ENVIRONMENT & DEVELOPMENT GROUP

KOM OMBO 200MW PV PROJECT
ACWA Power

Baseline Survey – Geography, Geomorphology, Geology and Land Use

February 2020

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I. GEOGRAPHICAL SETTING

The ACWA Power project site (Figure 1) occupies an area of about 5 km^2 south of the Northern Faris road. It extends for 3 kms along the length of that road, and south of that road to a variable distance of 1.3 km at its western boundary and 2 km at its eastern boundary. The site is administratively within the Kom Ombo Administrative Center (*Markaz* Kom Ombo) of the Governorate of Aswan in Upper Egypt. It is about 22 km northwest of the town of Kom Ombo; the local administrative center seat. The Site is also reachable from Aswan (about 80 km to the south) and Edfu (about 70 km to the north) via the Luxor – Aswan, Western Desert highway. The Benban solar farm, which is now operational, is located about 22 km southwest of the Site. The nearest human settlement to the Site is the Faris village, which located about 10 km to the east, to which it is connected by the asphalt road, which connects the village to the Luxor – Aswan, Western Desert highway.

The Faris village is connected to the Luxor-Aswan Western Desert Highway via two roads. The older, northern road (18.5 km) links with the village's main road via the Ramadi El-Qibli - El-Raqbaa secondary road. The new, southern road runs more or less parallel to the older road and 3 to 5 km to the south of it. This wider, modern highway will cross the Nile, about 3 km south of Faris through a bridge, which is currently under construction. The Ramadi El-Qibli - El-Raqbaa runs just west of Faris and parallel to the Nile, connecting villages and towns on the western bank of the river.

Like most of the villages in Upper Egypt, Faris is built just above the western flood plain of the Nile River. The fertile land of the flood plain fronting the village, which is only 0.5 to 0.75 km in width and less than 10 meters above the level the Nile's water, is densely cultivated. Desert land west of the flood plain, both north and south of Faris, has been reclaimed for agriculture by local villagers using Nile water or ground water pumped to the higher desert areas above the flood plain. The cost of pumping ground, or Nile water seems to be the limiting factor for cultivating more of the uninhabited desert land to the west of Faris.

II. GEOLOGY AND GEOMORPHOLOGY

The ACWA Power project site is located in Nubian region of the Egyptian Western Desert, close to the western fringes of the flood plain of the Nile River of upper Egypt. The Western Desert, which is bordered by the Nile Valley in the east and Libyan border on the west, forms a uniform surface that is seldom broken by relief features. It is a mostly flat plateau gently sloping down from southwest to northeast. The flat surface of the Western Desert plateau is interrupted in several places with numerous closed-in depressions of various sizes that can sometimes reach below sea level. Longitudinal, northwest – southeast trending sand dunes run across the flat surface of that desert. Massive sand accumulations occur in many places but reach their greatest proportions in the Great Sand Sea at the extreme west close the Egyptian Libyan border.

The south-eastern region of the Western Desert where the project area is located, forms an almost featureless plain, which offers few prominent topographical or geological features that would reflect its intricate geological history. Most of the surface is covered with gentle-dipping Neogene strata of moderate lithological uniformity. Topographically, a monotonous plain extends from the shores of the Pliocene Messinian Marine Gulf, which marks the present-day valley of the Nile, to the eastern flank of the Libyan Plateau. The monotony of the plain is only rarely interrupted by occasional low questas.

