SUBMITTED TO:
Republic of Yemen
Ministry of Electricity and Energy

Al Mokha 60 MW Wind Farm Project (WMFP)

Republic of Yemen

ENVIRONMETAL AND SOCIAL IMPACT ASSESSMENT

FINAL REPORT

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LIST OF ACRONYMS AND ABBREVIATIONS

AFD	Agence Française de développement
ARP	Abbreviated Resettlement Plan
CDM	Clean Development Mechanism
CSO	Central statistical Organization
ECS	EcoConServ Environmental Solutions
EIA	Environmental Impact Assessment
EMF	Electromagnetic Field
EPC	Engineering Performer Construction
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
FCC	Feedback and Complaints Committee
FGD	Focus Group Discussion
GCFMS	General Corporation for Fish Marketing and Services
GHG	Greenhouse Gas
GOY	Government of Yemen
GP	General Practitioner
GTZ	German Technical Cooperation
GW	Gega Watt
HGV	Heavy Goods Vehicles
HH	Household
IDB	Islamic Development Bank
ILO	International Labour Organization
JICA	Japan International Cooperation Agency
KV	Kilo Volt
MEE	Ministry of Electricity and Energy
MPP	Al-Mokha Power Plant
MW	Mega Watt
MWFP	Al-Mokha 60 MW Wind Farm Project
NGOs	Non Governmental Organizations
O&M	Operation and Maintenance
OP	Operational Policy
PAP	Project Affected Persons
PEC	Public Electricity Corporation
PM&E	Participatory Monitoring and Evaluation
PPE	Personal Protective Equipment
RESAP	Renewable Energy Strategy and Action Plan
PMU	Project Management Unit
RAP	Resettlement Action plan
RED	Renewable Energy Department
RPF	Resettlement Policy Framework
SDO	Social Development Officer
SFD	Social Fund for Development

SPC	Special Purpose Company
SSI	Semi Structured Interviews
UK	United Kingdom
UNDP	United Nations Development Program
UNFCCC	United Nations Framework Convention on Climate Change
US$	United States Dollars
WB	World Bank
WFP	World Food Program
WHO	World Health organization
WTG	Wind Turbine Generator
YR	Yemeni Riyal
ZVI	Zone of Visual Impacts

EXECUTIVE SUMMARY

Introduction

Background

Al Mokha 60 MW Wind Farm Project (MWFP) was initiated with the objectives of demonstrating the financial feasibility of wind power through implementing the first wind power development project in Yemen and adding 60 MW of clean energy to the national grid. In June 2010 the Final Feasibility Study has been prepared for the project, in which the technical and financial feasibility of the project was confirmed.

The Government of Yemen (GoY) has submitted a request to the World Bank , the Islamic Development Bank (IDB) and the Agence Française de développement (AFD) to assist in financing the MWFP. The preparation of an Environmental and Social Impact Assessment (ESIA) to assess different environmental and social impacts associated with the proposed project is a prerequisite for approving developmental projects according to the Yemeni legislation and the policies of the above international organizations. In order to ensure that the project will not result in unacceptable resettlement of any affected persons a Resettlement Policy Framework (RPF) has been also prepared. The MEE has prepared Terms of Reference (ToR) for preparing an ESIA and RPF for the MWFP, in which EcoConServ Environmental Solutions (ECS) has been awarded these two studies.

The Environmental and Social Impact Assessment Objectives

- Assess the potential environmental and social impacts of the project
- Conduct an ornithological analysis that examines the potential impact of the project on birds life
- Compare the impacts in relation to relevant national and international requirements and guidelines
- Develop an environmental management plan for the mitigation of the potentially negative impacts and for monitoring compliance with the relevant environmental laws
- Assess the capacity of the implementing agencies to implement the developed environmental management plan
- Develop a capacity building program to cover any identified gaps in the capacity of the implementing agencies regarding environmental and social measures

A separate RPF has been prepared in a separate report and submitted to MEE with the objective of addressing cases where involuntary resettlement may occur.

The Environmental and Social Impact Assessment Methodology

The work in the ESIA has been undertaken in three parallel directions: the environmental assessment, the social assessment and the ornithological assessment. The outcomes of the three directions have been integrated and presented in this ESIA.

The environmental baselines conditions of the project area were compiled from site surveys undertaken during the preparation of the ESIA and the project's Feasibility Study and available literature. Quantitative assessment has been undertaken for some impacts using relevant calculations, these impacts were compared to applicable standards in order to reach judgment about its severity. Other impacts that could not be assessed quantitatively were assessed qualitatively and the severity of these impacts was identified by the experience of the consultant in similar projects.

The preparation of the social part of the ESIA involved employing different mechanisms and tools for gathering a combination of primary and the secondary information. Primary information has been collected Focus Group Discussions (FGD), Semi Structured Interviews (SSI), transact walks, field observations and survey questionnaires. Secondary information (reports, studies, statistics … etc) have been collected from different project stakeholders, web searching and from available studies to the consultant.

Two ornithological field investigations were carried out during the autumn of 2009 and spring of 2010 and involved 50 days of field observations. Autumn ornithological investigations extended between 23 October and 14 November 2009. The spring season ornithological investigations extended between 1 March and 7 May 2010. The survey team was composed mainly of two observers with the principal investigator attending between certain periods during the survey.

Legislative and Regulatory Considerations

Relevant Legislation in Yemen

The Environmental Protection Law was issued in 1995 aiming at protection conservation of the environment and maintenance of its natural ecosystems. The Executive Regulations of the law has been issued by Decree of the Council of Ministers 148 for the year 2000. The Law comprises articles to control the preparation of Environmental Impact Assessment studies, protection of wild life and biodiversity, specification of ambient air quality, specification of vehicles air emissions, specification of ambient noise and management of hazardous substances. These articles have been considered in relevance to the MWFP. In addition to that , Mokha is a culturally significant site and the Heritage (Antiquities) Law No 21 for year 1994 and its amendments with Law 8 for year 1997 are pieces of legislations with relevance to the project site.

The key Yemeni legislation related to resettlement and compensations are the Constitution, The Civil Law, Law no 21 of 1995 concerning State Land and Real Estate

and The Republican Decree 170, 1996, Waqf Law no 23 year 1992 and The Republican Decree 99, 1996 and Law no 1 of 1995 (The Public Eminent Domain Law)

International Conventions

The relevant International Conventions to the MWFP are the United Nations Framework Convention on Climate Change (UNFCCC) which was ratified by Yemen in September 2004, the International Labour Organization (ILO) conventions in which Yemen has ratified about 30 of these conventions, the Convention on Biological Diversity (CBD) ratified by Yemen in June 1992, and the Convention on the Conservation of Migratory Species of Wild Animals (also known as CMS or Bonn Convention) which is the most relevant to the development of wind energy along migratory routs, as it necessitates that member countries protect and conserve certain migratory species. Yemen ratified this convention in December 2006. Yemen also has ratified the World Heritage Convention in October 2008 and it has several properties inscribed at the world heritage list.

World Bank Safeguard Policies

Three Safeguard Policies are potentially triggered by the MWFP, the first is the World Bank (WB) Operational Policy on Environmental Assessment (OP 4.01) in which the Bank requires environmental assessment of projects proposed for Bank financing to help ensure that they are environmentally sound and sustainable, and thus to improve decision making. The MWFP is classified as an environmental Category B, as a project that could have potential adverse environmental impacts on human populations and the environment. However, potential environmental impacts are site-specific and reversible that can be mitigated with the implementation of an environmental and social management plan. This ESIA has been prepared in accordance with OP 4.01.

The second is the Operational Policy OP 4.12 on Involuntary Resettlement which safeguards against impacts often associated with unmitigated involuntary resettlement, such as dismantling of production systems; people facing impoverishment when their productive assets or income sources are lost; people are relocated to environments where their productive skills may be less applicable and the competition for resources greater; community institutions and social networks are weakened; kin groups are dispersed; and cultural identity, traditional authority, and the potential for mutual help are diminished or lost.. OP 4.12 was the guideline that was followed in drafting the RPF in order to set a framework for the needed actions and policies in case any of the project components triggered involuntary resettlement. And the thirds is the Operational Policy OP 17.50 on “Disclosure” which was followed for timely dissemination of information to affected local groups, including nongovernmental organizations.

Other relevant WB Safeguard Policies are not expected to be triggered by the project activities such as OP 4.04 on conservation of natural habitats and OP 4.11 on Physical Cultural Resources. The project location does not completely fulfill the definition of OP

4.04 definition of natural habitats[1] as the vegetation cover is almost exclusively formed by the invasive Mesquite tree *Prosopis juliflora,* which is not a native plant to Yemen and the site has been moderately modified by human interventions through over grazing and cutting of vegetation Concerning OP 4.11 although the project site does not include any objects or structures that have cultural importance, chance-find procedures have been proposed in the ESMP for adequate management of any objects or structures found during project construction.

Project Description

The target capacity of the project (60 MW) will be met through introducing a number of Wind Turbines Generators (WTG). The project shall be implemented over an area of about 48 km^2 near Al-Mokha Power Plant (MPP). The project Feasibility Study includes three scenarios for WTGs rating, number and layout, in which the financial analysis indicates that Scenario 3 (30 WTGs each of 2 MW capacity) has shown best cost/production ratio. However, the final type and amount of WTGs will only be known after tendering process.

Other than WTGs and their accessories the project will also include the following components:

- Internal roads which will include a connection from the main road, a main distributor road and three stretches serving WTG rows. The total length of internal roads, in case of Scenario 3, will be about 22 km.
- Internal cabling which will connect each row of WTGs will be underground 33 Kv cables that will be fixed in underground trenches for a total length of about 23 km.
- 33/132 substation which will be located at the southwest respect of the project site. The substation elements will be located in a fence enclosure with appropriate dimensions. Medium voltage power cells and low voltage measurements control and protection panels will be placed inside a closed building. The substation building will have a control room, cell room, warehouse, remote control room and rest room. The substation will have an earthling system to avoid electrocution.
- Overhead 132 Kv power line, which will connect the wind farm substation to MPP substation for a distance of about 2.6 km.
- At the MPP substation an input portal shall be built for evacuating energy produced from the wind farm. An overhead/underground terminal at MPP substation will turn the 132 KV overhead power line to underground line so that it will enter MPP with only minimum space requirement at the substation. The energy produced at the wind farm will, most probably, be evacuated in MPP substation using an empty GIS position in the substation, however, if using the empty position in the substation is not possible due to technical/economic factors an extension to the existing MPP substation will be constructed.

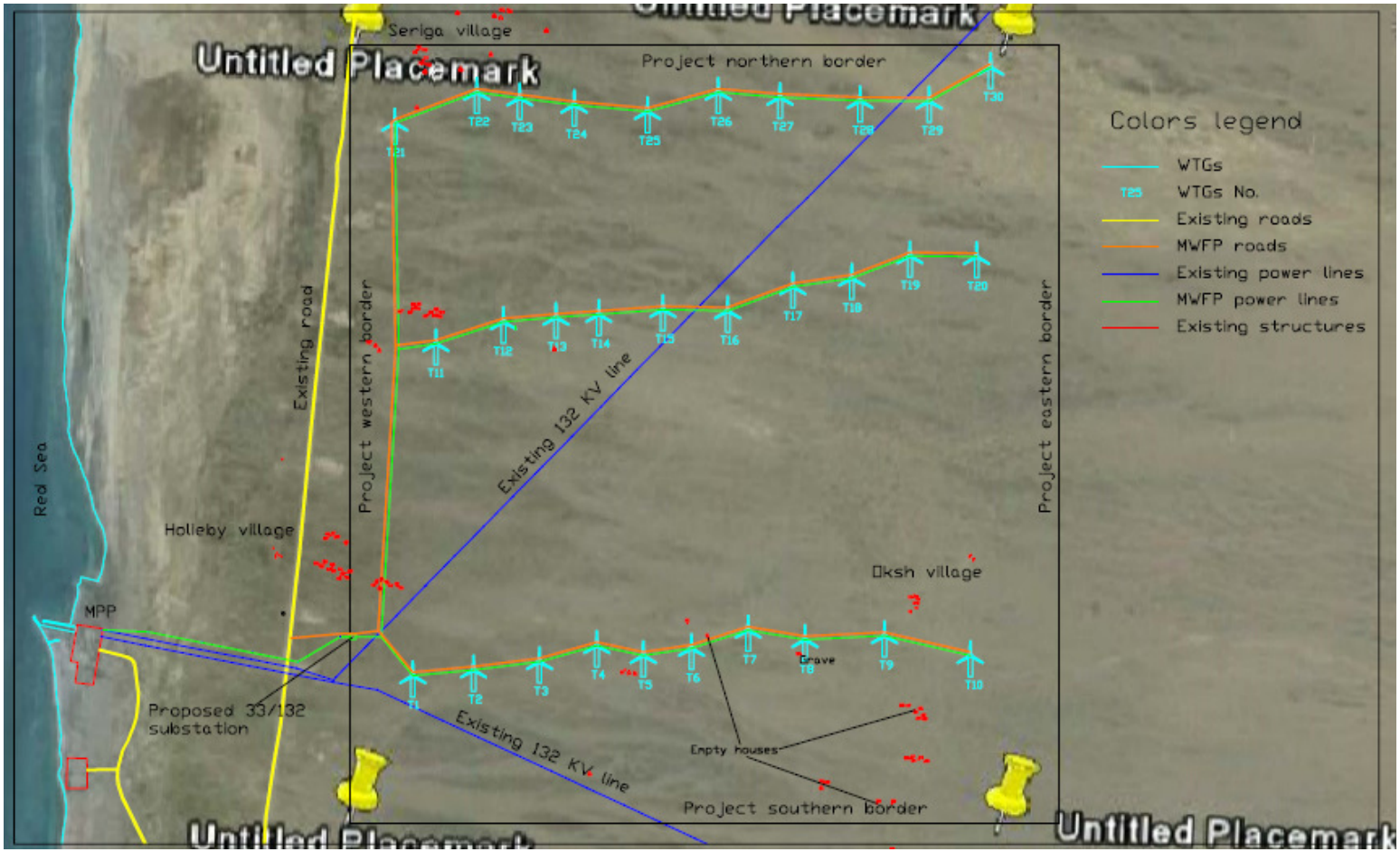
[1] According to OP 4.04 natural habitats are land and water areas where (i) the ecosystems' bio-logical communities are formed largely by native plant and animal species, and (ii) human activity has not essentially modified the area's primary ecological functions

The project components and layout of WTGs according to Scenario 3 is shown in the following Figure. The project will be implemented by MEE and it has been decided that a Special Purpose Company (SPC) will be established as a subsidiary of PEC for operating the project. The SPC will be financially independent from PEC, but will have a power purchase agreement with PEC. An Engineering Procurement Construction (EPC) Contractor will be recruited for implementation of the construction activities of the project.

The capital cost for the project is $ 119,560,001 in which about 85% is for WTGs, sbout 10% is for civil works, about 5% is for electric works and 0.5% is for project management.

The construction phase of the project will last for about 2 years when the project commissioning will take place. The expected operational life of WTGs is estimated by 20 years.

Figure 0-1: Layout of WTGs according to Scenario 3 and different project components



Project Alternatives

No Project Alternative

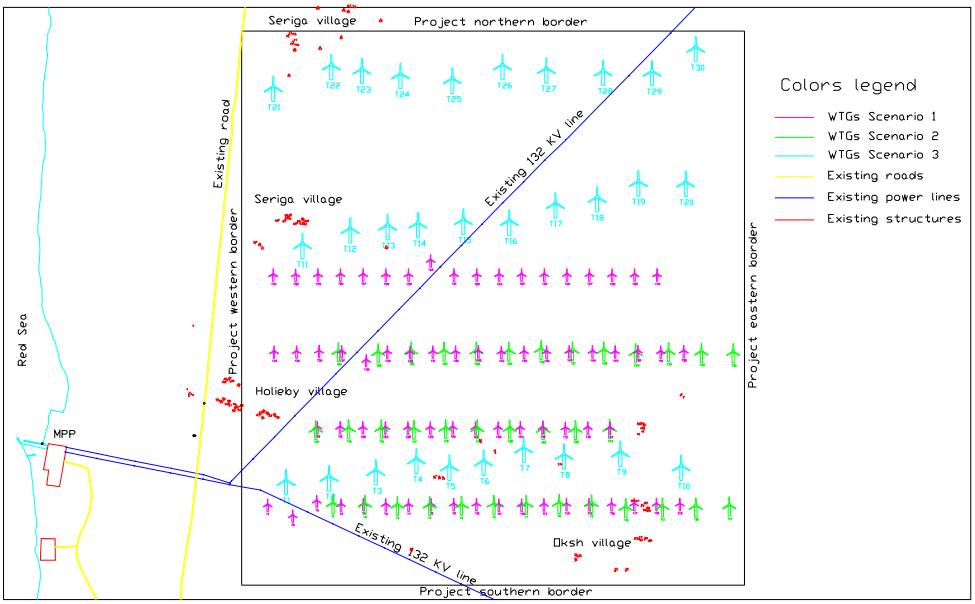
The no project alternative has been investigated, and it was concluded that the project will achieve many environmental and social benefits as it will generate clean energy that would save about 3.23 million tonnes of CO_2 emissions if equivalent energy would be generated from small diesel generators distributed in different parts of the country, in addition to achieving several social benefits to the local community. The negative environmental and social impacts of the project are mainly limited and could be mitigated through available technologies normally offered by different suppliers. By implementing mitigation measures that are later detailed in the ESMP all negative environmental and social impacts would be of minor significance. Accordingly there are no environmental and social reasons for stopping the implementation of the project; on the contrary, the net environmental and social impacts are expected to be positive.

WTG Capacities and Layout Alternatives

Three scenarios have been developed for the turbines capacities and layout as follows; the following Figure illustrates the layout of the three scenarios:

- Scenario 1: installation of 70 WTGs each of 850 KW capacity
- Scenario 2: installation of 36 WTGs each of 1.65 MW capacity
- Scenario 3: installation of 30 WTGs each of 2 MW capacity

Figure 0-2: Layout of WTGs according to the three scenarios



The three scenarios have been investigated from the environmental and social perspective and it was concluded that Scenario 3 is the most advantageous from this perspective as it is:

- More efficient in energy production and achieves more reductions of CO_2 emissions
- Less risky for birds because it has less density of WTGs, provides more maneuverability for birds to avoid collision, slower blades rotation and more obvious and visible to birds from a distance.
- Associated with less WTG noise as less houses are located within the possibly impacted zone
- Associated with less disturbance during construction as less construction works are required and less disturbance to traffic will be caused

In terms of shadow flickering, Scenario 2 is slightly preferred as slightly less houses are located in the impacted zone, but the overall preference is for Scenario 3 due to the above factors.

It should be noted that the slight advantage of Scenario 3 does not mean that the other two scenarios are rejected as long as the mitigation measures recommended in the ESMP are implemented. It is expected that the EPC contractor will identify the exact locations of WTGs according to the site conditions during the project implementation, in which the micro-siting of WTGs could be slightly different than the preferred scenario, therefore the ESMP measures recommended in this study should be implemented in light of the exact locations of WTGs which will be agreed between MoEE and the EPC Contractor during pre-construction phase.

WTG Transportation Routes Alternatives

Two routes for transportation of WTGs parts from the Harbor to the project have been investigated. The first is unloading the shipment in Al Mokha Harbor and using a 10-km direct road to the project site. The second is unloading the shipment in Al Hodeidah Harbor and using the coastal road between Al Hodeidah and Al Mokha for about 230 km. Although Hodeidah Harbor has more suitable unloading facilities, the first alternative has been considered more advantageous from the environmental and social perspective as fewer disturbances will be caused to traffic and less exhaust gases will be emitted from the WTG convoys.

Resettlement or Maintaining Local Community Alternatives

Because there are small settlements located within and near the project site, two alternatives have been considered for minimizing environmental and social impacts on these settlements:

- Alternative 1: Resettle the local residents within the project site and establish the wind farm with minimal micro-siting restrictions.

- Alternative 2: Allow local residents within the project site to maintain living in the settlement and ensure safety buffer zones are considered within the project design

Alternative 2 is believed to be more advantageous as it is perceived to be:

- More sensitive to the concerns of the local community and their interests in the area
- An economically viable alternative
- A realistic alternative that understands the local community capabilities and work within these capabilities rather than being an over ambitious alternative with unattainable objectives.

The ESIA team believes that there will not be security restrictions during project operation except for the substation, control room and offices. Thus the access of local residence to their houses could be maintained and in this case, alternative two will be definitely the favorable one.

Description of Baseline Environmental and Socioeconomic Conditions

The Project Area

The area identified for the project implementation is located about 5 km northwest from Al Mokha city near Al Mokha Power Plant (MPP). The project area is about 48 km^2 bordered by a rectangle 7.2x6.6 km as previously shown in Figure E1.

The site is an open plain area comprised of sandy soil with scattered vegetation cover from the invasive Mesquite plant. There are a number of small settlements located within and around the project area; these settlements are comprised from small number of houses built from mud and woods. These villages are Al Houlibi Village settlements which is comprised of 31 houses and located around the western border of the project , Al Oksh settlement which comprise 36 houses (3 of them are uninhabited) and a grave and is located near the southern and eastern border of the project and Serega village which comprises 32 houses and is located around the northern border of the project. Some of the houses of these villages are located within the four borders of the project as shown in Figure E1. Further to the east the Red Sea shoreline is located about 2.5 km from the eastern border of the site. MPP is located on the coast about 2.5 from the eastern border of the site. Al Mokha city is located about 4 km southeast from the southeastern corner of the site, while Al Mokha Harbor is located about 6 km from the southeastern corner of the site.

The waste disposal site of Al Mokha city is located about 1.5 km to the south on the same road leading to the site. In addition to the domestic solid waste received at this site, dead animals received at Al Mokha Harbor are also placed in this disposal site, which causes offensive odors in this spot. A 132 KV power line exits MPP substation to the west and splits into two power lines that penetrate the project site, one to the northwest direction and the other to the southwest direction.

The ESIA team has conducted a walk through visit to the project site, and no spots of previous pollution were noticed. Because the project site was not subject of previous developments, except for the few houses as indicated above, it could be assumed that the project area does not include considerable spills of polluting materials.

Birds

One of the primary ecological concerns of wind energy developments is their potential negative impact on bird life. Experience from several locations in the world has shown that wind farms can be highly damaging to bird populations, when bird conservation issues are not properly addressed in the planning of wind energy developments.

Yemen is an important biodiversity hotspot with many endemic birds and is located along a primary bird migration corridor, where many thousands of soaring birds concentrate cross the Straits of Bab Al Mandab to Africa. Wind energy development plans in the region adjoining Bab Al Mandab is thus of potential concern from the biodiversity conservation point of view.

In total at least 113 species of birds (including 57 potential breeding species) are documented for the general Al Mokha region (this study, Jennings 2010). 81 species were observed during autumn 2009 and spring 2010 visit, of which 60 were observed within the project site (see Appendix 2). The majority of these are migratory however, and the resident and breeding avifauna is rather limited in diversity as well as in abundance and density. The most prominent species documented in the autumn season were Crested Lark *Galerida cristata*, Yellow-vented Bulbul *Pycnonotus xanthopygos*, Nile Valley Sunbird *Anthodiaeta metallica*, Palm Swift *Cypsiurus parvus*, Palm Dove *Streptopelia senegalensis*, Chestnut-bellied Sandgrouse *Pterocles exustus*, Southern Grey Shrike *Lanius meridionalis* and Black-crowned Finch Lark *Eremopterix nigriceps*. Potential breeding birds also included White-throated Bee-eater *Merops albicollis* and Cream-colored Courser *Cursorius cursor*. Several Tihama breeding species, such as the near-endemic Arabian Golden Sparrow *Passer euchlorus*, African Silver-bill *Euodice cantans*, Rüppell's Weaver *Ploceus galbula*, and Dark-chanting Goshawk *Melierax metabates* are also known. House Sparrow *Passer domesticus* and Indian House Crow *Corvus splendens* are two invasive species that dominated the avifauna at Al Mokha, and regularly enter the project site. The relatively poor resident and breeding avifauna at the project site could be partly attributed to the dense growth of the invasive *Prosopis*, which creates a habitat that is particularly species poor. Indeed, most birds were observed in areas with no or limited *Prosopis* cover.

In terms of migratory species soaring birds (particularly birds of prey) were the most prominent and diverse. An important component of waterbirds is found along the coast towards Al Khokha as well as further south towards Bab El Mandab, with many shore birds congregating in coastal lagoons, but generally not wandering inland. The exception was at newly reclaimed and irrigated (flooded) fields in the northern portion of the project site, where small numbers of wading birds were observed.

Existing knowledge of soaring bird migration in the vicinity of the project site

While the fact that Bab Al Mandab is an important bottle neck for migratory soaring birds is well known and accepted, very little field work has been carried out to document and describe this site. The first observations in the region were by Philips (1982), who observed substantial migration along the Tihama foothills at Mafraq Al Mokha. While Porter and Christensen (1987) described the migration at five different sites along the Tihama foothills (resulting in 3546 soaring migrants in 38 hours of observations), forming parts of the main flyway leading to Bab Al Mandab. Welch and Welch (1991) found that the migratory flyway extends northwards into Saudi Arabia along the Asir foothills as well.

Table 0-1: Summary of bird counts at Bab Al Mandab from Djibouti in the autumn of 1985 and 1987 (Welch and Welch 1988)

Species	15 October – 1 November 1985	3 October - 9 November 1987
Accipiter nisus	403	2135
Accipiter brevipes	2	7
Accipiter sp.	13	17
Aquila clanga	6	12
Aquila fassciata	2	2
Aquila heliaca	16	70
Aquila nipalensis	60897	76586
Aquila pennata	124	1123
Aquila pomarina	0	31
Aquila sp.	26	27922
Buteo buteo	17875	98339
Buteo rufinus	4	131
Ciconia ciconia	4	60
Ciconia nigra	9	166
Ciconia abdimii	0	643
Ciconia sp.	0	15
Circaetus gallicus	203	1202
Circus aeruginosus	6	45
Circus macrourus	16	67
Circus pygargus	6	17
Circus sp.	17	116
Falco subbeto	16	69
Falco tinnunculus	48	183
Falco naumanni	4	8
Falco vespertinus	0	1
Falco eleonorae	*2*	*1*
Falco biarmicus	*8*	*9*
Falco cherrug	*3*	*0*
Falco peregrinus	*16*	*7*
Falco sp.	*22*	*48*

Gyps fulvus	*0*	*3*
Milvus migrans	*55*	*579*
Neophron percnopterus	41	554
Pandion haliaetus	0	3
Grus grus	0	26
Bird of prey sp.	1	7294
Total	**80732**	**246478**

There are two previous systematic counts of birds crossing Bab Al Mandab it self during autumn: one between 15 October – 1 November 1985, and between 3 October - 9 November 1987 (Welch and Welch 1988). These counts were conducted from the Djibouti side of the Bab Al Mandab Straits. To date no systematic counts seem to have been conducted from the Yemeni side. A maximum total number of 246,478 soaring birds were counted in autumn of 1987 (Welch and Welch 1988). Key migrating species and their maximal counts are as follows: Steppe Buzzard 98,339 (plus 29,851 "*Buteo* sp."), Steppe Eagle 76,586 (plus 27,922 "*Aquila* sp."), Sparrowhawk 2,135; Short-toed Eagle 1,202; Booted Eagle 1,123; Egyptian Vulture 773 ; Black Kite 579; Abdim's Stork 643 (Welch and Welch 1988). The autumn migration season can be anticipated to extend from late September into late November (as indicated by other soaring bird studies conducted throughout the Middle East); however the bulk of migration takes place in October and the first half of November. In both the above studies the peak migration was observed between the second and fourth week of October.

During spring there is even less information available from both the Yemeni and the Djibouti sides of Bab Al Mandab, but as can be anticipated from the geography of the site the intensity of migration is less than that during autumn. Welch and Welch (1998) reported 1877 soaring birds crossing Bab Al Mandab between 5-7 March 1990, while 1677 were observed from the Yemeni side between 22-25 March 1998. The composition of migration was also very different from autumn, with Egyptian Vulture and Booted Eagle forming the bulk of migrants, with only very few Buzzards and Steppe Eagles. This information indicated that there is some soaring bird migration through the region during spring, but little was known about the orientation, elevation and potential volume of migration, particularly over Al Mokha area.

Table 0-2: Summary of bird counts at Bab Al Mandab from both the Yemen and Djibouti sides in the springs of 1998 and 1990 respectively (Welch and Welch 1998).

Species	Yemen 22 – 25 March 1998	Djibouti 5 - 7 March 1990
Accipiter nisus	37	0
Aquila nipalensis	1	13
Aquila pennata	736	953
Aquila sp.	1	0
Buteo buteo	26	0
Circaetus gallicus	0	134
Circus aeruginosus	2	0
Circus macrourus	12	1

Species	Yemen 22 – 25 March 1998	Djibouti 5 - 7 March 1990
Circus pygargus	14	2
Circus sp.	21	2
Falco tinnunculus	3	1
Milvus migrans	1	0
Neophron percnopterus	773	733
Pandion haliaetus	1	0
Bird of prey sp.	16	38
Total	**1644**	**1877**

Ornithological studies conducted in the autumn of 2009 and spring of 2010 had The following results:

In autumn a constant and relatively stable volume of soaring bird migration was detected over al Mokha proposed wind farm site, with an average of passage of 440 birds per day, totaling 5544 birds belonging to 22 species during the study period, with a potential total volume of between 25-30,000 birds per season, assuming fairly constant flow of birds throughout the autumn migratory season. The average altitude was 258 m, however about 33% of all birds flew below the precautionary "safe" altitude of 200 m. There was limited landing or roosting at the project site; however several potentially highly risky areas that can attract large concentrations were identified; most importantly the municipal dump and newly cultivated areas.

The situation between Dubab and Baba Al Mandab in autumn is clearly critical for soaring migrants (as they land and fly at very low altitude in very large numbers), and the establishment of any wind turbines in the section of the coastline would be highly detrimental by all measures. The situation between Dubab and Al Mokha needs further evaluation to determine where conditions of high risk are not prevalent (probably some where between 10-20 km north of Dubab). While rapid reconnaissance indicate that the Gulf of Aden coast between Aden and Bab Al Mandab has almost no migratory activity (but this needs further verification).

In the spring observations indicate that soaring bird migration through Yemen at large is of small volume and limited significance, particularly when compared with the volume during autumn. At the project site there was a very limited number of migratory soaring birds observed (349 birds belonging to 14 species). It is likely that the lack of migrants over Al Mokha in spring is probably not only due to the position of the site away from the main migratory pathway for soaring birds (along the Tihama foothills), but is also likely due to the limited overall volume of birds returning through Yemen in spring. This was supported by our observations made at Bab El Mandab, where very few birds moving across the strait and entering the Arabian Peninsula from Africa were found during the spring. This strongly suggests that the spring migration of soaring birds largely follows a more westerly rout along the western coastline for the Red Sea, north to Egypt and Suez. The limited number of soaring birds observed at the site were either wintering or resident birds, largely composed of Black Kites and Egyptian Vultures.

Several globally threatened bird species are known to migrate through the proposed project area; however it is one species (Egyptian Vulture) which could be of particular concern due its passage in relatively large numbers, tendency to fly low and land in search for food and lack of maneuverability in the face of wind turbines. The likely negative impacts on Egyptian Vultures and other birds of prey and storks due to the presence of solid waste disposal sites in the proximity of the project site is highlighted as one of the primary concerns that must be addressed prior to turbine operation.

The natural habitats at the site do not represent any rare or restricted habitat types and are not the home for any rare or threatened species, although several endemic species are found.

Socioeconomic Characteristics

According to the Development Report prepared by Al Mokha Local council, 2008, the Directorate is inhibited by 62,471 persons. 3 settlements are located within and around the project site as indicated in Figure E1, the largest of these settlements is Al Oksh which comprise about 31 houses inhibited by around 148 persons.

The local inhabitants of these settlements are mainly working in herding and fishing

Grazing and wood collection are most common economic activities practiced by the local residents at the project site, as they were originally wandering shepherds. They settled in this area of land long time ago because they found important resources that help them to maintain their living and settle. Several forest-based activities were found to be in-common among this group of residents, most importantly breeding sheep, goats and camels, collecting fire wood, making and selling charcoal and marketing dairy products. Residents also utilize the available resources in producing other products like natural compost which they sell in other areas with cultivated land. They also use straw, mud and other materials in building their homes. It should be noted, though that grazing is not the sole source of income local families. In most of the cases, people try to juggle with more than one source of income, such as fishing and working as daily laborers, in order for them to secure a daily living. However, most of the sources are characterized by being marginal and vulnerable businesses.

The average electricity supply in Al Mokha Directorate is 19% of the population most of them in Al Mokha City (coverage ratio is 87%), however, most of the connected households referred to the irregularity of power supply and the frequent cut offs. The 4 settlements in and around the project site are not connected to electric power supply.

About 30% of Al Mokha Directorate households are connected to water supply, most of them in Al Mokha City (about 82% of the city is covered). For the villages located within the project site, the only available water supply is shallow wells. Residents use this water only for animal drinking and washing. For, drinking water, they fetch water form MPP. The situation is slightly different in Al Oksh village, where residents use the ground

water from the shallow wells in different purposes including drinking. In Al Oksh, residents spoke about the salty taste of water and the negative impact on their health.

Sanitation network is inexistent in the whole Directorate. Residents of settlements within the project site mentioned that toilet facilities are inexistent at their homes/shanties.

The main conclusion that was reached from the field observation and the different consultation activities in the field is that Al local community suffers from vulnerability and insecurity of livelihoods that made this community clearly characterized by poverty. The following poverty symptoms were observed:

- Poor level of education for both children and adults. The majority of families do not send their children to schools due to the following reasons:
    - Poverty and the need for children input in pursuing a living.
    - Children input is needed in some domestic labor like fetching water. Girls are also needed for other household responsibilities.
    - Early marriage age
    - Long distance to schools prevents children from regular attendance particularly girls
    - The fact that they do not have access to higher level of education, discourages them from sending their children to schools.
- Instability of income sources
- Very poor housing condition in terms of the low quality of construction material, the small sizes of houses, the unavailability of services and the unsecured land ownership with 100% of the village resident do not own any documents that prove their ownership to the land.
- Labor distribution on the household level, along with other factors, largely constitute an additional load on women and children, adding vulnerability to them and challenge them from acquiring opportunities like schooling opportunities

The ESIA team believes that the current living conditions of local residents are extremely poor and that they should be regarded as a vulnerable group in need for protection and high level of consideration. To ensure adapting a socially sensitive approach by the project, the interests of these groups should be protected, or at least efforts should be in place to ensure that the project will not result in serious negative impacts to this community. Mitigation measures were proposed under the ESMP to ensure that those local communities benefit from the project fruits and that they will suffer the least of the negative impacts.

Potential Environmental Impacts and Mitigation Measures

Environmental and Social Benefits

The project will achieve many environmental and social benefits as a pioneer demonstration project for generating clean renewable energy. The project will achieve annual savings of CO_2 emissions estimated by about 161,515 tons/year if the same amount of energy were produced by the adjacent Al Mokha Power Plant (MPP). Being a

demonstration project these environmental benefits will achieve indirect positive impacts through offering experience to similar renewable energy projects in the country. Through improving supply of electric energy general social benefits will be attained through improving health, educational and social services at the community level. At the local residence levels, many social benefits are expected to be achieved by the project as part of the ESMP, such as connecting local houses to electricity supply, facilitate their access to LPG, giving them priority in job opportunity and including them in a capacity building to widen their access to different economic activities.

Specific Impacts on Local Residents

The project site and its surroundings comprise houses distributed in three small settlements inside and near the four project borders. The calm conditions currently surrounding these settlements will change during the construction phase as the site will receive different sub-contractors and suppliers, the noise and dust emissions generated during construction will be temporary and could be managed through recommended measures in the ESMP while other incontinences are expected to be tolerated by local inhabitants if they will benefit from different services provided by the project such as better access roads, connection to electricity, job opportunities and capacity building programs. The expected environmental and social impacts on these settlements during operation are also expected to be manageable and within relevant standards if the recommended ESMP measures are implemented. It is not expected that involuntary resettlement for the local inhibitors will be required in light of the analyzed impacts, especially that micro-siting of WTGs could be planned as far as possible from existing houses to avoid different impacts, except if security precautions during project operation will limit access of local residence in the area, or if some residents would not tolerate the some inconveniences during the construction phase[2].

Impacts and Mitigation Measures during Construction Phase

Negative environmental and social impacts expected from the projects construction and operations have been classified to two main degrees: medium impacts and minor impacts according their likelihood and severity. No impacts were classified as major impacts, meaning that they would directly lead to violation of standards by their own.

The expected medium negative impacts and correspondent mitigation measures, recommended in the ESMP, during construction phase are:

- Impacts of construction wastes. For mitigating these impacts the ESMP includes measures for including waste management aspects in the tendering requirements for selecting EPC Contractors, use excavation waste for covering fresh waste in the dumpsite in an engineered manner[3], allocate area for safe storage of fuels and hazardous substances, sound disposal of empty drums of hazardous substances, and provide adequate system for collecting garbage and sewage from construction

[2] Which most probably would not happen if they gain suitable benefits during project operation

[3] This will serve closing down this dumpsite which is a mitigation measure to reduce risks on birds by reducing attractions

staff camps. The ESMP includes monitoring efficiency of closing existing dumpsite and recording amount of hazardous substances handled in the site.

- Impacts of construction air emissions. For mitigating these impacts the ESMP includes measure for wetting soils and aggregates before earth works, enforce EPC Contractor to use machinery with efficient combustion engines and prohibit the use asbestos in temporary offices or any construction materials. The ESMP includes quarterly monitoring of ambient TSP and PM_{10} at nearby settlements locations.
- Impacts of construction noise and vibrations. For mitigating these impacts the ESMP includes measures for enforcing construction labor to use ear muffs in noisy zones, organize construction works between 07:00 and 18:00, provide acoustic barriers during construction of internal roads near existing settlements, provide adequate protection for existing structures from vibrations and locate power generators and staff camp as far as possible from existing settlements. The ESMP includes monthly monitoring of noise levels, during construction, at location of nearby settlements; this monitoring becomes daily during construction of internal road stretch near existing houses.
- Impacts on traffic during transportation of different construction materials and services. For mitigating these impacts the ESMP includes measures to ensure suitability of selected routes for bearing expected loads, prepare traffic plan to avoid unacceptable delays caused by the WTG convoys, ensure adequacy of the trucks parking area in Al Mokha Harbor and identify suitable times (during low traffic) for transportation of different goods and services. The ESMP includes monitoring traffic delays caused by WTG convoys.
- Accidents risks to workers and local community. For minimizing these risks the ESMP includes measures for including safety issues in the selection criteria of EPC Contractors, provide safety induction training to workers, communicate relevant safety tips with the local community and inspect compliance of different parties to safety instructions. The ESMP includes monitoring of number and causes of occupational accidents.
- Inconvenience to local residents on the project site in terms of possibly effecting privacy, mobility (especially for women), access to site resources and increasing pressures and crowdedness on the area resources. For mitigating these impacts the ESMP includes measures for setting and activating efficient feedback and complaint mechanism, adopt transparent approach for sharing information that will help local people to avoid disturbing activities, prioritize local people in construction job opportunities, provide local people access to electricity and LPG, and impose contractual conditions on EPC Contractor for adequately performing activities of concern to local people. The ESMP includes monitoring of number of local workers employed in the project activities and number of households connected to electricity grid.

The construction activities are also expected to cause impacts that was classified as minor/negligible impacts, which is a negligible loss of natural habitat on the areas that will be occupied by WTGs and other constructions. It was considered a negligible impact because no vulnerable, rare or endangered flora and fauna species exists in the project

location (dominant flora cover in the area is the invasive Mesquite trees and non avian fauna is limited to some reptiles and rodents) and the area occupied by WTGs and the substation could be negligible compared to the coastal plain forming the project area. Accordingly the World Bank Safeguard Policy on Natural Habitats (OP 4.04) will not be triggered as previously indicated.

Table E2 demonstrates different negative impacts and correspondent mitigation measures and monitoring activities which will be carried out during the construction phase.

Table 0-3: Summary negative impacts, mitigation measures and monitoring activities during construction phase

Potential Impact	Mitigation Measures	Monitoring Activities		
		Monitoring indicator	Monitoring Methods	Monitoring Duration
Impacts of construction wastes	Include waste management issues in the tendering procedures for selecting contractors	% coverage of the existing dumpsite with excavation waste	Visual estimation of covered areas to the total dumpsite area	Monthly
	Coordinate with Local Council to enforce dumpsite closure prior to construction works			
	Direct transfer of excavation waste to the dumpsite with minimum stockpiling			
	Effective coverage of waste at the dumpsite			
	Prepare suitable area for storing hazardous substances, properly mark it and provide it with secondary containment	Amounts of hazardous substances handled in the site	Counting with admission of substances and monthly reporting	Counting with admission of substances and monthly reporting
	Sound disposal of empty oil drums and hazardous waste			
	Provide sufficient garbage bins and regularly collect garbage			
	Provide sufficient sewage collection tank and frequently evacuate it			
Impacts of construction air emissions	Include requirements for prior wetting of soil, efficient combustion machinery and ban on asbestos use in tender document	TSP and PM_{10}	Sampling ambient air quality	Quarterly
	Wetting soil and aggregates before earth works			
	Provide machinery with efficient combustion engines and provide emission certificates			
	Prohibit use of asbestos in temporary offices or any construction materials			
Impacts of construction noise	Construction workers working in areas of noise levels of more than 85 dBA should wear PPEs with working shifts suitable to noise levels	Noise levels	Taking measurements by noise	Monthly for general construction
	Construction works should be limited to day time from 07:00 to 18:00			

Potential Impact	Mitigation Measures	Monitoring Activities		
		Monitoring indicator	Monitoring Methods	Monitoring Duration
	Provide acoustic barriers on both sides of roads construction for internal roads near Al Houlibi and Al Oksh settlements		meters for a representative duration	noise, and daily for road construction near houses
	Prepare structural condition report for existing structures to assess if they would bear vibrations			
	Implement identified measures for protecting existing houses from construction vibration			
	Locate power generators and staff camp as far as possible from existing houses			
Impacts on traffic	Undertake structural review about the condition of the access road from Al Mokha Harbor to the project site	Duration of WTG convoys trips and duration of passing intersections	Time recording by a stopwatch	Daily during supply time
	Prepare detailed traffic plan for WTGs convoys throughout the supply period			
	Advise road and intersections users about expected delay and complaint mechanism			
	Ensure HGV waiting area in the Harbor is sufficient and complies with the traffic plan			
	Identify preferable times for transfer of materials and goods from and to the project site			
Risks on Workers and Local Communities	Include safety issues in the tendering procedures for selecting contractors	Number and type of occupational accidents	Reviewing accidents reports	Monthly site progress reports
	Provide safety induction training to construction workers			
	Inspect workers compliance with safety measures			
	Communicate safety tips with local community			
Inconvenience	Set and activate Efficient Feedback and Complaints Mechanism	Number of	Reporting	Quarterly

Potential Impact	Mitigation Measures	Monitoring Activities		
		Monitoring indicator	**Monitoring Methods**	**Monitoring Duration**
to Local Residents on the Project Site	Residents Notifications and Information Sharing	local people employed by the project	labor origin and calculate numbers of laborer from the village	
	Give Priority to Local People in the Generated Job Opportunities	Number of households in the project site and Al Mokha at large connected to power grid	Review power distribution action plans and addresses of connected households	Quarterly
	Provide access to local people to electric power and improve power network at Al Mokha Directorate			
	Contractual Procedures and Conditions			

Impacts and Mitigation Measures during Operation Phase

Concerning negative impacts during the operation phase, the following impacts have been classified as of medium significance:

Risks to birds due to wind energy development: It is concluded that the current proposed wind energy development at Al Mokha is unlikely to have impacts on birds of catastrophic nature, and that the level of risk to migratory and local birds is within a "tolerable" or "acceptable" range; i.e. that the level of damage that could affect birds is expected to be limited and would not have significant conservation consequences to their populations if prescribed mitigation and precautionary measures are taken.

This assessment of risk is based and supported by the following findings:

- The volume of birds flying over the site appears to be relatively modest and does not represent the main migratory flyway of soaring birds in the region;
- The size of the proposed development is relatively small ;
- The window for soaring bird migration is confined to one season (autumn), with a limited time frame of about 3 months per year;
- The majority of birds fly higher than 200 m, with only an estimated 36% of birds flying below 200 m (for both spring and autumn);
- Migration is on a broad front, i.e. is not concentrated over the proposed project site;
- There are limited species that migrate in large dense flocks, which are particularly vulnerable to wind farms (such as storks);
- With the exception of the Egyptian Vulture, there is limited occurrence or likely risks to globally threatened bird species;
- There is limited landing and roosting in the area and no natural attractions for birds;
- The terrain is simple and flat;
- Wind direction and velocity is very constant during autumn (ensuring that limited variation to observed patterns are likely to occur), but is much more variable in spring, however not much birds are present then;
- Visibility is usually good.

The conclusion made here is based on a number of important assumptions

- The size of proposed development remains limited in scale and not changed from current proposal (without further assessment);
- Existing man made risk factors (solid waste dumps and cultivations) will be relocated to a safe distance from the proposed wind farm. The ESMP measures emphasize that no construction activities in MWFP should take place before an engineering and feasibility studies for identifying a new location for solid waste disposal landfill are carried out, completed and

approved upon by all stakeholders. Erection of WTGs should not start before the new site is fully operational and the existing dumpsite south of the project site is completely covered

- Mitigation measures are implemented.
- Impacts of WTG noise on local settlements. For mitigating this impact the ESMP includes measures for giving low noise WTGs higher scores in technical evaluation of tenders, considering noise impacts during micro-siting of WTGs, and providing acoustic barriers to reduce noise levels in unforeseen conditions. The ESMO includes monthly monitoring of noise at locations of houses near WTGs.
- Impacts of WTG shadow flickering disturbing local residents. For mitigating this impact the ESMP includes measures for considering shadow flickering impacts during micro-siting of WTGs and provide WTGs with automatic breaking system based on sunlight sensors and astronomic/geometric calculations. The ESMP includes monitoring of times and duration of applying the automatic breaking system.
- Impacts of scrap and maintenance waste. For mitigating this impact the ESMP includes measures for enforcing maintenance contractors for taking away scrap items for reuse/recycle, providing transformers with impermeable containment, prevent oil spillage during transformer maintenance and prepare a detailed waste management plan before decommissioning WTGs.
- Affecting the stability and livelihood of local population through limiting their access and conflicting with their interests in the area. For mitigating this impact the ESMP includes measures for ensuring the access of local people to their current houses, giving them the opportunity to benefit from the project through prioritizing them in job opportunities, building their capacity to enable them acquire alternative source of livelihood, and networking with other organizations to facilitate their access to suitable working opportunities. The ESMP includes monitoring of number of local residents employed by the project and number/affiliation of people benefited from capacity building programs.

The operation phase is also associated with some negative impacts that have been classified as of minor significance:

- Stability risks of WTGs which has very low likelihood according to safeguards normally taken by WTG suppliers
- Impacts of dust generation due to traffic over un-asphalted internal roads which is considered minor because of expected low traffic volume
- EMF impacts which is considered minor due to very low contribution of the project assets to the existing EMF
- Visual impacts which is controversial in its perception as positive or negative impact, however, because of its unique nature in the country many people may regard it as a positive impact

Table E3 demonstrates different negative impacts and correspondent mitigation measures and monitoring activities which will be carried out during the operation phase.

Table 0-4: Summary negative impacts, mitigation measures and monitoring activities during operation phase

Potential Impact	Proposed Mitigation Measures	Monitoring Activities		
		Monitoring indicator	Monitoring Methods	Monitoring Duration
Risks on birds biodiversity	Closing existing dumpsite and relocating it in another location at least 5 km from the project site	Number and type of dead birds due to colliding with WTGs	Visual inspection and photography	Monthly reporting
	Prevent agriculture, land reclamation and logging within a buffer zone of 3 km around the site borders			
	Removal of animal carcasses and waste accumulation within a 3-km buffer zone	Visual birds congregations	Visual inspection	Monthly reporting
	Undertake seasonal ornithological studies for the site during first three years of operation			
Impacts of WTG noise	Technical scoring of WTGs tender should include weight for less WTGs source noise	Noise levels	Taking measurements by noise meters for a representative duration during nighttime	Monthly
	Whenever feasible, the micro-siting of WTGs should be as far as possible from houses, especially for T5, T6, T9, T10, T11, T13, T21 and T22			
	In case of high monitored noise levels at some settlements, acoustic barriers or relocation of impacted houses for few meters should be considered			
Impacts of WTG shadow flickering	Consider the shadow flickering impacts during the micro-siting of WTGs	Number of WTG applied to automatic breaking and correspondent breaking time and duration	Taking results of system software	Continuous monitoring, monthly reporting
	Include automatic breaking system in some WTGs based on sunlight sensors and astronomic/geometric calculations of shadow flickering impacts for nearby houses			

Potential Impact	Proposed Mitigation Measures	Monitoring Activities		
		Monitoring indicator	Monitoring Methods	Monitoring Duration
Impacts of scrap and maintenance waste	Include taking away scrap items during WTGs maintenance in the maintenance contract	n/a	n/a	n/a
	Reuse/recycle removed WTG parts in country of origin			
	Substation scrap and maintenance waste to be taken by suppliers of new equipment or alternatively reused in other substations			
	Transformers to have impermeable containment and oil changing should be using tight piping			
	Detailed waste management plan should be prepared before decommissioning WTGs			
Affecting the Stability and Livelihoods of Local Population	Ensure Local People are allowed to maintain living in their current houses (as a short term solution)	Number of local residents from Al Mokha in general and AL Houlibi, in particular hired for the project	Reporting labor origin and calculate numbers of laborer from the village	Once after the operation of the project and in every case the project develop new employment contracts
	Hiring, as many people as possible, in the project			
	Building local communities capacities to enable them to acquire alternative source of livelihoods			
	Networking with other organization to facilitate local people access to opportunities in other fields.			
Stability risks of the WTGs	Supplier's experience on WTG structural stability in similar conditions to be considered in the tendering procedure	Tilting , corrosion or unstable blade movement	Visual inspection	Monthly
	Suppliers should be responsible on design and execution of foundations			
	Maintenance program to include corrosion abatement measures			

Environmental and Social Management Plan

It was recommended that the PMU Manager will have overall responsibility for implementing the ESMP. A full-time HSE Officer will be recruited early in the process for day to day implementation of the ESMP measures. A Social Development Officer (SDO) will also be recruited for ensuring the sound implementation for the social mitigation measures. Capacity building programs have been recommended for different project stakeholders.

The implementation of the ESMP will involve input from different project stakeholders, and accordingly some of the ESMP costs will be indirect costs that would be reflected in more expensive financial offers from EPC Contractors, therefore an allowance has been made for this in the ESMP budget. The ESMP budget is $ 465,000, distributed among four main categories as shown in Table E5.

