

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT (ESIA) FOR KOSPO 51.75 MW WIND POWER PROJECT IN TAFILEH



ESIA

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Project Developer:

DAEHAN WIND POWER Co., PSC

ESIA Practitioner:



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CONTACTS

ECO Consult	CUBE
Physical Address:	Physical Address:
ECO Consult	Ramboll CUBE GmbH
Jude Centre, 4th floor, Building #1	Stadtdeich 7
Salem Hindawi Street	20097 Hamburg
Shmeisani	Germany
Amman	
Jordan	
Mailing Address:	Mailing Address:
ECO Consult PO Box 941400 Amman 11194 Jordan	Ramboll CUBE GmbH
Tel: +962 6 569 9769	Stadtdeich 7
Fax: + 962 6 569 7264	20097 Hamburg /Germany
Email: info@ecoconsult.jo	Tel: +49 40.6000. 94 67-10
	Fax: +49.561.28 85 73-19
	Email: hamburg@cube-engineering.com
Contact Persons:	Contact Persons:
Ibrahim Masri	Jonas Feja
ibrahim.masri@ecoconsult.jo	jonas.feja@ramboll.com
Lana Zubi	Annika Müller
Lana.zubi@ecoconsult.jo	annika.mueller@ramboll.com

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ABBREVIATIONS

ASL	Amman Silicified Limestone
BOO	Build, Operate and Transfer
CARC	Civil Aviation Regulatory Commission
CBO	Community Based Organization
CEA	Cumulative Effect Assessment
DLS	Department of Lands and Survey
DoA	Department of Antiquities
DoM	Department of Meteorology
DoS	Department of Statistics
EHS	Environment, Health and Safety
EIA	Environmental Impact Assessment
EPC	Engineering, Procurement and Construction
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
GWh	Gega-Watt Hour
IBA	Important Bird Area
IFC	International Finance Corporation
IFI	International Financing Institutions
IUCN	International Union for Conservation of Nature
JoD	Jordanian Dinar
JRTV	Jordan Radio and Television Corporation
KS	Kurnub Sandstone
KwH	Kilo-Watt Hour
MCM	Million Cubic Meters
MEMR	Ministry of Energy and Mineral Resources
MoA	Ministry of Agriculture
MoEnv	Ministry of Environment
MoH	Ministry of Health
MoL	Ministry of Labor
MoMA	Ministry of Municipal Affairs
MoT	Ministry of Transport
MW	Mega Watt
MWI	Ministry of Water and Irrigation
NEPCO	National Electric Power Company
NGO	Non-Governmental Organization
NRP	Natural Research Projects Limited
NTS	Non-Technical Summary
OHTL	Overhead Transmission Line
PPA	Power Purchase Agreement

PS	Performance Standard
RJAF	Royal Jordanian Air Force
RSCN	Royal Society for the Conservation of Nature
SEP	Stakeholder Engagement Plan
SNH	Scottish Natural Heritage
TRC	Telecommunication Regulatory Commission
TTA	Tafileh Technical University
VP	Vantage Point
WAJ	Water Authority of Jordan
Wg	Wadi Ghudran
WSL	Wadi Sir Limestone
WWTP	Wastewater Treatment Plant

EXECUTIVE SUMMARY IN ARABIC

ملخص تنفيذي

خلفية المشروع

تم تحديث "الاستراتيجية الرئيسية لقطاع الطاقة في الأردن" في عام 2007، والتي قدّمت رؤية لتطوير قطاع الطاقة حتى عام 2020، وكان من أهم نتائجها الحاجة إلى تنويع مصادر الطاقة وزيادة حصة الطاقة المتجددة إلى 7٪ عام 2015 وصولاً إلى 10٪ عام 2020 - بحيث تمثل طاقة الرياح والطاقة الشمسية الحصة الأكبر منها.

وفقاً لما ذكر أعلاه، فقد اكتسب قطاع الطاقة المتجددة في الأردن زخماً منذ دخول "قانون الطاقة المتجددة وكفاءة الطاقة رقم (13) لعام 2012 وتعديلاته رقم (33) لعام 2014" حيّز التنفيذ. وقد وضع هذا القانون حجر الأساس للقطاع الخاص في الأردن لتقديم مقترحات لمشاريع الطاقة المتجددة إلى وزارة الطاقة والثروة المعدنية.

وبناء عليه، فقد تم اختيار شركة كوريا الجنوبية للطاقة المحدودة كوسبو (KOSPO) (المشار إليها فيما يلي باسم "المطور") من قبل وزارة الطاقة والثروة المعدنية لتطوير مشروع طاقة الرياح بقدرة 51.75 ميغاواط في محافظة الطفيلة (ويشار إليها باسم "المشروع").

تطلب وزارة البيئة، وفقاً لـ "نظام تقييم الأثر البيئي" رقم (37) لسنة 2005 " لمشروع بهذا الحجم والطبيعة، إجراء تقييم للأثر البيئي والاجتماعي من أجل الحصول على التصريح البيئي لتنفيذ المشروع. وبالإضافة إلى ذلك، فإن المطور سوف يسعى لتمويل المشروع من المؤسسات المالية الدولية - وفي الأساس من مؤسسة التمويل الدولية (IFC). ولذلك، فإن المطور يرغب في تصميم وإدارة المشروع وفقاً للممارسات والمعايير الصناعية الدولية الجيدة.

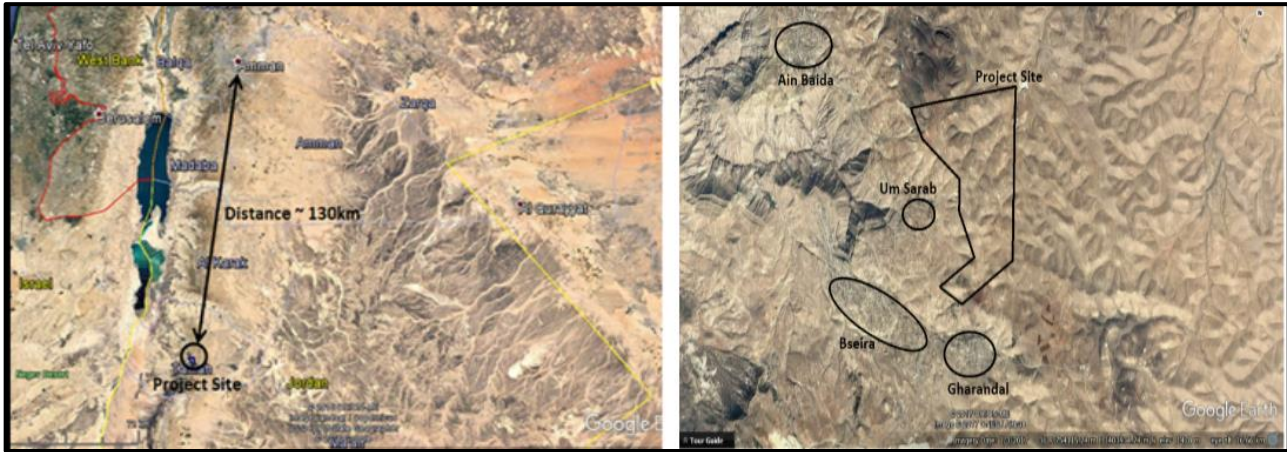
تقدم هذه الوثيقة النتائج الرئيسية لدراسة تقييم الأثر البيئي والاجتماعي التي تم تنفيذها لهذا المشروع، والتي تم إعدادها من أجل الحصول على التصريح البيئي من وزارة البيئة. وقد تم إعداد تقييم الأثر البيئي والاجتماعي وفقاً لـ "نظام تقييم الأثر البيئي رقم (37) لسنة 2005"، وللمعايير الأداء الخاصة بمؤسسة التمويل الدولية IFC للاستدامة البيئية والاجتماعية و "إرشادات البيئة والصحة والسلامة".

وصف المشروع

(أ) موقع المشروع

يقع المشروع في محافظة الطفيلة في جنوب الأردن على بعد حوالي 130 كم إلى الجنوب من العاصمة عمان (الشكل أ أدناه). وبصورة أكثر تحديداً، يقع المشروع في لواء بصيرا الذي يشمل عدة قرى أقربها لموقع المشروع هي: قرى أم سراب وبصيرا التي تقع على الحدود الغربية لموقع المشروع على مسافة كيلومتر واحد و 3 كم على التوالي، وقرية غرنذل التي تقع على بعد حوالي 1.3 كم إلى الجنوب من موقع المشروع، وعين البيضاء التي تقع على بعد حوالي 4 كم إلى الشمال الغربي من موقع المشروع.

تبلغ مساحة المشروع حوالي 8.7 كيلومتر مربع (أي ما يعادل 8 700 دونم والمبينة باللون الأسود في الشكل أ أدناه) - ولكن لن يتم استخدام كامل الأرض لتطوير مشروع مزرعة الرياح بقدرة تبلغ 51.75 ميغاواط. وقد نجحت شركة كوسبو في تأمين موافقة ملاك الأراضي في المنطقة (بموجب عقود إيجار) لاستئجار 61 قطعة من الأراضي من عدة ملاك في المنطقة لتطوير المشروع المقترح.



الشكل أ: موقع المشروع

(ii) عناصر المشروع

يتألف المشروع من العناصر الرئيسية التالية:

عدد 15 من مولدات توربينات الرياح مع أبراج من أنابيب الصلب، و 15 قاعدة من الأساسات الخرسانية المسلحة، ومحطة تحويل كهربائي فرعية للمشروع، وشبكة من الخطوط الكهربائية التي تتصل بخطوط النقل العلوية القائمة، والكابلات الكهربائية الأرضية، وخطوط الاتصالات، والطرق المؤدية للمشروع، والمنصات الرافعة ومناطق التنزيل، وأبراج قياس سرعة الرياح التي تهب بشكل دائم، ومجمع الإنشاءات المؤقت، وموقع إنشاء مكونات المشروع.

التوربينات المقترحة للمشروع هي من نوع فيستاس V136 بقوة 3.45 ميغاواط للتوربينة الواحدة وبارتفاع 112 م للمحور الحامل للتوربينة. ويبلغ قطر المروحة الدوارة 136 م.

(iii) مراحل المشروع

تشتمل الأنشطة المحتملة التي ستنفذ خلال تطوير المشروع على ثلاث مراحل مختلفة: التخطيط والإنشاء، والتشغيل، وإيقاف التشغيل، وفيما يلي موجز لكل منها:

التخطيط والإنشاء: وتشمل بشكل أساسي إعداد التصاميم التفصيلية للمشروع، ونقل مكونات المشروع المختلفة إلى الموقع، وأنشطة إعداد الموقع وتركيب توربينات الرياح ومكونات أخرى مختلفة. وسوف يتضمن إعداد الموقع أعمال الحفريات، وإزالة الأتربة. وسيضطلع بهذه الأنشطة مقاول الهندسة، والمشتريات، والإنشاء الذي يتم تعيينه من قبل المطور (شركة فيستاس)؛

التشغيل: يتطلب هذا المشروع أنشطة تشغيلية محدودة تشمل أساساً صيانة التوربينات ومختلف المعدات الكهربائية. وتشمل هذه الأنشطة على سبيل المثال، صيانة التوربينات والمراوح الدوارة، وتزييت بعض الأجزاء، وغسل شفرات المراوح، وصيانة المكونات الكهربائية، الخ.؛ و

إيقاف التشغيل: في حالة إيقاف التشغيل، سيتم فك الأبراج ومراوح توربينات الرياح وإنزالها بواسطة الرافعة، وتفكيك مكوناتها، ثم تقطيعها إلى أحجام مناسبة للخردة. ومن ثم إزالة قاعدة التوربينات بع عمق حوالي 1 متر وإعادة تعبئتها. واستصلاح الموقع بأكمله، بما في ذلك جميع المناطق المستعملة في المشروع (مثل مناطق التخزين ومناطق إنزال الرافعة)، وإعادة الموقع إلى وضع قريب من الطبيعي، كما يتم أيضاً تغطية المسارات التي تسلكها مركبات الصيانة.

ومن المتوقع وفقاً للجدول الزمني الحالي، أن تبدأ أعمال إنشاء المشروع في نهاية ب د اية عام 2018 حتى نهاية ب د اية عام 2020، لبدأ بعدها التشغيل التجاري للمشروع والذي يستمر مدة 20 عاماً.

تقييم الأثر البيئي والاجتماعي للمشروع

ستنتج عن المشروع آثار بيئية واقتصادية إيجابية هامة على المستويين الاستراتيجي والوطني نظراً للتحديات الراهنة التي تواجه قطاع الطاقة في الأردن. ونظراً لأهمية هذه الآثار الإيجابية، فمن المهم أن تؤخذ في الاعتبار وتشمل ما يلي:

يسمح المشروع بتمتية أكثر استدامة، ويظهر التزام الحكومة الأردنية بتحقيق استراتيجيتها للطاقة وتحقيق الأهداف المحددة لمصادر الطاقة المتجددة؛

وسوف يسهم المشروع في زيادة أمن الطاقة من خلال الاعتماد على موارد طاقة طبيعية لا تنضب، والأهم من ذلك أنها مصادر مستقلة لا تعتمد على الإستيراد. وستستخدم الكهرباء المتوقعة توليدها من المشروع احتياجات الكهرباء السنوية لأكثر من 35,000 أسرة محلية؛

سوف ينتج المشروع الطاقة النظيفة. وبالإضافة إلى ذلك فإن استخدام طاقة الرياح سوف يساهم في خفض تكاليف إنتاج الكهرباء بالمقارنة مع التكاليف الحالية المرتبطة بأنواع الوقود السائل، وبالتالي سيؤدي إلى انخفاض كبير في العجز المالي للحكومة الأردنية؛ و

من المتوقع أن تحدّ الطاقة النظيفة التي يقوم المشروع بتوليدها من استهلاك زيت الوقود و / أو الغاز الطبيعي المستخدم حالياً في توليد الكهرباء من محطات الطاقة الحرارية في الأردن. وسوف يساعد هذا في الحد من انبعاثات غازات الدفيئة وكذلك الانبعاثات الملوثة للهواء - من المتوقع أن يسهم المشروع في الحد من انبعاث ما يعادل أكثر من 112,000 طن من غاز ثاني أكسيد الكربون سنوياً.

ومن ناحية أخرى، سينتج عن إقامة المشروع بعض الآثار البيئية السلبية. وعلى الرغم من ذلك، تشير نتائج دراسة تقييم الأثر البيئي والاجتماعي إلى أن هذه الآثار على درجة ضئيلة من الأهمية، ويمكن التخفيف من آثارها بتطبيق الإجراءات المناسبة للمعالجة والرقابة. سيتم أدناه باختصار مناقشة هذه الإجراءات المتبعة في المعالجة والمراقبة لكل من هذه الآثار البيئية والاجتماعية، كما سيتم عرضها بالتفصيل في خطة الإدارة البيئية والاجتماعية الواردة في وثيقة تقييم الأثر البيئي والاجتماعي.

وسيؤدي المشروع إلى آثار على المستقبلات البيئية / الاجتماعية التالية، والتي سيتم مناقشتها بالتفصيل من خلال هذا الملخص: المناظر الطبيعية والبصرية، وميض الظل، الضجيج، استعمالات الأراضي؛ جيولوجية وهيدرولوجية الموقع؛ التنوع البيولوجي؛ موائل الطيور؛ الخفافيش؛ علم الآثار والتراث الثقافي؛ جودة الهواء؛ البنية التحتية والمرافق؛ الصحة والسلامة المهنية؛ والصحة المجتمعية، والسلامة والأمن؛ والظروف الاجتماعية والاقتصادية.

(أ) المناظر الطبيعية والمرئية

وصف الوضع البيئي الحالي

يمكن وصف المنظر الطبيعي في موقع مزرعة الرياح بأنه منطقة شبه صحراوية جرداء تتميز بندرة وتناثر الغطاء النباتي. وهناك بعض أنشطة الرعي والأنشطة الزراعية المحدودة. ولا تتميز المنطقة المحيطة بالموقع بالإكتظاظ السكاني، وليس لها أهمية ترفيهية خاصة. وتبعد محمية ضانا الطبيعية (التي تعتبر موقفاً مهماً للترفيه وقضاء العطلات) مسافة حوالي 7,500 م إلى الجنوب الغربي من موقع المشروع. وتتخفّض التضاريس عند الإتجاه من محمية ضانا غرباً نحو أخدود وادي الأردن.

تقييم الآثار المحتملة وتحديد تدابير التخفيف والرقابة

يعتبر المحيط الحيوي لمحمية ضانا الطبيعية المنطقة الأكثر حساسية في محيط مزرعة الرياح المخطط لإنشائها، ولن يكون لمزرعة الرياح تأثير يذكر عليها بسبب موقعها الطبوغرافي. ومن خلال حساب مناطق الرؤية النظرية من المحمية، يمكن التأكيد بأنه لا يمكن رؤية توربينات الرياح من الأماكن المستخدمة بشكل متكرر في المحمية مثل قرية ضانا وبرج ضانا. كما أن الطبوغرافيا تحد كثيرا من رؤية التوربينات من بلدة غرندل، وهي أقرب بلدة لمزرعة الرياح.

(ii) وميض الظل

وصف الوضع البيئي الحالي

إذا تم تغطية أقل من 20% من أشعة الشمس بواسطة الشفرة الدوارة للمروحة، فإن شدة الظل الناتجة في الموقع المجاور لن تكون قوية بما فيه الكفاية لتكون مصدراً للإزعاج. وبالنسبة للتوربينات نوع فيستاس V-136، فإن هذا يتوافق نظرياً لمسافة أقصاها 1,816 متر من توربينات الرياح. وبالتالي، تحدد هذه المسافة منطقة الدراسة الرئيسية لتقييم وميض الظل. ونظراً لكون المسافة الفاصلة بين موقع المشروع وأقرب مزرعة قائمة للرياح والعائدة لشركة رياح الأردن (JWPC) تبلغ 3500 متر، فسيتم اعتبارها (خط الأساس) بالنسبة لوميض الظل. وقد جرى خلال زيارة الموقع تحديد وتوثيق المستقبلات ذات الصلة بحساب وميض الظل.

تقييم الآثار المحتملة وتحديد تدابير التخفيف والرقابة

تقتصر آثار وميض الظل المحتملة على السكان القريبين من موقع المشروع، وتشمل المساكن الواقعة إلى الغرب من الموقع المقترح، وسوف تحدث آثار الوميض فقط في ساعات الصباح. أما بالنسبة لبلدة غرندل فلن يكون لوميض الظل أي تأثير عليها نظراً لموقعها إلى الجنوب من المشروع. ومن أجل الحد من تأثير وميض الظل على المساكن الواقعة غرب المشروع، فسيتم تركيب وحدات اغلاق للوميض على التوربينات. ولدى تركيب هذه الوحدات على التوربينات، فسوف يقتصر زمن تعرض هذه المساكن لوميض الظل إلى مدة أقصاها 30 ساعة في السنة وبما يعادل 30 دقيقة يومياً.

(iii) الضجيج

وصف الوضع البيئي الحالي

جرى قياس خط الأساس للوضع الحالي للضجيج في ثلاثة مواقع بالقرب من مزرعة الرياح. واعتبرت القيم المقاسة نموذجية بالنسبة للبيئة الريفية المحيطة بالموقع. تقع مزرعة الرياح التابعة لشركة رياح الأردن على بعد حوالي 3,500 م إلى الجنوب الشرقي من الموقع المقترح لمزرعة الرياح المخطط لها لشركة كوسبو الكورية. ونظراً لبعد المسافة بين هذين المشروعين، فلا يتوقع حدوث تأثيرات تراكمية مهمة للمشروعين. ومع ذلك، فقد تم عند تخطيط المشروع أخذ وضع التوربينات المقامة حالياً لشركة رياح الأردن بعين الاعتبار.

تقييم الآثار المحتملة وتحديد تدابير التخفيف والرقابة

تم لأغراض التقييم، اعتماد المستوى الأقصى الذي تضمنه الشركة الصانعة لانبعاث الضجيج والبالغ 105,5 ديسبل (أ). وسوف تكون جميع التوربينات مجهزة بحواف مسننة زائدة من أجل الحد من انبعاثات الضجيج.

وقد أجريت النمذجة في إطار افتراضات الحالة الأسوأ: وهي ظروف انتشار الضجيج لكل موقع من مواقع التوربينات باتجاه الريح، ولكل موقع استقبال عند نسبة رطوبة للهواء تبلغ 70 في المائة ودرجة حرارة 10 درجات مئوية، وعند أقصى مستوى لصوت التوربينات ((أ) ديسبل).

(وتعتبر هذه الظروف أقصى ما يمكن توقعه عند هبوب الرياح العاتية)، ولم ينظر في إخفاء الضجيج الناتج عن التوربينات بسبب الضجيج الناتج عن الرياح نفسها.

وقد تم اختيار الموقع الأفضل لمزرعة الرياح في الطفيلة من أجل تقليل تأثير الضجيج عن طريق الحفاظ على مسافة كافية من المستقبلات المحيطة. وقد كان هذا أحد العوامل الرئيسية التي تم اعتبارها أثناء عملية التصميم. وحيث أن المسافة بين التوربينات والمستقبلات المجاورة لها قد تمت زيادتها في أحدث تخطيط للمشروع (الحالة 4f)، والتي نتج عنها الإستجابة لمتطلبات حدود الضجيج (المحددة في الأردن والمعدة دولياً)، فلم تعد هناك ضرورة لتشغيل التوربينات في وضع خفض الضجيج بعد الآن.

(iv) استعمالات الأراضي

وصف الوضع البيئي الحالي

قام فريق تقييم الأثر البيئي والاجتماعي بالتحقيق في استعمالات الأراضي الرسمية وغير الرسمية (أو 'الفعلية') لمنطقة موقع المشروع كما هو مبين أدناه. وقد قام فريق تقييم الأثر البيئي والاجتماعي بالتحقيق في التخطيط الرسمي لاستعمالات الأراضي الذي أعدته مختلف المؤسسات الحكومية (مثل وزارة الشؤون البلدية، ووزارة البيئة، ووزارة الزراعة، وما إلى ذلك)، وكانت النتيجة أنه لا يوجد أي تعارض للمشروع مع خطط استعمالات الأراضي في هذه المنطقة.

كما قام فريق تقييم الأثر البيئي والاجتماعي بالتحقيق في الاستعمال الفعلي للأراضي لموقع المشروع، لتحديد ما إذا كانت ذات قيمة بالنسبة للمجتمعات المحلية والجماعات البدوية. وفيما يلي النتائج الرئيسية:

يمتد موسم الرعي من شهر فبراير / شباط حتى أوائل شهر مايو / أيار في المنطقة بما في ذلك موقع المشروع. ويشمل ذلك أساساً جولات يومية للرعي في المنطقة، وتعود هذه الجماعات بعد موسم الرعي إلى القرى التي قدمت منها.

يجري القيام بأنشطة الحصاد (أساساً للقمح والشعير) من شهر حزيران / يونيو حتى شهر أيلول / سبتمبر. وتجري أنشطة الحصاد من قبل أصحاب الأراضي في أملاكهم. ويقوم أصحاب الأراضي أنفسهم بأنشطة الحصاد، أو من خلال أفراد آخرين من المجتمع المحلي بالاتفاق مع ملاك الأراضي، أو من قبل أفراد من المجتمع المحلي يستأجرهم ملاك الأراضي. وتقوم المجتمعات المحلية طوال هذه الفترة بأنشطة الحصاد خلال النهار وتعود إلى قراها في المساء يومياً.

من المعروف أن بعض العشائر البدوية تسكن منطقة المشروع وتتحول فيها في مواسم الرعي. وهم ينتقلون إلى منطقة المشروع خلال فترة الربيع / الصيف (بين شهري أيار / مايو وأيلول / سبتمبر). وطوال هذه الفترة يقيمون في خيام في منطقة المشروع. وبحلول نهاية شهر أيلول / سبتمبر، عندما يصبح الطقس أكثر برودة، فإنهم ينتقلون مرة أخرى إلى المناطق الأكثر دفئاً. وهم يعتادون على الإقامة في المنطقة كل عام في موسم الرعي، ولكنهم لا يستقرون كل عام في نفس المواقع. ويقيمون عادة في الأراضي من خلال اتفاق شفهي مع ملاك الأراضي أو على الأراضي العامة الأخرى المتاحة في المنطقة.

تقييم الآثار المحتملة وتحديد تدابير التخفيف والرقابة

بالنظر إلى أن المشروع لا يتعارض مع أي تخطيط رسمي لاستعمالات الأراضي الذي وضعته مختلف الجهات الحكومية أعلاه، فلا توجد أية آثار على الاستعمال الرسمي للأراضي.

وفيما يتعلق بالاستعمال غير الرسمي للأراضي، فيمكن أن يؤثر تطوير المشروع على الأنشطة التي يقوم بها حالياً المجتمع المحلي وجماعات البدو في المنطقة. ومع ذلك، فإن هذه الآثار طفيفة وغير مؤثرة، ويرجع ذلك أساساً إلى أن مكونات المشروع لا تستحوذ إلا على مساحة ضئيلة (لا تتجاوز 4% من إجمالي مساحة الأراضي المستأجرة و 1.4% من كامل حدود منطقة المشروع) - وبالتالي، فيمكن أن تستمر نشاطات الرعي وإقامة الجماعات البدوية في مناطق أخرى خارج المواقع المحددة التي ستقام عليها مكونات المشروع.

ومع ذلك، يحدد تقييم الأثر البيئي والاجتماعي ضرورة القيام بالمزيد من المشاورات وتبادل المعلومات من قبل المطور مع المجتمعات المحلية والمجموعات البدوية فيما يتعلق بتطوير المشروع واستعمالات الأراضي داخل المنطقة. ومع تطبيق مثل هذه التخفيفات، فلن يكون هناك تأثير ذو أهمية للمشروع.

(v) الجيولوجيا والهيدروجيولوجيا

وصف الوضع البيئي الحالي

تتكون التشكيلات الجيولوجية المهيمنة في منطقة المشروع بصفة عامة، من حجر وادي السير الطباشيري الجيري، وتكوينات التربة الحديثة. ومن وجهة نظر الهيدروجيولوجيا، فإن المشروع يقع على الحدود بين أحواض المياه السطحية في الحسا وشمال وادي عربة مع عدد من أنظمة الأودية التي تمر في الجزء الأوسط والشرقي من موقع المشروع. وأخيراً، من منظور الهيدروجيولوجيا، فإن المشروع يقع داخل حوض الموجب للمياه الجوفية.

تقييم الآثار المحتملة وتحديد تدابير التخفيف والرقابة

تتعلق الآثار المحتملة المتوقعة خلال مراحل الإنشاء والتشغيل فيما يتعلق بالجيولوجيا والهيدروجيولوجيا بمخاطر الفيضانات والإدارة غير السليمة لتدفقات النفايات كما هو مبين أدناه.

كما ذكر سابقاً، هناك العديد من أنظمة الأودية التي تمر داخل الموقع. ويمكن أن تتعرض هذه الأنظمة لمخاطر الفيضانات المحتملة خلال التدفق الغزير للفيضانات والتي قد تؤثر بدورها على مكونات المشروع. وكجزء من تقييم الأثر البيئي والاجتماعي، فقد أجري تقييم لمخاطر الفيضانات، وقد خلص إلى أن هناك مخاطر طفيفة من الفيضانات في أربعة 4 أنظمة رئيسية للأودية التي تمر في موقع المشروع. وتوصي الدراسة بتجنب تصميم أي من مكونات المشروع في حدود عشرة 10 أمتار من هذه الأودية. وفي حالة وجود أي من مكونات المشروع داخل منطقة الأودية أو المنطقة العازلة (مثل الطرق)، فينبغي إجراء دراسة تفصيلية لتحديد الهياكل الهندسية المناسبة لتصريف مياه الفيضانات. ومع تطبيق مثل هذه التخفيفات، فلن يكون هناك تأثير ذو أهمية.

وقد تؤدي الإدارة غير السليمة لتدفقات النفايات (النفايات الصلبة، والمياه العادمة، والنفايات الخطرة، وما إلى ذلك) إلى تلويث التربة، مما قد يؤدي إلى تلوث موارد المياه الجوفية. ومع ذلك، فقد حدد تقييم الأثر البيئي والاجتماعي تدابير التخفيف المناسبة التي تهدف إلى السيطرة على هذه الآثار وضمان تنفيذ الممارسات والتدابير الإدارية السليمة خلال مراحل إنشاء وتشغيل المشروع. ومع تطبيق مثل هذه التخفيفات، فلن يكون للمشروع تأثير ذو أهمية.

(vi) التنوع البيولوجي

وصف الوضع البيئي الحالي

أجريت دراسة استقصائية للتنوع البيولوجي في موقع المشروع. ويخلص الاستطلاع الذي أجري إلى أن الموقع ليس له أهمية بيئية تذكر نظراً لظروفه الطبيعية؛ التي تتميز بغطاء نباتي محدود ومتناثر في بيئة قاحلة. ومع ذلك، تم تحديد العديد من الأنواع النباتية والحيوانية المهددة في موقع المشروع. وتشمل الأنواع النباتية المسجلة في الموقع العيصلان، *Colchicum ritchii*، واللوف (جعدة، رقيقة سميعة) *Eminium spiculatum*، وشوك مؤاب *Cousinia moabitica*. وتشمل الأنواع الحيوانية السلحفاة مهمازية الورك - مع أنه لم يتم تسجيلها ولكن من المرجح أن تكون موجودة داخل الموقع.

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قد تؤدي أنشطة إعداد الموقع في مرحلة الإنشاء إلى إزعاج الموائل الموجودة، ومع ذلك تعتبر هذه التأثيرات معتدلة نظراً للأهمية الإيكولوجية المنخفضة للموقع.

وقد تم تحديد تدابير التخفيف، والتي تتطلب أساساً إجراء مسح تفصيلي لتحديد وجود السلحفاة مهمازية الورك، وتحديد مواقع الأنواع النباتية المهددة من أجل توفير التعليمات اللازمة للممارسات والتدبير الإداري السليم أثناء مرحلة الإنشاء لمنع إلحاق الأضرار بالتنوع البيولوجي في الموقع. وتشمل هذه الممارسات على سبيل المثال حظر الصيد ومنع قطف أي نوع من النباتات في أي وقت من قبل العمال، وضمان التخزين والتخلص السليم من النفايات، وغيرها. وينبغي اتخاذ هذه التدابير خلال مرحلتَي الإنشاء والتشغيل للمشروع. ومع تطبيق مثل هذه التخفيفات، فلن يكون للمشروع تأثير ذو أهمية.

(vi) موانئ الطيور

وصف الوضع البيئي الحالي

تم إجراء مسح أساسي للوضع الحالي للطيور في موقع المشروع في خمسة 5 مواسم مختلفة تشمل فصلي ربيع وخريف عام 2013 وخريف عام 2014 وريبع وخريف عام 2015. وكان الهدف هو مراقبة وتسجيل عدد وسلوك الطيور المهاجرة والطيور المقيمة المحلّة التي تمر عبر موقع المشروع. وتم تنفيذ ما مجموعه 730 ساعة مراقبة خلال موسم الربيع و 344 ساعة خلال الخريف.

استناداً إلى المسوحات التي أجريت، فقد بلغ العدد الإجمالي للطيور المهاجرة المستهدفة المسجلة حوالي 9300 طائر تنتمي إلى 21 نوع. ومن بين هذه الأنواع، كان هناك أربعة 4 أنواع محدودة العدد مسجلة كأشكال كائنا كانوا بحاجة للحماية لدى الاتحاد الدولي لحماية الطبيعة. وبالإضافة إلى ذلك، فقد تبين من النتائج أن نوعين من أعداد الطيور الـ 9,300 تمثل معظم الأنواع المسجلة وهي - صقر العسل الأوروبي وصقر السهوب. وينقسم العدد الإجمالي للطيور المهاجرة بالتساوي تقريباً بين موسمي الهجرة في الربيع والخريف، مما يشير إلى أن موقع المشروع يستخدم من قبل الأنواع المختلفة في موسمي الهجرة على حد سواء.

ومن ناحية أخرى، فإن الطيور المقيمة المستهدفة المسجلة في جميع المسوح تنتمي إلى ثلاثة 3 أنواع فقط. وتسجل كل هذه الأنواع أدنى حالة من الاهتمام من قبل الاتحاد الدولي لحماية الطبيعة، إلا أن هذه الأنواع تتكاثر بشكل كبير على المستويين المحلي في منطقة المشروع و / أو الوطني.

وسجلت التقييمات الأساسية أعداداً متوسطة من الطيور المحلّة المهاجرة التي تمرّ بموقع المشروع. وبعض هذه الأنواع المسجلة لها وضع هام على الصعيد الدولي والإقليمية والوطنية. ويخلص تقييم خط الأساس للوضع الحالي إلى أن الموقع لا يعتبر ضمن المناطق متوسطة الحساسية بالنسبة للموائل الحيوانية. وتبين مقارنة هذه النتائج مع مناطق أخرى أن موقع المشروع يعتبر متاخماً لمسار الهجرة المكثف في أخدود وادي الأردن. وبناء على ما سبق، فيمكن اعتبار بيئة الاستقبال ذات حساسية متوسطة.

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يتمثل الأثر الرئيسي للمشروع على الطيور خلال مرحلة التشغيل، ويرتبط أساساً بمخاطر التعرض للضربات والاصطدام لكل أنواع الطيور المحلّة المهاجرة والمقيمة. ويمكن أن يكون لهذه الآثار عواقب وخيمة خاصة على أنواع معينة لها حالة حماية دولية و / أو محلية.

