on the ground for the whole anchor span, i.e. from one angle tower to the next.
The wires and wire ropes are unfolded on the ground along the anchor span and then raised and strung sequentially on the towers and tensioned.

The line is then energized with a protective voltage to prevent the theft of the wires and steel parts: These unfinished sectors have a special warning sign “Danger! High voltage!” The ground around the tower bases in cultivated areas is re-cultivated and the construction site is restored as far as possible to its original state. When the whole transmission line is completed, it is connected to the design voltage of 500 kV and is then operational.

4.3.9 Operation & Maintenance

Once lines are constructed the main impacts that arise stem from their physical presence, the Electromagnetic Field (EMF) together with noise created by the Corona effect. Physical presence creates a visual impact and a threat to birds from collision with the wires.

*Electromagnetic Fields (EMF)*

The size of the RoW and the protection zone is largely determined by EMF, where measurements have shown that the EMF of 500 kV lines at a distance of 25 m from the footprint of the line is < 5 kV/m, which is in conformance with stipulated standard for limitless exposure.

It is also noted that the “Protection Zone” along the line is 25 m from both of each sides of the routing, with the closest house to the routing, if existed, being some 220 m away. This is in contrast to Europe; in the United Kingdom for instance, 0.63% of homes (139,000 houses) in England & Wales are within 200m of 275-440 kV lines with 0.007% (1,700 houses) directly underneath the wires[1]. However, it must be made clear that this applies to 275-440kV transmission lines where the EMF fields are substantially less.

*Noise*

Transmission lines produce noise through the Corona effect and noise levels can be significant, especially in foggy, damp, or rainy weather conditions, when power lines can create a subtle crackling sound due to the small amount of the electric current ionizing the moist air near the wires.

The Corona effect can produce ozone and oxides of nitrogen in the air surrounding the conductor, especially in humid conditions. Corona consists of the ionization of air within a few centimetres immediately surrounding conductors. Ozone is a reactive form of oxygen and combines readily with other elements and compounds in the atmosphere.

---

Corona on transmission line conductors can cause interference with radio waves, primarily with AM radio stations and the video portion of TV signals, depending on the frequency and strength of the radio and television signal.

Interference with communications equipment is also caused by loose or damaged hardware on the transmission line itself and can be remedied by repairing equipment.

**Accidental events**

The most common types of accidental events with transmission lines are toppling of towers (frequency in the order of 1 event per year for older designs) and breakage of transmission wires (frequency >10 events/year). If a wire breaks normally it makes a short circuit and the power is disconnected. Tower toppling can occur in high winds or, more often, from the theft of nuts and bolts and consequential weakening of the structures.

Normally the main consequences of tower toppling, wire failure and fires are not significant. The size of the sanitary protection zone provides enough distance to ensure that people do not get harmed.

**Maintenance**

The main part of service is maintaining the protected area of the transmission line especially in croplands, with the cutting of vegetation, lopping branches and maintaining ground cover around the tower bases. The integrity of line is normally visually inspected once a year. If any problems are revealed, the line is disconnected and repaired at times when the electricity demand is low.

**4.3.10 Decommissioning**

The expected field life of a transmission line is approximately 50 years. No decommissioning of 500 kV lines has been carried out in Egypt as yet, but it is expected that the decommissioning process will be essentially the reverse of the installation process, with opportunities for reducing the environmental impact and offsetting cost by re-using or recycling materials.
5. DESCRIPTION OF THE ENVIRONMENT

5.1 PROJECT LOCATION

The study area is located in the stretch between Zahraa Al-Maadi and the west Samallout area in the Nile Valley, along the areas of Helwan, Es-Saff, Wadi Ar-Rashrash, Jabal Humr Shybun, Beni-Sueif, Wadi Sannur, Jabal Al-Mirayar, Jabal Al-Ahmar, Beni-Mazar and Samallout. These areas belong successively to four consecutive Governorates namely, Cairo, Giza, Beni-Sueif and El-Minya.

It is easily to drive along the high way from Zahraa Al-Maadi in the North to Samallout in the Nile Valley in the southwest (North of El-Minya City).

Figure-11 illustrates the main 10 areas located in the 4 Governorates, namely (from the North to the South) Cairo, Giza, Beni-Sueif and El-Miya.

5.2 PHYSICAL ENVIRONMENT

5.2.1 Regional Climatic Conditions

This section describes regional climatic conditions in the entire area of the interconnecting transmission lines of the Helwan South power project.

The Cairo-El-Minya elongated area is characterized by a sub-tropical desert climate with predominantly very hot summers, mild winters, and generally dry and sunny conditions. Rainfall events are rare and occurrences of gales, thunderstorms, and dust storms are occasional.

The climate of the region is caused primarily by the sub-tropical high pressure belt that is prevalent in this area, leading to clear skies for most of the time. The prevailing winds are northerly and can become strong during the winter. The northerly winds are caused by a sub-tropical high pressure cell in the western desert of Egypt during the winter months and by the western edge of a huge Asiatic low over northwestern India during the summer. The sparse rainfall in this area usually falls in the form of showers during the cold season (December, January, February) while under the influence of cold upper level troughs to the north. The highest temperature generally occurs in June through August when tropical continental air masses arrive from western Syria and Iraq on northeast winds while the lowest temperatures are recorded in January and February as polar continental air masses to the north are dragged down in the rear of winter Mediterranean depressions. Relative humidities remain low for most of the year reaching a maximum in November and December or January and a minimum in April and May or June.
Figure-11

Maps Names of the Areas which Accommodates the 500 kV Transmission Lines Routes for Interconnecting Helwan South Power Project

Scale: 1:50,000
Summaries of climatic variables for the region are available from meteorological data collected at four meteorological stations along the route distance of the electrical interconnecting lines. The meteorological data furnish wind speed, wind direction, temperature, pressure, precipitation and relative humidity information that are considered to be representative of the entire route sites.

A 35-year Helwan South (the mid-point of the Route) data base (1975-2010) indicates a prevailing northerly wind at the site (35 percent from North quadrant) with a secondary maximum of winds from the North quadrant (32 percent) followed by North-North-easterly winds (23 percent) and winds from the North-North-West quadrant (18 percent) and then westerly-southerly winds and other directions (8.4 percent). Calm and variable winds occur approximately 18.6 percent of the time. Wind speeds and directions measured for 2010 are shown on the Wind Rose in Figure-12. Wind speeds are generally light to moderate with an annual-average speed of approximately 4.23 meters per second and rarely exceed 5.0m/sec.

The temperature data collected at Helwan for a 35 year period indicate a maximum daily-average temperature of 34.9°C in July and a minimum daily-average temperature of 7.5°C in December. Summertime high temperatures average 34.1°C while winter lows reach 8.6°C. The annual-average temperatures is 21.6°C with record highest and lowest temperatures of 47.5 and 7.5°C, respectively.

Air pressure in the Helwan area remains generally high throughout the year. The mean atmospheric pressure value decreases gradually from December (1019.1 mbar) to July (1008.6 mbar) before rising again to reach 1019.1 mbar during December.

The annual rainfall precipitation does not exceed 25 mm. Rain falls showers and varies considerably from year to year. Generally, the rainfall is scarce over most of the year and occurs occasionally in the form of sudden and short signals associated with the northwest wind.

Annual mean of relative humidity is about 46% with maximum value of 69% in November and minimum value of 46% in May. Relative humidity does not vary greatly through the year, staying between 46-58% at none and between 59-69% in the morning and in the evening.

Natural evaporation rate ranges from 3.9 mm/d in January to 5.8 mm/d in May. It means that the evaporation rate is high from March to October and is low in winter season.
Figure-12

Wind Rose of Helwan South
(Helwan Meteorological Station, 2010)
5.2.2 Regional Geomorphic Features

- **Dissected Plateau:**
  This plateau overlooks the Nile to the east assuming a relief of 305 m. over the pediments to the west. The plateau is very irregular in outline and striking, generally in a north-south trend. Several embayment's and their corresponding promontories distinguish the rim of the plateau. The embayment may cut back in the plateau surface for a distance of 3 km. The most important of these embayment's is occupied by Wadi Abu Tarefei which runs west northwest-east southeast for a distance of 3.5 km. Northwards, another major embayment is distinguished which is occupied by Wadi Soraka. Enclosed between these two embayment's a major promontory, known as Gebel Hormret Sheiboun is located. This promontory stretches westward towards the Nile and is separated from its bank by only 7.5 km. Gebel Hormret Shaiboun has the highest altitude in the area, 334 m above sea level and has a relief of 171 m, all over the pediment surface (the upper pediment). South of Gebel Hormret Shaiboun, the plateau recesses back, eastward, and has a smooth outline displayed as a major arc. This arc terminates nearly at the area of Wadi Sanur. Many wadis drain the plateau surface and run along the scarp face crossing the pediments to the Nile. The general trend of these wadis is east-west and the drainage system is parallel to sub-parallel. The plateau is covered by marl and limestone beds, assuming 177 m. in thickness, exposed both over the pediment surface and at the scarp face.

- **Pediments:**
  Two main rock-cut pediments are distinguished in the area namely, the upper and the lower pediments.
  - **The Upper Pediment** stretches parallel to the scarp face bounding the plateau.
  - **The Lower Pediment** runs nearly parallel to the upper pediment and overlooks the Nile terraces to the west. In few places along its stretch, the pediment forms a scarp of 44 m. high above the Nile terraces.

