OFFICAL USE

Jbel-Sendouq Khalladi

Wind Farm and 225kV Power Line Projects

Project Description and Discussion of Environmental Planning Assessments, Tangier, Morocco

Prepared for:

International Company for Power and Water (ACWA Power)

Submitted to:

European Bank for Reconstruction and Development (EBRD)

July 2015

5 Capitals Environmental and Management Consulting
PO Box 119899, Sheikh Zayed Road, Dubai, UAE
Tel: +971 4 343 5955 Fax: +971 4 343 9366

Document Information

Project	Wind Farm and 225kV Power Line Projects
Project Number	1305/001/025
Report Title	Project Description and Discussion of Environmental Planning Assessments
Client	ACWA Power
Project Manager	Carlos Ponte
Project Director	Ken Wade

Document Control

Issue	Issue Date	Description	Author	Reviewed	Approved
1	14/07/2015	Issue 1	ZMJ	CPM	KRW
2	26/07/2015	Issue 2	ZMJ	CPM/KRW	KRW

Table of Contents

Definitions and Abbreviations

Abbreviation	Meaning	Definition
ACWA	ACWA Power	Part owner of the Khalladi Power Project.
BM	Build Margin	
BPP	Biodiversity protection Plan	
CDER	Centre de Développement des Energies Renouvelables au Maroc	
CIA	Cumulative Impact Assessment	
CNEIE	Comite National des Etudes d'Impact sur L'Environnement	
CTF	Clean Technology Fund	
EBRD	European Bank for Reconstruction and Development	
EF	Emission Factor	
EIE	Etude d'Impact Environmental	
EMS	Environmental Management System	
EPC	Engineering Procurement and Construction	Entity responsible for the detailed design and construction of the Windfarm. Will implement the requirements of the ESIA and ESMMP and other environmental/Social Management – Monitoring plans.
EPs	Equator Principles	
ESAP	Environmental and Social Action Plan	
ESIA	Environmental and Social Impact Assessment	
ESMMP	Environmental and Social Management and Monitoring Plan	
GHG	Green House Gas Emissions	
IFC	International Finance Corporation	
IFI	International Finance Institution	
LAP	Land Acquisition Plan	
MW	Mega Watt	
NTS	Non Technical	

Abbreviation	Meaning	Definition
	Summary	
O&M	Operation and Management	Entity responsible for the operation and management of the project, implementation of the ESIA, ESMMP and other environmental/Social Management – Monitoring plans. For this project, Nomac a subsidiary management branches of ACWAPower will be the designated O&M.
OM	Operating Margin	
ONE	L'Office National de l'Electricité	
PPA	Power Purchase Agreement	20 year term
PL	Power Line	
PR	Performance requirement	
SEP	Stakeholder Engagement Plan	
SIA	Social Impact Assessment	
UPC	UPC Renewable	Part owner of the PPA project.
WF	Windfarm	
-	Project Owner	The Consortium of ACWA Power and UPC renewables.
-	Site access Road	New or upgraded roads that lead from existing arterials, though the villages to the entrance of the Wind farm.
-	Subcontractor	Construction and Operation subcontractors are contractually bound to implement the ESIA, ESMMP and other environmental/Social management and monitoring plans has provided by the EPC/O&M.
-	120MW Khalladi Windfarm	The 40 turbines positioned along the ridge of the Jbel Sendoug, permanent access roads, underground cables and other support facilities, and the overhead Power Line extending from Meloussa to Tetouan.
-	Turbine tracks	Tracks are located on the ridge, and are the connecting paths between the turbine platforms.
-	Underground cable	This cable is located on the ridge, and runs parallel to the turbine track. The cable contains all of the electricity lines from each turbine and eventually runs underground to the substation in Meloussa. Again this cable will parallel the access road from the ridge at the wind farm to the substation. The easement required for the underground cable does not exceed 2 metres on either side of the cable.
5 Capitals	5 Capitals Environmental and Management Consulting	

1 INTRODUCTION

The Khalladi Windfarm Facility is a 120MW windfarm, which will be built in the region of Tangier along the ridge of the Jbel Sandouq, in the Kingdom of Morocco, under Law 1309 (private ownership).

The Project Developer, UPC prepared an *Etude d'Impact Environnemental (EIE)* (hereafter referred to as the Environmental Impact Assessment, EIA) of the Wind Farm (WF) in July 2011 and obtained the approval of the EIA by the Comite National des Etudes d'Impact sur L'Environnement (CNEIE) in July 2012. The validity of the approval covers a period of 5 years, in which time construction should have commenced.

In 2014, ACWA Power acquired a share in the Khalladi Wind Farm project and has since sought funding support from the European Bank for Reconstruction and Development (EBRD), an International Finance Institution (IFI).

In addition to the WF, L'Office National de l'Electricité et de l'Eau Potable (ONEE) had originally envisaged that the construction of the 225kV Power Line (PL) for the WF, would be undertaken under a separate contract. However, discussions with ACWA Power have led to the agreement that the PL would be constructed under the same EPC as the WF. As such, the environmental and social impacts from the construction and operation of the PL would need to be studied and relevant mitigation and management measures developed as part of the environmental and social documentation for the Wind Farm.

Based on the Performance Requirements and meaningful disclosure procedures of the EBRD, the current EIA and supporting environmental management reports should be updated to ensure that appropriate mitigation, management and monitoring plans have been developed following the environmental and social assessment of the WF and PL project using the Business and Biodiversity Offsets Programme's (BBOP) Mitigation Hierarchy procedure. As such, the following documents have been prepared for the disclosure package:

1. Project Description and Discussion Environmental Planning Assessments
2. Biodiversity Protection Plan (BPP)
3. Social Impact Assessment (SIA)
4. Stakeholder Engagement Plan (SEP)
5. Land Acquisition and Livelihood Restoration Plan (LALRP)
6. Environmental and Social Management and Monitoring Plan (ESMMP)
7. Non Technical Summary (NTS)
8. Environmental and Social Action Plan (ESAP)

The present document is the Project Description and discussion of Environmental Planning Assessments, which provides a description of the WF and PL project elements and planning, and a discussion of the project alternatives, cumulative impacts and Green House Gas Emissions (GHG).

2 PROJECT DESCRIPTION

2.1 Project Location

The proposed Khalladi Wind Farm project and associated 225kV Power Line is located within the Tanger-Tetouan Region of Morocco. This region is divided into 11 Provinces /Prefectures, and of these 11 Provinces, the Wind Farm will be built in the Fas Anjra province, whilst the Power Line will start in the Fas Anjra province and head south into the Tetouan province.

Moroccan provinces, are further broken down into Communes, and with respect to the Wind Farm and Power line project the following table lists the Communes located within these two Provinces:

Province/Prefecture	Commune No. (urbain/rural)	Commune Name
Fas Anjra	7 (0/7)	**Meloussa**, **Ksar Sghir**, **Kmis Anjra**, Jouamaa, Taghramt, Ksar el Majaz, Al Bahraoyine
Tetouan	22 (2/20)	**Souk Kdim**, **Sadina** Mun. Tetouan, Ouad Laou, Al Hamra, Al Ouad, Oulad Ali Mansour, Zaitoune, Azla, Zinat, Dar Bni Karrich, Bni Said, Zaouiat S. Kacem, Ain Lahsan, Jbel Lahbin, Bni Harchen, Al Kharroub, Mallalienne, Bni Imrane, Bni Idder, Sahtryine, Bghaghza

Of all these communes, the physical footprint of the Wind Farm, which comprises of the turbines, access roads and substation, falls within the Meloussa, Ksar Sghir and Khmis Anjra Communes of the Fas Anjra Province. For the Power Line, the alignment will start in Kmis Anjra then cross into the communes of Souk Kdim and Sadina, which are located in the Tetouan Province.

The map provided in the Annex, show the delineations of the Provinces and Communes along with the overlay of the Wind Farm and Power Line alignment.