Table 0-5:The estimated ESMP budget

Category	Item	Budget (US$)
Studies and technical support	Measurements of dust emissions during construction	5,000
	Technical study to choose location for another disposal site including the technical designs	50,000
	Seasonal ornithological studies during first three years of operation	60,000
Tools and equipment	Allowance for higher construction bid prices due to the ESMP measures (hazardous waste management, wetting of soil, provision of acoustic barriers during construction of internal roads, vibration barriers, …etc.)	50,000
	Noise meters	10,000
	Allowance for removing animal carcasses and wastes in and around the project site	10,000
	Allowance for possible acoustic barriers during project operation	10,000
Management and coordination	Salaries for HSE Officer and SDO for 5 years	60,000
	Set and activate Efficient Feedback and Complaints Mechanism	50,000
	Networking with other organization to facilitate local people access to opportunities in other fields.	10,000
	Carry out mid-term review for the environmental and social impacts	50,000

Category	Item	Budget (US$)
Training and awareness	Capacity building programs for different groups of stakeholders	100,000
Total		**465,000**

Consultation with Stakeholders

Consultation with various types of stakeholders, including Governmental officials of various affiliations and levels, NGOs, donors communities and various local community groups (Please refer to Annex 1 and Annex 3A for a comprehensive list of the consulted stakeholders). The consultations went along the course of the ESIA which lasted from June 2009 to May 2010. It passed various stages of the projects from scoping, impacts identifications, presenting and commenting on the ESIA findings. During the scoping period, several in-depth interviews, scoping sessions, semi structured interviews (SSI) and survey questionnaires were applied with various types of stakeholders. Focus groups discussions were also carried out with men in Al Houlibi village on the project site. After drafting the first version of the ESIA, a public consultation workshop has been conducted where different project stakeholders were invited in a plenary session to share their views about the project. This public consultation workshop has the primary objective of disclosing the ESIA report, and reviewing its main findings and identified impacts with key stakeholders. Different dissemination tools were employed to ensure announcing the public consultations and encourage various categories of stakeholders from different backgrounds, with different interests, to come together and discuss critical issues related to the ESIA. Participants' feedbacks and recommendations were incorporated in the final ESIA report.

The main findings of the carried out consultation during the course of the preparation of the ESIA include, most importantly, the following:

- Al Mokha is a Directorate with wide range of unutilized potentials including, among others, the long coastal road, the historical port, strategic location, several tourism attractions, numerous amount of palms and large areas of cultivated lands.
- The most dominant economic activities are of the marginal nature. This includes small scale fisheries, grazing, handicrafts…etc. Small portion of population is employed by the governmental sector, particularly in services related activities.
- The main challenge that hinders the development of Al Mokha is the absence of resources to fund infrastructure projects. This is perceived as the main factor that makes investors, especially those who are originally from Al Mokha, reluctant to invest in Al Mokha.
- Al Mokha hosts a number of local NGOs with various interest including women development, fishermen and farmers support and charity oriented associations. Several donor agencies and development partners also participated in funding projects in Al Mokha. The Civil Society sector is challenged by the absence of voluntary

spirit, conflict of interests, lack of financial resources and the weak monitoring and supervision on these organizations.
- Power shortage, in particular, is one of the key challenges that face the directorate. The power sector is challenged by the relatively limited capacity of the Power Plant and the fact that the old age of the network and the atmospheric conditions (high level of humidity) affects the station performance and consequently the power supply of most of the Directorate with less that 20% of the population has access to electricity.
- Lack of electricity also poses a household level challenge with limited access to many power based domestic services like refrigerating, lighting, TV…etc. It also negatively affects the householders' access to different educational and awareness materials that are promoted through media. This in turn negatively affects the level of awareness, particularly among women.
- Low level of awareness about the development of wind farms was significantly observed among different stakeholders of local communities. However, among local governmental officials, relatively higher level of awareness of the wind farm was observed. A previous unsustainable project that involved erecting wing turbines in Al Mokha was also introduced and the main reasons why the project did not sustain was identified as the lack of sound contextual specific planning.
- The local authorities highlighted the importance of the project in utilizing a cheep, exhaust free source of energy to generate power that will benefit not only Al Mokha but the entire region. Several long term returns were discussed, most importantly the economic returns from enhancing the power sector and from generating job opportunities during both the construction and operation phases.
- Local Authorities expressed fears from the potential negative impact on local communities where the project site will be located. The Local Council realizes the risks of relocating these groups particularly because they are among the poorest and most vulnerable on the level of the Directorate.
- The local authorities stated that they do not have the resources to provide development alternative to PAPs. However, they stressed the importance of mitigating the negative impacts on those categories and provide a fair compensation in any form. The importance of capacity building programs and training and giving priority to PAPs in the project generated jobs were also other important issues that were stressed by officials.
- The MWFP will achieve direct benefits to the operation of Al Mokha thermal Power Plant (MPP) as the wind farm output will help reducing the overload demand on MPP which will allow for maintenance and renovation of the plant.

The main comments that were raised during the Public Consultation Workshop that was carried out after submission of the draft ESIA included:
- Many delegates emphasized the importance of the project and the expected environmental and socioeconomic benefits.
- Fair compensations should be given to local residents who might be resettled from their homes. This comment was made by many people during the consultation especially from local residents. It was made clear to the participants that the project environmental and social impacts are not expected to cause involuntary resettlement

and that an RPF was prepared for the purpose of working as guidelines to direct the resettlement process in the worst case if this occurs during project implementation.

- The workshop participants emphasized the importance of granting local residents the opportunity to benefit most from the project either directly in the created jobs or indirectly from the other project outcomes (e.g. electricity, improved services in the neighborhood…etc) as possible. They referred to previous cases where local communities were excluded from the projects benefits and only bore the negative impacts.
- A representative form the Local Council raised a question about who will finance the new waste landfill that will be established instead of the existing dumpsite south of the project site, he emphasized that the financial resources of the Local Council could not satisfy this requirement. The ESIA team believes that this is an important remark that should be settled at an early stage of the project planning.
- One of the participants recommended that there should be measures to protect the area from floods coming from the east. Although the topographic map of the site (shown in Figure 4-1) and the satellite image of the project area do not show that there are major flooding routes particularly in the project area, the delegate confirmed that rainwater floods pass the project area. Accordingly this recommendation has been added to the ESMP related to the structural stability of WTGs.
- Noise impacts were also pointed out by referring that it might be more significant to the areas north of WTGs. The noise attenuation calculations used in Section 5.2.2 are for down wind direction and the impacted areas were identified accordingly
- A representative from the Local Council mentioned that the project area was previously planned for installing a wastewater treatment plant and a solid waste disposal site. It was emphasized to all participants that these activities could not be implemented in the project area and the buffer zone identified by 3 km from the 4 project borders as recommended in the ESMP.
- Participants referred to the need for improving local communities' access to water supply. They suggested this to be done in coordination with Mokha Power Plant.
- Despite the predicted benefits that will be attained from the construction of the wind farm, restricting farming in the buffer zone of the wind farm and additionally in areas where the wind farm might be expanded in the future is perceived as a hinder for development potentials in the area. The future expansions for wind farm project should be designed as integrated development programs to consider alternative sources of income for the local communities' livelihoods are required.
- The project developer, out of social responsibility, should work to provide local communities within the project area with sustainable development opportunities. This might include providing education opportunities and enterprises in various areas.
- Participants recommended the involvement of natural leaders (e.g. sheikhs) and the NGOs in implementing the measures that came under the ESMP.

Conclusion

MWFP is expected to attain many important benefits that overweigh limited negative impacts which could be mitigated through the proposed Environmental and Social Management Plan.

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1. INTRODUCTION

1.1 Background

The Ministry of Electricity and Energy (MEE) has prepared the Renewable Energy Strategy and Action Plan (RESAP) in 2008 with the objective of promoting sustainable development and improving the standard of living of the rural populations by providing affordable access to modern and clean energies. The RESAP has assessed different energy resources including wind, solar, geothermal, hydropower, and biomass energy resources.

The RESAP concluded that the Republic of Yemen is endowed with significant amount of renewable energy, and that the energy resources with potential for large-scale exploitation include wind, solar and geothermal energies. Being the largest renewable energy resource in the country, with practicable potential to generate about 34 GW, wind energy potential have been studied under the RESAP, in which it was highlighted that areas with high wind power concentration, e.g. high capacity factors and high full load hours, are located in the coastal plains, from the south of Hodeidah Governorate to Taiz, Lahej, Aden, and some part of Abyan, as well as mountain areas in Saadah and Amran, north of Sana'a, Dhamar, Al-Beida, and Al-Dhale'e. The coastal plains from central Hodeidah up to northern tip of Hajjah as well as Abyan and Shabwa have been also regarded to have good potential for wind power development.

As a preliminary step for implementing the RESAP findings, MEE has erected two meteorological masts near Al Hodeidah and Al Mokha cities in order to have the requirement wind measurements that will enable judging the feasibility of establishing a wind farm demonstration project in one of these two areas. The measurements campaign started in early 2006 and it was concluded that Al Mokha site is more feasible for implementing the project, because wind regimes and capacity factor are more favorable in Al Mokha. Accordingly Al Mokha 60 MW Wind Farm Project (MWFP) was initiated with the objectives of demonstrating the financial feasibility of wind power through implementing the first wind power development project in Yemen and adding 60 MW of clean power to the national grid. In June 2010 the Final Feasibility Study has been prepared for the project, in which the technical and financial feasibility of the project was confirmed.

The Government of Yemen (GoY) has submitted a request to the World Bank and the Islamic Development Bank (IDB) to assist in financing the MWFP. The preparation of an Environmental and Social Impact Assessment (ESIA) to assess different environmental and social impacts associated with the proposed project is a prerequisite for approving developmental projects according to the Yemeni legislation and the policies of the above international organizations. In order to ensure that the project will not result in unacceptable resettlement of any affected persons a Resettlement Policy Framework (RPF) has also been prepared. The MEE has prepared Terms of Reference (ToR) for

preparing an ESIA and RPF for the MWFP, in which EcoConServ Environmental Solutions (ECS) has been awarded these two studies.

1.2 The ESIA Objectives

The specific objectives of the ESIA are to:

- Assess the potential environmental and social impacts of the project
- Conduct an ornithological analysis that examines the potential impact of the project on birds life
- Compare the impacts in relation to relevant national and international requirements and guidelines
- Develop an environmental management plan for the mitigation of the potentially negative impacts and for monitoring compliance with the relevant environmental laws
- Assess the capacity of the implementing agencies to implement the developed environmental management plan
- Develop a capacity building program to cover any identified gaps in the capacity of the implementing agencies regarding environmental and social measures

A separate RPF has been prepared in a separate report and submitted to MEE with the objective of addressing cases where involuntary resettlement may occur.

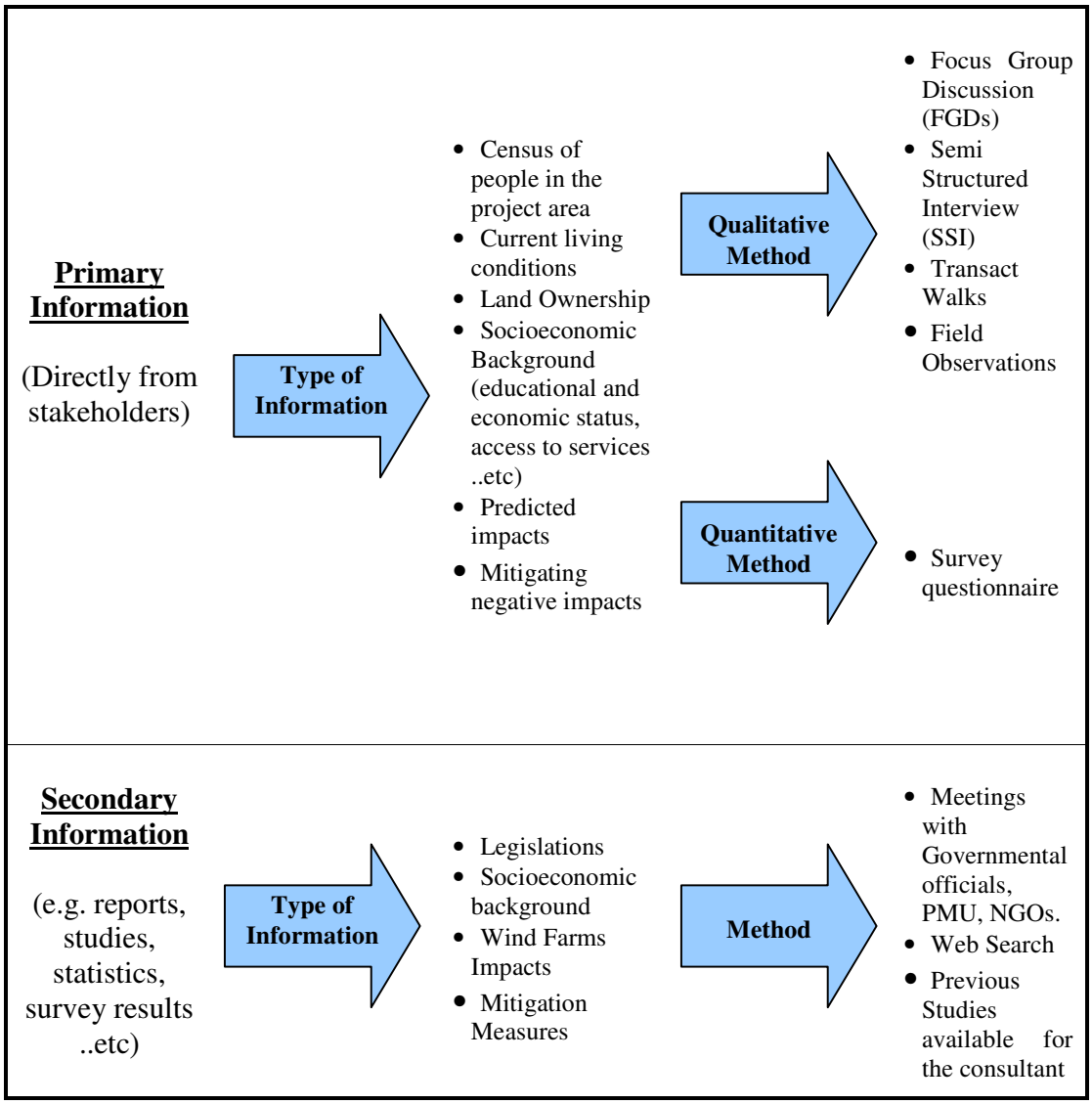
1.3 The ESIA Methodology

The work in the ESIA has been undertaken in three parallel directions: the environmental assessment, the social assessment and the ornithological assessment. The outcomes of the three directions have been integrated and presented in this ESIA.

The environmental baselines conditions of the project area were compiled from site surveys undertaken during the preparation of the ESIA and the project's Feasibility Study and available literature. Quantitative assessment has been undertaken for some possible impacts using relevant calculations, these impacts were compared to applicable standards in order to reach judgment about its severity. Other impacts that could not be assessed quantitatively were assessed qualitatively and the severity of these impacts was identified by the experience of the consultant in similar projects.

The preparation of the social assessment involved employing different mechanisms and tools for gathering a combination of primary and the secondary information as indicated in Figure 1-1 below.

Figure 1-1: Summary of the Social Impact Assessment Methodology



The adapted methodology, for the social assessment, has been successful in informing the impact analysis process. It helped in achieving multiple gains for the project as general and the ESIA in particular. This could be summarized in the following:

- Employing a context-sensitive participatory mechanism that aims to engage a wide range of stakeholders. This helped in building the sense of stakeholders' acceptance and ownership to the project. List of the most important interviewed stakeholders are included in Annex 1
- Ensuring credibility and transparency with the potentially affected groups and engaging them in proposing mitigation measures for the negative impacts that they might encounter.

- Engaging local and national consultants in the process was of high benefit particularly in facilitating the process of approaching local community.
- Raise stakeholders' awareness with the potential of wind energy in generating electricity in an environmental sound manner.
- Give the chance to the poorest and most vulnerable groups, who have never been approached with any type of development, the chance to participate in the preparation of the study and in ranking their priorities.
- Develop an environmental social management plan (ESMP) that is highly socially sensitive, particularly to the concerns of the poorest segment of the community.

Two ornithological field investigations were carried out during the autumn of 2009 and spring of 2010 and involved 50 days of field observations.

The autumn survey team was composed of two observers during the first part of survey period between 23 and 30 October, and a single observer between 8 and 14 November 2009. In total 15 days were spent in the field with an average of 5-6 hours of field observations of migration per day, with a total of 72 hours of stationary observations, in addition to observations made while traveling from one location to another, particularly during exploration of the site and its vicinity in the first three days of the field study.

The spring season ornithological investigations extended between 1 March and 7 May 2010. The survey team was composed mainly of one observer during much of the survey period, with the principal investigator attending between 28 March and 4 April. In total 35 days were spent in the field with an average of 5-6 hours of field observations of migration per day, with a total of bout 175 hours of stationary observations, in addition to observations made while travelling from one location to another, during exploration of the site and its vicinity to investigate regional migration patterns.

Initially observations were made in the general region surrounding the proposed wind farm location, extending as far east as a few kilometers east of Mafraq Al Mokha, north to Al Khokha and south to Bab Al Mandeb; in order to establish the general pattern of migration of soaring birds around the site. All other biodiversity resources in the site and its vicinity were recoded and documented photographically and identified to species level whenever possible. The focus was on vertebrates and flora primarily, which represent a strong indicator for overall biodiversity and are better known than other groups. Most diurnal observations were made incidentally during migration studies, but several nocturnal excursions were made to detect nocturnal wildlife in the area. These were made immediately after sunset when nocturnal activity is usually at its maximum. Extensive literature review and consultations with local and international scientists were made to augment information collected in the field.

2. LEGISLATIVE AND REGULATORY CONSIDERATION

2.1 Relevant Yemeni Regulations

2.1.1 Environmental Protection Law (Law No. 26 of 1995)

The Environmental Protection Law was issued in 1995 aiming at protection conservation of the environment and maintenance of its natural ecosystems. The Executive Regulations of the law has been issued by Decree of the Council of Ministers 148 for the year 2000

The Law requires the preparation of an environmental impact assessment study as a licensing prerequisite for new projects as stipulated in Article 35: "*It is not permissible for any competent body to give permission or issue a license to establish or operate or amend projects or establishments that effects and damage the environment or contribute to its deterioration or causing its pollution or participate in occurring such effect or harm human health or other living organisms, only in accordance to the standards or citerias or specifications or conditions that are determined and specified by the council*[4]". The Executive Regulations stipulates in Article 3 that projects that could be a source of pollution or there is a possibility that an environmental damage could result from its activities should have an environmental impact assessment study, especially projects listed in Annex 1 of the Executive Regulations. Although wind farm projects are not included in the list of projects in Annex 1, probably because no such projects were implemented previously in the country, some renewable energy projects are included such as hydraulic power projects.

Concerning biodiversity and conservation issues Articles 6 - 14 provide a framework for the establishment of Protected Areas, provides legal framework for control and use of pesticides. Articles 22-29 provide framework for the control of pollution and the conservation of natural resources and the protection of wildlife and marine organism specially those endangered and threatened of extinction. Article 28 prohibits the hunting of specified types of wild birds and animals, as well as the destruction of their natural habitats.

Although the MWFP is not expected to cause air pollution during its operation, some of its activities during the construction phase may cause direct and indirect air emissions. An example for that is the air emissions which will be caused by the convoy transporting wind turbines parts. These air emissions are regulated by Article 42 of the Executive Regulations, which specifies maximum vehicles emissions as illustrated in Table 2-1.

[4] The Environmental Protection Council has been changed to the Environmental Protection Authority

Table 2-1: Maximum vehicles emissions according to the Executive Regulations

Type of vehicle	Speed in range 600-900 rpm		Maximum acceleration
	CO	Non-combusted hydrocarbons	Smoke
Vehicles operated before 1997	7% of volume	1000 ppm	65% degree of opacity or equivalent
Vehicles operated after 1997	4.5% of volume	900 ppm	50% degree of opacity or equivalent

Noise standards are identified in the Executive Regulations in Article 51 and Annex 7. There are no specific noise standards for wind turbines, however, the general standards for ambient noise in areas affected by general public works and electricity power plants are illustrated in Table 2-2.

Table 2-2: Ambient noise standards for public works and electricity power plants

Type of area	Equivalent Noise Level as (dBA)		
	07:00 – 18:00 weekdays	18:00 – 23:00 weekdays	23:00 – 07:00 weekdays and all day during holidays
Rural and recreational areas	45	40	25
Residential areas in districts	50	45	40
Urban residential areas	55	50	45
Urban residential areas with some workshops	60	55	50
Industrial and commercial areas	70	65	60

For handling hazardous substances and wastes, the law stipulates that handling hazardous materials is not allowed without permission from the competent body, the Executive Regulations include, in Annex 3, lists of hazardous materials and wastes in which wasted mineral oils are included. Handling of limited amounts of some hazardous substances (such as transformers mineral oils and wind turbines lubricating oils and diesel) are expected during MWFP construction and operation. However, during the preparation of this ESIA the licensing procedure for hazardous materials was not in place, therefore the Environmental and Social Management Plan (ESMP) in Chapter 7 has recommended abidance to this legal requirement when it is actively in place, but before then general best known practices of hazardous materials handling will be adopted until it is legally documented.

2.1.2 Legislation Related to Resettlement and Compensation

From the Yemeni legislations and in relation to resettlement issues, the following are the key relevant legislations:

Table 2-3: Main legislation regulating resettlement and compensation

Public Ownership
Yemeni Constitution, Article 18 , 19 and Civil Law, Articles 118, 119, 120

Private Property
Yemeni Constitution, Article 7 , 20 and Civil Law, Articles 1154, 1159

Common Use of Land
Law no 21 of 1995 concerning State Land and Real Estate and The Republican Decree 170, 1996

Waqf/ Endowment Land
Waqf Law no 23 year 1992 and The Republican Decree 99, 1996

Agriculture Land
Yemeni Constitution, Article 7, papra (C) and Civil Law, Articles 761, 765, 770, 1159

Neighborhood Rights
Civil Law, Articles 1161, 1163, 1164

Squatters
Law no 21 of 1995 concerning State Land and Real Estate, Articles 58, 59

Land acquisition issues for the public interest

Law no 1 of 1995 (The Public Eminent Domain Law)

- Articles 1, 2 (defining projects for public interest)
- Article 4 on the administrative procedures for land acquisition
- Article 6 on the mutually agreed procedures for land acquisition
- Article 7 on the judicial procedures for land acquisition
- Articles 12 – 16 on temporary acquisition
- Articles 21, 27 provide general provision on acquisition

The legislations related to resettlement are explored in more details in the Resettlement Policy Framework (RPF).

2.1.3 Heritage (Antiquities) Law No 21 for year 1994

Mokha is a culturally significant site and the Heritage (Antiquities) Law No 21 for year 1994 and its amendments with Law 8 for year 1997 are pieces of legislations with relevance to the project site.

2.2 International Conventions

2.2.1 Climate Change

The Kyoto protocol is a protocol to the United Nations Framework Convention on Climate Change (UNFCCC). The Protocol was initially adapted in Kyoto in December 1997 and entered into force on February 2005. Like the UNFCCC, Kyoto Protocol recognizes the climate change as a larger challenge of sustainable development and one of the most serious threats to poverty eradication. Developing countries, and the poorest people who live in them, are the most vulnerable to climate change. The Kyoto Protocol and its provisions are providing tools for an effective and equitable global response through adopting flexible mechanisms.

Yemen ratified Kyoto Protocol in September 2004. Since then several projects that have the potential to reduce GHG in Yemen include amongst others, renewable energy projects, including PV, wind and geothermal. Yemen also adapted other important instruments like the Clean Development Mechanism (CDM).

2.2.2 International Labor Organization

From the International Labour Organization (ILO) conventions, Yemen has ratified around 30 conventions that regulate labour standards and work conditions. The last ILO convention was ratified by Yemen in August 2008 and it is about the Seafarer's Identity Document Convention. The oldest Yemen ratification returns to year 1976 and is about the Weekly Rest (Industry) Convention.

2.2.3 Biodiversity

Yemen is signatory to a number of primary conventions concerned with biodiversity and the conservation of migratory species. Yemen signed the convention on Biological Diversity (CBD) in June 1992. It is also signatory to the Convention on the Conservation of Migratory Species of Wild Animals (also known as CMS or Bonn Convention), which is the most relevant to the development of wind energy along migratory routs, as it necessitates that member countries protect and conserve certain migratory species, chief amongst them are soaring birds (such as birds of prey and storks) which are the main groups of concern at Al Mokha . Yemen ratified this convention in 2006

2.2.4 World Heritage Convention

Yemen also has ratified the World Heritage Convention in October 2008 and it has several properties inscribed at the world heritage list.

2.3 World Bank Safeguard Policies and Guidelines

2.3.1 OP 4.01 – Environmental Assessment

The MWFP has been classified as a Category B project, requiring an environmental assessment in accordance with the Banks Operational Policy on Environmental Assessment (OP 4.01). Projects under Category B could have potential adverse environmental impacts on human populations or environmentally important areas - including wetlands, forests, grasslands, and other natural habitats. These impacts are site-specific; mainly reversible; and in most cases mitigation measures can be designed.

The environmental impacts that are likely to be caused by the project have been analyzed in this ESIA. Mitigation measures were identified for all expected negative impacts, along with an Environmental and Social Management Plan (ESMP) presenting mechanisms for implementation of these mitigation measures.

2.3.2 OP 4.12 – Involuntary Resettlement

Involuntary Resettlement safeguard policy addresses impacts related to MWFP. The project will involve the need for land in order to develop the project components as well as to secure safety buffers to minimize any potential risk from the project both during construction and operation. In this sense and sue to the fact that few scattered settlements exist on the project site, involuntary resettlement is a concern that should be considered. The policy deals with involuntary resettlement in wider terms than the physical displacement of people due to development projects. It rather considers individuals who might be subjected to adverse economic, social, or cultural impacts. OP 4.12 was the guideline that was followed in drafting the RPF that was prepared as part of the project in order to set a framework for the needed actions and policies in case any of the project components triggered involuntary resettlement.

2.3.3 OP 17.50 – Disclosure

WB policy OP 17.50 on “Disclosure” details the Banks requirements for making operational information available to the public. The Bank reaffirms its recognition and endorsement of the fundamental importance of transparency and accountability to the development process. In addition, timely dissemination of information to local groups affected by the projects and programs supported by the Bank, including nongovernmental organizations, is essential for the effective implementation and sustainability of projects.

Other relevant WB Safeguard Policies are not expected to be triggered by the project activities such as OP 4.04 on conservation of natural habitats and OP 4.11 on Physical Cultural Resources. The project location does not completely fulfill the definition of OP

4.04 definition of natural habitats[5] as the vegetation cover is almost exclusively formed by the invasive Mesquite tree *Prosopis juliflora,* which is not a native plant to Yemen and the site has been moderately modified by human interventions through over grazing and cutting of vegetation Concerning OP 4.11 although the project site does not include any objects or structures that have cultural importance, chance-find procedures have been proposed in the ESMP for adequate management of any objects or structures found during project construction

[5] According to OP 4.04 natural habitats are land and water areas where (i) the ecosystems' bio-logical communities are formed largely by native plant and animal species, and (ii) human activity has not essentially modified the area's primary ecological functions

3. PROJECT DESCRIPTION

3.1 Project Components

The target capacity of the project (60 MW) will be met through introducing a number of Wind Turbines Generators (WTG). The project shall be implemented over an area of about 48 km^2 near Al-Mokha Power Plant (MPP). The project Feasibility Study includes three scenarios for WTGs rating, number and layout as follows:

- Scenario 1: installation of 70 WTGs each of 850 KW capacity with hub height of 55m
- Scenario 2: installation of 36 WTGs each of 1.65 MW capacity with hub height 70m
- Scenario 3: installation of 30 WTGs each of 2 MW capacities with hub height 78m, according to the layout shown in Figure 3-1.

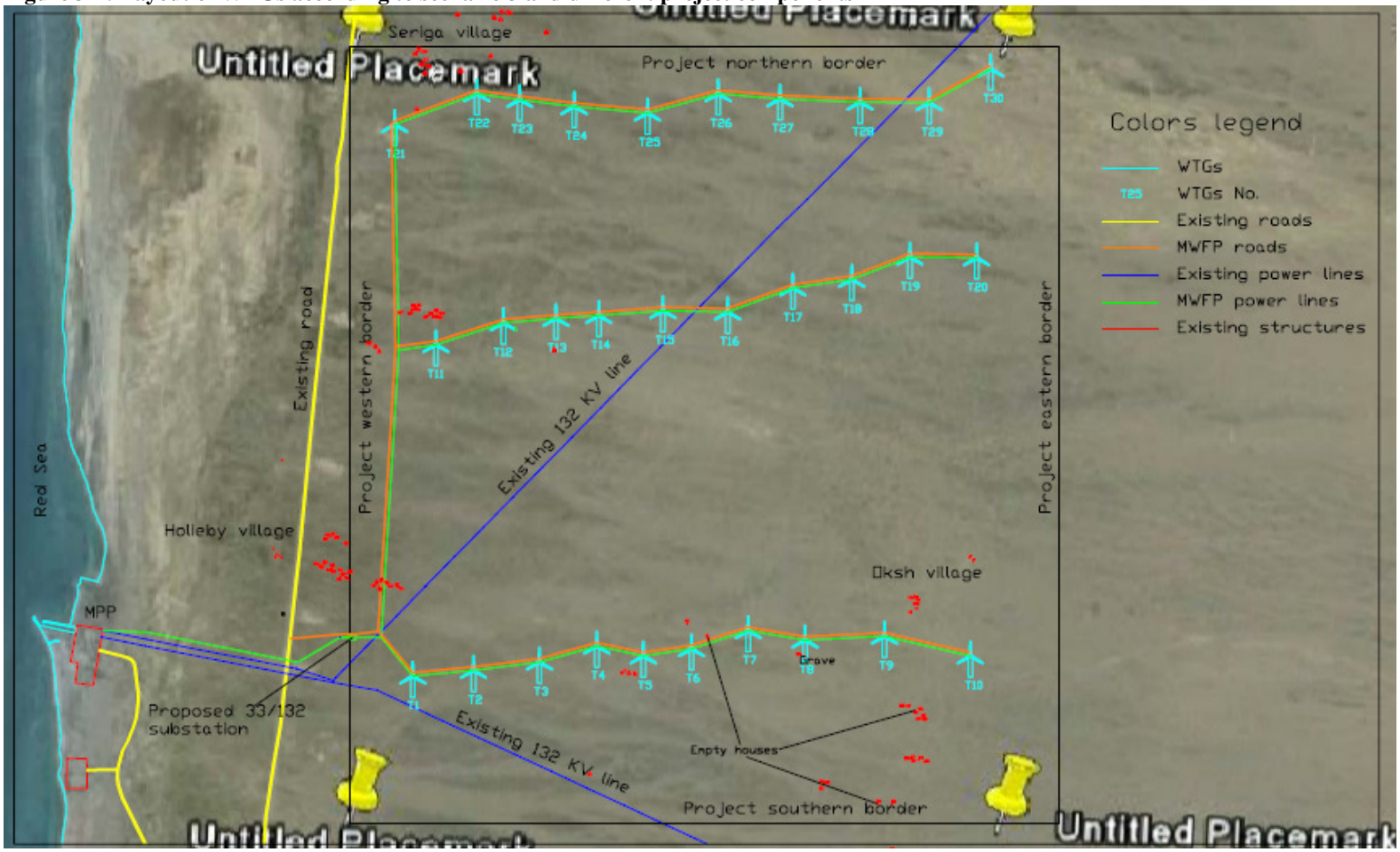
The financial analysis of the three scenarios recommends that Scenario 3 has shown best investment cost/production ratio and best Operation & Maintenance (O&M) costs/production ratio, accordingly the description of the project is based on Scenario 3. An assessment of the three alternatives from an environmental and social view points is presented in Chapter 6. However, the final type and amount of WTGs will only be known after tendering process.

Other than WTGs and their accessories the project will also include the following components:

- Internal roads which will include a connection from the main road, a main distributor road and three stretches serving WTG rows. The total length of internal roads, in case of Scenario 3, will be about 22 km.
- Internal cabling which will connect each row of WTGs will be underground 33 Kv cables that will be fixed in underground trenches for a total length of about 23 km.
- 33/132 substation which will be located at the southwest respect of the project site. The substation elements will be located in a fence enclosure with appropriate dimensions. Medium voltage power cells and low voltage measurements control and protection panels will be placed inside a closed building. The substation building will have a control room, cell room, warehouse, remote control room and rest room. The substation will have an earthling system to avoid electrocution.
- Overhead 132 Kv power line, which will connect the wind farm substation to MPP substation for a distance of about 2.6 km.
- At the MPP substation an input portal shall be built for evacuating energy produced from the wind farm. An overhead/underground terminal at MPP substation will turn the 132 KV overhead power line to underground line so that it will enter MPP with only minimum space requirement at the substation. The energy produced at the wind farm will, most probably, be evacuated in MPP substation using an empty GIS position in the substation, however, if using the

empty position in the substation is not possible due to technical/economic factors an extension to the existing MPP substation will be constructed.

Figure 3-1: Layout of WTGs according to scenario 3 and different project components [6]

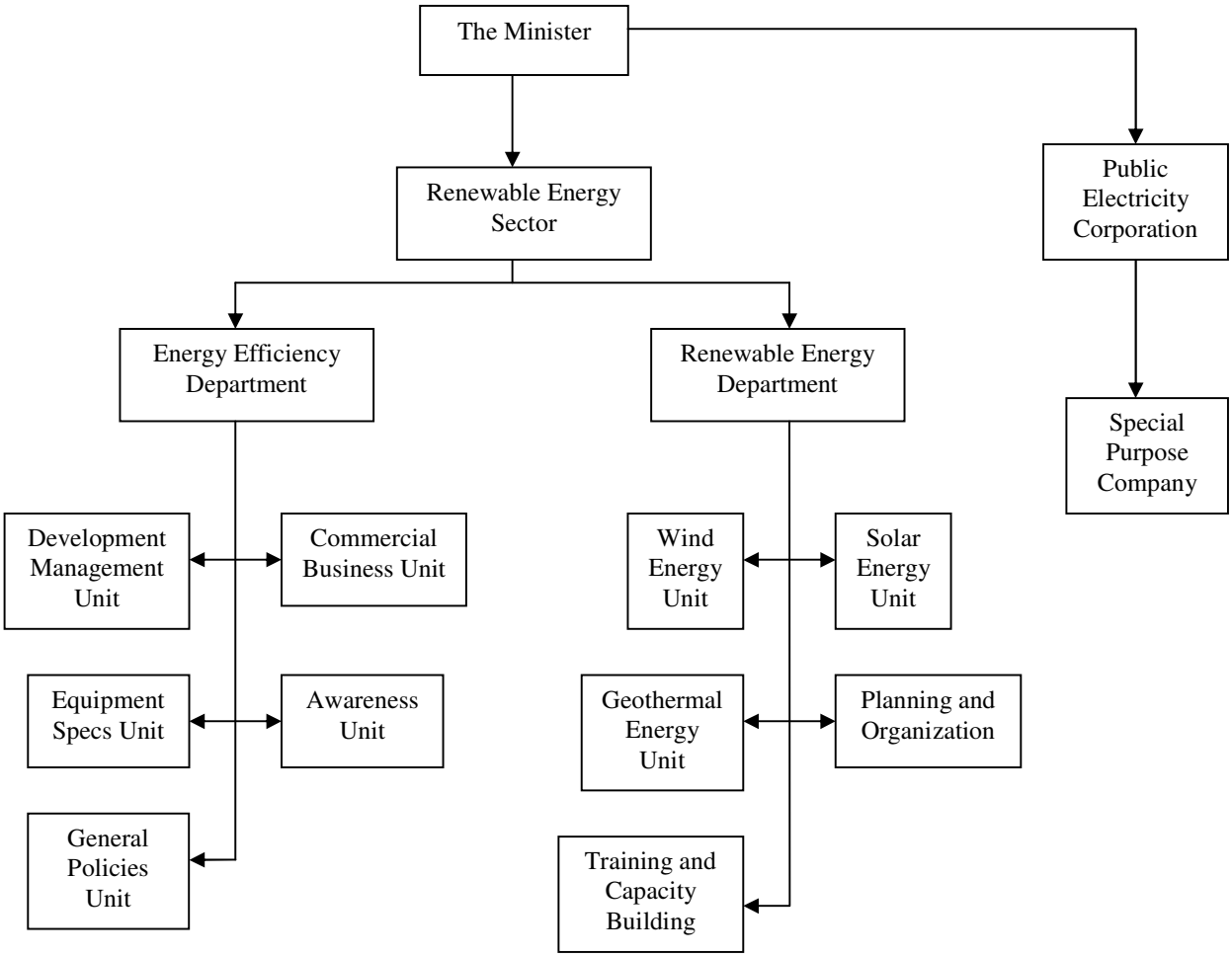


[6] The WTGs shapes shown in the figure are indicative (not an actual plan view) where the exact location of each WTG is at the center of the three blades rotation

3.2 Institutional Set-up

The conventional power generation, transmission and distribution is being carried out by the Public Electricity Corporation (PEC) of the Ministry of Electricity and Energy (MEE). The Ministry has recently established a Renewable Energy Sector which comprises many departments and units, as illustrated in Figure 3-2, including a unit for Wind Energy.

Figure 3-2: Organizational chart of MEE showing relevant departments to the MWFP



The supervision on the MWFP will be through MEE, but it was not clear, as to the preparation of this ESIA, the exact sector, department of body that will be responsible for the overall supervision on the project. However, it has been decided that a Special Purpose Company (SPC) will be established as a subsidiary of PEC, as illustrated in Figure 3-2, for operating the project. The SPC will be financially independent from PEC,

but will have a power purchase agreement with PEC. An Engineering Procurement Construction (EPC) Contractor will be recruited for implementation of the construction activities of the project.

3.3 Project Costs

According to the project Feasibility Study the capital cost for the project is $ 119,560,001 broken down as illustrated in Table 3-1.

Table 3-1: Project Capital Costs

Category	Item	Cost ($)
WTGs	Wind turbines	80,498,880
	Transportation and assembly	19,166,400
	Subtotal	99,665,280
Civil Works	Foundations	5,125,015
	Roads and access	1,707,538
	Cable trenches	837,317
	Cranes	3,701,921
	MWF Substation	608,933
	Works at MPP	53,240
	Subtotal	11,757,649
Electrical Works	Transformers and accessories	2,546,760
	Switchgears	631,827
	Cables and conductors	1,536,895
	Overhead power line	397,970
	Grid connection at MPP	592,295
	auxiliary services, materials, installations and assembly	199,517
	Subtotal	5,905,262
Engineering and training	Consultancy	432,575
	Project Management	1,356,543
	Training	166,375
	Subtotal	1,955,493
Total		**119,560,001**

The estimated operation costs for the project is $ 0.0078/kwh during the first two years, $ 0.0135/kwh from year 3 to year 5, $ 0.0176/kwh from year 6 to year 10 and $ 0.027/kwh after the 10th year.

3.4 Description the Construction Phase

The construction phase is expected to start with site preparation works including surveying works to mark locations of WTGs, internal roads, underground cabling, substation … etc. Also the contractor will prepare a temporary construction yard to establish temporary offices, labor camp, and storage area for construction materials.

Internal roads construction should be early in the construction phase so as access for heavy machinery is facilitated. As illustrated in Figure 3-1 internal roads network will be connected to the main road from the substation, and will have a distributor road from the substation to the three internal roads serving the WTGs rows. The construction works will comprise compaction of the existing sub-base soil, laying of the base layer and final leveling compaction of the road. According to the Feasibility study, there is no need for having asphalt internal roads, a well-made rocky road or non-slippery gravel is sufficient, however, it might be better to pave at-least the access road to the substation because of the relatively higher volume of traffic that will be pass through it, so less air-borne dust would be generated during the operation phase. It is worth noting that there may be requirement for repairing/upgrading some of the access road from Al Mokha harbor to the project site, in order to qualify it for the passage of heavy trucks transporting WTG parts, this requirement will be confirmed before the shipment of WTGs based upon assessment of the road condition.

There will be relatively large-scale earth works for fixing the foundations of the WTGs. There was no data available, before the preparation of this ESIA, about the size of each WTG foundation, however, from the consultant's experience from other projects the foundation for the turbines would be between 15x15m to 20x20m of reinforced concrete for a depth of about 2.5m. Accordingly the construction of these foundations will involve excavation of about 500-1000 m^3 of soil, in addition to fixation of piles. The site's geotechnical report (which was based on boreholes analysis) indicates that no groundwater was found until the depth of 15 meters, therefore no dewatering works for foundation fixation are expected. Earthworks will also include excavation of underground cable trenches, foundations of the substation building, fences and access gate/security area.

The turbines will be shipped by an international specialized supplier, most probably from Europe, through sailing to Al Mokha Harbor[7]. Because there are no suitable cranes in the harbor to unload turbines parts, it is expected that a truck crane should be deployed at the harbor to unload turbines parts.

According to some manufacturers catalogues of 2 MW WTGs it has been understood that each turbine will be shipped in 9 parts: the nacelle, the hub, the three blades and the

[7] The Feasibility Study of the project mentioned that the maximum ships draft at Al Mokha Harbor is 7.9m and maximum length is 150m, which may not be suitable to large ships navigating from Europe to Yemen, however, it is expected that the project management will overcome this obstacle either by selecting suitable ships to Mokha Harbor limitations or through phasing the navigation trip, especially that in other projects wind turbines parts have been unloaded in harbors having similar characteristics of Al Mokha Harbor

towers which is formed from 4 sections. If such turbines are used in the project, the crane will load each of these turbines parts in a heavy duty truck that will transport these parts to the site. According to the above scenario transportation of the 30 WTGs will require 270 truck journeys from Al Mokha Harbor to the site (about 10 km).

Assembly of WTGs will take place at the site using cranes of 500 tones capacity. According to a market search presented in the project's Feasibility Study, there are no such cranes available in the local market, therefore, most probably; the cranes will be mobilized from Saudi Arabia. A crane platform (35x25 m) will be established next to each WTG. The lower tower section is first fixed on the foundation, then the other tower section is connected, then the nacelle is connected to the top section of the tower, then the hub and cone are placed and finally the blades are connected.

The electric connections of the WTGs are established parallel to their assembly. Underground cables will be fixed in their trenches and connected to the substation, while overhead power line will be established to connect the wind farm substation by the MPP substation. When all components are in place the wind farm will be commissioned.

The construction phase of the project is expected to last for about 2 years. At the end of construction phase, the construction yard and temporary offices/labor camp will be decommissioned and the site will be delivered to the operating body.

3.5 Description of the Operation Phase

Operation and Maintenance (O&M) activities of the project will include cleaning of blades, replacement of the oil, adjustment and changing light components. Repair works that will need removing blades, the hub or the nacelle will require rental of crane and undertaking the repair work on ground before fixing back the removed part.

The expected operational life of WTGs is 20 years, in which maintenance/repair works are lower in the first years of the WTGs life span and gradually increases towards the end of turbines life.

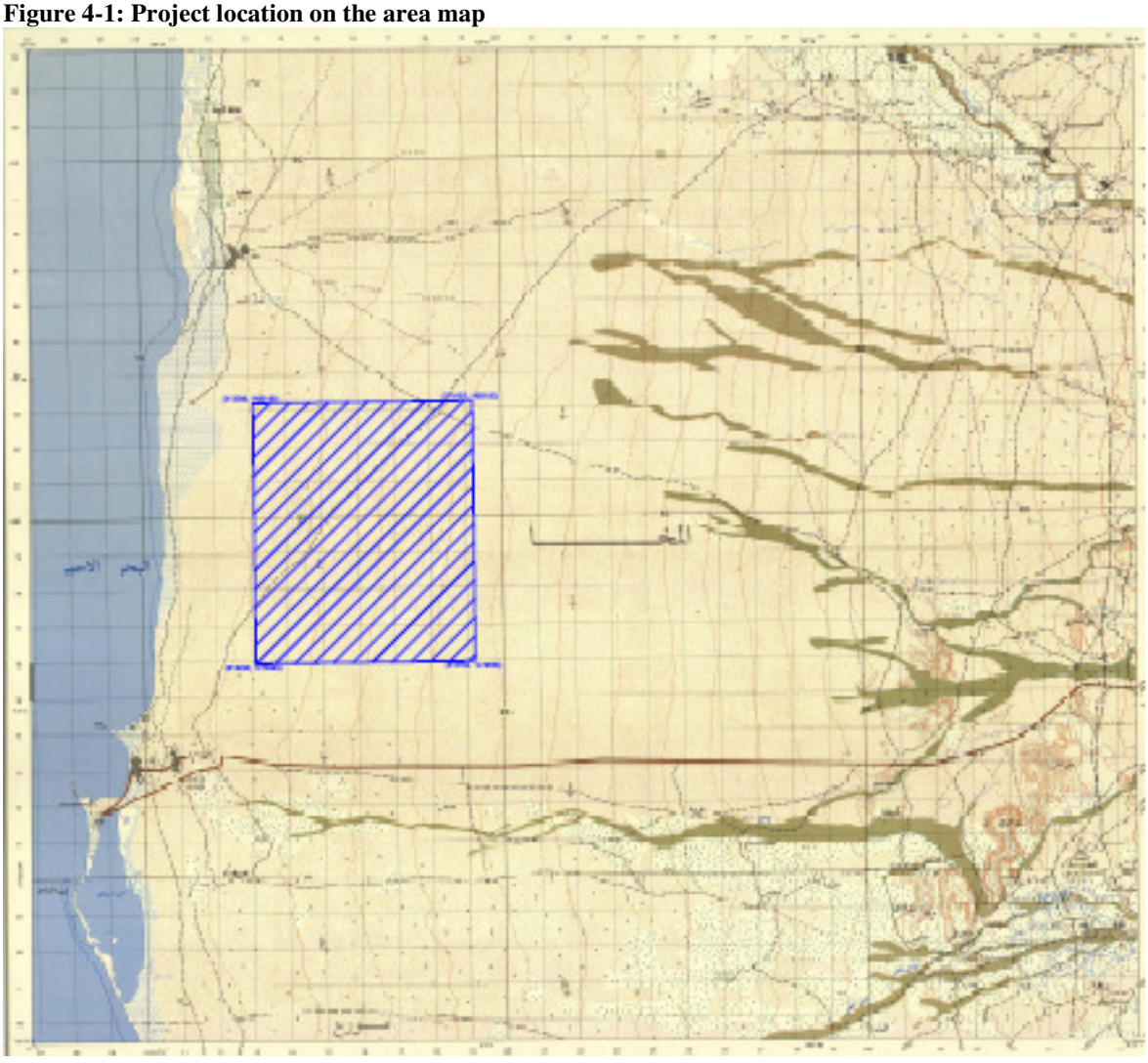
At the end of WTGs life, they will either be replaced by new WTGs or the project will be decommissioned by removing the WTGs, cables and electric fixutes in the substation. Foundations and structures are expected to be also removed so that the project area could be used for another development.

4. DESCRIPTION OF BASELINE ENVIRONMENTAL AND SOCIOECONOMIC CONDITIONS

4.1 The Project Area

The area identified for the project implementation is located about 5 km northwest from Al Mokha city near Al Mokha Power Plant (MPP). The project area is about 48 km^2 bordered by a rectangle 7.2x6.6 km as shown on a topographic map of the area in Figure 4-1.

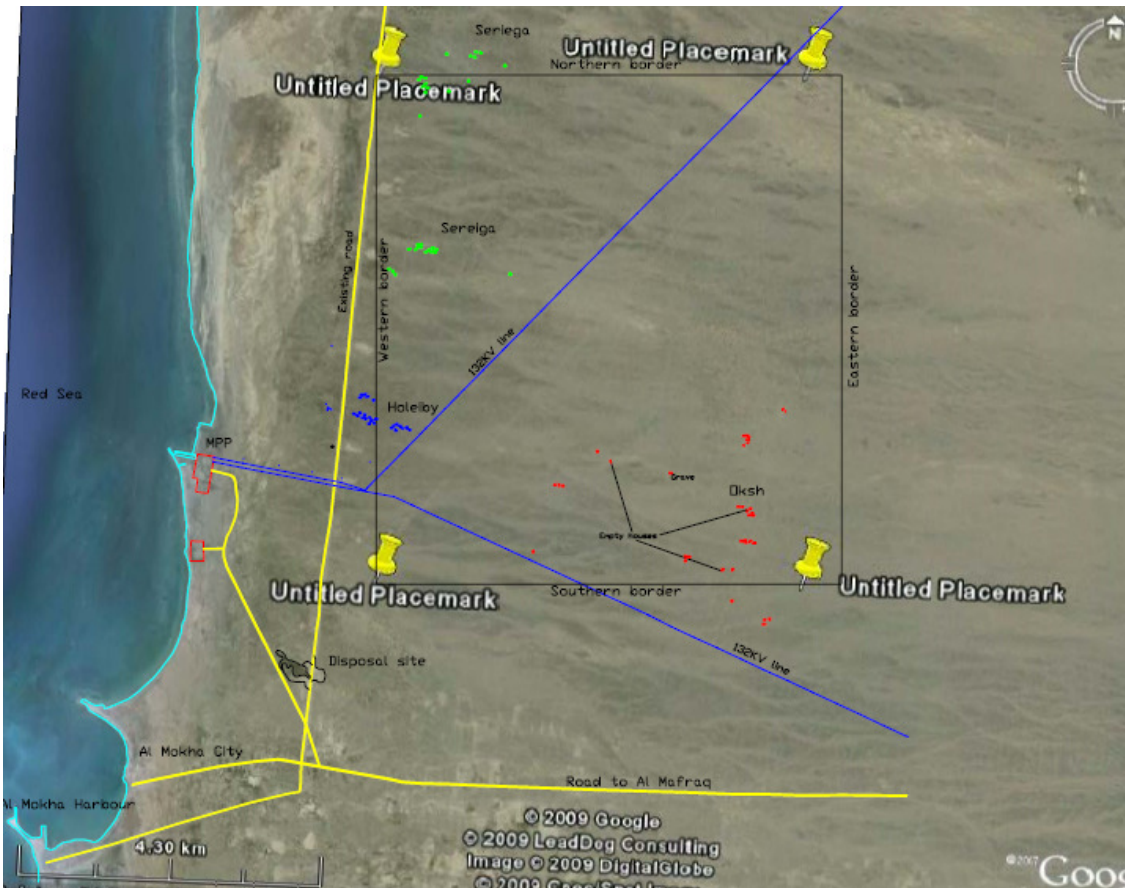
Figure 4-1: Project location on the area map



The site is an open plain area comprised of sandy soil with scattered vegetation cover from the invasive Mesquite plant. The carried out social surveys within the project site, as will be elaborated in more details below, showed that there are a number of small settlements located within and around the project area; these settlements are comprised

from small number of houses built from mud and woods. These villages are Al Houlibi Village settlements which is comprised of 31 houses and located around the western border of the project , Al Oksh settlement which comprise 36 houses (3 of them are uninhabited) and a grave and is located near the southern and eastern border of the project and Serega village which comprises 32 houses and is located around the northern border of the project. Some of the houses of these villages are located within the four borders of the project as shown in Figure 4-2. Further to the east the Red Sea shoreline is located about 2.5 km from the eastern border of the site. MPP is located on the coast about 2.5 from the eastern border of the site. Al Mokha city is located about 4 km southeast from the southeastern corner of the site, while Al Mokha Harbor is located about 6 km from the southeastern corner of the site.

Figure 4-2: Project site and its surroundings (Houlibi Village is marked with blue, Oksh with red and Seriega with green) [8]



The waste disposal site of Al Mokha city is located about 1.5 km to the south on the same road leading to the site. In addition to the domestic solid waste received at this site, dead animals received at Al Mokha Harbor are also placed in this disposal site, which causes offensive odors in this spot.

[8] Locations of houses in the project area where taken by a GPS

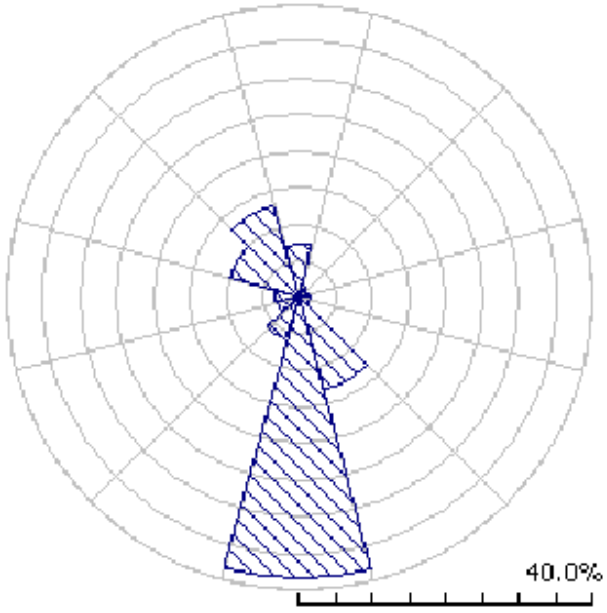
A 132 KV power line exits MPP substation to the west and splits into two power lines that penetrate the project site, one to the northwest direction and the other to the southwest direction as illustrated in Figure 4-2.