- **Fan-glomerat:** These are found in 3 places in the mapped area, the northern fan is irregular in outline, covering 23.7 km². This fans has been formed by the coalescence of several wadis which fan out in this area depositing their loads before reaching the Nile. The sediments covering the fan are mainly conglomerates and loose sands.

- **Nile Terraces:** These make a thin strip along the Nile, 0.5 to 1 km wide. Most parts of these terraces are now cultivated and only very limited rocky places are desert. Nile mud and silt of variable thicknesses are recorded by drilling in these terraces.

- **Cultivated Lands:**
  The site is situated in the edge of the cultivated lands at the eastern bank of the River Nile. It forms the flat area which is a part from the Nile Valley. Many small villages (Ezzab / Kafr) are littered around the area.
• Sand Dunes:
  It extends in a longitudinal shape from the central part of Wadi El-Rayan Depression to the western margins of the Nile Valley flood plain opposite the Dayrut town in the south for a distance of about 185 km.

5.2.3 Geological Setting

A- STRATIGRAPHY

The exposed rocks fall into the following stratigraphic rock units from base to top (Figure-13):

The Eocene Rock Units (Te): The rock units exposed east of the Nile Valley can be classified into Middle and Upper Eocene units. Different formation are as follows:

1. Moqattam Formation:

This term was first introduced by Zittel (1883) to describe the limestone and clastic beds at Gebel Moqattam east of Cairo. The Middle Eocene, Moqattam Formation is highly fossiliferous with *Nummulites gizehensis*, *Lucina pharaonis* Ball, *Fish teeth*, *Operculina sp.*, and others.

2. The Qurn Formation:

This name was given by Farag and Ismail (1959), to a chalky limestone, sandy marl, and marly limestone, succession at Wadi Hof area near Helwan.

3. Wadi Hof Formation:

This is the third and top most unit of Farag and Ismail (1959), given by them to a series of marl and sandy limestone at Helwan area, south east of Cairo.

4. Abu-Zabaal Formation (To): It consists of basalt flow in the form of basalt dyke west of El-Bahnasa -Ahnas area and trending in a North-West direction which parallel to the faulting system in the study area. The age was assigned to the Oligocene time.

5. Umm Raqaba Formation / Kom El-Shelul Formation (Tpl): This unit makes nearly the whole section of Gebel Umm Raqaba southeast of Beni Sueif which is a conspicuous butte at the southern part of the area covering an extension of 4.70 km².

6. Idfu Formation (Q1): The Idfu Formation (Gravels) represents the early fluvialite deposits during the Protonile phase. The formation mainly consists of gravels and coarse sands.
# Figure-13

Stratigraphical Composite Columnar Section

<table>
<thead>
<tr>
<th>Age</th>
<th>Formation</th>
<th>Thick m.</th>
<th>Lithology</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quaternary</td>
<td>Wadi Deposits</td>
<td>5</td>
<td></td>
<td>Sand and gravels</td>
</tr>
<tr>
<td>Pleistocene</td>
<td>Nile Sediment</td>
<td>3</td>
<td></td>
<td>Silt, fine sand</td>
</tr>
<tr>
<td></td>
<td>Armant &amp; Issawia</td>
<td>10</td>
<td></td>
<td>Gravel and coarse sandstone</td>
</tr>
<tr>
<td>Pliocene</td>
<td>Kom El-Shellul</td>
<td>5</td>
<td></td>
<td>Yellowish brown gritty calc. sandstone</td>
</tr>
<tr>
<td>Eocene</td>
<td>Wadi Hof</td>
<td>22</td>
<td></td>
<td>Fossiliferous, calcareous sandstone and claystone</td>
</tr>
<tr>
<td></td>
<td>Wadi Garawi</td>
<td>44</td>
<td></td>
<td>Limestone, marls, and shales, poorly fossiliferous</td>
</tr>
<tr>
<td></td>
<td>Qurn</td>
<td>70</td>
<td></td>
<td>Marly and chalky limestone with shales and sandy marl</td>
</tr>
<tr>
<td>Middle</td>
<td>Observatory</td>
<td>77</td>
<td></td>
<td>White to yellowish y massive limestone , highly fossiliferous</td>
</tr>
<tr>
<td></td>
<td>Gebel Hof</td>
<td>120</td>
<td></td>
<td>Limestone and chalky limestone with Nummulite gizehensis</td>
</tr>
</tbody>
</table>
7. **The Qena-Dandara Formation (Q2):** It is the most extensive and important unit for the groundwater aquifer in the Nile Valley and Delta. It consists of fluvialite sands.

8. **Abbassia Gravel (Q2):** It has a wide extension on the surface and limited extension in the subsurface.

9. **The Debira-Arkin Formation (Q3):** This is the youngest unit which represents the flood plain deposits of the famous fertile alluvial land of the modern River Nile.

10. **El-Khafoug Formation (Q3):** The dune field of Wadi El-Rayyan represents the third cycle of dune movement in west Minia region in which the Aeolian sand dune remains known as El-Khafoug Formation of Said, 1981, inter-finger both the Prenile deposits of the Middle Pleistocene (ending 200,000 BP) and the Neonile sediments of Late Pleistocene estimated to be 12,000 - 20,000 BP.

11. **Aeolian Sand (Qd):** It extends in a longitudinal shape from the central part of Wadi El-Rayyan Depression to the western margins of the Nile Valley flood plain opposite the Dayrut town in the south for a distance of about 185 km.

### 5.2.4 Ground Water Resources

Due to the continuity of the water bearing formation, there is an east-west and west-east groundwater flow from the reclaimed area (high in elevation) to the flood plain aquifer. Little of this flow is intercepted by the drains, so the flood plain aquifer is continuously recharged. This causes upward leakage and waterlogging of the original Nile Valley lands.

Referring to the Hydrogeological Map of Egypt, the groundwater conditions and the aquifer geometry can be summarizing as in the following:

1. **The Nile Valley aquifer system (Qena Formation) of semi-confined type is underlain by thick clay beds (Pliocene rock unit) which act as aquiclude. It consists mainly from sands, gravels and silt.**
2. **The Quaternary fluviatile and fluvio-marine sand and gravel with interbeds of clay and having a thickness of about 60 m. Most of the shallow water wells are restricted to the top most part of this aquifer.**
3. **Fissured Carbonate Aquifer System:** This aquifer is mainly consists of thick fractured limestone and dolomite of the Middle Eocene rock units. The depth to the water bearing beds ranging from 100 - 150 m. from the ground surface while the water level is about 90 m. from the level of the ground surface.
4. **Irrigation:** The irrigation water is free of charge and readily available for almost all lands that officially declared as agriculture land. The irrigation system in the study area is combined to the gravity and water lifting system. Some wells were located in the new cultivated and Urban areas.
5. **Drinking and domestic:** All water for drinking and domestic purposes are processed and treated Nile water.
5.2.5 Natural Hazards

The area usually suffered and threatens by the main natural hazards; flash flood, earthquake and sand dune encroachment.

A. Flash Flood:

The climate of the Nile Valley is characterized by aridity typified by very low rainfall, high evaporation rate and high summer temperature. Nevertheless, the region is occasionally subjected to heavy rainstorms that commonly followed up by floods. These may cause disastrous impacts on life, roads and settlements.

The system of natural drainage of the area is remarkably simple, but little rain, as is well known, falls in central and southern portions. The rain-channels are dry during the greater part of the year and vary in length according to the season.

B. Earthquakes:

The area under the consideration is located within the Unstable Shelf. The historical information indicated that many earthquakes caused severe damage in the northern part of Egypt. Some of these events are related to the convergence between the African and Eurasian plates while the others are located within the plate itself. Epicenters of the historical activity are located in some specific areas, which are tectonically active. Very important information about the tectonics of Egypt can be obtained from the distribution of seismic activity. According to Mahmoud, 2003, Egypt may be divided into eight seismic zones according to its seismicity maps. In the Egyptian territory, the distribution of epicenters of moderate to large and small earthquakes and micro-earthquakes indicates that the earthquake activity tends to occurs along three main seismically active belts and trends.

5.2.6 Background Air Quality

Air Quality Monitoring along the Entire Route

Concentrations of ambient pollutants vary according to both time and location. They are affected by many factors, the most significant being the size, number and location of emission sources and the prevailing weather.

Air quality monitoring at the proposed site was undertaken by the Air Pollution Preclusion Department, National Research Center during February 2012 on behalf of ECG. Monitoring took place at Nine monitoring sites along the entire route, namely Helwan, Es-Saff, Wadi Ar-Rashrash, Mid-area between Jabal Humr Shaybun & Beni-Suef, Wadi Sannur, Jabal Al-Mirayr, Jabal Al-Ahmar, Beni-Mazar and Samallout.
Continuous measurements, over a period of 24 hours, were taken for nitrogen oxides (NOx), carbon monoxide (CO), carbon dioxide (CO2), sulfur dioxide (SO2), aldehydes (HCHO), hydrogen sulfide (H2S), smoke and total suspended particulates (TSP). The results of this monitoring are shown in Table-5 and Table-6 below. Comparison with Egyptian Threshold Limit Values (TLVs) (as stipulated in Law 4/1994) show that the concentrations of gaseous pollutants in ambient air along the proposed route are within the TLVs for 24 hour averages.