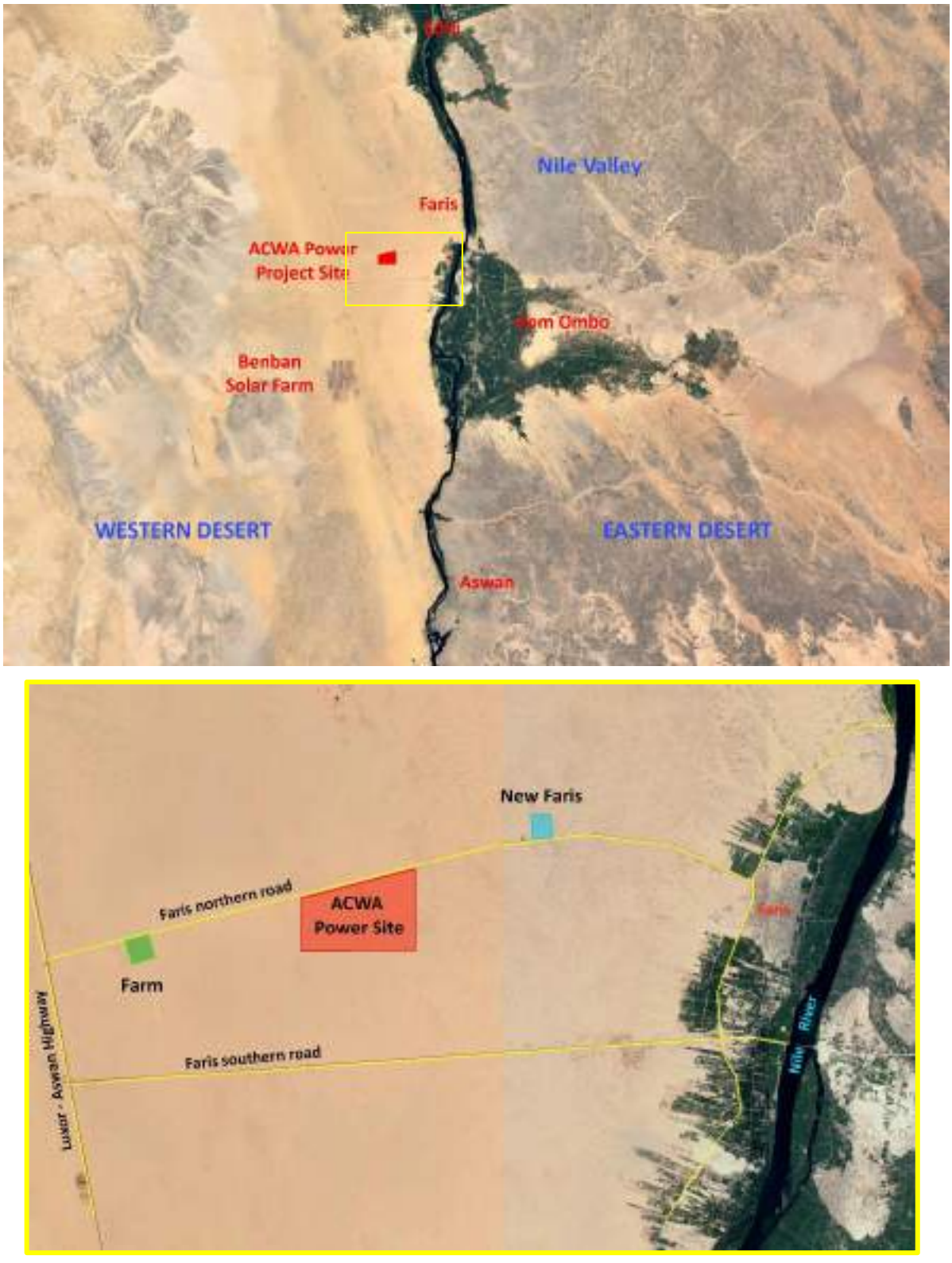

Figure 1. Geographic relations of the ACWA Power Project sit.

West of that plain, the Libyan Plateau, runs parallel to the Nile Valley and less than 100 km to the west of it. The rugged, extremely arid bad land that forms the surface of this plateau presents a formidable barrier separating the Nile Valley from the sandy interior of that desert.

The project site and the surrounding area are located in the gravel to sandy plain extending between the Libyan Plateau and the Nile Valley. The site has a nearly flat topography ranging in altitude between 150 to 140 meters above sea level and some 70 above the Nile water level in that region. About 30 to 40 km to the west, the Eocene limestone Libyan Plateau (Figure 3) rises to the moderate height of 400 to 500 meters and extends westwards to the edge of the great hollow that forms the Baris – Kharga - Dakhla depression with its many oases. To the east, and for the last 1 to 2 kms, the flat desert plain slopes down steeply into the Nile Valley to reach the nearly flat flood plain, which is only few meters above the Nile water. Figure 2 shows a relief map of Egypt indicating the project site.