The ESIA team has conducted a walk through visit to the project site, and no spots of previous pollution were noticed. Because the project site was not subject of previous developments, except for the few houses as indicated above, it could be assumed that the project area does not include considerable spills of polluting materials.

4.2 Climate

A meteorological mast has been installed near the project area at a height of 40m for measuring temperature and wind conditions, which have been used in the feasibility analysis of the project. The prevailing wind direction in the area is south, as shown in Figure 4-3, with mean wind speed 9.06 in m/s in a complete twelve month at 39 m above ground level.

Figure 4-3: Wind rose chart of prevailing wind directions as recorded at the meteorological mast near the project site



The coastal regions of Yemen generally experience hot weather with low rainfall. Characteristic climate data recorded at Khalifa meteorological station, west of Hodeidah about 150 km north of the project site, are illustrated in Table 4-1.

Table 4-1: Meteorological data at Al Khalifa 1994-2003 [9]

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Temperature (° C)	26.3	27.3	29.4	31.7	33.6	34.2	34.7	33.1	31.6	30.4	28.8	27.4
Humidity (%)	69.4	69.1	66.9	62.7	60.9	60.1	55.1	65.0	72.0	71.2	66.4	68.9
Rain fall (mm)	0.6	0.9	14.4	0.9	0.6	4.4	6.6	29.8	13.8	5.1	3.1	3.1
Evaporation (mm)	5.0	5.4	6.5	7.6	8.4	8.9	10.7	7.8	6.1	6.2	5.7	5.1

4.3 Air Quality

The main source of air pollution near the project area is Al Mokha Power Plant (MPP) located about 2.5 km west of the project site. MPP includes 4 steam turbines each generating 40 MW (total capacity 160 MW) working with Mazout (heavy oil No. 6) and diesel as an alternative oil. To the preparation of this ESIA MPP did monitor its emissions, but according to data gathered from MPP and using the emission factors suggested by USEPA (Document AP-42) the average air emission from MPP are illustrated in Table 4-2[10].

Table 4-2: Estimated air emissions of MPP using USEPA Emission Factors

Pollutant	CO_2	SO2	SO3	NOx	CO	Filterable PM
Estimated emissions (tonnes/day)	3,150	53.4	1.9	5.9	0.6	3.5

Other than MPP no major sources of air pollution near the site, especially that traffic flow in the adjacent roads is relatively low and that air emissions of Al Mokha Harbor are relatively far from the project location.

4.4 Topography

The project is located in Tihama coastal plain which is characterized by gentle slope from the sea level at the coastline until reaching an elevation of 100 meters about 15 km to the east. The project area also slopes gently to the east, as the lowest elevation at the project site is about 6 meters near the western border and the highest elevation is about 38 meters near the eastern border of the site.

[9] Source: Master Plan of Al Hodeidah City 2007

[10] The information gathered during July 2007 indicates that the daily consumption of Mazout is about 1050 m^3/d and that the Mazout has sulfur content of 2.7%, specific gravity of 0.9544 and calorific value of 9650 kcal/kg

The site and its immediate vicinity are located on a broad alluvial plain, the topography is generally flat, and the surface is composed of moderately coarse alluvium made up of gravels, some stones, and coarse sand with some limited aeolian sand accumulations in some sheltered areas and around the bases of some vegetation. Although the area is not within any major drainage basins and is located a distance away from the major wadis in the region (e.g. Wadi Mawza to the south or Wadi Rasyan to the north), there is clear evidence of active and regular flash flooding through the site as evidenced by erosion along newly constructed coastal highway to Al Hodeida.

4.5 Soil

Five boreholes and three test pits were performed from the project site in order to characterize the soil type and stratification of the top 15 meters depth of the soil.

In general, stratification of course grained soils dominated by gravelly soil with cobble was encountered. Cohesive soil layers, clayey soil, were only encountered at two boreholes at depths of 3 and 3.5 meters; the thicknesses of these layers are approximately of 5.5 m and 3.4 m at the two boreholes. At the top of boreholes the soil consists of a high quantity of organic matter for 1-1.5 m under the ground surface. The soil investigation reported indicated that the dominating sand and gravel (with less than 12% fine grains) could be used as fill and backfill material. According to the soil investigation report no groundwater was encountered in the whole depth of boreholes (15 m).

4.6 Flora and Fauna

4.6.1 Flora

The Tihama at large comprises two main habitat types. First, along the coast are sandy beaches often fringed with *Phoenix dactylefera* palm groves, sabkah and intertidal mudflats and areas of mangrove *Avicennia marina*. The second habitat occurs further inland and consists of shallow sandy wadis and stony plains with xerophytic plant associations and open woodland of *Salvadora*, *Commiphora* and *Acacia*, with scattered Doum Palm *Hyphaene thebaica* groves.

Scholte et al. (1991) identified eight plant communities on the coastal Tihama plain, three of these are applicable to the general vicinity of the project site, starting from the coast inland as follows: Sabkha, *Suaeda* sparse dwarf-shrub land and bare land; Palm groves, *Phoenix-Salvadora* woodland; and Salt-bush lands, *Salsola, Odyssea* dwarf-shrub land.

The proposed wind farm site is located about 2.5 km from the Red Sea coast, thus there is no coastal habitat within the site, but the coast in the project vicinity is sandy with a fringe of halophytic vegetation. Much of the land area in the proposed wind farm site and immediate vicinity is covered with a dense cover of Mesquite *Prosopis juliflora*, which is an invasive shrub or small tree native to Mexico, South America and the Caribbean that has invaded many parts of Asia, Africa and Australia. However, this tree seems to be

more or less restricted, in this area, to a 2-3 km band along side the coastal highway and eventually gives way to the native vegetation further inland. The natural vegetation of the site is dominated by *Acacia tortilis* trees dwarfed by the predominant strong winds of the region, with scattered *Salavadora persica* and *Capparis decidua* bushes and groves of Dom Palms. The shrub layer is dominated primarily by the spiny grass *Odyssea mucronata*, with scattered shrubs of *Panicum turgidum, Zygophylum simplex* and *Leptadenia pirotechnica*.

Figures 4-4 to 4-15 illustrates flora species observed during the site visit.

Figure 4-4: Vegetation in the neighborhood of the meteorological mast, showing elements of the native flora including the tree *Acacia tortilis* being encroached upon by the invasive *Prospois juliflora*

Figure 4-5: The grass *Panicum turgidum*

Figure 4-6: Vegetation in the neighborhood of the meteorological mast, showing elements of the native flora including the tree *Acacia tortilis* being encroached upon by the invasive *Prospois juliflora*

Figure 4-7: The spiny grass *Odyssea mucronata* plays an important role as a refuge for many animals inhabiting this region

Figure 4-8: *Salvadora persica* bushs cover extensive areas of the Tihama.

Figure 4-9: *Senna italica* was common at the project site

Figure 4-10: View of the coastal plain showing Tamarix sp. Forming large phytogenic mounds (on the right) with Odyssea mucronata conbuting much of the rest of the cover

Figure 4-11: Recent floods provide opportunity for new seedlings of *Calotropis procera* and *Zygophlum simplex*

Figure 4-12: Doum Palm *Hyphaene thebaica* groves are commonly scattered near the coast. This grove is located in the north western part of the proposed project site

Figure 4-13: Flowers of *Capparis decidua* attract many insects and birds on the Tihama

Figure 4-14: *Leptadenia pyrotechnica* in the foregrownd *juliflora*

Figure 4-15: *Zygophylum simplex* is an annual that grows rapidly after seasonal rains

According to 2008 Development Report of Al Mokha Directorate, the cultivated land in the Directorate is about 32,000 Hectare most of it cultivated with cereals followed by vegetables then animal fodder.

4.6.2 Birds[11]

In total at least 113 species of birds are documented for the general Al Mokha region (this study, Jennings 2010). 81 species were observed during autumn 2009 and spring 2010 visit, of which 60 were observed within the project site (see Appendix 2). The majority of these are migratory however, and the resident and breeding avifauna is rather limited in diversity as well as in abundance and density. The most prominent species documented in the autumn season were Crested Lark *Galerida cristata*, Yellow-vented Bulbul *Pycnonotus xanthopygos*, Nile Valley Sunbird *Anthodiaeta metallica*, Palm Swift *Cypsiurus parvus*, Palm Dove *Streptopelia senegalensis*, Chestnut-bellied Sandgrouse *Pterocles exustus*, Southern Grey Shrike *Lanius meridionalis* and Black-crowned Finch Lark *Eremopterix nigriceps*. Potential breeding birds also included White-throated Bee-eater *Merops albicollis* and Cream-colored Courser *Cursorius cursor*. House Sparrow *Passer domesticus* and Indian House Crow *Corvus splendens* are two invasive species that dominated the avifauna at Al Mokha, and regularly enter the project site.

Table 4-3: List of birds found breeding within the project site boundaries.

English name	Scientific name
Stone Curlew	*Burhinus oedicnemus*
Namaqua Dove	*Oena capensis*
African Collard Dove	*Streptopelia roseogrisea*
Palm Dove	*Streptopelia senegalensis*
Chestnut-bellied Sandgrouse	*Pterocles exustus*
Crested Lark	*Galerida cristata*

[11] This section presents a summary of a detailed ornithological study that is an annex report to this ESIA. This ornithological study covers more than Al Mokha site, as it extends to the coastal area from Mokha to Abyan

Black-crowned Finch Lark	*Eremopterix nigriceps*
Greater Hoopoe-Lark	*Alaemon alaudipes*
Blackstart	*Cercomela melanura*
Graceful Prinia	*Prinia gracilis*
Yellow-vented BulBul	*Pycnonotus xanthopygos*
Arabian Babbler	*Turdoides squamiceps*
Nile Valley Sunbird	*Anthodiaeta metallica*
Palm Swift	*Cypsiurus parvus*
Southern Grey Shrike	*Lanius meridionalis*
Indian House Crow	*Corvus splendens*
Brown-necked Raven	*Corvus ruficollis*
Arabian Golden Sparrow	*Passer euchlorus*
House Sparrow	*Passer domesticus*
Rüppell's Weaver	*Ploceus galbula*
African Silverbill	*Euodice cantans*

During the spring season the composition of local and breeding avifauna changed somewhat from the autumn, with the appearance of several Tihama breeding species, such as the near-endemic Arabian Golden Sparrow *Passer euchlorus*, African Silver-bill *Euodice cantans*, Rüppell's Weaver *Ploceus galbula*, and Dark-chanting Goshawk *Melierax metabates*. Most of these species are small low fliers and would not be affected directly much (except perhaps due to disturbance), with the exception of the Goshawk, which could fly within the strike zone of the wind turbines. This, however, is a widespread species, which occurs in a low density in the region and the negative impact of the wind turbines is likely to be limited.

Jennings (2010) has listed 57 potential breeding birds in the general Mokha area (see Appendix 2), however this list reflects a much larger area and includes both marine and coastal, as well as mountainous habitats, all of which are not found within the immediate vicinity of the project site. Our observations indicate that at least 18 species breed within the project site boundaries, while at least six other local breeders like Black Kite *Milvus migrans*, Egyptian Vulture *Neophron percnopterus*, Griffon Vulture *Gyps fulvus*, Long-legged Buzzard *Buteo rufinus*, African Eagle Owl *Bubo africanus* and Dark-chanting Goshawk mostly nest outside the site, but include its area as part of their home ranges.

The relatively poor avifauna at the project site could be partly attributed to the dense growth of the invasive *Prosopis*, which creates a habitat that is particularly species poor. Indeed, most birds were observed in areas with no or limited *Prosopis* cover.

In terms of migratory species soaring birds (particularly birds of prey) were the most prominent and diverse (these will be dealt with in greater detail later). An important component of waterbirds was found along the coast towards Al Khokha as well as further south towards Bab El Mandab, with many shore birds congregating in coastal lagoons, but generally not wandering inland. The exception was at newly reclaimed and irrigated (flooded) fields in the northern portion of the project site, where small numbers of wading birds were observed.

The Arabian Bustard *Ardeotis arabs*, which is Yemen's largest bird and is a declining species throughout its range, was known from the vicinity of Al Mokha (Dr. John Grainger pers. com.). The last record in the general vicinity of Al Mokha was in 2001 (Jennings 2010). Mike Evans (in litt.) indicated that most of the recent records of the species are in the northern part of the Tihama in Yemen near Hodieda. Yemen is probably now the only country within the Arabian Peninsula with a self-sustaining population of the species, and the Tihama is the only place where this bird occurs in the country. The Arabian Bustard would be one of the few resident bird species that could be at special risk from possible wind farm developments on the Tihama due to its large size, sensitivity to disturbance and large home range requirements. No records or evidence of the species' occurrence were obtained during the current study and its unlikely to occur in the immediate vicinity of the proposed project site as it is likely to be too densely overgrown with *Prosopis* trees for the species' to survive.

There are several species that are considered to be globally threatened found in Yemen and which could potentially occur at the proposed project site, including: Greater Spotted Eagle *Aquila clanga*, Imperial Eagle *Aquila heliaca*, Pallid Harrier *Circus macrourus*, Lappet-faced Vulture *Torgos tracheliotos*, Ferruginous Duck *Aythya nyroca*, Houbara Bustard *Chlamydotis undulata*, Corncrake *Crex crex*, Lesser Kestrel *Falco naumanni* and Northern Bald Ibis *Geronticus eremic* (IUCN 2009).

Table 4-4: Globally threatened bird species, known (in bold) or could possibly occur at the project site and adjacent areas, according to the *IUCN Red List of Threatened Species* (IUCN 2010).

English name	Scientific name	Status
Egyptian Vulture	*Neophron percnopterus*	Endangered
Pallid Harrier	*Circus macrourus*	Near-threatened
Greater Spotted Eagle	*Aquila clanga*	Vulnerable
Eastern Imperial Eagle	*Aquila heliaca*	Vulnerable
Sooty Falcon	*Falco concolor*	Near-threatened
Red-footed Falcon	*Falco vespertinus*	Near-threatened
Lesser Kestrel	*Falco naumanni*	Vulnerable
Saker Falcon	*Falco cherrug*	Endangered
White-eyed Gull	*Larus leucophthalmus*	Near-threatened
European Roller	*Coracias garrulus*	Near-threatened
Corncrake	*Crex crex*	Vulnerable
Cinereous Bunting	*Emberiza cineracea*	Near-threatened

BirdLife International (Evans 1994, BirdLife 2009) has also designated three Important Bird Areas (IBAs), which are found the vicinity of the project site or within the adjoining region, as follows:

Straits of Bab Al Mandab (43°29' E, 12°46' N)

Bab Al Mandab is the narrowest point in the southern Red Sea linking the Arabian Peninsula with Africa. It is a major bottleneck for soaring of international importance (Zalles and Bildstein 2000). Migratory birds, especially birds of prey, flying between Africa and their Eurasian breeding grounds, mainly Steppe Buzzard *Buteo buteo*, Steppe Eagle *Aquila nipalensis* and Egyptian Vulture concentrate here in globally significant numbers (Evans 1994, BirdLife 2009), potentially putting large numbers at risk from any adverse conditions on the ground. See further details below.

Mafraq Al Mokha (13°22'N 43°38'E)

An important soaring bird migration concentration area in autumn. Most birds pass over at high altitude, unless driven low by strong southerly headwinds, but large numbers descend to roost in the area at night, and raptors are attracted to drink at the wadis as well (Evans 1994, BirdLife 2009). The following numbers have been counted: Black kite *Milvus migrans* 273, Steppe Buzzard 55, Greater Spotted Eagle 6, Steppe Eagle 168, Sparrowhawk 5, and Levant Sparrowhawk *A. brevipes* 100. Small numbers of White *Ciconia ciconia* and Black Stork *Ciconia nigra* migrate and winter in the area. The area also holds a representative breeding assemblage of species characteristic of Acacia-Commiphora bushland (Evans 1994, BirdLife 2009). Together with two other bottleneck IBAs Wadi Rijaf (14° 53' N 43° 26' E) and Al Kadan (15° 18' N 43° 14' E) this IBA represents a section along the main migratory rout for soaring birds along the Tihama foothills.

Al Mokha – Al Khawkhah (13°35' N 43°17' E)

This IBA includes about 70 km of the Red Sea coastline extending between the towns of Al Mokha in the south and Al Khawkhah in the north. The IBA is primarily a wetland composed of intertidal habitats including coastal lagoons, mangroves, mudflats and littoral habitats that provides valuable feeding habitat for coastal waterbirds, and large numbers of gulls and terns. Wintering species include Spoonbill *Platalea leucorodia* and Black-headed Gull *Larus ridibundus*. Migrants include Lesser Sand Plover *Charadrius mongolus*, Broad-billed Sandpiper *Limicola falcinellus*, Terek Sandpiper *Tringa cinerea*, Lesser Crested Tern *Sterna bengalensis*, and Common Tern *Sterna hirundo*. Breeding species of the mangroves include Green Heron *Butorides striatus*, Nubian Nightjar *Caprimulgus nubicus* and Black-crowned Tchagra *Tchagra senegala* (Evans 1994, BirdLife International 2009).

Figure 4-16: Crab Plover Dromas areola one of the shore birds found on interdidal flats near Al Khokha

Figure 4-17: Whte-eyed Gull Larus *leucophthalmus* (Near Threatened) was common on the beach of Mokha

Figure 4-18: Black-crowned Finch-Lark *Eremopterix nigriceps*, one of the common breeding birds of the region

Figure 4-19: African Eagle Owl *Bubo africanus*. Traffic casualty found at the project site. Other owl species could also occur at the site, but were not detected

During the autumn 2009 field study[12], 607 observations were made resulting in recording a total of 18326 soaring birds belonging to 24 species, described in the following sections.

4.6.2.1 Bird migration through the project site and adjacent region

Generally there is relatively limited systematic information about bird migration through this area. Migrants can be grouped into three migration groups according to their physiology, flight behavior and ecology as follows:

[12] Another field survey has been conducted during spring 2010 and its results will be included in the following versions of the ESIA

Passerines and near passerines

The most numerous migrants are passerines and near passerines that spend the winter in sub-Saharan Africa. The number of species that pass the region during migration is relatively high and the total number entering Africa has been estimated at 800 million individuals (Biebach and Baha El Din 1995). Passerines migrate in a broad front alone or in loose groups, with little tendency for concentration in bottlenecks, they do not normally form large flocks or follow narrow migratory routes (like soaring birds do). They mostly fly at night, and stop to rest and refuel (if possible) during the day, resting on the ground, in vegetation, in rocky crevices or any available shelter, but very few also continue to fly during the daytime.

Flight usually takes place at considerable elevation where cooler and more moist air can be found. About 90% of all small migrants recorded during spring in Mauritania, were flying above 1000m, and more than 50% were above 2500m (Liechti and Schmaljohann 2007). Schmaljohann et al (2007). Found that autumn migration of songbirds across the Sahara took place at lower altitudes than spring, and migration was more highly restricted to night-time than in spring, when about 17% of the songbird migration occurred during the day. A radar study of the flight altitude of small migrants passing through Egypt at night showed that only 21% of all birds flew below 100 m (Biebach and Baha El Din 1995). It was estimated that the number of passerines flying below 100 m is between 16,000-65,000 per night per kilometer (Biebach and Baha El Din 1995). A radar study by Decon-Fichtner (2007) of nocturnal migrants at the Gebel El Zeit area found that the maximum observed number of birds per hour in one kilometre distance was 3,000 (in autumn). Decon-Fichtner (2007) also found that 30% of 10,820 night migrants detected by radar flew below 200 m and 19% below 150 m during spring. In autumn 36,420 night migrants were detected, but only 8.6% were found flying below 200m.

Waterbirds

The Red Sea coast in Yemen is also a route for migrating waterbirds as well as an important wintering ground, including species such as herons, gulls, terns, ducks and waders. Waterbirds mostly migrate in flocks usually offshore following the coastline, but frequently small flocks or individuals of various heron species (such as Grey Heron *Ardea cineria* , Purple Heron *A. purpurea* and Night Heron *Nycticorax nycticorax*) will fly over land and could be encountered at the project site. Indeed two Grey Herons were seen flying over the site. Soaring waterbirds such as storks and pelicans are treated under soaring birds.

Soaring birds

Soaring birds are birds that use thermals or warm air currents to fly. These currents form during the day time when the land is heated by the sun. There are no thermals at night so the vast majority of soaring birds come down to roost on land. As thermals also do not form over the sea, soaring birds avoid any extensive water bodies and select to cross over

land bridges or narrow waterways. For this reason soaring birds tend to concentrate along narrow passage ways and well established bottlenecks, where huge numbers of these birds congregate on their migration on a predictable seasonal pattern. Entire populations of some species can pass through some of these bottlenecks.

Soaring birds are of special conservation concern because they are usually large birds that are few in number have a long life history and take a long time to reproduce and need large areas of habitat to do so, so they are by nature of conservation concern and are vulnerable to any additional impact to their populations even if it is relatively small and sustained.

There are two types of soaring birds: passive and active fliers. Passive fliers, which are birds that rely almost exclusively on thermals as a means of flight and are highly reluctant to cross any water surfaces. Passive fliers include larger birds of prey such as vultures, eagles and most buzzards and storks.

Active fliers are soaring birds that depend to a lesser extent on thermals and are capable of sustaining fairly long flights without thermals through active flapping. Active fliers include species such as pelicans, cranes and some of the smaller birds of prey such as Honey Buzzard *Pernis apivorus*, harriers, sparrow hawks and falcons. These active fliers are less reluctant to cross water bodies and are generally more flexible in their choice of migration route.

Some soaring birds like storks, pelicans and cranes fly in monospecific flocks, often in huge flocks. Birds of prey tend to migrate in multi-species streams, often forming huge kettles, where masses of various soaring birds of prey spiral together upwards on hot air thermals to gain altitude.

4.6.2.2 Ornithological studies at proposed wind energy development at Al Mokha - Results of the autumn 2009 study

During the autumn 2009 field study, 607 observations were made resulting in recording a total of 18326 soaring birds belonging to 24 species.

Migration general orientation

As anticipated from the literature and the nature of the topography of the region, the main stream of autumn soaring bird migration moved in a southerly direction along the Tihama foothills in a fly way that leads directly to Bab Al Mandab. Observations at Al Mafraq located 40 km east of Al Mokha confirmed the heavy passage of birds along a north to south axis parallel to the mountain foothills bordering the Tihama from the east.

Birds moved south to Bab Al Mandab and congregated there in large numbers to attain altitude and attempt the crossing of the sea west wards to Djibouti. Due to the very strong southerly winds at Bab Al Mandab (prevailing throughout the region) many birds attempting to cross the sea to Djibouti fail to reach the western side and are forced

northwards along the Yemeni Red Sea coast. Most of these birds are seen arriving in large numbers off the Red Sea just north of Bab Al Mandab and north to Dubab (where many land, apparently exhausted and overwhelmed by the strong winds). These birds are pushed further northwards along the coast reaching up to Al Mokha and beyond. The volume of birds at Al Mokha varies according to wind velocity, being greater during strong winds. These birds attempt to head eastwards and eventually rejoin the stream of soaring birds moving south along the Tihama foothills, where the southerly winds are much reduced and hence attempt to cross the straits of Bab Al Mandab again.

The situation at Bab Al Mandab it self was rather chaotic, with a large influx of birds coming from the north along the last of the Tihama foot hills mixing with birds coming off the Red Sea after failing to cross the Straits of Bab Al Mandab. During the day huge numbers build up over the hills of Bab Al Mandab, being held back by the violent southerly winds and attempting to gain sufficient altitude to facilitate the crossing of the sea to Djibouti. This situation makes it very difficult to assess the total volume of migrants passing through Bab Al Mandab with any accuracy as it appears that many birds might attempt the crossing several times. This leaves the counts from the Djibouti side as the best option for assessing the volume of birds utilizing this bottleneck. Welch (in litt.) made a similar observation of spring migration from the Djibouti side of Bab Al Mandab, where birds made several attempts to cross the sea in the face of strong headwinds from the north.

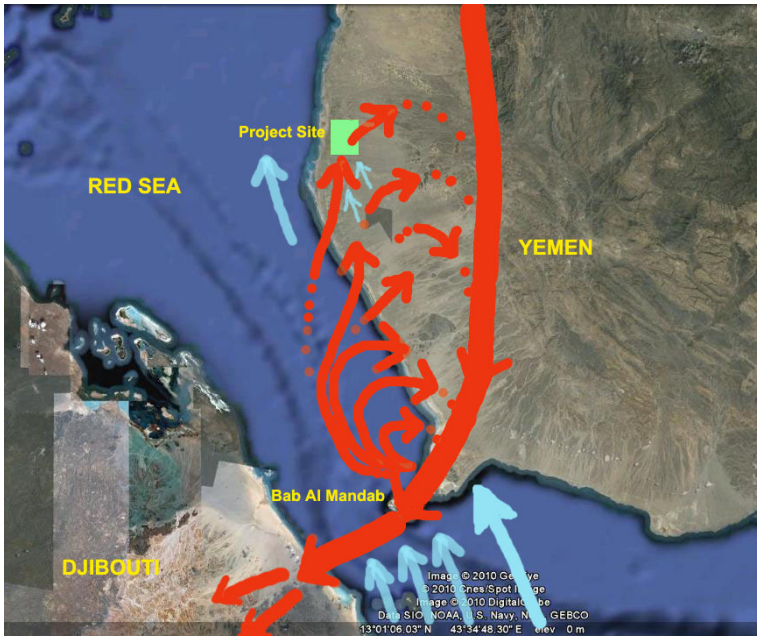


Figure 4-20: Schematic map of Yemen showing the soaring birds migration pattern during autumn (Red: main migration routs; Blue: predominant wind direction; Light green: project location).

At the proposed wind farm location most birds were largely observed moving in a north easterly direction (average 43º). These almost certainly represent birds that failed to make the sea crossing at Bab Al Mandab and returned to the Yemeni side in the area between Bab Al Mandab and Dubab, where they get pushed northwards by the strong

southerly winds. These birds were noted to attempt to take more easterly or even southerly heading, but despite their intended orientation, they were still being pushed northwards by the very strong southerly winds. After a few attempts to correct their direction towards the south, most birds surrender to the prevailing wind. Further east towards the Tihama foot hills a more easterly direction of movement was observed, and once the Tihama foot hills were reached the relentless southerly winds die off and the normal southerly migration direction was assumed again by all the birds.

Soaring bird migration in Bab Al Mandab, Lahj and Abyan

Part of the consultant's TORs call for an assessment of bird migration in Lahj and Abyan Governorates on the Gulf of Aden including Bab Al Mandab, where there is also good potential for wind energy development. In theory there is the possibility for a secondary migratory rout along the Gulf of Aden, leading also to Bab Al Mandab during autumn.

In Autumn it was immediately obvious that the situation between Dubab and Bab Al Mandab (south of Al Mokha) was critical for soaring migrants (as they land in very large numbers and fly at very low altitude), and the establishment of any wind turbines in the section of the coastline would be detrimental by all measures.

A rapid reconnaissance of migration activity was conducted on 30 October 2009 between Bab Al Mandab and Aden. Frequent spot searches along the coastal stretch. These searches revealed no migration activity, and the only soaring bird was a Steppe Eagle recorded flying low along the coast towards Aden, half way between the latter locality and Bab Al Mandab, where it probably originated.

Indeed all signs of migration stopped within a few hundred meters from (south and east of) Bab Al Mandab on the road towards Aden. Very strong southerly winds probably prevent birds from coming too close to the Gulf of Aden, which they don't have any interest or ability to fly over in any case. So there is apparently a complete avoidance of the costal plain in this region. At Aden it self there was a number of soaring birds including Steppe Eagles, Booted Eagle, Imperial Eagle, Black Kite, but this however represent a wintering population, which is probably augmented by some of the birds that fail to cross Baba Al Mandab. These preliminary results are based on a very small sample size, and should only be seen as indicative but not definitive.

Volume

A total of 18326 soaring birds were counted during systematic counts at all sites visited during the entire study period (see Table.). Additionally there were huge numbers of eagles and buzzards seen at great distance spiraling above the mountains overlooking Bab Al Mandab, during the two visits made there (not included in the systematic counts). These birds were too far to identify or count to any degree of accuracy, but it could be estimated that well over 3000 birds were involved in each case. These birds seem to be accumulating over a long part of the day and did not move much, probably deterred by

the strong winds and waiting for the opportunity to make an attempt of crossing the sea, when and if the winds ease off.

At the proposed project site and its vicinity, modest numbers of soaring migrants were noted on all days of observation, and up to several hundred birds were noted on some days, with a total of 5544 birds counted during the study period.

However, the intensity of migration varied greatly according to location (see Table 2, where counts made had to be adjusted to reflect observation effort at each location). For example at the metrological mast 3311 birds were counted during 49 hours of observation, while at location (Q) at Bab Al Mandab an estimated 5023 birds were counted within only 1.5 hours of observation. This represents almost a 50 fold greater volume at Bab Al Mandab than at the proposed project site. The Bab Al Mandab locations generally had the greatest volume of birds in the study area. But as indicated elsewhere this is certainly an inflated volume caused by the constant accumulation of birds that fail to cross the sea and remain circulating the area for an unknown length of time. The average volume of about 300 birds/hour documented in the locations around Al Mafraq (locations F,G,H,J, I,K,L in Fig. 1 and Table 2) probably represent the "normal" volume of migration per hour along the main migratory rout.

Species composition

22 species of soaring birds, as well as European Bee-eater *Merops apiaster* and Grey Heron *Ardea cinerea*, were documented during the current study. As noted on the Djibouti side of Bab Al Mandab (Welch and Welch 1988) Steppe Buzzard *Buteo buteo* and Steppe Eagle *Aquila nipalensis* were the most abundant species, making up 94% of the entire volume of birds counted during the current study. Other important migrants are Black Kite *Milvus migrans*, Egyptian Vulture *Neophron percnopterus* and Sparrowhawk *Accipiter nisus*. There was a notable difference in the abundance of Steppe Eagles at the project site and at Bab Al Mandab, being significantly more abundant at the latter locality.

Figure 4-21: Adult Egyptian Vulture Neophron percnopterus flying over project site

Figure 4-22: Immature Steppe Eagle Aquila nipalensis flying over project site.

Table 4-5: Species composition at the project site and for all sites visited

Species	Numbers recorded at project site	% of total	Numbers recorded at all localities visited	% of total
Accipiter nisus	114	2.1	132	0.7
Aquila clanga	9	0.2	10	0.1
Aquila heliaca	2	0.0	2	0.0
Aquila nipalensis	347	6.3	2886	15.7
Aquila pennata	15	0.3	24	0.1
Aquila pomarina	0	0.0	1	0.0
Aquila rapax	0	0.0	2	0.0
Aquila sp.	111	2.0	111	0.6
Buteo buteo	4393	79.2	14209	77.5
Buteo rufinus	5	0.1	5	0.0
Ciconia ciconia	2	0.0	17	0.1
Ciconia nigra	112	2.0	112	0.6
Circaetus gallicus	38	0.7	90	0.5
Circus aeruginosus	45	0.8	45	0.2
Circus macrourus	8	0.1	8	0.0
Circus pygargus	11	0.2	12	0.1
Circus sp.	1	0.0	1	0.0
Falco subbeto	1	0.0	1	0.0
Falco tinnunculus	24	0.4	28	0.2
Gyps fulvus	4	0.1	32	0.2
Milvus migrans	208	3.8	374	2.0
Neophron percnopterus	85	1.5	215	1.2
Ardea cinerea	1	0.0	1	0.0
Merops apiaster	8	0.1	8	0.0
Total	**5544**	**100.0**	**18326**	**100.0**

Figure 4-23: Steppe Buzzard Buteo buteo vulpinus taking off from the ground at Dubab

Figure4-24: Spotted Eagle Aquila clanga sitting on the ground in the face of fierce winds north of Bab Al Mandab .

Flight altitude

The altitude at which migration takes place is a critical aspect of the migration, as it is strongly linked with potential risks from wind turbines. Elevation of migrants varied according to location, time of day, season and species. Generally the birds were lower near the coast than inland.

In autumn the average flight altitude at the metrological mast was 230 m (n [observations]= 368, n [birds]= 3311, sd=163 m, range 10-1000 m), while the overall average elevation in the general vicinity of the proposed wind farm site was 258 m (n [observations]= 479, n [birds]= 5544, sd=267 m, range 0-2000 m). Towards the mountains at Al Mafraq, where the main migration route is, the average elevation was 550 m (n [observations]= 90, n [birds]= 2977, sd=394 m, range 0-2000 m); while further south on the coast near Dubab the average elevation was much lower at 108 m (n [observations]= 20, n [birds]= 2461, sd=104 m, range 0-400 m); and even lower at Bab Al Mandab at 56 m (n [observations]= 18, n [birds]= 7344, sd=24 m, range 0-100 m).

The low flight altitudes near the coast at Bab Al Mandab, Dubab during autumn is due to the fact that birds were arriving off the Red Sea after losing altitude and failing to make the crossing to Djibouti. In deed many of the birds were resting on the ground. Al Al Mokha the returning birds would have gained some altitude as the site is further inland, generating stronger thermals. At Al Mafraq the greatest altitude was achieved, due to the presence of ideal conditions for thermal formation along the mountainous Tihama foothills.

In autumn about 33% of birds recorded in the general proposed project site were documented below 200 m (1768 birds), and 31% (1710 birds) were flying between 200-300 m. While 68% of birds were above 200 m, over 50% of observations were made below 200 m, this is due mainly to the fact that much of the observations at lower altitudes were of smaller species such as harriers and falcons that normally migrate singularly or in small groups (see Table 4). When considering only the observations made at the meteorological mast, a slightly greater proportion of birds (36%) is documented below 200 m, possibly due to its relative proximity to the coast. The altitude of migrants is affected by ground temperature and the creation of strong thermals. Ground temperature changes during the day, rising rapidly after sunrise and thus affecting the flight altitude of soaring migrants throughout the day (see Fig. 24).

Soaring birds will not start moving until the grounds starts getting heated up and some thermals form. Migrants were the lowest during the first hour of observation between 7-8 in the morning (usually below 100 m), but then rapidly gained altitude as the ground and ambient temperatures became higher, reaching an average altitude over 400 m between 11-12 noon. Around noon time some birds were estimated to be flying 2 km above ground and even higher. It is probable that many migrants were overlooked during that period as they were too high and out of sight. It is also possible that the rather abrupt absence of soaring migrants after 13 hours, is due to their reaching extreme altitudes that cannot be detected visually from the ground.

Harriers, sparrow hawks and falcons were observed at lower elevations than buzzards, eagles, storks and vultures (see Table 4). Harriers are active flyers that do not depend greatly on thermals and commonly migrate below 100 m.

Table 4-6: Altitudinal distribution of birds at the general project site during autumn 2009 (localities A-E).

Altitude	Number of observations	%	Number of birds	%
<100	158	32.98	750	13.52
100-200	109	22.75	1036	18.68
200-300	101	21.08	1710	30.84
300-500	71	14.82	1422	25.64
500-1000	30	6.26	463	8.35
>1000	10	2.08	163	2.94
Total	479	100	5544	100

Table 4-7: Altitudinal distribution of birds at the meteorological mast during autumn 2009 (locality B).

Altitude	Number of observations	%	Number of birds	%
<100	112	30.43	336	10.14
100-200	101	27.44	868	26.21
200-300	84	22.82	946	28.57
300-500	52	14.13	809	24.43
500-1000	19	5.16	352	10.63
Total	368	100	3311	100

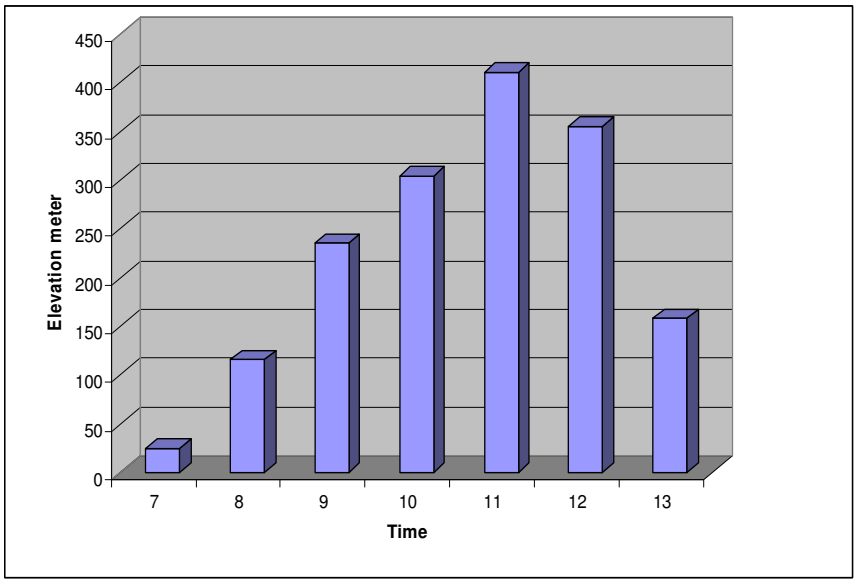


Figure 4-25: Showing change in average elevation of migrating soaring birds through the day during autumn 2009

Table 4-8: Average altitude of soaring migrants by species in autumn 2009.

Species	Average altitude (m)
Accipiter nisus	189
Aquila clanga	100
Aquila heliaca	400
Aquila nipalensis	362
Aquila pennata	424
Aquila pomarina	50
Aquila rapax	250
Aquila sp.	264
Ardea cinerea	300
Buteo buteo	339
Buteo rufinus	145
Ciconia ciconia	340
Ciconia nigra	261
Circaetus gallicus	340
Circus aeruginosus	91
Circus macrourus	271
Circus pygargus	81
Circus sp.	10
Falco subbeto	10
Falco tinnunculus	87
Gyps fulvus	439
Merops apiaster	50
Milvus migrans	340
Neophron percnopterus	264

Table 4-9: Summary of observations made during the autumn 2009 ornithological studies in Al Mokha vicinity, Yemen.

Location symbol *	Location Name	Coordinates	Average direction of migration (in degrees)	Total birds observed at locality	Observation effort (hours spent at location)	Relative estimated migration intensity (total adjusted by observer effort).	Average elevation of observed birds (in meters)
A	Al Mokha Town	13°19'40"N 43°15'54"E	135	19	3.3	5.76	20
B	Metrological mast	13°21'45"N 43°16'06"E	43	3311	48.7	67.99	230
C	North wind farm	13°25'20"N 43°16'24"E	15	2146	6.5	330.15	510
D	South wind farm	13°19'12"N 43°19'32"E	11	4	1.5	2.67	170
E	North wind farm	13°27'45"N 43°18'49"E	44	66	3	22.00	100
F	West of Al Mafraq	13°19'10"N 43°25'25"E	NA	1	0.17	5.88	NA
G	West of Al Mafraq	13°19'06"N 43°25'49"E	180	11	0.17	64.71	50
H	East of Al Mafraq	13°23'41"N 43°39'46."E	180	75	0.34	220.59	100
I	East of Al Mafraq	13°22'31"N 43°38'5"E	225	271	1	271.00	400
J	West of Al Mafraq	13°20'4"N 43°33'52"E	167	2364	2	1182.00	630
K	West of Al Mafraq	13°19'59"N 43°31'18"E	135	145	1	145.00	420
L	West of Al Mafraq	13°19'11"N 43°24'12"E	180	110	0.25	440.00	2000
M	North of Dubab	13° 4'31"N 43°21'11"E	0	230	0.25	920.00	100
N	North of Dubab	12°58'12"N 43°24'24"E	0	201	0.25	804.00	50
T	North of Dubab	12°59'37"N 43°23'56"E	0	163	0.5	326.00	280
O	South of Dubab	12°55'52"N 43°25'52"E	56	305	0.25	1220.00	50
P	South of Dubab	12°49'26"N 43°29'59"E	45	1102	0.25	4408.00	30
S	South of Dubab	12°51'36"N 43°28'14"E	180	50	0.1	500.00	100
U	South of Dubab	12°50'52"N 43°29'3"E	23	410	0.17	2411.76	100
Q	Bab El Mandab	12°44'35"N 43°28'25"E	83	5032	1.5	3354.67	50
R	Bab El Mandab	12°41'48"N 43°29'12"E	90	2000	0.45	4444.44	50
V	Bab El Mandab	12°45'33"N 43°29'42"E	90	312	0.17	1835.29	100
Totals				18328	71.82	255.19	

* These letters correspond to those in Figure 1. Sites highlighted in yellow represent the general proposed wind farm locality and are combined in further discussion and evaluation in the current document.

- Results of the spring 2010 study

During the spring 2010 field study, 287 observations were made resulting in recording a total of 1005 soaring birds belonging to 18 species in all areas visited.

Migration general orientation

Overall the spring season observations indicate that soaring bird migration through Yemen at large during this season is of small volume and limited significance, particularly when compared with the volume during autumn. There are only two published studies with limited scope about spring migration in Yemen and across the Strait of Bab Al Mandab (Welch and Welch 1991, Welch and Welch 1998). Both suggested a modest volume of passage and limited diversity of species (see Table 3). However, our more extensive study indicates that the volume of birds is even smaller than what earlier studies had indicated.

At the project site there was a very limited number of migratory soaring birds observed. The current study indicates that the lack of migrants over Al Mokha in spring is probably not only due to the position of the site away from the main migratory pathway for soaring birds (along the Tihama foothills), but is also likely due to the limited overall volume of birds returning through Yemen in spring.

This was supported by our observations made at Bab El Mandab during the spring season on 30 March, 19 April and 7 May 2010, when we found very few birds moving across the strait and entering the Arabian Peninsula from Africa. This strongly suggests that the spring migration of soaring birds largely follows a more westerly rout along the western coastline for the Red Sea, north to Egypt and Suez. This is also supported by a lack of any active migration of soaring birds in other sampled localities around Al Mokha. In the vicinity of Mafraq Al Mokha and towards Taizz fairly large numbers of soaring birds were observed, but these were either wintering or resident birds, largely composed of Black Kites, Egyptian Vulture, White Stork and some Eagles.

The movement of bird over the project site during the spring season was unlike that during autumn, when there was a clear and almost unimodal direction of flight north or north east over the site, with little interest in stopping or prospecting by the birds. In spring bird movement was almost equally divided between east, north and south orientations (see Table 8). This probably reflects the local nature of the birds observed, which are either of breeding or wintering populations.

Table 4-10: General orientation of soaring birds over project site in spring 2010.

Direction of flight	Number of observations	% of total
E	65	26.6
N	90	36.9
NE	4	1.6

Direction of flight	Number of observations	% of total
S	64	26.2
SW	1	0.4
SE	2	0.8
W	18	7.4
	244	100.0

Volume

Systematic observations at the project site during the entire spring study period indicated a very limited volume of migratory soaring birds flying over the site. A total of 349 soaring birds made up of 14 species were documented flying over the proposed project site at Al Mokha.

This limited volume was evident under various wind regimes. Wind direction and speed was much more variable than during autumn; however this did not seem to have any observable effect on bird migration volume at and around the project site. During the principal investigator's visit there were three days of weak northerly wind, when almost no migration of any form was evident. The number and variety of birds did not change much when wind direction returned to its prevailing strong southerly direction.

Species composition

The species richness of soaring birds was notably lower in spring than in autumn (16 species versus 22 respectively). The great majority of the birds recorded over the site seem to represent resident and breeding species or populations, rather than migratory species. For example most Black Kites, Egyptian Vultures, Griffon Vulture and possibly Kestrels, represent local breeding birds, rather than migrants. While species such as Steppe Eagle, White Stork, Booted Eagle, Sparrowhawk and Buzzard are certainly all migratory as they have no local breeding populations and most move north to breed or spend the summer. Tawny Eagle and Dark Chanting Goshawk are two breeding birds, which have not been documented previously during the autumn season at the project site.

The local resident nature of many of the birds observed was indicated by the movement patterns of these birds, showing no urgency to follow a particular direction and tending to fly around and land often in search for food. This was particularly true in the case of the Egyptian Vultures. Most Black Kites observed belonged to the local breeding race *Milvus migrans aegyptius*, often regarded as a distinct species. This taxon is abundant and breeds widely in many parts of Yemen including the Tihama.

Figure 4-26: Booted Eagle Aquila pennata over Baba Al Mandab

Figure 4-27: Part of a flock of Black Kites Milvus migrans attracted to the solid waste dump near Taizz

Although the number of soaring migrants at Al Mokha project site is limited, the numbers of the Endangered Egyptian Vultures there is of some concern. These birds almost certainly represent local breeding birds or wintering birds that roam around this part of the Tihama, and are attracted to the site because of the solid waste dump (which contained several dead animals during the PI visit). Dead live stock from the quarantine (which holds mostly cattle imported from Somalia) are dumped at a locality at the southern part of the project site, also acting as an attraction focal point for these birds.

The total numbers of Egyptian Vultures at both the project site and solid waste dump (69 and 92 birds respectively) is probably inflated as these figures are likely to represent the same local resident birds seen repeatedly by the study team at the same sites but on different days, and do not represent a true population estimate (this would apply to most other resident soaring bird species). The maximum of 13 Egyptian Vultures seen together at the solid waste dump probably provides a better representation of the real population size in the region.

Table 4-11: Soaring bird species composition at the project site and at near by solid waste dump in spring

Species	Numbers recorded at project site	% of total	Numbers recorded At solid waste dump	% of total
Accipiter nisus	32	9.25		
Melierax metabates	13	3.76		
Aquila clanga	4	1.16		
Aquila nipalensis	17	4.91		
Aquila pennata	1	0.29		
Aquila rapax	2	0.58		

Species	Numbers recorded at project site	% of total	Numbers recorded At solid waste dump	% of total
Aquila sp.	6	1.73		
Buteo buteo	37	10.69		
Buteo rufinus	1	0.29		
Ciconia ciconia	11	3.18		
Ciconia abdimii			1	0.62
Circus aeruginosus	4	1.16	1	0.62
Falco tinnunculus	11	3.18		
Gyps fulvus	6	1.73		
Milvus migrans	126	36.42	67	41.61
Neophron percnopterus	69	19.94	92	57.14
Pelecanus rufescens	6	1.73		
Total	**349**	**100**	**161**	**100**

Our observations don't correspond with those by Welch and Welch (1998), who observed a soaring bird migration at Bab Al Mandab composed of several hundred Booted Eagles and Egyptian Vultures during three days of observation in March 1998. While during the entire spring season study we only documented four Booted Eagles and a 288 Egyptian Vultures in all localities visited (including Bab Al Mandab, and areas intervening between Mafraq Al Mokha, Taizz and Hodeida). This might reflect the stochastic nature of migration in the region in response to weather or large climatic conditions, or other factors.

Table 4-12: Non-soaring bird species composition at the project site and at near by solid waste dump in spring

Species	Numbers recorded at project site	% of total	Numbers recorded At solid waste dump	% of total
Bubulcus ibis	59	41.55	154	100
Merops persicus	4	0.28		
Merops albicollis	10	7.04		
Pterocles exustus	67	47.18		
Corvus ruficollis	2	1.41		
Total	**142**	**100**	**154**	**100**

Flight altitude

In spring the average flight altitude was significantly lower than during autumn. At the metrological mast it was 113 m (n [observations]= 241, n [birds]= 489, sd=94 m, range 0-1300 m), while the overall average elevation in all areas visited during spring was 123 m (n [observations]= 284, n [birds]= 1005, sd=110 m, range 0-1300 m). The lower flight altitude during spring is probably due to the presence of more resident or local breeding birds searching for food and being attracted to the solid waste dump and other attractions in the area.

Table 4-13: Altitudinal distribution of birds observed at the meteorological mast during spring

Altitude	Number of observations	%	Number of birds	%
On ground	1	0.47	2	0.57
1-100	100	47.17	154	44.13
100-200	98	46.23	167	47.85
200-300	12	5.66	25	7.16
300-1000	0	0.00	0	0.00
>1000	1	0.47	1	0.29
Total	212	100	349	100

4.6.3 Non-Avian fauna

Reptiles were a prominent part of the local fauna, observed on all days of the field visit. Species composition is typical of hot arid regions, with a considerable diversity of nocturnal species, particularly geckos. No evidence of amphibians was found, although the endemic toad *Bufo tihamicus* can be expected to be found.

At least three South Arabian endemic species can be expected at the project site, including Stenodactylus yemenensis and Scincus hemprechii, both of which are only found on the Tihama coastal plain and were documented during the field visit. By nature of their limited range these species are of conservation concern, however, no globally threatened species of reptiles and amphibians are known to exist in the project site.

Threatened marine turtles are known from the Red Sea in close proximity to the project site but are not directly affected by project activities.

Figures 4-27 to 4-32 describes fauna species found on the project site.

Figure 4-28: The gecko Stenodactylus yemenensis is endemic to the Tihama, and was found in small numbers at night at the project site

Figure 4-29: The diurnal Semaphora Gecko *Pristurus flavipuncatatus* was commonly seen on the vegetation throughout the project areas, including invasive *Prosopis Juliflora*

Figure 4-30: The Arabian Chamaeleon *Chamaeleo arabicus* is endemic to southern Arabia. This example was a road casuality found near the meteorological mast

Figure 4-31: *Acanthodactylus boskianus* s.l. was the only lacertid lizard to be found in the project site

Figure 4-32: *Scincus hemrichii* is a nocturnal species endemic to the Tihama coastal plain

Figure 4-33: Psammophis schokari is a widespread snake and the most common at the project site, with up to five individuals documented during the field visit

Very little evidence of wild mammals was obtained during the field visit. Several rodent tracks and burrows (probably *Meriones* and *Gerbillus*), and fox tracks were seen at the project site. Rats *Rattus rattus* were observed at Al Mokha and a Red Fox *Vulpes vulpes* killed by traffic was seen on the road to Aden. Other wise only feral cats and dogs were observed in large numbers in and around Al Mokha.

No tracks of any ungulates were observed (beside those of domestic goats and sheep) and the local inhabitants and scientists confirmed that almost all the large mammals of the region have been exterminated due to hunting and the widespread availability of fire arms.

Other than locally extirpated angulates there are no known threatened species of mammals known from the project site.

4.7 Historic and Cultural Sites

Historically, Al Mokha used to be the major port in Yemen on the Red Sea, and it had an international reputation of being a marketplace for coffee. Therefore Al Mokha city includes a number of historical sites, especially old mosques and forts from the Ottoman era. However, most of these historic sites are concentrated in the city itself and near the Harbor.

No such historic sites are near or around the project site. Because the project site has not been known to include old settlements or buildings, chance find of antiquities during excavation of the foundations is unlikely.

4.8 Socioeconomic Characteristics

This section of the ESIA sheds the light on the baseline information of relevance to the socioeconomic conditions of Al Mokha, where the project will be located. The gathered information from Al Mokha Local Council provided comprehensive background information on the level of the Directorate. The availability of statistics on the level of smaller administrative division (gathering) also allowed giving more site specific information related to the project site. Moreover, additional quantitative and qualitative in-depth information have been collected from interviews, surveys and group discussion in the project site and the neighboring areas as indicated earlier in Figure 1-1 (social assessment methodology).

This Section of the ESIA is presenting the baseline social information of relevance to Al Mokha Directorate and will compare the situation of the different population gatherings. Moreover, a full report on the registration survey results that has been carried out in the project location is presented in Annex 4. In certain parts, reference will be made to the project specific site to compare its situation with the situation in other gatherings. The presentation, afterwards, will move to the socioeconomic background from the perception of the interviewed stakeholders, more specifically from the project's surrounding communities' views.