The Start and End coordinate of the WF and PL, in WGS 84 is:

	Windfarm	Power Line
Start Point	35°46'36.95"N 05°36'9.61"W	35°44'52.20"N 05°33'23.81"W
End Point	35°43'20.53"N 05°33'33.16"W	35°34'10.79"N 05°27'53.43"W

In Morocco, Communes are broken down into Douars, and a Douar is essentially a grouping of households varying from 50 to 400 dwellings. It should be noted that Douars are not defined in any official geographic reference and consequently, the naming and numbers of Douars in a Commune may change from one administration to the next.

With respect to the WF project, no Douars are located on the ridge of the mountain, nor on the flanks of the mountain. Consequently, the Douars closest to the project are located at the base of the Jbel Sendouq and are clearly distinguished as groupings of dwellings, which are connected by roads that vary in condition from asphalt to dirt. The following table lists these Douars.

Table 2-1: Douars of the WF

Commune	Douar (Population)
Meloussa	Ghzielech (704)
	Aïn Hamra (800)
	Lanjriech/Msiaad (698)
	Brarek/Oqal (168)
Qsar Sghir	Aïn Rmel (1,180)
	Dhar Foual (524)
Khmis Anjra	Fahammine (424)
	Mlaleh (647)

With respect to the Power line, the 24km long alignment, comprising of 75 pylons, passes through 3 types of properties: Communal, Habous and Private. It should be noted, that the alignment aimed to avoid populated areas, and consequently the vast majority of the pylon will be built on plots that are far from Douar centres.

The following table list the pylon number against the type of land and respective Commune/Douar.

Table 2-2: Douars and properties of the PL

PL	Province	Commune	Douar	Land Type		
				Communal	Habous	Private
1	Fahs Anjra	Khmis Anjra	Fahamine			P
2	Fahs Anjra	Khmis Anjra	Fahamine			P
3	Fahs Anjra	Khmis Anjra	Fahamine			P
4	Fahs Anjra	Khmis Anjra	Fahamine	Fahamine		
5	Fahs Anjra	Khmis Anjra	Fahamine			P
6	Fahs Anjra	Khmis Anjra	mlalah			P
7	Fahs Anjra	Khmis Anjra	mlalah			P
8	Fahs Anjra	Khmis Anjra	mlalah			P
9	Fahs Anjra	Khmis Anjra	mlalah	mlalah		
10	Fahs Anjra	Khmis Anjra	Dar Kachana			P

PL	Province	Commune	Douar	Land Type		
				Communal	Habous	Private
11	Fahs Anjra	Khmis Anjra	Dar Kachana			P
12	Fahs Anjra	Khmis Anjra	Dar Kachana		Ramla Village	
13	Fahs Anjra	Khmis Anjra	Dar Kachana			P
14	Fahs Anjra	Khmis Anjra	Dar Kachana			P
15	Fahs Anjra	Khmis Anjra	Dar Kachana			P
16	Fahs Anjra	Khmis Anjra	Dar Kachana	Dar Kachana		
17	Fahs Anjra	Khmis Anjra	Dar Kachana		Ramla Village	
18	Fahs Anjra	Khmis Anjra	Dar Kachana		Ramla Village	
19	Fahs Anjra	Khmis Anjra	Dar Kachana			P
20	Fahs Anjra	Khmis Anjra	Beni Atab	Beni Atab		
21	Fahs Anjra	Khmis Anjra	Beni Atab			P
22	Fahs Anjra	Khmis Anjra	Beni Atab			P
23	Fahs Anjra	Khmis Anjra	Zaouia	Zaouia		
24	Fahs Anjra	Khmis Anjra	Zaouia	Zaouia		
25	Fahs Anjra	Khmis Anjra	Zaouia	Zaouia		
26	Fahs Anjra	Khmis Anjra	Zaouia	Zaouia		
27	Fahs Anjra	Khmis Anjra	Zaouia	Zaouia		
28	Fahs Anjra	Khmis Anjra	Zaouia			P
29	Fahs Anjra	Khmis Anjra	Zaouia			P
30	Fahs Anjra	Khmis Anjra	Zaouia			P
31	Fahs Anjra	Khmis Anjra	Boulaichich			P
32	Fahs Anjra	Khmis Anjra	Boulaichich	Boulaichich		
33	Tetouan	Sadina	Ouad Akla			P
34	Tetouan	Sadina	Ouad Akla			P
35	Tetouan	Sadina	Ouad Akla			P
36	Tetouan	Sadina	Ouad Akla			P
37	Tetouan	Sadina	Ouad Akla			P
38	Tetouan	Sadina	Ouad Akla			P
39	Tetouan	Sadina	Ouad Akla			P
40	Tetouan	Sadina	Ouad Akla	Ouad Akla		
41	Tetouan	Sadina	Ouad Akla			P
42	Tetouan	Sadina	Ouad Akla	Ouad Akla		
43	Tetouan	Sadina	Ouad Akla	Ouad Akla		
44	Tetouan	Sadina	Ouad Akla	Ouad Akla		
45	Tetouan	Sadina	Ouad Akla	Ouad Akla		
46	Tetouan	Sadina	Ouad Akla	Ouad Akla		
47	Tetouan	Sadina	Ouad Akla			P
48	Tetouan	Sadina	Keddan	Keddan		
49	Tetouan	Sadina	Keddan	Keddan		
50	Tetouan	Sadina	Jaabak			P
51	Tetouan	Sadina	Jaabak			P

PL	Province	Commune	Douar	Land Type		
				Communal	Habous	Private
52	Tetouan	Sadina	Jaabak			P
53	Tetouan	Sadina	Jaabak			P
54	Tetouan	Sadina	Jaabak	Jaabak		
55	Tetouan	Sadina	Jaabak	Jaabak		
56	Tetouan	Sadina	Jaabak			P
57	Tetouan	Sadina	Jaabak			P
58	Tetouan	Sadina	Jaabak			P
59	Tetouan	Sadina	Jaabak			P
60	Tetouan	Sadina	Sadina			P
61	Tetouan	Sadina	Sadina			P
62	Tetouan	Sadina	Sadina		Sadina	
63	Tetouan	Souk Kdim	Bounzal			P
64	Tetouan	Souk Kdim	Bounzal		Bounzal	
65	Tetouan	Souk Kdim	Bounzal			P
66	Tetouan	Souk Kdim	Bounzal			P
67	Tetouan	Souk Kdim	Bounzal		Bounzal	
68	Tetouan	Souk Kdim	Bounzal			P
69	Tetouan	Souk Kdim	Bounzal			P
70	Tetouan	Souk Kdim	Bounzal			P
71	Tetouan	Souk Kdim	Bounzal		Bounzal	
72	Tetouan	Souk Kdim	Bounzal			P
73	Tetouan	Souk Kdim	Bounzal		Bounzal	
74	Tetouan	Souk Kdim	Bounzal		Bounzal	
75	Tetouan	Souk Kdim	Bounzal			P

The figures provided in the Annexes show the location of the Communes, Douars and properties discussed in this section for the WF and PL.

2.2 Site Condition and Land Use

Windfarm

The proposed Wind Farm will be positioned along the main ridge of the Jbel Sandouq, running in a north to south direction, with offshoots along three spurs located at the northern end of the ridgeline. The mountain's slopes are too steep for habitation and as such the slopes and ridge are not inhabited. Consequently, the ridge and slopes comprise of vestiges of the native cork oak forests (Suberaie), Mediterranean shrubland (Maquis), planted Pine woodland (Pinede), and planted Eucalyptus woodland.

With respect to the land use of the area where the WF will be built, it is entirely located over communal land, which is managed by the Douars listed previously. Since the land is communal, access and use of the land is open and shared by all villagers of the

neighbouring Douars. As such the land is essentially used for grazing or as passage from one side of the mountain to the other in order to access more suitable grazing land.