### Table-4

**Mean Concentrations of Gaseous Air Pollutants along the Entire Route**

<table>
<thead>
<tr>
<th>No.</th>
<th>Site</th>
<th>CO mg/m3</th>
<th>CO2 mg/m3</th>
<th>SO2 µg/m3</th>
<th>NO2 µg/m3</th>
<th>HCHO µg/m3</th>
<th>H2S µg/m3</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.</td>
<td>Es-Saff</td>
<td>1.14</td>
<td>64.15</td>
<td>17.97</td>
<td>26.62</td>
<td>28.31</td>
<td>8.33</td>
</tr>
<tr>
<td>3.</td>
<td>Wadi Ar-Rashrash</td>
<td>2.22</td>
<td>69.32</td>
<td>32.66</td>
<td>46.3</td>
<td>20.21</td>
<td>30.95</td>
</tr>
<tr>
<td>4.</td>
<td>Jabal Humr Shaybun/Beni-Sueif</td>
<td>0.95</td>
<td>59.02</td>
<td>61.28</td>
<td>58.32</td>
<td>26.4</td>
<td>6.86</td>
</tr>
<tr>
<td>5.</td>
<td>Wadi Sannur</td>
<td>1.91</td>
<td>44.11</td>
<td>35.13</td>
<td>27.12</td>
<td>25.12</td>
<td>9.18</td>
</tr>
<tr>
<td>6.</td>
<td>Jabal Al-Mirayr</td>
<td>2.17</td>
<td>31.12</td>
<td>32.17</td>
<td>21.15</td>
<td>47.31</td>
<td>14.18</td>
</tr>
<tr>
<td>7.</td>
<td>Jabal Al-Ahmar</td>
<td>1.88</td>
<td>41.77</td>
<td>29.41</td>
<td>23.62</td>
<td>57.11</td>
<td>15.17</td>
</tr>
<tr>
<td>9.</td>
<td>Samallout</td>
<td>1.17</td>
<td>48.30</td>
<td>27.18</td>
<td>28.59</td>
<td>68.61</td>
<td>4.75</td>
</tr>
</tbody>
</table>

**EEAA TLV\***

<table>
<thead>
<tr>
<th></th>
<th>µg/m3</th>
<th>µg/m3</th>
</tr>
</thead>
<tbody>
<tr>
<td>JL (8-hr mean)</td>
<td>150</td>
<td>150</td>
</tr>
</tbody>
</table>

**Notes:**

- Not listed in the law.

CO= Carbon monoxide  CO2= Carbon dioxide
SO2= Sulphur dioxide  NO2= Nitrogen dioxide
H2S= Hydrogen Sulphide  HCHO= Aldehydes

### Table-5

**Mean Concentrations of Solid Air Pollutants along the Entire Route**

<table>
<thead>
<tr>
<th>No.</th>
<th>Site</th>
<th>Total Suspended Particulate µg/m3</th>
<th>Smoke µg/m3</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Helwan</td>
<td>177.85</td>
<td>45.11</td>
</tr>
<tr>
<td>2.</td>
<td>Es-Saff</td>
<td>211.91</td>
<td>89.53</td>
</tr>
<tr>
<td>3.</td>
<td>Wadi Ar-Rashrash</td>
<td>199.33</td>
<td>68.13</td>
</tr>
<tr>
<td>4.</td>
<td>Jabal Humr Shaybun/Beni-Sueif</td>
<td>123.51</td>
<td>52.21</td>
</tr>
<tr>
<td>5.</td>
<td>Wadi Sannur</td>
<td>155.83</td>
<td>59.71</td>
</tr>
<tr>
<td>6.</td>
<td>Jabal Al-Mirayr</td>
<td>115.91</td>
<td>39.43</td>
</tr>
<tr>
<td>7.</td>
<td>Jabal Al-Ahmar</td>
<td>145.49</td>
<td>53.74</td>
</tr>
<tr>
<td>8.</td>
<td>Beni-Mazar</td>
<td>77.18</td>
<td>29.47</td>
</tr>
<tr>
<td>9.</td>
<td>Samallout</td>
<td>115.62</td>
<td>33.95</td>
</tr>
</tbody>
</table>

**TLV**

<table>
<thead>
<tr>
<th></th>
<th>µg/m3</th>
</tr>
</thead>
<tbody>
<tr>
<td>230</td>
<td>150</td>
</tr>
</tbody>
</table>

**Notes:**

5.2.7 Background Noise Level

The measurements were carried out at both of the Zahraa Al-Maadi S/ST and Samallout S/ST locations with precision sound level meter type B&K. All of the instruments used conform to IEC651 Type 1 accuracy.

Measurements Conclusion at Zahraa Al-Maadi indicate that:
- For the current situation the sources is very limited only noise comming from the wind.
- All 1/3 octave analysis indicate normal reading for the noise level not exceeding the expected values around the area.
- The direction of the wind will help reducing noise level.

Measurements Conclusion at Samallout indicate that:
- For the current situation based on the nearby activity the sources is basically noise comming from the traffic.
- The area down to the proposed line have some small village is considered to be a residential area having some framers that works in villages.
- All 1/3 octave analysis indicate normal reading for the noise level not exceeding the expected values around the area. apart from low range generated from irrigation equipments.
- The direction of the wind will help reducing noise level on that villages
- There will be no effect on the power line on the residential area from noise point of view.
- Most line alignment are some distance from residential areas.

5.3 BIOLOGICAL ENVIRONMENT

5.3.1 Wild Life

The area of the study is generally characterized by low vegetation and some desert wild plants, while most of the area was planted by many crops.

A. Plants and Vegetation:

The soil appears generally dry sandy with some salt affected area. This sand layer covered by dry loose sand in depth ranges from 10-800cm. The dominant plant species are salt excreting as *Tamarix tetragyna*, or succulents as *Cornulaca monacantha*, these species can adapt such environmental conditions.
Wild Plant Species

- Tamarix tetragyna (Tamaricaceae), perennial shrub up to 5m, grow in sandy soil, salt marshes, wet lands, and edges of saline waste lands. This species is the dominant species in the studied area.
- Sarcocornia fruticosa (Chenopodiaceae), Small shrub up to 80 cm high. Succulent salt tolerant species.

B. Reptiles

Many reptilian species are known to occur in this area. In the relatively flat, sand or gravel desert around the studied site, Saber (1989) listed 30 desert dwelling reptilian species. Most abundant of these were Acanthodactylus scutellatus, A. boskianus, Trachelus flavimaculatus, Scincus scincus, Chamaeleo chamaeleon, Varanus griseus, Psammophis schokari, Spalerosophis diadema and Cerastes viper a. In wadis draining the limestone plateau in the northern sector of this desert, common reptiles include Ptyodactylus guttatus, Acanthodactylus boskianus, Uromastix aegyptius, Chamaeleo camaleon, Coluber rhodorchachis, Walterinnesia aegyptia and Cerastes cerastes . In the southern part of this inland desert Ptyodactylus hasselquistii, Pseudotrapelus sinaitus, Trachelus flavimaculatus, Uromastix ocellatus, Mesalina guttulata, M. rubropunctata and Cerastes cerastes are the characteristic reptiles.

C. Birds

Many birds of resident avifauna of this desert is composed of y species of ‘true desert birds’ (Baha el Din and Saleh, 1983), such as Hirundo rustica savignii, Motacilla flava pygmaea, Galerida cristata maculate, Lanius collurio collurio, Acrocephalus arundinaceus arundinaceus, Prinia gracilis gracilis, Phylloscopus sibiricu, Sylvia curruca curruca, Ficedula parva parva, Oenanthe oenanthe oenanthe, Cursorius cursorius, Pterocles coronatus, P. senegallus, Ammonites cincturis, A. deserti, Alaudipenis, Oenanthe lugens, O. leucopityga, Scotocerca inquisita, Corvus ruficolis, Bucanetes githa-gineus and Emberiza striolata.

Falcon Birds are rarely observed in the study area, however mitigation measures are to be taken to prevent bird collision with the OHTL (see Chapitre 7).

Most of the line routing locate on the desert areas (88%), where no nesting locations exist atall. The rest of the route (12%), which is located in the agricultural area of the Samallout zone, doesn’t include nesting locations as it is totally extended on the green flat cropland.

D. Migrant Birds

The Nile Valley with its abundance of water and food available for birds, provide an important, relatively, easy and safe route for trans-Saharan, palearctic migration. Huge numbers of individuals of many species utilize this route during
both spring and autumn migrations. The region also provides wintering habitats for large populations of many palearctic migratory species (Goodman et al., 1989).

However, TL route is not located on the migration route of migrating birds. Only a very limited part crossing the Nile River at the Samallout zone may intersect the TL route. A recent JICA study is conducted for identifying bird migration characteristics in El-Minya area and the outcome of this study is expected to be announced by the end of 2013. These outcomes of the study will be put into consideration regarding TL operation in the Samallout Zone.

E. Mammals

Rodents form the largest mammalian group of the area (Table 3), being represented by many species and the most common species - besides of course the normal cats and dogs- are the Field Rat *Arvicanthis niloticus* and the Black Rat *Rattus rattus*, which are nocturnal and feed on vegetables and seeds. Burrows are shallow and usually under shrubs.