4.8.1 Al Mokha Administrative Affiliation

Al Mokha Directorate administratively affiliates to Taiz Governorate and is located to the west of Taiz City on the coast of the Red Sea. The Directorate is bordered by the Red Sea from the west, Bab El Mandab and Mozea Directorates from the south, Mozea and Makbana Directorates from the east and Al Khowkha Directorate from the north.

Al Mokha is located on a total area of around 1617 km^2 and is considered to be the largest Directorate on the level of Taiz Governorate. 50% of the Directorate land is utilized in agriculture, 30% is of mountains and marginal land and 20% of the area is coastal sand beaches. Administratively the Directorate is divided into four main gatherings (group of villages), namely, Al Mokha, Al Zahary, Al Mashalha, Al Gomaa.

Table 4-14: Al Mokha Directorate area division on the main four gatherings

Name of Gathering (group of villages)	Total Area (km^2)	% to the Total Area
Al Mokha	44	3%
Al Zahary	539	33%
Al Mashalha	591	37%
Al Gomaa	443	27%

Source: *Al Mokha Development Report 2008*

The project site is located on the second and the third gatherings, Al Zahary and Al Mashalha.

4.8.2 Population

According to the Development Report prepared by Al Mokha Local council, 2008, the Directorate is inhibited by 62,471 persons[13] (51% male and 49% female). The average number of families is 10,477 families and the average family size is 7 persons/family. The demographic statistics on the Directorate level shows that 55% of men and women population are in work age.

Table 4-15: Population Distribution on the four gatherings (group of villages) of Al Mokha Directorate

Name of Gathering	Male		Female		Total	
	Male	% of Total Directorate	Number	% of Total Directorate	Number	% of Total Directorate
Al Mokha	7162	10	6558	10	13720	20
Al Zahary	8213	12	7895	12	16108	24
Al Mashalha	3895	12	7508	11	11403	23
Al Gomaa	11052	16	11258	17	22310	33

Source: *Al Mokha Development Report 2008*

As indicated on Table 4-15 above, around 47% of the Directorate population reside in Al Zahary and Al Mashaha gatherings. Three gatherings of settlements are located within and around the project site, in which the largest settlement is Al Oksh which includes about 33 households[14]. For more details please refer to Annex 4.

4.8.3 Economic Activity

4.8.3.1 Agriculture

Agriculture is the most important economic activity in Al Mokha Directorate, but it is considered a secondary activity in the gatherings where the project site exists, where

[13] 2004 Census
[14] Source: Social Survey carried out in the project site

grazing , fishing and other marginal temporary activities are more dominant. The number of agriculture land holders in Al Mokha Directorate is around 2481 and the average land holding is around 3.7 hectare/holder. The sources of irrigation water in the Directorate vary between natural rain water that fed into wadis and ground water which is abstracted with pumps. The main crops include onion, watermelon, wheat, fruits and vegetables. The consulted stakeholders mentioned that the extended onion cultivation results in over consumption of ground water and that modern irrigation techniques are needed in order to protect this important scarce resource from depletion.

The agriculture sector in Al Mokha face several challenges, namely, problems related to marketing products, lack of agriculture extension programs, high level of salination, ground water depletion and lack of credit scheme to assist farmers.

4.8.3.2 Fishing

Fishing is one of the most important economic activities in the Directorate with the around 45 km extended on the Red Sea coastal strip. The coastal area is characterized by several small gulfs and coral reefs that made it a suitable environment for the reproduction of several kinds of fish. In particular for the residents of Al Mokha and Al Zahary gatherings, fishing is the main economic activity. There are 5 Fishing Cooperatives in the directorate and it is estimated that the two gathering have around 2864 fishermen (1384 members in Cooperatives and 1480 of small fishermen who are non Cooperative members). Al Mokha gathering also hosts a Fish Download Centre that belongs to the General Corporation for Fish Marketing and Services (GCFMS). This was established in 1987 and it employs 10 formal employees (permanent and contracted).

Figure 4-34: Small-scale fishermen on Al Mokha coast

Figure 4-35: Fishing activities on Al Mokha coast

The fishing sector in Al Mokha is faced by a number of obstacles, most importantly, lack of resources which prevents access to several essential infrastructural and complementary facilities. The absence of electricity in fish download centers in Yakhtel and Al Zahary is considered one of the big challenges mentioned by the interviewed officials.

4.8.3.3 Grazing and Forest Products

These types of economic activities are very important for the poorest families. They largely rely on the natural resources available in the area to pursue a living. These activities were found to be very important to the residents of the settlements on the project site. They settled in this area of land long time ago because they found important resources that help them to maintain their living and settle.

Several forest-based activities were found to be in-common among this group of residents, most importantly breeding sheep, goats and camels, collecting fire wood, making and selling charcoal and marketing dairy products. Residents also utilize the available resources in producing other products like natural compost which they sell in other areas with cultivated land. They also use straw, mud and other materials in building their homes.

Figure 4-36: Housing style in Al Houlibi village

Figure 4-37: Goats grazing in the project area

This marginal economic activity face a number of challenges, most importantly, lack of veterinary services, unorganized and uncontrolled cutting for trees which is a threat for the plantation, particularly within the conditions of rain scarcity.

It should be noted, though, that grazing is not the sole source of income for residents of the settlements within the project site. In most of the cases, people try to juggle with more than one source of income in order for them to secure a daily living. However, most of the sources are characterized by being marginal and vulnerable businesses.

4.8.3.4 The Private Sector

The private sector dominates agriculture and fishing activities and the other supplementary activities like trade/marketing products. There is no clear figure on the percentage of labour force participation in private sector, however, it could be claimed that this sector absorbs a large portion of the labour force[15]. Al Mokha Directorate hosts

[15] Officials in the Local Council

few major private sector investments, namely Al Mokha Cement Factory located in Al Mokha Port, Water Purification Station which is currently under establishment and two ice factories. Al Mokha port is an important infrastructure that is widely used in importing and exporting goods, particularly to the countries of the horn of Africa.

4.8.3.5 Tourism

The Directorate includes wide range of tourism ingredients which is widely perceived to be poorly utilized. The most important include historical sites with high cultural and religious value, this include mosques, castles, temples, old schools …etc that prevail in different places of the directorate. Al Mokha also is home for various landscape attractions including the extended distinguished beautiful beaches, palms and wadis.

The Local Authority has invested in several projects that aim to flourish tourism in Al Mokha. The most important investment included developing the first phase of the cornice road. However and despite these efforts, the tourism sector is neither contributing to the economics of the Directorate nor to the livelihoods of local people. This mainly returns to the big challenges that discourage investors from contributing to this sector. Electricity shortage along with shortage in other important services and infrastructure, lack of marketing strategies and lack of qualified human resources are the key challenges that need to be addressed in order to empower such a vital and rewarding sector.

4.8.4 Education

It is important to mention that Al Mokha is considered one of the leading directorates that cared about education and schools since Yemen Revolution in 1962. During this time, the first primary school was established in Al Mokha City and is still functioning till today.

However, and despite the absence of updated figures that shows the educational status in the Directorate, the available statistics and the field observation showed that school enrolment is not meeting the targets and that gender inequalities is a considerable problem related to access to education.

Table 4-16: Enrolment in basic education by gender on the level of Al Mokha Governorate

Name of Gathering	# of Schools	Targeted			Enrolled			% Enrolled to Targeted		
		Male	Female	Total	Male	Female	Total	Male	Female	Total
Al Mokha	3	1733	1587	3320	1540	1349	2889	89	85	87
Al Zahary	15	1988	1910	3898	1579	1384	2963	79	72.5	76
Al Mashalha	11	2023	1817	3840	1563	1162	2725	77.3	64	71
Al Gomaa	11	2674	2724	5398	2211	2016	4272	82.7	75.7	79
Total	40	8418	8038	16456	6893	5956	12849	81.9	74.1	78.3

Source: Analysis from *Al Mokha Development Report 2008*

Table 4-17: Enrolment in secondary education by gender on the level of Al Mokha Governorate

Name of Gathering	# of Schools	Targeted			Enrolled			% Enrolled to Targeted		
		Male	Female	Total	Male	Female	Total	Male	Female	Total
Al Mokha	4	531	486	1017	258	237	495	48.6	48.8	48
Al Zahary	2	608	585	1193	117	59	176	19.2	10.1	15
Al Mashalha	2	620	556	1179	131	27	158	21.1	4.9	13
Al Gomaa	2	819	834	1653	127	23	150	15.5	2.8	9
Total	10	2578	2461	5039	633	346	979	24.6	14.1	22

Source: Analysis from *Al Mokha Development Report 2008*

As could be observed from Table 4-16 and Table 4-17 above, the situation in Al Mokha gathering in terms of meeting the targets of basic and secondary education enrolment is considered favorable compared to the other gatherings in the Governorates. The percentage of enrolled students against the target in basic education showed 87% in Al Mokha gathering against 78.3% on the level of Directorate. The same is applicable to Secondary education where that variance between the percentage of enrolled population to targeted between Al Mokha gathering and Al Mokha Directorate gets even wider.

Comparing these universal findings to gender desegregated figures shows that girls' actual enrollment to school is significantly lower than the targeted percentage among girls and also much lower compared to boys enrolment percentage, particularly in the secondary education with no more than 14.1% of girls are enrolled to schools compared to the target. The lowest figure was observed in Gomaa Gathering.

It is worth here to highlight the fact that these relatively favourable indictors related to schools enrolment in Al Mokha gathering could not be generalized and are totally inapplicable to the residents of the project area. It was notices that schools enrolment among boys and girls of the settlements of the project site is very limited and the reasons will be explored in more details below.

4.8.5 Health Services

Al Mokha Directorate has a number of health utilities that serve the residents of the four gatherings. However, the distribution of these utilities is not made on equitable basis among the four gatherings. As could be observed from Table 4-18 below Al Mokha Gathering has the highest percentage of population coverage. This mainly returns to the existence of a specialized hospital in the gathering[16], that not only benefit gathering population but also the population of other gatherings who are not served except with primary health care facilities that are mainly concerned with mother and child health services.

[16] The specialized hospital is the only utility that employs specialized physicians. The rest of utilities has only health workers, midwives, nurses and in very limited cases, general practitioners.

Table 4-18: The distribution of heath facilities on Al Mokha Gatherings and the average service coverage

Name of Gathering (group of villages)	Available health utility details (type and number)			% coverage of population
	Health Unit	Health Center	Hospital	
Al Mokha	0	1	1	110
Al Zahary	3	1	0	59
Al Mashalha	2	0	0	19
Al Gomaa	4	0	0	28

Sources: *Al Mokha Development Report 2008*

The main challenges that face the health sector in Al Mokha are very similar to those facing the health sector on the national level. This mainly involves sever shortage in human resources and lack of functioning health utilities along with serious financing challenges.

The residents of the settlements within the project site stated that they sometimes use the Health Clinic of the Power Plant and in more serious cases they go to Al Mokha Hospital which is 5-6 km from the village. This usually associates with transportation and time costs. The long distance to the health service and the lack of means of transportation always increase the risk factor in rescuing emergency cases.

4.8.6 Infrastructure

4.8.6.1 Power Supply

Al Mokha Power Plant (MPP) is located to the north of Al Mokha city. It feeds several surrounding Governorates. Around 87% of Al Mokha gathering is served with electricity but most of the connected households referred to the irregularity of power supply and the frequent cut offs.

From Al Zahary gathering only Yakhtel village is connected to power. The remaining parts of Zahary gathering and two third of Al Gomaa gathering and the whole population of Al Mashalha gathering and are not connected to electricity. This makes the average electricity coverage percentage on the level of the directorate does not exceed 19% of the population.

Wind potential has been realized and a previous experience related to utilizing wind energy in power generation took place in Al Mokha in 2002. The project was a small scale wind farm with fund provided from the Jordanian Government to Yemen MEE. The project did not sustain due to some weaknesses in the design which was perceived to be mainly related to the structural unsuitability of the wind turbines and capacity to the wind power, directions and the humidity conditions in the area[17]. The wind turbines collapsed and currently the remains of the project equipment are stored in the MPP. According to

[17] Views expressed by the Local Council during the preparation of the ESIA

officials, this unsustainable experience highlights the importance of considering the whole contextual specificities including the environmental and social conditions of the area in designing the project.

4.8.6.2 Water Supply

Ground water is the main sources of water in the Directorate, particularly in coastal areas. Water provision to residents is mainly done through governmental and civil projects. However, a large portion of population relies on fetching water from different water sources that locates away from their residence. Children in particular play important domestic role in fetching water. This is one of the tasks that consume a lot of their time and energy and in many cases was one of the reasons for schools drop outs.

Table 4-19: Percentage of population with access to household water supply

Name of Gathering (group of villages)	% of Population with household water supply (water tap)
Al Mokha	82
Al Zahary	40
Al Mashalha	22
Al Gomaa	6
Average	**30**

Source: *Al Mokha Development Report 2008*

As could be observed from Table 4-13 above, the overall percentage of population with access to household water supply does not exceed 30% of the total Directorate population. In Al Mokha gathering, the Local Water Authority locates and there is a Governmental project implemented with support from the German Technical Cooperation (GTZ). Al Mokha Development Report 2008 stated that the poor level of maintenance and the need for rehabilitating the internal network are the main problems that face the project. The over consumption of water especially for farming purposes resulted in depleting the water resources.

Within the settlements on the project site, the only available water supply within the area is shallow wells. Residents use this water only for animal drinking and washing. For, drinking water, they fetch water form MPP. The situation is different in Al Oksh village, where residents use the ground water from the shallow wells in different purposes including drinking. In Al Oksh, residents referred to the salty taste of water and the negative impact on their health.

4.8.6.3 Sanitation Services

Sanitation network is inexistent in the whole Directorate. The problem of cesspits and septic tanks frequent overflow is more obvious in Al Mokha gathering due to the location by sea side which results in high groundwater level. Residents of the settlements on the project site mentioned that toilet facilities are inexistent at their homes/shanties.

4.8.7 NGOs and Donor Activities in Al Mokha

Al Mokha is home to around 17 NGOs and Cooperatives distributed on the four gatherings. There are several areas of interest for the existing NGOs and cooperatives with the development oriented model most dominating Table 4.20 below shows the list of existing NGOs in Al Mokha

Table 4-20: List of NGOs, Cooperatives and Charity Associations in Al Mokha Directorate

NGO/Cooperative Area of Interest	Name	
Development	▪ Shams El Behar	▪ Kheyoul Al Badia
	▪ Yakhtel	▪ Al Fanar
	▪ Al Diaa	▪ Al Wafaa
	▪ Al Salam	▪ Al Ekhtyar
Vocational	▪ Al Zahraa Vocational Association for Women Development	
Fishing Cooperatives	▪ Fishermen Fishing Cooperative	
	▪ Al Zayady Fishing Cooperative	
	▪ Yakhtel Fishing Cooperative	
	▪ Al Behera Fishing Cooperative	
	▪ Al Zahary Fishing Cooperative	
Charity Association	▪ Al Rahma	
	▪ Al Hekma	

Source: Interview with Al Mokha Local Council

The development oriented NGOs were registered in the period from February 2000 to October 2002 with support from the National Poverty Reduction Program (UNDP-funded project). These NGOs are active in the area of supporting micro enterprises, group lending activities, supporting vocational activities and support agriculture and fishing related activities.

Al Zahraa Vocational Association for Women Development is considered to be one of the most active women NGOs in Al Mokha. It was registered in 1998 It is concerned with the activities of women development particularly those in the field of handicrafts and vocational training. The Association managed to raise funds from different sources to implement wide range of projects, most importantly, midwifes training, literacy classes, IT training, training and capacity building on rights related topics.

Figure 4-38: Al Zohraa NGO building funded by the Local Council and the Public Works

Figure 4-39: The Kindergarten bus of Al Zahraa NGO

Several donor agencies and national development partners target Al Mokha with various types of development interventions. Table 4-16 below shows the most important donors programs and their scope of work.

Table 4-21: Donor programs working in Al Mokha

Program Name	Scope of work
Decentralization Support Program	Capacity building for the local authorities, support the investment budget and logistical support
Japan International Cooperation Agency (JICA)	Girls education and teachers support program in Goma gathering
SFD	Education and health
UNICEF	Education, health and water
Public Works	Education and health
Fisheries Enhancement Fund	Fishing boats support program
The Fisheries Fifth Project	Support and build the capacity of fishermen
Social Care Fund	Low interest loans and support to poor families
Basic Education project	Education support
GTZ	Support for the Water Authority and solid waste management project
DIA France	Support water supply and food security
Italian Aid	Health
World Food Program (WFP)	Health and education

Source: Al Mokha Development Report 2008

It is worth noting that the communities of the settlements within the project site have not been accessed by any development or assistance program despite the fact that it is regarded as one of the poorest communities in Al Mokha. The Government represented by the Social Care Fund provides social solidarity pension to very few cases from Al

Houlibi families. The field survey showed that only 3 out of 24 households of Al Houlibi benefit from this pension. This involves a female-headed household, and two elders men whose sources of income is only limited to selling charcoal and grazing. However, the interviewed groups mentioned that several needy cases are still not served and that the paid amount is significantly inadequate to fulfill any of the needs of the targeted families

"…… even if they have it, it is YR 12000 on quarter basis. This do not secure a flour bag"

A resident of Al Houlibi Village

Apart from this, only little solidarity initiatives are provided to this community from the officials of MPP and their families and this is done on charity basis as will be mentioned in more details below.

4.8.8 The Main Findings of the Field Consultations

During the preparation of the ESIA, several consultation activities have been carried out with the local communities within the project site. Moreover, a full registration survey has been conducted by the consultant as part of the project efforts to secure full documentation for the residents of the site. A full profile for these communities is presented on Annex 4 of the ESIA. Issues around the characteristics of the communities that might be affected by the project and the nature of impacts were explored. This section of the report explains the key features of the surveyed communities in Al Oksh, Al Houlibi and Al Serega, being the group of people with the highest likelihood to be affected from the project. It also presents some quantitative findings driven from the survey carried out on the project site.

The average population of the three settlements gatherings on the project site of households where residents accepted to reveal information is around 339.[18]. Further quantitiative figures from the survey including the average of families size, the coordinates of he houses and the length of stay in this location are presented on Annex 4.

As presented in Figure 6.1 and discussed in details under Chapter 6 of this ESIA, according to the preferred scenario of the wind turbine selection and micro-siting from social and environmental prospective, a number of the households located on the project site will be affected by the construction inconvenience during the construction phase and the impacts of shadow flickering during operation. These impacts will be mitigated by adherence to the proposed measures of the ESMP. The impacts during operation on these households as long as these households will not be resettled, as concluded by the ESIA, are expected to fall with acceptable levels.

Housing style of the surveyed mentioned villages is what local people call “The Tihama coastal houses" which is very close to cottages. The most dominant construction

[18] The results of the survey carried out on Al Houlibi village

materials for these structures are mud, straw, trees wood and palm leaves. In very few cases residents used cement bricks in supporting their shanties.


Figure 4-40: ***Housing style in Al Houlibi village***

The villages residents are originally of Bedouins who used to wander in the desert seeking water and grass for their animals. They mentioned that they live in this site since 1990, while few of them mentioned that they live since 35 years. According to them this place includes lots of attraction factors that allowed them to make a living. These attraction factors include the following:

- Open space and vegetation allow them to keep up their grazing activities
- Accessing trees which allow them to cut and burn wood and use it for domestic activities (cooking) and sell it.
- Accessing the sea where some of them learned fishing activities and were able to work for boat owners.
- Proximity to Al Mokha where plenty of the male population pursue a temporary living by working in the Port or in other daily labour basis.
- Proximity to markets where different products (meat, milk) could be sold.
- Accessing some types of services (drinking water, school and clinic), informally, due to their proximity to the MPP. Villagers are allowed to fetch water that they use for drinking purposes using donkeys. Few of them send their children to the school in the Power Plant and they use the clinic in cases of light health problems.
- They also managed to dig wells where they collect water for animals drinking and washing.
- Proximity to the high way where some of the young male residents make a living through offering transport services to the road users.

For local residents, life in this place is convenient in terms of a more stable mode of livelihoods because of their access to the various sources of living mentioned above. They highly appreciate the solidarity efforts and the support offered by the officials in the Power Plant which enable them to access some services and also some temporary jobs.

"Thanks God, we are much more stable now. We have
access to the sea, large open space for grazing and

some of us go to Al Mokha for work. God keep the
kind people of the Power Plant, they are supporting us
in many ways "
A resident of Al Houlibi Village

Main Socioeconomic Characteristics of the local Communities in the Project Area

The main conclusion that was reached from the field observation and the different consultation activities in the field showed that local communities (from villages of Al Houlibi, Oksh and Serega) suffers from vulnerability and insecurity of livelihoods that made this community clearly characterized by poverty. The following are the a in poverty characteristics of these local communities:

- Poor level of education for both children and adults. The majority of families do not send their children to schools due to the following reasons:
    - Poverty and the need for children input in pursuing a living.
    - Children input is needed in some domestic labour like fetching water. Girls are also needed for other household responsibilities.
    - Early marriage age
    - Long distance to schools prevents children from regular attendance particularly girls
    - The fact that they do not have access to higher level of education, discourages them from sending their children to schools.
- Instability of income sources
- Very poor housing condition in terms of the low quality of construction material, the small sizes of houses, the unavailability of services and the unsecured land ownership with 100% of the village resident do not own any documents that prove their ownership to the land.
- Labour distribution on the household level, along with other factors, largely constitute an additional load on women and children, adding vulnerability to them and challenge them from acquiring opportunities like schooling opportunities

To conclude, the ESIA team believes that the current living conditions of local residents is extremely poor and that they should be regarded as a vulnerable group in need for protection and high level of consideration. To ensure adapting a socially sensitive approach by the project, the interests of these groups should be protected, or at least efforts should be in place to ensure that the project will not result in serious negative impacts to this community. The mitigation measures proposed under Chapter 7 aims to ensure that those local communities benefit from the project fruits and that they will suffer the least of the negative impacts.

5. POTENTIAL ENVIRONMENTAL AND SOCIAL IMPACTS

The assessment of potential impacts has been done through analyzing different project activities and envisaging possible changes to the environment. Each potential impact was qualitatively analyzed to classify its significance to three degrees: *major impacts* which are impacts with a reasonable likelihood that are likely to cause violation of applicable standards, *medium impacts* which are impacts with a reasonable likelihood that are likely to cause violation of applicable standards only in combination with the impact of other sources, and *minor impacts* which are impacts which are not likely to cause violation of applicable standards whether on its own or in combination with other sources[19]. The likelihood of each impact has been qualitatively evaluated to two degrees: highly probable and low probable.

It should be noted that the project is a new model that Yemen has not developed before. Due to this fact, the majority of the consulted stakeholders particularly of local communities and NGOs seemed to have very limited level of awareness about the project potential impact, due to their lack of knowledge about the project components, construction process and the different consequences of the wind farm operations both the positive and the negative. Thus, the consulted local community groups have not been very informative in predicting the impacts of the wind farms. Apart from the short term impacts which are strongly linked to access to land and resources and impact on livelihoods, the presented impacts are predominantly the result of the ESIA team analysis.

Due to the subjectivity associated with social issues and the fact that no "clear cut" criteria could be used in the consultant's judgments, decisions about the significance or severity of social impacts was mainly subjective. It should be noted, though, that the consultant gave significant weight to the issues related to local communities' safety, rights of ownership, and livelihoods. Other issues like temporary disturbance to livelihoods, temporary limitation to mobility and visual impacts are granted lower significance.

An Environmental and Social Management Plan (ESMP), presented later in Chapter 7, includes mitigation measures that minimize the negative impacts by adapting appropriate technological and administrative procedures.

5.1 Impacts during Construction Phase

5.1.1 Impacts of Construction Waste

The construction activities will be associated with generating different types of wastes such as excavation waste, general construction waste, hazardous waste and empty oil containers, human garbage and wastewater.

[19] This criteria for classifying impacts significance is used in environmental legislation of Saudi Arabia

In terms of quantity, excavation wastes that will result from earthworks for fixing the WTGs' foundations are expected to be of relatively large volume. Assuming that the raft of each WTG will be 20x20x2.5 m then the excavation wastes will be 1,000 m^3 for each WTG in addition to other excavation wastes generated from the piling process. Furthermore there will be excavation works for underground cables that will connect the WTGs to the MWF substation. There is no exact identification, as per preparation of this ESIA, of the underground cables dimensions, however, assuming that trench section dimensions are 0.5x0.2 for single circuit trenches, 0.5x0.4 for double circuit trenches, 0.5x0.6 for triple circuit trench and 0.5x0.8 for 4 circuit cables[20] for triple cables trenches the total excavation waste will be about 3,700 m^3. In addition to that, foundation raft for MWF substation will be in the range of 1,300 m^3 (44.1x31.2 m) and foundations for overhead line will form a minor quantity (about 10 footings x 1m^3). If the above assumptions are considered, the estimated excavation waste would be in the range of 35,000 m^3.

Inert construction waste is expected to comprise concrete, wood trimmings, off specs steel bars, extra concrete and bricks blocks. Normally these types of waste have high reuse value but it needs to be well managed to keep good housekeeping image for the construction site.

The utilization of hazardous materials (such as oils used for fueling and lubricating construction machinery) will be associated with generation of wastes that could be regarded as hazardous waste such as empty oil containers and causing soil contamination due to unaccounted for spellings. Although such wastes are not expected to form a major quantity, however, its hazardous nature and risks associated with secondary use of empty containers gives special environmental importance. Quantities of such waste are difficult to speculate, but it will be generally produced by contractors using generators, cranes, loaders, excavators, pilling hammers … etc.

Human waste of garbage and sewage will be generated from the construction camps that will be temporary formed at the project site, either as offices or as accommodation for some workers. Good management of such waste is very important for preventing development of foul odors, breeding of flies, mosquitoes and other disease vectors.

Impact Significance

Regarding excavation waste the impacts are related to aesthetic effects of waste stockpiling and possible generation of airborne dust. Despite of the relatively large amount of excavation waste (estimated by 35,000 m^3) there will be high demand for such soil in covering the existing dumpsite south of the project site[21] as the existing area of the dumpsite is about 160,000 m^2 and by assuming that a coverage cap of 30 cm is required

[20] Assuming trench depth of 50 cm, distance between cables 20 cm and distance between cables and trench side is 10 cm

[21] This requirement is to reduce birds attractions to the dumpsite so as to minimize risks of birds collision in WTGs as shall be further explained later in this Chapter

the whole excavation waste could be utilized in such practice. The same applies to inert construction waste (wood, metals, bricks … etc.) as there will be high demand in its reuse which would minimize the risk of un-sound disposal.

Concerning hazardous materials that will be utilized in the construction site and subsequent generation of hazardous waste, as mentioned above, from one hand the expected limited amount of such waste is a factor for reducing the impact significance, while from the other hand the hazardous nature of the waste is a factor for increasing the significance, therefore impact could be considered of medium significance. The same also applies to garbage and sewage impacts. However, the ESMP in Chapter 7 includes measures to minimize such impacts through implementing sound waste management procedures.

5.1.2 Affecting Air Quality by Air Emissions During Construction Works

The relatively large scale of earthworks will be associated with generation of airborne dust that will increase the particulate matter concentration in ambient air. Excavation works for foundations, loading of tipping trucks with excavated soils, transfer of aggregate for internal roads sub-base and general vehicles movements on non-asphalt roads are all activities that are expected to generate considerable amount of air-borne dust. Having the top soil layer from gravels and sandy clay, as mentioned in Chapter 4, is factor that will increase generation of dust. Using the emission factor recommended by the USEPA AP-42 for heavy construction activities, and assuming that construction area will be a strip of 40 meters around WTG rows, in addition to the substation area, the expected emission from the construction site is about 190 tons of TSP per month of construction works.

Other than dust emissions, the machinery used in construction works (cranes, excavators, loaders, trucks, piling hammers … etc.) are expected to produce air emissions due to fuel combustion. The extend of these emissions depends on type of fuel and fuel combustion efficiency of such machines.

Because of the extended use of asbestos in Yemen, it may be tempting to the EPC Contractor to use temporary offices from asbestos due to its relatively low price, in such case another source of air emissions may arise which is hazardous asbestos fibers, however, the ESMP will include measures for making sure that no asbestos is used in the construction site.

Impact Significance:

Despite the relatively high number of fuel combustion machines and trucks that will be employed the air emissions resulting from fuel combustion could be considered with low significance to the air quality if compared to the air emissions of the nearby MPP.

The dust generation is expected to be of a considerable significance due to large extent of earthworks and the relative proximity of Al Holieby, Al Oksh and Serega settlements to

the construction site. However, most of these settlements are surrounded by the invasive Mesquite trees which shall work as wind barriers that will provide partial protection to these settlements from airborne dust. Due to the temporary nature of this impact is has been regarded as of medium significance. The ESMP includes measures for wetting of soil prior to earthworks which is expected to significantly reduce dust emissions.

5.1.3 Construction Noise and Vibrations

Many construction activities are associated with high levels of noise, especially those activities involving hammering, welding, operating of cranes, generators, HGVs, soil compaction, materials loading and unloading and construction labor activities (ACs, loud conversations, staff vehicles, … etc.). Such operations will significantly raise ambient noise levels at the settlements located at the project site (Al Houlibi, Al Oksh and Serega) compared to the existing low ambient noise levels prior to the project implementation.

Noise from combined activities is expected to cause maximum impacts to the surrounding areas. Examples for such activities are:
- Excavations for WTGs foundations which will involve backhoe, loader and HGVs
- Piling of deep foundations, which will involve pile drivers and support vehicles.
- Pavement of internal roads, which will involve roller, bulldozer, HGVs and paver for each stretch of the road.
- Assembly of WTGs which will involve operation of a crane, HGVs, welding and bolting machines
- Activities of construction staff camp, which will involve operation of ACs, power generator(s) workers vehicles.

Impacts of construction noise could be discussed in two main aspects: the first is the impacts on labor force whom will be nearest to the noise sources, but only for working hours, while the second is the impacts on the near settlements residents whom will be relatively far to noise sources but will have continuous exposure.

Further to construction noise impacts, driving deep foundation piles of WTGs will be associated with soil vibrations, which may impact the stability of the existing houses of the four settlements in the project area especially that many houses are made from mud and bricks, without engineered foundations to bear horizontal vibrations.

Impact Significance:

The noise impacts on workers although higher in intensity it is lower in duration. Generally construction workers are usually familiar with noise of their correspondent construction machines, but the ESMP, in Chapter 7, includes measures for safe exposure of construction workers to noise.

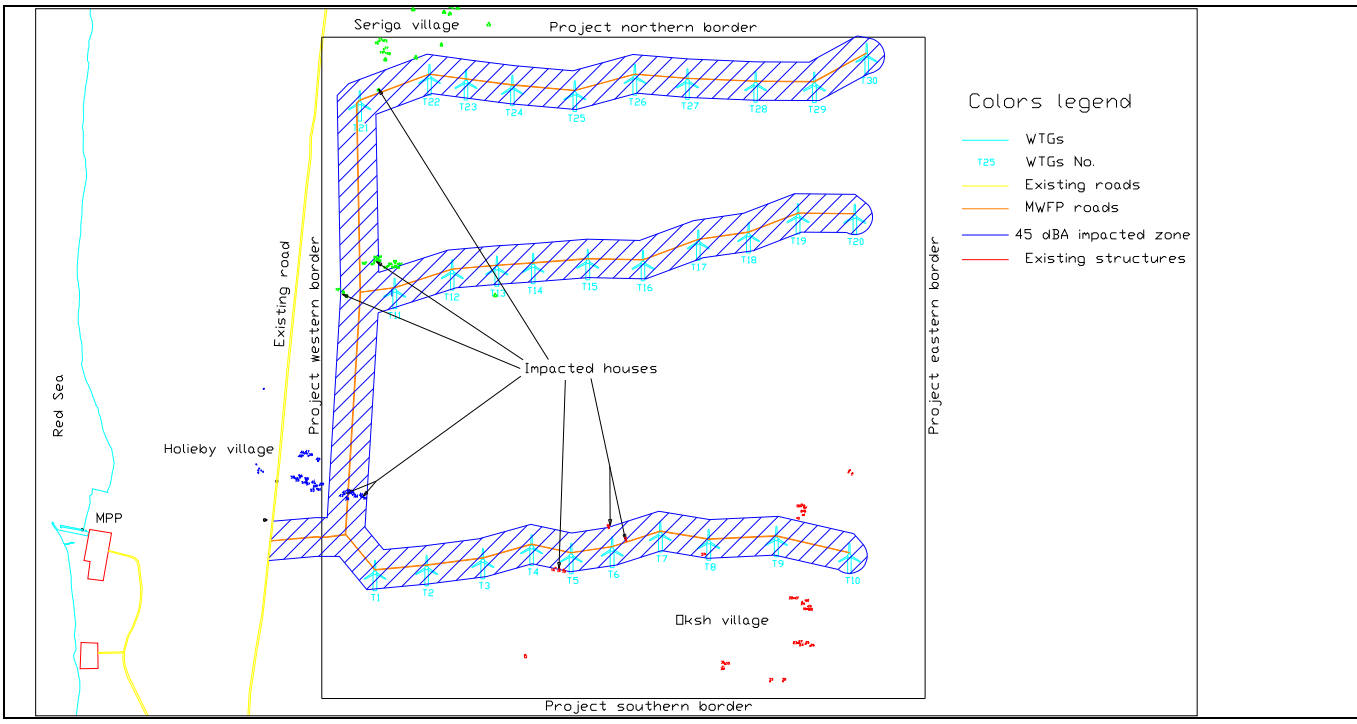
Regarding community noise, a simulation for assessing the impacts of the five noisy activities given above has been done using attenuation equations of the international standards ISO 9613-2, in order to identify a the impact zone from such activities to

maintain average background noise of 45 dBA correspondent to evening noise average (07:00-18:00 hours) is the Yemeni legislation for rural areas in districts (Table 2-2 in Chapter 2).

Table 5-1: Simulated construction noise impacts and impact zone

Operation	Noise sources	Estimated distance (m) to maintain 40 dBA noise[22]
Excavation of surface foundations	Backhoe excavator, loader and 2 HGVs	90
Piling of deep foundations	Pile driver and 2 HGVs (intermittent hammering not calculated)[23]	140
Roads pavement	Roller, Bulldozer, 2 HGVs and paver for each 1 km	210
WTGs assembly	Crane, 5 HGVs, one welding and one bolting machine	195
Staff camp	One generator, 10 AC compressors and 2 HGVs	115

Figure 5-1: Zones impacted by construction noise



[22] Taking into consideration geometric divergence and atmospheric attenuation
[23] Intermittent noise impact on long term noise average is very low, the impact is rather effective instantaneously

The impact will lead to exceeding noise regulation for a number of cases; however, because of the temporary nature of this impact (limit exceeding for each case may be only for few days if work is commenced during evenings) the impact has been classified as of medium significance. Mitigation measures have been recommended minimize noise and vibrations for workers and local residence so that noise standards will not be exceeded.

5.1.4 Impacts on Traffic

Construction materials will be transferred to the site using different vehicles that will use existing roads network that serves the area.

As mentioned earlier in Chapter 3, WTG parts will be transferred by 270 truck journeys from Al Mokha Harbor to the project site. If the crane will be ready in the harbor before the ship arrival, the ship/unloading-truck loading time for each piece is about 30 minutes[24], the same duration will be required at site for unloading the trucks in the designated location at the site and the heavy trucks and the crane(s) will pass the distance between the Harbor and the project site with average speed of 10 km/hr, the net working cycle of each truck will be at least 3 hours with the return of the truck back to the harbor. Given the limited trucks waiting area available in Al Mokha Harbor and using simple calculations the total loading/unloading period will continue for several days and maybe weeks.

The relatively slow speed of the heavy trucks will cause reducing the speed on the road connecting the Harbor to the project site, especially on the curved stretch of the road, as shown in Figure 5-1, where the trucks convoy speed will be even slower. The route from the harbor to the project site (about 10 km) passes two main intersections, the intersection with the coastal Road and the intersection with Al Mafraq-Al Mokha Road, as shown in Figure 5-1, and accordingly there might be traffic delays on these intersections during the passing of the convoy. In addition to traffic delay impacts, these heavy trucks may cause damages to the roads surface pavement or un-accounted for settlements if their loads are too heavy for some stretches of the road, which may cause further traffic delays until such damage is repaired.

In addition to the trucks that will be transporting WTGs parts, there will be other types of vehicles that will be serving the construction activities such as trucks transferring different construction materials and busses/passengers vehicles that will be transporting construction staff to and from the site. These vehicles will use different access roads, according to their types, and will accordingly raise the traffic flow on these roads.

The aggregate that will be used in internal roads construction will most probably be transferred through tipping trucks from the nearby quarries. The total length of internal roads will be about 23 km, assuming that the aggregate base layer will be 0.5-meter thick with a slope 2:1 the total amount of aggregates that transferred to the site will be about 75,000 m^3. Assuming that Heavy Goods Vehicles (HGV) of carrying capacity of 5 m^3,

[24] Arbitrary estimate

there will be a need for about 15,000 rotations of HGV, from and to the quarry, over the roads construction period estimated by 10 months. This will cause average daily HGV trips of about 60 on each of the both ways of the access road.

Figure 5-2: Trucks route from Al Mokha Harbor to the project site

Another type of common vehicles that will be used in the project construction is the concrete transfer trucks, which will be supplying concrete to the project constructions. There is no accurate identification to the amount of concrete that will be used in the construction, but most of the concrete will be used in foundations. The foundations volume has been estimated by about 35,000 m^3, as previously indicated. If it is assumed, arbitrarily, that the total amount of concrete that will be transferred is 40,000 m^3 and it will be transferred by 5 m^3 capacity concrete trucks the average daily trips over the 11 months civil works will be 28 trips on both ways of the access road to the concrete plant. Also, the excavation waste quantity estimated by 35,000 m^3 will be transferred, as recommended in the ESMP, to the dumpsite located right to the south of the project area. If HGV were used to transfer this excavation waste to the dumpsite this will require 30 HGV trips per day per direction of the MWFP access road during the foundation construction period estimated by 9 month.

Regarding transportation of construction staff, the majority of the workers are expected to be transported through a few number of busses or minibuses, while the engineers and project managers area are expected to access the site through passengers vehicles.

There will be also transfer of other construction materials, such as reinforcement steel bars, woods, generators, hoists, mixers, bricks, building finishing materials … etc. However, the trucks transferring such materials are expected to be of much less frequency than aggregates, concrete and soil trucks discussed above.

Impact Significance

If the HGVs transferring WTGs parts travels individually once they are loaded, the occupation of the access road and the intersections maybe for long times and in an unorganized pattern throughout the day, which may cause significant traffic delays. Accordingly the ESMP includes measures for organizing travel of WTGs convoys during light traffic periods, which shall reduce traffic delays. The ESMP also includes measures for conducting comprehensive survey for the road condition and its suitability to bear HGV loads and undertake prior maintenance, if needed, to avoid any damages to the road.

There were no traffic counts available for the selected access road or the passing intersections, but the average flow on some similar roads in Hodeidah, such Al Mina Road and Jizan Road is in the average range of 900-1100 vehicles per hour, which makes the expected increase of traffic flow due to MWFP vehicles serving construction activities less than 1%, which makes such impact a minor impact. The ESMP also includes measures for planning HGV travel times in light traffic periods to avoid traffic delays as much as possible.

Overall the impact has been classified as of medium significance because of some uncertainties regarding the transportation of WTG convoys.

5.1.5 Risks to Workers and Local Community

Vocational health and safety are usually issues of concern during the construction phase. The increased number of workers in an area, operation of powered huge machinery, and storage and handling of fuel/flammable substances represent a risk on both the local population and the workers on the site. Construction activities and personnel could increase the risk for fire hazard due to risks of sparks or flames resulting from substandard machine maintenance, improper welding practices among other reasons. The households within the project area are considered more vulnerable to this type of risks.

The presence of two 132 KV power lines penetrating the site also cause some risks of electrocution during equipment movement, especially that there will be large cranes employed for the fixation of WTGs. The movement of such tall cranes close to existing power lines is associated with electrocution risks to crane workers, and possibly other workers existing in the area.

Furthermore, construction works will include operation of hoisting machinery, scaffolding and working over heights which are risk factors to workers and people existing near such machinery. Such risks are minimized if adequate safety precautions are implemented, workers are trained, and suitable safety gear is provided.

Impact Significance

This impact is linked to the health and safety of the community so it is of significant importance. Generally, the modern construction technologies and the safety measures normally applied by large construction companies and WTG suppliers highly contribute to reducing the potential risk of occupational accidents, however, because of the ambiguity, at this stage, of the contractors and suppliers who will be recruited during construction, this impact has been classified as of medium significance. The ESMP includes measures to minimize the significance of this impact.

5.1.6 Loss of Natural Habitats

Although the total area of the project borders is about 48 km^2, the actual area that would be occupied by project assets would be only 2-3% of this area. The area that would be occupied by construction activities would be slightly larger than the actual area of WTGs and infrastructure because there will be temporary storage areas for different construction materials[25] and facilities, this, although will not significantly increase the ratio of the 48 km^2 occupied by the project activities, may imply taking some security measures that will limit access to more project areas.

Impact Significance:

As previously mentioned in Chapter 4 the dominant flora cover in the site is from the invasive Mesquite trees which, if some of these trees were removed to clear the designated area for construction activities this will not cause loss of important natural species. Also in terms of fauna, the dominant fauna species found in the project area are limited to some reptiles and rodents with no any rare or threatened species. Accordingly the loss of natural habitat due to area occupied by construction activities, and later by project assets, could be assumed of negligible significance.

On the other hand, the security precautions, in addition to the noise and disturbance caused by construction activities, will limit the area available for animal grazing, but, again, the grazing characteristics of the project area are abundant in the whole area and surroundings, and accordingly the loss of grazing area could be regarded as of negligible significance[26]. Accordingly, it could be concluded that the World Bank Safeguard Policy on Natural Habitats (OP 4.04) will not be triggered.

[25] The proposed time plan for construction activities indicates that delivery of WTG parts will start well prior to WTGs assembly, which means that there will be requirements for limiting access to certain areas of the project site for storage of WTG components.

[26] The social impacts related to inconvenience to local residence of limiting their grazing areas were discussed earlier.

5.1.7 Inconvenience to Local Residence on the Project Site

As explained earlier in Chapter 4 Al Houlibi, Al Oksh, and Serega villages are locate within or near the project site and their residence and livelihoods are linked to accessing land and other resources in the area. It is expected that during the construction phase, the different construction activities will probably result in several forms of temporary inconvenience. The following sections explore these forms.

Affecting Privacy

The local community might be disturbed due to the expected influx of non-local construction crew. The existence of construction camp during the construction period might result in some disturbance for the privacy of these groups which is a very closed and conservative community.

Affecting Mobility

Women currently contribute to some of the outdoor activities like wood collection for cooking purposes. The existence of strangers[27] in the area is expected to limit women mobility. Foreign experts will most likely be present on the site during construction. Considering the cultural background of the community and the fact that it is a rural tribal community, makes it predictable that they might not be very much in favour of the existence of outsiders in the neighborhood. This is predicted to affect the mobility of women.

Affecting Livelihoods

It is also expected that security limitations might be imposed on the site during the construction period both to secure and protect the equipment of the construction and for occupational health and safety consideration. This, in turn, will likely mean prohibiting residents from accessing different grazing areas within the project site. This will in turn affect the livelihoods of local villages' residents by limiting access to certain parts of land which is currently used in herding activities and fire wood collection.

Figure 5-3 : Project area currently used for grazing and fire wood collection

[27] Engineers, site supervisors, labourers …etc,

Pressure on the Area's Resources

The construction of the wind farm necessitates the use of heavy equipment that occupies a large portion of the project site. This will also be associated with increased pressure on traffic and crowdedness for the site and potential damage to the site habitat.

Affecting Local Community Property

In the consultation meetings that were carried out during the scoping phase, men in Al Houlibi mentioned that they are usually faced by the risk of stealing their goats and sheep because they can not afford controlled sheds that protect these cattle. There is a fear that the increased exposure to more outsiders might form a threat on local community property, particularly because no security restrictions are in place to protect these belongings.

Impact Significance

Due to the temporary mode of this impact, it was classified to be of minor significance. However, some procedural activities could be taken in order to mitigate the negative consequences of this impact and limit the consequences of inconvenience on local people to the extent possible.

5.1.8 Generation of Job Opportunities

During the project construction, it is predicted that several types of jobs will be created for a relatively long duration of time that is estimated by 2 years. These opportunities could be created to construction workers, drivers, engineers, contractors, local suppliers …etc. It is expected that the local population of Al Mokha Directorate will benefit from the generated opportunities. These generated opportunities should be directed to the extent possible to local people, except for jobs that require high technical qualifications which are not available on the local level. Contractors and providers of construction materials and drivers from Al Mokha should be given higher priority in selecting candidates for the different required occupation. The interviewed local residents expressed wishes to get the chance to work in the project. Big portion of them are already involved on jobs that require physical efforts like loading. It is, thus, expected that the type of construction work will be suitable to local people abilities. In addition to possible direct job opportunities the project construction is expected to cause momentum to economic activities, especially in the services sector.

It should be also noted that the project will, necessarily, involve benefiting from international experience to fill the areas of qualifications which might not be available in Yemen. This more likely will include the jobs related to the design and engineering of the wind farm.

Impact Significance

This impact is a positive impact with high significance. It will generally help creating economic opportunities to local people.

5.1.9 Building Capacities of Local Stakeholders

The collaboration between the local authorities, namely, MEE (RED, SPC and PMU) and Al Mokha Power Plant from one side and the International Project Management Consultant who will be involved in the construction and operation phase, from another side will likely contribute to build the local capacities and transfer the international experience to local stakeholders. This collaboration is seen as a very health procedure to ensure building the local experience and contribute to the technical sustainability of the project. Considering the fact that this is a pilot project that aims to be extended in the area in the near future, the future reliance on international expert, particularly for O&M should be decreased to the extent possible in the future.

It is, thus, needed to ensure that the assignment of international consultants who will be working throughout the different phases of the project will involve building the capacity of and transferring the know-how experience to local partners to attain this positive impact.

In the meantime, under the ESMP developed in Chapter 7, capacity building programmes are suggested for different categories of stakeholders in order to enable them to efficiently implement the suggested procedures and activities under the ESMP. Thus, the project implementation will bring the positive impact of building the capacities of the local stakeholders groups, including the civil society groups, on topics related to their work.

Impact Significance

This impact is a positive impact with high significance. It will generally contribute to enhancing the human assets[28] of local stakeholders in a positive way both for them and the project.

Table 5-2: Assessed Significance of Expected Impacts during Construction Phase

Impact	Likelihood and severity	Significance	Mitigation Measures Effects
Impacts of construction wastes	Likely to have medium impacts	Medium	Reduce impacts significance to minor
Impacts of construction air emissions	Likely to have medium impacts	Medium	Reduce impacts significance to minor
Impacts of construction noise	Impacts are for limited short period	Medium	Reduce impacts significance to minor

[28] Within the Sustainable Livelihoods Analysis Framework (one of the important development approaches), human assets include different personal asset that people use in acquiring a livelihoods. This includes knowledge, education, health...etc.

Impact	Likelihood and severity	Significance	Mitigation Measures Effects
Impacts on traffic	Uncertain impacts of WTGs convoy	Medium	Minimizes impacts significance to minor
Risks on Workers and Local Communities	Medium Likelihood	Medium	Reduce impact significance to minor
Loss of natural habitat	Likely impacts are negligible	Minor	No mitigation measures needed
Inconvenience to Local Residents on the Project Site	High Likelihood	Minor	Minimize impact significance
Generation of job opportunities	High likelihood, high significance	Positive impact	No mitigation measure required
Building the Capacities of Local Stakeholders	High likelihood, high significance	Positive impact	No mitigation measure required

5.2 Impacts during Operation

5.2.1 Risks to birds[29]

Wind turbines and associated infrastructure such as power lines and pylons present collision and/or electrocution risk to birds, particularly soaring birds, and have been shown to injure or kill many birds in different parts of the world.

BirdLife International (2002) identified three specific risks in relation with the development of wind farms, which would be applicable at the site:

- Direct mortality caused by collision with WTGs and associated structures (pylons, power lines etc.) and by electrocution in energized power lines.
- Disturbance leading to displacement , including barriers to movement;
- Loss of habitat to wind turbines and associated infrastructure**.**

The above-mentioned impacts, except the collision with WTGs, are considered of relatively low significance. The disturbance impacts are believed to be moderate because the site already has poor local avifauna (as indicated in Chapter 4) due to the invasive *Prosopis* trees, and disturbance of migrants from the site is seen to be a positive impact because it will reduce collision risks. The layout of the WTGs, especially according to Scenario 1, is not regarded as a barrier of concern due to its low footprint and location in an open unrestricted plain that no significant modifications in migratory pattern is expected. Also, due to the same reasons indicated above, the loss of habitat impact is considered minor. Because the length of the new power line connecting the wind farm with the substation at MPP is relatively short compared to the already existing power

[29] This section presents a summary of a detailed ornithological study that is an annex report to this ESIA.

lines in the area, the impacts of electrocution and collision with power lines are also considered minor.

The major concern of many impact studies of wind energy focused on the risk for birds colliding with the rotor blades of the wind turbine and getting killed or injured. The majority of studies indicate that while collision rates per turbine are low, mortality can be significant where wind farms comprise several hundred turbines, especially so for rarer longer-lived species with generally low annual productivity and slow maturity, particularly when they are already rare (BirdLife 2002). Clausager and Nøhr (1995) concluded in a review on impact of wind turbines on birds that "some species, such as birds of prey, may have an increased risk of collision during feeding. In situations of wind turbines located in areas with large concentrations of migrating birds the risk of collision may increase, but even in such cases the number of bird colliding has not been alarmingly high".

However, even relatively small increases in mortality rates may be significant for populations of large birds of prey. Evidence from the US suggests that this is a site-specific problem, with death rate varying from one site to the other according to attractiveness to birds. At the Altamont Pass Wind Resource Area in California, a wind farm with some 7000 wind mills, a mortality rate of 0.15 bird deaths/year/ turbine was estimated by Thelander and Rugge (2000) (equivalent to a total of 1050 casualties /year), with most of the casualties being large birds of prey. At the Tarifa Wind Farm located in a similarly sensitive area for migratory soaring birds near Gibraltar in Spain an even larger mortality rate was estimated at 0.34 birds/turbine/year (Montes and Jague 1995). Also high levels of mortality have been found by some studies of smaller numbers of turbines in coastal locations with large concentrations of waterfowl. For example wind farms near the coast in the Netherlands it has been estimated that between< 0.3% 1% of the birds passing on migration at night would collide with a turbine while the proportion during the day is much lower (< 0,03%), (BirdLife / UNDP 2005).

The risk assessment of MWFP on birds mortality due to collision with WTGs has been made based on different factors related to the birds', occurring at the site, characteristics and the site specific characteristics. These factors are mainly the following:

- Regularity, volume and density of migration
- Speed of migration
- Altitude of flight
- Roosting, staging and feeding
- Condition of birds
- Potential risk to threatened bird species
- Behavioral traits and species specific avoidance capacity
- Site specific factors
- Wind direction and speed
- Visibility

Regularity, volume and density of migration

The presence of a predictable and high volume of birds, which are densely concentrated at the site of a wind farm, would obviously directly increase the risks of conflict greatly.