وللتحكم بهذه الآثار، يتطلب تقييم الأثر البيئي والاجتماعي تنفيذ خطة رصد للطيور أثناء مرحلة تشغيل المشروع. ويجب إجراء الرصد في موقع المشروع من قبل علماء الطيور المؤهلين بشكل مستمر وبشكل رئيسي طوال موسمي الربيع والخريف. والهدف من الرصد هو تجنب الاصطدام بالتوربينات عن طريق التحكم بتشغيل وإيقاف التوربينات من قبل مراقبي التشغيل في الحالات التي تشكل خطراً وشيكاً على قائمة أنواع الطيور الرئيسية التي تم تحديدها باعتبارها مثيراً للإهتمام. وبالإضافة إلى ذلك، يجب استكمال خطة الرصد بخطة بحث عن الطيور النافقة يجري تنفيذها أثناء التشغيل لإثبات فعالية الرصد والسماح بتقدير العدد السنوي لوفيات الطيور الناجمة عن الاصطدام بالتوربينات. وترد في خطة الإدارة البيئية والاجتماعية تفاصيل إضافية عن خطة رصد ومراقبة الطيور النافقة. ومع تطبيق مثل هذه التخفيفات، فلن يكون للمشروع تأثير ذو أهمية.

(vii) الخفافيش

وصف الوضع البيئي الحالي

تم إجراء ما مجموعه ثلاث دراسات استقصائية عن الخفافيش في موقع المشروع؛ وذلك خلال مواسم الصيف / والخريف لعام 2013، وخريف عام 2014 و ربيع / وصيف عام 2016. وقد تبين أن نشاط الخفافيش كان منخفضاً نسبياً وسجلت ثلاثة أنواع الحد الأدنى من النشاط. وتعتبر جميع الأنواع المسجلة من الأنواع الشائعة التي يتم تقييمها على أنها أقل مدعاة للإهتمام وفقاً للقائمة الحمراء للاتحاد الدولي لحماية الطبيعة بالنسبة للأنواع المهددة بالانقراض.

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التأثيرات الرئيسية على الخفافيش هي خلال مرحلة التشغيل التي تتعلق أساساً بخطر الضربات التي تتعرض لها الخفافيش والاصطدامات مع مراوح توربينات الرياح العاملة. ومع ذلك، وكما هو مبين أدناه فإن نشاط الخفافيش داخل موقع المشروع هو بالحد الأدنى، وبالتالي تعتبر هذه الآثار طفيفة وغير ذات أهمية.

مع ذلك، يتطلب تقييم الأثر البيئي والاجتماعي أن يقوم مشغل المشروع بتنفيذ برنامج رصد لوفيات الخفافيش لمدة ستة 6 أشهر خلال مرحلة التشغيل المبكر لتوربينات الرياح. ويجب أن يتم تنفيذ برنامج رصد الخفافيش النافقة مرة كل شهر، ويجب أن يشمل البحث عنها الملاحظات البصرية حول كل توربينة من توربينات الرياح. واستناداً إلى نتائج برنامج الرصد، فإن لم يتم تحديد أية قضايا مثيرة للإهتمام، فيمكن وقف البرنامج (وهذا هو السيناريو الأكثر احتمالاً). ومع تطبيق مثل هذه التخفيفات، فلن يكون للمشروع تأثير ذو أهمية.

(viii) الآثار والتراث الثقافي

وصف الوضع البيئي الحالي

أجرت دائرة الآثار العامة مسحاً للمواقع الأثرية والتراث الثقافي في موقع المشروع. وقد تم من خلال المسح تحديد عشرة 10 مواقع تعتبر ذات أهمية أثرية في منطقة المشروع بصفة عامة. وتشمل هذه المواقع بقايا مساكن، وهياكل مباني، وعناصر معمارية، وكهوف، وما إلى ذلك والتي تعود عادة إلى العصور النبطية والرومانية والإدومية والعصور الحديدية الثانية.

وتعتبر هذه المواقع مهمة نظراً لقيمتها الأثرية والثقافية، لكنها ليست فريدة من نوعها أو مميزة، والأهم من ذلك أنها لن تؤثر على تطوير المشروع. ويمكن العثور على هذه المواقع على نطاق واسع في هذه المناطق الجبلية التي كان بها على الأرجح تواجد قديم للإنسان وخاصة خلال العصور النبطية / الرومانية والإدومية. وقد تم تقديم خطاب موافقة رسمي لتطوير المشروع من دائرة الآثار العامة.

تقييم الآثار المحتملة وتحديد تدابير التخفيف والرقابة

يتمثل الأثر الرئيسي المتوقع خلال مرحلة الإنشاء. ويشمل ذلك الآثار الناجمة عن أنشطة إعداد الموقع التي ستجرى لترتيب التوربينات ومكونات المشروع المختلفة. ويمكن أن تؤدي أنشطة الإنشاء هذه إلى حدوث اضطراب وأضرار في هذه المواقع الأثرية إذا لم تؤخذ في الحسبان كما ينبغي.

يتطلب تقييم الأثر البيئي والاجتماعي أن يتجنب التصميم التفصيلي تركيب أي من مكونات المشروع (وتشمل التوربينات والطرق والمحطات الفرعية والمستودعات وغيرها) ضمن المناطق الأثرية التي تم تحديدها جنباً إلى جنب مع منطقة عازلة مناسبة. وبالإضافة إلى ذلك، يحدد تقييم الأثر البيئي والاجتماعي التدابير الأخرى التي يتعين تنفيذها خلال مرحلة الإنشاء لضمان حماية المواقع الأثرية - وهذا يشمل ترسيم المواقع والتخطيط السليم وحركة الآليات والمعدات في المنطقة، وضمان إنفاذ قواعد السلوك السليم من قبل العمال ، وما إلى ذلك. ومع تطبيق مثل هذه التخفيفات، فلن يكون للمشروع تأثير ذو أهمية.

بالإضافة إلى ذلك، هناك فرصة لاكتشاف بقايا أثرية مدفونة في الأرض خلال مرحلة الإنشاء. وقد تؤدي الإدارة غير السليمة (إذا تم اكتشاف المواقع) إلى إزعاج أو تلف هذه المواقع التي قد تكون ذات أهمية أثرية. ومع ذلك، يتطلب تقييم الأثر البيئي والاجتماعي تنفيذ الإجراءات المناسبة إذا توفرت فرصة اكتشاف بقايا أثرية مدفونة في الأرض طوال مرحلة الإنشاء.

(ix) جودة الهواء

وصف الوضع البيئي الحالي

اعتبر الرصد الأساسي للوضع الحالي لجودة الهواء غير ضروري (أي قياسات ملوثات الهواء)، نظراً لطبيعة الآثار المتوقعة من المشروع - التي تتعلق أساساً بتوليد الغبار.

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يتمثل الأثر الرئيسي المتوقع للمشروع خلال مرحلة الإنشاء. ويشمل ذلك الآثار الناجمة عن أنشطة إعداد الموقع التي ستجرى لتثبيت توربينات الرياح وغيرها من مكونات المشروع. ومن المرجح أن تؤدي أنشطة الإنشاء هذه إلى زيادة مستوى انبعاثات الغبار والجسيمات، مما سيؤثر بشكل مؤقت على نوعية الهواء المحيط. ومع ذلك، فقد حدد تقييم الأثر البيئي والاجتماعي تدابير كافية لإخماد الغبار للتحكم في هذه الآثار. ومع تطبيق مثل هذه التخفيفات، فلن يكون للمشروع تأثير ذو أهمية.

(x) البنية التحتية والمرافق

وصف الوضع البيئي الحالي

يناقش هذا القسم البنية التحتية الأساسية للمرافق والخدمات والتي تشمل: الموارد المائية؛ ومياه الصرف الصحي، والنفايات الصلبة، والنفايات الخطرة؛ شبكات الطرق؛ والطيران وشبكات الاتصالات السلكية واللاسلكية والتلفزيون والراديو.

a. مرافق ومصادر المياه:

سكنون إمدادات المياه للمشروع على الأرجح من نظام إمدادات المياه الرئيسي في الطفيلة بسعة إجمالية تبلغ 5 مليون متر مكعب في السنة. ومن المرجح أن يتم توفير المياه من خلال صهاريج النقل.

b. مرافق مياه الصرف الصحي، والنفايات الصلبة، والنفايات الخطرة

- من المرجح أن يتم التخلص من مياه الصرف الصحي من المشروع في محطة مياه الطفيلة أو جرف الدراويش
- من المرجح التخلص من النفايات الصلبة في مكب جرف الدراويش.
- من المحتمل التخلص من النفايات الخطرة في مرفق معالجة النفايات الخطرة في سواقة.

c. شبكات الطرق:

- سوف يتم نقل التوربينات وغالبية المواد والمعدات المستخدمة في المشروع بشكل رئيسي خلال مرحلة الإنشاء بواسطة الشاحنات ذات الحمولات الثقيلة.
- تعتبر حركة المرور على الطرق الموجودة في موقع مزرعة الرياح منخفضة للغاية في الوضع الحالي.
- تم إجراء مسح أولي للطرق الداخلية من قبل شركة كيوني وناجل Kuehne & Nagel في شهر آذار/ مارس عام 2016. وقد تبين ضرورة إجراء بعض التعديلات / التحسينات على الطرق الداخلية في موقع مزرعة الرياح.

d. الطيران ، والاتصالات السلكية واللاسلكية، والتلفزيون ووصلات الراديو

- أقرب مطار مدني في المنطقة هو مطار الملكة علياء الدولي في عمان، ويبعد حوالي 110 كم شمال موقع المشروع. وبالإضافة إلى ذلك، فإن أقرب قاعدة جوية عسكرية هي قاعدة الملك فيصل الجوية الواقعة على بعد حوالي 65 كم إلى الجنوب الغربي من موقع المشروع.

- تم جمع معلومات من هيئة تنظيم قطاع الاتصالات وجميع شركات الاتصالات الأردنية الثلاث وتشمل زين وأورانج وأمنية عن شبكات الاتصالات وأبراج البث في المنطقة.
- لا توجد أبراج بث تلفزيونية أو إذاعية في منطقة المشروع أو المناطق المحيطة بها.

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- الموارد المائية والمرافق: متطلبات المياه للمشروع أثناء مراحل الإنشاء والتشغيل ضئيلة، ومن المتوقع أن يتم توفيرها بسهولة بدون أية قيود على المستخدمين الحاليين.
- ب. مياه الصرف الصحي والنفايات الصلبة والنفايات الخطرة: كل هذه الكميات المتولدة أثناء مراحل الإنشاء والتشغيل ضئيلة، ومن المتوقع أن يتم التعامل معها بسهولة بواسطة المرافق التي نوقشت أعلاه.
- ج. شبكات الطرق: قد ينتج عن حركة المرور في موقع مزرعة الرياح زيادة طفيفة في القضايا المتعلقة بالتوقف المؤقت للسير . ومع ذلك، فإن هذا يقتصر على وقت قصير أثناء توريد مكونات المشروع خلال مرحلة الإنشاء. وسوف تقتصر الآثار على حركة المرور والنقل المرتبطة بمزرعة الرياح خلال مرحلة التشغيل بشكل رئيسي على تلك الناجمة عن استخدام المركبات الخفيفة لأغراض الصيانة وتعتبر لا تذكر.
- د. النقل الجوي والاتصالات السلكية واللاسلكية والتلفزيون والراديو: تم الإتصال بشكل رسمي مع الجهات الحكومية المعنية المسؤولة عن عناصر البنية التحتية وتشمل لجنة تنظيم الطيران المدني، وسلاح الجو الملكي، ولجنة تنظيم قطاع الاتصالات، ومؤسسة الإذاعة والتلفزيون الأردنية. وقد تم حتى تاريخه، الحصول على رد رسمي بعدم الاعتراض على إنشاء المشروع من لجنة تنظيم الطيران المدني، ومن مؤسسة الإذاعة والتلفزيون الأردنية ، ولم يتم الحصول على ردود سلاح الجو الملكي، ولجنة تنظيم قطاع الاتصالات، (ومع ذلك لا يتوقع حدوث أية قضايا مثيرة للاهتمام بهذا الخصوص). ويتعين متابعة هذه الجهات للحصول على ردود رسمية بعدم الاعتراض.

(xi) الصحة والسلامة المهنية

وصف الوضع البيئي الحالي

ستكون شركة فيستاس Vestas هي مقاول الهندسة والمشتريات والإنشاء لأعمال إنشاء المشروع. وقد تم اعتماد الشركة وفقاً للمبادئ التوجيهية المعمول بها وسياسات الموارد البشرية التي سيتم تطبيقها طوال مرحلة الإنشاء. وبالإضافة إلى الأنظمة التي تنص عليها هذه السياسات، فإن الشروط والالتزامات المحددة في خطة الصحة والسلامة المهنية ملزمة أيضاً. وقد تم تصميم المواصفات الفنية للتوربينات الحديثة لتحديد أقل التأثيرات على السلامة العامة أثناء مرحلة التشغيل.

تقييم الآثار المحتملة وتحديد تدابير التخفيف والرقابة

يجب على المدير المسؤول عن الصحة والسلامة المهنية عقد اجتماعات منتظمة للسلامة مع ممثلي سلامة الموظفين وممثلين عن المقاولين المعنيين من الباطن وشركاء التعاون الآخرين في الموقع. ويجب إدراج المسائل التي ستناقش في اجتماعات السلامة في جدول أعمال الاجتماعات.

ويجب إبلاغ المدير المسؤول عن الصحة والسلامة المهنية عن أية مهمة متعلقة بالتوربينات يتم تنفيذها في الموقع، ويتوجب على المدير إعطاء الإذن بالعمل قبل تنفيذ المهمة.

ويجب أن يتمتع جميع الموظفين والمقاولين من الباطن وغيرهم من شركاء التعاون ذوي الصلة بالكفاءات اللازمة للسماح لهم بتنفيذ المهام المحددة الموكلة إليهم.

(xii) صحة المجتمع والسلامة والأمن

وصف الوضع البيئي الحالي

تظهر جميع القياسات المستمرة للضجيج بالمستويات دون الصوتية المتاحة حالياً أن مستويات الضجيج الناتج عن التوربينات الهوائية دون السمعية يقل كثيراً عن عتبة السمع البشرية، وبالتالي فهي أقل بكثير من عتبة التأثير التي يمكن تصورها، حتى في المنطقة المجاورة مباشرة حول التوربينات (مسافة 100-250 متر).

ويمكن أن تحدث انعكاسات مزعجة عندما تكون الشمس مشرقة، تسمى "تأثير الديسكو"، من أشعة الشمس على توربينات الرياح، على غرار انعكاس الأشعة عن الأسطح العاكسة الأخرى مثل ألواح النوافذ الشفافة.

كما يمكن أن يتراكم الجليد في ظل ظروف معينة في الغلاف الجوي على توربينات الرياح كما هو الحال مع أي هيكل، وذلك عند تدني درجات الحرارة المحيطة إلى ما يقرب من درجة التجمد (0 درجة مئوية) جنباً إلى جنب مع ارتفاع نسبة الرطوبة النسبية، وتجمد المطر، أو تكوّن الصقيع.

تقييم الآثار المحتملة وتحديد تدابير التخفيف والرقابة

يمكن خفض "تأثير الديسكو" بشكل كبير من خلال طلاء الأبراج والمراوح الدوارة بألوان تتميز بخفض شدة انعكاس الأشعة. وقد يتسبب سقوط الجليد بإلحاق أضرار بالهياكل والمركبات وإصابة موظفي الموقع وعامة الجمهور، ما لم تتخذ تدابير كافية للحماية. وينبغي وضع علامات تحذير لحماية موظفي الموقع والجمهور. وهناك إمكانية إيقاف تشغيل التوربينات عن بعد عندما يكتشف الموظفون في الموقع تراكم الجليد على المراوح.

(xiii) الظروف الاجتماعية-الاقتصادية

وصف الوضع البيئي الحالي

يمكن تلخيص الأوضاع الاجتماعية والاقتصادية الرئيسية للمجتمعات المحلية القريبة من موقع المشروع (بصيرا وأم سراب و غرنندل وعين البيضاء) على النحو التالي:

- تشمل أنماط المعيشة والعمالة الرئيسية لتلك المجتمعات المحلية الخدمة العامة (وتشمل أساساً الخدمة العسكرية ودرجة أقل الخدمة المدنية في الدوائر الحكومية المحلية والمركزية والتعليم وما إلى ذلك)، وثانياً في الصناعة والتجارة ولكنها تقتصر على تجارة التجزئة الصغيرة (مثل محلات البقالة التي تتبع الأغذية والمشروبات). وتشارك هذه المجتمعات أيضاً في تربية الماشية والأنشطة الزراعية ولكن لأغراض الاكتفاء الذاتي وليست لتكون مصدراً مدراً للدخل.
- تعتبر البطالة والفقر مسألة مثيرة للقلق داخل هذه المجتمعات والتي تعتبر أحد التحديات الاجتماعية والاقتصادية الرئيسية في المنطقة. ويعزى ذلك إلى عدة عوامل تشمل: (1) عدم وجود مشاريع استثمارية حكومية أو خاصة يمكن أن توظف العمالة، وبالتالي تؤثر تأثيراً إيجابياً على الفقر ومستويات البطالة؛ (2) فشلت مشاريع / برامج الاستثمار والتنمية التي استهدفت الطفلة بشكل عام في توظيف أفراد المجتمع المحلي، حيث كانت فرص العمل هذه موجهة بشكل عام إلى أفراد من خارج المجتمعات المحلية؛ (3) القاعدة الاقتصادية لتلك المجتمعات هي في المقام الأول الخدمة العسكرية التي تعتبر وظيفة منخفضة الأجر.

تقييم الآثار المحتملة وتحديد تدابير التخفيف والرقابة

- سيوفر المشروع حوالي 70 فرصة عمل خلال مرحلة الإنشاء، وحوالي 10 فرص عمل خلال مرحلة التشغيل. ويهدف المطور لتوظيف أفراد من المجتمع المحلي إلى أقصى حد ممكن. وبالإضافة إلى ذلك، فإن المطور ملتزم ببرامج المسؤولية الاجتماعية الأخرى تجاه المجتمع المحلي. ويمكن أن يساهم ذلك إلى حد ما في تعزيز أحوال السكان المعيشية ورفع مستوى معيشتهم.

- ومع ذلك، فقد ورد في تقييم الأثر البيئي والاجتماعي توصيات للمطور بهدف تعزيز هذه الآثار الإيجابية، حيث يوصي بتقييم الأثر البيئي والاجتماعي بأن يعتمد المطور وينفذ خطة تكامل مجتمعي للعمل مع أعضاء المجتمع المحلي. وينبغي أن تنظر الخطة كحد أدنى في ما يلي:
- إدارة التوقعات بحيث تكون واقعية حول الفرص المتاحة للمجتمعات المحلية من المشروع، وبحيث تحدد الالتزامات المتعلقة بالتنمية الاجتماعية بوضوح من قبل المطور ؛
- تحديد عدد فرص العمل للعمال المهرة وغير المهرة الموجهة إلى المجتمع المحلي في جميع مراحل الإنشاء والتشغيل. ومن المتوقع أن يقدم المطورون بالتفصيل المؤهلات والمهارات المطلوبة والقيود المفروضة على أعضاء المجتمع المحلي، وإلى أي مدى يمكن معالجة تلك المشاكل من خلال التدريب وبناء القدرات؛
- اتباع إجراءات توظيف شفافة للمجتمع المحلي. ويجب أن توفر هذه الإجراءات فرصا متساوية للجميع، بمن فيهم الإناث؛
- تفصيل المجالات الإضافية التي يمكن إشراك أفراد المجتمع المحلي فيها إلى جانب فرص العمل، شريطة أن يكون لديهم المهارات والخبرات المطلوبة (مثل التعاقد مع مقاولين محليين للقيام ببعض الأعمال)؛ و
- التواصل المستمر وفي الوقت المناسب وتبادل المعلومات بين المطورين وأعضاء المجتمع المحلي.
- النظر في تخصيص أموال لبرامج المسؤولية الاجتماعية التي سيتم تنفيذها للمجتمعات المحلية، من خلال نهج منظم يستند إلى الاحتياجات الفعلية لهذه المجتمعات.

EXECUTIVE SUMMARY IN ENGLISH

BACKGROUND TO THE PROJECT

In 2007, the “Master Strategy of Energy Sector in Jordan” was updated and provided a vision for the development of the energy sector till the year 2020, where one of its main outcomes was the need to diversify energy resources and increase the share of renewable energy to 7% in 2015 and 10% in 2020 – with the major share coming from wind and solar power.

In accordance with the above, the renewable energy sector in Jordan is gaining momentum since the “Renewable Energy and Energy Efficiency Law No. (13) of the year 2012 and its amendments No. (33) of the year 2014” entered into force. This law established the basis in Jordan for the submission of renewable energy project proposals by the private sector to the Ministry of Energy and Mineral Resources (MEMR).

To this extent, , Korean Southern Power Co., Ltd (KOSPO) (hereafter referred to as ‘the Developer’) has been selected by MEMR for the development of a 51.75 Mega Watt (MW) wind power project in the Tafileh Governorate (hereafter referred to as ‘the Project’).

The Ministry of Environment (MoEnv), in accordance with the “Environmental Impact Assessment Regulation No. (37) of 2005”, requires a Project of this scale and nature to undertake an Environmental and Social Impact Assessment (ESIA) in order to obtain the environmental permit and. In addition, the Developer will be seeking financing for the project from International Financial Institutions – mainly the International Finance Corporation (IFC). Therefore, the Developer wishes to design and manage the project in accordance with good international industry practice and standards.

This document provides the main outcomes of the ESIA that was undertaken for the Project and which was prepared in accordance with the “Environmental Impact Assessment Regulation No. (37) of 2005” and the IFC “Environmental and Social Sustainability Performance Standards” and “Environment, Health, and Safety (EHS) Guidelines”.

PROJECT DESCRIPTION

(iv) Project Location

The Project is located within Tafileh Governorate in the south of Jordan approximately 130 km south of the capital city of Amman (Figure A below). More specifically, the project site is located within Bseira District which hosts several communities the closest being Um Sarab and Bseira which are located to the western border of the project site at a distance of 1 km and 3 km respectively Gharandal which is located around 1.3 km to the south of the Project site Ain Baida which is located around 4 km to northwest of the Project site.

The Project area is approximately 8.7 km² (equivalent to 8,700 Dunums as represented in black in Figure A below) – however not the entire land will be utilized for the development of the 51.75 MW wind farm project. KOSPO has succeeded in securing land lord consents for 61 parcels of lands within the project area with different land owners for the development of the proposed project.

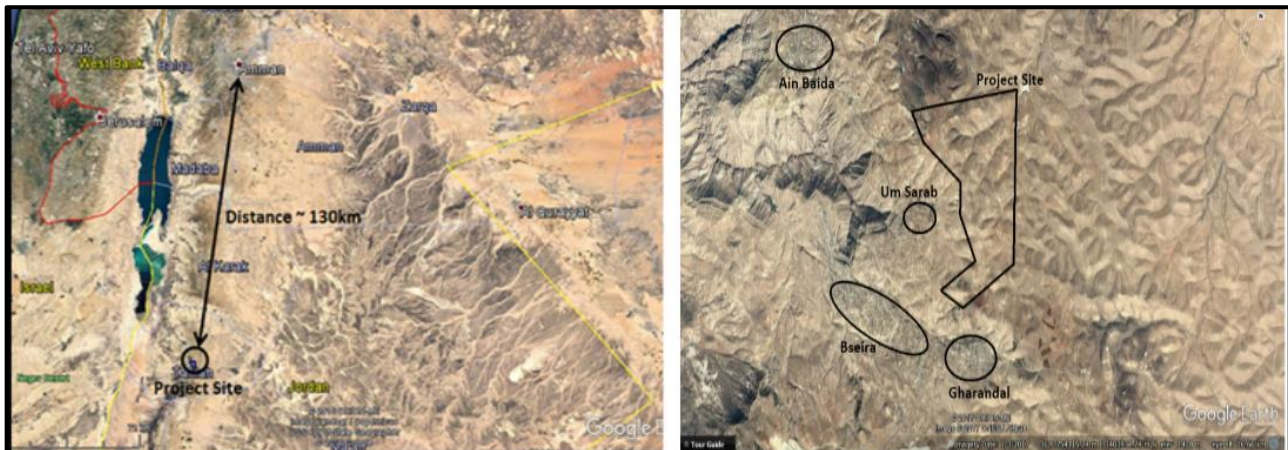


Figure A: Project Location

(v) Project Components

The project consists of the following major components:

15 wind turbine generators (WTG) with tubular steel towers, 15 steel-reinforced concrete foundations, one project substation, grid connection to existing overhead line via overhead cables, underground electrical & communication cables, access roads, crane pads and laydown areas, permanent wind measurement tower, temporary construction compound, site operation building.

The proposed turbine for the project is the Vestas V136 with a capacity of 3.45 MW and a hub height of 112m. The rotor has a diameter of 136m.

(vi) Project Phases

The likely activities to take place during the project development include three distinct phases: planning and construction, operation and decommissioning each of which is summarized below.

Planning and Construction: this mainly includes preparing a detailed design for the project, transportation of the various project components to the site, and site preparation activities for installation of the wind turbines and various other components. Site preparation will include excavations and land clearing activities. Such activities will be undertaken by an Engineering, Procurement, and Construction (EPC) Contractor appointed by the Developer (Vestas);

Operation: Such a project requires limited operational activities which mainly include maintenance of the turbines and the various electrical equipment. This includes for example, turbine and rotor maintenance, lubrication of parts, washing of blades, maintenance of electrical components, etc.; and

Decommissioning: In the case of decommissioning, the tower and blades of the removed wind turbine will be taken down by crane, disassembled into components, and then cut into sizes suitable for scrap. The turbine foundation will be removed to a depth of approximately 1 m and refilled. The whole site, including all flattened areas (e.g. storage- and crane pad areas) will be reclaimed to a close natural status and tracks used for maintenance vehicles will be covered over.

According to the current timeline, construction of the project is anticipated to commence in late 2018 until end of 2020. Operation of the project is anticipated in 2020 for 20 years.

THE ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT OF THE PROJECT

The Project will result in crucial positive environmental and economic impacts on the strategic and national level given the current challenges the energy sector in Jordan is facing. Such positive impacts are important to consider and take into account and include the following:

The Project allows for more sustainable development and shows the commitment of the Government of Jordan to realizing its Energy Strategy and meeting the set targets for renewable energy sources;

The project will contribute to increasing energy security through reliance on an indigenous, inexhaustible and mostly import-independent energy resource. The expected electricity generation from the project will serve the annual electricity needs of around 35,000 local households;

The project will produce clean energy. In addition the use of wind energy will contribute to lowering electricity generation costs when compared to the current costs associated with liquid fuels, and thus leads to a substantial decrease in the Government of Jordan's fiscal deficit.

The clean energy produced is expected to reduce consumption of fuel oil and/or natural gas currently used at thermal power plants for electricity generation in Jordan. This will help reducing greenhouse gas emissions as well as air pollutant emissions – the project is expected to offset more than 112,000 ton of CO₂ annually.

On the other hand, the project will result in certain negative environmental impacts. Nevertheless, the ESIA concludes that such impacts do not pose any issues of concern, and through the implementation of the appropriate mitigation and monitoring requirements they are considered not significant. Such mitigation and monitoring measures are discussed briefly below for each environmental/social receptor, and are presented in details within the Environmental and Social Management Plan (ESMP) in the ESIA document.

The project will result in impacts on the following environmental/social receptors each of which is discussed in details throughout this summary: landscape and visual; shadow flicker, noise, land use; geology and hydrology; biodiversity; birds (avi-fauna); bats; archeology and cultural heritage; air quality; infrastructure and utilities; occupational health and safety; community health, safety and security and socio-economic conditions.

(vii) Landscape and Visual

Description of Baseline Environment

On the wind farm site the landscape can be characterized as relatively sparse or desert-like. There are some grazing activities and low farming activities. The surrounding of the site is not densely populated and has no particular recreational importance. The Dana Biosphere Reserve, as an important site for recreational users and holiday users is located in a distance of approximately 7,500 m southwest of the site. From the Dana nature reserve the terrain drops down towards the direction of the Jordan Rift Valley.

Assessment of Potential Impacts and Identification of Mitigation and Monitoring Measures

The most sensitive area in the surrounding of the planned Kospo wind farm, the Dana Biosphere Reserve, is hardly affected by the development due to its topographical location. By calculating zones of theoretical visibility (ZTVs) it could be confirmed that there is no visibility of the turbines from the frequently used places like the Dana village and the Dana tower. The topography also largely limits the visibility of the turbines from Gharandal, the nearest town to the wind farm.

(viii) Shadow Flicker

Description of Baseline Environment

If less than 20 % of the sun is being covered by the passing rotor blade, the resulting shadow intensity at a neighbouring property will not be strong enough to account for a nuisance. For the Vestas V-136, this corresponds in theory to a maximum distance of 1,816 m from the wind turbines. Consequently, this distance defines the main study area for the shadow flicker assessment. Due to the distance of 3,500 m to the closest existing wind farm (JWPC) there will be no existing (baseline) shadow flicker.

During the site visit the relevant receptors for the shadow flicker calculation were identified and documented.

Assessment of Potential Impacts and Identification of Mitigation and Monitoring Measures

The potential shadow flicker impacts on nearby residents are limited to dwellings west of the proposed site and will only occur in the morning hours. Due to its location in the south the town Gharandal will remain unaffected by shadow flicker.

In order to limit the impact of shadow flicker for the dwellings west of the site, shadow flicker shut down modules will be installed in the turbines. Having the WTGs equipped with these modules, the shadow flicker times will be limited to a maximum of 30 hours per year and 30 minutes per day.

(ix) Noise

Description of Baseline Environment

A baseline (ambient) noise measurement was conducted at three locations in vicinity of the wind farm. The measured values were regarded as typical for a rural environment. The JWPC windfarm is located approximately 3,500 m southeast of the planned Kospo wind farm. Due to this large distance between these two projects significant cumulative impacts are not expected. However, the existing JWPC turbines were taken into consideration within the prediction.

Assessment of Potential Impacts and Identification of Mitigation and Monitoring Measures

For the assessment the maximum noise emission level (LWA) of 105.5 dB(A), which is guaranteed by the manufacturer, was considered. All turbines will be equipped with serrated trailing edges in order to reduce the noise emissions.

The modelling was carried out under the following worst-case assumptions: downwind noise propagation conditions for each turbine location and for each receptor, 70% humidity and 10°C air temperature, the maximum sound power level (in dB(A)) of the turbine was used (to be expected only under high wind conditions), masking of the turbine noise by the noise of the wind itself was not considered.

The wind farm location in Tafileh was optimized in order to minimize the impact of noise by keeping a sufficient distance to the surrounding properties. This has been one of the key factors during the design process. Since the distance of the WTGs to the nearby receptors was increased in the latest layout (case 5c) the noise limits (Jordan and international) are met and operating the turbines in a noise reduced mode is not required anymore.

(x) Land Use

Description of Baseline Environment

The ESIA team investigated the formal and informal (or ‘actual’) land use of the project site area as discussed below. The ESIA team investigated the formal land use planning as set by the various governmental institutions (such as the Ministry of Municipal Affairs, Ministry of Environment, Ministry of Agriculture, etc.) and concluded that there is no conflict with such set land use plans for the area.

The ESIA also investigated the actual land use of the Project site, to determine if it is of any value to local communities and nomadic settlements. The main outcomes are as follows:

Grazing Activities are undertaken from February till early May within the area including the Project site. This mainly involves day trips to the area where afterwards the local communities return to their villages.

Harvesting activities (mainly wheat and barley) are undertaken from June till September. Harvesting activities take place in each of the land owners designated land area. Harvesting activities are undertaken by land owners themselves, or through other local community members in agreement with the land owner, or by local community members hired by the land owner. Throughout this period the local communities undertake their harvesting activities and return to their villages on a daily basis.

Certain nomadic tribes are known to inhabit the project area and which move around on a seasonal basis. They move to the project area during spring/summer time (between May and September). Throughout this period they reside in the project area by setting tents in which they live. By the end of September, as the weather becomes colder, they move back to warmer areas. They generally occupy the area each year, but do not settle in the exact area each year. They generally reside in lands through verbal agreement with the land owner or on other available public lands in the area

Assessment of Potential Impacts and Identification of Mitigation and Monitoring Measures

Given that the project does not conflict with any of the formal land use planning set by the various governmental entities above, there are no impacts on formal land use.

With regards to the informal land use, the project development could affect the activities currently undertaken by the local community and nomads in the area. However, such impacts are minor and not significant mainly due to the fact that the project components have a very minimal footprint (4% of the total leased lands area and 1.4% of the entire project site boundary area) – therefore agricultural, grazing activities and nomadic settlements can continue to take place in other undisturbed areas.

Nevertheless, the ESIA identifies additional consultations and disclosure requirements by the Developer with local communities and nomadic groups on project development and land uses within the area. With such mitigations, impact is considered not significant.

(xi) Geology and Hydrology

Description of Baseline Environment

In general the dominant geological formations within the project area consists of Upper Cretaceous Wadi Sir Limestone (WSL) and recent Soil (S) units. From a hydrology perspective, the project site is located on

the border between Hasa and North Wadi Araba surface water basins with a number of wadi systems running within the central and eastern part of the project site. Finally, from a hydrogeology perspective, the project site is located within the Mujib groundwater basin.

Assessment of Potential Impacts and Identification of Mitigation and Monitoring Measures

The anticipated potential impacts during the construction and operation phase from project on geology and hydrology are related to flood risks and improper management of waste streams both of which are discussed below.

As discussed earlier, there are several wadi systems running within the site. Such wadi systems could be subject to potential flood hazards during flash flood events which in turn could affect the project components. As part of the ESIA, a flood risk assessment was undertaken and which concludes that there are minor flood risks within 4 major wadi systems that run within the Project site. The study recommends that the design avoid sitting any of the project components within 10m from the wadi systems. Should any elements be sited within the wadi or buffer area (such as roads), a detailed study should be undertaken to determine the appropriate engineering flood discharge structures. With such mitigations, the impact is considered not significant.