Given that land is communal, land acquisition and financial compensation is not applicable. Instead Livelihood Restoration Measures will be developed to ensure that the landuser's socio-economic condition is not negatively impacted and potentially improved compared to the existing situation. Details of these mitigation measures are provided in the Land Acquisition and Livelihood Restoration Plan (LALRP).

The ridge of Jbel Sendouq can be accessed from its north flank and mid-west flank. From the north, asphalt roads P4613 and P4701 lead to dirt roads, one flanking the north east side of the mountain, whilst the other flanking the north west. These two dirt roads actually connect at the top of the ridge, thereby creating a small, though winding loop road. From the mid-west flank, the same P4071 can be followed in a southerly direction, which connects with a dirt road heading directly west and up towards the middle section of the Jbel sendouq.

These dirt roads and the P4701/P4613 run though the foothills and plains surrounding the Jbel Sendouq. The land use of these foothills and plains comprises of subsistence agricultural practices, such as the cultivation of cereals, legumes and some fruit.

The approximate total population of the Douars Is 5,145, based on the details of 2014 census, which is discussed in the Social Impact Assessment report.

Power Line

The 24Km long Power Line will start from the Khalladi substation, which will be located at the base of Jbel Sendouq on its Midwest Flank, and connect to the ONEE Substation located 10Km west of the town of Tetouan, and accessible from the P4071.

The land use of the communal and Habous properties affected by the PL are used for grazing, as such they are not cultivated. The privately owned lands, on the other hand, are cultivated with cereals and legumes, or are plantations.

The approximate total population of the two Douars is 1,651, based on the details of 2014 census, which is discussed in the Social Impact Assessment report. With regards to the 43 private properties the impacted population will comprise of the landowners and their household. Finally with regards to the communal and Habous plots, these fall within another 8 different Douars, however given the plots isolation from the Douar centres, and the fact that the land use is grazing, an estimate of the affected population can only be provided based on a conservative valuation of the Douar population size and the fraction of herders. A conservative estimate would be to consider that ½ the Douar population will comprise of

herders, as such with an average Douar population of 640, the potential affected population would be 2,560.

The land acquisition process for the WF and PL, has been on-going for the last four years and is expected to be completed in August 2015. The agreements for the right of way of the Power Line have been signed and payment made for all but 9 plots (89.5% completion), which are expected to be completed in early August 2015. All the land acquisition has been undertaken through voluntary agreements with the relevant private and public landowners.

The following series of Images show the typical site condition and land use around the Jbel Sendouq.

Plate 1 Northern Crest

Plate 2 Southern Crest

Plate 3 West Flank – mid section of the Jbel

Plate 4 East Flank – mid section of the Jbel

The following series of Images show the typical site condition and land use around the Power Line Alignment.

Plate 5 Land Use in North Sector of Project (PL 1- 5)

Plate 6 Land Use in Center Sector of Project (PL 34- 35)

Plate 7 Land Use in South Sector of Project (PL 68- 75)

Further discussion of the environmental characteristics of the WF and PL project areas which are relevant to the assessment of environmental impacts are provided in the Biodiversity Protection Plan and Ecological chapter of the EIA. The characteristics of each of the affected Douars is provided in the Social Impact Assessment and the affected plot of land and their uses is discussed in the Land Acquisition Plan.

2.3 Project Design

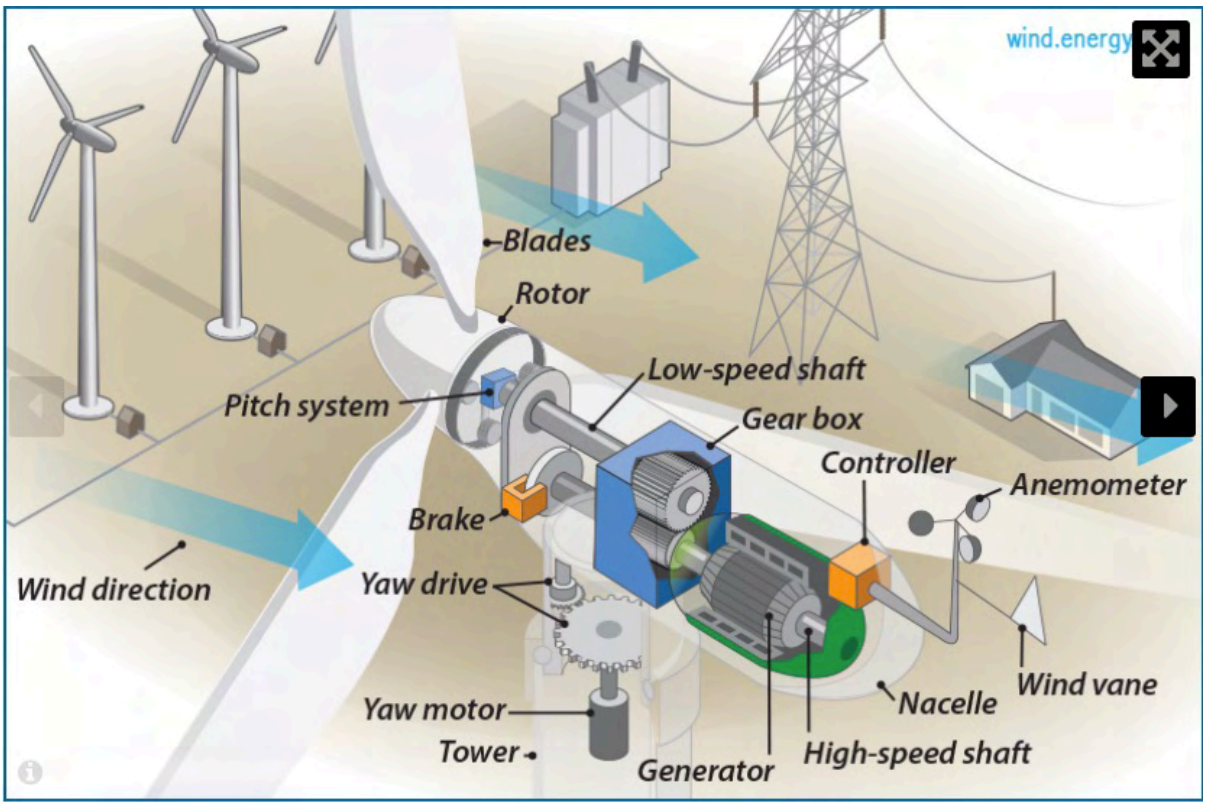
The principal of a wind farm is to capture wind energy, convert it to kinetic energy by a rotational movement, which drives a conventional electric generator to produce electricity. The mechanism by which the energy of the wind is converted to electric power is the Turbine.

The proposed Khalladi Wind Farm will comprise of 40 turbines, with an individual output capacity of 3MW, thereby producing a total potential output of 120MW. The footprint of the Wind Farm, which comprises of the roads, road easement, turbine platforms, guard houses, and substation plot will cover an area equivalent to 180Ha manly falling across the ridge of the Jbel Sendouq.

The turbines model is a Vestas V90-3000, each of the three blades will be 44m long and the tower height will be 80m. The turbine comprises of the following components:

- Rotor which comprises of the hub and up to three blades
- Tower, upon which the rotor and Nacelle is affixed
- Nacelle, is a compartment which contains the generator and other moving parts
- Shaft, which is connect to the generator and driven by the spinning rotor, and his housed in the Nacelle.
- Anemometer and controller, these measure wind speed and activate and control the spinning of the rotor. Typically, a turbine will operate in the range of 9km/hr to 50km/hr.
- Pitch system, which turns the blades out of the wind system, to control spinning speed or stop the spin entirely.
- Brake, which is used for emergency stopping of the spinning rotor
- Yaw drive, which ensures that the turbine is always facing the wind.