The preliminary results of this study suggests that there is a regular and predictable passage of soaring birds over the proposed project site during the autumn season, and that the passage is not incidental or related to aberrant weather conditions. In other words it can be predicted that soaring bird migration occurs at the site annually during autumn as a natural phenomenon. In autumn, soaring birds were observed at the proposed project site on *all* days of the autumn study in a fairly steady flow (except for increased volume during very windy days), with a total of 5544 birds observed during 63 hours of observations, represents a minimal average of 88 birds / hour or 440 birds / day (based on 5 hours of observation / day). In contrast in spring there was almost no passage, with only a total of 349 soaring birds documented over 165 hours of observation (less than that observed during a single day in the autumn season), representing an average of 2.1 birds per hour or about 11 birds per day (based on 5 hours of observation / day).

Although the robustness of the conclusions made as a result of a single relatively short study of bird migration (such as this current study) is likely to be rather weak, the observed broad patters of migration over the proposed project site during autumn (occurrence of a sustained migration from south to north) and spring (lack of migration) are certainly conclusive. In this sense one could conclude that soaring migrants occur only during 50% of the migration seasons.

At Gebel El Zeit in Egypt, Decon-Fichtner (2007) indicated that 40% of the (study) time there were no migrants at study sites, while the vast majority of soaring birds passed in just 15% of the observation time. Indicating a much more unpredictable and variable pattern of migration than at Al Mokha .

Table 5-3: Migration rates at two investigated sites in Egypt and Al Mokha
Based on results from this study, Baha El Din and Baha El Din (1995) and Decon-Fichtner (2007)

Location	Season	Birds counted	Hours of observation	Rate birds/hour
Zafarana	Spring	236	50	4.7
	Autumn	9	40	0.2
	Spring & autumn combined	245	90	**2.7**
Gebel Zeit	Spring	159276	604	263.7
	Autumn	71256	459	155.2
	Spring & autumn combined	230532	1063	**216.9**
Al Mokha	Spring	349	165	2.1
	Autumn	5544	63	88.0
	Spring & autumn combined	5893	228	**25.8**

The combined migration rate for both autumn and spring at the proposed project site contrasts strongly when compared with migration study results at both Zafarana and Gebel El Zeit in Egypt. While the soaring bird migration rate seems greater at Al Mokha than at Zafarana (25.8 birds/hour vs 2.7 birds/hour respectively); it is certainly much smaller than at Gebel El Zeit (216.9 birds/hour). Zafarana has had wind farm developments for some 10 years now with little evidence of adverse impacts on soaring birds (Bergen 2007), while much of Gebel El Zeit has been excluded from wind energy development.

Density of passage (for example very dense flocks) is likely to be positively correlated with increased risk levels. At the proposed project site there was a constant flow of birds during the study period, which was both spatially and temporally fairly evenly distributed, with no obvious tendency for clustering or achieving great density.

In comparison the migration pattern at Gebel El Zeit area (which is much larger in area than Al Mokha site) is highly stochastic temporally and irregular spatially. So birds were not always detectable in all parts of the site, while in some locations (in the southern part of the site) larger numbers were seen; the majority of these were contributed by a few but very large flocks of mainly white storks and honey buzzards (Decon-Fichtner 2007). At the Al Mokha site and Bab Al Mandab there are very limited numbers of the species that tend to form huge compact flocks like storks and cranes or honey buzzards.

Speed of migration (risk exposure potential)

In spring most of the time birds moved very rapidly over the site, which means that the exposure to risk per bird is very small, but it also means that a large volume is exposed to this risk factor. In spring the few birds flying over the site tended to have less urgency and were often actively searching for food. The impact on local resident species is likely to be high initially, until vulnerable populations are reduced and / or are acquainted with the wind turbines. With the exception of the Egyptian Vulture, non of the currently known resident species in the area are of particular conservation concern or are especially vulnerable to wind energy development and are most likely either avoid the wind farm area due to disturbance or continue utilizing the habitats below the turbines.

Altitude of flight

Flight elevation is one of the most important factor positively correlated with increased risk level to migrant birds. (Decon-Fichtner 2007) considered 200 m as a precautionary safe upper altitude for birds migrating through wind farms with wind mills reaching up to 100 m with their rotors. In our case the tallest of the three wind turbine options considered for this project (Gamesa G90 2 MW) reaches up to 120 m from the ground, thus we similarly adopt the 200 m as a safe lower altitude.

Our results indicate that about 36% of birds recorded (in both seasons) in the general proposed project site were documented below 200 m (2019 birds), while 15% were documented below 100 m (906 birds). This is significantly less than the rate documented

at Gebel El Zeit where in autumn 2006 where 41% of birds were documented below 200 m (16,311 birds) whiles 28% (11,000 birds) were documented below 100 m (Decon-Fichtner 2007).

These figures do not mean that all birds flying within rotor range will be struck or damaged, as there are many other factors that influence any potential casualty rates, one of which is that many species will completely avoid the wind turbines (see barrier effect). One species that tends to do this id Buzzard (which is the most numerous species at the Al Mokha site) (Langston and Pullan 2004).

Roosting, staging and feeding

The basic strategy for all migrants traversing the Middle East is to pass through as fast as possible, with as few stops as possible. This also applies to soaring birds. Roosting and landing of birds in the vicinity of wind farms is obviously of great concern since it can bring them within the strike zone. Most soaring birds under normal circumstances need to roost during the night when there are no thermals (one exception is Common Crane, which is known as well to fly at night in significant numbers).

For the most part birds land opportunistically wherever they find themselves at the end of the day. Birds of prey will prefer to roost in inaccessible locations, such on mountains, trees, or also on man mad structures like pylons.

Unlike the situation at Bab El Mandab and Dubab, there was limited evidence of landing (roosting and resting) at the proposed wind farm location it self. However many birds were attracted to the nearby municipal solid waste dump. Locals also were not aware of any major roosting activity in the area, except at Al Mokha dump site and at newly reclaimed areas where locals confirmed that soaring birds were attracted to their cultivations.

Condition of Birds

Birds that are exhausted, thirsty or injured tend to land more than healthy birds to rest, seek shelter and replenishment. The amount of time spent resting is usually brief in healthy birds, at the most overnight. Stressed birds will remain on the ground for longer and tend to get attracted to anomalies on the desert surface, hence becoming more at risk of conflict with wind turbines. Increased persecution and disturbance in the region adjacent to the wind farm (as is the case with falcon catching) would increase levels of distress and reduces speed of migration through the site.

During the current study there were no indications of adversely affected migrants within the project site, and with the exception of falcon catching there were no obvious persecution or disturbance to birds.

Potential risk to threatened bird species

Threatened species and species of special conservation concern and those with small populations should be of primary concern in any risk assessment at the site, as even very small losses for these species could be significant. See Table 1 for a list of species of special conservational concern (according to the IUCN 2009 Red List) occurring or likely to occur at the proposed project site. Five globally threatened species of birds have been documented in the project site or its immidiate vicinity as follows Egyptian Vulture (Endangered), Pallid Harrier (Near-threatened), Greater Spotted Eagle (Vulnerable), Sooty Falcon (Near-threatened) and White-eyed Gull (Near-threatened).

The volume of threatened species documented at the project site in both spring and autumn are limited, with the exception of the Egyptian Vultures (Endangered), which occurred in constant and locally significant numbers, which raises some concern. These birds almost certainly represent local breeding or wintering populations that roam around this part of the Tihama, and are attracted to the site because of the solid waste dump (which contained several dead animals during the PI visit). Dead live stock from the quarantine (which holds mostly cattle imported from Somalia) are dumped at several localities at the southern edge of the project site, also acting as an attraction focal point for these birds.

More over Egyptian Vultures are by nature highly passive flyers which are likely to have minimal avoidance behavior in the face of wind turbines (Baha El Din and Baha El Din 2009), leading to a high collision risk for this species, as is the case for other vultures, such as Griffon Vultures which have very high fatalities in Spanish wind farms due to the same reasons. Thus, there is potentially a high risk for this globally threatened species from wind farm development at Al Mokha.

Decon-Fichtner (2007) predicted that Pallid Harriers (Near Threatened) and Lesser Kestrel (Vulnerable) are unlikely to be negatively affected by a wind farm development, because the former flies quite low, and would pass below the active rotors of wind turbines (a prediction which could be faulty in our opinion) and the latter because it is a very active flyer. They both also migrate over a large front and thus are not concentrated within the area. Nevertheless, Decon-Fichtner (2007) indicate a possible absence of avoidance behavior in Lesser Kestrels as that observed in Common Kestrel, which might increase the risk of collision. Collision risks for Greater Spotted Eagle (Vulnerable) and Eastern Imperial Eagle (Vulnerable) are likely to be modest, since their numbers are small in the area and they tend to migrate at higher altitudes above 200 m, although both are very passive flyers that could be sluggish in their response to wind turbines.

To assess the significance of collision risk at species level the population size of a species has to be considered. For large populations a low incremental mortality might be compensated and absorbed if these losses are not sustained over a long period or indefinitely, whereas even low numbers of fatalities can cause a population decrease in small populations. Given the small size of their global populations both the Egyptian Vulture and (to a lesser degree) Greater Spotted Eagle can be considered the most

vulnerable species passing through the Al Mokha site. But since it is difficult to estimate the potential number of fatalities at a proposed wind farm, it is not possible to determine the exact weight of collision risk.

Behavioral traits and species specific avoidance capacity

Some species are more prone to collision because of inherent behavioral traits. Some species naturally fly low (such as harriers), others congregate in huge flocks, while some are more able to maneuver and avoid moving wind turbines, some don't seem to be disturbed by wind turbines and are thus more at risk. This means that some species are inherently more at risk than others, regardless of other external factors.

Steppe Buzzards, for instance, seem to regard wind farms as barriers. In comparison to Black Kites, Steppe Buzzards appear to be more sensitive to the presence of wind turbines. As a consequence, Black Kites might be more vulnerable to collision with wind turbines than Steppe Buzzard (Bergen 2007).

Decon-Fichtner (2007) regarded collision risk to be low for harriers because they usually migrate near the ground, at altitudes below rotor height. Indeed in the United States and Germany only very few harrier fatalities were recorded (Decon-Fichtner 2007, Sterner et al. 2007). Additionally harriers tend to migrate in a broad front and do not concentrate at specific bottlenecks, thus any mortality caused by wind turbines are highly unlikely to have significant population effects.

Large and very passive fliers like eagles and vultures, which lack good maneuverability, are more vulnerable to collision with wind turbines. However, the documented average migration altitude in the proposed project site area of over 200 m puts most of these birds out of rotor range. Although as indicated above Egyptian Vultures (a species of conservation concern) could be at a higher risk than all other species due to its behavioral traits, relatively large numbers at the site and conservation status. Also the fact that some of the observed birds could be of local origin means that they would have longer exposure to the wind turbine risk.

Site specific factors

The site location and characteristics play an important role in risk identification for birds, such as location in a major migration corridor, proximity to seashore, site topography and presence of attractions to birds.

Although the site is located near a migration corridor, it is not in the main migratory rout, however, there are birds passing regularly over the site at least during autumn. Also the proposed site is far enough from the coast to avert any significant coastal influences on the site and, hence, the risks for migrant and resident water birds, which usually follow the coastline, is relatively low.

Concerning topography, it is generally thought that there are more risks associated with migration over complex topography, as this creates turbulence that could complicate flight behavior of birds and their ability to respond to the presence of wind turbines in their flight path. Because the site is generally characterized by wide open and flat desert plains, it carries, in terms of topography low risk for migrating birds.

Any factors that attract birds to land or utilize the wind farm site or its immediate vicinity would lead to a direct and dramatic increase in risk. Any anomaly can be a potential attraction. Attractions to migrants include water (fresh and saline), green areas, gardens, buildings, garbage dumps, sewage lagoons, water leaks; even things looking like water such as petroleum oil leaks all attract tired, thirsty migrants. Towers, pylons, and even wind turbine towers can attract birds attempting to roost, especially birds of prey. Currently the proposed project site is generally not particularly attractive to migratory birds. Overall, birds landing there would do so in a more or less purely random manner. However, as mentioned earlier in Chapter 4, the municipal waste disposal site south of the project site, and to a less extent the cultivated areas north of the site and the grazing activities in the area, are attraction factors that increase the risk. Future developments near the site could increase the risk if these developments would be sources of attractions or reducing availability of resting sites in the region

Wind direction and speed

Wind is one of the greatest factors influencing migrating birds. It affects the numbers, speed, direction and altitude. Strong winds make the birds move faster, but can also affect their altitude and ability to maneuver. The constant high wind speeds in the area may make it difficult for the birds to maneuver amongst wind turbines and could increase the potential risk of collisions. The effect of wind orientation on level of risk to birds is not clear. Strong tailwind (which increases a bird's rate of travel) was cited as one of the contributing factors leading birds to collide with wind turbines. While, strong head winds, bird might be forced to land, however available wind data for 2006 indicate very constant southerly direction of wind at the site during autumn. Decon-Fichtner (2007) stated that collision rate will be higher when migrants face strong headwinds, affecting the birds' ability to control flight maneuvers.

Visibility

Poor visibility is widely cited as one of the contributing factors leading birds to collide with wind turbines. Low visibility affects birds in many ways causing them to fly at low altitudes, reducing ability to detect wind turbines, and in many cases birds might be forced to land. As mentioned earlier in Chapter 4, visibility was mostly good during the current study, with the exception of two days when very strong winds led to a thick dust storm, which reduced visibility significantly and blocked the sun on one day. No birds could be seen and it was not clear if the birds had stopped flying or were simply invisible. It is not clear from the supplied weather data for 2006 (Lahmeyer International 2007) if such dust storms or other climatic conditions that reduce visibility (like fog) are a common occurrence in either the spring or autumn seasons.

Cumulative risk factor

When considering risks to birds from wind farms it is important not only to focus on the potential annual mortality rates (birds/turbine/year) or total number of fatalities per year in a wind farm. Attention should also be given to the long-term population-level effects of fatalities, which can affect the viability of entire regional or global bird populations and directly jeopardize their conservation status. Also, losses can be considered on an annual basis for small species which reproduce on an annual cycle; this should not be the case for long lived birds such as large soaring birds of prey and storks, which have population dynamics that entail breeding and recruitment cycles that take several years. For example, if the White Stork has a 5 year reproductive cycle, then any anticipated risks to the species should be seen and considered at this scale (i.e. the potential cumulative impact of 5 years should be considered). Moreover, in the case of a long-term project such as a wind farm (which is there to stay for many years and is unlikely to be altered for a long time), it is critical to take into consideration the potential sustained and enduring negative impact on bird populations on a regional level when calculating the level of risk. Thus, potential risk must be calculated not as an annual or seasonal level but at a population level.

Impact Significance:

According to the ornithological analysis and risk factors discussed above, it could be concluded that a constant and relatively stable volume of soaring bird migration was detected over the proposed wind farm site, with an average of passage of 440 birds per day, with a potential total volume of between 25-30,000 birds assuming fairly constant flow of birds throughout the autumn migratory season. The average altitude was 258 m, however about 30% of all birds flew below the precautionary “safe” altitude of 200 m. There was limited landing or roosting at the site; however several potentially highly risky areas that can attract large concentrations were identified; most importantly the municipal waste dump site. Several globally threatened bird species are known to migrate through the proposed project area; however it is one species (Egyptian Vulture) which could be of particular concern due its passage in relatively large numbers, tendency to fly low and land in search for food and lack of maneuverability in the face of wind turbines. The habitats at the site do not represent any rare or restricted habitat types and are not the home for any rare or threatened species, although several endemic species are found. It is unlikely that the proposed wind farm with its current proposed dimensions would form any significant barrier to the movement of migratory birds, although limited negative impacts on the local populations of native species is anticipated naturally.

It is was concluded that the proposed wind energy development at Al Mokha is unlikely to have impacts on birds of catastrophic nature, and that the level of risk to migratory and local birds is within a “tolerable” or “acceptable” range; i.e. that the level of damage that could affect birds is expected to be limited and would not have significant conservation consequences to their populations if prescribed precautionary measures are taken.

This assessment of risk is based and supported by the following findings:

- The volume of birds flying over the site is modest and does not represent the main migratory flyway of soaring birds in the region;
- The size of the proposed development is relatively small ;
- The window for soaring bird migration is confined to one season (autumn), with a limited time frame of about 3 months per year;
- The majority of birds fly higher than 200 m, with only an estimated 36% of birds flying below 200 m (for both spring and autumn);
- Migration is on a broad front, i.e. is not concentrated over the proposed project site;
- There are limited species that migrate in large dense flocks, which are particularly vulnerable to wind farms (such as storks);
- With the exception of the Egyptian Vulture, there is limited occurrence or likely risks to globally threatened bird species;
- There is limited landing and roosting in the area and no natural attractions for birds;
- The terrain is simple and flat;
- Wind direction and velocity is very constant during autumn (ensuring that limited variation to observed patterns are likely to occur), but is much more variable in spring, however not much birds are present then;
- Visibility is usually good.

The conclusion made here is based on a number of important assumptions:

- The size of proposed development remains limited in scale and not changed from current proposal (without further assessment);
- Existing man made risk factors (solid waste dumps and cultivations) will be relocated to a safe distance from the proposed wind farm;
- Mitigation measures are implemented.

It should be clear that this was only a partial and preliminary assessment representing the autumn season. The final risk assessment will only be possible when the spring season is also covered and the migration is documented[30]. As Mandville (2009) notes, in light of our collective poor understanding about wind energy's impacts on wildlife and their habitats, the precautionary approach should used.

This current assessment of the autumn season should be considered as border line, as the potential risk level is subject to many variables that might not be all well understood yet, and given the fact that there is a constant and stable migration flow over the project site, and the relatively limited sample size upon which the assessment is based. In applying

[30] The ornithological study will be updated according to a survey undertaken during March-April 2010, which has been finalized shortly before submitting this ESIA, however, the preliminary findings of the spring assessment indicated very limited volume of migratory soaring birds passing over the site much less than what have been recorded in autumn

the precautionary principal, it is strongly recommended that some further monitoring of bird migration and behavior in the region be conducted. This is reflected in the ESMP

Overall the risk is classified as of medium significance, in which the ESMP measures will further minimize it.

It is worth noting that a detailed risk assessment is presented in a Biodiversity and Ornithological Investigations Report annexed to this ESIA.

5.2.2 WTGs Noise

Noise from WTGs comes from two main sources, the first is aerodynamic noise caused by the movement of the blades through the wind, and the second is mechanical noise caused by rotation movements of the gearbox and generator inside the nacelle. Modern manufacturers of WTGs take into consideration noise control measures during the manufacturing process through designing of the blades and the nacelle and providing sound insulation materials to it.

Normally the noise below a wind turbines is tolerable, however the intermittent swishing sound of the blades cause disturbance in case of long term exposure.

There are no specific standards for noise from wind turbines in Yemen, as mentioned earlier in Chapter 2[31]. There are international noise standards for wind farms in many countries, such the limit of 40 dBA of Ontario/Canada[32] and the limit of 45 dBA of Germany for villages' center[33].

Impact Significance:

The presence of small settlements near the WTGs works is a factor for raising the significance of this impact; therefore calculation of WTG noise levels in the area has been undertaken using sound attenuation equations of the international standards ISO 9613-2. The calculations have accounted for cumulative WTGs noise taking into consideration the geometric diversion attenuation and the attenuation due to atmospheric adsorption.

The sound level reaching receptors at the ground is proportional to the source noise level at the nacelle and reversely proportional with distance from WTGs. Although the later factor is known with reasonable accuracy, the first factor was not quite clear during the preparation of this ESIA. Because the source noise, at the nacelle location, is a very important factor for assessing noise impacts at the locations of the ground receptors, two iterations have been undertaken using different source noise levels of 105 dBA and 102 dBA as indicated in the sketches shown in Figures 5-3 and 5-4 respectively.

[31] The noise standards in the Environment Law are not specific to the long term exposure to WTGs noise
[32] Source: Section 47.3 (1) Environmental Protection Act R.S.O. 1990, Development of Noise Setback for Wind Farms
[33] Source: Lahmeyer Feasibility Study Report

The calculations show that if the noise level at the source is 105 dBA all houses of Al Holibi settlements will be located within areas with maximum noise levels less than 40 dBA. For Al Oksh settlements 13 houses[34] will be located in 40 dBA zone and for Serega settlements 18 houses[35] will be located in an area with noise levels more than 40 dBA. For the noise zone of 45 dBA, only one house of Seriega[36] and 5 houses[37] of Oksh are located within this zone as shown in Figure 5-4.

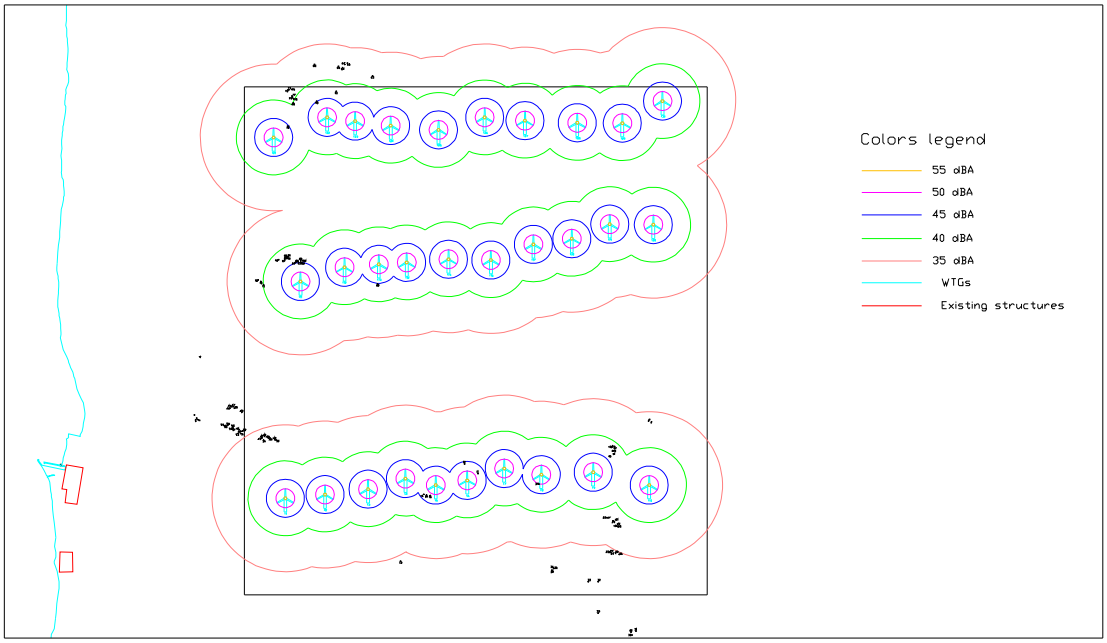


Figure 5-4: WTGs noise impacts for source noise at the nacelle 105 dBA (approximate sketch)

If the source noise is 102 dBA 6 houses in Al Oksh settlement[38] and 9 houses in Sereiga[39] will be within 40 dBA while for noise zone 45 dBA only one house in Al Oksh[40] will be affected as shown in Figure 5-5.

[34] Houses 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 14, 15 and 16
[35] Houses 62, 69, 71, 74, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92 and 93
[36] House 74
[37] Houses 11, 12, 14, 15 and 16
[38] Houses 3, 11, 12, 14, 15 and 16
[39] Houses 62, 69, 74, 82, 83, 84, 85, 86 and 93
[40] House 15

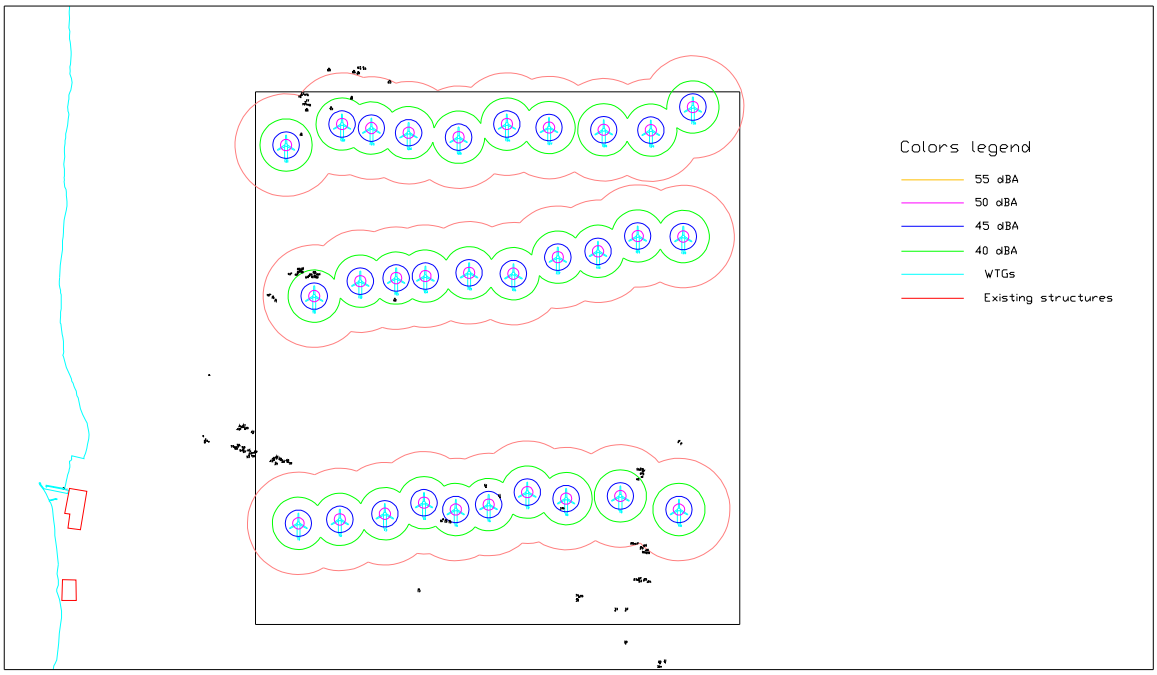


Figure 5-5: WTGs noise impacts for source noise at the nacelle 102 dBA (approximate sketch)

According to the above analysis the WTGs noise impacts could be classified as of medium significance taking into consideration the normal source noise of WTGs. The ESMP includes measures for including a condition in the WTGs tender to have minimum source noise. The EPC Contractor will be required to locate WTGs so that the maximum noise at settlements location will be 40 dBA, while the threshold limit that will be used in the monitoring program will be 45 dBA as explained later in Chapter 7.

5.2.3 Shadow Flickering

The rotation of WTGs blades causes shadow flickering through alternating changes in light intensity in the effected area. This shadow flickering may cause discomfort to residents or exposed people to this shadow flickering. Therefore some standards have been developed for maximum exposure time to WTG shadow flickering, such as in Germany where the maximum allowable exposure to shadow flickering is 30 minutes per day and 30 hours per year[41].

The height of the WTGs (90 meters hub height and 122 m maximum blades height) makes their shadows reach relatively large area around them. The shadow extent reaches its maximum right after sunrise and just before sunset, and the shadow movement along the day and its difference between days depends on the relative movements of the sun and the earth.

[41] Source: Lamahyer Feasibility Study and NIPSA Feasibility Study for the project

Because of the presence of four settlements near the WTGs makes, the turbines shadow may reach some of the houses, especially those located west and east of WTGs.

Impact Significance:

The extent of WTGs shadows has been calculated using astronomical data about sunrise and sunset times, sun latitude and azimuth angles during different days along the year at the project location[42]. Geometric calculations have been performed using the above astronomical data focusing on the area that are affected by WTG shadows 30 minutes after sunrise and 30 minutes before sunrise (which are the critical times for shadow extent). The affected areas by the shadows during these times along the year are given in the sketch in Figure 5-6.

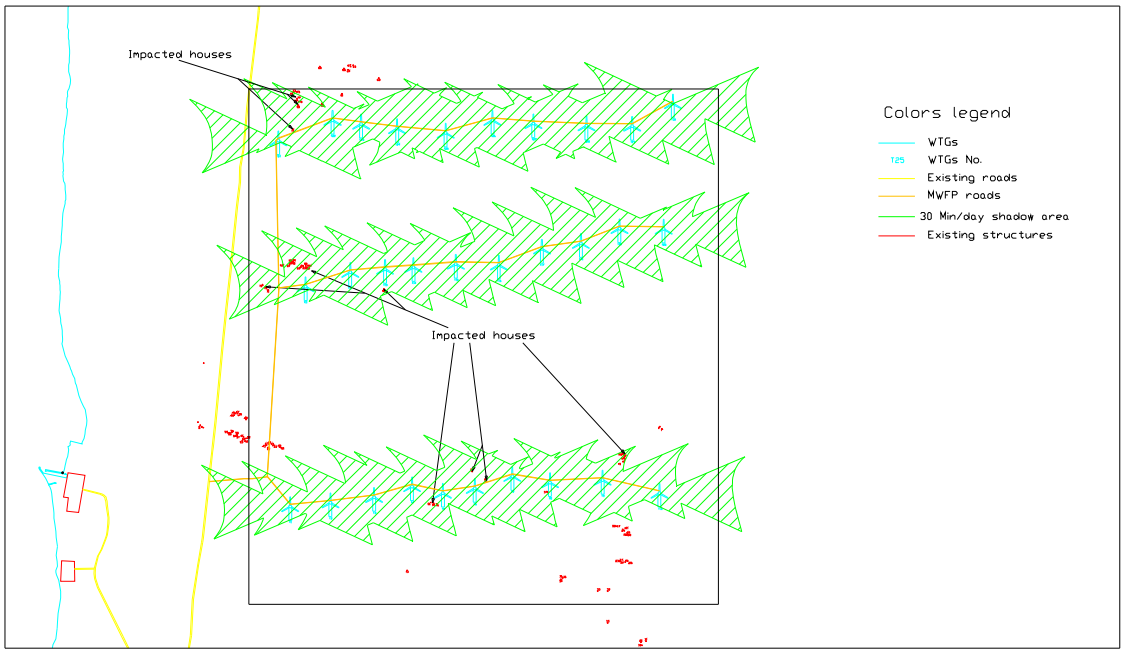


Figure 5-6: Affected area by WTG shadows for 30 minutes per day according to WTG Scenario 3

According to the calculations and the above sketch few houses (13 houses in Al Oksh[43] and 22 houses in Serega[44]) are located in the effected zone by 30 minutes of shadow per day. These calculations are very conservative, and may be a bit exaggerating, as it takes the worst case conditions, assuming that the sun is shining 24 hours per day, 365 days per year, that the WTGs are rotating all hours of the year which will not be the case during

[42] The data has been obtained from US Naval Observatory website: http://aa.usno.navy.mil/data/docs/RS_OneYear.php

[43] Houses 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 14, 15 and 16

[44] Houses 62, 69, 70, 71, 72, 74, 76, 77, 78, 79, 80, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91 and 92

operation and that the persons living inside these houses will be actually exposed to shadow flickering during these times[45].

Accordingly it cannot be concluded that shadow flickering at these 34 houses will definitely exceed the above-mentioned German standards, but there might be a probability for being close to these standards. Accordingly the impact has been classified as of medium significance. The ESMP includes measures for more in-depth study for this issue during the preconstruction phase, so as to consider this impact during the micrositing of WTGs, the ESMP includes also requirement for automatic control system for temporary breaking of some WTGs during high shadow exposure.

5.2.4 Risks of Scrap and Maintenance Waste

The maintenance activities of the project will include replacement of some WTG parts, insulators, cables, control panels … etc. Such items are usually left in open areas near the places they have been removed from, especially in open areas where there is plenty of space and where handling of such items is relatively difficult and costly.

The maintenance of WTGs and transformers will require handling of limited amounts of lubricating oils and transformers oils. The application of such oils will be associated with generation of empty oils containers and probability of limited soil contamination during application. Also changing batteries in the substation will be associated with generation of waste batteries which are considered as hazardous waste.

Impact Significance:

The disposal of non-hazardous scrap in open areas is associated with aesthetic impacts along with access limitation in the scrap yard, which makes cleansing of such areas difficult and inefficient, which may lead to development of dust accumulation and suitable habitat for rodents and vectors. The hazardous wastes, such as batteries and empty oils/chemicals containers, are associated with exposure risks to some hazardous properties according to the handling methods.

The significance of the scrap and wastes impacts is proportional to its volume, therefore, during the first years of the project's operation the impact could be considered minor, while during late stages of the project life reaching the decommissioning of some or all WTGs the scrap and waste impacts will get more significant, therefore, this impact has been classified as of medium significance. The ESMP, in Chapter 7, includes measures for adequate handling of scrap and hazardous wastes.

[45] The project's Feasibility Study has included modeling of shadow flickering impact using Wind Farmer Greenhouse mode, the results have concluded that 3 houses (not 11 houses as indicated above in this ESIA) are located within the affected zone. Probably the difference may be because the software includes some limitations that could not be included in the ESIA calculations such as the coverage percent of the WTG blades for the sun and the ratio of WTG operating hours distributed equally on a daily basis

5.2.5 Affecting the Stability and Livelihood of Local Population

Although the residents of Al Houlibi and affiliates Serega and Al Oksh, villages have a positive perception towards the project particularly with the predicted impacts of power supply and job opportunities generation, they seemed to be obviously concerned about the potential conflict of interest between the project and their interests in the area. The project need for land in order to establish the different project components negatively intervenes with the interests of the residents in the area. There is a fear that the project might restrict people's access to different resources in the area. This might be for security reasons, establishing safety buffer zones or in order to secure any other mitigation measures[46].

Although no formal land ownership documents is available with any of the village residents, their acquisition for land occurred since different durations that varies from 25-35 years and this give them – by law- the rights entitlement to claim ownership of land [47]. Local people seemed to be overwhelmed by concerns about their situation, particularly out of their fear of the negative previous experiences that involved denying squatters the right to access land and that this case could be replicated with them.

"We are afraid of ending up wandering around as we used to be in the past or that the project jobs go to other people and not to us"

One of Houlibi male residents

Impact Significance

Based on the principles of the WB on Involuntary resettlement driven from OP 4.12, involuntary resettlement should be to the extent possible avoided. Efforts were made during the project design to ensure that the project is designed in the highest level of social sensitivity. In the first place, design efforts aimed to ensure avoiding involuntary resettlement, being one of the unfavored social consequences of development projects. The micro-siting of the wind turbines considers the location of the houses located within the project site and ensured buffer zones for residents' safety. During the project operation, there are no restrictions to the grazing activities that local residents are currently doing[48]. It is unlikely that any security consideration will be taken to prevent access to green areas within the project site. In this sense, this impact could be classified as an impact of medium significance.

[46] Such as proposed measures to distract birds from the area
[47] Land and Real Estate Law no. 21 of 1995
[48] Except for measures taken to prevent accumulation of animals caracas leading to birds attraction which will have no or little impact on current grazing activities.

5.2.6 Stability Risks of the WTGs

Being relatively large structures exposed to several centripetal, gravitational and aerodynamic forces that could affect their structural stability, especially that the WTGs, despite their height, are only supported by foundations. The extreme hot and humid weather in Al Mokha is a factor that speeds up rusting and failure of metal structures, this has been evident in the stability of the metrological mast currently existing near the project site. Previous failure of a WTG in 2002, as previously mentioned in Chapter 4, makes stability an important issue in the operation of WTGs.

Besides risks of general structural failure of a WTG, there is also a risk of blade detaching from the rotor, which could lead to uncontrolled speed movement of one of the blades.

Impact Significance

Normally the suppliers of WTGs consider structural stability and failure risks in an appropriate manner. The reviewed literature showed that structural failure of WTGs or any of the blades is unlikely, especially after the advances in manufacturing technologies and the breaking system of the blades in high wind speed conditions. This risk has been regarded as of minor significance, in which the ESMP includes measures to further minimize the probabilities of this risk.

Figure 5-7: Tilted metrological mast near the project site

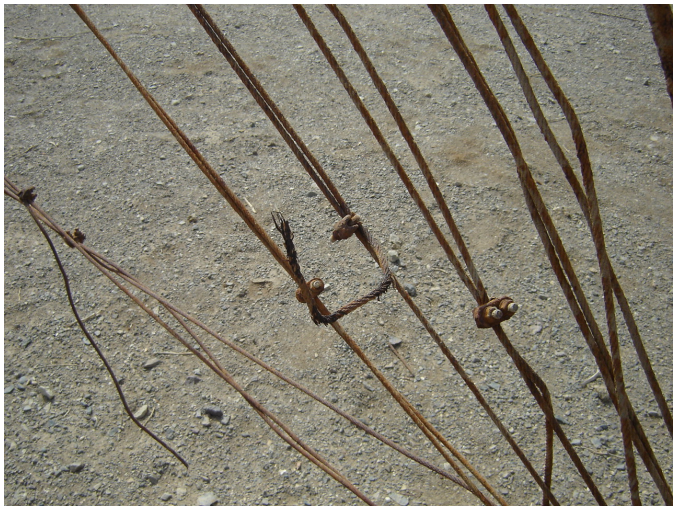


Figure 5-8: Rusted steel wires of the metrological mast

5.2.7 Dust Generation

Most of the internal roads that will be constructed to allow access to WTGs will be compacted rocky of gravel roads, which will cause generation of dust when vehicles pass by these roads for accessing WTGs.

Impact Significance:

Dust generation due to vehicles passing un-asphalted road is proportional to wight, velocity and number of vehicles passing the road. Given that vehicles will only pass the internal roads during maintenance, dust generation is expected to be minor and temporary. Accordingly the impact has been classified as minor.

5.2.8 Effects of electromagnetic fields

Energized power lines generate electromagnetic fields around the conductors, the intensity of such fields are proportional with the line voltage and electric current. EMFs attenuate rapidly at a relatively close distance from the conductor. Electric fields directly beneath overhead lines may vary from a few volts per meter to 100 or 200 volts per meter. Magnetic fields directly beneath overhead lines typically range from 10 to 20 mG. Peak EMF levels, however, can vary considerably depending on the amount of current carried by the line. Peak magnetic field levels as high as 70 mG have been measured directly below overhead distribution lines and as high as 40 mG above underground lines. Magnetic intensity attenuates rapidly with distance, for a typical 115 KV lines if magnetic fields under the lines reads 29 mG, it attenuates to 6.5 mG at 15 meters, 1.7 mG at 100 meters, 0.4 mG at 61 meters and 0.2 mG at 91 meters[49].

There are some concerns that EMFs could cause health impacts to the general public by prolonged exposure. EMFs have been considered by the International Agency for Research on Cancer (IARC) as possible carcinogenic, this classification was based on some evidences; however, there is no agreement among the scientific community about certain effects of EMFs.

Impact Significance:

The 132-KV overhead line is far enough from existing settlements (closest house at a distance of more than 500 meters) so that the associated EMF of the new line will be totally attenuated. Although the underground connecting 33KV cable between WTG rows is at a closer distance to Al Houlibi settlements (about 30 meters) the relatively low current passing through the line will be a factor for making EMF ineffective at that distance. The impact is classified to be of minor significance.

5.2.9 Visual Impacts

The athletic impact and the impact on the landscape are of the most common impacts associated with wind farms, because the natural visual extent will be obstructed by the WTGs. It should be noted, however, that evaluating this impact is mainly subjective. What is regarded as an acceptable/appealing landscape to certain group of people might be regarded as an unpleasant landscape by others.

[49] Source: Report on EMFs of power lines of the National Institute of Environmental Health Science

The project's Feasibility Study includes calculations for the impacted zone (Zone of Visual Impacts - ZVI), the presented calculations show that the WTGs will be visible from all corners of the project area and nearby access roads, however, the question is whether this will form a negative impact.

Impact Significance

The impact is of subjective nature and as mentioned above. Many people believe that the moving WTGs are a nice view, especially that this will be the first project in Yemen and the scenery will be unique. Others believe it is a negative impact to the landscape because it obstructs the natural extent of the scenery.

Given that the project site is not located in a landscape with special value and that it is likely that people will be tolerant with such impact as long as they are benefiting from the project. This impact could, thus, be classified as a minor impact.

5.2.10 Benefits of Renewable Energy Generation

Sources of renewable energy, such as wind power, are having increasing importance especially with the increase demand on electric power and the corresponding increase in emissions of greenhouse gases and other air pollutants.

The project is a pioneer project in Yemen for using the clean renewable wind energy in meeting the increasing demand on power supply in the country.

Impact significance:

The expected yearly production of the project is 231 GWh of clean energy. Assuming that this energy production would have been produced from small diesel generators, currently existing at different areas of the country, the associated emission factors and the correspondent emissions saving for 231 GWh of clean energy are given in Table 5-3.

Table 5-4: Air emissions if equivalent energy is produced from small diesel generators

Pollutant	CO_2	SO_x	NO_x	CO	PM_{10}
USEPA emission factors (g/kwh)[50]	699.20	1.25	18.85	4.06	1.34
Saved emissions for 231 GWh of clean energy (tonnes/year)	161,515	288	4,354	938	309

[50] Source: USEPA Document AP-42 – Table 3.3-1 Gaseous Emission Factors for Diesel Engines less than 600 Hp for uncontrolled burners

Under the Clean Development Mechanism (CDM) 161,515 tons of CO_2 annual emissions reduction can be sold for about $ 5.4 millions /year according unit price used in the Project Feasibility Study ($ 33.28 / ton CO_2).

5.2.11 Generation of Job Opportunities

During the operation of the wind farm, there will be a need for the permanent jobs for operation and maintenance (O&M) and security. The qualifications required to fulfill these jobs vary from low and medium qualification to high engineering education qualification. It is very likely that Mokha has individuals who are fit for the O&M jobs. During the interviews with local residents, they expressed keenness to get engaged in the job opportunities that will be created by the project. It is highly recommended to give priority to local people in benefiting from these jobs after targeting them with capacity building programs that could be needed to enable them to fulfill the job requirements.

Impact Significance

This impact is a positive impact that will generally help creating economic opportunities to local people and providing a more sustainable source of income to improve the living condition of these people and tackle one of the main reasons for their poverty.

5.2.12 Better Utilization of Different Resources

Al Mokha is perceived to be a Directorate with several unutilized potentials and it was clearly observed that lack of electricity is one of the main challenges that hinders the Directorate development. Stakeholders expressed lots of positive expectations related to the project. The Local Council officials stated that Al Mokha's strategic location and its closeness to Bab El Mandab, a very important international navigation route and its proximity to East Africa countries may bring to the Directorate uncountable returns if properly utilized.

The consulted stakeholders from NGOs predicted creating opportunities in agriculture related fields. They suggested this to include opening factories for dates packing in Yakhtel which is very famous for the production of dates.

In terms of tourism potentials, officials in the Local Council pointed to the fact that several activities related to tourism could be encouraged through better access to power. The enhanced level of access to electricity particularly in a sound environmental technique might play a role in encouraging ecotourism potential in Al Mokha, particularly with the virgin nature and the historical potential of the area.

Other potential development with link to electricity provision is improved functioning for the water station under construction and better operation opportunities for Al Mokha Port Upgrading project which is currently under planning.

It should be noted that the enhancement to the power sector will not be limited to Al Mokha Directorate. The project will rather add 60 MW of clean energy to the national Public Electricity Corporation (PEC) grid. By linking the generated power from the wind farm to the existing Thermal Power Plant, the project will benefit other Governorates by helping in the provision of more reliable and regular power provision.

Impact Significance

This impact is a positive impact with high significance. It will improve the economic conditions of the Directorate through better utilization of various resources. The ESMP includes measures to ensure better access of Al Mokha Directorate to electric power.

5.2.13 Better Functioning Social Services on the Level of Targeted Communities

Previous studies showed that the lack of electricity result, in many cases in poor operation for the exiting social services including health and education facilities[51]. Improving electricity provision means better functioning for the health and education facilities within the targeted communities. This impact is not limited to Al Mokha but it will rather extend to cover the different targeted communities who will experience improved level of service after the project. It is expected that this impact will be sensed more clearly in rural areas. This impact is perceived to be of special importance to the poor as they are the category the largely rely on the Governmental social services due to their inability to afford for the private sector services.

Impact Significance

This impact is a positive impact which has high likelihood to be attained. It could be classified as an impact with high significance.

5.2.14 Households Gains

The improved access to electricity will in turn help in improving the conditions on the level of households. It is predicted that several gains on the household level will be attained by the targeted population from the project. This is predicted to include the privilege of sufficient lighting, ventilation (electric fans) and refrigerating. This means less labor input as well as less time consumed in the several domestic activities. The availability of lighting for longer hours is predicted to be a motivation for parents to send their children to schools because they will be able to spend longer time studying in evenings. Women will be able to replace the traditional manual washing with the electric washing machines. The project is predicted to involve the positive impact of eliminating the harmful indoor fumes from kerosene, to which the groups of women and children are vulnerable and seriously exposed.

[51] ESIA for the Rural Electricity Access Project (REAP), 2009

Moreover, the project also has the potential to attract the attention of different development partners including local NGOs and donor agencies working in Al Mokha to the poor and marginalized communities of villages located in and around the project site. In that sense, more development programs and funds that might be out of the direct scope of the project could reach these local communities, particularly because the proposed ESMP involves coordination and cooperative activities with those stakeholders.

Impact Significance

This impact is a positive impact with high significance. The ESMP includes measures to ensure electricity supply to local inhabitants of the area.

5.2.15 Unfair Distribution of Project Benefits

Although this could not be regarded as an impact of any kind (direct or indirect) to the project, it is thought to be a big fear that procedures within the ESMP aimed to tackle through proposing measures that aim at ensuring that the local communities will be given a chance to benefit from the project. The overall perception about the project is positive, however, local communities are afraid that the project gains might not be equally distributed and that they will not be given the priority in benefiting from the project gains. They expect the project to be of considerable economic return to the State, developer and other empowered stakeholders but not to them.

"…. They are going to export our air, yes they will sell our wind …"

A man in the project neighborhood

As explained under several of the impacts above, it is very likely that some of the subjective impacts could be more seriously sensed by people who are excluded from the benefits or those who are excluded from the decision making process. People can tolerate with these impacts if they have a share in the benefit that helps in making the balance.

During the Interview with Al Oksh residents, they expressed big concern about their closeness to Al Mokha Power Plant which is located around 10 km to the south of their village and the fact that they still live without electricity. Accessing power, as well as other services, is insisting priorities for them that they have never attained.

"We are very close to Al Mokha Thermal Plant which feeds most of Yemen with electricity. It is within the neighborhood and we still live in darkness and illness. This is not fair. I swear that if this plant is on the neighborhood of well-off and empowered people and they were in our shoes, they would have

destroyed it but we are poor people who are chasing our daily bread"

A man from Al Oksh Village

" We are afraid of being left behind. We might be excluded from jobs because we are illiterate, unskilled. Electricity also may not reach our homes. We even might be restricted in the future from reaching grazing areas. In this case we will end up with a second model like the Power Plant which locates on our land like the "white elephant" we only breath its exhaust and it only provided very limited number of jobs to few of us with 300- 400 daily wage"

A man from Al Oksh Village

The gathered information from the interviews and the discussion during the public consultation showed that local communities are confused between high expectations from the project and plenty of fears driven from the previous experiences. They are highly sensitive to the project outcome and wish that it will help in meeting some of their expectations. As will be explained in the ESMP, even if the unfair distribution of project gains could not be regarded as an impact from the project, every effort should be made to ensure giving the priority to local people to benefit from the project to the extent possible.

Table 5-5: Assessed Significance of Expected Impacts During Operation Phase

Impact	Likelihood and severity	Significance	Mitigation Measures Effects
Risks to birds biodiversity	Tolerable level risk of birds colliding in WTGs	Medium	Minimize impact significance
Impacts of WTG noise	Likely to have medium impacts	Medium	Minimizes impacts significance to minor
Impacts of WTG shadow flickering	Likelihood for exceeding standards not definite	Medium	Minimizes impacts significance to minor
Impacts of scrap and maintenance waste	Likely to have medium impacts	Medium	Minimizes impacts significance to minor
Affecting the Stability and Livelihoods of Local Population	Medium likelihood for medium significance impact	Medium	Minimize impact significance
Stability risks of the WTGs	low likelihood	Minor	Minimize impact significance

Impact	Likelihood and severity	Significance	Mitigation Measures Effects
Impacts of dust generation	Likely to have temporary minor impacts	Minor	No mitigation measures needed
EMF impacts	Likely impacts are minor	Minor	No mitigation measures needed
Visual impacts	Impacts to view are likely but the nature is controversial	Minor	No mitigation measures needed
Reducing air emissions	Likely to achieve benefits	Positive Impact	No mitigation measures needed
Generation Job Opportunities	High likelihood, high significance	Positive impact	No mitigation measure required
Better Utilization for Different Resources	High likelihood, high significance	Positive impact	No mitigation measure required
Better Functioning Social Services on the level of Targeted Communities	High likelihood, high significance	Positive impact	No mitigation measure required
Households Gains	High likelihood, high significance	Positive impact	No mitigation measure required

6. PROJECT ALTERNATIVES

6.1 No Project Alternative

The project is expected to achieve many environmental and social benefits as previously presented in the previous chapter. A direct environmental benefit that would be yielded from the project implementation is the savings of air emissions equivalent that would have been emitted if the same amount of electric energy was generated from fossil fuel. Another direct benefit is saving sources of fossil fuel that are not abundant in Yemen. Using estimated emission factors for small diesel generators, as previously indicated in the previous Chapter, 20 years of project operation will save about 3.23 million of CO_2 emissions through generating 231 GWh of clean energy annually. The project is also expected achieve many social benefits such as improving social services to targeted social groups, generating job opportunities and improve living conditions for the local community.

Being a pioneer and a demonstration project, MWFP will also achieve indirect environmental and social benefits as the successful implementation of the project will pave the way for implementing other wind energy, and renewable energy at large, projects in the country which will achieve similar environmental and social benefits and will be a step in achieving the objectives of the RESRAP.

From the technical standpoint, the project output will be a factor in improving the operation of MPP, which is currently overloaded by high demand to an extent that the turbines could hardly be stopped for maintenance and repairs. The new input of the project will help reducing the demand on MPP giving a chance for technical improvement in the thermal plant operation.

The negative environmental and social impacts of the project are mainly limited and could be mitigated through available technologies normally offered by different suppliers. By implementing mitigation measures that are later detailed in the ESMP all negative environmental and social impacts would be of minor significance.

Accordingly there are no environmental and social reasons for stopping the implementation of the project; on the contrary, the net environmental and social impacts are expected to be positive.

6.2 Capacity of Turbines and Layout

Three scenarios have been developed for the turbines capacities and layout as follows:

- Scenario 1: installation of 70 WTGs each of 850 KW capacity with hub height of 55m
- Scenario 2: installation of 36 WTGs each of 1.65 MW capacity with hub height 60m

- Scenario 3: installation of 30 WTGs each of 2 MW capacity with hub height 78m, according to the layout previously shown in Figure 3-1 (Chapter 3)

The layout of WTGs according to the three scenarios is shown in Figure 6-1, where each scenario is shown with a different color.