Many Foxes were recorded in areas around the River shore. Individuals and their tracks were seen throughout the area, where it seems to inhabit date and fruit groves, cultivated areas and suburban gardens, commonly seen during daylight hours. It feeds on birds, rodents and insects. It is widespread around drains of Nile banks and Valley. However, wild carnivores have suffered a great deal of decline in the recent years as a result of secondary poisoning with pesticides widely used to control *Arvicanthis niloticus* and other rodent pests.

The Giant Musk Shrew; *Crocidura flavescens deltae*, was also recorded in many areas around the lake shore.

River Nile Bank

The Nile Valley is typical river oasis. The narrow cultivated valley is bordered by escarpments of limestone. The river runs closest to the eastern cliff boundaries at the Qena bend. Adjoining the river's western flood plain just south of the latitude of Cairo is the Faiyum Depression with its 1700 km² of fertile land. The depression receives its water mostly from the Nile via Bahr Yusef canal, which is a natural branch of the Nile in addition to a number of man-made canals.

Plants and vegetation:
River Nile Bank ecosystem is usually divided into 3 habitats; slope, water-edge and open-water of the Nile Bank. Each of these habitats has its specific flora.

Slopes of the Nile
A total of 69 species were recorded in this habitat: 45 annuals and 24 perennials. The unique species are: *Plantago major*, *Amaranthus hybridus*, *Coriandrum sativum*, *Gnaphalium luteo-album*, *Lathyrus marmoratus*, *Phalaris paradoxa*, *Sisymbrium irio*, *Sonchus macrocarpus* and *Trifolium resupinatum*. The common species are: *Phragmites australis*, *Arthrocnemum macrostachyum*, *Sarcocornia fruticosa*, *Suaeda vera*, *Salsola kali*,...
Senecio glaucus subsp. coronopifolius and Sonchus oleraceus. The rare species are: Paspalidium geminatum, Atriplex halimus, Ipomoea carnea, Ranunculus seleratus, Cichorium endivia subsp. pumilum, Hordeum marinum, Medicago polymorpha and Anagallis arvensis.

**Water-edges of the Nile**

A total of 59 species were recorded: 19 annuals and 40 perennials including 6 hydrophytes. The unique species are: Clerodendrum acerbianum, Sida alba, Medicago intertexta var. ciliaris, Rorippa palustris, Setaria verticillata and Setaria viridis. The common species are: Phragmites australis, Sarcocornia fruticosa and Azolla filiculoides. The rare species are: Halocnemum strobilaceum, Inula crithmoides, Cynanchum acutum, Suaeda maritima, Centaurea calcitrapa, Sphaeranthus suaveolens, Tamarix tetragyna and Anmmi visnaga.

**Open-water of the Nile Bank**

A total of 14 species were recorded in this habitat. The common species are: Phragmites australis, Eichhornia crassipes, Ceratophyllum demersum, Azolla filiculoides and Echinocloas stagnina. The rare species are: Arthrocnemum macroschatium, Sarcocornia fruticosa, Lemna perpusilla, Potamogeton crispus and Salsola kali.

Among the noteworthy species in this habitat are two species that cause severe infestation to the water ditches of Egypt:

1. **Phragmites australis.** An emergent aquatic that is a boon and bane to man. It causes severe infestations to the water bodies that hinders the navigation and lead to the fragmentation of the water body. It plays also an important role in increasing the silting process in shallow drains. On the other hand the plant had a long history of use by man as building material for houses and rafts (e.g. Egypt), as thatching (e.g. England), fodder (e.g. Egypt and other countries). It can be used also as paper pulp and source of bioenergy. Australian and German scientists found this plant to be an effective biological filter for wastewater renovation. The plant also is a source of organic matter and safe refuge for the fish and rests for the birds particularly during winter.

2. **Potamogeton pectinatus.** It is the most dominant submerged plant in the River Nile, tolerant to wide salinity variations but with a tendency or better growth in slightly brackish water. It is also a common aquatic plant in inland waters of Egypt, where it inhabits both stagnant and running waters. This plant usually dies off in autumn, leaving the rhizomes and winter turions to persist in mud till the next spring when new plants start to sprout.

**Fishes**

The occurrence of different habitats along the Nile Bank resulted in a large variety of fish species inhabiting these ecosystems. Tilapia zillii is widely distributed in this habitat on account of its high tolerance to environment; while Oreochromis niloticus was the second common species of cichlids as well as Clarias gariepinus Sarotherodon galilaeus and another cichlid, Hemichromis bimaculatus, avoid salty
water. Their occurrence was restricted to areas of low chlorosity. The introduced species *Gambusia affinis* shows a similar wide distribution.

Fishermen use usually traps to catch fish along the Nile Bank, which are set among aquatic vegetation, such as *Phragmites*, *Potamogeton* and *Ceratophyllum* beds. In open water free from vegetation, the traps are either fixed to the bottom by bamboo sticks or in rows among an artificially made barrier. The barrier is usually made from bamboo sticks with gaps at intervals into which the traps are placed.

The traps which are very commonly used to catch mainly *Tilapia*, may also catch mullet fishes. The mesh bars of the traps usually range from 14 to 50 meshes in 50 cm. On the other hand, the traps are used to catch fishes which are trapped behind an artificial muddy barrier. Traps with relatively narrow meshes are set in openings through the muddy barrier.

**Protected Areas**

No protected areas for their conservation value are located on the proposed project area. The proposed route itself and the surrounding land are poorly vegetated with much of the area having been disturbed by mine clearance (Figure-14).
Figure-14

The Natural Protectorates Map of Egypt

Source: Egyptian Environmental Affairs Agency (EEAA), 2012.
5.4 SOCIO-ECONOMIC ENVIRONMENT

5.4.1 Basic Information about the Project Sites

Cairo Governorate

The foundation of Cairo city dates back to 358 H / 969 AD by the Fatimid leader Gawhar El Sekly who laid the foundation of the city in the north of "Fustat" where it took him three years. He named it for Al- Mansureya then later came the Caliph- El Muez Ledeen El Lah El-Fatmy - to rename it El Qahirah "Cairo", the vanquisher, and made it the capital of his State. The city's total area at that time covered 340 feddans(Figure-15).

Cairo is privileged with a unique strategic location that qualified it to be the political capital of Egypt (Figure 5-89), besides its idiosyncrasy as a cultural, artistic, scientific, and historical capital of the Arab and the Islamic world. The governorate is one of Greater Cairo Region that includes Cairo, Giza, and Qalyubiya governorates.

Cairo's total area covers 3085,12 km². It is considered one of the governorates which comprises a sole city, and by large the biggest Arab city and the most populated in Africa and the Middle East.

According to the preliminary results of the 2006 census, Cairo is inhabited by 7.8 million people and visited by 2 million Arabs, Foreigners, and Egyptians daily either for health treatment, tourism, or for business.

In dealing with the population growth problem in Cairo, the New Urban Communities Authority - an affiliate to the Ministry of Housing - embarked on extension in desert and built new cities as New Cairo City, the closest city to Cairo, and one of the third generation cities that was established by virtue of presidential decree No 1991/2000.

The governorate hosts several industrial zones that make it a haven attracting capital, which could be invested to develop the national industry and enhance its competitiveness on the local and international levels. Some of these industrial zones are located in El Basateen, El Waily, Heliopolis, Helwan, and the duty free zone in Naser City, as well as in the new industrial zones in the newly established cities namely; Obour, Qatameyah, Badr, and El Amal. The governorate has a solid base of strategic and consumer industries such as iron and steel, cement, military equipment, electric appliances and cars, as well as textiles and ready-made clothes.
Giza Governorate

Giza governorate is one of the Greater Cairo Region that includes Cairo, Giza, and Qalyubiya governorates. It was established in year 20 Hegiri with the early Islamic conquest of Egypt (Figure-16).

The total area of the governorate covers 13184 km², representing 1.3% of the Republic's area (Figure 5-90). The governorate encompasses 10 Marakz, 12 cities, 7 districts, 51 rural local units annexed by 171 villages, and 636 hamlets.

According to the preliminary results of the 2006 census, population is 6.3 million people; 58.6% of them live in urban areas, and 41.4% in rural areas and population natural growth rate has reached 19.3 per thousand.

Beside being an agricultural governorate, Giza is also considered an industrial one as it hosts many industries such as: food, spinning and weaving, basic metals, engineering and electronics, as well as mining. Moreover, the governorate hosts two industrial zones; one of them is located along Cairo-Alexandria Desert Road and has big industrial companies. In addition to that, the governorate hosts many new projects such as the under construction new Egyptian Museum, the Smart Village, and the third underground line.

In addition, the governorate has the sound and light project and several museums and gardens that attract internal and bound tourism such as: Naggy Museum, the Zoo, the Agricultural Museum, and the Modern Arts Museum, in addition to entertainment places in El Haram street, besides the Media Production City in 6th of October City.