Improper management of waste streams (solid waste, wastewater, hazardous waste, etc.) could contaminate and pollute soil which in turn could pollute groundwater resources. However, the ESIA has identified adequate mitigation measures which aim to control such impacts and ensure proper housekeeping practices are implemented during the construction and operation phase of the project. With such mitigations, the impact is considered not significant.

(xii) Biodiversity

Description of Baseline Environment

A biodiversity survey was undertaken at the project site. The survey concludes that the site is not of important ecological significance due to its natural setting; characterized by having scattered vegetation cover in an arid environment. However, several threatened plant and faunal species have been identified within the project site. Plant species recorded onsite include *Colchicum ritchei*, *Eminium spiculatum*, *Cousinia moabitica*. Faunal species include the Spur-thighed Tortoise – however it was not recorded but is likely to exist within the site.

Assessment of Potential Impacts and Identification of Mitigation and Monitoring Measures

Site preparation activities during construction may disturb existing habitats, however these impacts are considered to be moderate due to the site's low ecological significance.

Mitigation measures have been identified, and which mainly require the undertaking of a detailed survey to identify the presence of the Spur-thighed Tortoise and locations of the threatened floral species in order to provide instructions during construction and good housekeeping to prevent damage to the biodiversity of the site. Such practices include for example prohibiting hunting or collection of species at any time by workers, ensure proper storage and disposal of waste streams, and others. These measures should be taken through the construction and operation phases of the project. With such mitigations, impact is considered not significant.

(xiv) Birds (Avi-Fauna)

Description of Baseline Environment

A bird baseline survey was undertaken at the project site in 5 different seasons to include spring 2013, autumn 2013, autumn 2014, autumn 2014 and spring 2015. The objective was to observe and record the

number and behavior of migratory and resident soaring birds passing through the project site. A total of 730 monitoring hours were undertaken during the spring season and 344 hours during autumn.

Based on the surveys, the total number of target migratory birds recorded was around 9,300 belonging to 21 species. Of those, 4 had an IUCN conservation status and their numbers were significantly small. In addition, of 9,300 birds results shows that two species account for most of the records – European Honey Buzzard and Steppe Buzzard.

The total number of migrating birds is almost equally divided between the two migration seasons of spring and autumn, indicating that the project site is used by the various species in both migration seasons.

On the other hand, the target resident birds recorded throughout all the surveys belong to 3 species only. All those species have an IUCN status of Least Concern – however they have important breeding populations at the regional and/or national levels.

The baseline assessments have recorded moderate numbers of migratory soaring birds over the project site. Some of those recorded species have an important status on the international, regional and national levels. The baseline assessment concludes that the site is not considered within a moderately sensitive area in terms of avi-fauna. Comparing these results to other areas reveals that the project site is considered to be located adjacent to an intensive migration route. Taking all of the above into account, the receiving environment is considered of medium sensitivity.

Assessment of Potential Impacts and Identification of Mitigation and Monitoring Measures

The key impact on birds is during the operation phase and is mainly related to risks of strikes and collision on both migratory and resident soaring birds. Such impacts could have crucial effects especially on certain species which have an international and/or local conservation status.

To control such impacts the ESIA requires that a bird monitoring plan is implemented during the operation phase of the project. Monitoring must be undertaken at the project site by qualified ornithologists' continuously and mainly throughout the spring and autumn season. The objective of the monitoring is for collision avoidance through observer-led turbine(s) shutdown in situations which pose an imminent risk on a list of key species of concern that has been identified. In addition, the monitoring plan must be complemented with a carcass search plan implemented during operation to demonstrate the effectiveness of the monitoring and allow an estimation of the annual number of bird deaths caused by the turbine. Additional details on the monitoring and carcass search plan is provided in the ESMP. With such mitigations, impact is considered not significant.

(xv) Bats

Description of Baseline Environment

A total of three bat surveys were undertaken at the project site; summer/autumn 2013, autumn 2014 and spring/summer 2016. Bat activity was relatively low and 3 species were recorded with minimal activity. All species recorded are common species that are assessed as Least Concern according to the IUCN Red List of Threatened species.

Assessment of Potential Impacts and Identification of Mitigation and Monitoring Measures

The key impacts on bats are during the operation phase which are mainly related to risk of bat strikes and collisions with rotors of the operating wind turbines. However, as noted below bat activity within the project site is minimal and therefore such impacts are considered minor and not significant.

Nevertheless, the ESIA requires that the project operator implement a bats mortality monitoring program for a duration of 6 months during the early operation phase of the wind turbines. The mortality monitoring program must be undertaken once per month and must include carcass search through visual observations around each wind turbine. Based on the outcomes, should no issues of concern be identified, the monitoring program can be discontinued (this is the most likely scenario to occur). With such mitigation the impact is considered not significant.

(xvi) Archeology and Cultural Heritage**Description of Baseline Environment**

An archeology and cultural heritage survey was undertaken for the project site by the Department of Antiquities (DoA). The survey identified 10 sites which were considered of archeological importance and which are located in the project area in general. Such sites include remains of settlements, building structures, architectural elements, caverns, etc. which generally date back to the Nabataean, Roman, Edom, and Second Iron Ages.

Such sites are considered important given their archeological and cultural value however they are not unique or distinctive and most importantly would not affect the project development. Such sites can be found extensively in such mountainous areas which have most likely ancient/old human presence especially during the Nabataean/Roman and Edom era. An official approval letter for the development of the project from DoA has been provided.

Assessment of Potential Impacts and Identification of Mitigation and Monitoring Measures

The key impact anticipated is during the construction phase. This includes impacts from site preparation activities which are to take place for the installation of the turbines and the various project components. Such construction activities could result in the disturbance and damage of such archeological sites if not taken into account properly.

The ESIA requires that the detailed design avoid sitting any of the project components (to include the turbines, roads, substation, warehouses, etc.) within archeological delineated areas along with an appropriate buffer zone. In addition, the ESIA identifies other measures to be implemented during the construction phase to ensure the protection of archeological sites – this includes demarcation of sites, proper planning and movement of machinery and equipment in the area, ensuring proper code of conduct is enforced by workers, etc. With such mitigations, impact is considered not significant.

In addition, there is a chance that throughout the construction activities, archaeological remains buried in the ground are discovered. Improper management (if sites are discovered) could potentially disturb or damage such sites which could potentially be of archeological importance. Nevertheless, the ESIA requires implementation of appropriate “chance-find” procedures should archeological remains in the ground be discovered throughout the construction phase.

(xvii) Air Quality**Description of Baseline Environment**

An air quality baseline monitoring survey was considered unnecessary (i.e. measurements of air pollutants), due to the nature of anticipated impacts from the project – which are mainly related to dust generation.

Assessment of Potential Impacts and Identification of Mitigation and Monitoring Measures

The main impact anticipated is during the construction phase. This includes impacts from site preparation activities which are to take place for the installation of wind turbines and other project components. Such construction activities will likely result in an increased level of dust and particulate matter emissions, which will temporarily impact ambient air quality. However, the ESIA has identified adequate dust control measures to control such impacts. With such mitigations, impact is considered not significant.

(xviii) Infrastructure and Utilities**Description of Baseline Environment**

This section discusses utility and service supply infrastructure to include: water resources and utilities; wastewater, solid waste, and hazardous waste utilities; (road networks; and aviation, telecommunication, television and radio links.

- e. *Water Resources and Utilities:* water supply to the project will most likely be from the Tafileh Main Water Supply System with a total supply capacity of 5 MCM/year. Water will most likely be supplied through tankers.
- f. *Wastewater, Solid Waste, and Hazardous Waste Utilities*
 - Wastewater from the Project will most likely be disposed at the Tafileh WWTP or Jurf Al Daraweesh Landfill
 - Solid waste will most likely be disposed at Jurf Al Darwish landfill.
 - Hazardous waste will likely be disposed at the Swaqa Hazardous Waste Treatment Facility.
- g. *Road Networks:*
 - The transportation of the WTGs and the majority of the used material and equipment will be done mainly during the construction period via HGV (Heavy Goods Vehicle).
 - The existing tracks on the wind farm site do have extremely low baseline traffic.
 - A preliminary internal route survey was carried out by Kuehne & Nagel in March 2016 some adjustments/improvements of internal roads at the wind farm site need to be conducted.
- h. *Aviation, Telecommunication, Television and Radio Links*
 - The closest civil airport in the area is the Queen Alia International Airport located in Amman and around 110 km north of the project site. In addition, the closest military air base is the King Feisal Airbase located around 65 km to the southwest of the Project site.
 - Information was collected from the TRC and all three Jordanian telecommunication companies to include Zain, Orange, and Umniah on telecommunication links and broadcasting towers in the area.
 - There are no television and radio broadcasting towers in the Project area or its surroundings.

Assessment of Potential Impacts and Identification of Mitigation and Monitoring Measures

- a. *Water Resources and Utilities:* water requirements of the project during construction and operation are minimal and are expected to be easily supplied with no constraints on the existing users.
- b. *Wastewater, Solid Waste and Hazardous Waste:* all such quantities generated during the construction and operation phase are minimal and are expected to be easily handled by the utilities discussed above.
- c. *Road Networks:* The traffic increase at the wind farm site may have a slight increase in severance related issues. However, this is limited to the short time of the concrete delivery. The operational traffic and transport impacts associated with the wind farm will mainly be limited to those arising from occasional maintenance trips using light goods vehicles and are considered to be negligible.
- d. *Aviation, Telecommunication and Television and Radio Links:* formal communications were established with the relevant governmental entities responsible for such infrastructure elements to include the Civil Aviation Regulatory Commission (CARC), Royal Jordanian Air Force (RJAF), Telecommunication Regulatory Commissions (TRC), and the Jordan Radio and Television Corporation (JRTV). To date official no objection letters from CARC and JRTV have been provided while RJAF and TRC are still underway (however no issues of concern are anticipated). Follow up with these entities is required to obtain the no objection letters.

(xix) Occupational Health and Safety

Description of Baseline Environment

Vestas will be the EPC contractor for the construction works. Vestas is certified according to the applicable guidelines and its human resources policies will be applied throughout the construction. In addition to the regulations given by these policies the conditions and obligations defined in the OHS plan are binding.

Technical standards of modern turbines are designed to determine lowest impacts during the operation on public safety.

Assessment of Potential Impacts and Identification of Mitigation and Monitoring Measures

The responsible HSE manager must conduct regular safety meetings with employee safety representatives and representatives from relevant subcontractors and other co-operation partners at the site. Issues to be discussed at the safety meetings must be listed on the agenda for the meetings.

The responsible safety manager must be informed of any turbine-related task that is carried out on the site, and the manager must give permission before the task can be carried out.

All employees, subcontractors and other relevant cooperation partners must have the necessary competences to be allowed to carry out a specific task.

(xx) Community Health, Safety and Security Safety

Description of Baseline Environment

All currently available subsonic noise measurements consistently show that the infrasound of wind turbines is considerably below the human hearing threshold and thus also clearly below a conceivable impact threshold, even in the immediate area around the turbines (100-250m distance).

When the sun is shining, disturbing reflections, called “disco effect”, of the sunlight can occur at a wind turbine, similar to other reflecting surfaces such as transparent window panes.

As with any structure, wind turbines can accumulate ice under certain atmospheric conditions, such as ambient temperatures near freezing (0°C) combined with high relative humidity, freezing rain, or sleet.

Assessment of Potential Impacts and Identification of Mitigation and Monitoring Measures

The “disco effect” can be reduced significantly by the use of medium reflecting colours for the tower- and rotor coating.

Falling ice may cause damage to structures and vehicles, and injury to site personnel and the general public, unless adequate measures are put in place for protection. Warning signs should be placed for the protection of site personnel and the public. WTGs will be remotely switching off when site personnel detect ice accumulation.

(xxi) Socio-economic Conditions

Description of Baseline Environment

The main socio-economic conditions of those local communities near the project site (mainly Bseira, Um Sarab, Gharandal, and Ain Baida) can be summarized as follows:

- The main livelihood and employment patterns of those local communities include public service (to include mainly military service and to a lesser extent public administration offices, civilian central government and education) and secondarily in industry and trade but which is limited to small scale retail trade establishments only (such as retail trade in food and beverage). Such communities also engage in livestock raising and agricultural activities but for self-sufficiency purposes rather than as a source of income.

- Unemployment and poverty is considered an issue of concern within such communities and which is considered one of the main socio-economic challenge in the area. This is attributed to several factors, which includes amongst others: (i) the lack of governmental and private sector investment projects that can employ labor and thus positively impact poverty as well as unemployment levels; (ii) the investment and development projects/programs that were targeted for Tafileh generally failed to employ local community members as such employment opportunities were generally targeted for people outside of the local communities; (iii) the economic base of those communities is primarily military service which is considered a low paying job.

Assessment of Potential Impacts and Identification of Mitigation and Monitoring Measures

The project will create around 70 job opportunities during the construction phase and around 10 job opportunities during the operation phase. The Developer is aiming to hire local community members to the greatest extent possible. In addition, the Developer is committed to other social responsibility programs towards the local community. This, to some extent, could contribute to enhancing the living environment for its inhabitants and elevate their standards of living.

Nevertheless, the ESIA has provided recommendations to the Developer which aim to enhance such positive impacts. The ESIA recommends that the Developer adopt and implement a community integration plan for working with the local community members. The plan should at a minimum consider the following:

Manage expectations so that local communities are realistic about opportunities from the project and clearly identify commitments by Developer related to social development;

Identify the number of skilled and unskilled job opportunities targeted to the local community throughout the construction and operation phases. The developers are expected to provide in details the qualifications and skills required and constraints of local community members and to which extent those could be addressed through capacity building;

Present transparent recruitment procedures for the local community. Such procedures must provide equal opportunities for all, including females;

Detail additional areas where local community members can be involved besides job opportunities provided they have the required skills and expertise (e.g. appointment of local contractors); and

Ensure timely and continuous communication and dissemination of information between the developers and the local community members.

Consider allocating funds for social responsibility programs to be implemented for the local communities through a structured approach and based on the needs of these communities.

1. INTRODUCTION

1.1 Project Background

His Majesty King Abdullah Ibn Al Hussein II has charged His Royal Highness Prince Hamza Ibn Al Hussein with the presidency of a Royal Commission to review and update the “Master Strategy of Energy Sector in Jordan”, in order to meet the energy demands and challenges facing the energy sector in Jordan. In 2007, the Royal Commission updated the Strategy and provided a vision for the development of the energy sector till the year 2020 to become the “Updated Master Strategy of Energy Sector in Jordan for the period (2007-2020)”. One of the main outcomes was the need to diversify energy resources and increase the share of renewable energy to 7% in 2015 and 10% in 2020 – with the major share coming from wind and solar power.

To this extent, and in accordance with “Updated Master Strategy”, the renewable energy sector in Jordan is gaining momentum since a temporary Renewable Energy and Energy Efficiency Law was approved in March 2010 and officially entered into force in April 2012, known as the “Renewable Energy and Energy Efficiency Law No. (13) of the year 2012 and its amendments No. (33) of the year 2014”. With this law, ‘Direct Proposal Submission’ of renewable energy projects to the Ministry of Energy and Mineral Resources (MEMR) was allowed, where investors (or developers) had the opportunity to develop renewable grid-connected electricity production projects.

MEMR issued a Request for Submission of Expression of Interest under the ‘Direct Proposal’ for qualified investors interested in investment in renewable energy projects for power generation on build, own and operate (BOO) basis. Within this context, Korean Southern Power Co., Ltd ‘KOSPO’ (hereafter referred to as ‘the Developer’) has successfully submitted an expression of interest to MEMR as part of the invitation for expression of interest on investment opportunities in the renewable energy projects through the ‘Direct Proposal Submission’ for the development of a 51.75 Megawatt (MW) wind power project in Tafileh Governorate (hereafter referred to as the ‘Project’). KOSPO and DHWP signed a Power Purchase Agreement (PPA) amendment for a WTG model change in March 2018 with the National Electric Power Company (NEPCO).

1.2 Project Location and Setting

The Project is located within Tafileh Governorate in the south of Jordan approximately 130 km south of the capital city of Amman (Figure 1 below). More specifically, the Project site is located within Bseira District in Tafileh Governorate which hosts several communities the closest of which being (i) Um Sarab and Bseira which are located to the western border of the Project site at a distance of 1 km and 3 km respectively (ii) Gharandal which is located around 1.3 km to the south of the Project site (iii) Ain Baida which is located around 4km to northwest of the Project site. Coordinates of the site boundary are listed in Table 1.

Table 1: Coordinates of the project site boundary

Point	Coordinates			
	UTM 36		WGS	
	N	E	Longitude	Latitude
1	3407263	755087	35.665208°	30.771026°
2	3403160	755075	35.664064°	30.734045°
3	3402099	753639	35.648818°	30.724788°
4	3402491	752975	35.641986°	30.728463°
5	3403194	753965	35.652490°	30.734589°
6	3404264	753495	35.647849°	30.744334°
7	3405014	753487	35.647951°	30.751096°
8	3405920	752398	35.636808°	30.759494°
9	3406646	752027	35.633113°	30.766108°

The Project site can be accessed from Highway #15 (known as the Desert Highway), considered as the main highway in Jordan that connects the capital city of Amman with the southern Governorates (including Tafileh). From Highway #15, an exit leads to Highway #60 which then connects to the Project area. In addition, the Project site can also be accessed through Highway #35 (known as the King's Highway), a secondary highway which connects Tafileh Governorate with the capital city of Amman in the North.

The Project site is located on a ridge in hilly terrain with altitudes ranging from 1,400 m to 1,500 m a.s.l, where the total Project area (represented in blue in the figure below) is 8.7 km² (equivalent to 8,700 Dunums) – however not the entire land will be utilized for the development of the Project. Figure 1 below presents the location of the Project site within Jordan.

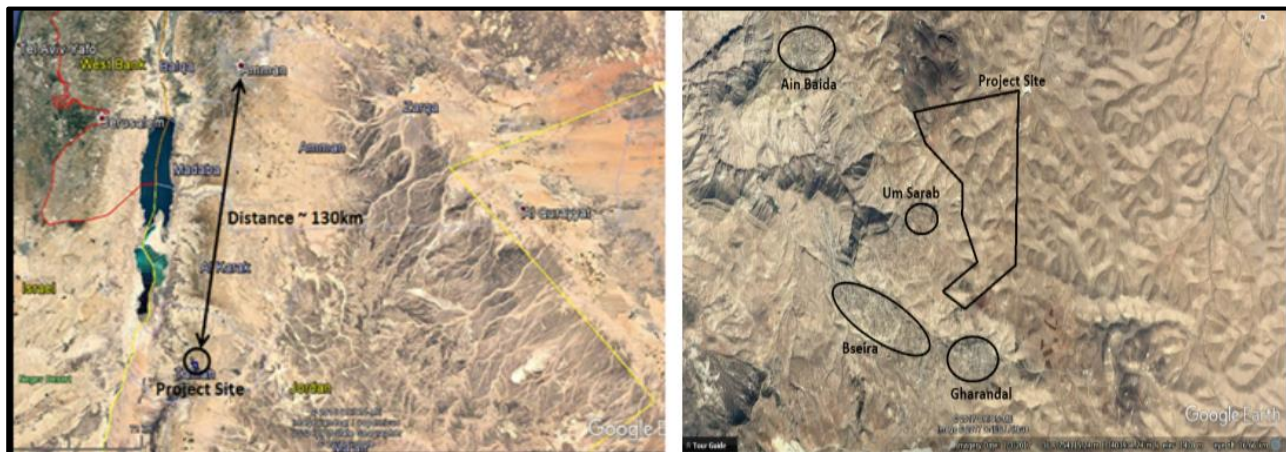


Figure 1: Project Location

1.3 The Environmental and Social Impact Assessment (ESIA) Report

The environmental clearance for this Project is governed by the Ministry of Environment (MoEnv), as stipulated by the “Environmental Impact Assessment Regulation No. (37) of 2005”. The MoEnv requires the preparation of a comprehensive Environmental Impact Assessment (EIA) for such a project before an environmental permit is granted, in order to commence with construction and operational activities.

The Developer will be seeking financing for the Project from prospective lenders, including international Financial Institutions (IFIs). Therefore the Developer wishes to design and manage the Project in accordance with good international industry practice and standards. For the purpose of the Environmental and Social Impact Assessment (ESIA) this has therefore been developed in accordance with:

- IFC Environmental & Social Sustainability Performance Standards (IFC, 2012);
- IFC General Environment, Health, and Safety (EHS) Guidelines (IFC, 2007); and
- Applicable IFC Industry Sector EHS Guidelines – mainly the EHS Guidelines for Wind Energy (IFC, 2015).

ECO Consult and Ramboll CUBE GmbH were commissioned by KOSPO to prepare the ESIA for the Project in order to apply for the necessary environmental permit. This report is the ESIA report to be submitted to the MoEnv. This ESIA is undertaken in accordance with the MoEnv’s “Environmental Impact Assessment Regulation No. (37) of 2005” and the IFC Performance Standards and EHS Guidelines.

1.4 Document Structure

The following table provides an overview of the Chapters within this ESIA document. The ESIA includes a standalone Non-Technical Summary (NTS) and supporting Annexes.

Table 2: Summary of the ESIA Content

Chapter	Description of Content
Chapter 2 – Project Description	Provides a detailed description of the Project in relation to its location, the key project components and an overview of the proposed activities that are to take place during the various Project phases.
Chapter 3 – Project Alternatives	Investigates several alternatives to the Project development in relation to the Project site, chosen technology, Project design, and finally investigates the ‘no action alternative’ – which assumes that the Project development does not take place.
Chapter 4 – Regulatory and Policy Framework	Provides an overview of the environmental and social regulatory and policy framework applicable to the Project.
Chapter 5 – ESIA Approach and Methodology	Presents the assessment methodology and approach for the ESIA study.
Chapter 6 – Stakeholder Consultation and Engagement	Discusses the stakeholder consultation and engagement plans which were undertaken as part of the ESIA process for the Project and provides an overview of the findings.
Chapter 7 – Overview of Strategic Environmental and Economical Impacts	This Chapter provides an overview of the significant positive environmental and economical impacts that will result from the Project development on the strategic and national level. The Chapter also highlights the potential site specific negative environmental and social impacts anticipated from the Project throughout its various phases – each of which is discussed in details in the subsequent chapters.
Chapter 8 – Chapter 21	Presents the environmental and social attributes that will be studied throughout the ESIA. This includes: landscape and visual (chapter 8), shadow flicker (chapter 9), noise (chapter 10), land use (chapter 11), geology and hydrology – soil and groundwater (chapter 12), biodiversity (chapter 13), birds – avifauna (chapter 14), bats (chapter 15), archaeology and cultural heritage (chapter 16), air quality (chapter 17), infrastructure and utilities (chapter 18), occupational health and safety (chapter 19), community health, safety and security (chapter 20), socio-economic conditions (chapter 21). For each attribute and where relevant, the baseline conditions within the Project site and its surroundings was assessed. Each chapter then moves on to identify and assess the potential impacts from the Project on each attribute and for each impact a set of mitigation measures have been identified to eliminate or reduce the impacts to acceptable levels
Chapter 22 – Summary of Anticipated Impacts	Provide an overall summary of the anticipated impacts during the various phases of the Project.
Chapter 23 – Assessment of Cumulative Impacts	Investigates the cumulative impacts which could results from incremental impacts from other known existing and/or planned developments in the area based on currently available information.
Chapter 24 – Environmental and Social Management Plan (ESMP) and Compliance Program	Presents the Environmental and Social Management Plan (ESMP) for the Project; which mainly summaries the impacts identified as well as the mitigation measures and monitoring requirements to be implemented throughout the various Project phases. In addition, this Chapter describes the institutional framework and procedural arrangement for the ESMP implementation.

1.5 Project Proponent and Key Contributors

Different entities are involved in the planning and implementation of the project. Responsibilities of each entity are listed in the text below along with a general description of their roles (Figure 2).

- Korean Southern Power Co., Ltd (KOSPO): project owner and Lead Developer;
- Daelim Energy. (DAELIM): Partner Developer;
- National Electric Power Company (NEPCO): is the national electricity company of Jordan with whom KOSPO signed the Power Purchase Agreement (PPA) on the 31st of March 2016 on a build, own and operate basis (BOO);
- Korea Trade Insurance Corporation (K-sure): The Developer will be seeking financing for the project from prospective lenders. K-sure will be the Lender for this project;

- **VESTAS - Engineering, Procurement, and Construction (EPC) Contractor:** The EPC Contractor will be responsible for preparing the detailed design and layout of the project; supply of the material, wind turbines, and equipment; and construction of the internal access roads, crane pads, foundations, operation building and the medium voltage and data interconnection between the individual wind turbines and the wind farm substation;
- **The Ministry of Environment (MoEnv):** the Regulator and the official governmental entity responsible for the protection of the environment in Jordan. The MoEnv is responsible for the approval of the Environmental Impact Assessment (EIA¹) Study and making sure it complies with the EIA Regulation No. (37) of the year 2005 and also responsible for granting the environmental clearance for the project;
- **ECO Consult and Ramboll CUBE GmbH (CUBE):** hereafter referred to as the ‘ESIA Team’ or ‘Consultants’ who are the ESIA Practitioner and the consultant commissioned by KOSPO to prepare the ESIA for the project in accordance with the requirements of the Ministry of Environment (MoEnv) and its EIA Regulation No. (37) of the year 2005. The ESIA will also be prepared in accordance with the IFC Performance Standards (PSs) and Environmental, Health and Safety (EHS) Guidelines.

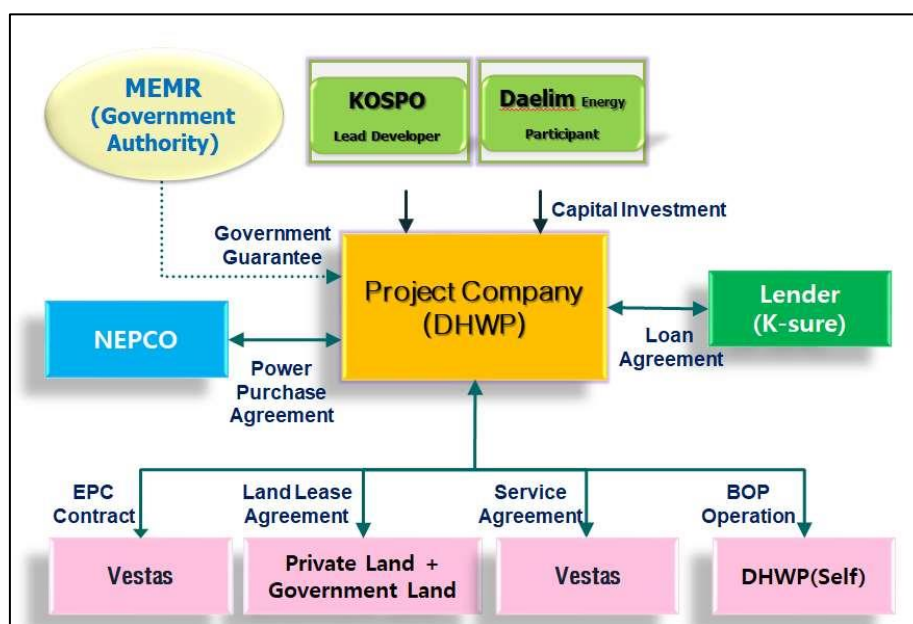


Figure 2: Project Proponent & Key Contributors

¹ In the Jordanian legal framework the term Environmental Impact Assessment (EIA) is used, whereas the international community uses the term Environmental and Social Impact Assessment (ESIA). Since this report addresses both national and international requirements, the terms are used interchangeably in this report.

2. PROJECT DESCRIPTION

This chapter provides a detailed description of the project in relation to its location, the key project components and an overview of the proposed activities that are to take place during the planning and construction, operation, and decommissioning phase.

2.1 Administrative Setup of Project Location

It is important to highlight the administrative setup as framed by district and municipal boundaries within Tafileh Governorate as those will be referred to many times throughout this document.

The project site is located within Tafileh Governorate which consists of three (3) main Districts (as highlighted in Table 3 below). Of those, the project is located within Bseira District. From a municipality perspective, the project site is not located within a municipal boundary – however the closest is Bseira Municipality.

Table 3: Administrative Setup of Tafileh Governorate

Governorate	District/Sub-District	Municipalities
Tafileh	District of Tafileh Qasabah <u>District of Bseira</u> District of Hasa	Greater Tafileh Municipality <u>Bseira Municipality</u> Qadisiyeh Municipality Al-Hasa Municipality

2.2 Project Location

The project is located approximately 130 km south of the capital city of Amman. As discussed above, the project site is located within Bseira District in Tafileh Governorate which hosts several communities, the closest of which being: (i) Um Sarab and Bseira which are located to the western border of the project site at a distance of 1 km and 3 km respectively (ii) Gharandal which is located around 1.3 km to the south of the project site (iii) Ain Baida which is located around 4 km to northwest of the project site.

The project site can be accessed from Highway #15 (known as the Desert Highway), considered the main highway in Jordan that connects the capital city of Amman with the southern Governorates (including Tafileh). From Highway #15, an exit leads to Highway #60 which then connects to the project area. In addition, the project site can also be accessed through Highway #35 (known as the King's Highway), a secondary highway which connects Tafileh Governorate with the capital city of Amman in the North.

Figure 3 below presents the project survey area in relation to the nearby villages and the main highways discussed above. The studies and survey for the ESIA were conducted for this area including a buffer area.

The proposed wind farm site is located on a ridge in hilly terrain with altitudes ranging from 1,400m to 1,500m a.s.l. The ridge runs in a north-south direction, approximately 2.5km east of Kings Road #35 and about 1.5 km north of the town of Gharandal, which stretches along the valley in western directions.

The maximum total footprint of the project is approximately 9km² for which KOSPO has succeeded in securing land lord consents (pre Land Lease Agreement) with different land owners for the development of the proposed project.

Due to the low intensity of land use for wind energy projects (one turbine needs approximately an area of 1 Dunum (about 1,000 m²) including crane pad); the final project footprint will likely be much smaller. The remaining land will be left to its original status. Hence the current land use will only be influenced in a minor way resulting in only minimal disturbance of nature. The total number of parcels which will be acquired and possibly needed for siting / construction / access should be 61 land parcels.

The land in the project area is moderately hilly and rocky, with sparse vegetation. There is some grazing activity in the area, and wheat is grown in the small areas of agricultural cultivation. There are no permanent urban structures in the project area that would be affected by the construction or operation of the project.

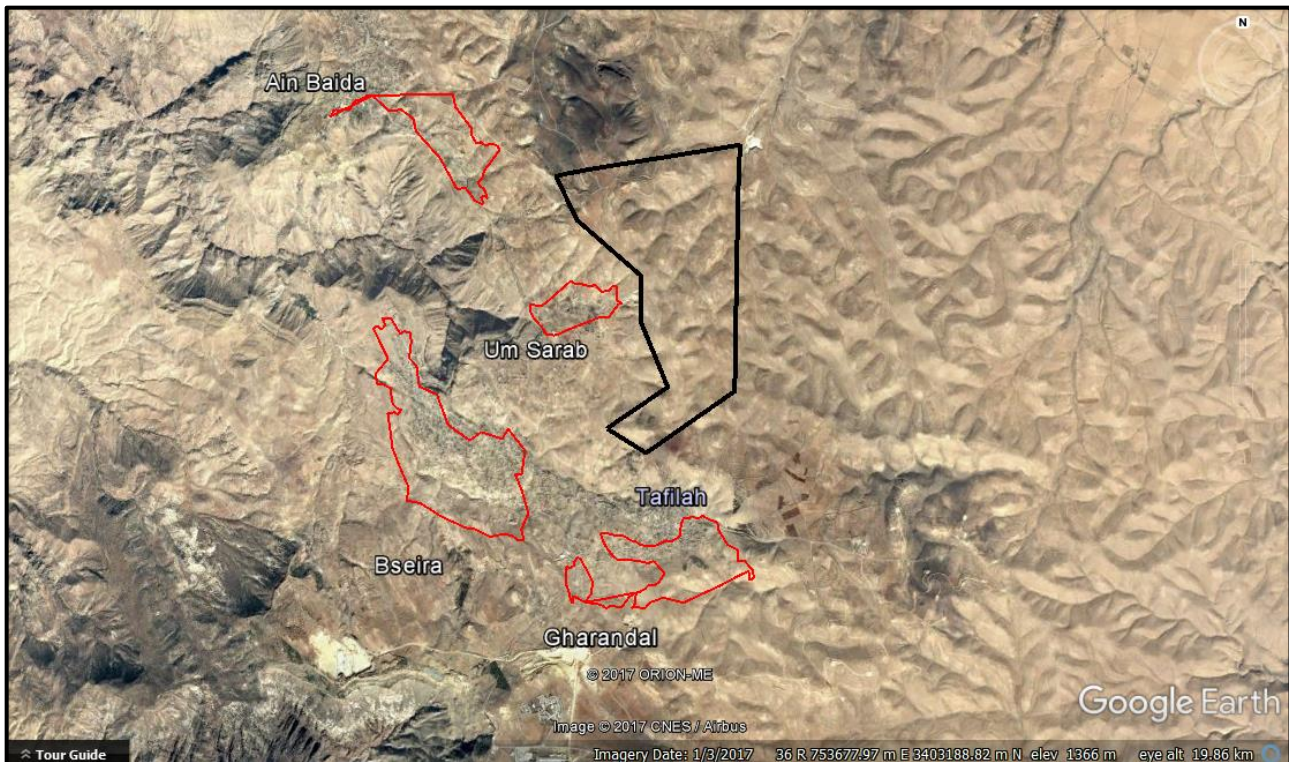


Figure 3: Project Survey Area

2.3 Project Components

The project consists of the following major components:

- 15 wind turbine generators (WTG) with tubular steel towers;
- 15 steel-reinforced concrete foundations;
- One project substation (electrical substation), including equipment for electrical protection, transformation, and metering;
- Grid connection to existing overhead line via overhead cables;
- Underground electrical & communication cables;
- Access roads;
- Crane pads and laydown areas;
- Permanent wind measurement tower;
- Temporary construction compound;
- Site operation building

2.3.1 Wind Turbines

The Danish manufacturer Vestas will supply the turbines for the Tafileh Wind Farm. The proposed turbine for the project is the Vestas V136 with a capacity of 3.45 MW. Information about the specifications of the turbine is provided in Table 4.