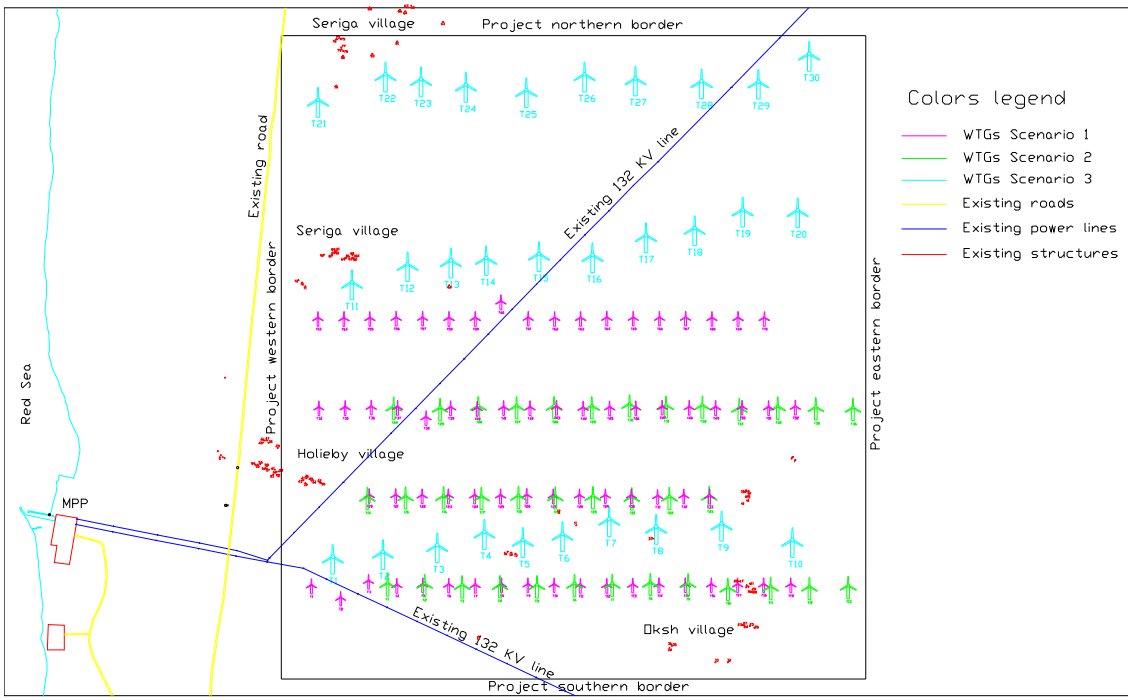


Figure 6-1: Layout of WTGs according to the three Scenarios

Although Scenario 3 has shown best investment cost/production ratio and best Operation & Maintenance (O&M) costs/production ratio, the decision about the most advantageous scenario has not been reached before the finalization of this ESIA. Many economic and engineering factors will effect the preference decision; however, in this section the three scenarios have been evaluated from an environmental and social perspective.

The environmental and social analysis of the three scenarios is based on giving preference to the following factors:

- Effectiveness of producing renewable energy and, hence, achieving better reduction in air emissions
- Causing less risks to birds
- Causing less noise
- Causing less shadow flickering impacts
- Causing less disturbance during construction to existing communities

6.2.1 Effectiveness in Renewable Energy Production

The more renewable energy produced from the project the less reliance on thermal power plants and accordingly less emission of air pollutants. The feasibility study of the project has estimated the annual energy production by each scenario through calculating energy losses (due to factors related to turbines type and their hub height), full load equivalent times which are demonstrated in Table 6-1 along with the correspondent CO_2 reductions if the same amount of energy were produced from small diesel generators[52].

Table 6-1: Resulting energy production analysis for the three scenarios

Energy production parameters	Scenario 1	Scenario 2	Scenario 3
Gross production (GWh/year)	222	238	259
Net production (GWh/year)	194	209	231
Full load equivalent hours/year	3263	3522	3844
Capacity factor	37 %	40 %	44 %
Proportional wake losses (eddy viscosity)	3.9 %	3.3 %	1.8 %
Correspondent CO_2 reductions (tons/year)	135,645	146,133	161,515

Accordingly to this factor Scenario 3 will generate more energy than the other two scenarios associated with more CO_2 reductions and accordingly will yield most environmental benefits from this aspect.

6.2.2 Less risks to Birds

The design of the wind farm plays an important role in increasing or reducing the risks of collisions. Large and high wind turbines reach greater altitude and occupy a large air space[53] and thus, in theory would increase the chance for bird-wind turbine collisions. However, the slower rate of rotation (rpm), smaller number of turbines, and greater visibility of the rotors is likely to make them less confusing to approaching birds; also the smaller density of turbines gives better spacing for birds to pass unscathed. In deed, there is a general agreement in the literature that smaller, faster, turbines placed in greater density are more risky for birds, and that the use of larger turbines reduces bird casualties.

The configuration of the wind turbines in relation to the direction of migration does not appear to be significant. However, the availability of gaps or corridors is generally regarded as a good measure to reduce the potential barrier effect of wind farms. Smallwood and Thelander (2004) found that wind turbines were most dangerous at the ends of turbines strings, at the edges of gaps in strings, and at the edges of clusters of wind turbines. Furthermore, the most isolated wind turbines killed disproportionately more birds.

[52] Assuming Emission Factor of 699.2 g/kwh for CO_2 as mentioned earlier in Chapter 5 (Table 5-3)

[53] This is the case for each single WTG, however, the total area swept by Scenario 1 turbines rotors is 184,940 m^2 (2,642x70), for Scenario 2 is 190,116 m^2 (36x5,281) and for Scenario 3 is 190,860 m^2 (30x6,362) which means the total swept area is less for Scenario 2, followed by Scenario 3 then Scenario 1

In this respect Scenario 3 is more favorable, because it entails the use of larger and fewer wind turbines (Gamesa G90 2 MW) than the other two scenarios which entail using smaller and more numerous and densely packed turbines, a set up that carries increased risk for birds.

6.2.3 Less WTG Noise

Generally WTG noise impacts depend largely on the source noise, and the hub height. If the source noise factor is equal between the three scenarios, the higher hub, in Scenario 3, is considered more advantageous because the noise divergence attenuation is more effective in that case.

It was mentioned in Chapter 5 that noise impacts at the area depend on the source noise at the nacelle, and that for a source noise of 102 dBA for Scenario 3 WTGs all houses, except one house in Serega, were located within noise zone of less than 45 dBA and all houses except 6 houses in Al Oksh and 9 houses in Serega are within area of less than 40 dBA. If the same calculations were applied to Scenarios 1 and 2 also the results are illustrated in Table 6-2, and illustrated in Figures 6-2 and 6-3

Table 6-2: Number of impacted houses by WTG noise according to the three scenarios

Village	Al Oksh			Al Houlibi			Serega		
	40 dBA zone	45 dBA zone	50 dBA zone	40 dBA zone	45 dBA zone	50 dBA zone	40 dBA zone	45 dBA zone	50 dBA zone
Scenario 1	24	7	2	0	0	0	4	0	0
Scenario 2	25	7	0	0	0	0	0	0	0
Scenario 3	6	0	0	0	0	0	9	1	0

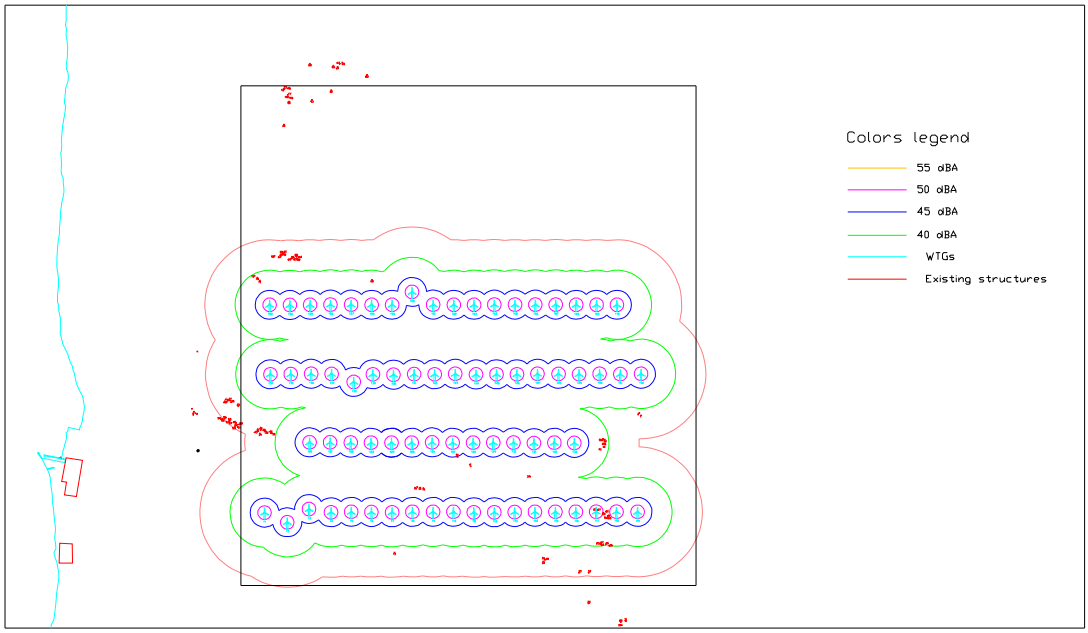


Figure 6-2: WTGs noise impacts for source noise at the nacelle 102 dBA according to Scenario 1 (approximate sketch)

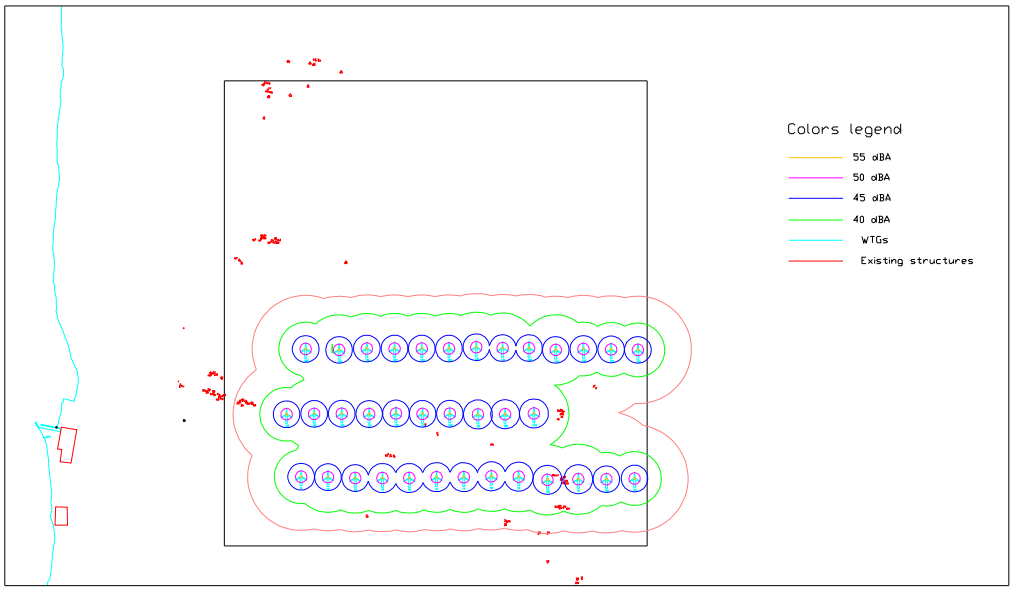


Figure 6-3: WTGs noise impacts for source noise at the nacelle 102 dBA according to Scenario 2 (approximate sketch)

Accordingly it has been considered that Scenario 3 is slightly preferred from the WTG noise stand point.

6.2.4 Less Shadow Flickering Impacts

Generally speaking higher WTGs impact larger areas, but this largely depends on the location of WTGs and shadow receptors in the area.

The astronomic/geometric calculations practiced for Scenario 3 resulted that 13 houses in Al Oksh and 22 houses in Al Serega will be at the edge of the impacted zone as previously mentioned in Chapter 5[54] (please refer to Figure 5-6). By applying the same calculations to Scenario 1 and Scenario 2 impacted zones are shown in Figures 6-6 and 6-7 respectively, the results of these calculations are also presented in Table 6-3.

Table 6-3: Number of impacted houses by shadow flickering according to the three scenarios

	Al Oksh	Al Houlibi	Al Serega
Scenario 1	19	6	1
Scenario 2	16	8	0
Scenario 3	13	0	22

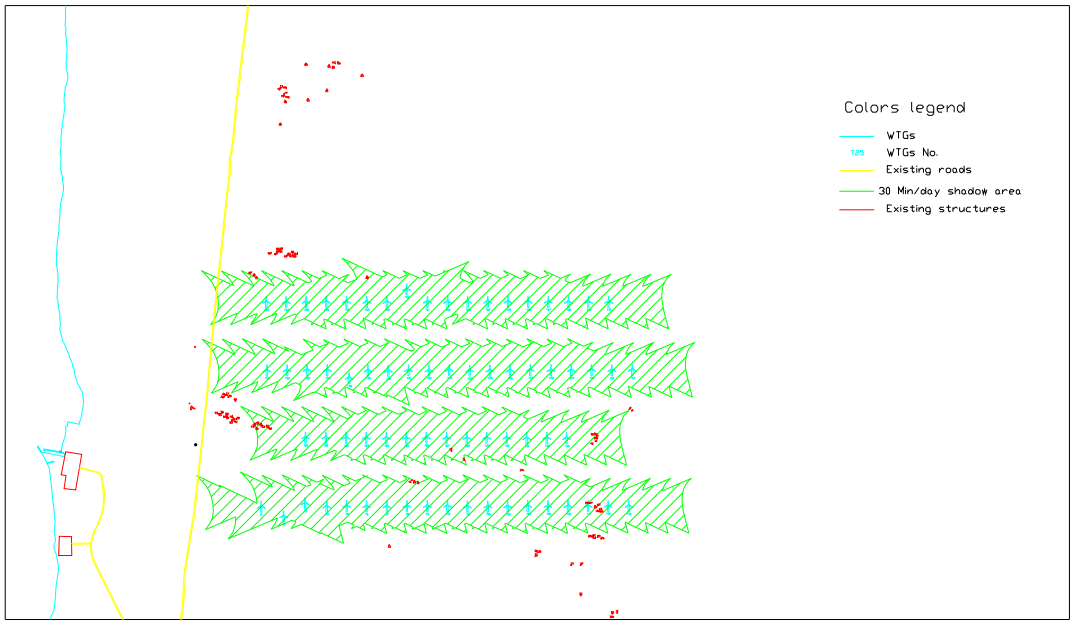


Figure 6-4: Sketch showing the impacted zone of shadow flickering of 30 minutes/day for Scenario 1

[54] These calculations were based on very conservative/exaggerating conditions as previously mentioned in Chapter 5

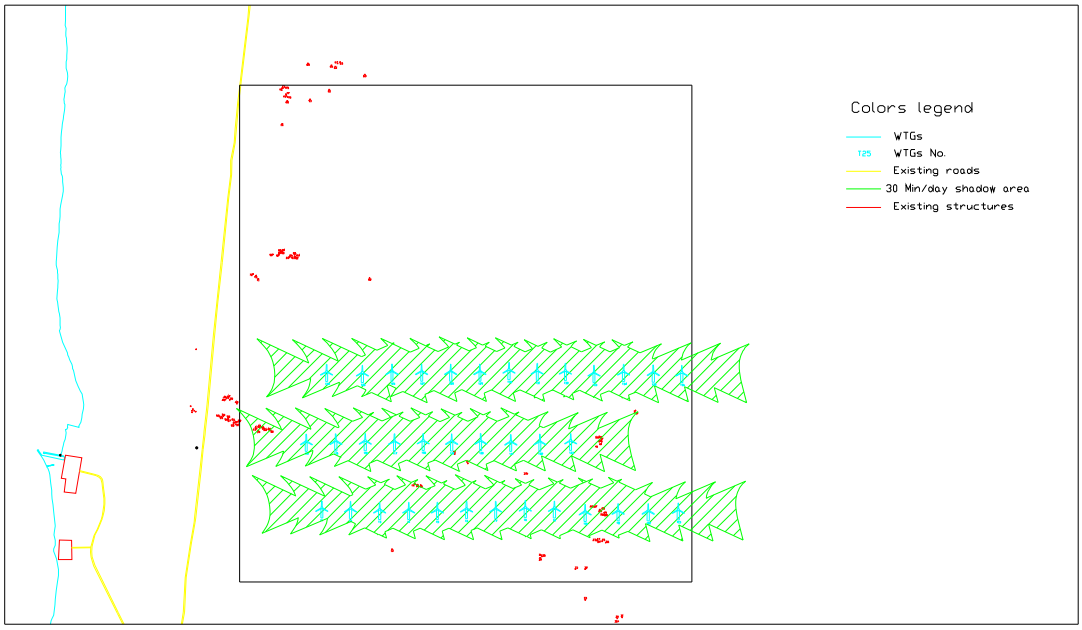


Figure 6-5: Sketch showing the impacted zone of shadow flickering of 30 minutes/day for Scenario 2

According to the results shown in Table 6-3 and taking into consideration total number of houses falling into the calculated shadow flickering zone, Scenario 2 will be slightly preferred over scenario 1 and 3 from this stand point.

6.2.5 Less Disturbance During Construction

Although larger turbines will require larger foundations the total volume of foundations and the correspondent generation of excavation waste and construction dust will be larger in smaller WTGs because of larger number of WTGs. Scenarios 1 and 2 is also associated with longer underground cable trenches and internal roads with means more generation of construction waste and dust, as well as more generation of scrap and maintenance waste during operation. Therefore scenario 3 is slightly preferred in terms of waste impacts.

In terms of impacts on traffic during supply and construction period, it is also believed that Scenario 3 is preferred, because the numbers of HGVs that will be used in the other two scenarios are much more, which means more disturbance for the traffic in the access road and longer traffic delays especially on the intersections.

In conclusion, Scenario 3 is considered more advantageous from the environmental and social perspective; however, the other two scenarios are not rejected but would require more mitigation measures for environmental and social impacts during construction and operation.It is worth noting that the final type and amount of WTGs will only be known after tendering process. It is expected that the EPC contractor will identify the exact locations of WTGs according to the site conditions during the project implementation, in which the micro-siting of WTGs could be slightly different than the preferred scenario, therefore the ESMP measures recommended in this study should be implemented in light

of the exact locations of WTGs which will be agreed between MoEE and the EPC Contractor during pre-construction phase.

6.3 Transportation Routes for Wind Turbines

The MWFP Feasibility Study has analyzed two alternatives for transportation routes for WTGs from the unloading harbor to the project site. The two alternatives are:

- Alternative 1: unloading WTGs parts at Al Mokha Harbor to suitable trucks which shall transport these parts to the site through the existing road from the harbor for a distance of about 10 km through the route shown in Figure 6-6. The advantages of this alternative from technical perspective is its proximity to the site and suitability of the access road as it is free from bridges and slopes that may not be suitable for passing the heavy trucks carrying turbines parts. According to the Feasibility Study the main disadvantage associated with this alternative is that Al Mokha Harbor has limitations for vessels drafts and Length (LOA) of 7.9 m and 150 m respectively, which may not be suitable to many large ships usually used for large distance trips such as from Europe to Yemen.
- Alternative 2: unloading at Al Hodeidah Harbour and transporting the parts through the coastal road from Hodeidah to Mokha for about 230 km as illustrated in Figure 6-7. The advantage of this alternative is that Al Hodeidah Harbor is equipped to receive larger ships (9.75 m draft and 200 m LOA), which is suitable to receive ships expected to carry the turbines parts. On the other hand, the disadvantages is the long road distance from the harbor to the project site which includes bridges and slopes that may not be suitable to passage of the heavy trucks carrying the turbines parts.

The first alternative was favored in the Feasibility Study because of its logistical benefits of being much closer to the project site, and that the access road does not have infrastructure limitation for the transportation convoy.

Figure 6-6: Transportation route from Al Mokha Harbor to the site according to Alternative 1

Figure 6-7: Transportation route from Al Hodeidah Harbor to the site according to Alternative 2

From environmental/social perspective the main factor that may be considered is the air pollutants that will be emitted from the transportation trucks which will be much higher in case the long route from Hodeidah Harbor. Also the longer distance and higher probabilities for facing infrastructure obstacles and other road obstacles will raise the risks of traffic congestions during the journey and the associated idle air emissions, noise and socioeconomic impacts associated with traffic congestions. Therefore, and given that a considerable number of trucks would be used in the transportation, Alternative 1 is preferred from an environmental/social perspective, given that the disadvantage of limited draft and LOA at Al Mokha Harbor could be feasibility overcome through choosing appropriate vessels to ship the turbines parts from the supplier's country.

6.4 Maintaining Local Community Living on the Project Site or Resettlement

In planning for the project, the selected site was found to be the most feasible technical wise. The fact that the existing households within this site are small, scattered informal type of settlement made it possible to establish the project within this proposed site with consideration for one of the following two alternatives:

- Alternative 1: Resettle the local residents within the project site and establish the wind farm with minimal micro-siting restrictions.
- Alternative 2: Allow local residents within the project site to maintain living in the settlement and ensure safety buffer zones are considered within the project design

The analysis of the pros and cons of the two alternatives scenarios helped on the selecting the more appropriate alternative on objective basis. Table 6-2 below presents the points of advantage and disadvantage in relation to each one of the two proposals.

Table 6-4: Pros and Cons of the resettlement/no resettlement alternatives

Alternative one	
Pros	**Cons**
- Technically, no distance restrictions will be imposed on the wind turbines micro-siting - No serious restrictions will be imposed on the construction crew mobility within the site. - There will be no negative social impacts from the project construction and operation existing population because no population will be existent within the site. - The land ownership formally belong the State	- Involuntary resettlement is a socially unfavorable alterative due to the uncountable negative consequences that associate with it (OP 4.12) - Local people are squatting on these land plots since long duration which give them the legal right to claim this land. - The current location within the project site provides numerous advantages from local people point of view. - According to the OP 4.12 of the WB, the resettlement process should be carried out as an integrated development program which is not limited to physical replacement and compensations. There is a question about the feasibility of this process considering the risk factors associated with the dominating negative perception and fear of people from this process and the fear that in all cases will be regarded as "involuntary".
Alternative Two	
Pros	**Cons**
- According to Op 4.12, efforts should be made to avoid involuntary resettlement to the extent possible. - The stakeholders' consultation interviews showed that people are reluctant to leave this location, in the first place. They are not in favor of accepting resettlement alternatives. - People will still be able to access housing and land, which are very valuable assets for them	- People will still be exposed to some negative temporary inconveniencies during construction - Maintaining the local community residence within this location is not a sustainable socioeconomic solution - There will be visual impact to the site residence, however, this may not be considered a negative impacts by some people.

- No serious resettlement consequences will be encountered - The impacts of WTGs noise and shadow flickering are minor and by adopting ESMP measures they will be within international standards	

From the analysis of Table 6-4 above and from the predicted project impacts analysis presented in Chapter 5, the ESIA team recommends alternative 2 in dealing with local communities within the project site. This scenario is perceived to be:

- More sensitive to the concerns of the local community and their interests in the area,
- An economically viable alternative
- A realistic alternative that understands the local community capabilities and work within these capabilities rather than being an over ambitious alternative with unattainable objectives.

The ESIA team believes that there will not be security restrictions during project operation except for the substation, control room and offices. Thus the access of local residence to their houses could be maintained and in this case, alternative two will be definitely the favorable one.

7. ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

The objectives of this Environmental and Social Management Plan (ESMP) are to initiate a mechanism for implementing mitigation measures for expected negative impacts and to monitor the efficiency of these mitigation measures based on relevant environmental and social indicators.

Due to the overlapping nature of the impacts, the social part of the ESMP is developed in the form of a comprehensive plan, rather than on impact-by-impact mitigation measures. It is also important to mention that one mitigation measure might in fact be addressing more than one impact. Reference will be made to these measures in their respective place.

As will be observed in the developed ESMP, the PMU shall be working closely with various stakeholders to ensure the efficient implementation for the ESMP. The concerned Governmental agencies, namely the MEE and Al Mokha Local Council are seen to play a crucial role for the success of the ESMP. The EPC Contractor is also a key party who has many responsibilities in the ESMP. NGOs in Al Mokha are also assumed to take a lead in many community related activities. Donors agencies should also be part of the coordination and their development interventions could be extended to approach the project affected groups. As previously mentioned, the project is a new model in Yemen, the involvement of external consultants to transfer the technical experience and provide the capacity building and training is very important to ensure the efficient implementation of the ESMP.

It has been proposed, as later detailed in this Chapter, to recruit a full-times Health, Safety and Environment Officer (HSE Officer) and a Social Development Officer (SDO) to play as focal points for implementing the environmental and social mitigation measures respectively. For documentation of the ESMP it has been proposed that a Monthly Progress Report should be submitted to the PMU Manager including achieved tasks during the month. These requirements are further detailed below.

7.1 Environmental and Social Management Plan During Construction Phase

7.1.1 Management of Construction Wastes

Mitigation Measures:

- Prior to excavation works at the site there should be planning for transferring excavation waste, in excess of the construction needs, to cover the dumpsite[55] south of the project site through including this requirements in the earthworks tender.
- The PMU should coordinate with the Local Council to enforce closure of the site and stopping dumping activities before starting excavation process in the project site.

[55] Closure of the dumpsite is a requirement for reducing attractions to birds in the region as shall be further elaborated in the ESMP

- Stockpiling of construction waste at the site should be as minimum as possible. The EPC Contractor should arrange for enough waste trucks so that the excavators will directly load the waste in the truck. In all cases, if limited waste stockpiling is to take place, arrangement should be taken to transfer this waste to the dumpsite at the end of the working day.
- The EPC Contractor should make sure that the waste tipping truck is dumping the waste above existing waste so that the waste would be covered. A loader may be needed to distribute the soil over the waste so as a layer of 30cm soil cover could be maintained.
- EPC Contractor should not leave any construction waste behind after finalizing their work. Temporary storage area of construction waste (such as woods, metals and bricks) should be identified, and waste storage at this area should be on classified basis.
- The site will have a specific area for storing hazardous materials (oils and fuels) this area should have signs clearly posted indicating that the area is used for storing hazardous substances. The area should be lined with suitable impermeable lining materials and bordered by suitable bounds to form a secondary containment for any spills. Any fuel storage tanks (such as diesel tanks for the generators) should also be surrounded by a secondary containment with 110% of tank's capacity.
- The EPC Contractor should make arrangement for sound management of empty oil containers either by making a documented agreement to return such containers to their suppliers for reuse, or through safe disposal in a special cell in the proposed new disposal site for Al Mokha City[56].
- There should be sufficient garbage bins distributed in different locations of the staff offices and accommodation camps. The EPC Contractor should make a documented agreement with a waste collection entity to transfer the waste to the city waste disposal site on frequent basis
- The EPC Contractor should provide a sufficient sewage collection underground water tight tank. There should be documented agreement with a tanker truck to frequently evacuate the sewage tank.

It is worth noting that the EPC tender document will have a clear condition to prohibit the use of any asbestos containing materials in the temporary offices and equipment as later indicated in Section 7.1.3.

Monitoring Activities:

- Coverage percentage of the existing dumpsite by excavation waste should be monitored by the HSE Officer on monthly basis
- Amounts of hazardous substances handled in site and amount of hazardous waste containers should be monitored by the HSE Officer and reported on monthly basis.

[56] As mentioned above the dumpsite will be closed and another site will be prepared. It is proposed that the engineering study for the new site shall be sponsored by the MWFP to encourage the City Council to take this step, and accordingly it is expected that the new site will include a secure cell for special waste as shall be further illustrated later in the ESMP

Reporting
The HSE Officer should report waste management procedures mentioned in the technical proposals of EPC Contractors to the PMU manager, this reporting should be associated with technical scoring for these tenders according to their waste management commitments. The HSE Officer should also report on his satisfaction about the compliance of the EPC Contractor to his waste management commitments, which should be considered when finalizing the EPC Contractor invoices, and results of the monitoring activities on his monthly progress reports submitted to the PMU Manager.

7.1.2 Reducing air emissions

Mitigation Measures:
- The EPC Contractor should provide a sufficient source of water at the construction site, probably through digging groundwater wells, for wetting the soils before excavation and transfer, wetting roads sub-base aggregates before application, and wetting internal routes of trucks and heavy machinery before use. In case the HSE Officer noticed high dust emissions at a certain location he should ask the contractor for more soil/aggregate wetting.
- The EPC Contractor will be requested to provide emissions certificate for the machines and vehicles that will be used at site. This shall be a requirement in the tendering procedures and should be supervised by the HSE Officer during construction
- No asbestos temporary constructions should be used. Again this should be a requirement in the tender document and should be inspected by the HSE Officer during construction.

Monitoring Activities:
- TSP and PM10 should be monitored at locations of Al Houlibi, Al Oksh, Al Serega settlements on quarterly basis during construction, with the first monitoring taking place prior to construction works

Reporting
The HSE Officer should prepare an evaluation reports for contractors technical proposals mentioning whether the above measures are included as a contractor commitment or not, and the correspondent technical score of the offer based on these measures. The HSE Officer should also report on his satisfaction about the compliance of the EPC Contractor to these commitments, which should be considered when finalizing the EPC Contractor's invoices, this along with the results of the monitoring activities should be reported on HSE Officer monthly progress reports submitted to the PMU Manager.

7.1.3 Management of Construction Noise and Vibrations

Mitigation Measures:
- Workers in noisy areas (noise levels more than 85 dBA) should put suitable ear muffs. The EPC Contractor should arrange worker's shifts so that workers exposure to noise is within acceptable range.

- Construction activities, especially close to existing settlements, should be only during day time (from 7:00 to 18:00) except in emergency cases.
- During construction of the north-south connecting internal road near Al Holeibi settlement the EPC Contractor may need to place acoustic barriers on both sides of the construction site. The same also applies to the southern internal road (near T5, T6 and T9) which is close to Al Oksh village[57]. This measure should be planned before construction activities starts, through estimating height and extent of the acoustic barriers that will be placed at different stages of the road construction and making arrangements for supplying the suitable type of barrier.
- Prior to construction activities, the structural conditions of the existing houses at the four settlements should be studied against possible vibrations that will take place during piles driving. This study should be undertaken by the EPC Contractor who should be responsible for any impacts on the existing houses due to construction vibrations..
- Any requirements to improve the structural strength of some existing houses, or to establish cutoff barrier through to absorb vibrations should be implemented by the EPC Contractor
- Placement of site power generator, and temporary offices a far as possible from existing settlements, preferably at the entrance of the site far enough south of Holeibi settlement.

Monitoring Activities:

- Monthly measurements of ambient noise levels should be undertaken at the locations of the nearest settlements to construction activities during the construction phase.
- The above measurements should be done on daily basis during construction of the road stretch (1 km) located near local settlements, as previously shown in Figure 5-1.

Reporting:

The structural status report will be submitted by the EPC Contractor to the PMU Manager. During construction stage the HSE Officer will submit monthly Progress Reports which will include the level of satisfaction of the HSE Officer about the compliance of construction workers in using ear muffs in noisy areas, compliance of working hours, along with noise monitoring reports. Any measures taken for protecting existing houses from noise and vibrations should also be reported in relevant Progress Reports.

7.1.4 Reducing Impacts on Traffic

Mitigation Measures:

- The access road between Al Mokha Harbor and the project site should be thoroughly studied from the structural stand point. An engineering report should be submitted by the EPC Contractor, as part of his commitments, and approved by

[57] Changing the location of the north-south road seems very difficult and un-economic to prevent proximity to 7 houses at Al Holibi

the Public Works Directorate. Any week areas should be adequately maintained in coordination with Public Works Directorate before starting the WTG shipment.

- A detailed traffic management plan should be prepared for the HGVs that will be employed in transferring WTGs parts from Al Mokha Harbor to the project site. The plan should be prepared by the WTG supplier, under PMU supervision, and approved by the Traffic Department. The plan should identify the travel times and duration of WTGs convoys, and the duration where it will pass the two main intersections with the Coastal Road and Al Mokha-Al Mafraq Road.
- The PMU should advise the users of the roads about the times that the WTG convoys will pass the access road and the expected delays during these times. These should be done through placing banners and signs along the access road and intersections in coordination with the Traffic Department. These banners and signs should include mechanism for receiving complaints for unaccounted for delays.
- The supplier should coordinate with Al Mokha Harbor Authority for the areas allocated for WTG trucks waiting so as not to obstruct traffic flow within the port. The number of HGVs that could park in this area should coincide with the overall traffic plan and the supply time of WTGs.
- The PMU should coordinate with the Traffic Department the most suitable times for transferring materials and goods from and to the site. This should be done in an early stage so that these suitable times should be included in the tender documents as part of suppliers commitments.

Monitoring Activities:

- Journey times and times of passing main intersections should be monitored by the HSE Officer for each WTG convoy
- Number of complaints about traffic delays due to WTG convoys should be monitored by the HSE Officer

Reporting

The reports describing the structural condition of the access road and the detailed traffic plan for WTGs convoys should be attached to the following HSE Progress Reports following their submission. Results of monitoring activities should also be reported by HSE Officer in his Progress Reports along with correspondence with Traffic Department, Harbor Authority, Public Works Department or any other governmental body.

7.1.5 Minimizing Risks to Workers and Local Community

Mitigation Measures:

- The tendering procedure for all equipment supply and construction works should include considering safety measures in and around the construction site. The tender documents should include requirements for EPC Contractor to submit an integrated safety plan tailored to the site conditions. The technical evaluation of tenders should give high scoring weight to safety measures that are proposed by EPC Contractors.

- The EPC Contractor should assign a safety contact person among his field staff. All workers in the site should have safety induction training before being admitted to the site. Signed attendance sheets of site safety induction should be available with the EPC Contractor contact person.
- During the construction period the HSE Officer should inspect the adherence of workers to safety precautions.
- Communicate health and safety tips with inhabitants of local community. This shall be supervised by Feedback and Complaint Committee described in more details later in this ESMP.

Monitoring Activities:

- Number and type of accidents should be monitored on monthly basis by the HSE officer of the SPC.

Reporting

The HSE officer should report on scoring of safety issues in the technical proposals (of EPC Contractors) to the PMU manager. Induction training attendance sheets and any comments on the contractor's adherence to the safety plan will be reported by HSE Officer on monthly progress report submitted to PMU Manager.

7.1.6 Reducing Inconvenience to Local Residents on the Project Site

It should be noted that full cooperation with local communities and other stakeholders is very critical in order to implement the construction with minimal inconvenience and to gain the support of local communities to the project. It is the EPC Contractor responsibility to ensure that the various steps of the project are developed in a fashion that is acceptable to the local communities. It is crucial to set notification mechanism with community members to inform them about the activities of construction and the potential impacts in a transparent manner.

The following are the main recommended mitigation measures that aim to minimize this impact:

1-Set and Activate an Efficient Feedback and Complaints Mechanism

It is recommended to set a feedback and complaints mechanism as a method that encourages local communities to express concerns and spell out complaints during the construction phase. The proposed mechanism should highly consider the local conditions and should be designed in the way that stimulates local people to participate. Considerations like accessibility issues, the educational status, and the culture of the community should be considered in designing this mechanism. It is recommended in this regard to form a Feedback and Complaints Committee (FCC) to be in charge of listing to local communities' complaints and work to solve these issues. FCC function will not be limited to the construction phase. It will rather have critical role along the project cycle.

FCC Composition

- A representative from the PMU, namely the Social Development Officer (SDO) (will be mentioned in more details later)
- A representative from the local Council
- A representative from the local NGOs (preferably a male and a female representative)
- The field Inspector
- Community leader/facilitator (male and female representative)

FCC Roles and Responsibilities

The FCC is designed with the main objective to work as a safeguard mechanism for the interests of local people along the project. The FCC should be accessing the local community and should rely to the extent possible on verbal one-to-one communication or group discussions in order to ensure the tools convenience to the educational status of the targeted audience. FCC should arrange regular meetings (semimonthly) to the project site, interviews residents, listen to complaints and record them in writing during construction. FCC should take actions to respond to the raised complaints.

FCC may also assist in sharing the different notifications with local communities on behalf of the contractor. It also should be responsible on disseminating the health and safety messages and answer community members related questions.

It should be noted that the FCC is a mechanism that will also serve in mitigating plenty of the other impacts, particularly through the involvement of FCC members in monitoring the mitigation measures, as will be referred to below.

Reporting

The PMU, represented by the SDO should be responsible on leading the different activities related to the formation and activation of the FCC. He/She also should report on the progress and integrate the findings and lessons learnt into the project periodic progress reports.

2- Residents Notifications and Information Sharing

There is a need for a transparent mechanism to ensure that different information related to the construction activities are well shared with local people and that they are notified with the different noisy activities, their times and impact in order to ensure that people will adhere to the safety measures.

The proposed FCC should play a role in this regard both by assisting the contract in information dissemination during their regular meetings with the community members as well as monitoring the contractor compliance to his obligation in announcing notifications, as mentioned.

Reporting

– Field inspector monitoring report

– FCC filed visit report

3- Give Priority to Local People in the Generated Job Opportunities and in Accessing Electric Power / LPG

As mentioned in Chapter 5, the more involvement local people have in the project benefits, the more tolerant they are with the potential negative impact. In other words, the project should encourage the "pain/gain share approach" by ensuring that local communities share the returns of the project in order to ensure they are supporting the project. As indicated earlier, excluding local community from sharing the benefit not only generates a sense of rejection to the project, it might rather stimulate a sense of dissatisfaction that might lead to aggression and undesired reactions.

In that sense, there is a need to ensure that local communities on the project area, to the extent possible, benefit from the generated job opportunities particularly during construction because this phase will more likely involve a need for some low and unskilled labour. This, on one hand is considered an economically viable option for the project and on other hand, the provided employment are perceived as a type of compensation for the negative impact that could be caused by the project. Engineering and contractual opportunities should be, in the first place, targeting Al Mokha Directorate residents and they should be given a priority in the provision of these opportunities. Training and capacity building programs should be considered as a preparatory step for the different jobs.

The settlements in and near the project site should be connected to the power distribution network, their existing deprivation from accessing electric power, if continued after implementation of the project, will lead to dissatisfaction and feeling of discrimination among the local population. Also, for the same reasons, Al Mokha power access to Al Mokha Directorate should be significantly improved after the implementation of the project. Also it is proposed that the project should assist the local people for accessing LPG and associated cooking facilities, in order to eliminate/reduce their need for logging in or near the project site[58].

Monitoring Activities:
- Review the contactor personnel lists
- Review connected households in project area and Al Mokha to power distribution grid

Reporting
The PMU should be responsible on monitoring and reporting the numbers of local community members who get engaged in the created jobs by the project. SDO should report this on quarter, semi annual and annual report

[58] Logging in the project site and within a buffer zone of 3 km from the site borders will be prohibited as a mitigation measures for reducing birds attraction to the site as shall be indicated later in the ESMP

4- Contractual Procedures and Conditions

Contractual conditions and field monitoring are considered the main required mitigation measures to minimize the level of inconvenience that might generate as a result of the construction activities. The conditions of the contract should consider the following and penalties should be enforced in case of violating any of these conditions:

- Locating a timely schedule for the construction activities
- Ensuring the different safety measures in the way that allows local people to maintain their activities to the extent possible. This could involve providing them with secured routes for community members to use in accessing and getting off the site.
- Allowing village residents to maintain the different economic activities including grazing, but in safe zones that should be defined in an early stage with full consultation with the community.
- Provide the needed security measure to protect local communities' property

Reporting
The field inspector should report on regular basis to the PMU. FCC should also record observation during the site visits and integrate into their monthly progress reports.

7.1.7 Management of Chance Finds of Culturally Valuable Objects and Structures

Although the project site does not include culturally valuable objects or structures, the following measures have been included in the ESMP to safeguard against any chance finds of cultural objects or structures during the earthworks that will be carried out in the construction phase:

- The HSE Officer should communicate with General Authority for Antiquities and Museums (affiliate to Ministry of Culture) prior to construction works to have a contact person for reporting any chance finds.
- In case an object is found during excavation that seems to be antiquity object or part of an old structure the HSE Officer should order immediate cessation of excavation works, leaving the object exactly on its found location, taking photographs to document time and status of the object, assigning guards to watch the found object and contacting the General Authority for Antiquities and Museums to handle the site.

Reporting:
In case of chance finds of culturally valuable objects the documentation procedures mentioned above should include be reported in the monthly progress reports prepared by the HSE Officer including date, time and exact location of the found object, in addition to the followed procedures until the object has been handled by, or the site has been cleared, the General Authority for Antiquities and Museums.

7.2 Summary of Pre-Construction measures that should be Taken

Because many important activities should be undertaken in the pre-construction phase the following measures, which should be implemented by the PMU prior to starting construction works, are summarized and listed so that they could be easy to follow up during the pre-construction phase:

- Because the existing waste dumpsite located south of the project site should be closed prior to starting construction activities of the project to eliminate birds attractions near the project site, as shall be further elaborated in Section 7.3, the PMU should ensure that environmental and engineering studies for identification of an alternative site for solid waste disposal, a landfill, of Al Mokha City should be completed well before starting construction activities of the project. The new landfill site should be agreed upon by all concerned stakeholders and, once this agreement is reached, the above studies should include engineering designs and cost estimate for construction and operation of the disposal site. The new landfill site should be suitable to receive all waste generated from the city, including animal carcasses received in the Harbor, in order to eliminate the need for using other dumpsites. The sources of finance to meet construction and operation costs of the new disposal site should be agreed upon prior to starting construction activities of the MWFP. **No construction activities should take place at MWFP site before these engineering and feasibility studies are completed and approved upon by all stakeholders. Erection of WTGs should not start before the new site is fully operational and the existing dumpsite south of the project site is completely covered**.
- Prepare MoU to be signed by MEE, Local Council, Harbor Authority and other concerned stakeholders to prevent waste disposal at the dumpsite south of the project location and to establish a 3 km buffer zone where land reclamation, or any other development that could pose a threat to migratory birds by creating potential foci of attraction for birds, should be prevented. This MoU should include implementation procedures and responsibilities of each party. The signature of this MoU is a pre-condition for starting construction activities of the MWFP.
- Establish Feedback and Complaints Committee (FCC) to be in charge of listening to local communities' complaints and work to solve these issues. The formation of the FCC should be considered during this early stage of the project.
- Set-up mechanisms for connecting local people to the electricity grid and providing them access to LPG and start working to connect local communities with external funds and development programs.
- Identify contact person from and procedures General Authority for Antiquities and Museums and certain procedures to follow in case of chance finds of objects or structures of that could have cultural value.

- Receive detailed micro-siting plan from EPC Contractor that ensures that WTG noise and shadow flickering impacts are within permissible limits as identified in this ESIA.
- Estimating height and extent of the acoustic barriers that will be placed at different stages of the road construction and making arrangements for supplying the suitable type of barrier. The EPC contractor should submit a report about this prior to construction phase.
- The following conditions should be included in the tender document for selecting EPC Contractor:
    - Preparation of construction waste management plan and procedures for covering the existing dumpsite as part of the technical proposal
    - Requirement of prior wetting of soil during excavation works
    - Requirement of complete ban for the use of any asbestos containing materials in construction activities
    - Requirements of emission certificates for used machinery and engines during construction
    - Requirement of limiting noisy construction works between 07:00 and 18:00, of providing construction workers, who will be in noisy areas, ear muffs and of adjusting the shifts of these workers to ensure safe noise exposure
    - Possibility of the need for using acoustic barriers, during internal roads construction, on both sides of roads construction locations near existing settlements.
    - Requirement for Preparing structural condition report about existing settlements to assess if they would bear construction vibrations, and that any impact on the structural integrity of existing houses, caused by construction works, will be full responsibility of EPC Contractor
    - Identify technical scoring weight for EPC safety measures and policy, source noise of WTGs, procedures for recycling WTG parts that will be removed during maintenance and decommissioning, and experience in maintaining structural stability of WTGs especially in hot and humid conditions.
    - Requirement of supervising construction of WTG foundations by skilled EPC Contractors staff
    - Requirement for giving priority for local residence in job opportunities especially for unskilled labor
    - Enforcing penalties in case of violating the following conditions:
        - Locating a timely schedule for the construction activities
        - Ensuring the different safety measures in the way that allows local people to maintain their activities to the extent possible. This could involve providing them with secured routes for community members to use in accessing and getting off the site. This should be done through regular consultation with local communities.

- Allowing village residents to maintain the different economic activities including grazing, but in safe zones that should be defined in an early stage with full consultation with the community
- Provide the needed security measure to protect local communities' property

Table 7-1: Environmental and Social Management Plan Matrix during Construction Phase

Potential Impact	Proposed Mitigation Measures	Project Phase	Institutional Responsibility for Implementation	Responsibility of direct supervision	Means of supervision	Estimated Cost (US $)
Impacts of construction wastes	Include waste management issues in the tendering procedures for selecting contractors	Tendering	SPC/HSE Officer	PMU Manager	Review waste management scoring of tenders	Management costs
	Coordinate with Local Council to enforce dumpsite closure prior to construction works	Preconstruction	PMU Manager	PMU Manager	Ensure effectiveness of site closure	Management costs
	Direct transfer of excavation waste to the dumpsite with minimum stockpiling	Construction	EPC Contractor	HSE Officer	Site supervision	Costs of construction bids
	Effective coverage of waste at the dumpsite	Construction	EPC Contractor	HSE Officer	Site supervision	Cost of construction bids
	Prepare suitable area for storing hazardous substances properly mark it and provide it with secondary containment	Construction	EPC Contractor	HSE Officer	Site supervision	Cost of construction bids

Potential Impact	Proposed Mitigation Measures	Project Phase	Institutional Responsibility for Implementation	Responsibility of direct supervision	Means of supervision	Estimated Cost (US $)
	Sound disposal of empty oil drums and hazardous waste	Construction	EPC Contractor	HSE Officer	Review disposal documents	Cost of construction bids[59]
	Provide sufficient garbage bins and regularly collect garbage	Construction	EPC Contractor	HSE Officer	Site supervision and review disposal documents	Cost of construction bids
	Provide sufficient sewage collection tank and frequently evacuate it	Construction	EPC Contractor	HSE Officer	Site supervision and review disposal documents	Cost of construction bids
Impacts of construction air emissions	Include requirements for prior wetting of soil, efficient combustion machinery and ban on asbestos use in tender document	Tendering	HSE Officer	PMU Manager	Review tender document and evaluation reporting	Management cost
	Wetting soil and aggregates before earth works	Construction	EPC Contractor	HSE Officer	Field supervision	Cost of construction bids[60]

[59] It is worth noting that because this item, as long as the above three items, are not regularly undertaken measures by contractors in Yemen the PMU should expect that construction bids costs will be slightly higher than normal

[60] This may slightly raise constructions bids as it may require digging groundwater wells, therefore allowance of $ 50,000 have been added to the ESMP budget to cover expected higher costs of construction bids related to ESMP measures

Potential Impact	Proposed Mitigation Measures	Project Phase	Institutional Responsibility for Implementation	Responsibility of direct supervision	Means of supervision	Estimated Cost (US $)
	Provide machinery with efficient combustion engines and provide emission certificates	Construction	EPC Contractor	HSE Officer	Review emission certificates	Cost of construction bids
	Prohibit use of asbestos in temporary offices or any construction materials	Pre construction and Construction	HSE Officer to include in tender document and EPC Contractor to implement	HSE Officer	Field inspection	No cost
Impacts of construction noise	Construction workers working in areas of noise levels of more than 85 dBA should wear PPEs with working shifts suitable to noise levels	Tendering and Construction	HSE officer to include measures in tender document and EPC Contractor during construction	HSE Officer	Site inspection	Construction costs
	Construction works should be limited to day time from 07:00 to 18:00	Tendering and Construction	As above	HSE Officer	Site inspection	Construction costs

Potential Impact	Proposed Mitigation Measures	Project Phase	Institutional Responsibility for Implementation	Responsibility of direct supervision	Means of supervision	Estimated Cost (US $)
	Provide acoustic barriers on both sides of roads construction for internal roads near Al Houlibi and Al Oksh settlements	Tendering, preconstruction and Construction	EPC Contractor	HSE Officer	Site inspection	Construction costs[61]
	Prepare structural condition report for existing structures to assess if they would bear vibrations	Preconstruction	EPC Contractor	HSE Officer	Review report	Construction costs
	Implement identified measures for protecting existing houses from construction vibration	Construction	EPC Contractor	HSE Officer	Field inspection	Construction costs[62]
	Locate power generators and staff camp as far as possible from existing houses	Construction	EPC Contractor	HSE Officer	Field inspection	Construction costs
Impacts on traffic	Undertake structural review about the condition of the access road from Al Mokha Harbor to the project site	Construction	EPC Contractor	PMU and Public Works Directorate	Review report	Cost of supplier

[61] This measure has been included in a total allowance of $ 50,000 to the ESMP budget to cover expected higher costs of construction bids related adding this measure to the tender

[62] As above

Potential Impact	Proposed Mitigation Measures	Project Phase	Institutional Responsibility for Implementation	Responsibility of direct supervision	Means of supervision	Estimated Cost (US $)
	Prepare detailed traffic plan for WTGs convoys throughout the supply period	Construction	EPC Contractor	PMU and Traffic Department	Review report	Cost of supplier
	Advise road and intersections users about expected delay and complaint mechanism	Construction	HSE Officer and Traffic Department	PMU Manager	Review awareness reports	PMU costs
	Ensure HGV waiting area in the Harbor is sufficient and complies with the traffic plan	Construction	EPC Contractor	HSE Officer and Harbor Authority	Review available area and documents	Cost of supplier
	Identify preferable times for transfer of materials and goods from and to the project site	Tendering	HSE Officer in coordination with Traffic Department	PMU Manager	Review correspondence and tender documents	Management costs
Risks on Workers and Local Communities	Include safety issues in the tendering procedures for selecting contractors	Tendering	SPC/HSE Officer	PMU Manager	Review safety scoring of tenders	Negligible additional costs
	Provide safety induction training to construction workers	Construction	EPC Contractor	HSE Officer	Review training attendance sheets	Negligible additional costs
	Inspect workers compliance with safety measures	Construction	EPC Contractor	HSE Officer	Visual inspection	Negligible additional costs

Potential Impact	Proposed Mitigation Measures	Project Phase	Institutional Responsibility for Implementation	Responsibility of direct supervision	Means of supervision	Estimated Cost (US $)
	Communicate safety tips with local community	Construction	EPC Contractor	FCC Site Inspector	FCC meetings with stakeholders Site observation	Negligible additional costs to construction bids
Inconvenience to Local Residents on the Project Site	Set and activate Efficient Feedback and Complaints Mechanism	Pre construction Construction	PMU Local Council NGOs	PMU (SDO)	FCC meetings with stakeholders	50,000[63]
	Residents Notifications and Information Sharing	Construction	EPC Contractor	FCC Site Inspector	FCC meetings with stakeholders Site observation	Negligible additional costs to construction bids
	Give Priority to Local People in the Generated Job Opportunities	Pre construction and construction	PMU (SFO) Contractor	FCC	Review of contractor's reports	Negligible additional costs to construction bids
	Provide access to local people to electric power and improve power network at Al Mokha Directorate	Pre construction and construction	MEE	PMU	Review power connection plans	Costs of MEE distribution network

[63] This budget is allocated to cover all the logistical and procedural requirements of the FCC during the construction period. This might include, but not limited to, expenses related to arranging meetings, incentives for members, transportation, stationary …etc.