The project site proper has a largely flat, slightly rolling topography. The ground surface is mostly covered with Quaternary surface deposits of mostly Late Pleistocene. A layer of sand, over-strewn with gravel in places covers the entire area. Some scattered cobles are also found at very few spots. The gravel and cobles are most likely the result of ancient surface flows. At the present time, however, there is no clear pattern in the distribution of these gravel surfaces in relation to the topography of the area and no surface drainage lines were detected anywhere at or near the site. Ancient drainage lines of the eastern flank of the Libyan Plateau, which are visible in satellite imageries, are quickly lost once they reach the plain, tens of kilometers west of the site. These shallow, ill-defined drainage lines have been inactive at least since the last wet episode of the early Holocene and have been mostly buried in recent, mostly aeolian sediments. Figure 4 shows the location of the site on the Geological Map of Egypt.

III. HYDROLOGY

Hydrologically, the area is located in an extremely arid region that receives virtually no precipitation (an average of 1.2 mm of rains per year). There is no sign of surface runoff in the area, which completely lacks any kind of surface drainage channels. Other than the Nile River, no permanent, surface water bodies of any sort are found in the area.

Groundwater is the only permanent water resource in the area with varying depths as sub-basins. According to the hydrological map of Egypt, the Nile alluvium is an extensive and highly productive aquifer. It underlies the Nile's floodplain region in the Tertiary and Quaternary deposits. It consists of a thick layer of graded sand and gravel with clay to silty clay aquitards at various depths in its major part, and an impermeable clay aquiclude at the bottom. The transmissivity of this aquifer is relatively high, especially in its shallower depths. Groundwater is essentially replenished through the aquifer's hydraulic interaction with the Nile River, seepage from irrigation and drainage canals, and deep percolation. The high productivity of this aquifer and the shallow depth to groundwater allow for high rates of water abstraction with relatively shallow wells and at relatively low pumping costs.

The area also overlies Nubian sandstone, epicontinental deposits. The Nubian sandstone forms "extensive and moderately to highly productive aquifers containing mainly fossil water, with essentially no surface recharge". Below the Nile alluvium aquifer, however, there are clayey deposits that were formed during the Pliocene, which are impermeable and prevent the connection between this aquifer and the Nubian Sandstone aquifer. Ground water seems to be extensively used in Faris and the surrounding area. The water is mainly used for domestic purposes and irrigation; its salinity is less than 1500 ppm.

Figure 2. A relief map of Egypt showing the location of the project site.

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Figure 3. The eastern flank of the Libyan Plateau, about 40 km west of the Project Site.