Table 4: Specifications of the planned WTG

Characteristics	Vestas V136
Number of WTG	15
Capacity	3.45 MW
Hub height	112 m
Rotor diameter	136 m
Swept area	14,527 m ²
Number of blades	3

The basic components of this wind turbine include:

- Conical tubular tower sections made of steel;
- Rotor blades, made of fiberglass, reinforced epoxy and carbon fibers;
- Nacelle, which houses the generator and the gearbox;
- Hub, which is the central point at which the three blades are connected to the nacelle;
- Generator, which converts mechanical energy into electricity;
- Gearbox;
- Converter;
- Transformer.

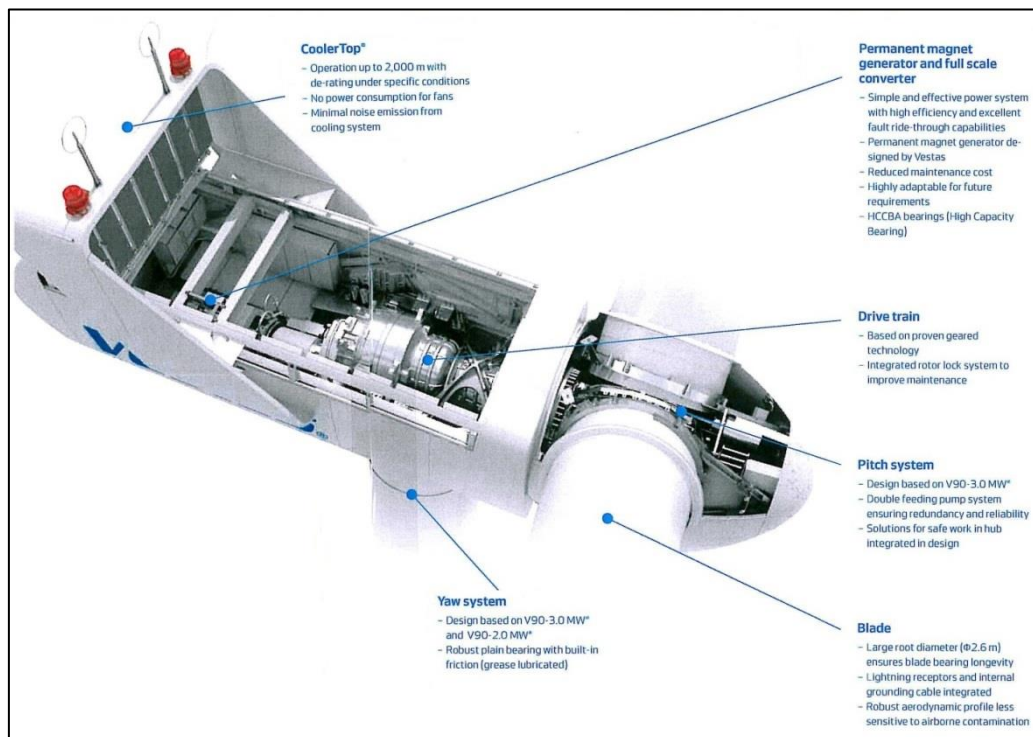


Figure 4: Vestas nacelle

The turbine locations were identified using a wind flow model based on a local wind measurement campaign of the area. The interactions of the WTG have been considered using a state-of-the-art computer model for the wake effect. Areas which are not suitable for turbine placement due to environmental, topographic, geologic, or other issues were excluded.

The turbines will be painted light-grey, with aviation safety lights at the top of the nacelle. The tips of the blades will be painted red, to improve visibility during daytime.

Access for maintenance personnel is provided via a secured door at the base of the turbine. An elevator and a ladder are installed within the tower enabling the maintenance personnel to access to the maintenance area in the nacelle.

2.3.2 Infrastructure and Utilities

The turbines will be fixed to the ground and stabilized via reinforced concrete foundations, which will ensure that the turbines remain stable under any foreseen condition. The foundations will be constructed below ground level, and soil will be placed over the foundation to return the visible area to nearly its original condition. A typical foundation diameter is 20m, with a depth of 2.5m, depending on the WTG and the subsoil. The actual final design of the foundations will be elaborated based on a final geotechnical study during the design phase of the project.

The project will require appropriate roads for access and hauling of WTG during construction and operation. These roads will be made of compacted soil and gravel, and are approximately 5 meters wide.

The wind farm internal roads will mostly follow the path of existing, legal roads in the project area. In situations where an existing road is not available or inappropriate for the transportation of WTG, a new road will be constructed on land which is leased by KOSPO. After construction these roads will be available for use by locals for agricultural or grazing transportation requirements and will be an improvement for local residents. The best environmental practices will be considered at all times.

For the assembly of turbine components and the operation of a crane for erection of the turbines, a limited amount of flat, compacted ground, about 1 Dunum (1,000 m²) per turbine, will be needed. These areas will be on land which is leased by KOSPO.

The area for the crane operation (crane pad) will be cleared of rocks and vegetation, leveled, graveled and compacted to provide a stable base for the crane to operate on. In addition to the crane pad, additional areas for temporary storage of the blades, the nacelle and the assembly of the crane are needed during the construction phase. These areas are only needed temporarily and will be restored to their original state after the turbine installation is completed. Parts of the land used for the crane pads will also be returned to its original condition; it is necessary to leave a smaller crane pad in place for the life of the wind farm so that maintenance and repair works can be carried out.

The project will require an electrical substation which serves as the central point for electricity collection and transformation of the electricity to the transmission system voltage. This will also be the hub for the data collection and communication system. The site substation's primary role is to collect the electricity from the turbines, measure the characteristics and quantity of electricity being produced, perform corrective or compensatory action where necessary, and transform the voltage from a medium voltage level (33kV) to 132kV before being injected into the NEPCO transmission line.

The project substation will address the following requirements and will be secured with a fence:

- Transformation and transmission of electricity;

- Electrical protection (i.e. switchgear, breakers, grounding), metering, and control;
- Communication and monitoring (SCADA System, etc.);
- Lighting, security, and safety equipment.

The turbines will transmit electricity to the project substation via underground electrical cables. Typically, several turbines are connected in line to form a “string” with these strings converging at centrally located site substation.

In addition to the cables required for electrical transmission, fibre-optic communication cables will be buried parallel to the electrical cables (or on land otherwise leased by KOSPO). These communication cables are capable of high speed transfer of data and signals between the turbines and the site substation. The cables will be buried at a depth of about 1 m, depending on the soil conditions, and backfilled with sand and soil and the topsoil returned to its natural state. The cables will be buried in land that is leased by KOSPO.

A temporary, central construction compound will be established which will contain the offices and temporary structures required to supervise construction. The required area will be cleared of rocks and vegetation, gravelled, levelled and compacted. This compound will be securely fenced and guarded. The compound will include:

- Office containers;
- Storage areas for equipment;
- Parking areas;
- Bathroom and waste collection facilities;
- Equipment for power generation;
- Communications equipment;
- Other miscellaneous small items as required.

After completion of construction, the construction compound will be disassembled, and the area will be returned to its original condition.

2.4 Footprint of the project Components

The maximum total footprint of the project is approximately 9 km² for which KOSPO has succeeded in securing land lord consents (pre Land Lease Agreement) with different land owners for the development of the proposed project. The actual land area permanently affected by the installation of infrastructure will only be a small portion of the total project footprint. The total actual footprint of the project is approximately 96,000 m², which affects approximately 61 land parcels. Each turbine requires approximately 1 Dunum or about 1,000 m² for performance use, including crane pad. The land which is not directly affected by project infrastructure will be left in its original state, allowing for continuation of current land use patterns, and minimal disturbance to flora and fauna in the area.

2.5 Overview of Project Phases

2.5.1 Planning and Construction Phase

Construction is planned to commence in the end of 2018 and conclude in 2020 (18 months, estimated). Construction methods will be conducted according to international and Jordanian Health & Safety guidelines.

On-site environmental, archaeological, and safety monitoring will be in effect during the whole construction period.

Typical activities during the construction phase for wind farms include the following:

- Transportation of wind turbine components to the project site. The components are expected to be transported to the Port of Aqaba and then transported by road to the project site;
- Site preparation and preparation of the turbine foundation and crane hardstands. Such activities are limited to relatively small individual footprints as generally the actual area of disturbance (e.g. the area required for the turbines and crane pads) is much less than the total project area;

Nevertheless, such activities could include excavations and land clearing activities at the close vicinity around each individual turbine or newly constructed internal road;

- Installation of turbine components such as towers, hub, rotor and nacelle will be done by mobile cranes. For the cranes a permanent crane hardstand is necessary as well as a temporary storage area (e.g. for rotor blades) which will be rebuilt after the assembly of the turbines;
- In addition to the erection of each turbine, there is additional construction work (which could include excavations, land clearing activities, etc) that must be conducted to connect each turbine to the power grid, this could include the installation and laying of transmission cables, and the installation of the electrical substation
- Internal road network and foundation construction;
- Construction of the building infrastructure such as administrative buildings; and
- Commissioning tests of the wind farm which usually involves standard electrical tests for the electrical infrastructure as well as the turbine, and inspection of routine civil engineering quality records. Careful testing at this stage is vital if a good quality wind farm is to be delivered and maintained.

2.5.2 Operation Phase

The project is anticipated to have a maximum operational life of 20 years. During the operation period, the project will be operated and maintained by a team of technicians which will ensure safe, reliable operation of the turbines and other electrical equipment year round.

The base of operations will be the Operations & Maintenance building, which will be located close to the project area, preferably in an inhabited region. In addition to the on-site operations and maintenance personnel, the project will be connected via high speed data cable to the internet, so that remote monitoring and control of the turbines can be achieved and any default is detected on time.

Based on a fixed schedule environmental issues will be monitored during operation period.

Wind turbines generally require limited operational activities as these mainly include the following:

- Normal daily operation of the wind farm. The long-term availability of a commercial wind turbine is usually in excess of 97 percent (i.e. 97% of the time, the turbine will be available to work if there is adequate wind). Generally, it will usually take a period of less than six months for the wind farm to reach full, mature, commercial operation and hence, during that period, the availability will increase from a level of about 80-90 percent after commissioning to the long-term level of 97 percent or more.
- Maintenance will also take place where a service team will regularly visit the site. Typical routine maintenance time for a modern wind turbine is 40 hours per year. Non-routine maintenance may be of a similar order. Although minimal, maintenance activities may include turbine and rotor maintenance, lubrication of parts, and maintenance of electrical components as necessary, full generator overhaul, etc.

2.5.3 Decommissioning Phase

In the case of complete decommissioning of a wind turbine the tower and blades of the removed wind turbine will be taken down by crane, disassembled into components, and then cut into sizes suitable for scrap. Most of these materials are salvageable (i.e. recyclable). The turbine foundation will be removed to a depth of approximately 1 m and refilled. The whole site, including all flattened areas (e.g. storage- and crane pad areas) will be reclaimed to a close natural status and tracks used for maintenance vehicles will be covered over.

Wind farms generally persist, with older wind turbines replaced with more modern, larger and more efficient wind turbines when needed. Therefore it is likely that a well-sited wind farm will persist as a productive entity for as long as humans need electricity. According to reported international experience, wind turbines on average last 17-25 years before repowering.

Consequently, a second scenario is that once selected, a well-sited wind farm remains well-sited, and the tracks, gates, distribution network tie-ins and local maintenance resources have value; it's cheaper to repower a site than to establish a new site. This means that an out-of-date wind turbine is replaced with a working turbine of equivalent or even better nameplate generation capacity.

2.5.4 Project Schedule

The project will be developed and executed in four phases.

- Pre-construction, in 2017 – e.g. site assessment, wind measurement, grid assessment, design, environmental and social impact assessment;
- Construction, 2018 until 2020;
- Operation until 2040;
- Decommission in 2040

This schedule is intended as a draft and will be updated and agreed between the project parties prior to the start of construction.

2.6 Workforce

According to information provided by the Developer and EPC Contractor, the project will require the following workforce throughout the construction and operation phase:

- Around 70 job opportunities during the construction phase for a duration of approximately 18 months. This will mainly include skilled job opportunities (such as engineers, technicians, management professionals, etc.), and unskilled job opportunities (such as labourers and security personnel). All unskilled and partially skilled job opportunities will be prioritised to the local communities around the project site and/or Jordanian residents (with required qualifications and skills). Onsite housing will not be provided for workers. The EPC Contractor will be responsible for providing accommodation within the closest community.
- Around 10 job opportunities during the operation phase for a duration of 20 years. This will include skilled job opportunities (such as engineers, technicians, administrative employees, etc.) and unskilled job opportunities (such as security personnel, drivers, etc.). All unskilled and partially skilled job opportunities will be prioritised to the local communities around the project site and/or Jordanian residents (with required qualifications and skills).

2.7 Resource Use Efficiency

The objective of this section is to demonstrate how the project development has endeavored to optimize the use of all natural resources (fossil fuels, water, etc.) involved in the project processes.

1. One of the key positive impacts of the project, as far as resource efficiency, is that it will be utilizing wind energy to produce electricity. The project is expected to be of an installed capacity of 51.75MW and will contribute to supplying electricity to the national grid for the use of bulk suppliers and help meet the increasing electricity demands throughout the Kingdom – as opposed to meeting such increasing demands through electricity production from conventional thermal power plants using fossil fuels. The project is expected to provide approximately 151 Gigawatt Hour (GWh) of electricity per year, which is enough to power around 35,000 average local households in Jordan. This has been based on taking into account that in 2014 (latest statistic) the annual electricity consumption of households in Jordan was 6,580 GWh (latest statistic available from MEMR, 2015) while the number of households in 2014 in Jordan was 1,590,762 (DoS, 2015) and thus the average annual electricity consumption can be assumed to be around 4,100 Kilowatt Hour (kWh).

To this extent, the generation of electricity through a renewable source will offset greenhouse gas emissions as opposed to generating electricity from conventional thermal power plants – which is currently utilized for producing electricity in Jordan through the burning of natural gas and/or heavy fuel oil. The project is expected to provide around 151 GWh of electricity per year; this will offset more than 112,000 ton of CO₂ per year, apart from the reduction of air pollutants emitted from conventional thermal power plants – such as ozone, sulfur dioxide (SO₂), Nitrogen Dioxide (NO₂), particulate matter, and other gases which are the cause of some serious environmental concerns such as smog, acid rain, health effects, and many others.

2. The nature of operation of wind farms does not entail the use of significant amounts of water resources during the construction and operation phase. Thus, the water requirements of the project are minimal and mainly required for the potable use by workers during the construction and operation phase – which are also considered to be relatively small in number. In addition, the project will save around 1 million m³ of water per year in comparison to an oil-burning power plant which utilizes water for cooling.

3. PROJECT ALTERNATIVES

3.1 Site Selection Alternatives

A number of advantages make the project site well suitable for the wind power generation. The area has very good wind conditions, which was proven by wind measurement campaigns. The individual turbine locations have been selected within the design and optimization process. In general, wind speeds increase with height above ground whereas turbulence intensity decreases at the same time. Therefore, the highest areas of the project site were considered for turbine locations where possible. In addition to this, distances in-between turbines, to the existing infrastructure (e.g. roads, power lines), constraints of archaeology, noise and shadow flickering, land access, environmental constraints etc. needed to be taken into consideration for establishing the final wind farm layout.

The area around the wind farm is not densely populated. Since there are no dwellings on the project site there is only a limited impact from noise and shadow flickering. Furthermore, the distances to the closest dwellings have been increased during the design process of the wind farm minimizing the potential impact further.

A further advantage of the site is the transmission line which is in the vicinity of the wind farm. Therefore there is only a limited environmental impact associated with the construction of the grid connection.

3.2 Design Alternatives

The suggested turbine type represents state-of-the-art and proven technology from one of the world's leading wind turbine manufacturer Vestas. Within the design phase various layouts with different turbine types were considered in order to make the best use of the available site. The finally selected turbine Vestas V136 is very efficient turbine. Due to its large rotor it has a high energy yield while having a small footprint. Consequently, fewer turbines will be required compared to smaller turbine models to achieve a similar energy output of the project.

3.3 Technology Alternatives

In 2007, the Royal Commission updated the Strategy and provided a vision for the development of the energy sector till the year 2020 to become the "Updated Master Strategy of Energy Sector in Jordan for the period (2007-2020)". One of the main outcomes was the need to diversify energy resources and increase the share of renewable energy to 7% in 2015 and 10% in 2020 – with the major share coming from wind and solar power. Therefore, projects in the field of the renewable energy need now to be realized.

The National Electric Power Company continues to work on constructing the green corridor project with the aim of assimilating (1200) MW of renewable energy from the projects of the first and second rounds participating in the Direct Proposal Submission implemented by the private sector in addition to the governmental projects in the same field, so as to generate electricity by utilizing solar energy and wind energy.

A combination of these energy sources will balance natural fluctuations e.g. during night-time (solar energy) or calm times (wind energy) and is therefore necessary to balance the energy distributed to the Jordanian grid. Based on internal assessments of different time depending wind data the differences between windy seasons and periods in the North and South of Jordan are significant. So, also in terms of geographical

locations the use of wind energy makes sense to enhance the energy system in terms of levelization and security.

Jordan has excellent conditions for the use of solar energy with more than 300 clear days during the year and a high irradiation. The solar potential increase from north to south by a factor of at least 1.5. Considering the recently comparatively low investment costs for PV plant, the development of private and industrial solutions with PV applications are expected to rise significantly.

The main disadvantages of PV power plants are the need to provide security for the installations and the huge demand in terms of land resources (factor of 150-200 in comparison to wind energy), the harsh environment (temperature, dust) which will decrease the PV modules' efficiency significantly as well as the impact to the grid (connection on low/medium voltage level with high penetration as well as peak times). However, the generation of solar energy follows the demand of cooling systems very well in general, which may support the quality and stability of the grid especially in urban areas.

Wind energy therefore should be regarded as the primary and adequate solution round the Tafileh region, where the wind resources are one of the best in the entire Kingdom of Jordan. However, wind resources are not the only criteria for the site selection: good infrastructure, grid connection capacity as well as impact to the environment are also crucial. Due to the number of settlements and urban area in relation to the wind resources the north of the country is considered being less suitable for a utility-scale wind farm project. In the south of the country, close to Aqaba, there may be harsher conditions. The area within the Governorate of Tafileh has been very attractive from the beginning: an area almost free of settlements and urban activities, with existing industry (e.g. LaFarge cement factory), high-voltage power transmission line, excellent wind conditions as well as high grid capacity is well suited to the use of wind energy.

Many other forms of renewable energy are not suitable for use in Jordan. Hydropower, for example, would not be suitable given the current water scarcity in the country. Biomass or biogas is also very dependent on water resources (indirectly because it is fuelled by plants which must be irrigated in order to grow).

Using geothermal energy from the deep in the earth as well as concentrated solar power (CSP) may be options for the future, but the assessment of these potential resources is rather complex and expensive. The feasibility of this kind of projects must be investigated carefully and compared to wind and solar applications which can be developed and installed substantially faster.

Power generation from conventional fossil energy sources like crude oil and gas is also not an attractive option for Jordan due to the lack of domestic resources. Moreover, Jordan's location in a region of high political insecurity has had an inhibiting effect on its ability to import energy. Therefore, wind energy can have a substantial role in improving energy security by harnessing the local wind resources. Furthermore, the use of wind energy reduces the consumption of water, which is heavily relied on to cool thermal power plants. This advantage of wind energy is considered to be particularly important due to the water scarcity in Jordan.

3.4 No Project Alternative

Under the "no-action alternative" the wind farm would not be built and would not support the development of the renewable energies in Jordan.

The project site would remain unchanged -overgrazed land with sparse vegetation and little agriculture- and project related adverse impacts would be averted. The positive environmental and social benefits of the project would also not be realized. Land lease agreements would not be made and the Jordanians owning land in the project site would not earn money with mostly fallow lying land.

The following positive effects would not occur by choosing the no action alternative:

- Reduction of reliance on fossil fuels;
- Contribution of securing national energy supply;
- Limitation of potential impacts arising from the production and the transport of natural resources;
- Reduction of CO₂
- Economic benefits for the inhabitants of Gharandil and the dwellings around;
- Lease payments for people owning land on the project site

See also Chapter 7 (overview of strategic environmental and economic impacts).

Due to the impacts of the construction phase, anticipated to be of short term nature, and due to the impact during the operation of the project, anticipated to be mostly of minor nature, the no-action alternative is not preferable.

4. REGULATORY AND POLICY FRAMEWORK

This chapter first provides an overview of the environmental clearance process for the project as governed by the Ministry of Environment (MoEnv). The chapter then discusses the regulatory context, which is directly related to environmental compliance, which must be adhered to by all parties involved in the project throughout the planning and construction, operation, and decommissioning. The chapter goes on to summarize the relevant international agreements and conventions to which Jordan is a signatory. Finally, as the project was seeking financing from prospective lenders, the chapter highlights the environmental and social policies and requirements of the IFC, which must be adhered to by the Developer and EPC Contractor.

4.1 Jordanian Environmental Clearance Process

The process for environmental clearance and obtaining the environmental permit for this project as required by the MoEnv is stipulated by the “Environmental Protection Law No. (52) of 2006”, “Environmental Impact Assessment Regulation No. (37) of 2005”, and the “Instructions for Site Selection of Development projects for the year 2012”.

Generally, the environmental clearance process, as governed by the MoEnv, is a two (2) step process. First, the Developer of the project, and prior to commencement of the ESIA study, must apply for a site approval permit in accordance with the “Instructions for Site Selection of Development projects of 2012”. The second step involves undertaking the ESIA study for the project in accordance with the “Environmental Impact Assessment Regulation No. (37) of 2005”.

Both steps are discussed in additional details below.

4.1.1 Location/Site Approval Permit and Environmental Assessment Requirements

- **Location/Site Approval Permit Application:** The project Owner/Developer applies to the ‘Central Licensing Committee’ within the MoEnv of the intention to undertake a development project using the application form available at the MoEnv. The ‘Central Licensing Committee’ includes representatives from the MoEnv as well as other governmental authorities such as: Ministry of Agriculture, Ministry of Health, Ministry of Water and Irrigation, Ministry of Municipal Affairs, Greater Amman Municipality, Energy and Minerals Regulatory Commission, and the Jordan Food and Drug Administration. The application lists the information required by the ‘Central Licensing Committee’ which includes:
 - General information on the location of the project supported by a site map;
 - A brief description of the planned project, purpose and nature, capacity, major components, etc.;
 - Implementation schedule for the proposed project at different phases and other.
- **Location/Site Approval Permit Decision:** The ‘Central Licensing Committee’, upon receipt of the application, evaluates the data submitted and undertakes a site visit to determine the appropriateness of the site for the proposed development. Based on the findings of the site visit, the Committee either approves the site of the project or rejects the site for the development.

Generally, this is decided based on requirements from the MoEnv stipulated within the “Instructions for Site Selection of Development projects for the year 2012” stipulated in accordance to Article No. 4 of the “Environmental Protection Law No. 52 for the Year 2006”. The 2012 instruction identifies requirements on the setting of development projects and minimum distances that must be respected in relation to nearby sensitive receptors (including renewable energy projects). Article 34 is related to renewable energy projects and requires that wind farm development projects adhere to a 1km setback distance between any turbine and the closest organized boundary of villages.

However it is important to note that in 2016 the Instruction was revised to become the “Instructions for Site Selection of Development projects for the year 2016”. One of the key changes in the Instruction is that wind farm development projects are now required to comply with a 700m buffer distance (instead of a 1km) between the closest turbine and the regularized boundaries of nearby villages

The Central Licensing Committee has approved the site for the development of the project in August 2015 on the condition that a 1 km buffer zone is respected between the closest turbine and the Regularized Boundaries of nearby villages as stipulated in Article 34 of the 2012 Instruction. However, after the 2016 Instruction was issued, ECO Consult reapplied to the MoEnv to reduce the setback distance to 700m instead of 1km. An official letter was issued by the MoEnv approving the 700m setback distance for the project instead of the 1km distance.

- **Screening Decision/ESIA Requirement:** As part of the same decision process, the ‘Central Licensing Committee’ determines whether or not the proposed development project is subject to a formal Environmental Assessment procedure. The EIA Regulation lists the projects that require a full EIA or a Preliminary Environmental Impact Assessment study. Any project which may have a significant impact on the environment is classified into Category 1 which refers to projects in Annex 2 of this regulation. Category 1 projects require the preparation of a comprehensive EIA before permission to operate (or license to begin construction) can be given. Annex 2 of the Regulation requires that any project generating energy/electricity is requested a comprehensive EIA study.

In accordance with the above, the MoEnv has officially requested that KOSPO undertake a comprehensive ESIA study for the project.

4.1.2 EIA Study & Environmental Permit

- **EIA Technical Committee:** in the case of a project where the ‘Central Licensing Committee’ rules that EIA is required, then the matter is transferred from the ‘Central Licensing Committee’ at MoEnv to the ‘EIA Technical Committee’ within the same Ministry and the ESIA Study procedures are officially started. The ‘EIA Technical Committee’ also includes representatives from the MoEnv as well as other governmental authorities such as: Ministry of Agriculture, Ministry of Health, Ministry of Water and Irrigation, Ministry of Municipal Affairs, Ministry of Public Works and Housing, Ministry of Planning and International Cooperation, Ministry of Energy and Mineral Resources, Ministry of Industry and Trade, and the Environmental Societies Association (which forms the umbrella for the all environmental NGO’s in Jordan).
- **EIA Study Phases:** In summary, two successive phases of activities are involved in the completion of a comprehensive EIA study in Jordan:
 - Scoping Phase: which includes the submission of a Pre-Scoping Report, undertaking a scoping session, and submission of a Scoping Report/Terms of Reference (ToR) approved by MoEnv for the Study; and
 - Assessment Phase: which includes undertaking the baseline studies, evaluation and assessment of impacts, and the development of an environmental management plan.
- **Scoping Phase:** The scoping phase proceeds with the submission of a Pre-scoping report to the Ministry. This provides the MoEnv with all available information about the project as well as the nature of impacts expected to result from the project and the relevant persons affected in order to initiate the EIA process by calling for a Scoping and Consultation Session. Then a scoping session is undertaken and following this a Scoping Report/ToR is submitted to the MoEnv which will include the issues addressed in the Pre-scoping Report in addition to other valid comments raised by the stakeholders during the scoping session. The report will also include a detailed Terms of Reference (ToR) that will present the methodology that will be adopted for the EIA study. This report must be approved by MoEnv, prior to undertaking the EIA study.

In accordance with the above, the scoping session for the project was held on 24 March 2016 and the ToR was submitted and approved on 11 May 2016.

- **Assessment Phase:** The assessment phase is carried out in accordance with the approved ToR by the MoEnv and involves undertaking the baseline studies, impact assessment and development of management plans for various components that are expected to be impacted by the project and its activities. The EIA document is the output of the assessment, prepared in accordance with the ToR.
- **Approval of EIA:** Upon submission of the EIA document, the EIA Technical Committee reviews the report and either approves the study and grants the environmental clearance for the project or rejects the project if the study indicates that the implementation of the project would cause significant impacts on the environment and/or the EIA fails to identify plans for reducing adverse impacts. In order to issue the environmental permit for the project environmental clearance is required.

In accordance with the above, the ESIA report was submitted to the MoEnv. The ESIA was approved and an environmental permit was issued for the project by the MoEnv in October 2017. The permit was conditional that the Developer undertakes the following;

1. Obtain the approval of the Energy and Minerals Regulatory Commission for the project
2. Adhere to the General Health Conditions for Crafts and Industry for 2013
3. Adhere to the Ministry of Environment's Instruction for Reduction and Prevention of Noise
4. Developer a Project with a capacity of 51.75MW
5. Adhere to a 700m buffer distance between the closest turbine and organized boundaries of villages/ populations in all directions
6. Start development of the project within 1 year from issue of the environmental permit

It is important to note that the ESIA that was submitted to the MoEnv was Rev 2 which considered case 4f layout for the turbines. At a later stage, the Developer changed the layout (case 5c – as included within this version of the report). The change mainly included the relocation of 11 turbines (ranging from 10m – 800m), but all of which remained within the project boundary. A letter was submitted by ECO Consult to the MoEnv informing them of this change. The MoEnv responded officially that it is not required to resubmit the ESIA and that the environmental permit previously issued (October 2017) is still applicable in this case.

4.2 Summary of Jordanian Environmental and Social Regulatory Context

This section lists those legislations that are directly related to environmental and social compliance that must be adhered to by all parties involved in the project throughout the planning and construction, operation, and decommissioning phase. These legislations include: (i) those issued by MoEnv (laws, regulations and instruction), and (ii) the relevant national legislations issued by other line ministries (laws, regulations, instructions, standards).

Table 5 below lists the key legislation and regulator/entity relevant to each of the environmental and social parameter being studied and assessed within this ESIA. Throughout the following chapters, reference to the requirements set out within legislation is provided under each relevant parameter.

Table 5: Legislative Context for each E&S Parameter being Studied and Assessed within this ESIA

Parameter	Responsible Regulator/Entity and Relevant Legislations
Pre-ESIA Compliance Requirements	
Site Selection Process	▪ Ministry of Environment (MoEnv): - Environmental Protection Law No. 52 of 2006 - Instruction for Site Selection of Development projects for the year 2012/ 2016
ESIA and Post ESIA Requirements	
Landscape and Visual	▪ Ministry of Environment (MoEnv): - Environmental Protection Law No. 52 of 2006
Land Use	▪ Ministry of Municipal Affairs (MoMA) - Municipalities Law No. Law No. 41 for the year 2015 - Land Use Planning Regulation no. (6) for the Year 2007 ▪ Ministry of Environment (MoEnv): - Environmental Protection Law No. 52 for the year 2006

	- Ministry of Agriculture (MoA): - Agriculture Law No. 13 for the year 2015
Geology and Hydrology (soil and groundwater)	- Ministry of Environment (MoEnv) - Environmental Protection Law No. 52 of 2006 - Solid Waste Management Regulation No. (27) of 2005 - Management, Transportation, & Handling of Harmful & Hazardous Substances Regulation No. (24) of 2005, - Instruction for Management and Handling of Consumed Oils for 2003, - Instruction for Hazardous Waste Management for the year 2003 - Ministry of Water and Irrigation (MWI) - Water Authority Law No. 18 for 1988 and it's amendments thereof - Groundwater Control Regulation No. 85 for 2002 and its amendments thereof - Instructions for the Protection of Water Resources Allocated for Drinking Purposes for 2006 - Ministry of Health (MoH) - Public Health Law No. 47 for 2008 - Jordan Institution for Standards and Metrology (JISM) - Jordanian Standard 431/1985 – General Precautionary Requirements for Storage of Hazardous Materials
Biodiversity	- Ministry of Environment (MoEnv) - Environmental Protection Law No. 52 of 2006 - Ministry of Agriculture (MoA) - Agriculture Law No. 13 of 2015 - Regulation for Categorizing Wild Birds and Animals Banded from Hunting No.43 of 2008
Avi-Fauna (Birds and Bats)	- Ministry of Environment (MoEnv) - Environmental Protection Law No. 52 of 2006 - Ministry of Agriculture (MoA) - Agriculture Law No. 13 of 2015 - Regulation for Categorizing Wild Birds and Animals Banded from Hunting No.43 of 2008
Archaeology	- Department of Antiquities (DoA) - Antiquities Law No. 21 of 1988 and its amendments No. 23 for 2004
Air Quality	- Ministry of Environment (MoEnv) - Environmental Protection Law No. 52 for the year 2006 - Air Protection Regulation No. 28 for 2005 - Jordan Institution for Standards and Metrology (JISM) - JS 1140-2006 Ambient Air Quality
Infrastructure and Utilities	- Ministry of Water and Irrigation (MWI) - Water Authority Law No. 18 for the year 1988 and it's amendments thereof - Groundwater Control Regulation No. 85 for 2002 and its amendments thereof - Instructions for the Protection of Water Resources Allocated for Drinking Purposes for 2006 - Ministry of Municipal Affairs (MoMA) - Municipalities Law No. Law No. 13 for the year 2011 - Ministry of Environment: - Environmental Protection Law No. 52 for the year 2006 - Instruction for Hazardous Waste Management for the year 2003 - Civil Aviation Regulatory Commission - Civil Aviation Law No. 41 for the year 2007 - Telecommunication Regulatory Commission - Telecommunications Law No.21 for the year 2011 - Jordan Radio and Television Corporation - Jordan Radio and Television Corporation Law No. 35 for the year 2000 - Ministry of Interior - Traffic Law No. 49 for the year 2008 - Regulations for the Registration and Licensing of Vehicles No. 104 for 2008 - Regulation for Maximum Dimensions, Weights and Total Engine Power for Vehicles No. 42 of 2002 - Instructions for Allowable Speed Limits for 2002
Occupational Health and Safety	- Ministry of Labor (MoL) - Labor Law No. 8 for the year 1996 and its amendments - Regulation of Protection and Safety from Industrial Tools and Machines and Work Sites No. 43 for 1998 and its amendment thereof - Formation of Committees and Supervisors of Occupational Health and Safety Regulation No. 7 for 1998 - Instructions for the Protection of Workers against the Risks of the Work Environment - Regulation for Preventive and Curative Health Care for Workers in Establishments No. 42 for 1998 and its amendments thereof - Regulation for the Fees of Work Permits for Non-Jordanians No. 67 for 2014 and its amendments thereof - Regulation for Labour Inspectors No. 56 of 1996 - Decision for the Works and Times prohibiting the employment of Women 2010 - Decision for the Hazardous or Exhaustive or Harmful Works on Health for under 18 years of age 2011

	▪ Ministry of Health (MoH) - Public Health Law No. 47 for 2008 - Crafts and industries Law No.16 for the year 1953 and its amendments thereof - Instructions for Prevention of Health Nuisances from Workers Accommodation No.(1) for the year 2013 - Health General Conditions for Crafts and Industries for the Year 2013
Community Health, Safety, and Security	▪ Ministry of Environment (MoEnv) - Environmental Protection Law No. 52 for the year 2006 - Instruction for Reduction and Prevention of Noise for 2003 ▪ Ministry of Health - Public Health Law No. 47 for the year 2008
Socio-economic	▪ National Building Council – Ministry of Public Works and Housing (MPWH) - Regulation for Obligatory Employment of Jordanian Workforce from Surrounding Communities in Development projects No. (131) for the year 2016

4.3 International Agreements

The Government of Jordan is signatory to a number of important international agreements which relate to the topics addressed in this ESIA, and has already incorporated many of the provisions in national legislation, often indicating that where the national law is inconsistent with international agreements to which Jordan is a signatory, the requirements of the international agreement will prevail. Accordingly, the terms of international agreements to which Jordan is a party are an important part of the legal framework within which the project operates. Key treaties and obligations are described below.