Potential Impact	Proposed Mitigation Measures	Project Phase	Institutional Responsibility for Implementation	Responsibility of direct supervision	Means of supervision	Estimated Cost (US $)
	Contractual Procedures and Conditions	Pre construction and construction	EPC Contractor	PMU FCC Site Inspector	Review of contractor's reports Site Supervision	Negligible additional costs to construction bids
Chance finds of culturally valuable objects or structures	Identify contact person from the General Authority for Antiquities and Museums	Pre construction	HSE Officer	PMU Manager	Review procedures	Management costs
	Apply chance finds procedures to found suspected culturally valuable objects or structures	Construction	HSE Officer	PMU Manager	Site supervision – review procedures	Management costs

Table 7-2: Environmental and Social Monitoring Plan Matrix during Construction Phase

Potential Impact	Monitoring Indicator	Monitoring Location	Monitoring Methods	Monitoring Frequency	Monitoring Responsibility	Estimated Cost
Impacts of construction wastes	% coverage of the existing dumpsite with excavation waste	Dumpsite south of the project location	Visual estimation of covered areas to the total dumpsite area	Monthly	HSE Officer	Management costs
	Amounts of hazardous substances handled in the site	Project site	Counting containers of hazardous substances and loads of bulk substances	Counting with admission of substances and monthly reporting	HSE Officer	Management costs
Impacts of construction air emissions	TSP and PM_{10}	Holieby, Oksh, and Serega settlements	Sampling ambient air quality	Quarterly	Independent laboratory	Allow 5,000
Impacts of construction noise	Noise levels	Nearest houses in Holieby, Oksh, and Serega settlements to construction locations	Taking measurements by noise meters for a representative duration	Monthly	HSE Officer	10,000 for two noise meters
	Noise levels	Nearest houses in Holieby, and to roads construction	Taking measurements by noise meters for a representative duration	Daily	HSE Officer	Included in above item

Potential Impact	Monitoring Indicator	Monitoring Location	Monitoring Methods	Monitoring Frequency	Monitoring Responsibility	Estimated Cost
Impacts on traffic	Duration of WTG convoys trips and duration of passing intersections	Access road from the Harbor to the project site	Time recording by a stopwatch	Daily during supply time	HSE Officer	Management costs
Risks on Workers and Local Communities	Number and type of occupational accidents	Project site	Reviewing accidents reports	Monthly site progress reports	HSE Officer	Management costs
Inconvenience to Local Residents on the Project Site	Number of local people employed by the project	Project site	Reporting labour origin and calculate numbers of laobourer from the village	Quarterly	PMU	Management costs
	Number of households in the project site and Al Mokha at large connected to power grid	MEE	Review power distribution action plans and addresses of connected households	Quarterly	PMU	Management costs

7.3 Environmental and Social Management Plan During Operation Phase

7.3.1 Minimizing Risks to Birds

Mitigation measures:

- The municipal dump site located south of the project site should be closed for waste dumping activities, fresh waste covered before the erection of the WTGs and another location; at least 5 km from the project borders should be identified for solid waste disposal. The waste coverage could be done using excavated soils for establishing the WTGs foundations which shall be undertaken by the EPC Contractor under supervision from the HSE Officer. As indicated earlier in Section 7.2, **No construction activities should take place at MWFP site before engineering and feasibility studies for identifying and designing new waste landfill are completed and approved upon by all stakeholders. Erection of WTGs should not start before the new landfill is fully operational and the existing dumpsite south of the project site is completely covered**. Stopping further waste dumping at the site shall be monitored by the local authority, which is the enforcing body, in coordination with the HSE Officer, who shall report for waste dumping activities, and the Mokha Port Authority, as it is the source of many dumping activities at the site. MEE should prepare a Memorandum of Understanding (MoU) with the Local Authority and the Harbor Authority to activate the above measure and to direct waste disposal activities to the new site. As an incentive to the local authority for relocating the disposal site, the detailed technical and environmental studies for identifying the new location shall be from the ESMP budget. It is worth noting that the location and the source of finance for construction and operation of the new disposal site should be clearly identified in an early stage of the project planning, well before starting excavation works, to ensure the implementation of this measure. Accordingly all technical and environmental studies regarding transferring the disposal site, along with the proposed MoU, should be completed well before the construction works start as earlier indicated in the measures that should be implemented during the pre-construction phase (Refer to Section 7.2) .
- Prevent agriculture reclamation of land in a rectangular area within a buffer zone of 3 km around the project borders. The MoU mentioned in the above point should include this measure, in which this buffer zone should be respected in allocating land for reclamation. The HSE Officer should monitor any unauthorized cultivation in this buffer zone and report it to the local authority. Prevent also any logging activities in the site or in the buffer zone identified in the above point. Again this will be enforced by the local authority and monitored by the HSE Officer.

Turbine design

- To reduce potential bird wind turbine collisions, it is thought that fewer larger, slower wind turbines that are more widely spaced are preferable to greater

numbers of smaller, faster, more densely packed wind turbines. It is strongly recommended to adopt the first option proposed by NIPSA and Mercados (2009) which entails the use of larger and fewer wind turbines (Gamesa G90 2 MW).

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- Lattice towers should be avoided as these afford perching and potential nesting opportunities to birds. It is preferred that the towers be smooth, tubular shells. External ladders and platforms on tubular towers should be avoided placing to minimize perching and nesting sites. No guy support wires should be used for the towers or other structures. Where guys must be used, they should be marked with the recommended bird deterrent devices (Manville 2005).

Wind Turbine Placement and Spacing

- Turbine arrays should be configured to avoid potential avian mortality where feasible. The studies reviewed recommend that turbines be placed in a line formation parallel to the main flight direction to reduce bird strikes. The turbine arrays proposed by NIPSA and Mercados (2009) run east to west, perpendicular to the northerly bird migration orientation in autumn. However, we do not see this as a matter of concern as the size of the development is limited and spacing between turbines should be large (if the large Gamesa G90 2 MW are used).
- Some studies recommend having corridors or ample space between individual turbines or rows or clusters of wind turbines to reduce collisions by providing room for birds to fly and maneuver between the wind turbines should they venture into the farm. USFWS (2003) suggested that turbines should be grouped rather than spread widely. BirdLife International (2002) recommended a loose cluster to be the best arrangement. The American Birding Conservancy (2004) proposed wide corridors between clusters of turbines and breaking up lines of turbines. Decon-Fichtner (2008) recommended that the minimum distances between wind turbines to be not less than 3.5 x rotor-diameters. In our case if the large Gamesa G90 2 MW turbines are used (as we recommend) there should be more than 4 x rotor diameter (90 m) if three rows of turbines are regularly spaced across the available space as indicated in NIPSA and Mercados (2009), which gives a space of about 450 m between turbines. This space combined with the limited size of wind farm, should be sufficient to dilute any barrier effects and negate the need for any corridors or longitudinal arrangements of turbines.

Power lines

- Power lines are potentially more hazardous to birds than the wind turbines. This does not only applies to power lines erected inside the plant, but also those constructed to connect the grid. It is recommended that the EU Guidelines and standards on power lines bird safety be followed as detailed in “Protecting birds from power lines, Nature and Environment No. 140, Council of Europe Publishing”; “Draft Recommendation on Protection Birds from Power lines (Council of Europe 2004)” and “Suggested Practices for Avian Protection on Power lines, State of the Art in 2006” (Avian Power line Interaction Committee

2006). Under ideal circumstances, it would be preferable that any new power lines be buried under ground rather than erected above ground as this is the best means to mitigate potential impacts with birds. The main deterrent is the greater cost associated with underground cables.

Lighting

- The use of lights that could attract or disorient birds at night should be limited inside the wind farm area and its immediate surroundings. Lighting turbines should be avoided whenever possible. If lighting is essential, then avoid lighting all turbines. The minimum number of intermittent flashing white lights of lowest effective intensity should be used and should be flashed simultaneously on lighted structures. Solid red or pulsating red incandescent lighting should be avoided.
- Removal of any animal carcasses or waste accumulation within the 3 km buffer zone identified above, and dispose these items in the new disposal site. This measure should be implemented immediately if the HSE Officer noticed any birds' congregations in or near the site.
- Seasonal ornithological studies should be conducted by an independent consultant for the first three years of the project's operation, with the objective of assessing bird behavior around the wind turbines, identifying any unforeseen risks, documenting any impacts on local avifauna, and recording any bird mortality. Bird mortality surveys should be conducted on a regular (monthly) basis by the HSE Officer, and other project staff, who will be trained throughout the project's life.

Monitoring activities:

- Recording number and type of bird's mortality and documenting this by photography. It is worth noting that the HSE Officer shall be trained to identify birds, especially the Egyptian Vulture.
- Viewing any birds' congregations in and around the project site and find out the reason of such congregations

Reporting:

The observations of the monitoring program should be reported on monthly basis to the PMU Manager. Documents and studies made for relocating the dump site, maintaining buffer zones, and seasonal ornithological studies should also be submitted to the PMU with copies kept in the Environmental Register of the project.

7.3.2 Reducing WTGs Noise Exposure

Mitigation Measures:

- The tender document for WTGs should include a condition for having minimum WTG noise. The technical scoring of WTGs supplier should give special weight for less WTG noise.

- The micro-sighting of WTGs should be as far as possible from the settlements. Particularly it will be preferable to slightly move T5, T6, T9 and T10 slightly away from the nearest Al Oksh houses, and to slightly move T11, T13, T21 and T22 away from Serega settlement if these movements will not affect the generation efficiency of the project. The micro-sighting of WTGs should be designed so that the maximum ambient noise at the above settlements does not exceed 40 dBA.
- In case noise levels at some houses locations were above 45 dBA, during operation, the PMU should either establish acoustic barriers to protect such houses from high noise levels, or consider relocation of some houses for few meters to reduce noise exposure.

Monitoring Activities:

- Monthly measurements of ambient noise levels should be undertaken at the locations of the nearest settlements to the WTGs. The measurements should be undertaken at the eastern end of Al Houlibi (nearest house to T1 and T2), the Al Oksh settlement near T5, T6, T9, and T10 and Serega settlement near T11, T13, T21 and T22. The noise measurements should be for a representative duration during nighttime.

Reporting:

The inclusion of WTGs noise in the tender document along with the technical scoring of suppliers and the correspondent score of low WTG source noise should be reported to the PMU Manager in the Monthly Progress Reports that will be submitted next to tender document preparation and tenders evaluation. Results of noise monitoring should be reported in the Monthly Progress Reports submitted to the PMU Manager during operation.

7.3.3 Reducing Exposure to WTG Shadow Flickering

Mitigation Measures:

- An in-depth study of the existing houses orientation regarding expected shadow flickering of WTGs should be done by the EPC Contractor, using surveying tools for accurate location of the houses relative to the WTGs. The micrositing of WTGs on the field should account for the shadow flickering impact so than no house should be located within an area that are exposed to 30 minutes of shadow flickering per day or 30 hours per year.
- The WTGs should have automatic system for breaking specific WTGs that may cause high exposure to shadow flickering at some houses, such as T5, T6, T7, T9, T11, T12, T13, T14, T21, T22 and T23. The system will be provided by the supplier and should include a sunlight sensor (mounted on the WTG tower) and software that includes astronomic and geometric data of the site and the coordinates of specific houses that could be impacted.

Monitoring Activities:

- The system operator of SPC should monitor WTGs which the automatic break system has been applied to and correspondent times for system breaking.

Reporting:

The WTG supplier should submit a report to the HSE Officer about the shadow flickering considerations that have been considered during micro-siting of WTGs. The inclusion of automatic breaking system of WTGs in the tender document and the technical scoring for this issue in different supplier's offers should be reported by the HSE Officer in correspondent monthly progress reports. The results of WTG breaking monitoring should also be reported in the monthly progress report through coordination between the SPC operator and the HSE Officer.

7.3.4 Management of Scrap and Maintenance Waste

Mitigation Measures:

- The supplier repairing or maintaining WTGs should be committed to take scrap items and/or empty oil containers in his custody for possible reuse/recycle in the country of WTG origin. This commitment should be reflected in the maintenance contract with the supplier during the tendering stage and its implementation should be followed up by the HSE Officer.
- Scrap items and waste generated during repair and maintenance of the substation should be taken by the supplier of the new items as part of his commitments, or alternatively reused in other substations in coordination with MEE.
- Transformers should be fixed inside a containment of a non-permeable material. Changing transformers oil should be done though closed piping system with tight connection and level control to minimize oil leakage risks.
- Decommissioning of WTGs should be preceded by adequate planning for recycle/reuse of WTG parts. A detailed waste management plan should be prepared by the decommissioning contractor.

Reporting

The HSE Progress report should include, whenever relevant, the HSE Officer's evaluation of suppliers and maintenance contractors compliance with the waste management procedures indicated above.

7.3.5 Management of Potential Impacts on Stability and Livelihood of Local People

In order to ensure that no negative impact on local people stability and livelihoods will occur during the project operation, local people in villages within and near the project area should be allowed to maintain their housing and, their grazing activities, to the extent possible[64]. This goes in line with the WB OP 4.12 principles on avoiding

[64] Although there will be limitations on logging activities in and around the site, the need for such activities will be reduced after connecting local houses with electricity and providing them with access to LPG cooking facilities. For people working in wood trade

involuntary resettlement, considering the framework and perceptions of resettlement which is not limited to the physical relocation.

Despite the lack of stability and convenience of the current housing model, this is the only available option for people and it is strongly linked to several other life dimensions as mentioned earlier in details. It is assumed that as long as design efforts allowed sufficient setbacks between the turbines and the houses, there will be no problem in people maintaining living in their current place. However, these could never be regarded a sustainable living solution. The project could positively improve local people housing conditions through assisting them in acquired a more stable mode of livelihood (as mentioned below) and attracting the attention of the Government, NGOs and donor programs to the needs of this community. Although this might be regarded as out of the project direct scope, the project is recommended to carry outcome activities in this regards driven from the social responsibility.

In terms of the potential impact on the stability of livelihoods and considering the fact that grazing and wood collection and burning are the only natural resource-based activities. Also, considering the fact that these activities are currently practiced as complementary activities –by most of the families- that assist these poor families in securing livelihoods, there is a need to ensure that – at least in the short term – people will be allowed to maintain these activities in the project area, within all the safety consideration. In he meantime, and for a longer term vision, local people should be assisted in finding a more sustainable source of livelihoods. This could be attained by:

- Hiring, as many local people as possible, in the project
- Building local community capacities to enable them to acquire alternative source of livelihoods or to enable them to widen their scale in the other activities (e.g. driving, fishing….etc). More details about the recommended capacity building subjects are discussed later in this Chapter.
- Networking with other organization to facilitate local people access to opportunities in other fields. The PMU and the FCC to carry out regular meetings and networking activities with other stakeholders.

Monitoring activities

- Number of local residence of the villages in and near the project site, and in Al Mokha at large, employed by the project should be monitored at the beginning of the project operation and frequently afterwards.
- Specific number within each stakeholder group benefit from capacity building programs should be monitored after the training

Reporting

- The regular reports of the FCC.
- Monthly, quarterly and semi annual reports from the SDO

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they should be compensated for logging in other locations or being assisted by capacity building programs in order to enable them to pursue different livelihoods opportunity. This, for instance, might include further

7.3.6 Minimizing Risks of Structural Failure

Mitigation measures:

- Structural safety should be considered during evaluation of technical proposals of WTG suppliers during the tendering process. The experience of suppliers in erecting similar WTG in similar hot and humid weather conditions should be reflected in the technical score of the tender.
- The WTG supplier should be responsible for the foundation design and supervision of its construction to ensure that design specs are respected. The EPC Contractor should make sure that flooding rainwater from the eastern highlands will not cause impacts on the structural stability of the WTGs[65].
- The WTG supplier should provide in the maintenance program a program for preventing corrosion

Monitoring activities:

- The HSE Officer should notice any tilting, corrosion or un-stabilized movement of the rotors.

Reporting:

The relevant score correspondent to structural safety precautions and supplier's experience in similar weather conditions should be reported by the HSE Officer to the PMU Manager during tendering process. Any comments recorded during foundation construction, WTG assembly or WTG operation should be reported in monthly progress reports prepared by the HSE Officer.

[65] This measure has been added according to a recommendation from one of the delegates in the public consultation workshop

Table 7-3: Environmental and Social Management Plan Matrix during Operation Phase

Potential Impact	Proposed Mitigation Measures	Project Phase	Institutional Responsibility for Implementation	Responsibility of direct supervision	Means of supervision	Estimated Cost (US $)
Risks on birds biodiversity	Closing existing dumpsite and relocating it in another location at least 5 km from the project site	**Pre construction** and construction	Local authority – MEE - Al Mokha Harbor Authority - EPC Contractor	PMU Manager - HSE Officer	Review MoU and field supervision of site closure	50,000 [66]
	Prevent agriculture, land reclamation and logging within a buffer zone of 3 km around the site borders	Construction and operation	Local Authority	PMU Manager - HSE Officer	Review MoU and monitoring implementation	Management costs
	Removal of animal carcasses and waste accumulation within a 3-km buffer zone	Operation	HSE Officer	PMU Manager	Review progress reports	Allow 10,000[67]
	Undertake seasonal ornithological studies for the site during first three years of operation	Operation	Ornithological consultant	HSE Officer	Review studies	60,000
Impacts of WTG noise	Technical scoring of WTGs tender should include weight for less WTGs source noise	Tendering	HSE Officer	PMU Manager	Review tender documents and tenders evaluation	Management costs

Potential Impact	Proposed Mitigation Measures	Project Phase	Institutional Responsibility for Implementation	Responsibility of direct supervision	Means of supervision	Estimated Cost (US $)
	Whenever feasible, the micro-siting of WTGs should be as far as possible from houses, especially for T5, T6, T9, T10, T11, T13, T21 and T22	Construction	WTG supplier	HSE Officer	Review supplier's WTG plan	Project costs
	In case of high monitored noise levels at some settlements, acoustic barriers or relocation of impacted houses for few meters should be considered	Operation	HSE Officer	PMU Manager	Review monitoring program and taken measures	Allow 10,000[68] for possible acoustic barriers
Impacts of WTG shadow flickering	Consider the shadow flickering impacts during the micro-siting of WTGs	Construction	WTG supplier	HSE Officer	Review supplier's report	Project costs
	Include automatic breaking system in some WTGs based on sunlight sensors and astronomic/geometric calculations of shadow flickering impacts for nearby houses	Tendering and Operation	HSE Officer during tendering and STC Operator during operation	HSE Officer	Review breaking monitoring reports	Project costs[69]

[68] A separate budget for possible resettlement, in case it is needed, will be specified as later indicated in this Chapter
[69] Price of such system will increase the expected costs of the WTGs

Potential Impact	Proposed Mitigation Measures	Project Phase	Institutional Responsibility for Implementation	Responsibility of direct supervision	Means of supervision	Estimated Cost (US $)
Impacts of scrap and maintenance waste	Include taking away scrap items during WTGs maintenance in the maintenance contract	Tendering	HSE Officer	PMU Manager	Review maintenance contract	Management costs
	Reuse/recycle removed WTG parts in country of origin	Operation	WTG supplier	HSE Officer	Review supplier's reports	Project maintenance costs
	Substation scrap and maintenance waste to be taken by suppliers of new equipment or alternatively reused in other substations	Operation	Electrical suppliers or alternatively MEE	HSE Officers	Review supplier's reports	Project maintenance costs
	Transformers to have impermeable containment and oil changing should be using tight piping	Construction and operation	EPC Contractor and maintenance contractor	HSE Officers	Field supervision	Project costs
	Detailed waste management plan should be prepared before decommissioning WTGs	Operation	Decommissioning contractor	HSE Officer	Review contractor reports	Project costs
Affecting the Stability and Livelihoods of Local Population	Ensure Local People are allowed to maintain living in their current houses (as a short term solution)	Operation	PMU	FCC PMU (SDO)	Site observation	Management costs

Potential Impact	Proposed Mitigation Measures	Project Phase	Institutional Responsibility for Implementation	Responsibility of direct supervision	Means of supervision	Estimated Cost (US $)
	Hiring, as many people as possible, in the project	Pre operation and operation	PMU	PMU FCC	Review of employment contract	Management costs
	Building local communities capacities to enable them to acquire alternative source of livelihoods	Operation	Training Consultants	PMU FCC	Review consultant's reports Capacity building M&E reports	45,000[70]
	Networking with other organization to facilitate local people access to opportunities in other fields.	Construction and operation	PMU FCC NGOs	PMU	Channels created between local community and development organizations	10,000
Stability risks of the WTGs	Supplier's experience on WTG structural stability in similar conditions to be considered in the tendering procedure	Tendering	HSE Officer	PMU Manager	Review reports on tenders evaluation	Management costs

[70] This amount is mentioned again under the training and capacity building matrix Table 7- 5

Potential Impact	Proposed Mitigation Measures	Project Phase	Institutional Responsibility for Implementation	Responsibility of direct supervision	Means of supervision	Estimated Cost (US $)
	Suppliers should be responsible on design and execution of foundations	Pre construction and construction	WTG supplier	HSE Officer	Review design and field inspection	No additional costs to WTG price
	Maintenance program to include corrosion abatement measures	Construction and operation	WTG suppliers	HSE Officer	Review maintenance program	No additional costs to WTG price

Table 7-4: Environmental and Social Monitoring Plan Matrix during Operation Phase

Potential Impact	Monitoring Indicator	Monitoring Location	Monitoring Methods	Monitoring Frequency	Monitoring Responsibility	Estimated Cost
Risks on birds biodiversity	Number and type of dead birds due to colliding with WTGs	Project site	Visual inspection and photography	Monthly reporting	HSE Officer	Management costs
	Visual birds congregations	Project site and buffer zone	Visual inspection	Monthly reporting	HSE Officer	Management costs
Impacts of WTG noise	Noise levels	Nearest houses in Holieby, Oksh, and Serega settlements to WTGs	Taking measurements by noise meters for a representative duration during nighttime	Monthly	HSE Officer	Previously accounted for as mentioned in Table 7-2
Impacts of WTG shadow flickering	Number of WTG applied to automatic breaking and correspondent breaking time and duration	Project site (control room)	Taking results of system software	Continuous monitoring, monthly reporting	SPC Operator	Management costs

Potential Impact	Monitoring Indicator	Monitoring Location	Monitoring Methods	Monitoring Frequency	Monitoring Responsibility	Estimated Cost
Affecting the Stability and Livelihoods of Local Population	Number of local residents from Al Mokha in general and AL Houlibi, in particular hired for the project	Project site	Reporting labour origin and calculate numbers of laobourer from the village	Once after the operation of the project and in every case the project develop new employment contracts	PMU (SDO)	Management costs
	Specific number within each stakeholder group benefit from capacity building programs		Review consultant reports Carry out monitoring activities to measure capacity building programs impacts (jobs, knowledge)	Pre the training Training assessment after the training Six weeks after the training (evaluation)	PMU (SDO)	Management costs
Stability risks of the WTGs	Tilting , corrosion or unstable blade movement	WTGs	Visual inspection	Monthly	HSE Officer	Management costs

7.4 Additional Recommendations Related to Local Communities

Under this ESIA, it is proposed that adherence to the proposed mitigation measures under both construction and operation will result in protecting local people concerns and livelihoods. The designed ESMP aimed at mitigating any potential direct impact from the project on local communities. Maintaining people access to the area and enhancing their opportunity to benefit from the project benefits are the key outcomes that this ESIA seeks to attain, particularly because there are no significant social and environmental restrictions that prevent these outcomes from being achieved. The following are conclusive important recommendations that should be considered:

1. **The tendering process and tenders selection should give weight to the level of socioeconomic costs associated with each offer**. The type of wind turbines and the their micro-siting are crucial issues to minimize the social impacts and avoid resettlement. Thus, the findings of this ESIA should inform the tenders selection process.

2. As became obvious during the previous presentation of the socioeconomic conditions of Al Houlibi and affiliates Seregaas well as Oksh, the current living conditions of these communities lack lots of basic requirements that resulted in maintaining their situation in sever poverty and insecurity. Despite the fact that this might be out of the direct scope of the project, within the framework of the proposed EMSP some benefits might be delivered to them. **These benefits on local communities including access to electricity, LPG and other infrastructural and social services should be regarded as necessities and social responsibilities ingredients for both the project and other organization (e.g. NGOs) towards these hosting communities.** These benefits should also be considered as a starting point for a developing these communities.

3. The team highly recommends that **any future projects in the area should be designed as comprehensive programs with separate socioeconomic development components that aim to empower local communities.** Reference here is made to MEE interest in extending wind farm project in further places in Mokha. In order to attain positive social outcomes from this proposed extension, the project should be designed as an integrated development program, where resources should be allocated to maximize the socioeconomic positive outcomes.

4. It is made clear under this ESIA that **involuntary resettlement is avoidable in case of adherence to the mentioned measures. The PMU should play a key role in this regard by safeguarding the interests of local communities** during the various stages of pre-constriction, construction and operation.

5. **Along the project cycle and within the practical terms, in case any direct impact on local community settlements or livelihoods became unavoidable; it will be the**

PMU responsibly to enforce the RPF that has been prepared and ensure that fair compensations are provided. Within this scenario, and according to the WB OP 4.12, the RPF will provide the technical guidance for the resettlement process through setting the main steps for the Resettlement Action plan (RAP)/ Abbreviated Resettlement Plan (ARP). The proposed Social development Officer (SDO) under the PMU should be the main responsible officer in charge of supervising the resettlement activities.

7.5 Institutional Setup for the Environmental and Social Management Team

7.5.1 Staffing and Affiliations

As previously mentioned in Chapter 3, it has been decided to establish a Special Purpose Company (SPC) within the Public Electricity Corporation (PEC) to operate the MWFP, the SPC will be independent financially from PEC. It is also expected that a Project Management Unit (PMU) will be established within MEE for the overall management of the project. The proposed setup for implementing the ESMP includes inputs from different management levels. As previously indicated in the ESMP, the PMU Manager will be receiving monthly progress reports from different parties; therefore it is proposed that the PMU manager act as the overall manager of the ESMP.

Because the environmental management of the project will require major input through site inspection, it is proposed that the SPC should include a full-time HSE Officer who will be responsible for daily follow-up of the ESMP. The HSE Officer shall be recruited in an early stage of the project by the PMU, where he can implement/follow-up the ESMP measures during the tendering and construction phase, the HSE Officer will report to the PMU Manager. After establishment of the SPC, the HSE Officer will then be shifted from the PMU to the SPC. The HSE Officer should have technical background and should have 5 years experience in HSE. The tasks of HSE Officer should include

- Overall supervision on the ESMP implementation and providing PMU Manager with support related to HSE issues
- Follow up and review outputs of different stakeholders
- Prepare HSE requirements in the Tender Documents
- Provide input to the technical scoring of EPC Contractors proposals according to HSE requirements
- Provide field supervision on EPC Contractors during construction phase for ensuring implementation of HSE requirements
- Implement
- Supervise implementation of ESMP measures during operation and maintenance of the project
- Carry out specific tasks on monitoring program during construction as per ESMP requirements and supervise monitoring tasks of other parties
- Prepare monthly reports about the HSE performance of the project

Within the PMU, it is recommended to appoint a Social Development Officer (SDO) whose main responsibility will involve ensuring the sound implementation for the mitigation measures with the ESMP in a socially sensitive approach that highly consider local communities concerns. The SDO is recommended to have a strong practical background on the application of different participatory approaches and techniques. He/She should be familiar with PM&E tools and have strong reporting skills.

Main Tasks of the SDO:
- Design and implement the different social related activities of the project
- Follow up the formation and operation of the FCC and monitor its activities
- Apply participatory monitoring and evaluation (PM&E) techniques
- Work in designing and facilitating awareness raising activities
- Coordinate with NGOs and donor agencies
- Follow up and review of social consultant who could be hired along the project life cycle.
- Monitor the implementation of different ESMP activities and develop periodical reports that inform the project reports

7.5.2 Training Needs

Training and capacity building programs are perceived to be key ingredients that will enable the various stakeholders of relevance to the project to efficiently implement the different proposed measures under the ESMP. Tailored training on the environmental, social and administrative issues related to the project should be the main focus of the capacity building program. The process of the ESIA preparation involved wide consultations with those stakeholders. This came out with list of training needs for each group of the stakeholders. Additional topics or some amendments could be done to these lists along the project cycle based on the actual need. It is recommended to start within the early stage of the project with an introductory training on the suggested issues for each stakeholder category. A mid term refreshing training should be delivered on the same topic this should also include an evaluation for the implementation of the ESMP within the first term of the project.

Evaluation for the training and capacity building should not be limited to the completion of training activities but rather should measure the impact of the training on the performance of every stakeholders group in the implementation of the ESMP.

The input of external consultants and training will likely be needed both in designing and delivering the training programs and in monitoring and evaluating stakeholders performance. The following are the main categories of stakeholders who are seen to have an important role in the ESMP and the recommended topics for building their capacities

For PMU (Manager, technical staff and SDO) and SPC (HSE Officer and technical / engineering Staff)

- Tailored training on ESMP measures
- Ornithological importance of the site and the proposed monitoring program
- Involuntary Resettlement and the associated Yemeni and WB laws and legislations
- Participatory Monitoring and Evaluation (PM&E)
- Communication skills
- Reporting skills
- Community participation tools and techniques

Technical staff from the Local Council is recommended to receive the following training:

- Renewable energy potential
- Wind energy related subjects.
- Topics related to O&M of the wind farms
- Ornithological importance of the site
- General waste management

For NGOs

The interviewed NGOs showed high willingness and interest in participating in the implementation of the ESMP, particularly in the activities that involve engaging local community and consultation related activities. It is recommended for the NGOs that will participate in the ESMP implantation to have their capacities built in order to enable them to work effectively with the project. In a rapid training needs assessment that has been carried out as part of the preparation of the ESIA, the following topics have been identified as needed topics for the training.

- Participatory research tools
- PM&E
- Building voluntary spirit
- Community awareness raising
- Training on renewable energy related topics
- Communication and coordination with donors and development organizations
- Fund raising and proposal writing
- Micro-credit management
- Accounting, Administration and financial management
- Building community skills on vocations and micro enterprises
- Women and children rights
- IT training

For FCC

After the formation of the FCC, members should have their capacities built on some of the in-common topics that will be benefit the core of their responsibilities under the FCC. This is suggested to include:

- Involuntary resettlement and the relevant laws from the Yemeni legislations and the WB safeguard policies

- Community participation tools and techniques
- Communication skills
- Reporting skills
- PM&E

*For Community Members***:**

Capacity building and training for the community members of villages in and near the project site comes in the framework of rehabilitating the affected communities from the project and as a method to ensure that they will be able to restore their livelihoods in case they have been negatively affected by the project.
Capacity building and training will empower this community through allowing them to pursue a living in new and relatively more stable fields. It is recommended that the training programs target the following main categories:

1) Community members who will benefit from the created job opportunities of the project: On-the-job training for both the construction and operation jobs.
2) For those who will not be engaged in the generated jobs from the project, tailored training programs on case-by-case basis should be considered. The proposed issues from the local community members including fishing related issues, and vocational training (particularly for women), training on livestock and dairy products projects, which is quite relevant to their current interests. Capacity building on these topics should be supported with networking efforts to enable the local communities to access micro credit schemes from NGOs and donors to carry out projects in these areas, including supplying the targeted population with the equipment and tools needed for them to practice what they learnt and use it in acquiring alternative sources of livelihoods.

Moreover, and according to the recommendations of the participants in the public consultation, youth of the neighboring communities should be targeted with better education opportunities both through improving the direct access to educational facilities and connecting them to educational organization that offer scholarships or similar skills development opportunities.

Table 7-5: Training and Capacity Building Matrix

Target Group	Subject	Frequency	Cost ((US$))
PMU (Manager, SDO) and SPC (HSE Officer and technical / engineering Staff)	Tailored training on ESMP measures, Ornithological importance of the site, involuntary resettlement and the associated Yemeni and WB laws and legislations, PM&E, communication skills, reporting skills, community participation tools and techniques	Two main courses, a start up and a mid term. Refreshing short courses are recommended	15,000
Technical staff from the Local Council	Renewable energy potential, wind energy related subjects, topics related to O&M of the wind farms, ornithological importance of the site, SWM issues	A start up course	5,000
NGOs	Participatory research tools, PM&E, voluntary spirit, community awareness raising, renewable energy, communication and coordination with donors and development organizations, fund raising and proposal writing, micro-credit management, accounting, Administration and financial management and building community skills on vocations and micro enterprises, IT training	Two main courses, a start up and a mid term. Refreshing short courses are recommended	15,000
Feedback and Complaints Committee (FCC)	Involuntary resettlement and the relevant laws from the Yemeni legislations and the WB safeguard policies, community participation tools and techniques, communication skills, reporting skills, PM&E	Two main courses, a start up and a mid term. Refreshing short courses are recommended	20,000
Community groups			**45,000**
• Men who will be hired by the project	On-the-job training for both the construction and operation jobs	To be defined as needed	
• Men who will not be engaged in the generated jobs from the project	Tailored training programs on case-by-case basis. Training topics might includes, but is not limited to: • fishing related issues and • training on livestock projects		
• Women	vocational training and dairy products		
	Total Training and Capacity Building Budget		100,000

7.6 ESMP Budget

The implementation of the ESMP will involve input from different project stakeholders, and accordingly some of the ESMP costs will be indirect costs that would be reflected in more expensive financial offers from the EPC Contractors as previously indicated in the ESMP matrices presented in Tables 7-1 through 7-4, therefore an allowance has been made for this in the ESMP budget. The ESMP budget is $ 465,000, distributed among four main categories as shown in Table 7-6.

Table 7-6: The estimated ESMP budget

Category	Item	Budget (US$)
Studies and technical support	Measurements of dust emissions during construction	5,000
	Technical study to choose location for another disposal site including the technical designs	50,000
	Seasonal ornithological studies during first three years of operation	60,000
Tools and equipment	Allowance for higher construction bid prices due to the ESMP measures (hazardous waste management, wetting of soil, provision of acoustic barriers during construction of internal roads, vibration barriers, …etc.)	50,000
	Noise meters	10,000
	Allowance for removing animal carcasses and wastes in and around the project site	10,000
	Allowance for possible acoustic barriers during project operation	10,000
Management and coordination	Salaries for HSE Officer and SDO for 5 years	60,000
	Set and activate Efficient Feedback and Complaints Mechanism	50,000
	Networking with other organization to facilitate local people access to opportunities in other fields.	10,000
	Carry out mid-term review for the environmental and social impacts	50,000
Training and awareness	Capacity building programs for different groups of stakeholders	100,000
Total		**465,000**

8. CONSULTATIONS WITH STAKEHOLDERS

Consultation with various types of stakeholders has been carried out along the cycle of the ESIA which lasted from June 2009 to May 2010.

The primary objective of the consultation activities is to enhance the sense of ownership and public acceptability to the project and ensure that the project is well received and that the different interests, particularly those interests of the poor and vulnerable groups, are well addressed and considered. Of particular relevance to MWFP is the role played by the public consultation activities in introducing the idea of the project which was not familiar to most of the consulted stakeholders. These activities also were important to communicate the potential benefits of the project to the local community and larger region. These involve several environmental and economic benefits, particularly power generation through a clean and renewable source of energy. The public consultation activities were also crucial in learning about the issues around land ownership, land use and the expectations of local people from the project. The checklists that have been used during the interviews are attached in Annex 2, while the list of participants in the public consultation workshop is attached under Annex 3. A.

The consultation activities could be divided into two main phases, namely the consultations during the scoping phase and the disclosure phase which included the public consultation. During the scoping period which lasted from July 2009 to March 2010, several in-depth interviews, scoping sessions, semi structured interviews (SSI) and survey questionnaires with various types of stakeholders, namely governmental organizations, NGOs as well as various community groups. Focus groups discussions were also carried out with men in Al Houlibi village on the project site.

A public consultation workshop has been conducted after the preparation of the draft ESIA report were different project stakeholders were invited in a plenary session to share their views about the project on Tuesday 8th June 2010. This public consultation workshop has been carried out with the objective of disclosing the ESIA report, and reviewing its main findings and identified impacts with key stakeholders. Different dissemination tools were employed to ensure announcing the public consultations and encourage various categories of stakeholders from different backgrounds, with different interests, to come together and discuss critical issues related to the ESIA. Participants' feedbacks and recommendations were incorporated in the final ESIA report.

8.1 Key Findings from the Stakeholders Consultation during the Scoping Phase

The main findings of the carried out consultation during the scoping phase include, most importantly, the following:

- Al Mokha is a Directorate with wide range of unutilized potentials including, among others, the long coastal road, the historical port, strategic location, several tourism attractions, numerous amount of palms and large areas of cultivated lands.
- The most dominant economic activities are of the marginal nature. This includes small scale fisheries, grazing, handicrafts…etc. Small portion of population is employed by the governmental sector, particularly in services related activities.
- The main challenge that hinder the development of Al Mokha is the absence of resources to fund infrastructure projects. This is perceived as the main factor that makes investors, especially those who are originally from Al Mokha, reluctant to invest in Al Mokha.
- Al Mokha hosts a number of local NGOs with various interest including women development, fishermen and farmers support and charity oriented associations. Several donor agencies and development partners also participated in funding projects in Al Mokha. The Civil Society sector is challenged by the absence of voluntary spirit, conflict of interests, lack of financial resources and the weak monitoring and supervision on these organizations.
- Power shortage, in particular, is one of the key challenges that face the directorate. The power sector is challenged by the relatively limited capacity of the Power Plant and the fact that the old age of the network and the atmospheric conditions (high level of humidity) affects the station performance and consequently the power supply of most of the Directorate with less that 20% of the population has access to electricity.
- Lack of electricity also poses a household level challenge with limited access to many power based domestic services like refrigerating, lighting, TV…etc. It also negatively affects the householders' access to different educational and awareness materials that are promoted through media. This, in turn, negatively affects the level of awareness, particularly among women.
- Low level of awareness about the development of wind farms was significantly observed among different stakeholders of local communities. However, among local governmental officials, relatively higher level of awareness of the wind farm was observed. A previous unsustainable project that involved erecting wing turbines in Al Mokha was also introduced and the main reasons why the project did not sustain was identified as the lack of sound contextual specific planning.
- The local authorities highlighted the importance of the project in utilizing a cheep, exhaust free source of energy to generate power that will benefit not only Al Mokha but the entire region. Several long term returns were discussed, most importantly the economic returns from enhancing the power sector and from generating job opportunities during both the construction and operation phases.
- Local Authorities expressed fears from the potential negative impact on local communities in the three villages where the project site will be located. The Local Council realizes the risks of relocating these groups particularly because they are among the poorest and most vulnerable on the level of the Directorate
- The local authorities stated that they do not have the resources to provide development alternative to PAPs. However, they stressed the importance of mitigating the negative impacts on those categories and provide a fair compensation

in any form. The importance of capacity building programs and training and giving priority to PAPs in the project generated jobs were also other important issues that were stressed by officials.

- The MWFP will achieve direct benefits to the operation of Al Mokha thermal Power Plant (MPP) as the wind farm output will help reducing the overload demand on MPP which will allow for maintenance and renovation of the plant.

8.2 Public consultation workshop and key findings

After submitting the Draft ESIA, a public consultation workshop was held on the 8th June, 2010 with the aim of reviewing the findings of the ESIA and incorporating the stakeholders' comments into the assessment. This action came in accordance with the WB policy requirements for making operational information available to the public as stated in OP 17.50 on "Disclosure" out of recognition for the fundamental importance of transparency and accountability to the development process. The workshop was a useful opportunity for the different stakeholders to come together, review and comment on the assessment. It involved sufficient time for comments, questions and open discussion. Further documentation for the workshop is included in the different parts of Annex 3.

The participants of the workshop included different stakeholders from Governmental organizations, representatives from the local residents at the project site, NGOs and donors. Both written and verbal invitations were directed to participants two weeks before the workshop. Invitation sample is attached in Annex 3.B. Along with the written invitations, an Arabic Executive Summary of the ESIA was made available to invited stakeholders before the workshop, and was distributed to all participants during the workshop.

The decision on the selection of the workshop venue was made with the primary focus on local communities' convenience and accessibility. Despite the modesty of the logistical facilities in Mokha Local Council building that hosted the event, it was an ideal venue for local residents and NGOs. A key merit from selecting this venue was the wide participation of local residents who reached to around 26 out of total 64 participants in the workshop. The relatively easy accessibility and local residents' familiarity with the place encouraged them to participate.

Figure 8-1: Opening Speeches During the Public Consultation

Figure 8-2: Presenting the findings of the ESIA to Public Consultation Participants

Figure 8-3: Women Participation in the Public Consultation

The team paid big attention for recording the various feedbacks and comments of participants in order to make sure that various comments are accommodated on the ESIA and mentioned in this chapter of the ESIA. For this purpose, various methods were applied included open discussions and note taking as well as written notes sheets that were distributed to participants to have written record of their comments. In order to ensure the concerns of the illiterate portion of participants are taken into accounts, members of the ESIA team were made available to participants to help in writing down their comments on the comments sheets. Sample of the written comments sheets are presented in Annex 3 C.

The workshop went in two main sessions. The first included welcome statements and introductory speeches by General/ Mohammad Salah Kaed- Head of the Security Zone, Mr. Aref Magour – Deputy Governor of Taiz Governorate and Eng. Abdel Salam Al Janad – Representative from MEE. The first session included also the social and economic findings of the ESIA. This was followed by a short break and then the second session resumed the ESIA presentations to include the findings from the risk assessment on birds. An open discussion was followed where all participants were given the chance to comment on the presentation and reveal their concerns.


تكلفتها ١٢٥ مليون دولار

تقييم الأثر البيئي والاجتماعي لمشروع مزرعة الرياح لتوليد الكهرباء بتعز

Figure 8-4 : The published news about the public consultation in Al Thawra Newspaper, 9th June 2010

Different issues raised during this workshop were considered during the production of this final version of the ESIA. The main comments that were raised included:

- Many delegates emphasized the importance of the project and the expected environmental and socioeconomic benefits.
- Fair substitutions should be given to local residents who should be resettled from their homes. This comment was made by many people during the consultation especially from people who claimed ownership to their houses of local residents. It worth noting that all these claims were denied by Governmental officers, namely members of the Local Council, who stressed that fact that the land is a State ownership and that the Government has the full authority to use the land for projects for public interest. The response of the ESIA team made it clear to participants that the environmental and social impacts are not expected to cause involuntary resettlement for any of the existing houses in case the project implementation adhered to the proposed preferred scenario and the various mitigation measures. It was also made clear that a Resettlement Policy Framework (RPF) was prepared with the main objective of being used as safeguard measure and guidelines for the actions and compensation schemes that should be considered in the unlikely cases of the need for involuntary resettlement. In the meantime, The ESIA made it clear that security precautions during the operation phase and whether they might imply any limitations to the movements of local inhabitants are still unclear for both the team and the representatives from the formal authorities. In case security precautions resulted in need for involuntary resettlement, compensation schemes as per the RPF should be employed. It worth noting that some of the residents were in favor of taking fair compensation and leave the area to another place that having infrastructure and better facilities. However, local communities representatives' both written and verbal comments seemed to be fully overwhelmed with the historical similar cases in Yemen

where people were denied access to land and resources as part of development projects and no fair compensations were ever provided.

- Many participants emphasized the importance of granting local residents as many as possible job opportunities in the project. According to comments that the ESIA team received from local residents, their benefit from the created jobs during construction will make them more tolerant with the inconvenience impacts.
- A representative form the Local Council raised a question about who will finance the new waste landfill that will be established instead of the existing dumpsite south of the project site, he emphasized that the financial resources of the Local Council could not satisfy this requirement. The ESIA team believes that this is an important remark that should be settled at an early stage of the project planning.
- A delegate recommended that there should be measures to protect the area from floods coming from the east. Although the topographic map of the site (shown in Figure 4-1) and the satellite image of the project area do not show that there are major flooding routes particularly in the project area, the delegate confirmed that rainwater floods pass the project area. Accordingly this recommendation has been added to the ESMP related to the structural stability of WTGs.
- A delegate pointed out that noise impacts may be more significant to the areas north of WTGs. The noise attenuation calculations used in Section 5.2.2 are for down wind direction and the impacted areas were identified accordingly
- A representative from the Local Council mentioned that the project area was previously planned for installing a wastewater treatment plant and a solid waste disposal site. It was emphasized to all delegates that these activities could not be implemented in the project area and the buffer zone identified by 3 km from the 4 project borders as recommended in the ESMP.
- Participants referred to the need for improving local communities' access to various services, particularly water supply. They suggested this to be done in coordination with Mokha Power Plant which enjoys a good waster connection that local communities in the neighboring villages could benefit from.
- Despite the predicted benefits that will be attained from the construction of the wind farm, restricting farming in the buffer zone of the wind farm and additionally in areas where the wind farm might be expanded in the future was perceived by the General Secretary of the Local Council as a hindrance for development potentials in the area. Currently, no farming activities exist within the buffer zones of the wind farm under investigation. However, for future wind farm projects there is a need to consider this critical livelihoods issue by designing the wind farm project in the framework of integrated development programs that consider the socioeconomic conditions and opportunities of local communities.
- The project developer, out of social responsibility, should provide the local communities in the project area with opportunities that prevent them from being grabbed more into the poverty conditions. The ideas of providing education opportunities for youth and developing enterprises in areas that fit local community's skills like dairy products and livestock development were discussed. The involvement of local NGOs in the public consultation workshop is perceived as a good starting

point for channeling development programs and funds to the local communities near the project site.
- Since no NGOs exist in the project area, participants recommended the involvement of natural leaders (e.g. sheikhs) and the NGOs with wider scope of service in the level of Mokha in implementing the measures that came under the ESMP.

Some participants also raised other points that were regarded as irrelevant to the project and its associated environmental and social issues.

9. CONCLUSIONS

Environmental and social impact assessment was performed on the MWFP activities during construction and operation phase. The conclusions of the analysis are illustrated in the following discussion:

The project will achieve many environmental and social benefits as a pioneer demonstration project for generating clean renewable energy. The project will achieve annual savings of CO_2 emissions estimated by about 161,515 tons/year. Being a demonstration project these environmental benefits will achieve indirect positive impacts through offering experience to similar renewable energy projects in the country. Through improving supply of electric energy general social benefits will be attained through improving health, educational and social services at the community level. At the local residence levels, many social benefits are expected to be achieved by the project as part of the ESMP, such as connecting local houses to electricity supply, facilitate their access to LPG, giving them priority in job opportunity and including them in a capacity building to widen their access to different economic activities.

The project site and its surroundings comprise houses distributed in four small settlements inside and near the four project borders. The calm conditions currently surrounding these settlements will change during the construction phase as the site will receive different sub-contractors and suppliers, the noise and dust emissions generated during construction will be temporary and could be managed through recommended measures in the ESMP while other incontinences are expected to be tolerated by local inhabitants if they will benefit from different services provided by the project such as better access roads, connection to electricity, job opportunities and capacity building programs. The expected environmental and social impacts on these settlements during operation are also expected to be manageable and within relevant standards if the recommended ESMP measures are implemented. It is not expected that involuntary resettlement for the local inhibitors will be required in light of the analyzed impacts, except if security precautions during project operation will limit access of local residence in the area, or if some residents would not tolerate the some inconveniences during the construction phase[71].

Negative environmental and social impacts expected from the projects construction and operations have been classified to two main degrees: medium impacts and minor impacts according their likelihood and severity. No impacts were classified as major impacts, meaning that they would directly lead to violation of standards by their own.

The expected medium negative impacts and correspondent mitigation measures, recommended in the ESMP, during construction phase are:

[71] Which most probably would not happen if they gain suitable benefits during project operation

- Impacts of construction wastes. For mitigating these impacts the ESMP includes measures for including waste management aspects in the tendering requirements for selecting EPC Contractors, use excavation waste for covering fresh waste in the dumpsite in an engineered manner[72], allocate area for safe storage of fuels and hazardous substances, sound disposal of empty drums of hazardous substances, and provide adequate system for collecting garbage and sewage from construction staff camps. The ESMP includes monitoring efficiency of closing existing dumpsite and recording amount of hazardous substances handled in the site.
- Impacts of construction air emissions. For mitigating these impacts the ESMP includes measure for wetting soils and aggregates before earth works, enforce EPC Contractor to use machinery with efficient combustion engines and prohibit the use asbestos in temporary offices or any construction materials. The ESMP includes quarterly monitoring of ambient TSP and PM_{10} at nearby settlements locations.
- Impacts of construction noise and vibrations. For mitigating these impacts the ESMP includes measures for enforcing construction labor to use ear muffs in noisy zones, organize construction works between 07:00 and 18:00, provide acoustic barriers during construction of internal roads near existing settlements, provide adequate protection for existing structures from vibrations and locate power generators and staff camp as far as possible from existing settlements. The ESMP includes monthly monitoring of noise levels, during construction, at location of nearby settlements; this monitoring becomes daily during construction of internal road stretch near existing houses.
- Impacts on traffic during transportation of different construction materials and services. For mitigating these impacts the ESMP includes measures for ensure suitability of selected routes for bearing expected loads, prepare traffic plan to avoid unacceptable delays caused by the WTG convoys, ensure adequacy of the trucks parking area in Al Mokha Harbor and identify suitable times (during low traffic) for transportation of different goods and services. The ESMP includes monitoring traffic delays caused by WTG convoys.
- Accidents risks to workers and local community. For minimizing these risks the ESMP includes measures for including safety issues in the selection criteria of EPC Contractors, communicate relevant safety tips with the local community and inspect compliance of different parties to safety instructions. The ESMP includes monitoring of number and causes of occupational accidents.
- Inconvenience to local residents on the project site in terms of possibly effecting privacy, mobility (especially for women), access to site resources and increasing pressures and crowdedness on the area resources. For mitigating these impacts the ESMP includes measures for setting and activating efficient feedback and complaint mechanism, adopt transparent approach for sharing information that will help local people to avoid disturbing activities, prioritize local people in

[72] This will serve closing down this dumpsite which is a mitigation measure to reduce risks on birds by reducing attractions

construction job opportunities, provide local people access to electricity and LPG, and impose contractual conditions on EPC Contractor for adequately performing activities of concern to local people. The ESMP includes monitoring of number of local workers employed in the project activities and number of households connected to electricity grid.

The construction activities are also expected to cause impacts that was classified as minor/negligible impacts, which is a negligible loss of natural habitat on the areas that will be occupied by WTGs and other constructions. It was considered a negligible impact because no vulnerable, rare or endangered flora and fauna species exists in the project location (dominant flora cover in the area is the invasive Mesquite trees and non avian fauna is limited to some reptiles and rodents) and the area occupied by WTGs and the substation could be negligible compared to the coastal plain forming the project area. Accordingly the World Bank Safeguard Policy on Natural Habitats (OP 4.04) will not be triggered.

Concerning negative impacts during the operation phase, the following impacts have been classified as of medium significance:

- Risks on birds' biodiversity due to possible birds' mortality caused by collision with moving WTG blades. According to autumn and spring ornithological analysis of the project site and its surroundings and based on modest volume of birds, their flight altitude, limited flying in large/dense flocks, limited landing/roosting in the area, flat terrain, southern prevailing wind direction, relatively good visibility and assumption that recommendations for preventing birds attractions in and around the site, it was concluded that risks on birds are within tolerable level. The ESMP includes measures for reducing/preventing birds attractions in the area through closing the dumpsite located south of the project site, preventing land reclamation and logging within a buffer zone of 3 km around the site borders, remove animal carcasses and wastes in this buffer zone. The ESMP also includes undertaking seasonal ornithological analysis during the first three years of project operation and monitoring of birds colliding accidents and birds congregations in the area.
- Impacts of WTG noise on local settlements. For mitigating this impact the ESMP includes measures for giving low noise WTGs higher scores in technical evaluation of tenders, considering noise impacts during micro-siting of WTGs, and providing acoustic barriers to reduce noise levels in unforeseen conditions. The ESMO includes monthly monitoring of noise at locations of houses near WTGs.
- Impacts of WTG shadow flickering disturbing local residents. For mitigating this impact the ESMP includes measures for considering shadow flickering impacts during micro-siting of WTGs and provide WTGs with automatic breaking system based on sunlight sensors and astronomic/geometric calculations. The ESMP includes monitoring of times and duration of applying the automatic breaking system.

- Impacts of scrap and maintenance waste. For mitigating this impact the ESMP includes measures for enforcing maintenance contractors for taking away scrap items for reuse/recycle, providing transformers with impermeable containment, prevent oil spillage during transformer maintenance and prepare a detailed waste management plan before decommissioning WTGs.
- Affecting the stability and livelihood of local population through limiting their access and conflicting with their interests in the area. For mitigating this impact the ESMP includes measures for ensuring the access of local people to their current houses, giving them the opportunity to benefit from the project through prioritizing them in job opportunities, building their capacity to enable them acquire alternative source of livelihood, and networking with other organizations to facilitate their access to suitable working opportunities. The ESMP includes monitoring of number of local residents employed by the project and number/affiliation of people benefited from capacity building programs.

The operation phase is also associated with some negative impacts that have been classified as of minor significance:

- Stability risks of WTGs which has very low likelihood according to safeguards normally taken by WTG suppliers
- Impacts of dust generation due to traffic over un-asphalted internal roads which is considered minor because of expected low traffic volume
- EMF impacts which is considered minor due to very low contribution of the project assets to the existing EMF
- Visual impacts which is controversial in its perception as positive or negative impact, however, because of its unique nature in the country many people may regard it as a positive impact

It was recommended that the PMU Manager will have overall responsibility for implementing the ESMP. A full-time HSE Officer will be recruited early in the process for day to day implementation of the ESMP measures. A Social Development Officer (SDO) will also be recruited for ensuring the sound implementation for the social mitigation measures. Capacity building programs have been recommended for different project stakeholders.