Beni Suef Governorate

Beni Suef governorate is located in the North Upper Egypt Region that encompasses Giza, Beni Suef, and Minya Governorates (Figure-17). It is known for its rural style. The governorate covers an area of 10954 km² representing 1.08% of the Republic's total area. It comprises 7 Marakz, 7 cities, and 39 rural local units annexed by 222 villages and 690 hamlets. According to the preliminary results of 2006 census, the population is about 2.3 million; 23.3% of them live in urban areas, and 76.8% in rural areas. The population natural growth rate has reached 21.9 per thousand. Beni Suef is an agricultural governorate. The cultivated areas cover 279.8 thousand feddans. Major crops are: wheat, cotton, sugar cane, in addition to medical and aromatic plants. Arable agricultural lands amount to 63 thousand feddans.

The governorate contributes to the industrial activity through big industries such as cement, clay bricks, and textiles, besides small industries such as: carpets, and
handmade carpets. Furthermore, it hosts zones for light industries, and another for medium industries as well as small industries complex.

**El-Minya Governorate**

El-Minya governorate is located in the North Upper Egypt Region that encompasses El-Minya and Beni Suef governorates (Figure-18). It is characterized with its rural style. El-Minya is known as the beautiful bride of Upper Egypt. The governorate covers an area of 32279 km², representing 3.2% of the Republic's total area. It comprises 9 Marakz, 9 cities, 61 rural local units, 360 villages and 1429 hamlets. According to the preliminary results of the 2006 census, the population is estimated at 4.2 million; 18.8% of them live in urban areas and 81.2% in rural areas. The population natural growth rate has reached 22.8 per thousand. The governorate moved towards the expansion into the desert and established new urban communities such as New Minya City and is expected to achieve human and economic development (urban, agricultural, and tourist). Minya is an agricultural governorate with estimated cultivated areas of 472.7 thousand feddans. Cotton, wheat, onion, and sugar cane are the major crops. Besides being an agricultural governorate, it has made major strides in industry, particularly in food processing, spinning and weaving and chemicals, in addition to the establishment of an industrial area in the East of the Nile, 12 km south of Minya bridge. The area was mapped out and divided into nine industrial zones, along with establishing the small enterprises complex as well as the main and secondary services centers taking into consideration environment friendly standards.

### 5.4.2 Basic Demographic Characteristics

The total population of Cairo Governorate is 7.786.6 million person among which 49.3% are females. The average of family members is 3.8 person. While Giza propulsion is 6.490.8 million. Females represent 48.5%. the average family size is 4 persons. The total population of Minya is estimated with 4.179.3 million among which 49.0 are females. The average family size is relatively high 4.6 persons. The total population in Beni Suef is 2.371 in Beni Suef. Density rate and female percentage is almost exactly like Minya.

The natural growth rate is higher in Minya as it represents 22.8 followed by Beni Suef 21.9 and Giza 19.3. the lowest natural increase reported was in Cairo 16.1.

### 5.4.3 Access to Basic Services

**a. Access to Electricity**

Access to electricity in Upper Egypt is high at (99.0%) (EHDR 2010). That is primarily due to the care given to improve living conditions for people in Egypt.
in particular access to electricity. Even squatter areas have access to electricity regardless of their formality and legality. That indicates to the stability of infrastructure in most of areas.

The census showed that the majority of households use electricity as the main source of light represent 98.8% of the population in Beni Sueif and 98.5% in Minya. Regarding Cairo and Giza almost 99.0% of the population use electricity.

b. Source of Potable Water

The four governorates depend almost entirely on Nile water for all its water needs whilst ground water, which is extremely saline and brackish in nature, is not used for drinking water purposes and is only partially used for irrigation in some areas.

Accessibility to potable water is high in Cairo and Giza while it is lower in Beni Suef and Menya, indicating the well being of community there. The high rate of access to potable water is mainly due to the Government's clear prioritization of water quantity and quality issues. Most households have easy access to water (tap water in dwellings) (68.8% in Beni Suef and 60.14% in Menya). Not only that, the type of source of water available reflects the well being of the house conditions as it is mainly tap water inside the unit. Few percentage reported using other types i.e. wells or pumps. However, it is worth mentioning that the quality of water supply is poor as water in some area has bad smelling and colored.

c. Sanitation

Access to a proper Sewage System is not high in both governorates, with a connectivity rate of (13.0%) in Minya and (13.1%) in Beni Suef (CAPMAS 2006). That is consistent with the low connectivity reported in upper Egypt which is less than 37.2% (EHDR 2010).

The main sanitary system reported was the septic tank which represents (84.0%) in Beni Sueif and (80.1%) in Minya Governorate. The septic tanks cause so many environmental problems to the community people and affects their standard of health conditions.
Figure-15

Administrative Map of the Cairo Governorate

Cairo Governorate
Figure-16

Administrative Map of the Giza Governorate

Giza Governorate
Figure-17

Administrative Map of the Beni-Sueif Governorate

Bani Swaif Governorate

Source: Egypt Description by Information 2009.
Figure-18

Administrative Map of the El-Minya Governorate

منطقة المنيا
Menia Governorate

Source: Egypt Description by Information 2009.
5.4.4 **Human Development Profile**

*a. Work Status*

Labor force is an important indicator for any socio-economic study. In Minya (35.4%) of the population are in the labor force among which (31.4%) are females. Minya is famous for agriculture, such types of work might need more manpower. Therefore, (56.1%) of the labor force work in agriculture. While, (12.8%) of the labor force works in industrial sectors, whilst, (29.1%) work in services sector. Professional and technical staff represents (9.1%) of the laborers.

The data reported in Beni Sueif is identical to some extent with Minya data as (36.0%), of the total population are in the labor force among which (33.7%) are females. (55.1%) work in the agriculture sector followed by services (29.3%) and 15.6% in industrial fields. The professional and technical staff is a little bit higher as they represent about (12.0%) in Beni Sueif.

*b. Economic Wellbeing*

In 2010, EHDR reported that the real gross domestic product (GDP) per capita is 8857.4 in Beni Suef, 8655.9 in Minya and 7787.0 in Egypt. This means that gap between the two governorates and Egypt is relatively high.

5.4.5 **Land Types**

1. **Type of Lands in the Area**

The majority of lands in the populated areas (spots) are cultivated lands. However, few percentage was a lands suitable for construction. It was crucial to cover this issue on the level of governmental institutes. It was notable that the desert lands are divided into two types:

1. the desert areas that is located close to the cultivated lands
2. the desert areas located along the Western Road.

The near desert areas are:
- Facilitated with different services (electricity, water supply ...etc)
- Potential jobs

The far desert areas are:
1. Completely empty desert lands
2. Along paved road passes in parallel to it

The army constructed a good condition road that facilitate moving to and fro the governorates in upper Egypt (Beni Suef, Minya and Assuit).

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1. GDP per capita for Egypt is estimated from the National Income Accounts of 2006/2007. The estimated GDP per capita in local currency (LE) is transformed to its value in US$ using an appropriate exchange rate (taking into consideration the estimations of the Ministry of State for Economic Development). Then the real GDP per capita (ppp US$) is calculated by applying a suitable factor to the estimated GDP per capita in US$ (the factor used in the International Human Development Report for 2008). This resulted in a national GDP per capita index for Egypt of 0.727 in 2008.
2. Land Price

Many determinants work for estimating the land prices in the cultivated areas. In case of any expropriation the average prices of lands are as follow:

1- Owned cultivated lands 100,000 L.E: 250,000 L.E per Feddan.
2- Owned legitimate lands 200,000 L.E: 250,000 L.E per Feddan.
3- Owned illegitimate land 50,000 L.E: 100,000 L.E per Feddan.

According to the qualitative interviews the determinants of land prices are as follow:

1- legality of the ownership
2- type of lands (cultivated – desert)
3- Availability for source of water
4- Access to different facilities

3. Availability of Social and Political Institutes

Reviewing one of the recent quantitative study about the socioeconomic conditions in these areas, about 95.9% of the areas have some NGOs around, not necessarily in the areas, but at least they provide services to the residents. 87.80% of the areas have community development associations. About 50.0% of the sample reported having an NGO related to Muslims, while 31.6% of the sample reported having Christian NGOs in areas.

5.4.6 Land-use, Land-cover

Categories of land are defined according to the type of use: agricultural land, land for housing, nature protection land, recreation land, and land used by industries, etc. At this stage, detailed information on land ownership and land use in the RoW of the transmission line are being gathered by EETC. Such information will be completed during preparation of the working design documents when the construction contract has been tendered.

It is not foreseen that any of the activities of the transmission line project, or its attachments, would result in involuntary resettlement, particularly with most of the routing pathways of the electrical transmission lines (around 88% of its routing pathway) are located within uninhabited uncultivated State-owned desert lands and the rest (12%) of the route is located at cultivated lands with a very limited pieces of land to be occupied by transmission towers' footings against fair compensation and no alternative proposed routing other than the one selected is envisaged as shown clear in the map of the surveyed routes (see Figure-19 and Figure-20).
5.4.7 Cultural Environment

Archaeology / Cultural Heritage

During the project technical design the transmission line route was submitted to and approved by Government and Local Administrations of the Supreme Council of Antiquities. The result of the approval process was a clearance that the line route doesn't pass through any of the areas of importance in terms of antiquities and cultural heritage.