4.3.1 International Agreements on Biodiversity, Flora and Fauna

These include the following:

- Convention on Biological Diversity (1993) - signed by Jordan in 1993. Under this agreement, signatories are required to develop plans and policies for the protection and monitoring of biodiversity and to integrate these into national plans for development;
- Convention on Migratory Species (1979) - signed by Jordan in 2000. Signatories are required to protect migratory species throughout the migration range by coordinated efforts and research;
- Agreement on the Conservation of African-Eurasian Migratory Water birds (1995) - came into force in 1999 when ratified by a number of at least fourteen Range States, comprising seven from Africa and seven from Eurasia. The Agreement covers 255 species of birds ecologically dependent on wetlands for at least part of their annual cycle;
- Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) (1973) - objective of this convention is to save many and varied forms of wild fauna and flora by regulating trade in specimens of species of wild fauna and flora;
- International Plant Protection Convention (1970) - the objective of this convention is to prevent the international spread of pests and plant diseases;
- UN Convention to Combat Desertification - the objective is to combat desertification and mitigate the effects of drought in countries experiencing serious drought and/or desertification through effective action at all levels; and
- Stockholm Convention on Persistent Organic Pollutants (POP) (2004) - the objective of this Convention is to protect human health and the environment from persistent organic pollutants.

4.3.2 International Agreements on Energy and Climate Change

These include the following:

- UN Framework Convention on Climate Change (UNFCCC) 1992 - the UNFCCC was established so as to begin to consider what can be done to reduce global warming and to cope with whatever temperature increases are inevitable, aiming to stabilize greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system;

- Kyoto Protocol to the UN Framework Convention on Climate Change (1997) - establishes a legally binding commitment for the reduction of four greenhouse gases produced by industrialized nations, as well as general commitments for all member countries; and
- UNEP Montreal Protocol on Substances that Deplete the Ozone Layer (1987) - an international treaty designed to protect the ozone layer by phasing out the production of a number of substances believed to be responsible for ozone depletion.

4.3.3 International Agreement on Cultural Heritage

This includes the following:

- Convention Concerning the Protection of the World Cultural and Natural Heritage, (World Heritage Convention, 1972) - the primary mission of the Convention is to identify and protect the world's natural and cultural heritage considered to be of outstanding universal value.

4.3.4 Other International Agreement Relating to Environmental Protection

This mainly includes the following:

- Basel Convention on the Trans-boundary Movements of Hazardous Wastes and Their Disposal - designed to reduce the movements of hazardous waste between nations, and specifically to prevent transfer of hazardous waste from developed to less developed countries.

4.3.5 Obligations Relating to Membership of the International Labor Organization (ILO)

The International Labor Organization sets guidelines and requirements relating to labor relations and workers' rights. Jordan has ratified a range of ILO Conventions that are relevant to the project. These are set out in the Box below.

List of ILO Conventions ratified by Jordan and relevant to the Project

- C 29 Forced Labor Convention, 1930 (No.29) ratified 06:06:1966
- C 81 Labor Inspection Convention, 1947 (No. 81) ratified 27:03:1969
- C 98 Right to Organize and Collective Bargaining Convention, 1949 (No.98) ratified 12:12:1968
- C100 Equal Remuneration Convention, 1951 (No.100) ratified 22:09:1966
- C105 Abolition of Forced Labor Convention, 1957 (No.105) ratified 31:03:1958
- C 106 Weekly Rest (Commerce and Offices) Convention, 1957 (No.106) ratified 23:07:1979
- C 116 Final Articles Revision Convention, 1961 (No.116) ratified 04:07:1963
- C 117 Social Policy (Basic Aims and Standards) Convention, 1962 (No. 117) ratified 07:03:1963
- C 118 Equality of Treatment (Social Security) Convention, 1962 (No. 118) ratified 07:03:1963
- C 119 Guarding of Machinery Convention, 1963 (No.119) ratified 04:05:1964
- C 120 Hygiene (Commerce and Offices) Convention, 1964 (No. 120) ratified 11:03:1965
- C 122 Employment Policy Convention, 1964 (No. 122) ratified 10:03:1966
- C 124 Medical Examination of Young Persons Convention, 1965 (No.124) ratified 06:06:1966
- C135 Workers' Representatives Convention, 1971 (No.135) ratified 23:07:1979
- C 142 Human Resources Development Convention, 1975 (No.142) ratified 23:07:1979
- C 144 Tripartite Consultation (International Labor Standards) Convention, 1976 (No. 144) ratified 05:08:2003
- C 147 Merchant Shipping (Minimum Standards) Convention, 1976 (No. 147) ratified 01:04:2004
- C 150 Labor Administration Convention, 1978 (No. 150) ratified 10:07:2003

- C 159 Vocational Rehabilitation and Employment (Disabled Persons) Convention, 1983 (No. 159) ratified 13:05:2003
- C 185 Seafarers Identity Documents Convention (Revised), 2003 (No. 185) ratified 09:08:2004
- C 111 Discrimination (Employment and Occupation) Convention, 1958 (No. 111) ratified 04:07:1963
- C 138 Minimum Age Convention, 1973 (No. 138) species at 16 years ratified 23:03:1998
- C182 Worst Forms of Child Labor Convention, 1999 (No.182) ratified 20:04:2000

5. ESIA APPROACH AND METHODOLOGY

This chapter describes the approach and methodology that was adopted for the ESIA study including the following:

- Approach to screening and scoping phases;
- Approach for the analysis of alternatives;
- Approach to stakeholder engagement;
- Approach to determining the spatial and temporal study area;
- Methodology for assessment of the baseline environmental and social conditions;
- Methodology used to assess the potential environmental and social impacts of the project – including the approach to determining significance, development of mitigation measures and the assessment of residual effects;
- Approach used for the assessment of cumulative and trans-boundary effects; and
- Approach for development of an Environmental and Social Management Plan (ESMP).

5.1 Screening, Scoping & Assessment

The ESIA process for the project has followed the environmental clearance process outlined in ‘Section 4.1’ earlier, as summarized below:

- **Location/Site Approval Permit & Screening Decision:** the Central Licensing Committee has approved the site for the development of the project conditional that a 1 km buffer zone is respected between the closest turbine and the Regularized Boundaries of nearby villages and that a comprehensive ESIA study is undertaken before commencement of any construction or operational activities. The Site Approval Permit has been granted on August 2015.
- **Scoping Phase:** the scoping session for the project was held on 24 March 2016. In addition, the Scoping Report/ToR was submitted to the MoEnv and was approved 11 May 2016.
- **Assessment Phase:** The assessment phase has been carried out in accordance with the approved ToR by the MoEnv. This ESIA report is the output of this assessment for submission to the MoEnv for approval. The ESIA has been approved by the MoEnv and an environmental permit issued in October 2017.

5.2 Analysis of Alternatives

The “Environmental Impact Assessment Regulation No. (37) of 2005” requires that the ESIA shall identify and analyse alternatives, including but not limited to project site location, process and technological alternatives, no project alternative (which assumes that the project development does not take place), and present the main reason for the preferred choice. The examination of alternatives is also considered to be a key element of the ESIA process under good international practice, including the “IFC Performance Standard 1” (IFC, 2012)

and the associated “IFC Guidance Note 1” (IFC, 2012). Environmental and social considerations have been part of the planning of the project and a core element of the decision-making process.

The analysis of alternatives has already been presented in “Chapter 3”. The chapter discussed and compared several alternatives to the project development in relation to: (i) the project site, (ii) the chosen technology, (iii) the project design, and finally investigated the ‘no action alternative’ – which assumes that the project development does not take place.

5.3 Stakeholder Engagement

Stakeholder consultation and engagement is an essential part of the ESIA process, and has been carried out in accordance with the regulatory requirements in Jordan and international best practice – to include requirements identified within the “EIA Regulation No. (37) of 2005” as well as “IFC Performance Standard 1” (IFC, 2012). The previous and future stakeholder consultation and engagement for the project are summarized below and discussed in detail in “Chapter 6”.

The stakeholder consultation and engagement for the project to date has included both of the following actions and are discussed in further details in “Chapter 6”: (i) high level consultations and (ii) detailed engagement and consultations. The high level consultation mainly includes the undertaking of a scoping session, and which is considered high level as various stakeholder groups representing various entities are consulted at once. The scoping session that was undertaken included stakeholder groups such as national governmental entities, local governmental entities, non-governmental organizations, academic and research institutions, etc. The detailed engagement and consultation focused on a single stakeholder group at a time in order to take their specific concerns into account throughout the ESIA study. This included: (i) local community and nomads through onsite consultations and/or local community consultation session; (ii) other stakeholders to include governmental and non-governmental organizations consulted and engaged through bi-lateral meetings, e-mail communication, phone communication, and formal letters.

“Chapter 6” also discusses future stakeholder engagement and consultations which are to take place once the ESIA has been approved by the MoEnv. This includes (i) the disclosure of the ESIA to stakeholders with regards to the findings and recommendations proposed within the ESIA study as well as the disclosure of the Non-Technical Summary (NTS) and Stakeholder Engagement Plan (SEP); and (ii) implementation of the Stakeholder Engagement Plan (SEP) by the Developer describes the planned stakeholder consultation activities and engagement process.

5.4 Delineation of Study Boundaries and Scope of Assessment

5.4.1 Definition of Spatial Study Area ECO

The overall Study Area for the ESIA represents the potential area of influence of the project. This is *‘the area over which significant effects of the project could reasonably occur, either on their own, or in combination with those of other developments and projects’*.

In general terms, the Study Area for the project ESIA includes the footprint of project disturbance as demarcated in blue in Figure 5 below. However, for the assessment of the individual environmental and social parameters (infrastructure and utilities, socio-economic, community health and safety, etc.), an appropriate thematic Study Area is determined for each theme on a case by case basis. Such a thematic Study Area is clearly identified within the relevant section it relates to throughout this ESIA. In identifying these thematic Study Areas, the type and degree of the potential direct and indirect effects were taken into consideration.

In identifying these thematic study areas, the type and degree of the potential direct and indirect effects were taken into consideration. The core area where direct effects are likely to occur was determined, as

well as the wider area of influence where indirect, combined and cumulative effects are likely to occur on the surrounding areas and communities.



Figure 5: Study Area

5.4.2 Temporal Scope of the Assessment

The project will be developed in a three phase sequence, as follows:

- Planning & Construction Phase
- Operation Phase
- Decommissioning Phase

It is important to note that the ESIA study does not cover the associated interconnection facilities and the activities that will be undertaken for their construction and operation. Such associated interconnection facilities include the NEPCO receiving substation and the high voltage overhead transmission line. Such activities will be undertaken by NEPCO. Detailed information is not available at this stage by NEPCO – which include methods of construction, layout of the receiving NEPCO substation, right of way, detailed grid connections plans and route for the overhead line, etc.

(i) Planning and Construction Phase

This includes construction activities which will be undertaken by the EPC Contractor. This mainly includes preparing the detailed design and layout of the project, transportation of project components onsite, as well as site preparation and construction activities for installation of wind turbines, foundations, internal access roads, buildings, etc.

(ii) Operation Phase

This includes activities to be undertaken by the project Operator. Activities expected to take place mainly include the normal daily operation of the wind turbines and the routine maintenance activities.

(iii) Decommissioning Phase

It has not been determined yet, whether at the end of the PPA term (which is set for 20 years) MEMR would take ownership of the project and continue operating it, or whether the project will be completely decommissioned by the Developer.

Nevertheless, should the project be completely decommissioned, then generally the anticipated impacts throughout the decommissioning phase are similar in nature to impacts assessed during the construction phase – and specifically in impacts related to soil and groundwater (from improper management of waste streams), air quality, and occupational health and safety. Therefore, the assessment of impacts for those receptors and mitigation identified during the construction phase is assumed to apply to this phase in particular without the need to reiterate or emphasize this throughout this chapter.

5.5 Environment & Social Baseline Conditions

As part of the ESIA process, the baseline environmental and social conditions of the Study Area were established. Describing the baseline includes identifying and defining the importance and sensitivity of the various environmental and social resources and receptors likely to be impacted, i.e. within the Study Area. Understanding the value or sensitivity of the resources and receptors to impacts and changes is an important consideration when determining the significance of effects, and allows for better identification of the most appropriate measures that could be employed to avoid impacts, and to mitigate any adverse impacts.

The description of environmental and social baseline conditions has considered a wide range of data and information gathered from various sources, including:

- Desk-based studies and literature reviews;
- Data from statutory and non-statutory stakeholders; and
- Field surveys and site investigations.

These studies have covered all the environmental and social aspects related to the project. The baseline conditions are treated as those conditions which would prevail in the absence of the project. Studies of the environment and social baseline are described under each chapter respectively and include the following: landscape and visual; shadow flicker; noise; land use; geology and hydrology (soil & groundwater); biodiversity; birds (avi-fauna); bats; archaeology and cultural heritage; infrastructure and utilities; community health, safety and security; and socio-economic conditions. Within each chapter, the methodology which was undertaken for assessment of the each of those baseline conditions is described in detail.

5.6 Impact Assessment Methodology

Given the scale and type of the project, the ESIA commences with an assessment of the positive environmental and economic impacts on the strategic and national level given the current challenges the energy sector in Jordan faces- as highlighted in “Chapter 7”.

It then moves forward and within each chapter (from Chapter 8 -21) the assessment of impacts on environmental and social parameters is undertaken as required under the ToR. The following section provides a description of the approach, methodology and process adopted for the impact assessment presented within this ESIA.

5.6.1 Approach to Assessment of Impacts

The adverse and beneficial environmental and social impacts of the project have been identified and assessed against the established baseline. A consistent approach to the assessment of impacts was followed to enable environmental and social impacts to be broadly compared across the ESIA. A set of generic criteria were used to determine significance (see below) which were applied across the various social and environmental parameters.

As far as possible, environmental and social impacts were quantified. Where it was not possible to quantify impacts, a qualitative assessment was conducted using professional experience, judgment and available knowledge, and including the consideration of stakeholder views. Where there were limitations to the data, and/or uncertainties, these have been recorded in the relevant chapters, along with any assumptions that were taken during the assessment.

In order to determine the significance of each impact, two overall factors are considered:

- The importance and/or sensitivity of the environmental and social receiving parameter, as determined during the assessment of baseline conditions; and
- Magnitude and Nature of the impact.

5.6.2 Sensitivity of the Receiving Parameter

Receiving parameter sensitivity was determined using information taken from the baseline description on the importance, significance or value of the social or environmental component under examination. It is important to understand the sensitivity of the receiving parameter, as this is a measure of the adaptability and resilience of an environmental parameter to an identified impact. The following categories of sensitivity were applied to the assessment:

- *High*: The environmental parameter/receptor is fragile and an impact is likely to leave it in an altered state from which recovery would be difficult or impossible.
- *Medium*: The parameter/receptor has a degree of adaptability and resilience and is likely to cope with the changes caused by an impact, although there may be some residual modification as a result; and
- *Low*: The parameter/receptor is adaptable and is resilient to change.

5.6.3 Magnitude and Nature of the Impact

The magnitude of the impact is the scale of change which the impact may cause compared to the baseline and how this change relates to accepted thresholds and standards. The following categories were applied to the assessment:

- *High*: a large change compared to variations in the baseline. Potentially a clear breach of accepted limits;
- *Medium*: change which may be noticeable and may breach accepted limits; and
- *Low*: when compared with the baseline, change which may only just be noticeable. Existing thresholds would not be exceeded.

Furthermore, in determining the magnitude of the impact it is important to take into account and consider several other factors which define the nature of the impact. This includes the following:

Type of Impact

- *Positive*: applies to impacts that have a beneficial environmental or social result, such as enhancement of the existing environmental conditions; and

- **Negative:** applies to impacts that have a harmful aspect associated with them such as loss or degradation of environmental resources.

Type of Effect

- **Direct:** applies to effects which can be clearly and directly attributed to a particular environmental or social parameter (e.g. generation of dust directly impacts air quality); and
- **Indirect:** applies to effects which may be associated with or are subsequent to a particular impact on a certain environmental or social parameter (e.g. high levels of dust could entail nuisance and health affects to construction workers onsite).

Duration (how long the stressor or its effect last)

- **Short Term:** applies to impacts whose effects on the environment will disappear within a 1 year period, or once construction activities are completed;
- **Medium Term:** applies to impacts whose effects on the environment will disappear within a 5 year period; and
- **Long Term:** applies to impacts whose effects on the environment will disappear in a period greater than 5 years.

Reversibility

- **Reversible:** applies to impacts whose significance will be reduced and disappeared over time (either naturally or artificially), once the impacting activity ceases; and
- **Irreversible:** applies to impacts whose significance will not be reduced nor disappeared over time (either naturally or artificially), once the impacting activity ceases.

5.6.4 Assessing the Significance of the Impacts

The concept of ‘significance’ is central to the ESIA process and aids the identification and categorization of environmental and social effects. As noted, in order to determine impact significance, the sensitivity of each environmental and social parameter/receptor is considered in combination with the magnitude of the impact. Table 6 below demonstrates how these parameters are considered in the assessment of significance.

Table 6: Determination of Significance

Magnitude and Nature of Impact Sensitivity of Receiving Parameter/Receptor			
	Low	Medium	High
Low	Not significant	Minor	Minor
Medium	Minor	Minor	Moderate
High	Minor	Moderate	Major

While the above matrix provides a framework for the determination of significance, and enables comparison across environmental and social parameters, a degree of professional judgement must be used and some parameter-specific factors to be considered in making the determination of significance. Below provides additional guidance to the degrees of significance used in this ESIA. Note that positive impacts are defined, but are not rated for significance.

- **Major significance:** requires thorough investigation in the ESIA. These impacts have been studied extensively by consulting expertise in the areas of the identified impacts to design needed mitigation and environmental management measures. Moreover, conducting specific studies and assessments to some of the key issues identified;

- *Moderate significance*: requires reasonable investigation in the ESIA. These impacts have been studied by expertise in the areas of the identified impacts to design needed mitigation and environmental management measures.
- *Minor significance*: must be listed, and addressed in some way, but do not require detailed assessment in the ESIA.
- *Not significant*: for completeness, impacts which have been included in the assessment but determined not to be significant, are rated formally as ‘not significant’.

5.6.5 **Management Measures**

Based on the impact assessment undertaken, a set of management measures are identified for each impact which aims to address it. Management measures include the following:

- Additional Requirements: those are generally regulatory requirements which have been identified and which must be taken into account at a later stage.
- Additional Studies: for certain environmental/social receptors additional studies must be undertaken at a later stage. Such studies and their scope, timing, etc. have been highlighted where relevant.
- Mitigation Measures: a vital step in the ESIA process is the identification of measures that can be taken to ensure that impacts are mitigated or reduced to acceptable levels. The ESIA will firstly consider the significance of any impacts caused by the project and then assigned mitigation options through applying the following hierarchy:
 - Avoiding or ‘designing out’ impacts wherever possible;
 - Considering alternatives or modifications to the design to reduce the impacts wherever possible;
 - Applying measures to minimize and manage impacts on the receptor; *then*
 - As a last resort, identifying fair compensation, remediation and offsetting measures to address any potentially significant residual effects.

Some negative impacts can be easily mitigated, whilst others cannot or are too difficult and costly to mitigate. The various potential impacts are described in this ESIA, along with the provision of ‘feasible mitigation measures’ that can be implemented.

- Recommendations: for positive impacts it is not possible to identify mitigation measures, but rather recommendations have been identified which aim to enhance the positive impact.

5.6.6 **Assessment of Residual Effects**

If there are mitigation measures it is then necessary to make an assessment of the ‘residual significance’ after mitigation has been taken account. A re-assessment of project impacts is then made, taking into account the effect of the proposed mitigation measures in order to determine the significance of the *residual effects*. Residual effects are discussed for each environmental and social theme in the ESIA chapters.

5.7 **Assessment of Cumulative Impacts**

For each of the impacts assessed, the ESIA investigates the cumulative impacts which could result from incremental impacts from other known existing and/or planned developments in the area, and based on currently available information on such existing/planned developments. Assessment of cumulative impacts is presented in ‘Chapter 23’.

5.8 Development of an Environmental and Social Management (ESMP) Plan

Based on the results of the impact assessment, development of mitigation measures, and development of monitoring plan, an Environmental and Social Management Plan (ESMP) was compiled into a single table that details all of the above. The ESMP will be a key document and will list the environmental/social requirements and detail the procedures necessary for managing the significant environmental/social issues connected to proposed project activities. The ESMP will be developed specifically to provide flexibility in the nature and exact location of operations, while ensuring all potential impacts are identified and properly mitigated and monitored throughout the later stages of the project. This ESMP can be used as a stand-alone document during the different phases of the project by Developer, EPC Contractor, project Operator, MoEnv, and other responsible parties. The ESMP is presented in 'Chapter 24'.

6. STAKEHOLDER CONSULTATION AND ENGAGEMENT

This chapter discusses in detail the stakeholder consultation and engagement plans which were undertaken as part of the ESIA process for the project and provides an overview of the findings. In addition, this chapter also discusses the future stakeholder consultation and engagement plans which are to take place at a later stage of the ESIA process as well the project development.

6.1 Introduction

Stakeholder engagement is an integral part of ESIA good practice and is a statutory requirement of the national EIA legal framework in Jordan and within the International Finance Corporation's (IFC's) Policy on Environmental and Social Sustainability and Performance Standards. The Developer is committed to a technically and culturally-appropriate approach to consultation and engagement with all stakeholders either directly or indirectly affected by the project. The consultation program for the project is based on informed consultation and participation in line with IFC requirements with affected people, and is designed to be both fair and inclusive. Consultation activities have been an ongoing process since the commencement of the ESIA study in February 2016.

A stakeholder is defined as any individual or group who is potentially affected by the proposed project or can themselves affect the proposed project directly or indirectly. Stakeholder consultation is an inclusive process for sharing information that enables stakeholders to understand the risks, impacts, and opportunities of a development or project, allowing them to express their views and articulate their perceptions towards it.

6.2 Objectives

The objective of stakeholder consultation is to ensure that a participatory approach takes place, which in turn documents concerns of all stakeholder groups and makes sure that such concerns are considered, responded to, and incorporated into the decision making process of the development. Stakeholder consultation needs to be a two-way communication process that imparts information to stakeholders, but also obtains additional and on-the-ground information from them. Stakeholder consultation and engagement must take place at the inception phase of the ESIA process and implemented all through the study period.

The specific objectives of this chapter are to:

- Summarize national and international legal & policy requirements for stakeholder engagement;
- Describe and identify the stakeholders affected and/or with an interest in the project;
- Summarize stakeholder engagement and consultation conducted to date. In addition describe how the views and issues raised have informed and influenced the development of the project; and
- Outline the future plans and approach to stakeholder engagement.

6.3 Requirements and Policy Requirements for Stakeholder Engagement

6.3.1 Jordanian Legal & Policy Standards

The Jordanian legal requirements for consultation and engagement are mainly included within the "EIA Regulation No. (37) of 2005". The requirements of the Regulation are summarized below.

The regulation requires that for those projects which the MoEnv requires a comprehensive ESIA study (as the case for this project), a scoping session must be held from the onset of the ESIA for all stakeholders whom may be potentially affected by the project. The objective of the session is to provide the stakeholder groups with all available information on the project and the surrounding environment, in order to allow them

to participate in investigating and identifying the potential impacts which may arise from the project so that their concerns are taken into account throughout the ESIA study.

To this extent, the MoEnv generally requires that the following stakeholder groups be invited to participate in the scoping session: (i) national governmental entities, (ii) local governmental agencies, (iii) Non-Governmental Organizations, (iv) academic and research institutions, and (v) local community representatives.

In addition, the regulation specifies that the outcomes of the ESIA study is to be announced to stakeholders and the public in a manner that the Ministry deems appropriate, and this is dealt with on a case by case basis – taking into account the type and nature of the project development. This is usually determined by the MoEnv once the ESIA study is reviewed and approved.

6.3.2 Requirements in IFC Performance Standards on Environmental & Social Sustainability (2012)

The IFC Performance Standards form part of their Sustainability Framework, where the “IFC Performance Standard 1” (IFC, 2012) sets out the following recommendations for stakeholder engagement:

- Stakeholder Engagement is an on-going process that may involve: stakeholder analysis & planning, disclosure & dissemination of information, consultation & participation, grievance mechanism, and on-going reporting to Affected Communities.
- A Stakeholder Engagement Plan (SEP) must be developed and implemented that is scaled to the project risks and impacts and development stage, and be tailored to the characteristics and interests of the Affected Communities.
- Affected Communities will be provided with access to relevant information on: (i) the purpose, nature, and scale of the project; (ii) the duration of proposed project activities; (iii) any risks to and potential impacts on such communities and relevant mitigation measures; (iv) the envisaged stakeholder engagement process; and (v) the grievance mechanism.
- When Affected Communities are subject to identified risks and adverse impacts from a project, a process of consultation will be undertaken in a manner that provides the Affected Communities with opportunities to express their views on project risks, impacts and mitigation measures, and allows the client to consider and respond to them.
- The extent and degree of engagement should be commensurate with the project’s risks and adverse impacts and concerns raised by Affected Communities.
- The consultation process will be tailored to language preferences of Affected Communities, their decision-making process, and the needs of disadvantaged or vulnerable groups.
- For projects with potentially significant adverse impacts, the client will conduct an informed consultation and participation.
- A grievance mechanism will be established to receive and facilitate resolution of Affected Communities’ concerns and grievances about the client’s environmental and social performance.
- As it is considered that the KOSPO Wind Power project is likely to be categorized as a Category A project under the IFC requirements, it will be disclosed for a minimum of 60 days.

6.4 Stakeholder Identification and Analysis

The project has been identifying potential stakeholders since it began the development of the ESIA program in February 2016. The project has a wide range of stakeholders ranging from national government and other bodies involved in the permitting and ESIA process, in addition to communities within the area of influence of the project. As such stakeholders have been identified at all geographic levels, including national, regional and local levels.

The two principal categories of stakeholders are as follows:

- Affected Communities, defined as the local community as well as other people directly affected by the project and/or those who have been identified as most vulnerable to change and who need to be engaged in identifying impacts and their significance, as well as in decision-making on mitigation and management measures.

In specific, within the Affected Communities, vulnerable groups must be identified. Vulnerable groups include those expected to be disproportionately affected by the project, and therefore require special consideration throughout the consultation process. Vulnerable groups are project specific and depend on a range of issues which must be understood such as project location, socio-economic and demographic context, as well as the nature of the development and type of impacts anticipated. The vulnerable groups within this context were identified by the 'ESIA Team'. Such vulnerable groups include the following:

- Women groups: due to cultural norms in Jordan (and specifically within the context and setting of the project area), the participation of women groups in the decision-making process is limited which could result in overlooking any specific concerns they might have.
 - Nomadic tribes: those are people that travel in different areas on a seasonal basis with no fixed residence. As they could not be present in an area year round, this could limit their participation in the decision-making process which could result in overlooking any specific concerns they might have.
- Other Interested Parties, defined as people and organizations that are interested in the project and/or could affect the project in some way. Those generally include governmental and non-governmental organizations.

6.4.1 Affected Communities

The Affected Communities have been identified based on: (i) detailed understanding of the project site location, its nature, administrative setup and the nearby surrounding receptors, and (ii) the nature of the anticipated impacts from the project throughout its various phases. Based on the above, the Affected Communities include the local communities of the project area and nomads.

(i) Local Communities

As discussed earlier, the project site is located within Tafileh Governorate and specifically within Bseira District which host several community settlements. The community settlements that are likely to be affected by the project development, logically includes those located within the vicinity of the project site and which are therefore anticipated to be impacted the most from the project's activities (during construction and operation).

This in turn was determined based on the detailed understanding of the nature and extent of the project's impacts. The main anticipated impacts which could affect the nearby communities (which are discussed in further details in each of the relevant chapter) include: (i) land use impacts from project development, (ii) visual impacts from the presence of the turbines and, (iii) noise and shadow flicker generated from the operating turbines. In addition, the socio-economic conditions of these local communities are also anticipated to be impacted (mainly in a positive matter) from such a development.

Such communities were determined to include: (i) Um Sarab and Bseira which are located nearby the western border of the project site at a distance of 1 km and 3 km respectively (ii) Gharandal which is located around 1.3 km to the south of the project site (iii) Ain Baida which is located around 4 km northwest of the project site. Those local communities are presented in Figure 6 below.

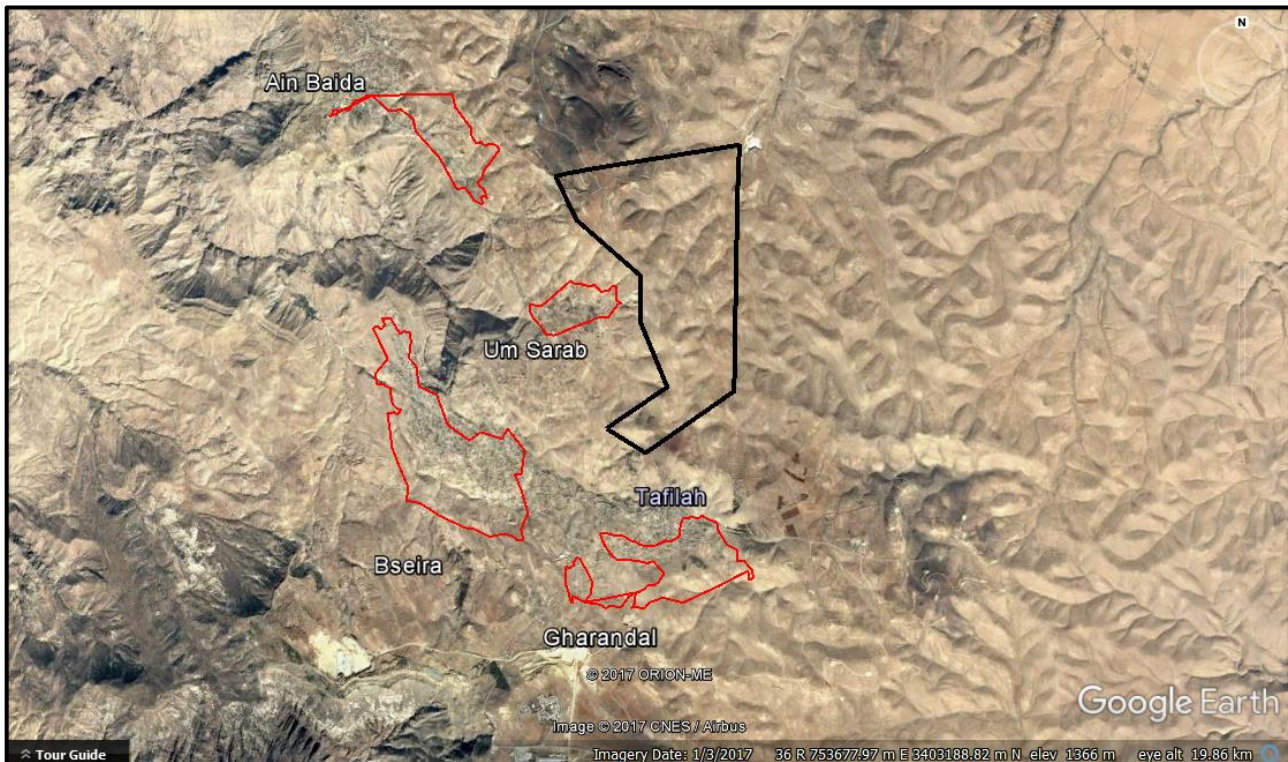


Figure 6: Affected Communities

(ii) Nomads

Based on the understanding of the area in general, it is known that there is some nomadic activity within the project site and its surrounding areas. Similarly, the main anticipated impacts which could affect the nomads (which are discussed in further details in each of the relevant chapter) include: (i) land use impacts from project development, (ii) visual impacts from the presence of the turbines and, (iii) noise and shadow flicker generated from the operating turbines.

6.4.2 Other Interested Parties/Stakeholders

Other interested parties and stakeholder groups were identified based on the understanding of the project location, nature of activities which are to take place, type of development, and the potential environmental and social impacts and how they could potentially affect certain stakeholder groups.