ESMP estimated budget is $ 370,000 in which 115,000 is for studies and technical support, 40,000 for tools and equipment, 115,000 for management and coordination and 100,000 for training and awareness.

In conclusion:

MWFP is expected to attain many important benefits that overweigh limited negative impacts which could be mitigated through the proposed Environmental and Social Management Plan.

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ANNEX 1: LIST OF CONSULTED STAKEHOLDERS DURING THE SCOPING PHASE

Al –Mokha Governmental Authority	
Name	**Position**
General. Ahmed Kayed Saleh	General Director of Al Mokha Directorate and Head of the Local Council
Mr. El Anes Kasem Zeid El Gabas	The General Secretary/ Directorate Deputy of Al Al-Mokha Directorate Local Council
Mr. Soltan Ahmed El Seragy	Office Manger of the General Secretary
Eng. Abdel Baki Abdel Gabar Maghli	Head of the Water Institution, Al-Mokha
Mr. Abdallah Mohammad Abdallah El Saragy	Head of the Planning Department, Al-Mokha Directorate Local Council
Mr. Tawfek Mohammad Mayhoub	Manger of the Public Works and Roads Department, Al Mokha
Eng. Abdel Baki Abdel Gabar	Heald of the Water and Sanitation Authority, Al Mokha
Mr. Ahmed Abas El Etery	Head of the Services Committee, Al- Mokha Directorate Local Council
Mr. Othman Awad Ali Tahoush	Head of the Social Affairs department, Al-Mokha Directorate Local Council
Mr. Kasem El Shazly	Head of the Roads and Utilities department, Al-Mokha Directorate Local Council
Mr. Kasem El Shazly	Head of the Education Department, Al-Mokha Directorate Local Council
Mr. Mansour Shaeq Al Eisaie	EPA Taiz

Mokha Thermal Power Plant	
Name	**Position**
Eng. Nabil Mekred	Power Station Engineer – Al Mokha
Mr. Mokhtar Abdel Bari	The Procurement Manger of the Power Station – Al-Mokha
Eng. Taha Hamed Salem	Deputy Manager of the Power Station – Al-Mokha

Mokha NGOs	
Name	**Position**
Mrs Bolkes Mohamed Kasem	Head of Al Zahraa NGO for Women Development – Al-Mokha
Tayseeer Hassan Abady	Al Zahraa NGO for Women Development – Al-Mokha, Treasurer
Nagwa Hassan Mohammad	Al Zahraa NGO for Women Development – Al-

Mokha NGOs	
Name	**Position**
Abdu	Mokha, Head of the kindergarten
Mrs. Anesa Mohamed Ali	Member in Alanwar Center for Human Development (NGO) – Al-Mokha
Mrs. Nawal Hekal Salam	Member in Alanwar Center for Human Development (NGO) – Al-Mokha

MOEE and PMU	
Name	**Position**
Ms Sabine Schwarz	Project Technical Advisor, MEE
Eng. Anwar El Kadi	Project Technical Specialist and Acting Manager, MEE
Eng Abdel Salam El Mansour El Janad	Renewable Energy Department Manger, MEE and ESIA Counterpart
Eng. Gamal Thabet	Project PMU Manager , MEE
Eng. Hassan Taleb	Procurment Manager, MEE

Local Community Members

From Al Houlibi Village

Othman Abdu Al Toubili	Guard for the Met Mast
Saleh Mohamad Ahmed Yebal	Daily laborer
Mohammad Abdallah Toubili	Daily laborer (diver on motorbike)
Ghaleb Saad El Seragy	Shepherd and fisherman (HH 1)
Said Ahmed Ali El Serag	Daily Labourer (HH2)
Abd Allah Said Ahmed Ali El Seragy	Contracted in Al Mokha Power Plant (HH3)
Abdo Said Ahmed Aly El Seragy	Employee in Al Mokha Power Plant (HH4)
Aly Mohamed Moghesh	Daily Labourer (HH5)
Mahmoud Mohamed Ahmed Kader	Daily Labourer and motorbike driver (HH6)
Mohamed Ahmed El Kader El Zohary	Contracted Guard in Al Mokha Power Plant (HH7)
Aly Mohamed Ainkazy	Motorbike driver (HH8)
Maged Mohamed Ahmed El Taby	Daily labourer and Shepherd (HH9)
Ahmed Mohamed Ahmed Tobaly	Daily Carrier in Al Mokha Port (HH10)
Abd Allah Zeid bekhet	Daily Carrier in Al Mokha Port (HH11)
Said Omar Hady	Bigger (HH12)
Noaman Abdo Mohamed El Tobaly	Daily Carrier in Al Mokha Port (HH13)
Abdo Mohamed Ahmed Said El Tobaly	Contracted in Al Mokha Power Plant (HH14)
Ahmed Abdo Mohamed El Tobaly	Daily labourer (HH15)

Mohamed Abdallah Mohamed Tobaly	Fisherman (HH16)
Osman Abdo Mohamed Tobaly	Shepherd and fisherman (HH 17)
Salem Abdo Mohamed Tobaly	Shepherd and fisherman (HH 18)
Yahya Mohamed Kader Zohry	Daily labourer (HH19)
Thabet Naser Zohry	Daily labourer and fisherman(HH20)
Zayed Naser Zohry	Contracted in Al Mokha Power Plant with daily wage (HH21)
Naser Mohamed Awad Zohry	Shepherd (HH 22)
Abdo Mohamed Zolamy	Fisherman (HH23)
Nabil Mohamed Zollamy	Selling charcoal (HH 24)
Mohamed Ben Mohamed Zollamy	Motorbike driver (HH25)
Fetany Mohamed Zolamy	Motorbike driver (HH26)
Aisha Salem Tobally	No work – a widow (HH 27)
Abd Allah Mohamed Zollamy	Selling charcoal (HH 28)

From Al Oksh Village:

Mohammad Awad El Dewesh	Daily laborer
Fateny Mohammad Serag	Daily laborer
Saad Ali Daoud	Farmer and shepherd

From Al Tobila Village:

Saeed Ali Tobili
Mohammad Saeed Ali Tobili
Ali Saeed Toubili
Salem Abdu Omar

ANNEX 2 : INTERVIEWS CHECKLISTS AND QUESTIONNAIRES

1- Interview Questionnaire Form

Household code			
Household coordinates			
Name of householder			
Educational status of the householder			
Number of families within household			
Number of individuals within household	Male ( )		
	Female ( )		
The occupation of householders and other working individuals within the family			
The formal and informal role of women			
Particular role of women in the outdoors activities, especially wood collection and grazing			
The existence of formal documents that prove land ownership			
Average area of the house (m^2)			
House structure and construction material			
Availability of the following services	Drinking water	Availability	
		Source	
		Cost	
	Electricity	Availability	
		Source	
		Cost	
Do household members practice any complementary activities to grazing? Please explain			
Who within the household is responsible on these activities?			
Does the household benefit from the Governmental social solidarity pension?			

Consultant Observation

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2- Stakeholders In-depth Interviews

Interview Checklist (1)
Interviews with Residents within the Project Site

The consultant should answer the questions in checklist (1) by employing observation and consulting with key informants in the project neighborhood. Based on the existing residential gatherings, FGDs and SSI should be carried out.

- Date of the field visit

- Names of the telephone number of the consulted stakeholders

- Name of the area/village/gathering

- The existence of houses (formal and informal) or ay structures: Yes ( ) No ( )

In case the answer is yes, the location coordinates should be recorded. Name of the area and the average population size of every gathering should be mentioned.

- Describe the area/village/gathering in terms of:

⇒ Size of population (average in case no accurate statistics exist)
⇒ Children (boys and girls) education: Do children go to schools? The availability of schools for various educational status? Distance to these schools. Do children work? What type of work?
⇒ Average size of families, or the families that have been interviewed.
⇒ Duration of living in the area/village/gathering
⇒ Level of education of the population (male and female)
⇒ The most important economic activities of the residents
⇒ The situation of land ownership documents
⇒ Services in the area
  Drinking water
  Sanitation
  Electricity
  Schools
  Hospitals and health units

N.B. In case of the unavailability of these services in the area, the interviewees should be asked about the alternatives that use (please mention the details of time and money costs, particularly for electricity)

- What are the main reasons that make them prefer living in this neighborhood.
- Level of satisfaction with the available services. Why?

- What are the main merits and demerits of living in this neighborhood?
- Which interventions are needed to develop the neighborhood

The consultant should present the project and observe the level of interviewees' awareness with renewable energy in general and wind energy in particular.

- How do interviewees perceive the project?
- What are the issues that should be considered to maximize local communities benefit from the project?
- Do interviewees have any fears from potential negative impacts that might accompany the project? How could these impacts be mitigated?
- What are the local NGOs or donor agencies that serve the area? What are the projects that have been implemented by these NGOs or donor agencies? Did you benefit from these projects? What are the main lessons learnt from these projects.

Consultant questions:

- What type of impacts does the consultant predict from the project on this community (positive and negative), please focus on the impacts related to affecting livelihoods and land use.

- What procedures/actions should be taken to eliminate the predicted negative impacts? What are the institutional roles and responsibilities?
- Are there any predicted conflict of interest? Please elaborate

Consultant Observation

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……
……

Interview Checklist (2)
Interviews with Residents around Project Site

The consultant should answer the questions in checklist (1) by employing observation and consulting with key informants in the project neighborhood. Based on the existing residential gatherings, FGDs and SSI should be carried out.

- Date of the field visit

- Names of the telephone number of the consulted stakeholders

- Name of the area/village/gathering

- The existence of houses (formal and informal) or ay structures: Yes ( ) No ( )

In case the answer is yes, the location coordinates should be recorded. Name of the area and the average population size of every gathering should be mentioned.

- Describe the area/village/gathering in terms of:

⇒ Size of population (average in case no accurate statistics exist)
⇒ Children (boys and girls) education: Do children go to schools? The availability of schools for various educational status? Distance to these schools. Do children work? What type of work?
⇒ Average size of families, or the families that have been interviewed.
⇒ Duration of living in the area/village/gathering
⇒ Level of education for the population (male and female)
⇒ The most important economic activities of the residents
⇒ The situation of land ownership documents
⇒ Services in the area
    Drinking water
    Sanitation
    Electricity
    Schools
    Hospitals and health units

N.B. In case of the unavailability of these services in the area, the interviewees should be asked about the alternatives that use (please mention the details of time and money costs, particularly for electricity)

- What are the main reasons that make them prefer living in this neighborhood.
- Level of satisfaction with the available services. Why?
- What are the main merits and demerits of living in this neighborhood
- Which interventions are needed to develop the neighborhood

The consultant should present the project and observe the level of interviewees' awareness with renewable energy in general and wind energy in particular.

- How do interviewees perceive the project
- What are the issues that should be considered to maximize local communities benefit from the project?
- Do interviewees have any fears from potential negative impacts that might accompany the project? How could these impacts be mitigated?
- What are the local NGOs or donor agencies that serve the area? What are the projects that have been implemented by these NGOs or donor agencies? Did you benefit from these projects? What are the main lessons learnt from these projects.

Consultant questions:

- What type of impacts does the consultant predict from the project on this community (positive and negative), please focus on the impacts related to affecting livelihoods and land use.
- What procedures/actions should be taken to eliminate the predicted negative impacts? What are the institutional roles and responsibilities?
- Are there any predicted conflict of interest? Please elaborate

Consultant Observation

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Checklist (3)

Interview with the Local Council

- Date and Place of the interview
- Names, positions and telephone number

The consultant to present the project and the objective of the visit

- Background about Al Mokha and the socioeconomic situation
- Key potentials, strengths and the main challenges that face the development of Al Mokha.
- Main economic activities in Al Mokha
- Details about a previous wind energy project that has been implemented in Al Mokha and has not sustained. When has this project been implemented? What was the funding source? What are the key reasons that prevented the project sustainability? Where are the project equipment exist now?
- Information about the electricity provision in Al Mokha including the level of service, number of hours of provision per day? Is the distribution done on equitable basis?
- In case electricity provision is poor, what are the main consequences?
- Does the Local Council plan include any intervention to target the poor community (e.g Al Houlibi village)? What are these interventions and what are the key challenges that face these families?

Project Impact Identification and Mitigation Measures

- The opinion of the responsible officials about the project.
- What are the main predicted impacts during construction and operation of the project
- What are the mitigation procedures that you propose
- Which institutions should play a role in the project? What are these roles?

Local NGOs and Donor Agencies

- What is the situation of local NGOs in Al Mokha in terms of numbers, experience, areas of interests and activities?
- Has any donor agencies been engaged before in projects in Al Mokha? What are these projects and the implementation date?
- Are NGOs playing important role in the development of Al Mokha?
- What are the main challenges that face NGOs and what are the recommended methods to overcome these challenges?

Training Needs

- What are the training and capacity building programs that you are in need for and the project could provide?

The consultant should gather all previous reports, studies and statistics available in the Local Council.

Checklist (4)
Interview NGOs in the Project Site or the Neighboring Area

- Name of the NGO
- Registration Date
- Interviewed members, positions and phone numbers
- Projects that have been implemented by the NGO, date of implementation, sources of funds and the main project outcomes

Project Impact Identification and Mitigation Measures

- The opinion of the Interviewed officials about the project.
- What are the main predicted impacts during construction and operation of the project
- What are the mitigation procedures that you propose
- Which institutions should play a role in the project? What are these roles?

ANNEX 3: PUBLIC CONSULTATION DOCUMENTATION

Annex 3- A 1: List of Participants in the Public Consultation Workshop, Tuesday 8th June 2010

Ser	Name	Position	Tel
1	Eng. Abd El Salam Mansour El Gana	Project Specialist – MOEE	777200449
2	Aly Abd El Alem Hassan	Head of the Agriculture Department, Mokha	777352702
3	Mohamed Mansour Mohsen	Water Studies Unit- Water Resources Department, Mokha Local Council	734129124
4	Eng. Fouad Aly Abd El Moghny	Deputy Manger of Land Protection and Ntural Resources, Mokha Local Council	777149131
5	Eng. Galal Abd El Warth Abd El Rashed	Project Site Engineer, MEE	771210054
6	Waheb Darhm Abd Aly	Project Financial Manger, MEE	777098213
7	Noaman Abdo Mohamed Tobaly	Houlibi village resident	-
8	Ibrahim Ahmed Mohamed El Seragy	Serega village resident	71495625
9	Eng Belal Abd El Kerim Kasem	Manger of Land Protection and Ntural Resources, Mokha Local Council	77191201
10	Aly Ahmed Medary	Serega village resident	-
11	Aly Mohamed Tobaly	Toubila village resident, Houlibi	-
12	Ahmed Mohamed Tobaly	Houlibi village resident	-
13	Abd Allah Zeid Bekhet	Houlibi village resident	-
14	Nabil Mohamed Zollamy	Houlibi village resident	-
15	Mohamed Mohamed Keried	Houlibi village resident	-
16	Thabit Naser Zohry	Houlibi village resident	-
17	Salem Abdo Tobaly	Houlibi village resident	-
18	Mohey Mohamed Keried	Houlibi village resident	-
19	Aly Mohamed Moghnes	Houlibi village resident	-
20	Mohamed Ahmed Kerier Zohry	Houlibi village resident	-
21	Ghaleb Saeid El Serigy	Al Oksh village resident	-
22	Mohamed Awad Awad	Al Oksh village resident	714116923

Ser	Name	Position	Tel
	Dewish		
23	Naser Mohamed Awad Zohry	Houlibi village resident	-
24	Said Omar Hady	Houlibi village resident	-
25	Said Mohamed El Seragy	Serega village resident	-
26	Abd Allah Said El Seragy	Serega village resident	-
27	Khaled Said Ahmed El Seragy	Serega village resident	
28	Said Aly Dawad	Al Oksh village resident	
29	Mouaaz Ahmed Abd El Rahman El Hadad	Red Crescent Association, Mokha	71106769
30	Melodie Breton	French organization GRET (Al Zahra NGO Partners)	736783189
31	Nagwa Hussien Mohamed Abd El Wahab	Al Zahraa NGO	04 362023
32	Tayser Hassan Abady	Al Zahraa NGO Treasurer	04 362023
33	Wedyan Mohamed Ahmed Mofdel	Al Zahraa NGO - Head of the Environment Committee	04 362023
34	Dr. Nezar faysal Aly Langery	Health Directorate, Mokha	77254468
35	Eng. Taha Hamed Salam	Deputy Manger of Mokha Power Plant	777746550
36	Eng. Aly Abd Alla Ibrahim	Planning Manger, Mokha Power Plant	771297040
37	Aly Al Oriky Mohamed El Khasheny	Local Council Member, Dabab	777362381
38	Elshikh/ Abd Allah Mohamed El Seragy	Mokha Head of Sheikhs and Local Council Member	777170818
39	Boshra Said Thabit	Head of the Women Sector., Shams El Behar NGO	632731
40	Sala Abd Allah Mohamed Fayrouz	Chairman of Al Fanar NGO	03 22548
41	Eng. Belal Abd El Kerim Kasem	Head of the Branch Office of the General Organization of Land, Survey and Urban Planning	71919201
42	Thabit bn Thabit Said	Head of the Agricultuer Department	777265398
43	Osman Awad Aly Tafout	Head of the Social Affairs Committee	777362157
44	Yahiya Abd Allah Nagy	Head of the Public Works Office	77362240
45	Abdo Mohamed Koballey	Houlibi village resident	-
46	Said Serag Mohamed Zolamy	Houlibi village resident	734622027
47	Kotany Mohamed Zollamy	Houlibi village resident	-

Ser	Name	Position	Tel
48	Abdo Mohamed Zollamy	Houlibi village resident	-
49	Yahiya Mohamed Serag	Houlibi village resident	-
50	Kasem Mohamed El Shazly	Head of the Education Office	777362237
51	Eng. Aref Bagour	Deputy Governor of Taiz Governorate	777771873
52	Mr. ghazy Ahmed Aly	General Manger of Public Electricity Corporation	777778600
53	Ahmed Kaaad Salah	Head of Mokha Directorate	777946434
54	Abd El Latif Abdo Ahmed El shafrery	Head of Bab El Mandab	7777333299
55	Eng Abd El Kaerim El Borkany	The Commercial Manger, Taiz Electricity Department	777439899
56	Eng. Mohamed Aly Al Mogaty	Head of the Communication Department	777004044
57	Eng . Aly Saleh Alhemekafy	Driver in Mokha Power Plant	711239394
58	Hamza El Abasy	Sabaa News Agency – Taiz	733897268
59	Abd Allah Ahmed El Megaaly	The Planning Department – Taiz Governorate	711841821
60	Aly Said Oakazy		
61	Eng. Wasek Abd El Fatah El Abusy	Project Manager, Diaa Organization	734592348 773505881
62	Mohamed Abd Alla Ibrahim Mohamed	Hygiene Officer, Health Office, Mokha	770956280
63	Mohamed Abd Alla Tobaly	Worker in the local Council, Mokha	
64	Mohamed Hassan El Kadry	Office Manager for the Deputy Governor	77724015

Annex 3- A 2: Scanned Copy of the List of Public Consultation Participants

الجلسة التشاورية لمناقشة نتائج دراسة تقييم الاثر البيئي و الإجتماعي الخاص بمشروع مزرعة الرياح ٦٠ ميجاوات بالمخا – الجمهورية اليمنية

الثلاثاء ٨ يونيو ٢٠١٠

قاعة الاجتماعات والمؤتمرات بالمجمع الحكومي بالمخا

قائمة تسجيل السادة الحضور

RECEIVED 20 JUN 2010 EcoConServ

م	الأسم	الوظيفة و الجهة التابع لها	هاتف	بريد إليكتروني	توقيع
١.	م/ عبد السلام محسن الحكيم		733200449	aljanad@gmail.com	
٢.	علي عبد العليمي الحلبي		٧٧٠٢٥٢٦١٢		
٣.	محمد ناصر محسن		٧٢٤١٢٩١٤٤	mocha-assetwid@yahoo.com	
٤.	أ/ فؤاد علي عبد المغني		٧٧٧١٢٩١٣١	fuadmagh@yahoo.com	
٥.	أ/ جلال عبد العزيز عبد الرشيد		7712100546	m.jalal@gmail.com	
٦.	طبيب وسام عبده		٧٧٠٩٢٥١٧		
٧.	نعمان عبد محمد طبيلي		—	—	
٨.	ابراهيم احمد محمد ابراهيم		٧١٢١٩٥٦٢٥	—	
٩.	أ/ بلال عبد الكريم قاسم		٧٧١٩١٩٥٠١		
١٠.	علي طاهر حيدرة		—	—	

الجلسة التشاورية لمناقشة نتائج دراسة تقييم الاثر البيئي و الإجتماعي الخاص بمشروع مزرعة الرياح ٦٠ ميجاوات بالمخا – الجمهورية اليمنية

الثلاثاء ٨ يونيو ٢٠١٠

قاعة الاجتماعات والمؤتمرات بالمجمع الحكومي بالمخا

RECEIVED 20 JUN 2010 EcoConServ

قائمة تسجيل السادة الحضور

م	الأسم	الوظيفة و الجهة التابع لها	هاتف	بريد إليكتروني	توقيع
١١.	علي محمد طبيلي	قرية الطبيلي	—	—	
١٢.	احمد محمد طبيلي	قرية الطبيلي	—	—	
١٣.	عبد الله زيد الجنيد	" "	—	—	
١٤.	نبيل محمد طبيلي	" "	—	—	
١٥.	محمد محمد كديد	" "	—	—	
١٦.	ثابت ناصر زهرة	" "	—	—	
١٧.	سالم عبده طبيلي	" "	—	—	
١٨.	حسن محمد كديد	" "	—	—	
١٩.	علي محمد هيلسة	" "	—	—	
٢٠.	حسن احمد كديد زهرة	" "	—	—	

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الجلسة التشاورية لمناقشة نتائج دراسة تقييم الاثر البيئي و الإجتماعي الخاص بمشروع مزرعة الرياح ٦٠ ميجاوات بالمخا – الجمهورية اليمنية

الثلاثاء ٨ يونيو ٢٠١٠

قاعة الاجتماعات والمؤتمرات بالمجمع الحكومي بالمخا

RECEIVED 20 JUN 2010 EcoConServ

قائمة تسجيل السادة الحضور

م	الأسم	الوظيفة و الجهة التابع لها	هاتف	بريد إليكتروني	توقيع
٢١.	غالب سعيد السراجي	العكش	.	—	
٢٢.	محمد عوض عوض درويش	العكش	٧١٤١١٦٩٢٣	—	
٢٣.	ناصر محمد عوض الحري	الطليبي	—	—	
٢٤.	سعيد عمر هادي	//	—	—	
٢٥.	سعيد محمد السراجي	السرجي	—	—	
٢٦.	عبدالله سعيد السراجي	السرجي	—	—	
٢٧.	خالد سعيد احمد السراجي	//	—	—	
٢٨.	سعيد يحيى داوود	العكش	—	—	
٢٩.	صالح احمد عبدالرحمن الحداد	[illegible]	٧١١٠٦٧٧٦٩		
٣٠.	Mélodie BRETON	French organisation GRET (Al Zahara's partner)	736 783 189	breton@gret.org	

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قائمة تسجيل السادة الحضور

م	الأسم	الوظيفة و الجهة التابع لها	هاتف	بريد إليكتروني	توقيع
٣١.	أروى حسين محمد عبدالوهاب	مديرة جمعية الزهراء	٠٤٢٦٦٢٠٢٣		
٣٢.	تيسير حسن عبادي	أمين صندوق	٠٤٢٦٦٢٠٢٣		
٣٣.	وديان محمد احمد مفضل	رئيسة الجمعية الخيرية الزهراء	٠٤٢٦٢٠٢٣	almocha.girl@gmail.com (Al Zahra's address)	
٣٤.	د. نزار [illegible]	[illegible]	٧٧٠٥٤٤٦٨		
٣٥.	١٢ طه حميد سلام	نائب مدير عام [illegible]	٧٧٧٧٤٦٥٥٠		
٣٦.	[illegible]	مدير [illegible]	771297040	ali-alsabaie.net.ye	
٣٧.	علي [illegible] محمد [illegible]	عضو المجلس المحلي [illegible]	٧٧٧٣٦٢٣٨١		
٣٨.	الشيخ عبدالله محمد [illegible]	شيخ مشايخ [illegible]	٧٧٧١٧٠٨١٨		
٣٩.	بشرى منصور [illegible]	[illegible]	٦٣ ٤٧ ٢١		
٤٠.	سالي عبدالله محمد فيروز	رئيسة جمعية [illegible]	٣٢٢٥٤٨		

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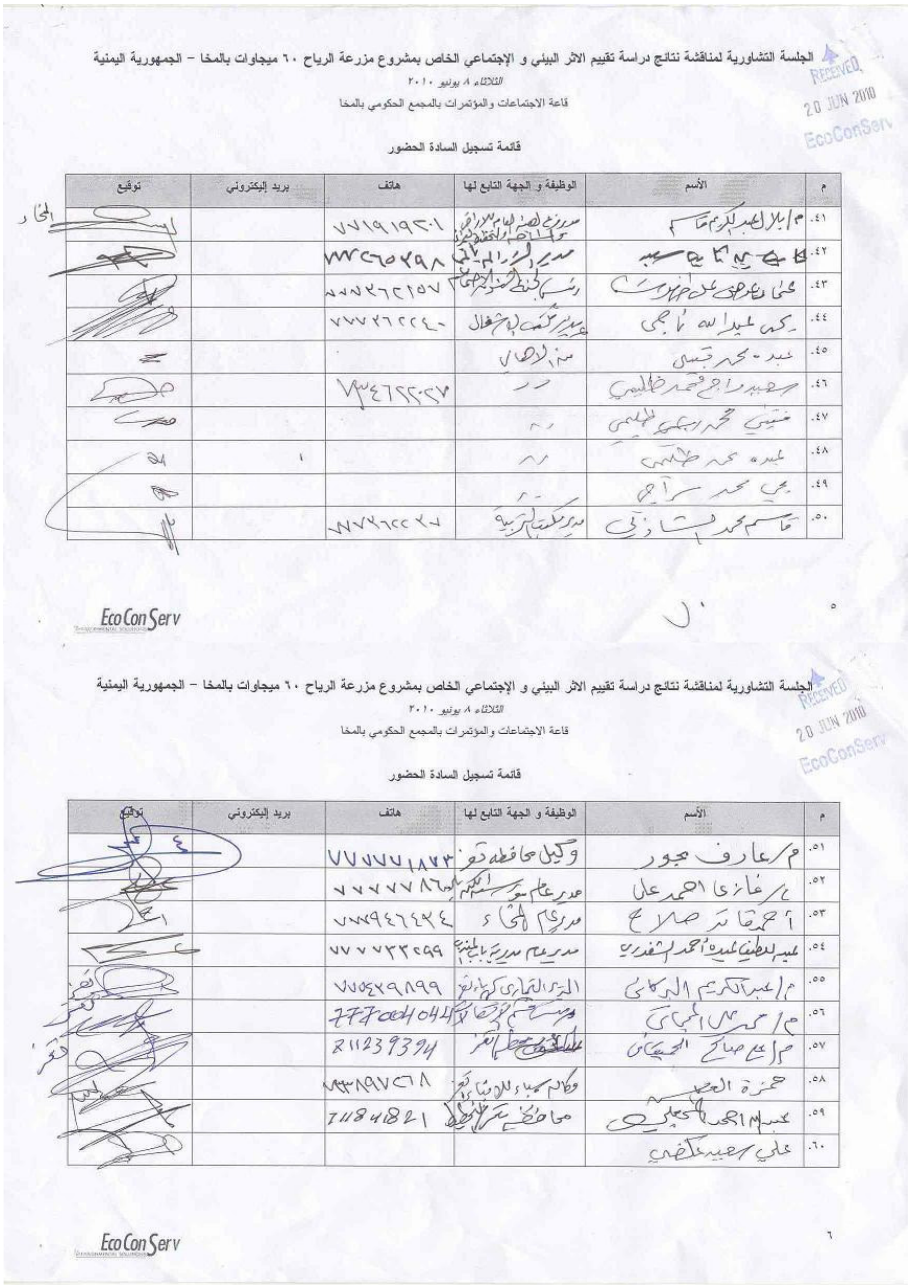

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الثلاثاء ٨ يونيو ٢٠١٠

قاعة الاجتماعات والمؤتمرات بالمجمع الحكومي بالمخا

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قائمة تسجيل السادة الحضور

م	الأسم	الوظيفة و الجهة التابع لها	هاتف	بريد إليكتروني	توقيع
٤١.	م/ بلال العبد الكريم		٧٧١٩١٩٣٠١		
٤٢.			٧٧٢٥٧٩٨		
٤٣.			٧٧٧٢٦٢١٥٧		
٤٤.			٧٧٧٢٦٢٢٤٠		
٤٥.					
٤٦.			٧٧٣٤٦٢٢٠٢٧		
٤٧.					
٤٨.					
٤٩.					
٥٠.			٧٧٧٦٠٠٢٧		

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الثلاثاء ٨ يونيو ٢٠١٠

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قائمة تسجيل السادة الحضور

م	الأسم	الوظيفة و الجهة التابع لها	هاتف	بريد إليكتروني	توقيع
٥١.	م/ عارف مجور	وكيل محافظة تعز	٧٧٧٧١٨٧٣		
٥٢.			٧٧٧٧٧٨٦		
٥٣.			٧٧٧٩٤٦٩٢٤		
٥٤.			٧٧٧٧٢٢٠٩٩		
٥٥.			٧٧٥٤٧٩٨٩٩		
٥٦.			777064044		
٥٧.			21123934		
٥٨.			٧٧٣٨٩٧٠٦٨		
٥٩.			711841821		
٦٠.					

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Annex 3- B: Invitation Sample

دعـــوة

يسر وزارة الكهرباء و الطاقة بالجمهورية اليمنية بالتعاون مع شركة إكوكونسرف للحلول البيئية

أن تدعوكم

لحضور الجلسة التشاورية لعرض نتائج دراسة تقييم الأثر البيئي و الاجتماعي لمشروع مزرعة الرياح بطاقة 60 ميجاوات بالمخا

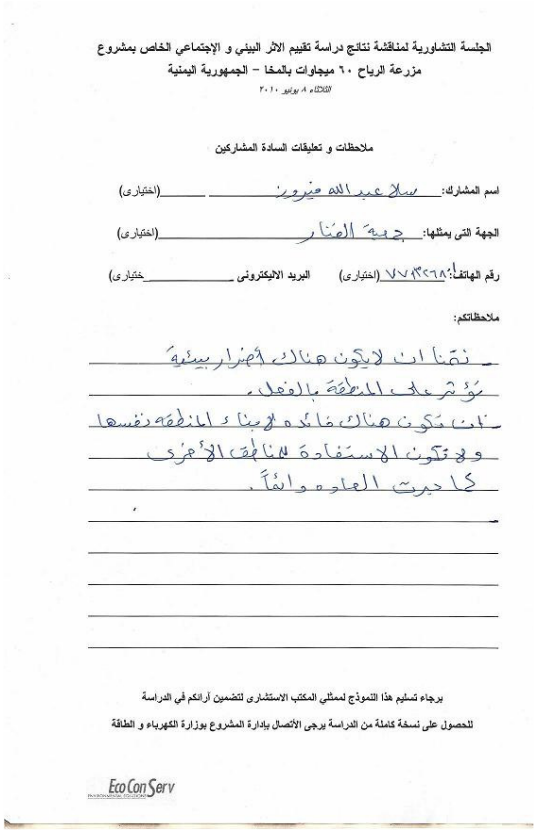
و ذلك بمشيئة الله يوم الثلاثاء الموافق 2010/6/8 في صالة اجتماعات مبنى مديرية المخاء في المخاء بمحافظة تعز

الساعة التاسعة و النصف صباحا

مرفق طيه برنامج الجلسة التشاورية و ملخص تقرير الأثر البيئي و الإجتماعي للمشروع

و أننا لنتطلع لمشاركة سيادتكم في هذه الجلسة

Annex 3- C: Sample of the Written Comments Sheets



الجلسة التشاورية لمناقشة نتائج دراسة تقييم الاثر البيئي و الإجتماعي الخاص بمشروع
مزرعة الرياح ٦٠ ميجاوات بالمخا – الجمهورية اليمنية
الثلاثاء ٨ يونيو ٢٠١٠

ملاحظات و تعليقات السادة المشاركين

اسم المشارك: سلاح عبد الله منور (اختياري)

الجهة التي يمثلها: جبة العنار (اختياري)

رقم الهاتف: ٧٧٩٣٢٦٨ (اختياري) البريد الاليكتروني (اختياري)

ملاحظاتكم:

- نتمنا ان لايكون هناك أضرار بيئية
تؤثر على المنطقة بالفعل.
- ان تكون هناك فائده لبناء المنطقه نفسها
و لا تكون الاستفادة للمناطق الأخرى
كما جرت العاده دائماً.

برجاء تسليم هذا النموذج لممثلي المكتب الاستشاري لتضمين آرائكم في الدراسة
للحصول على نسخة كاملة من الدراسة يرجى الأتصال بادارة المشروع بوزارة الكهرباء و الطاقة

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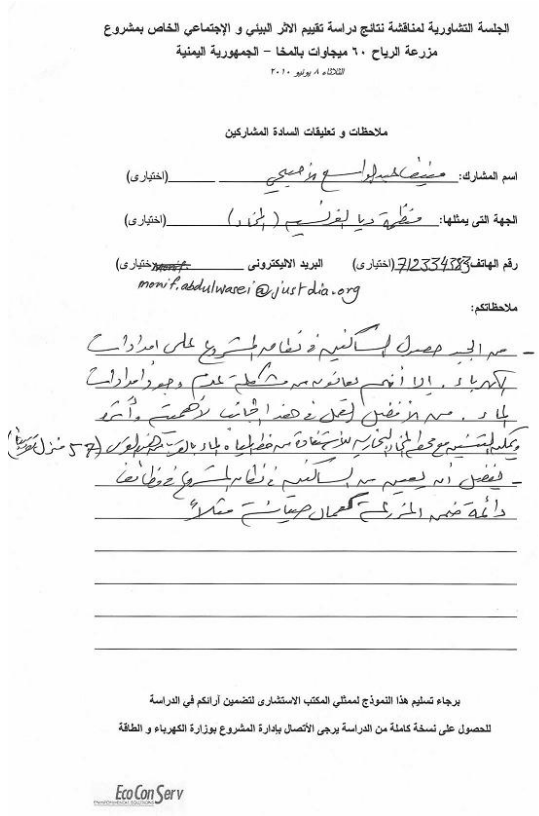

الجلسة التشاورية لمناقشة نتائج دراسة تقييم الاثر البيئي و الإجتماعي الخاص بمشروع
مزرعة الرياح ٦٠ ميجاوات بالمخا – الجمهورية اليمنية
الثلاثاء ٨ يونيو ٢٠١٠

ملاحظات و تعليقات السادة المشاركين

اسم المشارك: (اختياري)

الجهة التي يمثلها: (اختياري)

رقم الهاتف (اختياري) البريد الاليكتروني (اختياري)
monif.abdulwasei@just.edu.org

ملاحظاتكم:

برجاء تسليم هذا النموذج لممثلي المكتب الاستشاري لتضمين آرائكم في الدراسة
للحصول على نسخة كاملة من الدراسة يرجى الأتصال بادارة المشروع بوزارة الكهرباء و الطاقة

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ANNEX 4: REGISTRATION SURVEY RESULTS

Mokha 60 MW Wind Farm Project (MWFP)

Community registration survey

Registration Survey Objectives:

As part of the preparation of the Environmental and Social Impact Assessment for MWFP, a registration survey was requested by the WB and PMU to be carried out for households locating within the project site. The survey has been carried out in the duration from 19th to 23rd September 2010 with the main objective of registering the households within the project site as a control measure in order to avoid the influx of new residents who may come to the project area and claim compensation in case involuntary resettlement plan is considered in the future. The Survey Questionnaire is attached in Annex (4 -A).

Key results from the survey

Annex B of this report include full summary of the survey results. The key findings are as follows:

- The project location (both within the project site and the close outer boundaries of the project site) has a total of 91 inhibited households. There are also 3 uninhibited houses and a grave.
- The project location encompasses three villages, namely, Al Serega, Al Houlibi and Al Oksh. Households of these villages are indicated on the table below.

Name of the village	Number of households		Comments
	Within project site	Near the outer boundaries	
Al Oksh	29	4	3 uninhibited houses and 1 grave locate within this village
Al Houlibi	8	16	
Al Serega	26	6	
Total	**63**	**26**	

- 35 householders refused to give information about their households and/or refused to sign/finger pint the questionnaire. The survey team, in these cases, only recorded the household coordinates and filled the information that was made available. This, in itself, is regarded as a sufficient control measure to avoid future population claims for compensation.
- The total population of the households whose owners accepted to reveal information and sign the survey questionnaire is 339 individuals.
- It is assumed that the average family size of those who refused to reveal information is 6 members/ household. This means that a total of around 210 persons should be

added to the 339 individuals mentioned above to make a total of 549 persons which is the estimate figure of the population with the project location.

- The duration of the families stay in their current households varied from 2 years to a maximum of 20 years. The households that gave a specified figure about the length of their stay was limited compared to those who just mentioned that they have settled on this area since very long time without being able to specify.
- Most of the households are encompassed of one family except for three households that have 2 families.

Annex 4- A: Local Residents within Mokha 60 MW Wind farm Project Site

Household Questionnaire

1. Name of the village		
2. GPS coordinates of the household (to be measured 5 meters to the south of the house)		
3. Name of the household owner		
4. Number of families within the household		
5. Details of household members (expand cells as needed)		
Family (1):		
Full name	Gender	Age
Family (2):		
Full name	Gender	Age
Family (3):		
Full name	Gender	Age
6. Average area of the house (m^2)		
7. Duration of the family stay in the house		
8. Legal documents to prove ownership for the house		
9. Type of document (if any)		

I herby certify that the information above is correct and reflects the situation of my households

Name of householder …….
Signature of householder …….

Annex 4- B: Summary of the registration survey results at Mokha 60 MW Wind Farm Project (MWFP) Site

#	Name of householder	Village	Household Coordinates	Number of families/ household	Number of members within household	House area (average m^2)	Date of settling in this household	Documents to prove ownership of the house	Comments
1	Abdo Aly Dawd	Al Oksh	1478401-318912	1	8	40		Not available	
2	Aly Ahmed Zaid Moghyni	Al Oksh	1478436-318884	1	8	32	10 years	Not available	
3	Ahmed Ahmed Moghbish El Serage	Al Oksh	1477911-318306	1	-	35	Long time ago[74]	Not available	No information and/or no signature[73]
4	Mohamed Ahmed Moghbish El Serage	Al Oksh	1477945-318365	1	-	40	Long time ago	Not available	No information and/or no signature
5	Ghalep Ahmed Aly Moghbish	Al Oksh	1477991-318376	1	-	20	Long time ago	Not available	No information and/or no signature
6	Abdallah Ghalep Ahmed Aly Moghbish	Al Oksh	1477990-318370	1	-	40	Long time ago	Not available	No information and/or no signature
7	Abdo Ahmed Aly Moghbish	Al Oksh	1478020-318386	1	-	20	-	Not available	No information and/or no signature
8	Mohamed Abdo	Al Oksh	1478027-	1	-	12		Not	No information

[73] This refers o the cases where surveyors refused to provide the survey team with details and refused to sign the registration survey
[74] In cases where "long time ago" is mentioned, this reflects what the surveyors said without determining specific period of time

#	Name of householder	Village	Household Coordinates	Number of families/ household	Number of members within household	House area (average m^2)	Date of settling in this household	Documents to prove ownership of the house	Comments
	Ahmed Aly Moghbish		318378					available	and/or no signature
9	Aly Kaad Ahmed Aly	Al Oksh	1478040-318345	1	-	20	-	Not available	No information and/or no signature
10	Kaad Ahmed Aly Moghbish	Al Oksh	1478043-318337	1	2	15	Long time ago	Not available	No information and/or no signature
11		Al Oksh	1477664-316433	Uninhibited	Uninhibited	54			Uninhibited
12	Ahmed Abdallah Tobili	Al Oksh	1477803-316241	2	8	45	2 years	Not available	
13	Ahmed Omr Abdallah Tobili	Al Oksh	1476414-315326	2	15	45	2 years	Not available	
14	Aly Said Omr Abdallah Tobili	Al Oksh	1477357-315696	1	4	50	20 years	Not available	
15	Mohamed Said Omr Abdallah	Al Oksh	1477348-315745	1	6	45	20 years	Not available	
16	Said Omr Abdallah Tobili	Al Oksh	1477367-315658	1	10	63	20 years	Not available	
17	Aly Gaber Mokbil	Al Oksh	1477034-318283	2	7	21	Long time ago	Not available	
18	Aly Awd Ben Awd Darwish	Al Oksh	1476916-318412	1	6	21	10 years	Not available	
19	Mohammed Awd	Al Oksh	1476943-	1	7	15	Long time	Not	

#	Name of householder	Village	Household Coordinates	Number of families/ household	Number of members within household	House area (average m^2)	Date of settling in this household	Documents to prove ownership of the house	Comments
	Ben Awd Darwish		318425				ago	available	
20	Ahmed Mohammed Awd Darwish	Al Oksh	1475406-318617	1	10	28	Long time ago	Not available	
21	Salem Moghbish Moghbish	Al Oksh	1477009-318397	1	9	45	Long time ago	Not available	
22	Said Gaber Abdalah Moghbish	Al Oksh	1477034-318263	1	5	12	10 years	Not available	
23	Haael Said Abdallah Moghbish	Al Oksh	1476544-318308	1	4	24	Long time ago	Not available	
24	Mohammed Said Abdallah Moghbish	Al Oksh	1476539-318329	1	2	16	Long time ago	Not available	
25	Aly Mohamed Abdallah	Al Oksh	1476531-318396	1	4	9	Long time ago	Not available	
26	Ahmed Mohammed Abdallah Moghbish	Al Oksh	1476512-318448	1	3	8	Long time ago	Not available	
27	Aly Said Abdallah Moghbish	Al Oksh	1476542-318320	1	6	32	Long time ago	Not available	
28	Abdo Aly Awad Moghbish	Al Oksh	1476913-318427	1	2		-	Not available	
29		Al Oksh	1476991-318360	Uninhibited	Uninhibited	20	-	-	Uninhibited
30	Ahmed Saleh Abdo	Al Oksh	1475362-318631	1	2	12	Long time ago	Not available	

#	Name of householder	Village	Household Coordinates	Number of families/ household	Number of members within household	House area (average m^2)	Date of settling in this household	Documents to prove ownership of the house	Comments
31	Aly Ahmed Saleh Abdo	Al Oksh	1475420-318688	1	6	20	Long time ago	Not available	
32		Al Oksh	1475676-318148	-	-	132	-	-	No information and/or no signature
33		Al Oksh	1476122-318007	Uninhibited	Uninhibited	28	-	-	Uninhibited
34	Mohamed El sayed Abdo Mohgep	Al Oksh	1476286-317488	1	3	20	8 years	Not available	
35	Gaafr Abdallah Sayed Abdo Mohgep	Al Oksh	1476312-317515	1	5	24	8 years	Not available	
36	Abd Ellatef Abdallah Sayed	Al Oksh	1476311-317512	1	3	24	8 years	Not available	
37	A GRAVE	Al Oksh	1477515-317301	-	-	300			
38	Thabet Naser El Zohry	Al Houlibi	1478594-312951	1	2	24	20 years	Not available	
39	Meged Mohamed Elshikh	Al Houlibi	1478141-313370	1	1	36	Long time ago	Not available	
40	Said Omr	Al Houlibi	1478193-313381	1	2	12	Long time ago	Not available	
41	Ahmed Mohammed Elshekh	Al Houlibi	1478173-313346	1	5	28	Long time ago	Not available	

#	Name of householder	Village	Household Coordinates	Number of families/ household	Number of members within household	House area (average m^2)	Date of settling in this household	Documents to prove ownership of the house	Comments
42	Mohammed Mohammed El zohry	Al Houlibi	1478147-313530	1	2	24	Long time ago	Not available	
43	Abdallah Zaid	Al Houlibi	1478172-313335	1	6	28	-	Not available	
44	Salma Hezam	Al Houlibi	1478170-313459	1	1	9	Long time ago	Not available	
45	Aly Ahmed Ankf	Al Houlibi	1478168-313437	1	7	20	Long time ago	Not available	
46	Abdo Naser El Zohry	Al Houlibi	1478620-312910	1	2		Long time ago	Not available	
47	Zaid Naser Elzohry	Al Houlibi	1478619-312935	1	5	28	Long time ago	Not available	
48	Naser Mohammed El Zohry	Al Houlibi	1478598-312890	1	2	18	Long time ago	Not available	
49	Yahiya Mohammed Kadbr	Al Houlibi	1478536-313057	1	1	28	Long time ago	Not available	
50	Mohamed Ahmed Zohry	Al Houlibi	1478143-313546	1	3	48	Long time ago	Not available	
51	Salem Abdo Al Houlibi	Al Houlibi	1478233-313045	1	1	21	Long time ago	Not available	No information and/or no signature
52	Noaman Abdo Tobili	Al Houlibi	1478272-313073	1	-	24	-	Not available	No information and/or no signature

#	Name of householder	Village	Household Coordinates	Number of families/ household	Number of members within household	House area (average m^2)	Date of settling in this household	Documents to prove ownership of the house	Comments
53	Ahmed Abdo Tobili	Al Houlibi	1478237-313006	1	3	28	Long time ago	Not available	No information and/or no signature
54	Mohammed Abdallah El Zolemy	Al Houlibi	1478307-312922	1	1	9	Long time ago	Not available	
55	Abnaa Mohammed Mohammed Ghaleb	Al Houlibi	1478349-312829	1	5	18	Long time ago	Not available	
56	Mohamed Ben Mohammed El Zolamy	Al Houlibi	1478355-312858	1	3	28	Long time ago	Not available	
57	Abdallah Mohammed Zolamy	Al Houlibi	1478303-312933	1	7	20	Long time ago	Not available	
58	Fateni Mohamed Abdallah Zolamy	Al Houlibi	1478327-312932	1	5	20	Long time ago	Not available	
59	Abdo Ahmed Abdallah To Tobili	Al Houlibi	1478348-312804	1	4	12	Long time ago	Not available	
60	Abdo Abdo Tobili	Al Houlibi	1478268-313047	1	4	12	Long time ago	Not available	
61	Osman Abdo Tobili	Al Houlibi	1478291-313023	1	3	28	Long time ago	Not available	
62	Said Aly Dawd	Al Serega	1480368-	1	10	28	Long time	Not	Located on the project site

#	Name of householder	Village	Household Coordinates	Number of families/ household	Number of members within household	House area (average m^2)	Date of settling in this household	Documents to prove ownership of the house	Comments
	Hassan El Seragy		3149970				ago	available	boarder
63	Zaid Said Aly Dawd Hassan El Seragy	Al Serega	1483334-314926	1	3	20	Long time ago	Not available	Located on the project site boarder
64	Mohammed Ahmed Mohammed El Seragy	Al Serega	1483451-314497	1	1	20	Long time ago	Not available	Located on the project site boarder
65	Ahmed Mohammed Mohammed El Seragy	Al Serega	1483516-314567	1	2	16	Long time ago	Not available	Located on the project site boarder
66	Ibrahim Ahmed Mohammed El Seragy	Al Serega	1483470-314438	1	8	65	Long time ago	Not available	Located on the project site boarder
67	Mohammed Mohammed Ahmed El Sergy	Al Serega	1483497-314529	1	4	35	Long time ago	Not available	Located on the project site boarder
68	Said Mohammed Ahmed Aly El Seragy	Al Serega	1483497-314096	1	5	56	-	Not available	Located on the project site boarder No information and/or no signature
69	Akho Abady Ben El Seragy	Al Serega	1480675-313822	1	-	40	-	-	No information and/or no

#	Name of householder	Village	Household Coordinates	Number of families/ household	Number of members within household	House area (average m^2)	Date of settling in this household	Documents to prove ownership of the house	Comments
									signature
70	Abd Ahmed Hedary El Seragy	Al Serega	1480400-313334	1	9	28	Long time ago	Not available	
71	Lahgy Ahmed Hedary El Seragy	Al Serega	1480356-313369	1	6	45	Long time ago	Not available	
72	Mohamed Ahmed Hedary El Seragy	Al Serega	1480426-313293	1	7	28	Long time ago	Not available	
73	Salem Mohamed Aly El Seragy	Al Serega	1483137-313729	1	2	28	Long time ago	Not available	No information and/or no signature
74	Mohamed Saleh El Seragy	Al Serega	1482615-313719	1	6	20	Long time ago	Not available	No information and/or no signature
75	Awad Mohammed Aly El Seragy	Al Serega	1483142-313770	1	2	16	Long time ago	Not available	No information and/or no signature
76	Mohmmed Aly El Seragy	Al Serega	1483134-313716	1	3	20	Long time ago	Not available	No information and/or no signature
77	Aly Mohammed Aly El Seragy	Al Serega	1483047-313775	1	2	20	Long time ago	Not available	No information and/or no signature
78	Feteni Mohamed Aly El Seragy	Al Serega	1483006-313798	1	3	20	Long time ago	Not available	No information and/or no

#	Name of householder	Village	Household Coordinates	Number of families/ household	Number of members within household	House area (average m^2)	Date of settling in this household	Documents to prove ownership of the house	Comments
									signature
79	Awd Lahd Aly El Seragy	Al Serega	1483025-313779	1	2	20	Long time ago	Not available	No information and/or no signature
80	Ahmed Mohamed Aly E Sragy	Al Serega	1482950-313794	1	6	80	Long time ago	Not available	No information and/or no signature
81	Ahmed Zaid Moghbish El Seragy	Al Serega	1483113-314407	1	4	20	Long time ago	Not available	No information and/or no signature
82	Ahmed Mohammed Mohammed El Seragy	Al Serega	1480674-313915	1	1	24	Long time ago	Not available	No information and/or no signature
83	Yahiya Mohammed Mohammed El Seragy	Al Serega	1480679-313901	1	2	42	Long time ago	Not available	No information and/or no signature
84	ALy Mohammed Mohammed El Seragy	Al Serega	1480697-313931	1	2	20	Long time ago	Not available	No information and/or no signature
85	Abd Mohammed Mohammed El Seragy	Al Serega	1480708-313901	1	2	16	Long time ago	Not available	No information and/or no signature
86	Said Mohammed	Al Serega	1480679-	1	4	28	Long time	Not	No

#	Name of householder	Village	Household Coordinates	Number of families/ household	Number of members within household	House area (average m^2)	Date of settling in this household	Documents to prove ownership of the house	Comments
	Mohammed El Seragy		313831				ago	available	information and/or no signature
87	Aly Ahmed Mohammed El Seragy	Al Serega	1480713-313669	1	2	24	Long time ago	Not available	No information and/or no signature
88	Salem Ahmed Mohammed El Seragy	Al Serega	1480751-313702	1	2	16	Long time ago	Not available	No information and/or no signature
89	Mohammed Ahmed El Seragy	Al Serega	1480749-313706	1	2	12	Long time ago	Not available	No information and/or no signature
90	Said Ahmed Mohammed El Seragy	Al Serega	1480745-313712	1	2	20	Long time ago	Not available	No information and/or no signature
91	Abdo Mohammed Ahmed El Seragy	Al Serega	1480761-313722	1	2	20	Long time ago	Not available	No information and/or no signature
92	Awd Talep Kamel	Al Serega	1480713-313584	1	3	20	Long time ago	Not available	No information and/or no signature
93	Aly Zaid Moghbish El Seragy	Al Serega	1482973-314127	1	2	9	Long time ago	Not available	No information and/or no signature