Aesthetics / Visual Impacts

The area crossed by the transmission line route is a relatively flat terrain partially covered by mixed cultivars. As such, there is little opportunity for using the natural landscape to limit the visibility of the tower structures.
Figure-19

Example of the Agriculture Land Covered the Area around the Nile River Parallel to the Transmission Line
Figure-20

Example of the Urban Land Covered the Area around the Nile River Parallel to the Transmission Line
6. ASSESSMENT OF IMPACTS

The objective of the impact assessment is to identify and manage the risks to the environmental and society that are expected from the proposed activities. The process involves:

1. Identifying all the hazardous and beneficial activities
2. Assessing the level or risk arising in terms of frequency (how likely is it to happen?) and consequences (how good or bad is it?)
3. Assessing the acceptability of the risk.
4. Introducing mitigation measures to reduce those risks at acceptable level.

The hazardous and beneficial activities were identified using a Checklist based on EU Guidelines\(^1\) to provide a systematic approach and help to make sure that nothing is missed. Given that the construction contractor has yet to be appointed, the construction methods described in the project description are used as the basis for the impact assessment, although some additional scenarios have been considered, such as the use of mobile construction camps.

The risk assessment has been based on the identification of environmental aspects and impacts so that it is consistent with the requirements of ISO 14001-2004, the international standard for environmental management systems. This format makes it easy to use the impact assessment in the implementation of the contractor’s environmental management system.

The environmental risk associated with the environmental impacts is then determined by estimating the likelihood of occurrence and the environmental consequences and assessed for significance as being High, Medium or Low. Mitigation measures are developed to reduce the risk and risks are then re-assessed. Table-1 show the risk levels before and after the introduction of mitigation measures.

6.1 HIGH RISK IMPACTS BEFORE MITIGATION

While the majority of the route only passes through uncultivated, uninhabited, state-owned desert lands and avoids known archaeological sites and cultural resources, agricultural areas will also be affected as 32km of the 280km route (11%) passes through cultivated land. The impact will be reduced where possible by using the space as a nursery for new vegetation. It is quite possible that there could be an overall increase in biodiversity from good management of the cultivated land. Fair compensation will be provided to land owners or users as per the Egyptian legislation.

\(^1\) Guidance on EIA: Scoping, issued by the European Commission in June 2001.
The main safety risk arises from construction traffic and the dangers to other road users, especially pedestrians. This will be managed by the implementation of a road traffic management with co-operation and agreement of all local councils and traffic police along the route, to select preferred routes and make provision for sensitive times like market days or school opening and closing.

There is a risk to human health from electromagnetic fields (EMF), from the length of the line and number of people who could be potentially affected. There are mixed views within the scientific community on the health risks from EMF. Egyptian adopted norms of the WHO take a precautionary approach to the size of the protection zones and, based on the current scientific understanding, the mitigated risks are assessed as low, provided exposure times beneath the wires are observed.

Transmission lines have a substantial physical presence and the visual impact can cause strong public reaction. The landscape over the route is very flat and there is little opportunity for reducing the visual impact from using the topography of the landscape, although the wide background will help to accommodate the visual impact.

6.2 MEDIUM RISK IMPACTS BEFORE MITIGATION

Payment for land compensation and loss of earnings was a key area of concern during the scoping consultation meetings. EETC will use the Egyptian norms to guide the valuation and compensation of land required for the tower bases and compensate for damage or loss of crops and/or earnings during construction. There are health and safety risks arising from electrocution and working at heights during operations that will be managed in line with EETC’s current safety management systems and emergency response plans. EETC will also continue to communicate and talk to stakeholders about the progress of the project and respond to concerns.

Most of the remaining risks arise from the activities of the construction contractor, who will develop management plans to implement the required mitigation measures in the following areas in line with the Egyptian legislation:

- **Environmental Management**: Reinstatement of access roads and construction sites. Avoiding the nesting sites of some particularly sensitive areas in the spring and autumn.

- **Rules of Conduct**: This sets out the contractor’s expectations for the construction workforce to ensure good relations with people affected by the
project and generate a positive attitude to safety and the environment. A rapid response plan will be developed to allow people to contact the contractor quickly if incidents arise that require immediate attention - like a broken fence.

- **Waste Management**: Use of Licensed waste disposal contractors and use of best practice to prevent oil spills
- **Safety Management**: Induction training for workers and visitors and the development of emergency response plans. Site security will be provided to prevent unauthorised access and theft of materials.
- **Archaeological Chance Finds**: Assessing the importance of new finds and contacting the concerned authorities, together with suitable training for the workforce.

### OPPORTUNITIES FOR POSITIVE IMPACTS AFTER MITIGATION

While much of the construction work, like the erection of towers can only be carried out by specialists, there will be opportunities to boost the local economy by employing local people in semi-skilled tasks (like driving and land clearing) and general labouring. Similarly, there are opportunities to contract out other goods and services like accommodation and catering. EETC will favourably assess tenders that demonstrate a high content of local goods and services, with appropriate penalties for failing to deliver.

### CUMULATIVE IMPACTS

Transmission lines generate very little pollution during operation and the main cumulative impacts arise from their physical presence. This is a linear project that covers 280 km and the main cumulative impacts arise from the interaction with other transmission lines and highways. A balance has been struck between following existing infrastructure corridors and avoiding environmentally sensitive areas and private land. There are no extensive areas of interactions with other transmission lines and the creation of a "wirescape" when different transmission systems converge.

A summary of high risk impacts, medium risk impacts and positive environmental impacts is given in Tables-6, 7 and 8.
<table>
<thead>
<tr>
<th>No.</th>
<th>Aspect</th>
<th>Impact</th>
<th>Context</th>
<th>Risk</th>
<th>Mitigation measures</th>
<th>Residual Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Working in sensitive lands, soil disturbance</td>
<td>Changes in flora species</td>
<td>Churning up topsoil, creation of ruts, changes in topography</td>
<td>H</td>
<td>Use temporary plank-road (logs, branches etc.)</td>
<td>L</td>
</tr>
<tr>
<td>2.</td>
<td>Cutting down cultivars, land clearance</td>
<td>Destruction / degradation of habitats</td>
<td>No high value croplands on the route, but areas affected are moderate - long term change in land use</td>
<td>H</td>
<td>Use cleared spaces for nursery areas</td>
<td>L</td>
</tr>
<tr>
<td>3.</td>
<td>Cutting down cultivars, land clearance</td>
<td>Loss of income</td>
<td>No high value croplands on the route.</td>
<td>H</td>
<td>Compensation. Encourage use of cleared spaces for nursery areas</td>
<td>L</td>
</tr>
<tr>
<td>4.</td>
<td>Construction traffic</td>
<td>Safety / health impact for the neighbouring population</td>
<td>Risk of accidents from increased traffic</td>
<td>H</td>
<td>Traffic management schemes in place.</td>
<td>L</td>
</tr>
<tr>
<td>5.</td>
<td>Creation of EMF</td>
<td>Safety / health impact for the neighbouring population</td>
<td>Prevent potential damage to health from restricting time from working under the wires</td>
<td>H</td>
<td>Provide guidance on exposure times - 3-4 hr/day. Risk that advice may not be taken.</td>
<td>L</td>
</tr>
<tr>
<td>6.</td>
<td>Creation of EMF</td>
<td>Safety / health impact for workers</td>
<td>Prevent potential damage to health from restricting time from working under the wires</td>
<td>H</td>
<td>Provide guidance on exposure times. Risk that advice may not be taken.</td>
<td>L</td>
</tr>
<tr>
<td>7.</td>
<td>Physical presence of towers and conductors</td>
<td>Visual impact -&gt; Reduction of amenity value</td>
<td>Visual impact is highly emotive and subjective</td>
<td>H</td>
<td>Careful routing, consultation</td>
<td>L</td>
</tr>
</tbody>
</table>

(*) L = Low, VL = Very Low, M = Medium and H = High.
### Table-7
**Medium Risk Impacts before Mitigation**