(i) Jordanian Governmental Stakeholders (National and Local)

National and local government stakeholders include Ministries, Directorates, and other agencies that generally have a regulatory role in ensuring the implementation and compliance of projects with the various applicable legislations under the mandate of the relevant legislations. In addition, such entities are involved in the permitting and ESIA process. Thus, such stakeholders have the potential to influence the authorization of the project and assist in its delivery.

More specifically, it is important to note that the majority of these governmental entities (mainly ministries) are part of the 'EIA Technical Committee' which will review this ESIA study for approval and granting of environmental clearance.

Table 7 below provides a list of the key national and regional level government stakeholders along with a summary as far as possible of their key areas of interest.

Table 7: List of Key Governmental Stakeholders

Governmental Entity	Interest in/Influence on the project
National Governmental Entities	
Ministry of Environment (MoEnv)	The governmental body responsible for protection of the environment in Jordan. In addition, the MoEnv is responsible for approval of the ESIA and making sure it complies with the “EIA Regulation No. (37) of 2005” and granting the environmental clearance for the project.
Ministry of Energy and Mineral Resources (MEMR)	The governmental body responsible for the development of the private sector renewable energy projects in Jordan to include this project in specific.
Ministry of Agriculture (MoA)	The governmental body responsible for managing rangelands and forest as well as protecting and managing wildlife. For this project this includes land use issues related to grazing reserves and forest lands as well as potential impacts related to biodiversity.
Ministry of Municipal Affairs (MoMA)	The governmental body responsible for setting and designating land uses in Jordan which identifies certain activities and projects which are to be allowed. For this project, this mainly includes issues related to designated land use of the project site.
Ministry of Health (MoH)	The governmental body responsible for the health sector in Jordan, including public health and safety. For this project this mainly includes issues related to the public health of the nearby communities and nuisance prevention from the project (from issues such as noise, shadow flicker, waste management, wastewater management, etc.).
Ministry of Tourism and Antiquities (MoTA) / Department of Antiquities (DoA)	The governmental body responsible for tourism development and protection of antiquities in Jordan. For this project, this mainly includes potential impacts related to archaeology and cultural heritage related to the project.
Ministry of Transport (MoT)	The governmental body responsible for regulating and monitoring the road transport sector and services. For this project, this mainly includes potential impacts related to infrastructure and utilities – mainly transportation of project components to the project site and any impacts on roads capacity and safety.
Ministry of Water and Irrigation (MWI) / Water Authority of Jordan (WAJ)	The governmental body responsible for the overall monitoring of the water sector and water supply. For the project this mainly includes issues related to the water requirements and supply to the project.
Ministry of Labor (MoL)	The governmental body responsible for health and safety of workers and labour in Jordan. For this project, this mainly includes issues related to occupational health and safety.
Civil Aviation Regulatory Commission (CARC)	Governmental body responsible for civil aviation safety, security and regulatory compliance. For this project, this includes issues related to civil aviation safety from wind turbines.
Royal Jordanian Air Force (RJAF)	Governmental body responsible for military aviation safety and security. For this project, this includes issues related to military aviation safety from wind turbines.
Telecommunication Regulatory Commission (TRC)	TRC is the official entity for regulating the telecommunications and information technology services in the Kingdom. For this project in specific, this includes any potential impacts from the wind turbines on telecommunication transmission networks in the area.
Jordan Radio and Television Corporation (JRTV)	JRTV is the state broadcaster of Jordan for radio and television transmission networks. For this project in specific, this includes any potential impacts from the wind turbines on the radio/television transmission networks in the area.
National Electric Power Company (NEPCO)	Responsible for designing and building the substation, together with high voltage overhead lines and the connection to the existing grid.
Local Governmental Entities	
Tafileh Governorate	The official governmental body responsible for key government services (health, education, security, etc.) as well as coordination for socio-economic development in the region. For this project this mainly includes issues related to socio-economic development on the area from the project.

Governmental Entity	Interest in/Influence on the project
Local Municipalities – Bseira Municipality	Jordan has 93 local municipalities, providing local government services such as waste collection, street cleaning, street and road maintenance, public lighting, culture and sports. Municipalities are run by a mayor who answers to a locally elected municipal council. Municipalities vary greatly in size from populations of less than 5,000 people, to greater than 100,000 people, and also vary greatly in capacity. Municipalities report to the central Ministry of Municipal Affairs. The project site located within the Bseira Municipality.

(i) Non-Governmental Organizations and Academic Institutions

Other interested parties considered during the ESIA related consultation include those who have the potential to influence the authorization of the project and assist in its delivery. This mainly includes Non-Government Organizations (NGOs).

Table 8: List of Key NGO and Academic Institutional Stakeholders

Stakeholder	Interest in/influence on the Project
Environmental Societies Association	The Association forms the umbrella for the all environmental NGO's in Jordan and is also a member of the 'EIA Technical Committee' which will review this ESIA study for approval and granting of environmental clearance.
The Royal Society for the Conservation of Nature (RSCN)	The RSCN is an environmental NGO having a mandate for the conservation of Jordan's biodiversity and natural resources. In addition, it is empowered to establish and manage protected environmental reserves as well as Important Bird areas under the supervision of the MoEnv. For this project this includes land use issues related to environmental reserves and important birds areas as well as potential impacts from the project on biodiversity and birds.
BirdLife International – Middle East Regional Office, Jordan	The organization is widely involved in ensuring bird conservation and protection. For this project in specific this includes potential impacts from the project on birds.

6.5 Stakeholder Consultation and Engagement To-Date

The table below highlights the stakeholder groups as identified earlier, and the consultation/engagement method which has been undertaken for each group. As noted in the table below this mainly includes high level consultations as well as detailed engagement and consultations.

The high level consultations mainly include the scoping session representing various entities which are consulted at once (such as national governmental entities, local governmental entities, non-governmental organizations, etc.). The detailed engagement and consultation tends to focus on a single entity within a stakeholder group at a given time, whose concerns need to be taken into account throughout the ESIA study.

Table 9: Methodology for Stakeholder Engagement

No.	Stakeholder Group	Consultations/Engagement to Date	Future Consultations/Engagement
1	Affected Communities		
<i>a</i>	Local community	- Local Community Consultation Session - Detailed engagement – Onsite consultation	- Disclosure Session - Stakeholder Engagement Plan (SEP)
<i>b</i>	Nomads	Detailed engagement – Onsite consultation	Stakeholder Engagement Plan (SEP)
2	Other Interested Parties/Stakeholders	- High level consultation – Scoping Session - Detailed Engagement – meetings, e-mail communication, official letters, etc.	- Disclosure Session - Stakeholder Engagement Plan (SEP)

6.5.1 High Level Consultation – Scoping Session

In accordance with MoEnv's "EIA Regulation No. (37) of 2005", a scoping session must be held for those projects which require a comprehensive EIA study; as the case with this project. In coordination with the MoEnv, the Scoping Session for the project was held on 24 March 2016 at the Grand Millennium Hotel in Amman. The list of invitees was identified jointly by the MoEnv and the ESIA team.

The list of invites mainly included the following stakeholders: (i) national governmental entities (various ministries and other governmental entities), (ii) Local Governmental Agencies (e.g. Tafileh Governorate, Bseira Municipality), (iii) Non-Governmental Organizations (Environmental Societies Association representing all environmental NGO's in Jordan), and (iv) Academic and Research Institutions.

The ESIA Team documented all records of the scoping session to include transcripts, minutes of meetings, list of participants and attendees, comments and so on. This was presented in detail in the ToR report submitted to the MoEnv. Selected photos from the session are shown in Figure 7 below.

In general, the objectives of the Scoping Session include the following:

- Introduce the project and its various components to the stakeholders and provide them with all available information about the project;
- Present the various anticipated impacts from the project throughout its various phases and allow stakeholders to participate in the process of scoping environmental impacts of the project;
- Early consideration of stakeholders concerns and fears regarding the nature, scale and impacts of the project; and
- Present the suggested methodology for the ESIA and allow stakeholders to comment on the scope of work and methodology.

Throughout the scoping session, the following presentations were given:

- Welcoming Speech by **Eng. Izzat Abu Hamra, Director of the Licensing Directorate** in the MoEnv.
- A presentation of the project components by **Mr. Taeyong Lee from KOSPO**, in which he presented the following topics: Introduction about KOSPO, project location and layout, project components, project phases, anticipated job opportunities, and planned corporate social responsibility activities. There was time for questions and answers following this presentation as well as a facilitated discussion, moderated by KOSPO and ECO Consult.
- A presentation by the ESIA Team (ECO Consult and Ramboll CUBE GmbH) in which the ESIA process was explained as well as the anticipated negative environmental impacts during the various project phases and the methodology that will be adopted throughout the ESIA study for assessing those impacts on those key sensitive receptors. There was time for questions and answers following this presentation as well as a facilitated discussion, moderated by ECO Consult.



Figure 7: Selected Photos from the Scoping Session of 24th March 2016

The following table presents the main issues raised by the stakeholders throughout the scoping session and also highlights how those comments were taken into account and incorporated throughout the ESIA study.

Table 10: Summary of Comments Raised during Scoping Session and Response

Attribute	Comment	Response
Social and Economic Development	One stakeholder stressed on the importance of socio-economic development by the project to those local communities in the area on different level including ensuring that the project employs people from the local community.	KOSPO agreed that, to the extent possible, they intend to recruit people from the local communities surrounding the site and positions provided will depend on available capacity and qualifications. This shall and will also be considered by the EPC contractor (Vestas). Nevertheless it was explained that as part of the ESIA (as presented in 'Chapter 21'), the current social and economic conditions of those nearby communities will be characterized and the anticipated positive impacts throughout the various project phases will be assessed. The ESIA will identify requirements which aim to ensure support and involvement of local communities in the project to the greatest extent possible.
Transmission Lines	A question was raised whether the land owners within which the transmission line will pass will be compensated.	It was explained that the design and construction of the transmission lines falls under NEPCO's obligation. It was explained that at that time (and which also applies to date) detailed information is not available on the transmission line (such as the route) and therefore this was included within the ESIA study.

Attribute	Comment	Response
Air Quality	One stakeholder asked if air quality will be monitored as part of the ESIA.	It was explained that due to the nature of impacts on air quality mainly being limited to generation of dust from various construction activities, no air quality baseline will be undertaken. It was explained that the ESIA will provide mitigation and management measures to prevent/reduce any potential impacts on surrounding environment as provided in 'Chapter 17'. The above approach also was approved by the MoEnv as detailed within the ToR/Scoping Report.
Noise	Will noise tests take into account the different wind speeds and are the selected turbines of a smart design with lower noise levels	The methodology for the noise monitoring baseline is discussed in further details in 'Chapter 20' and which takes into account different wind speeds. In addition, it was also explained that the turbines considered of the project are state of the art which have much lower noise levels compared to older turbine models.
Birds	RSCN asked whether any bird surveys will be done for the exact project site or if the assessment will only rely on the baseline surveys undertaken for JWPC. They also asked if the ESIA will follow all requirements regarding vantage points and monitoring seasons, frequency, etc. Another stakeholder wanted to know if the flight height of birds was recorded within the survey.	It was explained that KOSPO undertook a site-specific survey throughout the years 2014 – 2015 that were checked and revised by the IFC and the bird experts that took part of the Cumulative Effect Assessment (CEA) study that was managed and funded by the IFC. Additional details on the survey is discussed and provided in 'Chapter 14'.
Health and Safety	Some question raised by stakeholders included the following: - Internal roads will be established within the project site and according to the topography of the area; some roads will be on hilly terrain. As noticed in most project sites, internal roads do not always have safety measures, would this be the case in this project? - It is important that regular health tests are carried out, especially since the project will result in a high level of noise generated from turbines, which would likely affect personnel. Also, are the Jordanian health standards taken into account? Will there be a health clinic at the project site, and how would the clinical waste be handled?	It was explained that a General Health and Safety (HSE) Plan will be developed and implemented that covers transportation and road safety. In addition, the EPC contractor, who has also implemented another wind project in the neighbouring area and from previous worldwide experience, they follow strict safety instructions that are based on international best practices and standards as well as national requirements. Prior to the construction phase, the EPC contractor will develop an HSE plan that will also ensure all Jordanian requirements and standards are met. This HSE plan will incorporate international standards and covers all required information and regular health tests for employees. In addition, before construction, the relevant entities, such as the Ministry of Health and the Ministry of labour will be contacted to ensure requirements are met. The ESIA provided guidance and high-level requirements on this issue as discussed in further details in 'Chapter 19'.
Aviation	Has there been any coordination with the Royal Jordanian Air Forces (RJAF) or with the Civil Aviation Regulatory Commission (CARC), in order to study potential impact of turbines on aviation and telecommunication	Official communication has been undertaken with RJAF, CARC and Telecommunication Regulatory Commission (TRC) as part of the ESIA study. This is discussed in further details in 'Chapter 18'.

Attribute	Comment	Response
Community participation	One stakeholder questioned why representatives of local community were absent from the session	It was explained that key representatives of local community were invited to the session through the MoEnv (such as Tafileh Governorate, Bseira Municipality, etc.) but they did not attend. In order to ensure their active participation in the ESIA, it was explained that another local community consultation session will be undertaken in Tafileh as discussed in further details below.

6.5.2 Detailed Engagement – Affected Community

This section presents the detailed engagements that were undertaken with the Affected Communities and which include onsite consultations with local communities and nomads as well as a local community consultation session both of which are discussed in further details below.

(i) Local Community Consultation Session

The 'ESIA Team' has undertaken additional consultations with the local community through a consultation session which was held on the 23 May 2016 at Bseira village, headed by Bseira Municipality. Such consultation session focused on the local community which includes the closest community settlement to the project site as discussed earlier and who are likely to be affected by the project development, to include Um Sarab, Bseira, Gharandal and Ain Baida.

The representatives were identified jointly by the 'ESIA Team' and Bseira Municipality to include the following groups:

- Representatives of local community members;
- Community Based Organizations (CBO);
- Elder representatives of tribal groups;
- Local enterprises and businesses;
- Woman Groups; and
- Youth and unemployed.

Generally, such consultations aimed to take into account their thoughts and concerns on the project development, while allowing the discussion to focus on slightly different angles from more of a first-hand experience/practical, less technical perspective. The 'ESIA Team' documented all records of the consultation session to include transcripts, minutes of meeting, list of participants and attendees, comments and so on. Selected photos from the session are shown in Figure 8 below.



Figure 8: Selected Photos from the local Scoping Session 23th May 2016

In accordance with the above, the consultation session focused on five (5) main themes, each of which is discussed below.

Introduction to the Project

The 'ESIA Team' started the session by first introducing the project, its location, the various project components and provided the local community with all available information. The objective was to discuss and allow the local community to raise any questions or concerns they might have regarding the project in general.

Several questions were raised and which are mainly related to issues such as: (i) land selection process for the project; (ii) investment required to develop such a project, (iii) amount of electricity produced from the project and whom will it supply.

Discussion on Environmental and Social Impacts

The 'ESIA Team' then discussed the anticipated environmental and social impacts from the project throughout its various phases in order to address any concerns or fears regarding the nature, scale, and significance of the impacts. In addition, the objective was also to allow the local community to identify any additional impacts which must be taken into account throughout the ESIA study. Generally, the local community inquired about the nature of several of the identified impacts, but did not identify any additional impacts to be considered throughout the ESIA study.

Discussion on Land-Use Patterns within the Project Area

The land use activities for the area in general were discussed in order to understand whether the area surrounding the project is considered of any value to the local community. This included discussions on agricultural and grazing activities as well nomadic populations which could inhabit the surrounding area. This issue is discussed in further details in 'Section 11.1.3'.

Discussion on Socio-economic Conditions

Within the ESIA, the socio-economic conditions of Tafileh Governorate were established based on review of secondary data available mainly from the Department of Statistics (DoS) and the Social Development Unit (SDU) of Tafileh Governorate. However, statistical data often does not fully represent the situation in reality.

Therefore, one of the objectives of the local community consultation session was to verify/understand the socio-economic conditions of the local communities and the main challenges they face. Such discussions would allow a better understanding and characterization of the current socio-economic conditions – the outcome of such discussions are summarized below and presented in details in 'Chapter 21'.

Discussion on Socio-economic Development from the Project

At the end of the consultation session, the focus of the discussions was to allow the local community to express their expectations in terms of socio-economic development by the project, as well as understanding their views on the proposed development and ensure that those views are considered and taken into account throughout the project development. The main points raised by the local community in relation to their expectations in terms of socio-economic development are discussed in details in 'Chapter 21'.

(ii) Onsite Consultations

Onsite consultations and discussions were undertaken within the project area based on several site visits undertaken in May 2016 as it is considered the phase which entails the highest onsite land activities by the local community members as well as the period in which nomadic activity is known in the area. Such consultations and discussion entailed visiting each area where activity was noticed, to the greatest extent possible, starting from south to the north of the project area.

The objective of the consultations included:

- Introduce the project and its various components;
- Understand, characterize and assess the activities undertaken onsite (the outcomes of such discussions is presented in details in 'Section 11.1.3');

- Understand, characterize and assess their socio-economic conditions and patterns (the outcomes of such discussions is presented in details in 'Chapter 21'); and
- Present and discuss the potential impacts of the project which could affect their activities onsite in order to take into account their thoughts and concerns on such issues. This mainly includes impacts on land use and impacts from shadow flicker and noise. The outcomes of such consultations are discussed in further details in 'Section 11.1.3' and 'Chapter 20'.

The figure below presents selected photos for onsite consultations undertaken with local communities and nomads. It is important to note that consultations were gender specific – therefore specific consultations were undertaken with women onsite by a female specialist of the 'ESIA Team'. However, due to cultural norms in Jordan photos of consultations with women groups were not taken.



Figure 9: Selected Photos for Onsite Consultations with Nomads and Local Communities

6.5.3 **Detailed Engagement – Other Stakeholder Engagement Activities**

Throughout the ESIA process various stakeholders were engaged and consulted. From the onset of the ESIA study, and in accordance with the issues and impacts anticipated from the project throughout its various phases, the key stakeholder groups that needed to be consulted, involved, and collaborated with on a detailed level were identified.

Such engagement was intended for various purposes and which included to: (i) introduce the project and its overall concept and components, (ii) understand thoughts, views, and concerns from the project development, (iii) collection of relevant data for assessment of baseline conditions and anticipated impacts from the project, (iii) discussion on anticipated impacts, (iv) discussion on proposed mitigation measures, etc.

Such stakeholder groups were engaged and consulted through one or more of the following communication protocols: (i) bi-lateral meetings, (ii) e-mail communication, (iii) phone communication, and (iv) formal letters.

Table 11 below presents the entities which were engaged and consulted and the purpose of such engagement. Generally, the outcomes of such consultations are presented and included within the Section that the attribute relates to.

Table 11: List of Other Consultations during the ESIA

Entity	Attribute	Objective of Consultation
Ministry of Environment (MoEnv)	General	Ongoing discussions on the ESIA process as well as general concerns and impacts from project development.
Ministry of Agriculture (MoA)	Land Use	Collection of secondary data on grazing reserves as well as current and future land use planning in relation to agriculture.
Ministry of Municipal Affairs (MoMA)	Land Use	Current and future land use planning in project area as set by MoMA.
Ministry of Water and Irrigation (MWI)	Geology and Hydrology	Collection of secondary data on site geology and hydrology
	Infrastructure and Utilities	Collection of secondary data on infrastructure and utilities related to water resources and networks, wastewater networks and treatment plants, etc.
Department of Antiquities (DoA)	Archaeology and Cultural Heritage	Collection of any available secondary on archaeological resources on the area. In addition, coordinate with them to undertake archaeological survey and assessment for the project site.
The Royal Society for the Conservation of Nature (RSCN)	Land Use	Current and future land use planning in relation to areas of critical environmental concern.
Civil Aviation Regulatory Commission (CARC)	Infrastructure and Utilities	Discussion on potential impacts from the project on civil aviation safety and incorporating their requirements into account as part of the ESIA.
Royal Jordanian Air Force (RJAF)	Infrastructure and Utilities	Discussion on potential impacts from the project on military aviation safety and incorporating their requirements into account as part of the ESIA.
Telecommunication Regulatory Commission (TRC)	Infrastructure and Utilities	Collection of existing telecommunication networks in the area and discussion on potential impacts from the project.
Telecommunication company providers (Orange, Zain & Umniah)	Infrastructure and Utilities	Collection of existing telecommunication networks in the area and discussion on potential impacts from the project.
Jordan Radio and Television Corporation (JRTV)	Infrastructure and Utilities	Collection of existing radio and television networks in the areas and discussion on potential impacts from the project.
Tafileh Governorate and Bseira Municipality	Socio-economic	Understand thoughts, views, and concerns from the project development.
		Collection of secondary data on socio-economic indicators. In addition, meetings were undertaken to characterize and understand the socio-economic conditions in reality of those local communities.
		Socio-economic development and plans for local community engagement.
Tafileh Governorate – Joint Service Council	Infrastructure and Utilities	Collection of information on existing infrastructure element in the area such as municipal approved landfills.

6.6 Future Stakeholder Engagement and Consultation

Future stakeholder engagement and consultations will mainly include the following, each of which is discussed in further details below: (i) disclosure of the ESIA document and (ii) implementation of the Stakeholder Engagement Plan (SEP) by the Developer.

6.6.1 Disclosure of the ESIA document

The final ESIA, Non-Technical Summary (NTS) and the SEP will be disclosed on the Developer's website. In addition, hard copies of these documents will be available at the following locations:

- Ministry of Environment;
- Tafileh Governorate – Local Development Unit; and

- Bseira Municipality.

The ESIA will be disclosed for a minimum 60 day disclosure period.

6.6.2 Stakeholder Engagement Plan

Stakeholder Engagement is an on-going process that involves: stakeholder analysis & planning, disclosure & dissemination of information, consultation & participation, grievance mechanism, and on-going reporting to Affected Communities. A Stakeholder Engagement Plan (SEP) is developed and implemented that is scaled to the project risks and impacts and development stage, and be tailored to the characteristics and interests of the Affected Communities and key stakeholders.

The SEP for the project describes the planned stakeholder consultation activities and engagement process and includes the following:

- Define the project's approach to future stakeholder engagement;
- Identify stakeholders within the area influenced by the project;
- Profile identified stakeholders to understand their priorities;
- Propose an action plan for future engagement with identified stakeholders; and
- Set out the grievance/project complaints mechanism.

7. OVERVIEW OF STRATEGIC ENVIRONMENTAL AND ECONOMICAL IMPACTS

It is understood that the project will result in several site specific environmental and social impacts on various receptors throughout the project phases to include planning and construction phase and operation phase. Such impacts are discussed in the subsequent chapters for each environmental receptor respectively and which include the following:

- Landscape and Visual;
- Shadow flicker;
- Noise;
- Land Use;
- Geology and Hydrology (Soil and Groundwater);
- Biodiversity;
- Birds (Avi-Fauna);
- Bats;
- Archaeology and Cultural Heritage;
- Air Quality;
- Infrastructure and Utilities;
- Occupational Health and Safety;
- Community Health, Safety and Security; and
- Socio-economic conditions.

Nevertheless, the project will result in significant and crucial positive environmental and economic impacts on the strategic and national level given the current challenges the energy sector in Jordan is facing which have serious implications on Jordan's energy security as well as major economic burdens to the Jordanian economy.

Such positive impacts are important to highlight, consider, and take into account before investigating the potential negative environmental impacts anticipated from the project, as discussed in the following sections.

The anticipated positive environmental and economic impacts on the strategic level are discussed and highlighted below.

7.1 Master Strategy of Energy Sector in Jordan

The energy demand in Jordan is characterized with a rapid increase to cope with the development. The expected demand for primary energy in 2020 will amount to 15 million tons of oil equivalent, compared to 7.6 million tons of oil equivalent in 2007. Similarly, electricity demand in 2020 is 5,770 MW compared to 2,100 MW in 2007; and average increase of 300MW per year (MEMR, 2007).

To meet the energy demand and the challenges of the energy sector a comprehensive energy strategy was approved by the Cabinet in December 2004 revised in 2007 – “Master Strategy of Energy Sector in Jordan”. The Strategy is to provide a vision for development of energy sector over the next ten years. The Strategy studied all options and alternatives for securing all types of energy from the following points of views: (i) the optimal options to cope with the energy demands and its investment cost, (ii) reforming and restructuring the energy sector to open the market for competition, and (iii) expanding on renewable energy projects and implementing energy conservation programs.

To this extent, the future goals of the Strategy can be summarized as follows:

- Reduce the dependence on foreign energy sources (energy independence);
- Security of supply with energy production based on a variety of sources;
- The target for 2015 is for domestic resources to cover 25% of demand reducing imports to 75%;
- The target for 2020 is for domestic resources to cover 39% of demand reducing imports to 61% and achieving energy production from additional energy sources; and
- Promote renewable energy sources to share to 7% in the primary energy mix in 2015, and 10% in 2020. This is to be met through 600-1000 MW from wind energy and 300-600 MW from solar energy.

To promote renewable energy sources and in order to open the way for private sector to effectively participate in the implementation of renewable energy project, the Renewable Energy and Energy Efficiency Law was issued and officially entered into force in April 2012. With this law, and for the first time in Jordan, investors had the opportunity to identify and develop renewable grid-connected electricity production through the Direct Proposal Submission as discussed earlier in “Chapter 1”.

In line with the above, this development allows for more sustainable development and shows the commitment of the Government of Jordan to realizing its energy strategy and meeting the set targets for renewable energy sources.

7.2 Energy Security

Recently, most policy makers around the world are grappling with issues related to energy security, energy poverty, and an expected increase in future demand for all energy sources – and Jordan is no exception. Almost certainly, the most spoken words by policy makers and government bodies in Jordan in the last couple of years revolved around ‘energy security’, which is one of the key goals of the Master Strategy of Energy Sector in Jordan discussed above.

Currently, the Jordanian local energy resources are very limited commercially and Jordan is highly dependent on imported energy, as the total imported energy amounted to 97% of Jordan's total energy needs.

In line with the above, the project in specific will contribute to increasing energy security through reliance on an indigenous, inexhaustible and mostly import-independent energy resource. The estimated electricity generation from the project is 151 GWh per year, on average; which will serve the annual electricity needs of around 35,000 local households.

This has been based on taking into account that in 2014 (latest statistic) the annual electricity consumption of households in Jordan was 6,580 GWh (MEMR, 2015) while the number of households in 2014 in Jordan was 1,590,762 (DoS, 2015) and thus the average annual electricity consumption can be assumed to be around 4,100 Kilowatt Hour (kWh).

7.3 Economic Benefits

The reliance on imported energy as discussed earlier above has led to major economic burdens to the Jordanian economy. Over the past couple of years, Egyptian gas supplies through the Jordan Gas Transmission Pipeline (JGTP) have been severely interrupted. To substitute the shortfall in Egyptian gas supply, Jordan had to rely to more expensive alternative fuels (imported fuel oil, diesel, gasoline) for power generation resulting in significant economic implications to the Government of Jordan's energy bill. In 2012, the cost of imported energy amounted to 20% of Jordan's Gross Domestic Product (GDP).

In line with the above, the project will produce clean energy which will contribute to lowering electricity generation costs compared to the current costs associated with liquid fuels and thus leads to a substantial decrease in the Government of Jordan's fiscal deficit.

7.4 Environmental Benefits

The negative environmental impacts from generating electricity through conventional fossil fuel burning at thermal power plants are very well known. This most importantly includes air pollutant emissions such as ozone, Sulphur Dioxide (SO₂), Nitrogen Dioxide (NO₂), particulate matter, and other gases which are the cause of some serious environmental concerns such as smog, acid rain, health effects, and many others.

In addition, the burning of fossil fuels results in carbon dioxide emissions; a primary greenhouse gas emitted through human activities which contributes to global warming. The main human activity that emits CO₂ is the combustion of fossil fuels for electricity production and transportation. Concurrently, global climate change has become an issue of concern and so reducing greenhouse gas emissions have also emerged as primary issues to be addressed as the world searches for a sustainable energy future.

Generating electricity through wind power is rather pollution-free during operation. Compared with the current conventional way of producing electricity in Jordan through thermal power plants using heavy fuel oil and/or natural gas, the clean energy produced from renewable energy resources is expected to reduce consumption of fossil fuels, and will thus help in reducing greenhouse gas emissions, as well as air pollutant emissions. The project will on average displace more than 112,000 metric tons of CO₂ annually. In addition, the project will save more than 1 million m³ of water per year in comparison to an oil-burning power plant which utilizes water for cooling.

8. LANDSCAPE AND VISUAL

Wind turbines are often placed at exposed locations to generate the best possible energy yield. Therefore the turbines may become dominant buildings in the landscape. To judge the visual consequences on people and on landscape zones of theoretical visibility (ZTV) of the proposed development and visualizations were generated. While the ZTVs give an impression which areas are affected by the wind farm, the visualizations give a realistic impression on how the landscape will look like after the wind farm construction.

Using this methodology, the Landscape impact assessment consists of predicting and evaluating the impact of the project on landscape characteristics such as settlement patterns, cultural history and land use.

8.1 Assessment of Baseline Conditions

8.1.1 Baseline Assessment Methodology

The baseline study first establishes the area of interest and then describes the existing conditions in this area. The purpose of this part of the chapter is to describe the existing situation in the project area. Included in this sub-chapter is the description of the:

- Landscape character, land use, landscape sensitivity;
- General visibility;
- Other wind farms existing in the vicinity of the project area.

At a site visit on the 22nd and 23rd of March 2016 the photos for the visualizations were taken and the sensitivity of the landscape was assessed.

8.1.2 Results

The site

The baseline studies provide a general description of the variety of landscape and visual resources within the wind farm site and study area (as considered for the ZTV assessment).

The project is located in the Governorate of Tafileh, and the Directorates of Arady Busayra and Arady at Tafileh. The project area is north of the town of Gharandil.

The land in the project area is moderately hilly and rocky, with sparse vegetation. The elevation of the project area varies from 1,300 to 1,500 m.

There is some grazing activity in the area (sheep, goats), and seasonal, low intensity crop production (wheat, cereals) is present in the small areas of agricultural cultivation. There are no occupied dwellings on the wind farm area. The agricultural fields which surround most of the turbine locations are of very low surface roughness.

There is an existing wind farm (JWPC) 3.5 km southeast of the project.

Settlements

West of the planned turbines in a distance of approximately 1,000 m there is a settlement with scattered houses. The closest village to the project is Gharandal in southwest direction. It lies in a distance of approximately 1,300 m to the project site.

The city of Tafileh lies approximately 6 km to the north of the wind farm site.

Landscape

On the wind farm site the landscape can be characterized as relatively sparse or desert-like. Nearly no high-growing plants are found on the site and its vicinity. The Dana Biosphere Reserve is located in a distance of approximately 7,500 m southwest of the site. From the Dana nature reserve the terrain drops down towards the direction of the Jordan Rift Valley.

In the west of the site the landscape is characterized by human activity including a scattered settlement, roads, small fields and olive plants plantations. In addition there is a quarry covering an area of approximately 200 x 200 m which is currently not in operation.

Bordering north of the site, on the highest peak in the area, there are two telecommunication masts which are widely visible in the area.

The area is moderately hilly and differences in altitude of ± 200 meter are common within the wind farm area. As described above the elevation decreases in height to the west towards the Jordan Rift valley

8.2 Assessment of Potential Impacts

8.2.1 Potential Impacts during the Construction Phase

The physical effects of the construction phase of the proposal on the landscape will be limited due to the relatively small footprint of the turbines, and will be reversible at the end of the operational life of the project. In addition, a series of tracks will be built to provide access to the turbines.

The changes that will occur in the landscape will be the introduction of more human activity together with the short-term introduction and movement of large construction vehicles and associated construction. These activities will affect a small proportion of the site leaving the majority of the existing landforms and associated vegetation and soil unaffected.

For the above reasons, the construction phase of the proposed development is considered to have a minor and not significant effect on the landscape of the site.

Effects during the decommissioning phase of the work will be similar to the construction stage, involving an increase in the human activity and heavy plant over a short period of time. Therefore the effects arising at this stage of the project are considered to be minor and not significant.

Mitigation Measures

No mitigation measures are required.

Monitoring and Reporting Requirements

Not required.

8.2.2 Potential Impacts during the Operation Phase

(i) Impact Assessment Methodology

a. Visibility Analysis

Roads

New tracks connecting the 15 proposed turbines will be required. The material used for the tracks will be similar to existing bedrock. Therefore the new tracks will not stand out visually from the surrounding. Since the project area is moderately hilly, the visibility of the new tracks will be limited and blocked by the topography.

The magnitude of change is considered to be low given that the tracks fit themselves into the surrounding and that most tracks are hidden. The new tracks will not be adding a new element to this landscape. Therefore the effect of new tracks on the landscape and visual resource is considered to be minor and not significant.

Cabling

The cables between turbines and linking to the substation will be undergrounded and routed along the line of new tracks. Only the connection from the substation to the transmission line will be built with overhead cables. Since the overhead line will be planned by the electric network company these are not included in this assessment.

Wind Turbines

The 15 turbines of the Tafileh wind farm will add man-made elements of considerable scale to the landscape establishing a new landmark feature and a point of reference in views from the wider area.

The visibility and visual impacts of a wind farm depend on the distance from which it is viewed, as well as other aspects such as weather conditions and siting. In the past, guidance notes have offered generic categories of visibility and visual impact in relation to distance, suggesting the following: in an open landscape at distances of up to 2 km, a wind farm is likely to be a dominant feature; between 2–5 km it will be less dominant; between 5–15 km it will only in clear visibility be seen as part of the wider landscape; and beyond 15 km it will only be seen in very clear visibility and as a minor element in the landscape. However, in practice these guidelines are limited in their application because the heights of turbines being built today are significantly larger than those considered in the guidances and because visual impacts are not directly proportional to distance, as the nature of a view (e.g. a framed view, open view or skyline view) and its context are as important as the size of a development within that view.

b. Landscape and visual impact assessment

Landscape impact assessment consists of predicting and evaluating the impact of the project on landscape characteristics such settlement patterns, cultural history and land use.