Plate 8: Components of a Wind Turbine (source: energy.gov)



In conformance with industrial best practice and design guidelines, the turbines will be positioned approximately 240m apart, which is equivalent to 5-7 times the length of the blade in the direction of the wind, and 3 times the diameter of the rotor in a perpendicular direction to the wind.

The 33kV electrical cables connecting the turbines to the substation, will be trenched parallel to the access road on the ridge and the access road to the Khalladi substation. The trenches will be 80-120cm deep and the burying of the electric cables will be in accordance with international electricity safety standards including the Commission Electrotechnique Internationale (CEI), the European Committee for Electrotechnical Standardization (CENELEC), and Good Industry Practice.

The Wind Farm will be accessed via the existing provincial roads and dirt roads, as described earlier. These dirt roads, which total approximately 4km, will be asphalted as part of the project requirements.

Once on the ridge, a dedicated road will be built as a link between the turbines. The approximate length of new road construction will be 3.2km.

The substation will be built on a 5,000m^2 plot located at the base of the east flank, northwest of the Douar El Fahammine. The structure will be positioned over 200metres away from any residential dwellings. Within the same substation plot, a secondary building and annexes will be built for the O&M of the Wind Farm. These structures will include: offices, material storage, and a tool shed.

Finally, two security posts will be positioned on the ridge, one at the north entrance and the second uphill of the substation in order to control vehicles using the WF access road.

The map provided in the Annex show the general layout of the WF.

The 225kV Power Line will transfer the electricity generated by the Khalladi Wind Farm from the Khalladi substation to the ONEE substation. The Khalladi substation will be located at the base of the eastern flank of Jbel Sendouq, near the mid point of the mountain range in Meloussa. The ONEE substation is located approximately 10Km west of Tetouan and is directly accessible from the P4701 road. The total length of the high voltage overhead power line is approximately 24km and will comprise of 75 pylons. This power line is alternatively called the Meloussa-Tetouan Transmission Line.

The components of the Power line are:

- Double circuit, in single voltage of 570mm^2 double branch Almelec conductor cables
- A 48-fiber Optical Ground Wire (OPGW) fiber optic cable installed as the line's protection cable, with Alec- AWG litz wire.
- 2T1P galvanized steel, tetrapod pylons.

During the lifetime operation of the power line and for maintenance purposes, a 60m wide easement will be maintained. Essentially, tall vegetation clearance will occur within this easement on a routine basis for the lifetime of the Power Line, and only low growing grasses will be sown as a dust and erosion control measure. This easement will also contain the 3.5 m wide access road that will run adjacent to the alignment of the PL. This road, as it is within the easement will be grassed and not surfaced or dirt.

The map provided in the Annex shows the general layout of the PL.

2.4 Construction Phase

The following series of works will be undertaken in association with the WF and PL Project:

Preparatory Works

- Site surveys
- Site preparation, vegetation clearing & development;
- Infrastructure works; and

- Construction facilities.

Civil Works

The 6 boreholes sampled during the preliminary geotechnical investigations indicate that general soil improvement will likely not be required. Compaction is expected to be limited to local areas where "soft spots" may be encountered, for road construction and backfilling to foundations.

Excavation methods will be dependent on the ground conditions and the depth of foundations. Therefore either, shallow strip foundation design or shallow raft foundations may be used depending on the technical requirements of the structures. Excavated soil will be reused where possible. During the construction phase, the civil contractor shall conduct a detailed geotechnical study for each foundation.

It should be noted that no blasting will be carried out on the ridge, given that Douars are located at the base of the Jbel, instead conventional equipment such as excavators and rock breakers will be used.

Construction Materials

Construction materials will be sourced locally where possible. Materials available locally include:

- Ready mix concrete;
- Concrete Products, road kerbing and paving etc.;
- Steel reinforcement;
- Building block work;
- Pipework;
- Tiling and finishing products, roof tiles etc.;
- Asphalt products.

Materials that are not sourced locally will be either regionally obtained or as a last resort will be imported from overseas. Local agents will be used wherever possible for sourcing mechanical and electrical plant and machinery. High quality finishing products may be imported if they are not available locally.

2.5 Construction Logistics

Programme

The construction of the wind farm will be conducted in two phases, which are further split into sections of multiple turbine units. The following table provides the indicative timeline for the construction of the sections.

Table 2-3: Wind Farm construction programme

	Start Date	End Date	Turbine IDs
Phase 1			
Section 1 – 7 units	14/12/16		# 34, 35, 36, 37, 38, 39 and 40
Section 2 – 5 units	30/12/16		# 27, 28, 29, 31 and 32
Section 3 – 7 units	01/02/17		# 20, 21, 22, 23, 24, 25 and 26
Section 4 – 7 units	24/02/17	04/05/2017	# 13, 14, 15, 16, 17, 18 and 19
Phase 2			
Section 5 – 2 units	03/03/17		# 30 and 33
Section 6 – 6 units	24/03/17		# 7, 8, 9, 10, 11 and 12
Section 7 – 6 units	14/04/17		# 1, 2, 3, 4, 5 and 6

The construction access roads will be the same roads that will be used during the operational phase of the project, and as such the earlier mentioned dirt road improvements and new road construction on the ridge, will be the first construction activities, followed by the phasing of the Turbine erection. With regards to the laydown areas, a central area will be built on the ridge, as shown in the figures provided in the Annex, this area will also include the worker accommodation, this area will also include the worker accommodation. Additional material storage will be contained within the Khalladi substation plot. As such no temporary roads or lay down areas will be created, as the construction footprint of the Wind Farm will be contained within the 180 ha operational footprint. Following completion of construction the worker accommodation and Laydown area on the ridge will be remediated; the details of which are discussed in the Biodiversity Protection Plan.

Upon completion of the final turbine units, NOMAC will operate and manage the Wind Farm, which is a subsidiary of ACWA Power.

The design studies and start of construction of the Power Line, will commence upon the notice proceed, which is expected on September 1st 2015. The same contractor who will take in charge the electrical works of the wind farm will build the power line. As with the Wind Farm, the operation access roads will double up as the construction access roads, and the construction laydown areas will be at the base of the pylons and at the Khalladi substation. As such no temporary roads or lay down areas will be created, as the construction footprint of the Power Line will be contained within the operational footprint.

The Power Line, upon completion of construction, will be the property of ONEE. The expected hand over date is 15/10/2016, before the start of turbine commissioning. In fact, the power line is required for the energization of the turbines and hence for the start of the commissioning works of the turbines.

Workers and Facilities

Given the duration of the contract and the volume of construction, it is expected that all workers, for both the WF and PL, will live at a dedicated worker accommodation, which will

be constructed in accordance with the IFC/EBRD Worker Accommodation Guideline (Worker's Accommodation: Process And Standards. A guidance note by IFC and the EBRD). The number of workers will be approximately 50 people at the beginning of construction and will reach the peak in the middle of the construction period, almost 300 people for civil works, electrical works, transport and WTGs erection. The number will reduce again to 20 people at the end during the WTGs commissioning. With regards to the power line, the number of workers is expected to be 40 people.

The local communities will be prioritized in the recruitment of workforce for the jobs not requiring high level of qualification such as excavation and concreting works, security and cleaning service. The expected number of workers from the local communities is expected to be 150. The requirement to hire workers from the local communities, is contractually passed to the contractors in the annex 05 of the BOP contracts "*Cahier de charge environnemental*".

Furthermore, the local suppliers will be first to be consulted for supply of commodities or other products.

The contractors will be responsible for the on site provision of workers services within the on site accommodation camp,, such as canteens, domestic facilities and transportation.

The canteens will generate putrescible and domestic waste, which will be collected from designated areas for storage and removal to an appropriate municipal waste disposal facility. Additionally, litterbins will be provided around the construction site.