<table>
<thead>
<tr>
<th>No.</th>
<th>Aspect</th>
<th>Impact</th>
<th>Context</th>
<th>Risk</th>
<th>Mitigation measures</th>
<th>Residual Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Solid waste generation and disposal</td>
<td>Contamination surface waters</td>
<td>Contamination from inappropriate waste disposal</td>
<td>M</td>
<td>Require contractor to dispose of waste in designated facilities</td>
<td>L</td>
</tr>
<tr>
<td>2.</td>
<td>Fire</td>
<td>Destruction / degradation of habitats</td>
<td>Fire arising from third parties or construction workers</td>
<td>M</td>
<td>Effective emergency response measures</td>
<td>L</td>
</tr>
<tr>
<td>3.</td>
<td>Solid waste generation and disposal</td>
<td>Impact to geomorphology (from soil and debris)</td>
<td>Careless disposal of soil from excavation of tower foundations</td>
<td>M</td>
<td>Ensure that there is an appropriate plan for disposal of soil</td>
<td>L</td>
</tr>
<tr>
<td>4.</td>
<td>Influx of labour</td>
<td>Safety / health impact for the neighbouring population</td>
<td>Potential increase in communicable and sexually transmitted diseases from migrant workers</td>
<td>M</td>
<td>Require contractors to follow Rules of Conduct</td>
<td>L</td>
</tr>
<tr>
<td>5.</td>
<td>Accidents from electrocution</td>
<td>Safety / health impact for the neighbouring population</td>
<td>People have been electrocuted trying to steal the transmission wires for scrap value</td>
<td>M</td>
<td>Take measures to make it difficult for people to steal</td>
<td>L</td>
</tr>
<tr>
<td>6.</td>
<td>Failure of wires</td>
<td>Safety / health impact for the neighbouring population</td>
<td>Risk from falling object, electrocution</td>
<td>M</td>
<td>Establish TL protected area, education, population informing</td>
<td>L</td>
</tr>
<tr>
<td>7.</td>
<td>Accidents and injuries</td>
<td>Safety / health impact for workers</td>
<td>Accidents arising from drug abuse, dangerous driving, firearms etc</td>
<td>M</td>
<td>Require contractor to follow Rules of Conduct</td>
<td>L</td>
</tr>
<tr>
<td>8.</td>
<td>Accidents from working at height</td>
<td>Safety / health impact for workers</td>
<td>High potential for serious/fatal accidents, relatively short exposure time</td>
<td>M</td>
<td>Training programs, supervision</td>
<td>L</td>
</tr>
<tr>
<td>9.</td>
<td>Accidents from electrocution</td>
<td>Safety / health impact for workers</td>
<td>Electrocution risk</td>
<td>M</td>
<td>Training programs</td>
<td>L</td>
</tr>
<tr>
<td>10.</td>
<td>Solid waste generation and disposal</td>
<td>Visual impact -&gt; Reduction of amenity value</td>
<td>Disposal of towers, wire etc at end of life</td>
<td>M</td>
<td>Implement responsible decommissioning program. Re-use or recycle material where possible</td>
<td>L</td>
</tr>
<tr>
<td>No.</td>
<td>Aspect</td>
<td>Impact</td>
<td>Context</td>
<td>Risk</td>
<td>Mitigation measures</td>
<td>Residual Risk</td>
</tr>
<tr>
<td>-----</td>
<td>---------------------------------------------</td>
<td>---------------------------------------------</td>
<td>-----------------------------------------------------------------------------------------------</td>
<td>------</td>
<td>-------------------------------------------------------------------------------------</td>
<td>---------------</td>
</tr>
<tr>
<td>11</td>
<td>Physical presence of towers and conductors</td>
<td>Visual impact -&gt; Reduction of property value</td>
<td>Property cannot be owned outright under Egyptian legislation but this is expected to change soon</td>
<td>M</td>
<td>Consultation and careful routing of line. Resolve compensation issues</td>
<td>L</td>
</tr>
<tr>
<td>12</td>
<td>Cutting down cultivations, land clearance</td>
<td>Changes in biodiversity</td>
<td>No high value croplands on the route. Risk of habitat islandisation.</td>
<td>M</td>
<td>Handover to local authority or re-IMATE on completion</td>
<td>L</td>
</tr>
<tr>
<td>13</td>
<td>Solid waste generation and disposal</td>
<td>Climate change, acidification</td>
<td>Disposal of vegetation, branches - burn or mulch?</td>
<td>L</td>
<td>Use as a mulch. Leave some small trees to rot</td>
<td>L</td>
</tr>
<tr>
<td>14</td>
<td>Physical disturbance (noise, movement, dust)</td>
<td>Changes in biodiversity</td>
<td>No high value croplands on the route, small footprint compared with RoW long term change in land use</td>
<td>M</td>
<td>Keep footprint to a minimum</td>
<td>L</td>
</tr>
<tr>
<td>15</td>
<td>Discharge of effluent / sewage</td>
<td>Contamination of surface waters</td>
<td>From mobile construction camps, if used</td>
<td>M</td>
<td>Make provision for appropriate disposal</td>
<td>L</td>
</tr>
<tr>
<td>16</td>
<td>Cutting down cultivations, land clearance</td>
<td>Destruction / degradation of habitats</td>
<td>No high value croplands on the route.</td>
<td>M</td>
<td>Handover to local authority or re-IMATE on completion</td>
<td>L</td>
</tr>
<tr>
<td>17</td>
<td>Change of land use</td>
<td>Destruction / degradation of habitats</td>
<td>Permanent loss of approx 3 hectares of land of cultivated types</td>
<td>M</td>
<td>Keep footprint to a minimum</td>
<td>L</td>
</tr>
<tr>
<td>18</td>
<td>Physical disturbance (noise, movement, dust)</td>
<td>Disturbance of mammals / nesting birds</td>
<td>Temporary disturbance - could adversely affect nesting birds.</td>
<td>M</td>
<td>Avoid disturbing nesting areas during nesting season</td>
<td>L</td>
</tr>
<tr>
<td>19</td>
<td>Compaction of soil</td>
<td>Impact on hydrological patterns</td>
<td>Impact of heavy machinery leading to long term damage, especially wetlands</td>
<td>M</td>
<td>Sensitive management by contractors, use of appropriate vehicles</td>
<td>L</td>
</tr>
<tr>
<td>20</td>
<td>Change of land use</td>
<td>Increased access &amp; secondary impacts</td>
<td>Increased access routes may lead to new settlements, illegal logging, though cultivars is well controlled</td>
<td>M</td>
<td>Handover to local authority or re-IMATE on completion</td>
<td>L</td>
</tr>
<tr>
<td>21</td>
<td>Change of land use</td>
<td>Loss of income</td>
<td>Temporary loss of land use</td>
<td>M</td>
<td>Make appropriate compensation</td>
<td>L</td>
</tr>
</tbody>
</table>
### Table-7 (Contd.)
#### Medium Risk Impacts before Mitigation

<table>
<thead>
<tr>
<th>No.</th>
<th>Aspect</th>
<th>Impact</th>
<th>Context</th>
<th>Risk</th>
<th>Mitigation measures</th>
<th>Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>22.</td>
<td>Accidental damage to crops / land / property</td>
<td>Loss of income</td>
<td>Some damage may be unavoidable in order to effect emergency repairs</td>
<td>M</td>
<td>Make appropriate compensation</td>
<td>L</td>
</tr>
<tr>
<td>23.</td>
<td>Land acquisition / use</td>
<td>Nuisance to neighbouring population, visitors</td>
<td>No one household affected, but moderate impact</td>
<td>M</td>
<td>Provide compensation</td>
<td>L</td>
</tr>
<tr>
<td>24.</td>
<td>Accidents and injuries</td>
<td>Safety / health impact for the neighbouring population</td>
<td>Danger from children playing on construction sites</td>
<td>M</td>
<td>Hazardous areas should be protected / secured</td>
<td>L</td>
</tr>
<tr>
<td>25.</td>
<td>Failure of towers / loss of structural integrity</td>
<td>Safety / health impact for the neighbouring population</td>
<td>Toppling of transmission towers from storms or theft of bolts</td>
<td>M</td>
<td>Good design. Welding bolts to prevent theft.</td>
<td>L</td>
</tr>
<tr>
<td>26.</td>
<td>Above ground cultural heritage sites</td>
<td>Visual impact - Reduction of amenity value</td>
<td>No impact expected on national monuments but possible concerns about sites of local interest</td>
<td>M</td>
<td>Consultation and careful routing of line</td>
<td>L</td>
</tr>
<tr>
<td>No.</td>
<td>Aspect</td>
<td>Impact</td>
<td>Context</td>
<td>Risk</td>
<td>Mitigation measures</td>
<td>Risk</td>
</tr>
<tr>
<td>-----</td>
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<td>--------</td>
<td>---------</td>
<td>------</td>
<td>---------------------</td>
<td>------</td>
</tr>
<tr>
<td>1.</td>
<td>Cutting crops, land clearance</td>
<td>Changes in biodiversity</td>
<td>No high value croplands on the route, but areas affected are moderate - long term change in land use</td>
<td>M</td>
<td>Use cleared spaces for nursery areas, may improve conditions for certain species (reptiles, raptors)</td>
<td>L</td>
</tr>
<tr>
<td>2.</td>
<td>Improved transmission efficiency</td>
<td>Climate change, acidification</td>
<td>Improved transmission efficiency and reduction of power losses</td>
<td>M</td>
<td>Positive impact wrt GHG emissions</td>
<td>L</td>
</tr>
<tr>
<td>3.</td>
<td>Influx of labour</td>
<td>Increased income</td>
<td>Opportunity for increased goods and services. Potential resentment of lost opportunity</td>
<td>M</td>
<td>Require contractor to maximise local labour wherever possible</td>
<td>L</td>
</tr>
<tr>
<td>4.</td>
<td>Cutting down crops, land clearance</td>
<td>Increased income</td>
<td>Additional work maintaining the RoW in cultivated areas</td>
<td>M</td>
<td>Use as a mulch. Leave some small vegetation to rot</td>
<td>L</td>
</tr>
</tbody>
</table>
7. MITIGATION OF IMPACTS

A summary of the mitigation measures and objectives that will be undertaken by EETC and the construction contractor is shown in Table-9 and Table-10.