After identifying the landscape resources in the studied area, the sensitivity of the landscape must be established. Landscape sensitivity is based on the landscape character and its components, as well as the impact of the proposed change. In this way, various impact receptors are taken into consideration in their number and nature.

The main characteristics on which the landscape sensitivity depends on are:

- Topography;
- Landscape elements and features;
- Density and characteristics of settlements;
- Cultural heritage;
- Tranquility;
- Initial level of visual impact.

Table 12: Receptor sensitivity criteria

Sensitivity levels	Characteristics
Very High	Receptor is highly sensitive to changes due to the following factors: • Receptor type is nationally valued, designated and or unique • Receptor type is of cultural value with strong historical or topical cultural associations e.g. important with tourists. • Views are almost free from existing distracting manmade structures like power lines, roads, large buildings etc. • Receptor is frequently visited by recreational users or holidaymakers
High	Receptor is high sensitive to changes due to the following factors: • Receptor type is of cultural value with historical or topical cultural associations e.g. important with tourists. • Receptor has a nature-related recreational feature • Low level of existing distracting manmade structures like power line, roads, large buildings etc. • Receptor is visited by recreational users or holidaymakers
Medium	Receptor is sensitive to changes due to the following factors: • Receptor type has some cultural value with historical or topical cultural associations • Receptor has to some extent nature-related recreational feature • Receptor or views are locally valued but regionally or nationally common • Medium level of existing distracting manmade structures like power line, roads, large buildings etc. • Receptor is occasionally visited by recreational users or holidaymakers

Sensitivity levels	Characteristics
Low	Receptor is less sensitive to changes due to the following factors: • Receptor type has low or none cultural value with historical or topical cultural associations • Receptor has no or very little nature-related recreational features • Considerable existing distracting manmade structures like power line, roads, large buildings etc. • Receptor is hardly visited by recreational users or holidaymakers

The purpose of visual impact assessment is to evaluate and predict the impact of the project on the human receptors. The visual impact assessment followed the conceptual model given by the University of Newcastle (2002) in the report “Visual Assessment of Wind farms Best Practice” (Scottish Natural Heritage Commissioned report F01AA303A).

Visual impact is evaluated according to the sensitivity degrees presented in the Table 12.

The magnitude of change can be described as very large, large, medium, small and very small (Table 13) and depends especially on:

- The size of the project;
- The landscape characteristics (initial level of visual impact, topography, vegetation);
- Distance from the receptors to the project.

Table 13: Criteria for magnitude of visual amenity change

Magnitude	Characteristics
Very Large	Very large changes in landscape characteristics, wind turbines controlling the view
Large	Range from notable changes in landscape characteristics, wind turbines can be easily and unmistakable seen
Medium	Moderate changes in landscape characteristics in a local area, wind turbines clearly visible
Small	Minor change in landscape characteristics, wind turbines are visible
Very Small	Very minor change in landscape characteristics, wind turbines not clearly visible or not obvious visible

To assess the project’s impact on the landscape and visual receptors, the magnitude of change and the landscape and visual sensitivity must be considered. By combining these two aspects the following matrix is obtained (Table 14).

Table 14: Significance matrix

Receptor sensitivity \ Impact magnitude	Low	Medium	High	Very High
Very Small	negligible	Slight to negligible	Slight	Slight
Small	Slight to negligible	Slight to moderate	Slight to moderate	Moderate to substantial
Medium	Slight to moderate	Moderate	Moderate to substantial	Substantial
Large	Moderate	Moderate to substantial	Substantial	Substantial
Very Large	Moderate	Substantial	Substantial	Substantial

The two tools used to evaluate the visual impact were mapping zones of theoretical visibility and viewpoints.

Zones of theoretical visibility (ZTV) are used to describe the area over which a development can theoretically be seen, and is based on a digital terrain model (DTM) created by using SRTM (Shuttle Radar Topography Mission) data with a resolution of 30m. The distance of a ZTV should extend far enough to include all those areas within which significant visual impacts of the wind farm are likely to occur.

The recommendations of the various consulted guidelines were taken into consideration and the distances of the ZTV for the project were defined as 10 and 35 km from the outer limit of the wind farm.

The second tool for assessing the visual impact is represented by the viewpoints. Viewpoints are selected as being those places from where a proposed development is likely to be visible and would result in significant effects on the view and the people who see it. For some of these viewpoints, photomontages were made which predict the visual change that will take place once the wind turbines are erected. The photomontages are attached in the Annex.

c. Assessment of the Impacts

(i) Results

The ZVI calculation of the area around the wind farm shows how many turbines are visible from the different locations. Two maps, one with a radius of 10 km and one with a radius of 35 km are shown in the Annex. Table 15 shows the sum of square meters according to how many turbines are visible.

Table 15: Sum of visibility of the turbines (10km radius)

WTG visibility	Area [m ²]	Area [%]
0	248,606,185	61
1-5	42,190,650	10
6-10	30,053,177	7
11-14	32,610,565	8
15	53,573,986	13

Table 16: The sensitivity assessment receptors

Receptor	Key Characteristics	Sensitivity
Um Sarab	Located approx. 1 km W of the wind farm. The scattered settlement west of the wind farm is characterized by small fields, olive plantations, roads and detached houses. As existing large man-made structures an abandoned quarry and telecommunication masts are clearly visible. The area has a spare population density and is usually not visited by recreational users or holidaymakers.	low
Gharandal	Located approx. 1.5 km S of the wind farm. Village including shops, schools, mosques and dwellings. Village is partly located in a valley with houses located on a slope towards south. South and east of the village there is the existing JWPC wind farm.	medium
Dana Village	Located approx. 7.2 km SSW of the wind farm. The village is the starting point for many tourists visiting the dana nature reserve and has several hotels. Therefore, it is frequently used by holidaymakers. From the hotels and viewpoints within the village there are striking views towards the Dana valley.	high
Dana tower viewpoint	Located approx. 7.8 km SW of the wind farm. The tower is the starting point for hikes into the dana nature reserve. The rooftop of the tower is accessible for visitors in order to provide an observation point over the dana nature reserve.	high

Receptor	Key Characteristics	Sensitivity
Dana Camping	Located approx. 8.9 km SW of the wind farm. From the campsite there are striking views towards the Jordan rift valley and a strong feeling remoteness und wilderness. There are no houses or man-made structures visible in the surrounding of the campsite.	high
Basira	Located approx. 2.5 km SW of the wind farm. Village including shops, schools, mosques and dwellings. Village is partly located in a valley with houses located on a slope towards southwest.	medium
Alqadesyah	Located approx. 8 km SSW of the wind farm. The village is located at the Kings Highway and on the edge of the Jordan Rift Valley.	medium
Kings Highway Parking	Located approx. 5.5 km SSW of the wind farm. This easy accessible parking off the Kings Highway offers striking views into the Jordan rift valley and is a popular location for local people and also a possible stop for tourists.	medium to high
Jurf ad Darawish	Located approx. 20 km E of the wind farm. The village is located at the intersection connecting the desert highway 15 with At Tafileh Highway. Several telecommunication masts exist in the area of the village.	medium to low
Lafarage	Located approx. 4.8 km SSW of the wind farm. The settlement is located north of the Al Rashideyah Cement Factory. East of the settlement the existing JWPC wind farm is located.	medium to low
Tafileh	Located approx. 7.5 km NNW of the wind farm. The town Tafileh is the capital of the Tafileh Governorate. It is the economy center of the region.	medium

Table 17: The visual effect of the WTG on the receptors

Receptor	Sensitivity	Magnitude of change	Significance
Um Sarab	low	-Large- Most of the turbines will be clearly visible covering the whole ridge east of the scattered settlement. (see also the visualization)	moderate

Receptor	Sensitivity	Magnitude of change	Significance
Gharandal	medium	-small to medium – In most locations of the village only a few turbines will be partly visible. From the school, which is located in the center of the village two turbines will be partly visible. The rest of the WTGs are located in a greater distance and their visibility is blocked by the topography. (see also the visualization) The visibility of the wind farm differs over the area of the village. In the higher located southern parts, the visibility of the turbines will be larger and in the valley the visibility will be reduced accordingly.	slight to moderate
Dana Village	high	-none- The ZTV demonstrates that the visibility is blocked by the topography.	not significant since there is no visibility of the wind farm from the receptor.
Dana tower viewpoint	high	-none- The ZTV and the photomontage demonstrate that the tower will have no views of the development. (see also the visualization)	not significant since there is no visibility of the wind farm from the receptor
Dana Camping	high	-none- The ZTV demonstrates that the visibility is blocked by the topography.	not significant since there is no visibility of the wind farm from the receptor
Basira	medium	-medium – The ZTV demonstrates that the visibility of the WTG in Bsaira differs to a great extent.	moderate
Alqadesyah	medium	-none- The ZTV demonstrates that the visibility is blocked by the topography.	not significant since there is no visibility of the wind farm from the receptor

Receptor	Sensitivity	Magnitude of change	Significance
Kings Highway Parking	medium to high	- small- The ZTV demonstrates that the visibility is blocked by the topography in the southern part of the Parking while parts of the wind farm will be seen in the north of the parking. Since the Jordan rift valley is located in the west of the parking and the planned wind farm is located northeast of the viewpoint the turbines does not interfere with views towards the valley.	Slight to moderate
Jurf ad Darawish	medium to low	-none- The ZTV demonstrates that the visibility is blocked by the topography.	not significant since there is no visibility of the wind farm from the receptor
Lafarage	medium to low	-small- The ZTV demonstrates that the visibility is blocked by the topography for nearly the entire area of the settlement.	slight
Tafileh	medium	-very small- The ZTV demonstrates that the visibility is blocked by the topography for almost the entire area of the town.	slight to negligible

The Dana Nature Reserve, is located close to the project. The nature reserve lies in the western slope of the Jordan Rift Valley. Accordingly the planned wind farm is hardly visible from the nature reserve. Therefore, the impact of the wind farm project is considered to be not significant.

Cumulative zones of visibility:

Inter-visibility between wind farms is normally found to be highest in those areas between the developments. However, the actual pattern of cumulative inter-visibility (CIV) is dependent on the land-cover, land-use and landform of the area subjected to combined visibility. Since there is hardly any high vegetation due to the climate and the high grazing activities the land-use, which usually reduces the visibility, was not considered in the calculation. The ZTV demonstrates that the individual visibility of the Kospo development will mostly occur within 5-7 km around its outer boundaries. The individual visibility of the Kospo project is highest in the western portion of the study area, being the area directly surrounding the wind farm.

Within 10 km theoretical CIV is mostly to the north, east and northwest. Beyond 4 km there is hardly theoretical CIV south of the development. The town of Tafileh would experience virtually no theoretical CIV.

The town Gharandal would experience theoretical CIV, however the visibility will be reduced by the buildings and only a few turbines will be partially visible.

To summarize, given the highly sensitive receptors within the study area, in particular the Dana Nature Reserve, there are only small negative impacts on the landscape and the visual amenity. The assessed impacts are of *moderate significance*. This is mainly due to the limited visibility. The ZTV illustrates that the high sensitive areas do not experience theoretical visibility. Even in Gharandal, the closest town, the visibility of the development will be very limited due to the existing topography.

Mitigation Measures

The following mitigation measures have been addressed within the design to mitigate elements of potential landscape and visual impacts.

- The layout of the wind farm was designed to have a reduced visual impact to the landscape;
- Tracks have been designed, as far as possible, to follow and fit with contours in the land. Permanent tracks take the shortest route to the turbines where possible;
- The turbines and all the other aboveground structures will be removed at the end of the operational lifetime.

Monitoring and Reporting Requirements

Not required.

9. SHADOW FLICKER

9.1 Assessment of Baseline Conditions

9.1.1 Baseline Assessment Methodology

A site visit in which the relevant receptors where identified and documented was conducted on the 22nd and 23rd of March 2016.

In order to account for cumulative impacts it must be assessed, if there are overlapping areas by nearby wind energy projects. The shadow flicker area depends on the dimensions of the turbine and the 20%-criteria (see below).

If less than 20 % of the sun is being covered by the passing rotor blade, the resulting shadow intensity at a neighbouring property will not be strong enough to account for a nuisance. For the Vestas V-136, this corresponds in theory a maximum distance of 1,816 m from the wind turbine (which will only be applicable at sunrise and sundown due to the geometry between the sun, the WTG and impacted properties).

9.1.2 Results

Due to the distance of 3,500 m to the closest existing wind farm (JWPC) there will be no overlapping shadow areas from the turbines of the Kospo project and the JWPC project. Therefore, cumulative impacts can be ruled out for shadow flicker.

9.2 Assessment of Potential Impacts

9.2.1 Potential Impacts during the Construction Phase

Shadow flicker events will be limited to the operational phase.

9.2.2 Potential Impacts during the Operation Phase

Shadow flicker may occur when the rotating blades of a wind turbine pass through the sun's rays seen from a specific location. This creates a fast-moving shadow with a "flicker" effect. The moving shadow can be annoying for residents of nearby dwellings. The impact depends on conditions such as astronomy, topography, weather and the distance between the turbine and the receptor.

The shadow flicker exposure naturally decreases with an increase in distance from the wind farm. Predicted exposure of a particular building to this shadow flicker effect is measured in minutes per day and cumulative yearly hours.

(i) Impact Assessment Methodology

The following objectives concern the shadow flickering assessment:

- To identify the areas that are affected by the shadow of the WTG;
- To assess impacts of the project on residential areas;

In order to assess the compliance with the recommended limits, shadow flicker should be modeled and predicted based on an astronomical worst-case scenario, which is defined as follows:

- There is continual sunshine and permanently cloudless sky from sunrise to sunset.
- There is sufficient wind for continually rotating turbine blades.
- Rotor is perpendicular to the incident direction of the sunlight.
- Sun angles less than 3 degrees above the horizon level are disregarded.
- Distances between the rotor plane and the tower axis are negligible.
- Light refraction in the atmosphere is not considered.

According to the IFC guideline (2015) the predicted shadow flicker duration should not exceed:

- Accumulated exposure on residential properties should not exceed a total of 30 hours per year;
- Exposure on residential properties should not be longer than 30 minutes per day.

If one of these thresholds is exceeded, mitigation methods such as turning off turbines during critical times must be considered.

Relevant for the shadow flickering effects are only residential houses that have one or more windows in the direction of the wind farm. The windows must belong to rooms of daily use.

The probability of shadow flickering occurrence and the extent of its effect on the residents depend on various factors such as the direction of the windows relative to the turbine, the distance from the turbine, the turbine hub height and the rotor diameter, the speed of blade rotation, the time of year and the time of day.

Nearby residential houses, further called immission points (IP), were detected as receptors of shadow flickering caused by the planned wind farm. These locations are indicated at the attached map.

Shadow flicker at the closest IPs has been calculated and mapped with the software WindPRO 3.1. For the calculation a digital terrain model (DTM) was created by using SRTM (Shuttle Radar Topography Mission) data with a resolution of 30 m. These results show the approximate hours of shadow flicker which accumulate at locations near the wind farm during a year.

Assessment:

The maximum possible duration of shadow flickering was calculated at the closest residential houses.

The limits for shadow flickering of 30 hours per year are exceeded at several houses west of the development. The limit of 30 minutes per day will not be exceeded. Due to the location of the village Gharandal, south of the proposed development, it is not affected by shadow flicker. Since the dwellings are located in the west of the planned turbines the shadow flicker events will be limited to the morning hours.

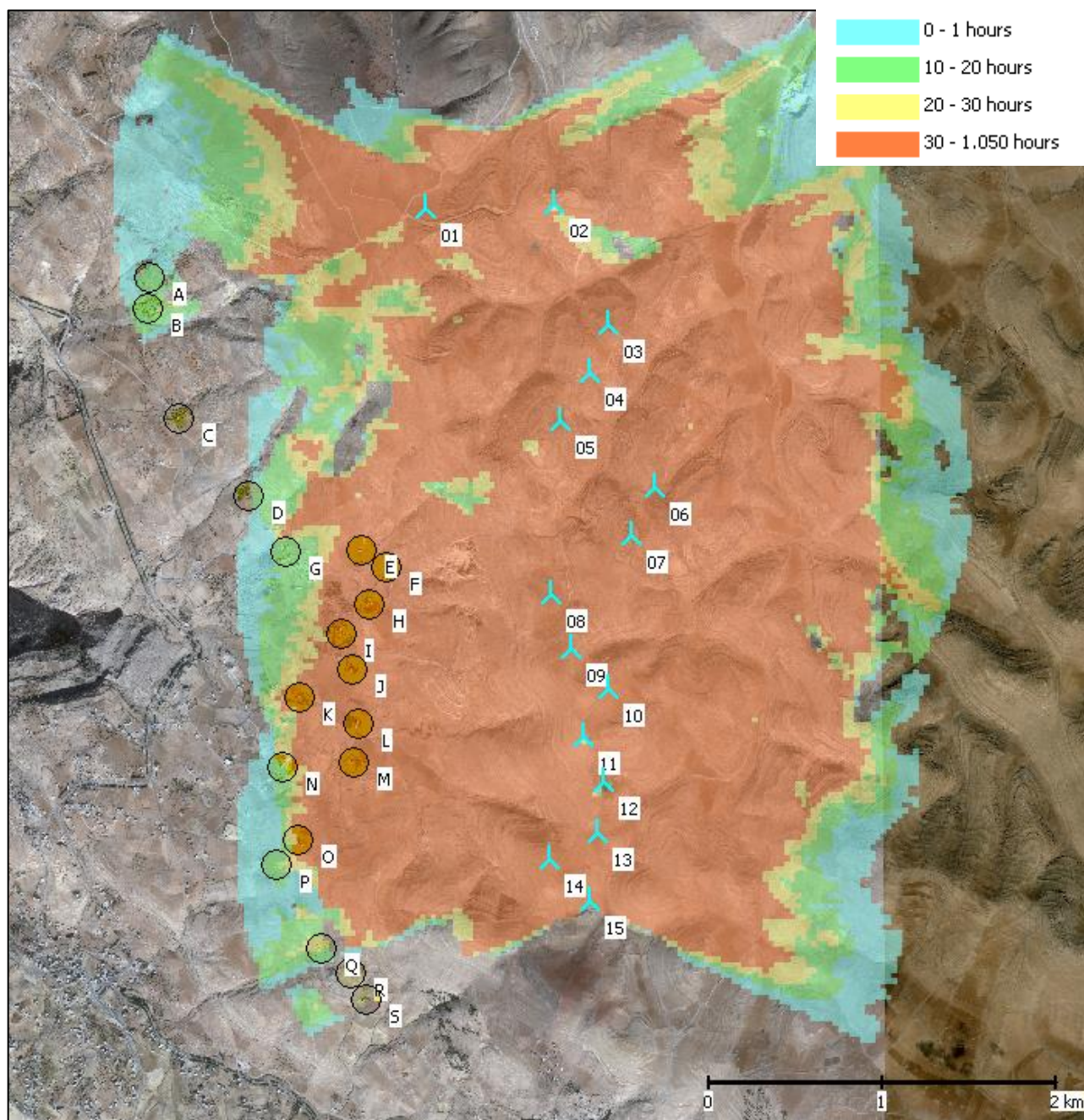


Figure 10: worst case scenario of the astronomically maximum shadowing (h/year)

Table 18: Duration of shadow flickering at immission points

	Astronomical maximum possible shadow flickering [Hours per year]	Astronomical maximum possible shadow flickering [Minutes per day]
House A	8:28	0:20
House B	15:09	0:20
House C	0:00	0:00
House D	0:00	0:00
House E	46:16	0:27
House F	59:21	0:31
House G	12:17	0:20
House H	75:25	0:29
House I	59:36	0:26
House J	70:42	0:27
House K	48:38	0:21
House L	81:11	0:25
House M	65:10	0:25
House N	12:17	0:19
House O	41:08	0:27
House P	6:33	0:19
House Q	21:54	0:24
House R	0:00	0:00
House S	0:00	0:00

The affected houses will not suffer from shadow flickering if:

- The weather is overcast;
- The rotor plane of the turbine is parallel with the imaginary line between the location of the sun and the respective IP;
- There is an obstacle between the respective building and the sun in the direction of the wind turbine;
- The wind turbines are not under operation;
- There is poor visibility due to fog.

In order to comply with the shadow flicker limits of 30 hours per year and 30 minutes per day the turbines, which cause the exceedance of the limits, should be equipped with a shadow flicker shut down module.

To summarize, the potential shadow flicker impacts on nearby residents are limited to dwellings west of the proposed site and will only occur in the morning hours. The impacts will be of a negative nature and medium magnitude, if shadow flicker shut down modules are not installed. The dwellings affected by shadow flicker are houses located in a rural environment and are considered of medium sensitivity. Given all of the above, such an impact is considered to be of moderate significance.

Mitigation Measures

Having installed shadow flicker modules for the WTG an exceedance of annual and day limits can be ruled out. Following the implementation of this mitigation measure, the significance of the residual impact can be reduced to not significant.

Monitoring and Reporting Requirements

Not required.

10. NOISE

10.1 Introduction

Noise from wind turbines has the potential to cause annoyance to people living near such installations. Ramboll CUBE GmbH was appointed to conduct a noise impact study. A background noise measurement was carried out on the site by the WIND-consult GmbH. The prediction assessment will be conducted by CUBE.

Noise sensitive areas are considered to be permanent occupied dwellings. In order to calculate the noise immissions the closest dwellings were taken into account as noise receptors.

For the assessment the commercial noise propagation software WindPRO 3.1 DECIBEL was used and the ISO 9613-2 was applied. Then the results of the noise calculation were compared to Jordan and international limits.

10.2 Assessment of Baseline Conditions

10.2.1 Baseline Assessment Methodology

As part of the site inspection which took place on the 22nd and 23rd of March 2016 the commercial activities in vicinity of the proposed wind farm site were established and the potential receptors were identified and documented.

A baseline (ambient) noise survey was carried out at three noise receptors to assess the sensitivity of nearby receptors. In order to cover the affected project area, measurements were conducted in the north-west (IP B), west (IP F) and south (IP L) of the proposed windfarm. The noise measurements were conducted in June 2016 by the german measuring institute WINDconsult. The measurement and data evaluation was carried out on the international standard "IEC 61400-11:2002 + A1:2006 – Wind turbine generator systems –Part 11 Acoustic noise measurement techniques" assessment.

10.2.2 Results

During the site visit most of the buildings within the wind farm area could be identified as farm sheds or storing building without permanent occupation. The remaining permanent dwellings were considered in the noise prediction as receptors.

The following commercial activities could be identified in vicinity of the proposed wind farm site.

Quarry:

Approximately 1,900 m northeast of the planned wind farm there is an existing quarry in which heavy machinery and lorries are operating. However, there are no permanent dwellings located in the vicinity of the land fill. Therefore, cumulative impacts on nearby residents can be ruled out.

Abandoned quarry:

Approximately 500 m northwest of the planned WTG 08 there is an abandoned quarry. Since no works are taking place in the quarry anymore cumulative impacts on nearby residents can be ruled out.

Wind Turbines

The JWPC windfarm is located approximately 3,500 m southeast of the planned Kospo wind farm. Due to this large distance between these projects significant cumulative impacts are not expected. However, the existing JWPC turbines will be considered in the prediction.

Baseline (ambient) noise survey

The measured sound power levels (10-minutes average) range from 35 dB(A) to 43 dB(A) and therefore can be regarded as typical for a rural environment.

A correlation between wind speed and background noise, which is usually found at wind turbines in lowlands, was not observed during the measurements. It is assumed that the reason for this is the location of the wind turbines, which are exposed to the wind on the ridges on the one hand and on the other hand the measurements which were conducted in the valley (close to the dwellings), where wind speeds are considerably lower. Therefore, an approach considering the background noise, masking the noise of the turbines does not seem suitable for the site.

10.3 Assessment of Potential Impacts

Impact Assessment Methodology

The noise assessment will include the following steps.

1. Identification of potentially affected properties on maps and aerial photos (receptors)
2. Verification of the exact locations and the usage of the properties during the site visit
3. Determination of the final receptors
4. Prediction of the turbine noise levels at the nearest receptors using the maximum guaranteed sound power level of the proposed turbine type
5. Comparison with local and international noise regulations.

Generally, the operational noise of a wind turbine has two sources: the aerodynamic noise produced by the rotating blades and the mechanical noise produced by the turbine's gearbox and generator. The intensity of the WTG noise depends on wind speed. At very low wind speeds no relevant noise emission is produced. WTGs become louder with increasing wind speed and power production. The planned Vestas V136 wind turbine has a guaranteed sound power level as presented in Table 19.

Table 19: Sound power level for Vestas V136, non-noise-reduced Mode 0 (source: Vestas, 2016)

Document no.: 0053-3713 V04
Document owner: Platform Management
Type: T05 - General Description

Performance Specification V136-3.45 MW 50/60 Hz
Operational Envelope and Performance Guidelines

Date: 2016-05-06
Restricted
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Original Instruction: T05 0053-3713 VER 04

3.4 Sound Modes

The sound modes listed below are available for the turbine.

Sound modes			
Mode No.	Maximum Sound Level	Serrated trailing edges	Available hub heights
0	105.5 dBA	Yes (standard)	82 m, 112 m, 132 m, 142 m, 149 m
0-0S	108.2 dBA	No (option)	82 m, 112 m, 132 m, 142 m, 149 m

Table 3-8: Available sound performance

Original Instruction: T05 0053-3713 VER 04

The Vestas V136 has several operational low-noise modes and can reduce noise levels by reduction of rotational speed. The V136 has a maximum noise emission level (LWA) of 105.5 dB(A) which is guaranteed by the manufacturer. For the noise modelling the guaranteed level of 105.5 dB(A) was considered. All turbines will be equipped with serrated trailing edges in order to reduce the noise emissions.

The Jordanian Noise Regulations (2003), set fix noise limits depending on the use of the noise sensitive areas (NSA). In Table 20 an overview is given on the noise regulation and the noise limits depending on the type of land use. It is the objective of the study to establish noise immissions for each relevant noise sensitive area and compare it with the local regulations.

Table 20: Relevant Jordanian noise regulation, 2003

Usage type / noise sensitive area (NSA)	Highest permissible limits of equivalent sound level (dB(A))	
	Day	Night
Residential, urban	60	50
Residential, suburban	55	45
Residential, rural	50	40
Residential area with workshops or small trade shops or commercial areas as well as offices (downtown area)	65	55
Industrial areas	75	65
Schools, hospitals, mosques and churches	45	35

Night time is defined as 18:00 -7:00.

The area around the wind farm is considered to be rural. As detailed information on zonal planning classification was not available the strictest noise limit of 40 dB(A) (residential areas in rural villages) was considered as a conservative assumption. However, there is also an argument to classify the receptors not as strictly residential since most of the properties are associated with farming activities.

The IFC / World Bank Environmental, Health, and Safety General Guideline (2007) addresses in chapter 1.7 the impacts of noise beyond the property boundary of the facility. Noise impacts should not exceed the levels presented in Table 21 or result in a maximum increase in background levels of 3 dB(A) at the nearest receptor location off-site.

Table 21: IFC/WBG noise level guidelines

Receptor	One hour LA _{eq} [dB(A)]	
	Daytime 07:00 – 22:00	Nighttime 22:00 – 7:00
Residential, institutional, educational	55	45
Industrial, commercial	70	70

These guidelines also address the measurement of noise as following:

The WHO guidelines for community noise was published in April 1999. These advise that noise impacts within dwellings include annoyance, speech interference and sleep disturbance. In 2009, WHO updated the guidance for night-time standards, proposing an external noise level of 40 dB(A) at night. This is intended as a long-term target level to prevent sleep disturbance, such as results from long term exposure to road traffic noise. The noise level is intended to apply over the entire night-time period, typically between 23:00 – 07:00 hours.

Table 22: Summary of WHO-criteria

Environment	Critical health effect	Sound level [dB(A)]	Time [hours]
Outdoor living area	Serious Annoyance	55	16
	Moderate Annoyance	50	16
Outside bedrooms (long term average)	Sleep disturbance	40	8
Outside bedrooms	Sleep disturbance, window open	45	8
Inside dwellings	Speech intelligibility and moderate annoyance	35	16
	Sleep disturbance, night-time	30	8
Bedrooms	Sleep disturbance	30	8
School, playground outdoor	Annoyance external source	55	During play
Industrial, commercial shopping and traffic areas, indoors and outdoors	Hearing impairment	70	24

The calculation model of the International Standard ISO 9613 'Acoustics – Attenuation of sound during propagation outdoors – Part 2 General method of calculation' is used to predict the levels of noise generated by the wind farm.

This model predicts the sound pressure level by taking the source sound power level for each WTG and subtracting a number of attenuation factors:

Predicted noise level = $L_w + D - A_{geo} - A_{atm} - A_{gr} - A_{bar} - A_{misc}$ with

L_w = sound power level of each turbine

D = directivity correction factor (not used for worst case downwind propagation)

A_{geo} = losses due to geometrical divergence

A_{atm} = losses due to atmospheric absorption

A_{gr} = losses due to the ground effect

A_{bar} = barrier losses where the turbine hub is unsighted

A_{misc} = miscellaneous effects (vegetation, buildings)

When calculating predicted noise levels with ISO 9613-2, it is assumed that the noise source is located upwind of the noise sensitive area (the location for which the noise level is calculated). For downwind situations, lower noise levels can be expected. When noise propagation for multiple sources in different directions is calculated, the results are always worst-case assumptions. However, it should be noted that not all of the noise sources can be upwind from the receptor at the same time. This is relevant for calculations for dwellings that are located in close proximity to the wind farm.

For this assessment, predicted noise levels according to ISO 9613-2 were calculated, using the WindPRO 3.1 DECIBEL commercial noise propagation software, using the loudest sound power level from 95% of the rated power (which is the loudest / the worst in all cases). The meteorological coefficient C_0 was set to 0 dB. The applied method does not use A_{bar} and the A_{misc} attenuation factors and therefore deliver more conservative results.

For the calculation a digital terrain model (DTM) was created by using SRTM (Shuttle Radar Topography Mission) data with a resolution of 30 m.

10.3.1 Potential Impacts during the Construction Phase

The following major activities will be conducted during the construction phase:

- Construction noise (breaker, excavator, dump truck etc.);
- Construction of access roads;
- Construction of electrical substation and associated structures;
- Erection of turbines.

Normal hours of construction works could be Saturday to Thursday 7 a.m. to 7 p.m. Some flexibility in working hours may be required, e.g. during the delivery of the main components of the turbines due to the use of Heavy Goods Vehicles (HGV).

Each of the construction activities includes working with heavy “balance-of-plant” machines with noise levels (L_{WA}) of up to 120 dB(A) taking into account the BS 5228:2009. They are usually carried out one after the other at each turbine location. For this assessment of the construction noise, it will be assumed that all the work will occur concurrently at two turbine locations (at turbines WTG 8 and WTG 9) in a close distance to the neighboring dwellings at the same time. This scenario represents a worst case which might not be expected or, even if, might occur only during a period of few weeks.

Table 23: Balance-of-plant machines

Activity	Balance-of-plant machines
Laying of access tracks	1 x excavator (107 dB(A)), 1 x compactor (107 dB(A)), 1 x bulldozer (109 dB(A)), 2 x dump truck (115 dB(A))
Excavation of foundations	1 x breaker (mounted on wheeled backhoe – 120 dB(A)), 1 x excavator (107 dB(A)), 3 x dump truck (115 dB(A))
Concreting of foundations	2 x concrete mixer (108 dB(A)), pumping (106 dB(A), or idling (99 dB(A))
Erection or dismantling of turbines	2 x mobile crane (106 dB(A)), 2 x flatbed truck (108 dB(A))

If a borrow pit will be used on site is not known at this stage of the project. Such information could be updated when a detailed construction schedule of the wind farm design is provided by the EPC contractor.

Construction noise was calculated for 14 locations around the wind farm, at the same noise sensitive areas that were used for the operational noise prediction. The equivalent continuous noise levels LA_{eq} were calculated and are presented in Table 23. The total sum in Table 24 is calculated under the assumption that all work will occur concurrently at the two nearest turbines. The allowed threshold, according to Category A of the British BS 5228:2009 guideline, is 65 dB(A) and will not be exceeded.

Table 24: Construction noise levels [dB(A)]

IP	IP Name	Laying of access roads	Excavation of foundations	Concreting of foundations	Erection of turbines	SUM (if works occur simultaneously)	Allowed noise level*
A	House	34	38	27	28	40	65
B	House	34	38	27	28	40	65
C	House	37	41	30	31	43	65
D	House	40	44	33	34	46	65
E	House	45	49	39	39	51	65
F	House	47	51	40	41	53	65
G	House	46	50	40	40	52	65
H	House	45	49	38	39	51	65
I	House	44	48	38	38	50	65
J	House	37	41	31	31	43	65
K	House	37	41	30	31	43	65
L	House	37	41	30	31	43	65
L2	House	37	41	30	31	43	65
N	House	33	37	26	27	39	65

* According to BS 5228:2009 – Category A

Access to the construction site is described in Chapter 18. The most intensive transport activity will take place during the concreting of the foundations with up to approximately 10 concrete trucks per hour, during 1 working day per turbine foundation. These transports will lead to additional noise at the properties along the public roads (as described in chapter 3). It should be noted that this transport intensity, and therefore the noise, will only last for the concreting phase of the overall construction work, which is assumed to last for a total of circa 20 days for all 15 turbines.