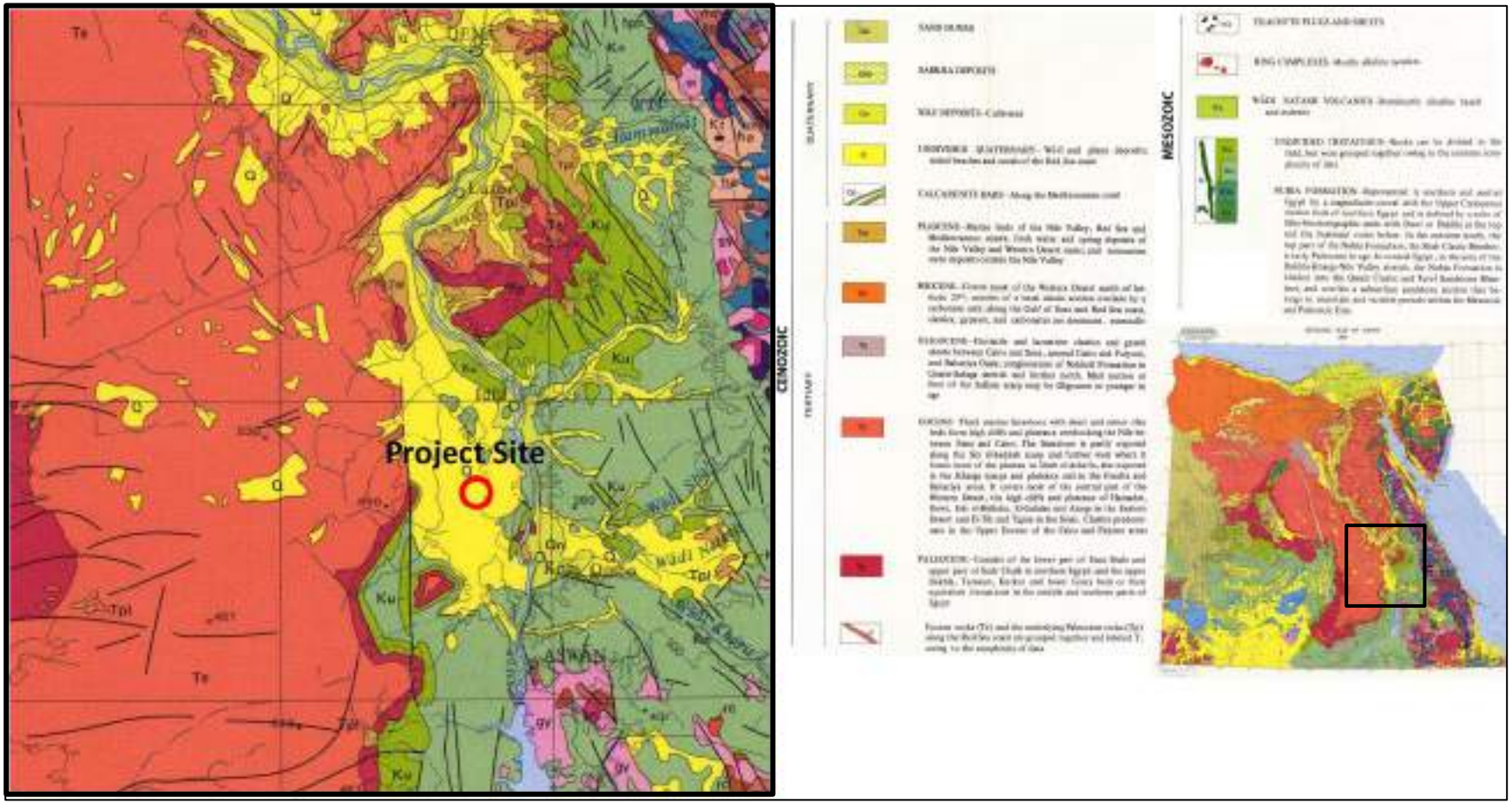

Figure 4. The location of the project site on the Geological Map of Egypt.

IV. LAND USE

Land use pattern at the study area was assessed based on a number drive through transects. These transects followed all roads in the area, including two main roads within Faris village. Geotagged, photographic records of areas on both sides of the road were taken every 50 meters using GPS cameras mounted on the vehicle. The geotagged photographs were subsequently reviewed and compared with available satellite imageries to estimate the extent of different land uses in the area. Figure 5 shows on example of these transects. Figure 6 shows areas covered by the land use photographic records shown in Figures 7 – 10, which show locations and photographic records of all current land uses in the study area.

FARMING

The nearest cultivated land to the project site is a small farm is located About 4.5 kms to the west of the site, just south of the northern Faris road (Figure 7). The farm, which has now about 20 hectares under cultivation, appears to have been much larger in the past as several plots are left fallow. Water for irrigating the small olive trees at the farm comes from one or more groundwater wells. At the present time, however, the farm does not appear to be very productive. According to Faris villagers, the establishment of the farm by an influential outsider, is intended as a means for staking a claim to a large piece of land as land value is expected to increase considerably as the area becomes, or developed.

In the Nile Valley and adjacent land reclamation areas, agriculture is the main land use. The small area in the narrow floodplain of the Nile is densely cultivated and have been for millennia using water from the Nile. Larger area of reclaimed desert land outside the floodplain are now under cultivation by Faris farmers. Land reclamation activities which appear to have been initiated by local farmers, seem to have started in the late 1980s. At the present time, reclaimed desert land regularly cultivated by Faris farmers equal or larger than the area of their traditional floodplain fields.

BUILDINGS AND HUMAN SETTLEMENTS

Faris village is the largest human community in the area. It covers about 2 square kilometres and includes hundreds of family houses and small shops. The village is the located 10 km east of the project site. It is built on the desert land at the margin of the fertile Nile Valley.

No permanent human settlements are found in the desert area along the northern or southern Faris roads. In the recent months, however, a number of caravans and small brick buildings have been erected mostly on the northern side of the northern road. These building have been built by local contractors either currently involved in on-going construction activities, or anticipating future work in the new solar energy projects. Some of the caravans and buildings appear to be used as temporary resting/accommodations for workers, managing construction logistics and storage of equipment and supplies. The numbers of workers we observed at these sites were generally very small. Locations and photographic records of these building are shown in Figure 8.