Table-9

<table>
<thead>
<tr>
<th>Commitment</th>
<th>Performance Objectives</th>
</tr>
</thead>
<tbody>
<tr>
<td>A copy of the Non-Technical summary is available for inspection by the public in the affected Local Councils and the full ESIA in all affected regions and administration offices</td>
<td>Documents distributed to all affected Local Councils, Zones and administrative offices</td>
</tr>
<tr>
<td>A complaints database is maintained and a consolidated summary is available for inspection by the public. Grievances are responded to within 30 days</td>
<td>Complaints and grievances are addressed adequately and in a timely manner</td>
</tr>
<tr>
<td>One pamphlet or announcement distributed to local communities each year providing information on health and safety risks</td>
<td>Raise and maintain awareness of public health issues related to the project</td>
</tr>
<tr>
<td>The environmental management of land in the right of way will be audited at least once during construction</td>
<td>Maximize biodiversity in the cultivated areas that have been cleared for the right of way. Reduce damage to surrounding areas</td>
</tr>
<tr>
<td>Careful monitoring for avian hazards</td>
<td>Parts of the transmission line that are potential to cross potential corridors</td>
</tr>
<tr>
<td>Meeting with EEAA&amp; ornithologists to assess the risk of bird mortality from collision with the transmission line and earthing lines after one year of commissioning the line</td>
<td>of migrating birds shall be constructed and protected according to the Guidelines: &quot;Protecting Birds from Power Lines; Nature and Environment, No. 110, Council of European Publishing&quot; (use of red poles, for instance is a successful mitigating measure that is utilized in many locations). Such measures will also be employed for the elevated line segment crossing the River Nile.</td>
</tr>
<tr>
<td>Database of land owners/users affected by land acquisition</td>
<td>Assess risks and possible requirements for additional mitigation measures.</td>
</tr>
<tr>
<td></td>
<td>Ensure the land acquisition process is adequately documented</td>
</tr>
</tbody>
</table>

Notes:
(*) First outcomes of the Draft Report of a JICA funded study for NREA Authority done by a German Consultant (DECON) on Bird Migration West of El-Minya Governorate have proved that almost no migrating birds would be found in the area.
(**) This point is adequately addressed in item 6.3.5 and Table 6-8, thus no mitigation measures are required. The study is presented by NREA in closed meeting, but the Report is not disclosed yet.
### Table 10

**Construction Contractor Mitigation Measures and Objectives**

<table>
<thead>
<tr>
<th>Commitment</th>
<th>Performance Objectives</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction operations schedules provided to local councils and administration.</td>
<td>Timely information allows land users to plan agricultural activities in advance</td>
</tr>
<tr>
<td>Environmental restoration of construction sites and removal of waste</td>
<td>Document restoration of the sites used for construction</td>
</tr>
<tr>
<td>Compliance with national safety management, emergency response legislation and rules of conduct</td>
<td>Safe operation, avoid risks to workers and general public</td>
</tr>
<tr>
<td>Compliance with specific recommendations for protecting the TL towers against flash floods and earthquakes.</td>
<td>Safe operation, avoid flash flood and earth-quake risks to TL towers.</td>
</tr>
<tr>
<td>Security at construction sites and works camp</td>
<td>Avoidance of risks to public, livestock and wildlife</td>
</tr>
<tr>
<td>Compliance with national legislation and norms in relation to archaeological and unexpected finds</td>
<td>Avoidance of risks to workers through contractor's obligations</td>
</tr>
<tr>
<td>Compliance with national legislation and norms for traffic management and noise levels.</td>
<td>Prevent damage to cultural heritage sites</td>
</tr>
<tr>
<td>Announcement of job opportunities in local communities and recording numbers of jobs given to local people</td>
<td>Avoid accidents and nuisance to people at risk</td>
</tr>
<tr>
<td></td>
<td>Maximise potential local employment opportunities from the project</td>
</tr>
</tbody>
</table>
8. ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN (ESMP)

8.1 ENVIRONMENTAL MANAGEMENT ORGANISATION

8.1.1 During Design and Construction

Suitably qualified and experienced contractors will be responsible for the detailed design and construction of the project. Construction workers will be required to demonstrate appropriate skills, qualifications, and/or experience prior to employment.

During construction, PIU/EMS will ensure that all contracts with Contractors and sub-contractors stipulate construction management measures (as given in this ESMP), operational design criteria and environment, health and safety standards which must be implemented at the project site.

Implementation of these measures will be enforced and supervised by the Assistant Project Manager who will have direct responsibility for the Environment, Safety and Quality Assurance program on site during construction and operation. The Assistant Project Manager is responsible for ensuring that construction works comply with the requirements of the ESMP and all environmental permits. His key roles will be to:

- assume the interface with authorities for environmental authorizations and permits;
- act as the Assistant Project Manager for local authorities, industrial and commercial interests and any other interested parties;
- ensure that mitigation measures to reduce impacts during the construction phase are implemented;
- ensure that monitoring to be undertaken during construction is implemented;
- ensure compliance with the environmental and social management plan; and
- ensure that health and safety requirements are respected.

8.1.2 During Project Operation

During operation, direct responsibility for environmental compliance and the implementation of the mitigation, management and monitoring measures described in this section and in Section 7 of this report, will continue to be with the PIU/EMS under direct supervision of the Assistant
Project Manager. This position, will report directly to the Chairman/General Manager of EETC.

The Assistant Project Manager will be based at the site and will be responsible for recruiting, training and managing his staff. He will be responsible for implementing the mitigation and management measures described above and for monitoring and record keeping of the following:

- emissions to the air;
- air quality;
- noise emissions;
- quality of effluent discharge; and
- waste management.

In his role, the Assistant Project Manager will also be responsible for maintaining any pollution control equipment and for developing and implementing procedures for safe handling and storage of any hazardous materials used on site.

The Assistant Project Manager will also have lead responsibility for maintaining a written Environmental Register with respect to environmental impacts as required under Egyptian, EIB and World Bank guidelines. The written records will identify the characteristics of discharges and emissions, details of periodic testing including results, procedures for follow-up environmental safety actions and the person in charge of this follow-up. Should any prescribed standards be breached, PIU/EMS, through the Assistant Project Manager, will immediately inform the EEAA and disclose the procedures being taken to rectify non-conformity.

Results of environmental monitoring as described above, shall be recorded and submitted to the EEAA, EEHC and to any other party (i.e. EIB & WB etc.) as required. The EEAA, EIB and WB are entitled to audit the project company in order to ensure conformity with environmental standards and requirements.

In addition, the project company must keep a record of any significant environmental incidents occurring at the project including accidents and occupational illnesses, spills, fires and other emergencies. The Assistant Project Manager will be responsible for ensuring that these records are maintained up to date and are available on site.

The Assistant Project Manager will supervise and lead the Environmental Unit (EU) and cooperate with the Environmental Management Staff (EMS) of the EETC directed by the PIU. Figure-18 illustrates the organization of the EMS.

(PIU / EMS roles during construction are shown in Figure 8-1 and specified in Table 8-1 as training requirements)
Social/Community Development Specialist

Within the PIU/EMS, a Social/Community Development Specialist will be recruited by EETC for managing all expected socio-economic impacts that are associated with the implementation of the project.

His/Her responsibility should basically include, but is not limited to, the following tasks:
- Solve problems related to valuation and compensation.
- Solve problems related to community interests.
- Community information and outreach.

8.2 ENVIRONMENTAL TRAINING

The Project Company will ensure that the transmission interconnection project is manned all working hours. All staff employed at the project will be trained in the following:

- general operation of the transmission line and substations;
- specific job roles and procedures;
- occupational health and safety; and
- contingency plans and emergency procedures.

Training will include:
- induction training on appointment;
- specialist training (as required for their prescribed job role); and
- refresher training as required.

The training program will be designed to ensure that appropriate skilled staff are used to operate the project at all times. Aspects of occupational health and safety and emergency procedures are described below.

In addition to this environmental training for all staff employed at the project, special environmental training will be given to the staff employed for the EMU. They will receive training in the following:

- day-to-day monitoring activities;
- collection and analysis of environmental quality data;
- monitoring the waste effluents;
- monitoring the waste disposal;
- use of monitoring equipment, operation and maintenance;
- industrial hygiene;
- occupational health and safety; and
- emergency and contingency procedures.
8.3 OCCUPATIONAL HEALTH AND SAFETY

EETC will establish and integrate policies and procedures on occupational health and safety into the operation of the transmission interconnection project which meet the requirements of Egyptian, the EIB and World Bank guidelines as given in Section 2 of the report. The policies and procedures will also be designed to comply with all manufacturers safety data sheets for oils and chemical storage and usage, so as to provide a safe and healthy working environment.

Occupational health and safety programs will be supported by staff training for the project and the appointment of the Assistant Project Manager. The training will include, but will not be limited to, the following:

- general area safety;
- specific job safety;
- general electrical safety;
- handling of hazardous materials;
- entry into confined spaces;
- hearing conservation;
- repetitive stress disorders;
- Code of Safe Practices;
- use of personal protective equipment; and
- first-aid.
Prior to Operation

EEHC PROJECT MANAGER

PIU

Assistant Project Manager

ENGINEERING CONSULTANT

Head of Environmental Management Staff (EMS)
(2-3 staff members recruited by EETC)

Implementation of ESMP Measures

Environmental Monitoring & Reporting

Environmental Data Collection & Analysis

EEHC Chairman

EEHC Head of Environmental Sector

Social / Community Development Specialist

During Operation

EETC ZONE MANAGER

Head of Environmental Unit
(2-3 staff members recruited by EETC)

Environmental Monitoring

Noise & EMF Monitoring

Occupational Health & Safety

Environmental Management & Emergency Procedures

ESIA for Helwan South Power Plant: Transmission Line Interconnection Project
May 2013 - Project No. 1750-HP