The domestic services will consist of sanitary facilities, including restrooms, water tanks and drinking water. All liquid sanitary facilities will drain to a centralized septic tank collection system, which will be emptied on a regular basis and transported off-site by a licensed contractor for disposal in a licensed wastewater treatment facility.

Water supply

Contractors will be responsible for the supply of water during construction. A water tank with sufficient capacity to meet construction water needs will be installed on site. Lorries will be used to fill the water tanks.

2.6 Operation Phase

As mentioned, the Wind Farm O&M will be NOMAC, whilst the Power Line will revert to ONEE ownership.

Use of the access road connecting the turbines will restricted via two security gates, located at the ridge. The first gate will be at the north tip of the Wind Farm, whilst the second gate will

be in the mid section of the WF. However, general access to the Jbel Sendouq, and therefore the ability to walk through the Wind Farm and cross the ridge will not be restricted. As such the pastoralist and any grazing animals will have open access to the entire Jbel Sendouq as is currently the situation.

The projected workforce for managing the WF is:

- 1 Operation manager
- 15 technicians
- 4 security guards
- 1cleaner

The local workforce will ensure the security and cleaning tasks. Expected number is 5.

The requirement to hire workers from the local communities, is contractually passed to the contractors in the annex 05 of the BOP contracts "*Cahier de charge environnemental*".

2.7 Decommissioning Phase

The Khalladi windfarm will operate under a PPA for a 20year period, if at that time, the Project Company (Consortium of ACWA Power/UPC Renewable) chooses to decommission the facility, then the Project Company will ensure the decommissioning of the wind farm with respect to the measures describe in the ""*Cahier de charge environnemental*". However, given the time lapse between the preparation of this Cahier and the decommissioning, the Project Company would be required to carry out an Environmental Impact Assessment of the decommissioning that will be in accordance with the national and international environmental regulations, and any lending institution's environmental policies in force at the time of decommissioning.

The Power Line, upon completion of construction, will be the property of ONEE and hence ONEE will be responsible of its decommissioning.

3 PROJECT MANAGEMENT AND RESPONSIBILITES

The "*Cahier de charge environnemental*", supplementary information in the Environmental and Social Management and Monitoring Plan, and management recommendations in the specific reports of the disclosure package provide detailed descriptions of the project management, staffing and roles and responsibilities of the EPC, O&M, Project company and any subcontractors working on the projects.

It should be noted that these environmental documents will be annexed to the EPC contracts. Furthermore, In accordance with clause 3.1.1 of the EPC, it is stipulated that the contractors shall comply mainly with the following World Bank Guidelines in the performance of the works:

- IFC General EHS Guidelines, April 2007
- IFC EHS Guidelines for Wind Energy, April 2007
- IFC EHS Guidelines for Electric Power Transmission and Distribution, April 2007

The ESMMP in particular, outlines the environmental and social management structure, which will be responsible for implementing the mitigation measures and procedures recommended in the EIA, and supplementary packages.

The ESMMP will define the respective roles and responsibilities with regard to the environment and identify the site's responsible Environmental Manager. Descriptions of individual environmental team responsibilities should detail and include, but not be limited to, the following team members:

Project Director/Manager is responsible for the delivery of the project, which includes environmental and social management requirements.

Construction Manager and Operation Site Manager are responsible for ensuring that Environment, Health and Safety (EH&S) measures are managed during construction and operational phases.

Contractors are responsible for consistently implementing environmental and social management measures in accordance with the mitigation and monitoring measures outlined in the EIA/supplementary packages and are in compliance with the national and international applicable regulations.

The **Subcontractors'** responsibilities parallel those of the Contractor's project personnel, and therefore all persons working on site will comply with the environmental and social requirements detailed in the ESMMP.

The assigned EPC will be required to employ a dedicated and experienced **Environmental/Social Coordinator** at all times on site, to ensure the Construction ESMMP mitigation measures are followed and resolve issues as and when they may arise.

4 ASSESSMENT OF ALTERNATIVES

Under Moroccan and international guidelines for environmental impact assessments, the evaluation of various project locations and design alternatives were considered, in order to ensure that the objectives of the proposed project have accounted for social, ecological, economic and technological options.

The following project alternatives were considered:

4.1 No Project

The "No Project" option is not a viable alternative, as the objective of the renewable energy law is to diversify the sources and production measures of power for the Kingdom of Morocco.

4.2 Alternative project location

An alternative study was undertaken along the coast of Tanger, north Morocco in December 2007, in order to identify other potential sites for the wind farm project (International Conseil Energie, 2007). A total of four (4) wind locations were visited and positive/negative aspects of each of these sites was identified. The following positive observations were considered for the Khalladi wind farm area:

The projected site for the power line and substation of Khalladi Wind Farm is characterised by areas that have been largely affected by long-term human agricultural use. The areas covered by Pine woodland and Mediterranean scrub represent nearly the total areas of implementation of the projected wind farm and these areas are used by collectives ('soulalahs') for the purpose of grazing. Most of the alternative locations had similar land use, as rural areas comprised most of the sites analysed during the alternative analysis phase.

Socio-economic considerations were taken into account when contemplating the best optional area for the proposed wind farm. Over two thirds (43.5%) of the economy of the region where alternative studies were undertaken is based on agriculture, livestock, forestry and fisheries. The proposed wind farm will provide new economic options for the local population, as new employment opportunities will be available during the construction and operational phases.

When considering accessibility, preference was given to sites that had several existing tracks in good conditions, as this would help to reduce land-take impacts, reduce costs and reduce construction time.

In terms of ecology and biodiversity, the Khalladi Wind Farm site offered the possibility of aligning the turbines in parallel to the main flight direction of migratory birds and thus a single row of turbines would be required. By aligning the turbines parallel to the migration path, the risk of migratory birds entering the vertical air space occupied by the turbine blade sweep is reduced.

When considering maximum implementation and wind average speed, Khalladi offered the best options with regards to accessibility, constructability and wind potential.

The following table summarises the main characteristics of each site, which were used in the Assessment of Alternatives.

Plate 9: Locations of Alternatives Sites

Table 4-1 Summary of characteristics for each site.

	JARDOUNA WF	KHALLADI WF	TAGRAMT WF	SOROR WF
Description				
Area	24 km^2	30km^2	4,6km^2	-
Maximum implementation, WT	9,5 km, above 200m, NS direction. Considering V80-2000 turbines, a maximum of 41 turbines could be installed with distance between turbines: 2xrotor diameter. Total potential capacity 80MW.	14.3km, above 200m, NS direction. Considering V80-2000 turbines, a maximum of 60 turbines could be installed with distance between turbines: 2xrotor diameter. Total potential capacity 120MW.	3.7km, above 200m, NS direction. Considering V80-2000 turbines, a maximum of 15 turbines could be installed with distance between turbines: 2xrotor diameter. Total potential capacity 30MW.	Given the complexity of the site it is difficult to assess the potential capacity at this stage. However, if access problems are resolved, a Total potential of 150MW could be developed.
Possible alignment	Yes	Yes	Yes	Yes
Noise Levels	Low	Low	Low	Low
Landscape, type	Rural	Rural	Rural	Rural
Access tracks	Good condition	Good condition	Good condition	No access onsite
Transport	Easy	Negligible difficulties	Easy	Very difficult
Potential				
Altitude, m	200-380	200-630	200-320	450-750
Construction Difficulty	Complex	Complex	Complex	Steep topography
Community City and location	Fnideq, E	Tanger, W	Tanger, W	Tetouan, S

	JARDOUNA WF	KHALLADI WF	TAGRAMT WF	SOROR WF
Wind Average Speed (m/s)	9,5	9,5	8	10
Expected load factor (%)	39	34	30	45
Biological resources				
Woodland	Low	Maquis up to 500m above sea level (pre-Alpine floor)	Maquis up to 500m above sea level (pre-Alpine floor)	Low to non existent
Valleys	Several shallow valleys major axis parallel NS	Several shallow valleys major axis parallel NS	Several shallow valleys major axis parallel NS	Several shallow valleys major axis parallel NS
Agriculture	Personal subsistence and grazing	Personal subsistence and grazing	Personal subsistence and grazing	Personal subsistence and grazing
Infrastructure				
Heritage	Touristic and residential areas to the east	Farmland and rural areas	Farmland and rural areas	Farmland and rural areas
Archaeological Sites	Mosque at the entrance of Fnideq town.	N/A	N/A	N/A
Main Roads	Good condition	Good condition	Good condition	Good condition
Global Assessment	**++**	**+++**	**+**	**+/-**

4.3 Alternative Design

The alignment, number of turbines, and type of turbines chosen for the proposed project was determined on the basis of total required power output, available technology, constructability on site, and wind strength and direction patterns and environmental and social constraints.