One cluster of about 100 houses was built by the government in 2008, north of the road and about 4.5 northwest of the ACWA Power site. The houses were part of the New Faris land reclamation scheme, which included developing water resources and irrigation infrastructure to encourage villagers from Faris to cultivate and own new agricultural land in that area. While the housing component of the project was actually

completed and turned over to the villagers, drilling of the wells and developing the irrigation infrastructure was never undertaken. Following the 2011 popular up-rise and the subsequent political turmoil, the project was completely abandoned by the government. The houses, which were actually turned over to the villagers who paid a small payment, were never occupied but still stand (Figure 9).

The area immediately to the east of the ACWA Power site has been allocated to another solar power project, and is currently under construction. Extensive construction work is currently on-going at area adjacent to the ACWA Power site, include levelling, some foundation work, as well as the construction of a transformer sub-station (Figure 8). Some of the caravans and other buildings referred to above belong to contractors working on that project.

Informal dumping of construction waste along the northern road is widespread. Just north of the ACWA Power site, an area of extensive dumping of excavation waste is found (Figure 8). The source of that waste is not clear. Illegal dumping of domestic waste is also widespread, particularly near Faris village. Areas of extensive dumping (Figure 10).

Figure 5. A series of geotagged photographs along a land use driving transect north of Faris.

Figure 6. Areas covered by the land use survey photographic records along the Faris northern road.

Figure 7. The location of the farm west of the ACWA Power Project site.

1. The farm

Figure 8. Land use in the vicinity of the ACWA Power Project site.

2. Building constructed by the Faris Contractors Union
3. Informal and temporary buildings north of the Site
4. Informal and temporary buildings north of the Site
5. Informal and temporary buildings north of the Site
6. Informal dumping of construction and excavation waste
7. Fenced-off storage area for construction equipment and material
8. Informal building northeast of the Site
9. Informal and temporary buildings northeast of the Site.
10. Construction activities just east of the Site
11. Temporary buildings at construction site just east of the Site
12. A transformer substation under construction just east of the site


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Figure 9. Land use along the Faris northern road in the vicinity of the New Faris village.

13. A paved area (helicopter landing pad?) north of the road
14. New Faris Village, 3.2 km northeast of the Site
15. A building about 3.5 north east of the site

Figure 10. Land use in the area just west of the Faris Village along the Faris northern road.

16. A paved area (helicopter landing pad?) north of the road
17. New Faris Village, 3.2 km northeast of the Site
18. A building about 3.5 north east of the site

HISTORICAL CHANGES IN LAND USE

Up to the early 1980s, land cultivated by the Faris village farmers was restricted to the Nile's floodplain and was entirely dependent on water pumped from the Nile. Area to the west, outside of the floodplain was an uninhabited, barren desert. The last two decades of the last century witnessed a rapid expansion of the Faris village itself over the desert land, and the beginning of agriculture activities above the river's floodplain using ground water pumped from the relatively shallow aquifer. Land reclamation activities continued to expand, particularly after 2011. The desert land area reclaimed for agriculture is now considerably larger than the original agricultural land in the Nile's floodplain. Figure 11 shows historical changes in cultivated land area based on historical satellite imageries.

All these land reclamation activities, as well as the expansion of the village itself, were based on informal ownership claims by individuals and families from the Faris area and involved informal occupation of public land. In the last two years, however, the government started to implement a nationwide scheme to identify, valuate and formalize ownership of informally/illegally occupied/utilized public land. According to that scheme, public land tenure can be sold to its informal occupier for a price to be determined by relevant government authority[1](usually the General Authority for Reconstruction Projects and Agricultural Development), taking into account the location and potential uses. For the Faris area, this land ownership formalization process is still ongoing.

VISUAL AND LANDSCAPE ASSESSMENT

The area surrounding the site is totally uninhabited and appears to have never been developed for any use. Faris village, about 10 km to the east of the site is the nearest community. The area between the project site and Faris is undeveloped desert with the exception of a small farms close to Faris and about 8.5 to 9.5 east of the site. Beyond and to the east of the Faris Village and the cultivated land in the Nile Valley, the Nile River is about 12 km east of the site.

Developments on the project site is not expected to interfere with any existing viewing opportunities from any of the present key visual receptors.

[1] The Ministry of Irrigation and Water Resources is responsible for granting permits to drill well to obtain groundwater for the agricultural project.

Figure 11. Historical changes in land use in the Study area based on satellite imageries taken through the past 36 years.