The determination of the number of potential turbines is based on the evaluation of the size of the turbine, spacing between turbines, accessibility to the ridge, available infrastructure that would prevent construction, connectivity to the grid, proximity to dwellings (in relation to noise, flicker and safety), and ecological sensitivities (avifauna and habitat).

The selection for the type and size of the turbine is dictated by:

- The maximum number of turbines that can be installed at the site; and
- The total height of the turbine taking in consideration visibility vs. efficiency.

The first point is covered by the previous discussion. With regards to visibility, a marginal decrease in the height of the turbine (to blade tip, in vertical position), would not change the magnitude of visual impact from the viewpoint of key sensitive receptors. However, the decrease in energy output would be significant and would result with a greater number of smaller turbines to provide the equivalent power output of fewer larger turbines.

Once the above factors have been selected, the layout of the wind farm can be further fine tuned, so as to further minimise the social and ecological impacts. The main factors that influence the layout are: topography, wind direction, proximity to sensitive receptors, and environmental constraints.

Based on the above evaluations, the resulting Wind Farm will comprise of 40 turbines, 124m high (to blade tip in vertical position), with an individual output of 3MW, and will follow the alignment of the main ridge of Jbel Sendouq, with offshoots along three spurs located at the northern end of the Wind Farm. The specific way in which the specific factors outlined above lead to the consideration of different alternatives was not document in detail, as alternative layouts, during the project development.

With regards to the Power line, UPC Renewables started looking into the preferred alignment for connecting the Meloussa Substation to the Tetouan Substation in 2010. The selection of the preferred alignment was based on a constraints analysis of social, engineering, maintenance and cost issues with relation to the evaluation of the following criteria:

- Voltage drop over distance
- Accessibility for construction and operation

- Suitability of terrain for facilitating the installation of the pylons and wires
- Availability of land for maintenance of a buffer zone
- Prudent avoidance of inhabited areas due to EMF

Once the general area of the Power line was identified, the refinement of the alignment focused on avoiding houses, structures or valuable land-uses and reaching voluntary agreements with all land owners. As such a local employee was hired to approach land owners and find out what would be the most suitable alignment. When a landowner expressed his reluctance to reach an agreement, the alignment was modified to avoid his land.

UPC Renewables considered several alternatives in connection with the transmission line for the Khalladi 120 MW power project. These included both medium voltage and high voltage transmission line options. The medium voltage option had the advantage of requiring a simple upgrade to an existing 60 kV line running adjacent to the project site. Given the quantity of power being evacuated, this option was dismissed as being technically not feasible.

ONEE was initially consulted for the high voltage line option and it proposed a pathway which UPC Renewables examined in more detail with its environmental consultants. Finding no environmental, heritage site or social constraints, UPCR set about discussing with local and regional representatives the line path being proposed. After having consulted with these various officials, UPC then started meeting with landowners and other stakeholders to discuss the power line. In certain circumstances the trajectory of the line was modified because a particular landowner did not want a pylon on his [or her] property. In other cases, the pathway was modified to accommodate technical considerations (e.g. distance of spans between pylons, geotechnical concerns for foundations, etc.). The final including approximately 75 pylons was approved by ONEE, regional and local authorities in 2012. It was subsequently modified slightly to accommodate the request of certain landowners. In this regard it is important to remember that the Khalladi site was initially identified by ONEE and assigned to UPC Renewables in the context of the Energie-Pro Term Sheet signed in January of 2008.

The final design of the 225kV PL resulted with an alignment of approximately 24km, with 75 pylons. The design and material selection of the pylons and wires will be in conformance to the technical specifications of the ONEE.

Finally it should be noted that micro-siting changes may still occur, and therefore the exact location of turbines, pylons, road alignments may vary in accordance with Environmental

and Social considerations raised during the stakeholder engagements and specialists ecological surveys.

5 CUMULATIVE IMPACTS

A cumulative impact assessment (CIA) process has been undertaken to understand the impacts of the proposed windfarm and Powerline development alongside other commercial, industrial and infrastructure developments in the area. The spatial boundary for identifying the cumulative impacts has been based on a 20Km radius of the approximate centre of the Khalladi Wind Farm project. Within this 20km radius, the following developments have been identified:

- Eight windfarm (inclusive of current project)
- Eight power lines (inclusive of current project)
- Two Substations
- One railway and three Highways
- Four quarries
- One car manufacturing Facility (Renault)
- One Port, Tanger-med

The Valued Environmental Components (VEC) that has been assessed for the CIA has focused on the social and economic environment and the ecological environment.

The main ecological VECs are Avifauna (birds and Bats) and Habitat fragmentation (EBRD PR6). The main social-economic VECs are land acquisition/economic displacement, worker migration, urbanisation and marginalisation of rural areas, and employment opportunities (EBRD PR 2, 5, 8).

The detailed CIA discussion and results are provided in the SIA and BPP report. The conclusions for the socio and ecological cumulative impacts reveal that the proportionate contribution of the proposed projects will result with an insignificant increase in negative or positive impact from the current level of impact within the studied radius.

6 GREENHOUSE GAS ASSESSMENT

The production of power by harnessing wind energy does not generate direct greenhouse gas emissions during the operational phase of the windfarm. An estimate of GHG savings potential for this project has been calculated using EBRD's Greenhouse Gas Assessment Methodology, where renewable energy power generation projects are assumed to displace the emissions associated with the national average grid electricity generation.

For the Khalladi Windfarm Facility, comprising of 40 wind turbines - nominal power of 3MW (120 MW installed power), the developer has estimated that the expected annual energy production will amount to approximately 429,942 MWh.

The calculation of emission savings is based on the following equation:

Annual production (MWh) x EFgrid, reduced (tCO_2/MWh) = Emission Savings (tCO_2/yr)

The Emission Factor (EF) for each country for Solar and Wind Generation is based on the following equation:

EF (t CO2/MWh) = [0.75 x OM (t CO2/MWh)] + [0.25 x BM (t CO2/MWh)]

Where the Operating Margin (OM) is the average CO2 emissions per unit net electricity generation (tCO_2/MWh) of all generating power plants; and the Build Margin (BM) is the most efficient fossil fuel electricity generation available in Morocco. According to the latest Clean Development Mechanism (CDM), the values for Morocco are:

- OM = 0.669 tCO_2/MWh
- BM =0.486 tCO_2/MWh

As such, the EF for Morocco will be:

EF = [0.75 x 0.699] + [0.25 x 0.486] = 0.623 tCO2/MWh

However, Clean Technology Fund (CTF) is using 0.633 tCO2/MWh for their projections. Consequently, based on further input from the EBRD, an EF of 0.630 t/MWh, has been used as a reasonable estimate.

Finally, the calculation of emission savings based on the values provided above will be in the order of 270,863.46 tons per year.

429,942 MWh x 0.630 tCO2/MWh = 270,863.46 tCO2

This total does not take into account other upstream emissions associated with the provision of materials, the construction phase, associated facilities and other life cycle impacts.

ANNEXES

Figure 1: Wind Farm and Power Line Project Locations

Figure 2: Khalladi Wind Farm – Douars

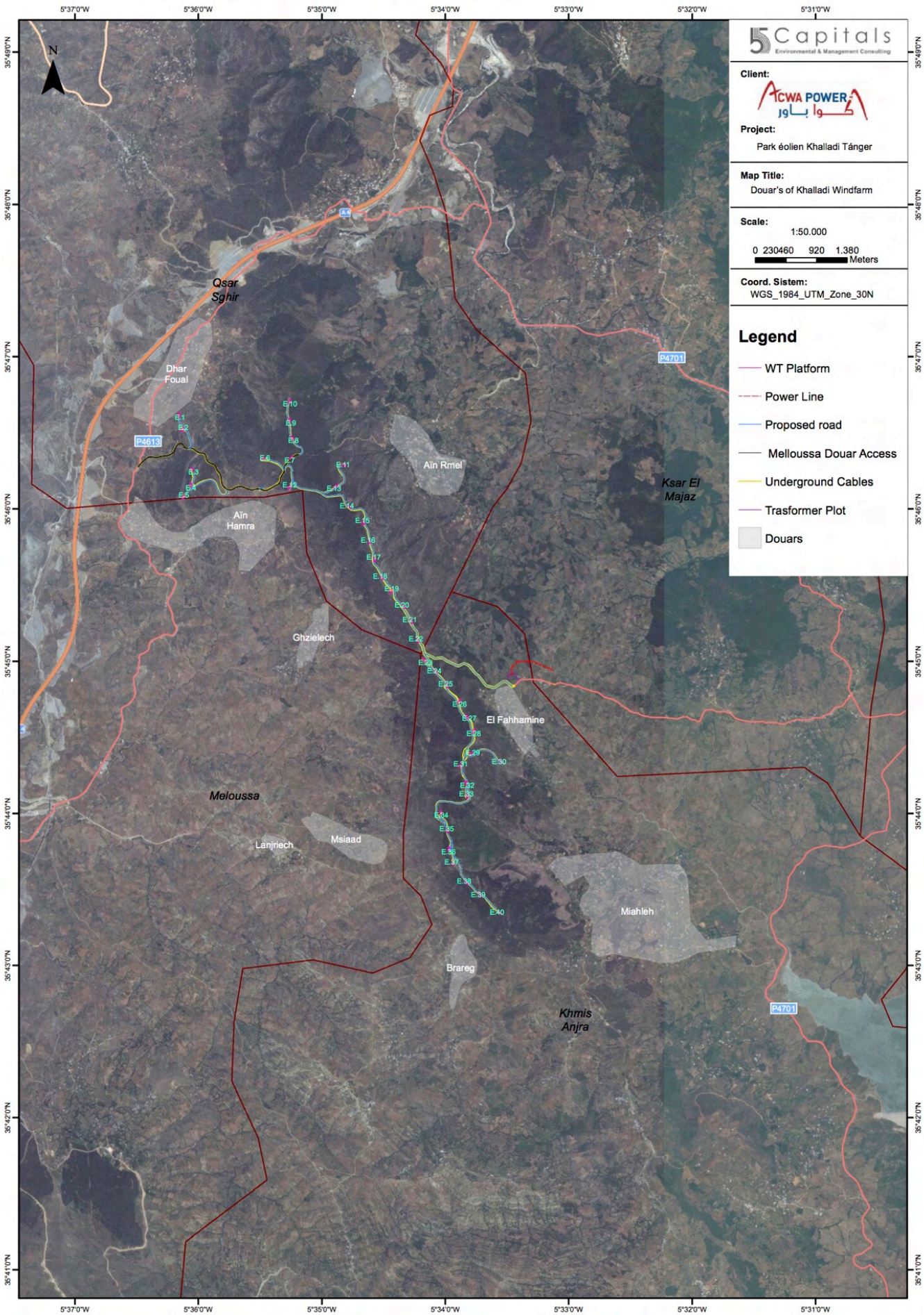


Figure 3: Habitats within the Windfarm Footprint

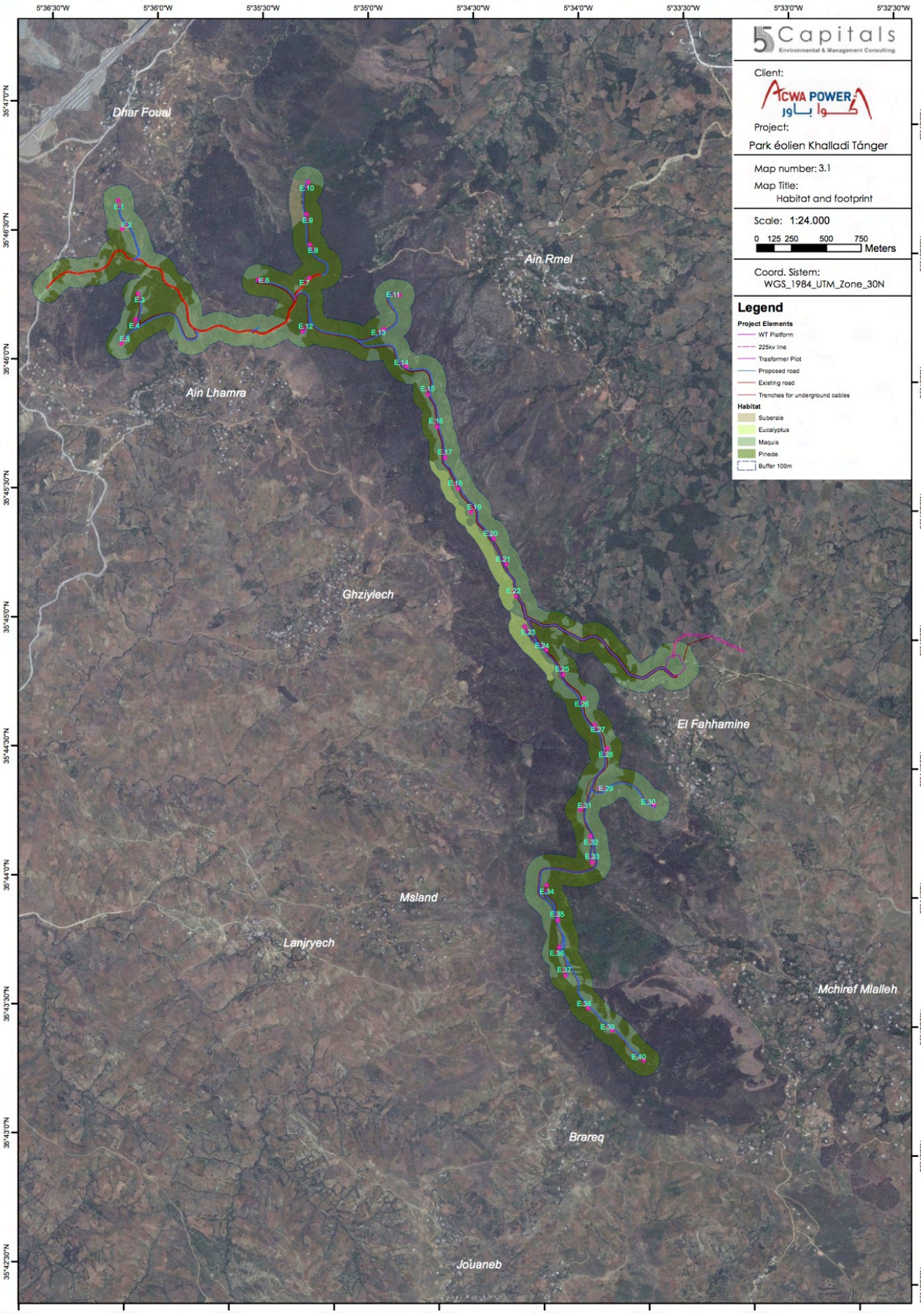


Figure 4: Habitats within the Power Line Footprint

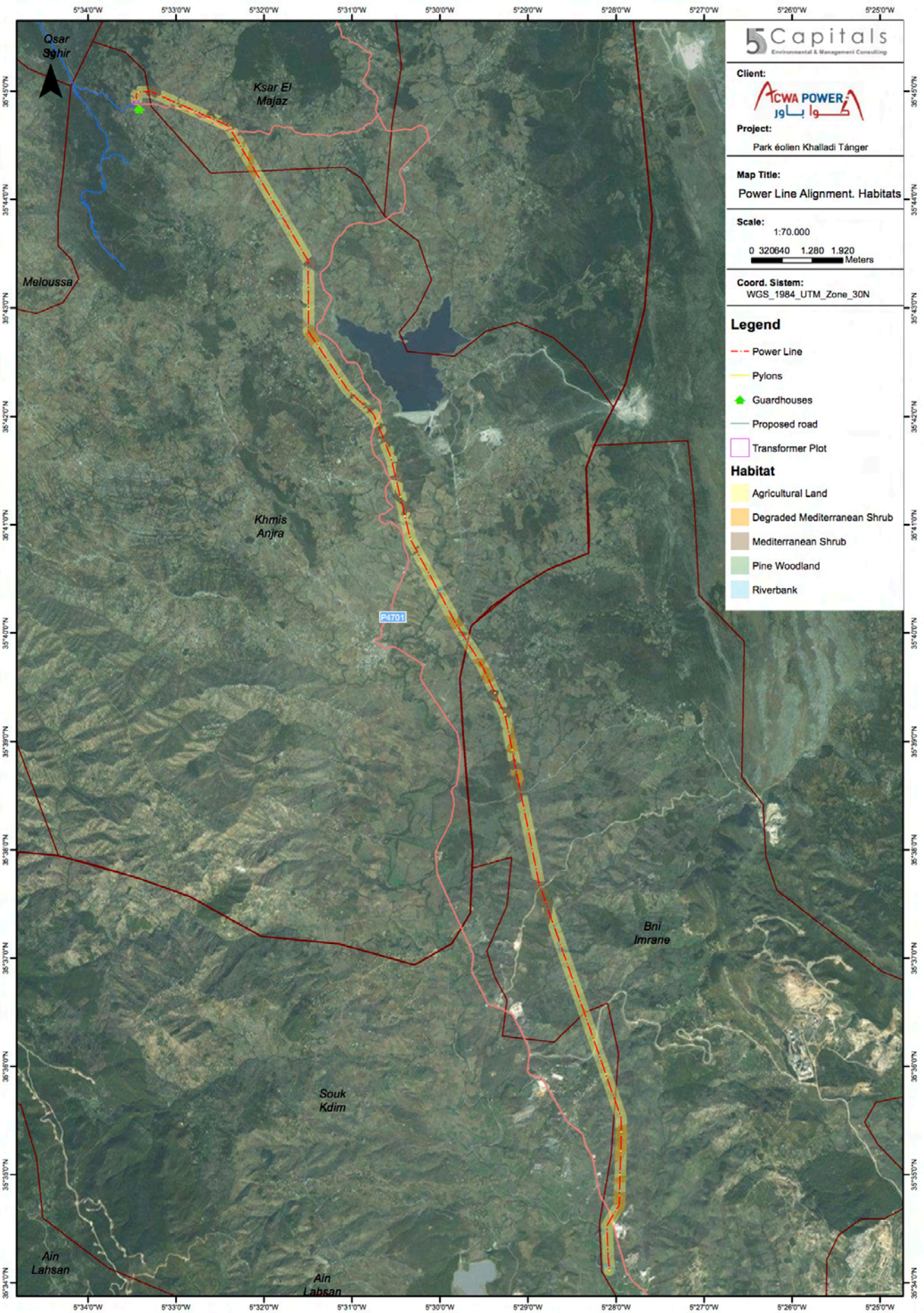


Figure 5: Wind Farm Layout

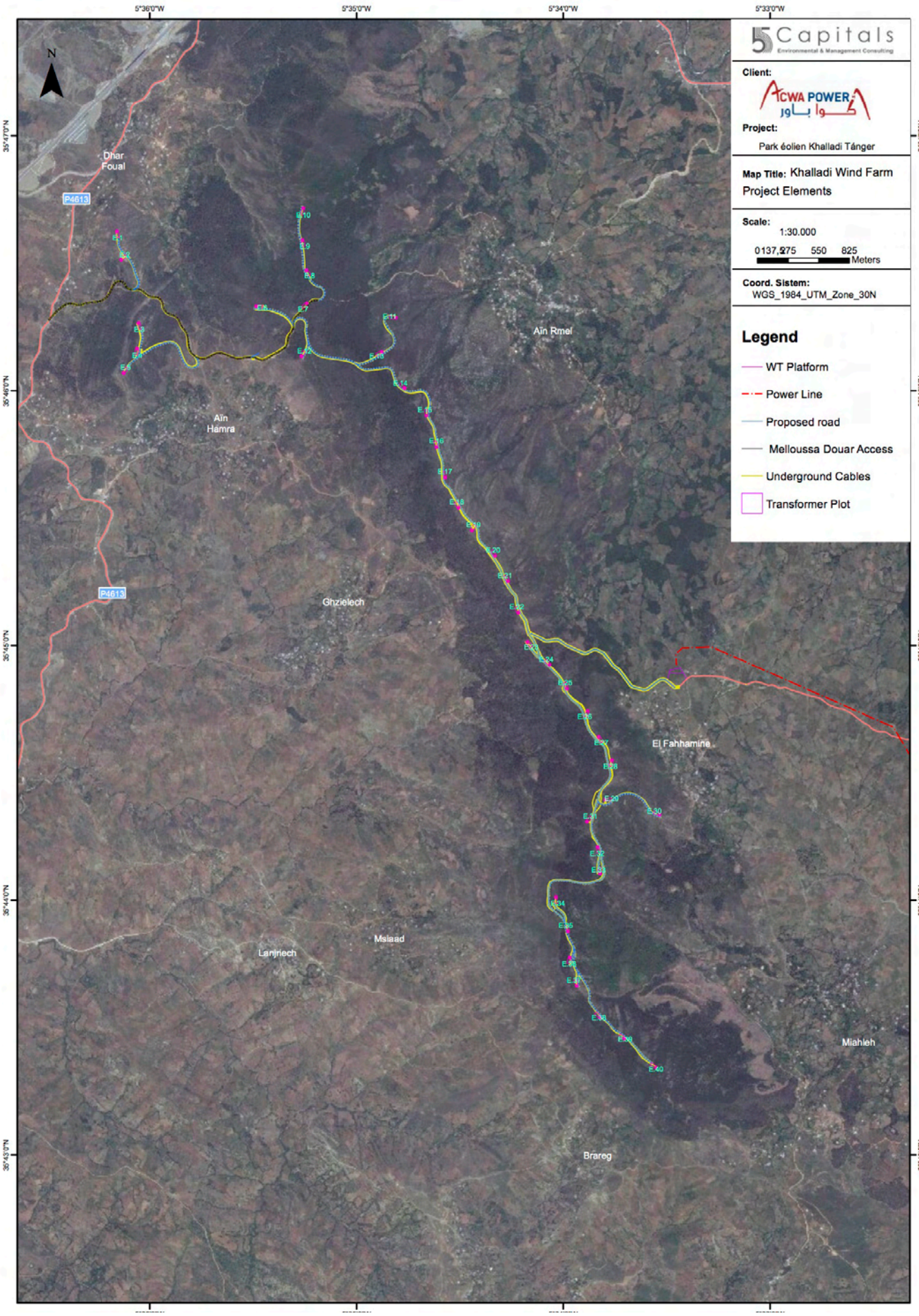


Figure 6: Power Line Layout and Land Uses