To summarize, the potential construction noise impacts on nearby residents are limited to a short time of the construction phase. The impacts will be of a negative nature but due to the large distance to the closest dwellings of low magnitude. The dwellings affected by the construction noise are houses located in a rural environment and are considered of medium sensitivity. Given all of the above, such an impact is considered to be of low significance.

Mitigation Measures

In order to organize the construction works with as little nuisance as possible, it is recommended to limit the working hours from Saturday to Thursday 7 a.m. to 7 p.m., if possible. Some flexibility in working hours may be required during the delivery and erection of turbines and depending on weather conditions. The final time schedule of the transport movements will be clarified with the authorities and communities.

Following the implementation of this mitigation measure, the significance of the residual impact can be reduced to low and therefore to not significant.

Monitoring and Reporting Requirements

Not required.

10.3.2 Potential Impacts during the Operation Phase

For the calculation at day and night-time the guaranteed level of 105.5 dB(A) was considered for all 15 turbines of the Kospo Project.

Table 25: operation noise levels: Kospo wind farm (case 5c layout)

IP	IP Name	Predicted noise level from turbines [dB(A)]	Noise limit acc. to Jordan Noise Regulation: 40 dB(A) nighttime (Rural Areas) Distance to limit [dB(A)]	IFC/ World Bank guidelines: 45 dB(A) nighttime Distance to limit [dB(A)]
A	House	30	-10	-15
B	House	30	-10	-15
C	House	32	-8	-13
D	House	34	-6	-11
E	House	38	-2	-7
F	House	39	-1	-6
G	House	38	-2	-7
H	House	38	-2	-7
I	House	38	-2	-7
J	House	34	-6	-11
K	House	34	-6	-11
L	House	36	-4	-9
L2	House	37	-3	-8
N	House	31	-9	-14

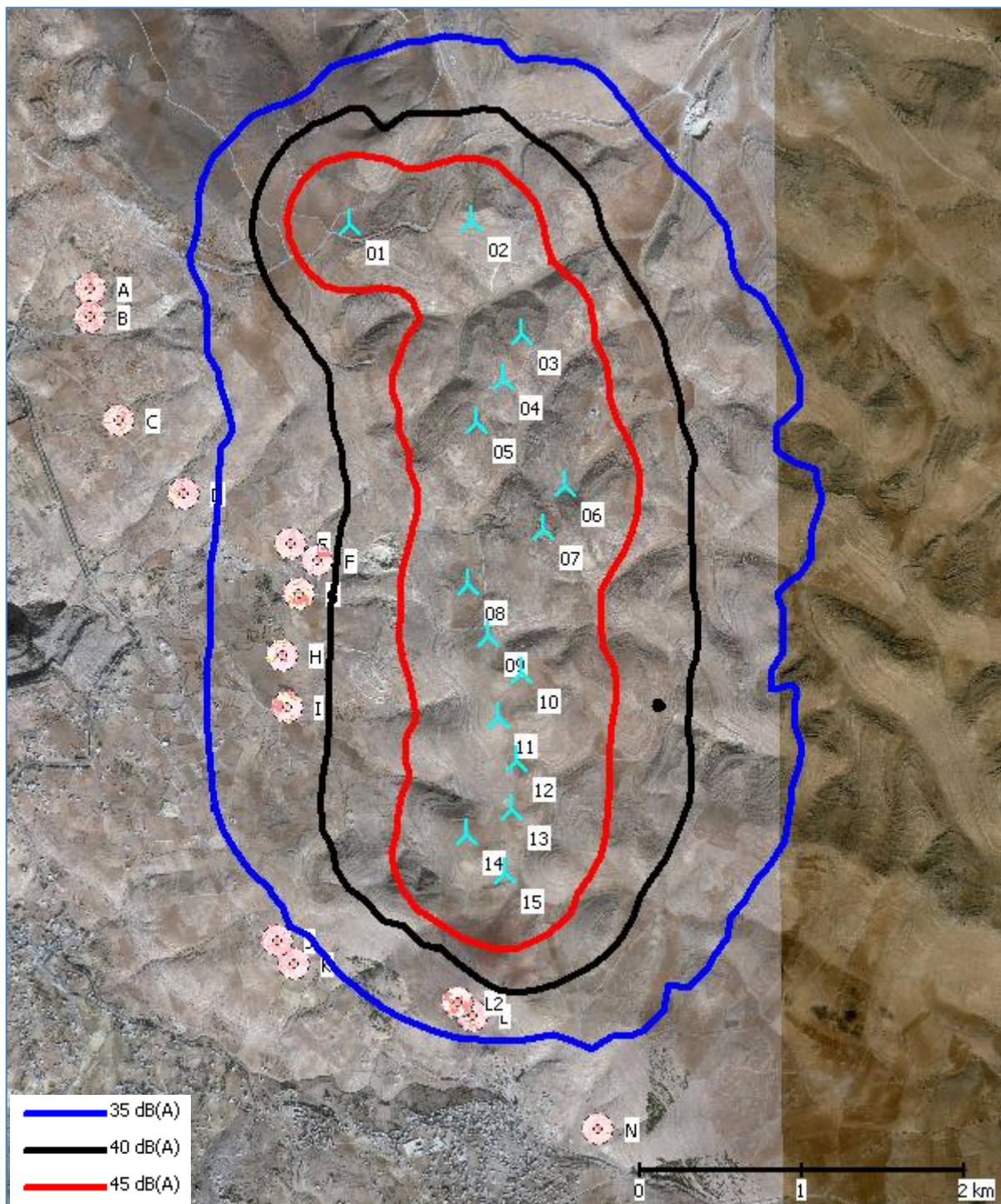


Figure 11: operational noise levels (day and night): Kospo Wind Farm (case 5c layout)

Table 26: nighttime operation noise levels: Kospo (case 5c layout) and JWPC wind farm

IP	IP Name	Predicted noise level from turbines (night) [dB(A)]	Noise limit acc. to Jordan Noise Regulation: 40 dB(A) nighttime (Rural Areas) Distance to limit [dB(A)]	IFC/ World Bank guidelines: 45 dB(A) nighttime Distance to limit [dB(A)]
A	House	30	-10	-15
B	House	30	-10	-15
C	House	32	-8	-13
D	House	34	-6	-11
E	House	38	-2	-7
F	House	39	-1	-6
G	House	38	-2	-7
H	House	38	-2	-7
I	House	38	-2	-7
J	House	34	-6	-11
K	House	34	-6	-11
L	House	36	-4	-9
L2	House	37	-3	-8
N	House	31	-9	-14

Table 27: daytime operation noise levels: Kospo (case 5c layout) and JWPC wind farm

IP	IP Name	Predicted noise level from turbines [dB(A)]	Noise limit acc. to Jordan Noise Regulation: 50 dB(A) daytime (Rural Areas) Distance to limit [dB(A)]	IFC/ World Bank guidelines: 55 dB(A) daytime Distance to limit [dB(A)]
A	House	30	-20	-25
B	House	30	-20	-25
C	House	32	-18	-23
D	House	34	-16	-21
E	House	38	-12	-17
F	House	39	-11	-16
G	House	38	-12	-17
H	House	38	-12	-17
I	House	38	-12	-17
J	House	34	-16	-21
K	House	34	-16	-21
L	House	36	-14	-19
L2	House	37	-13	-18
N	House	31	-19	-24

The above tables show that the resulting noise from the turbines will meet the Jordan noise limits. Since the IFC recommends a noise limit of 45 dB(A) this limit is also met. Moreover, the noise from the turbines is likely to be less in lower wind speeds or when the receptor is not directly downwind.

There is sufficient buffer to the noise limits since the modelling was carried out under following worst-case assumptions:

- downwind noise propagation conditions for each turbine location and for each receptor
- 70% humidity and 10°C air temperature
- the maximum sound power level (in dB(A)) of the turbine was used (to be expected only under high wind conditions)
- masking of the turbine noise by the noise of the wind itself was not considered

Consequently, there is a sufficient degree of conservatism in the modelling assumptions to make any under-prediction unlikely.

The model predictions are based on a widely validated prediction algorithm and manufacturer's technical data. Prediction errors are estimated to be within 2 dB(A).

The noise predictions for the proposed installation cannot be validated until the project is built. After erection, noise emission measurements can be carried out by accredited and independent international experts.

To summarize, the potential noise impacts on nearby residents affect largely a few dwellings west and south of the proposed site. The impacts will be of a negative nature and low magnitude since the noise limits are met. The dwellings affected by noise are houses located in a rural environment and are considered of medium sensitivity. Given all of the above, such an impact is considered to be of minor significance.

Mitigation Measures

The wind farm location in Tafileh was optimized in order to minimize the impact of noise by keeping a sufficient distance to the surrounding properties. This has been one of the key factors during the design process. Since the distance of the WTGs to the nearby receptors was increased, in the latest layout (case 5c), operating the turbines in a noise reduced mode is not required anymore.

If it would become necessary for any unknown reason to reduce the noise output of the wind farm, the selected turbine type offers the possibility to be operated in a noise-optimized mode. Albeit the power output would be reduced, this measure allows the reduction of the sound power levels once the wind farm is in operation.

Monitoring and Reporting Requirements

After erection a noise emission measurement should be carried out at one turbine in order to verify the sound power level of the turbine. Such a measurement could be conducted for instance at WTG 08 or WTG 09.

11. LAND USE

This chapter first provides an assessment of baseline conditions within the project site and surroundings in relation to land use (to include both formal and informal) and then assesses the anticipated impacts from the project throughout its various phases. For each impact, a set of management measures (which could include mitigation measures, additional requirements, etc.) and monitoring measures have been identified to eliminate or reduce the impact to acceptable levels.

11.1 Assessment of Baseline Conditions

This section discusses the methodology for the assessment of the baseline conditions in relation to land use (to include both formal and actual) and presents the outcomes and results.

11.1.1 Baseline Assessment Methodology

The baseline assessment of the ‘formal’ land use was based on collection of secondary data and land use plans set by the relevant governmental authorities – to include Ministry of Municipal Affairs (MoMA), Ministry of Environment (MoEnv), and the Ministry of Agriculture (MoA) etc.

Understanding and characterizing the informal or ‘actual’ land use of the project site was mainly based on several site visits undertaken by the ‘ESIA Team’ to the project site as well as consultation session with the local communities. The objective of such site visits and the consultation session was to investigate the actual land use of the site, and determine if it provides any certain value to the affected communities in the areas (e.g. agricultural activities, grazing, etc.).

The site visits were undertaken during May 2016 as it is considered the phase which entails the highest onsite land activities by the local community members. The site visits entailed visiting each area where activity was noticed, to the greatest extent possible, starting from south to the north of the project area. At each area, detailed discussions were undertaken with members onsite with the objective of (amongst other as stated previously in ‘Section 6.5’: (i) introduce the project and its various components; (ii) understand, characterize and assess the activities undertaken onsite; (iii) present the potential impacts which could affect their activities onsite and take into account their thoughts and concern on the project development. It is important to note that consultations were gender specific – therefore specific consultations were undertaken with women by a female specialist of the ‘ESIA Team’.

In addition, to the above a consultation session was undertaken with local community representatives in May 2016. The objective of the session included (amongst other as stated previously in ‘Section 6.5’: (i) introduce the project and its various components; (ii) understand, characterize and assess the activities undertaken onsite and verify the outcomes of the site visits undertaken; (iii) present the potential impacts which could affect their activities onsite and take into account their thoughts and concern on the project development.

11.1.2 Formal Land Use

The formal land use of the project site was investigated based on available plans set by the relevant governmental authorities. This includes the following: (i) land use planning by MoMA, (ii) planning for areas of critical environmental concern by MoEnv, and (iii) grazing reserves and forest lands planning by MoMA.

(i) Land Use Planning by MoMA

The project might conflict with the allowed land use set for the area by MoMA which designates specific land uses in Jordan where only certain activities are allowed. This issue has been investigated and the results are presented below.

In accordance with the “Law for the Organization of Cities, Villages and Buildings No. 79 for 1966”, MoMA designated specific land uses for areas in the Kingdom that are within organized boundaries (urban areas). However, at that time, no land use plans were developed for areas that lay outside of the organizational boundaries and therefore, in 2006 a project to prepare a land use map for such areas began. The output was the National Land Use Master Plan of 2007; which is a recent attempt to produce a harmonized land use plan for those areas that are outside of organized boundaries. Accordingly, the “Land Use Planning Regulation No. 6 of 2007” was issued to regulate land use for those areas outside of organized boundaries and to divide territories by using zoning cryptography as follows:

- Agricultural areas sector, identified by the symbol (A);
- Rural areas sector, identified by the symbol (B);
- Marginal areas sector, identified by the symbol (C);
- Desert areas sector, identified by the symbol (D); and
- Forest areas.

Figure 12 below presents the location of the project site and the land use plan set within the National Land Use Master Plan of 2007. The project site is located outside of the organized boundaries where the closest are Bseira, Gharandal, and Um Essarab which are represented in pink in the figure below; where such organized boundaries have assigned land use categories in the “Law for the Organization of Cities, Villages and Buildings No. 79 for 1966”. However, as the project site is located outside organized boundaries it is considered as areas outside planning zones with assigned land use categories set in accordance with the Regulation No. 6 of 2007.

According to Figure 12 below and the “Regulation No. 6 of 2007”, the project site is classified as the following:

Table 28: Land Use Classification of the Project Area by MOMA

Classification	Description
Agricultural Area of the 2 nd Degree	Such areas are mainly within the most northeastern and northwestern parts of the site. Article 6[A-2] describes area as suitable for crop cultivation. Article 6[B] of the Regulation specifically states “In those areas the following land use are allowed: electric power generation facilities, transmission, and distribution networks”.
Agricultural Area of the 3 rd Degree	Such areas are mainly within the most northwestern parts of the site. Article 6[A-3] describes the area as suitable for agro-forestry. Article 6[B] of the Regulation specifically states “In those areas the following land use are allowed: electric power generation facilities, transmission, and distribution networks”.
Rural Area of the 2 nd Degree	Such areas are within most of the project site. Article 7[A] describes the area as rural areas with no additional description. Article 7[B] of the Regulation specifically states “In those areas the following land use are allowed: electric power generation facilities, transmission, and distribution networks”.
Marginal Area of the 1 st Degree	Such areas are within the western parts of the project site. Article 8[A-1] describes the area as suitable for forestry and grazing. Article 8[B] of the Regulation specifically states “In those areas the following land use are allowed: electric power generation facilities, transmission, and distribution networks”.
Marginal Area of the 3 rd Degree	Such areas are within the northern parts of the site. Article 8[A-3] describes the area as suitable for forestry and grazing purposes. Article 8[B] of the Regulation specifically states “In those areas the following land use are allowed: electric power generation facilities, transmission, and distribution networks”.

To this extent, it is evident that the project site does not conflict with MOMA’s land use plan; in fact, the designated land use for the area allows for and encourages the development of such a project.

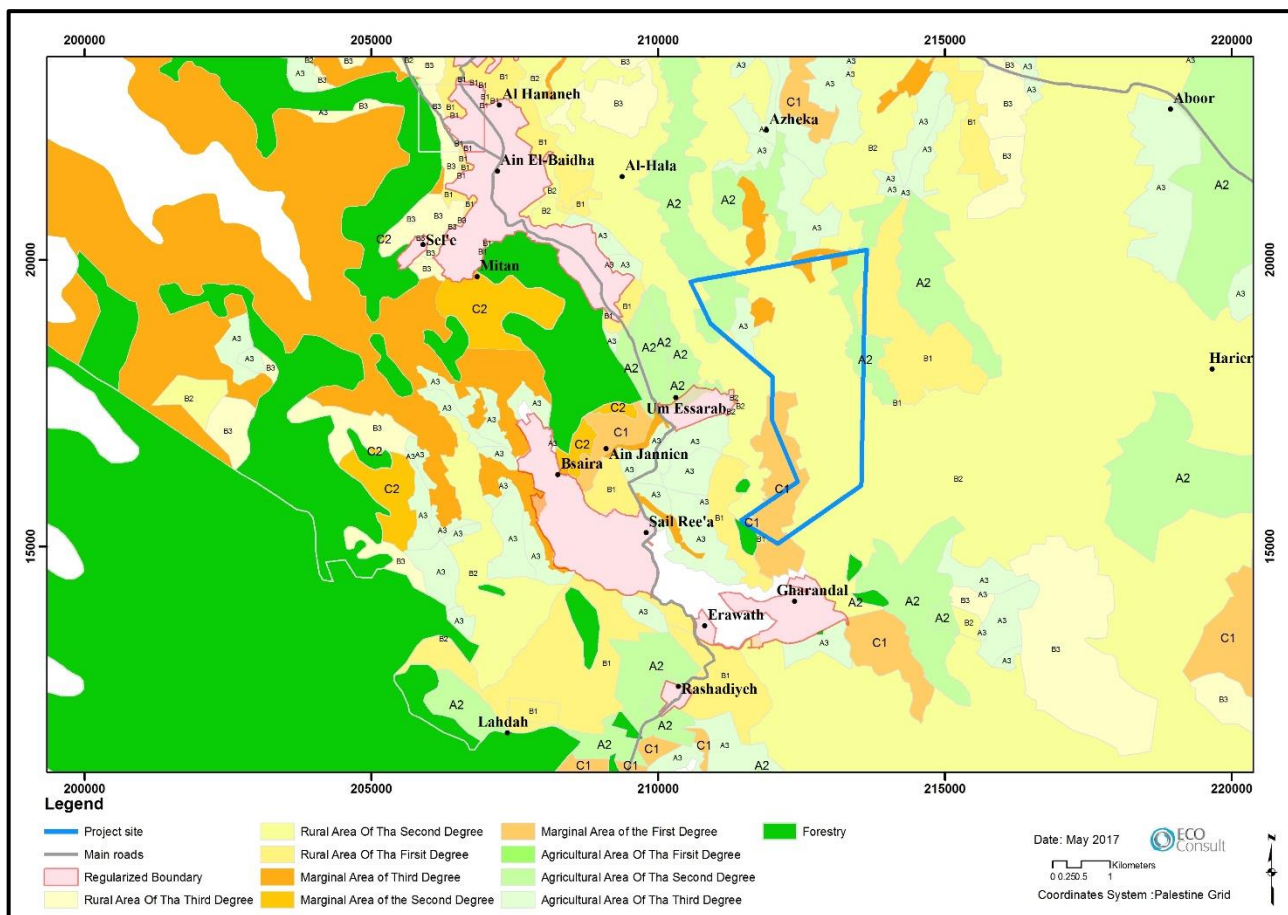


Figure 12: MoMA Land Use Master Plan of the project Site

(ii) Areas of Critical Environmental Concern Planning by MoEnv

The project could potentially conflict with the use of current or planned nearby specially designated areas such as wilderness areas, areas of critical environmental concern, and/or special recreation management areas. The Ministry of Environment (MoEnv) has the responsibility of establishing natural reserves, national parks, and any site of special environmental significance for protection and management.

However, the MoEnv delegates such responsibilities to the Royal Society for the Conservation of Nature (RSCN). In accordance with the above, the RSCN has designated four (4) categories for areas of environmental concern as highlighted below. Those have been assigned based on detailed reviews prepared by the RSCN and which include: (i) National Network of Protected Areas in Jordan and (ii) Important Bird Areas of the Hashemite Kingdom of Jordan.

- Established Reserves: in accordance with the “National Network of Protected Areas in Jordan” the RSCN has established a number of reserves which have been announced as protected areas and are currently managed and operated by the RSCN;
- Proposed Reserves: areas proposed within the “National Network of Protected Areas in Jordan” as protected areas but have not been announced as reserves yet and currently are not managed or operated by the RSCN;
- Reserves Under Establishment: areas proposed within the “National Network of Protected Areas in Jordan” as protected areas and are announced as so, but are still underway to be established, operated, and managed by the RSCN; and

- Important Bird Areas (IBA's): areas proposed within “Important Bird Areas of the Hashemite Kingdom of Jordan”.

Taking the above into account, the RSCN prepared a comprehensive plan that identifies the location of the reserves and IBA's discussed above. The figure below presents the closest areas in relation to the project site. As noted in the figure, there are no areas of critical environment concern within the project area or its immediate surroundings; there are no established, under establishment, proposed reserves or IBA's. A number of preservation areas exist further away from the project site with the closest delineation being around 2km away which includes the Dana Biosphere Reserve.

To this extent, it can be concluded that no conflict exists between the project site and the MoEnv/RSCN planning context. The project site is not located within established/planned reserves or important bird areas.

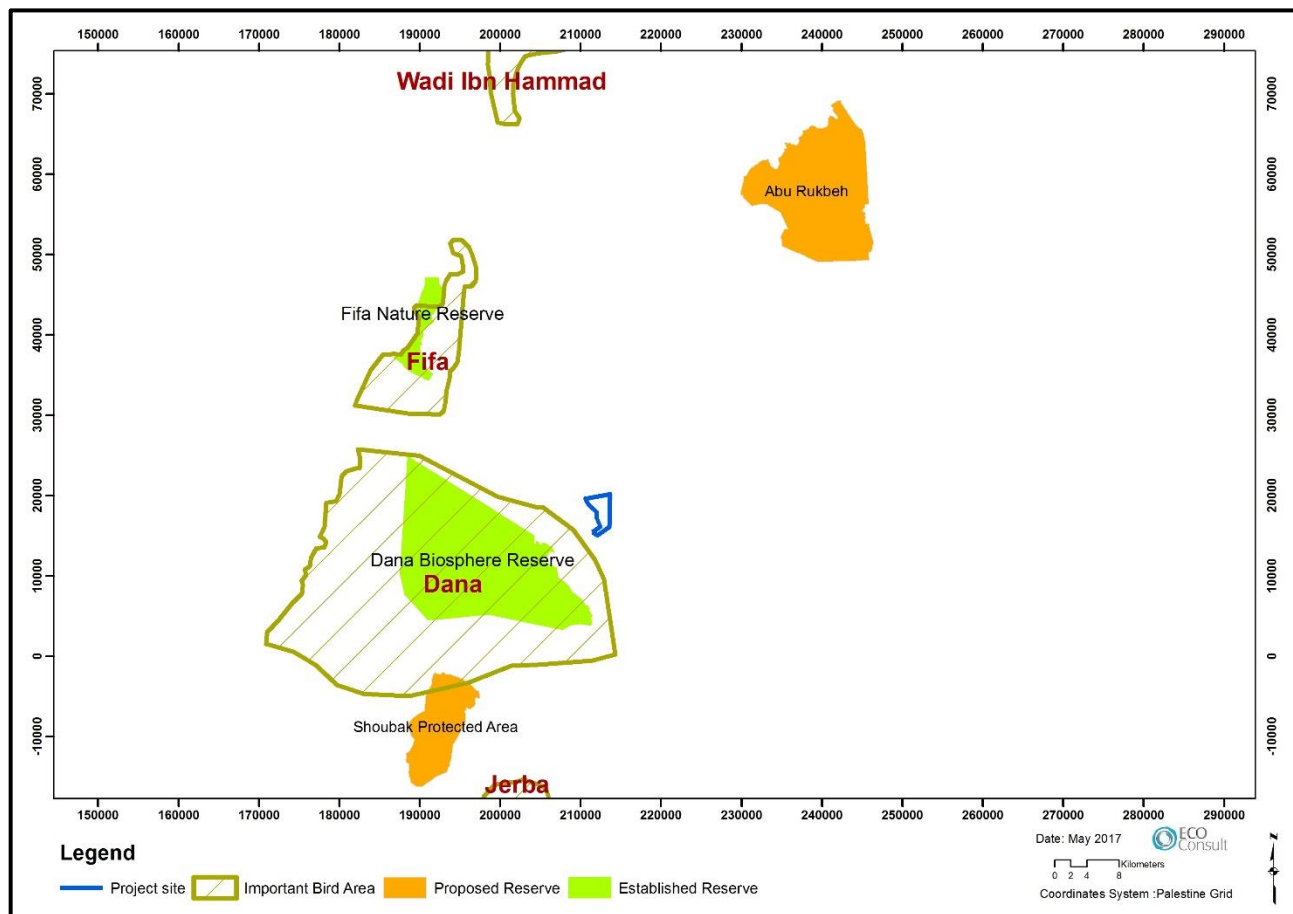


Figure 13: Areas of Critical Environmental Concern in Relation to Project Site

(iii) Grazing Reserves and Forest Area Planning by MoA

The project might conflict with current or proposed planning policies of the Ministry of Agriculture (MoA) for the general area. The most important planning issues that must be investigated include potential conflict with grazing reserves of the MoA and forest lands.

Grazing Reserves

The MoA is entitled to planning grazing reserves in the Kingdom on rangelands. According to discussions with the Rangeland Directorate, there are currently 34 grazing reserves distributed throughout the Kingdom that cover an area of around 80, 000 Dunums. Such reserves are planned and established for sustainable grazing and prevention of overgrazing which generally reduce the usefulness, productivity, and biodiversity of the land and is one cause of desertification and erosion.

The project site is not located within or near any grazing reserves. Figure 14 below presents the location of the Grazing Reserves in relation to the project site. Within the area, three (3) grazing reserve exist east and south of the project site known as Al Kamya Reserve (with an area of 7km² and located 20km from the site), Al-Twana (with an area of 12km² located 10km from the site), and Al Fujaj Grazing Reserve (with an area of 4km² and located 14km from the site).

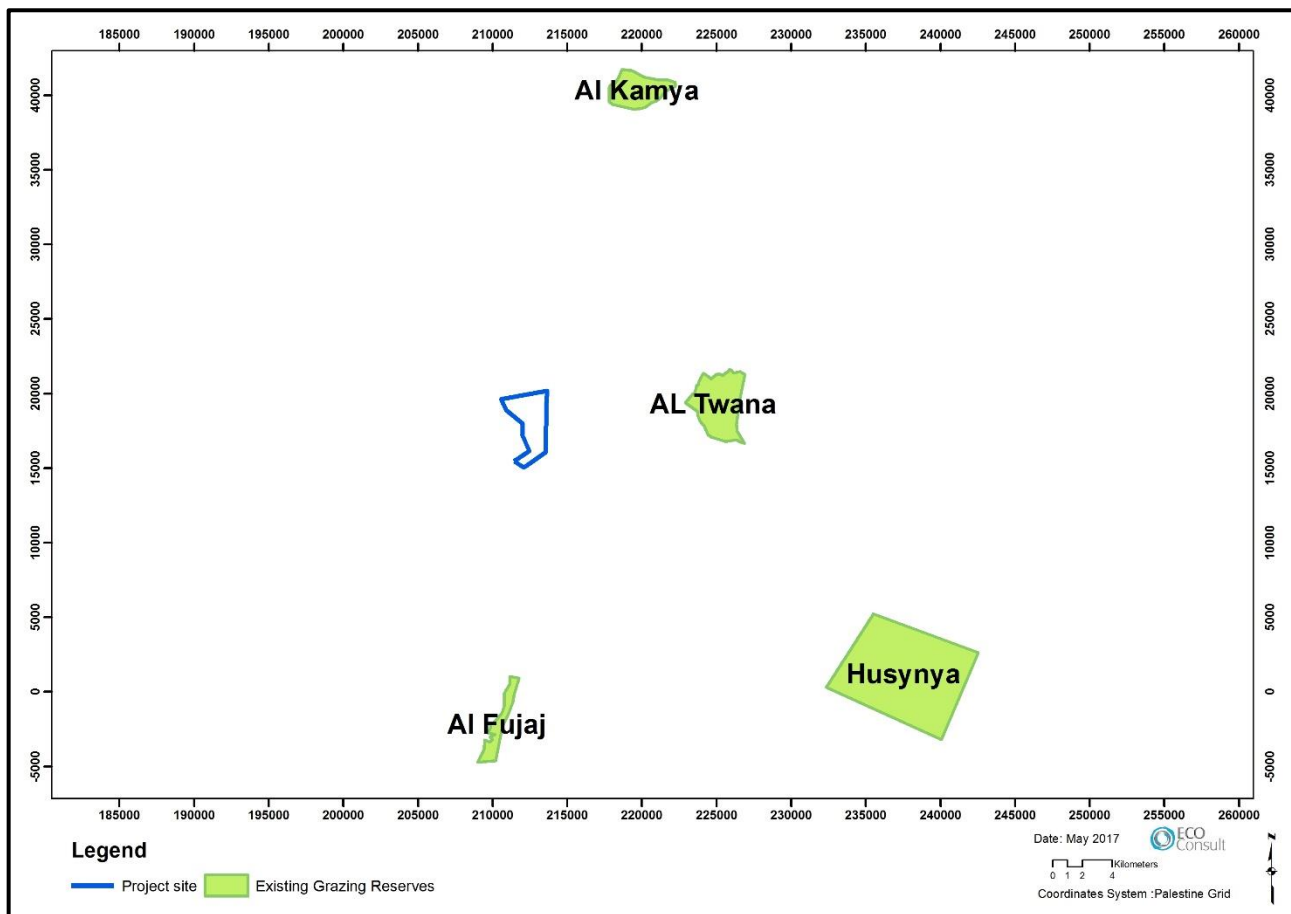


Figure 14: Grazing Reserves in Relation to Project Site

Forest Area Planning

According to the "Agriculture Law No. 13 for the year 2015" Forest Lands are lands of the State that are registered as forests and the lands of the State that are allocated for forestry purposes. The Law states that it shall be prohibited to abuse forest lands whether by erecting permanent or temporary residences, buildings or structures thereon, or digging wells or caves, or installing water, electricity or telephone lines, or opening sewage lines or canals therein, or by cultivation or ploughing, or by grazing therein, without a license.

However, according to discussion with the Department of Forestry, and given that the project will be developed on privately owned land (and not registered in the name of Treasury) the project site is excluded from being classified as a forest land.

The law also refers to private forests as forest trees, bushes, and plants growing on privately owned lands. The Law also states that it is prohibited on private lands to cut forest trees or bushes or wild plants without a license from the Minister.

Based on several site visits undertaken by the 'ESIA Team', several forest trees were noted within the project site which are generally scattered throughout the site and which include trees such as Pine, Pistachio, Wild Almond, and Wild Prunes.

In accordance with the above, and according to discussion with Department of Forestry, once a final detailed design has been prepared by the EPC Contractor for all the project components, and only if construction activities require any forest trees in the project site be removed, then the Developer must submit an application to Ministry of Agriculture (Tafileh Agriculture Directorate) in order to obtain their approval. The application must provide the final design details of the project, the expected number of trees that will be removed, along with a proper justification as to why they need to be removed (e.g. possible conflict with certain project components). The Directorate will review the application and officials would inspect the site. Such approvals are generally granted and it is highly likely that this will be the case for the project should it be required.

To this extent, it can be concluded that no conflict exists between the project Site and the Ministry of Agriculture’s planning context, specifically for grazing reserves and forest lands. However, should the project require any forest trees within the site be removed during the construction phase then the approval of the Ministry of Agriculture (Tafileh Agriculture Directorate) is required. It is highly likely that such an approval will be granted if required

11.1.3 Actual Land Use

This section presents in detail the actual land use of the project area by the local community and the nomads each of which is discussed in the further details below.

(i) Local Community

The lands within the project area are owned by the local communities surrounding the project site and which include, as discussed earlier, Um Sarab, Bseria, Gharandal and Ain Baida. The land selection and leasing process took place from the onset of the project development, and involved detailed discussions and consultations by the Developer and the local community members. Generally, the local community showed support for the project development from the onset and assisted the Developer in identifying lands in the area available for leasing for the proposed development. Based on that (as well as other technical factors), 61 parcels of lands were selected within the project area for leasing for the project duration.

Summarized below are the main land use patterns for the project area in general. This has been based on onsite consultations with local communities as well as a local community consultations session (as discussed in details in Section 6.5.2). Based on such consultations it was understood that the activities detailed below are restricted to the local community members of the nearby villages and which include Um Sarab, Bseira, Gharandal and Ain Baida.

- ***Grazing Activities (February – early May):*** throughout this season grazing activities take place within the area including the project site. This mainly involves day trips to the area where afterwards the local communities return to their villages. Generally, anyone is allowed to enter the lands for grazing except areas that are private farms and which are planted by the land owner (in order to protect their plantations from livestock grazing). Livestock raising activities are generally undertaken by the local communities for self-sufficiency purposes and less so as a source of income.
- ***Harvesting Activities (June – September):*** this is the season with highest land activity where the area in general is harvested with wheat and barley. Throughout this season harvesting activities take place in each of the land owners designated land area. Harvesting activities are undertaken by land owners themselves, or through other local community members in agreement with the land owner, or by local community members hired by the land owner. Generally, throughout this period, the local communities undertake their harvesting activities and return to their villages on a daily basis. Some of the lands in the area have small structures that are used for resting throughout the day. Agricultural activities are

generally undertaken by the local communities for self-sufficiency purposes and less so as a source of income.

- *Post Harvesting Season (September – January):* throughout the season no one inhabits the area in general. However, occasional day trips for grazing by the local community are possible, although they depend more on fodder to feed their livestock throughout this period.
- *Other Activities:* within the project site and specifically within the northern parts are small scale private farms planted with other crops such as pistachios, olives, grapes, and apricots (Figure 15 below). Some of these small scale farms have small structures that are used for resting throughout the day. Such farms are mainly used for self-sufficiency purposes and less so as a source of income. The harvest is usually collected in August and September. In addition, within the northern part of the project site an empty and deserted poultry barracks that is no longer in use (Figure 16).



Figure 15: Small Scale Private Farms in the Area



Figure 16: Deserted Poultry Barracks

(ii) Nomads

Certain nomadic tribes are known to inhabit the project area. Summarized below are the main land use patterns for the nomadic groups. This has been based on onsite consultations with the nomadic groups as well as a local community consultations session (as discussed in details in Section 6.5.2).

There are 2 main nomadic groups in the project area in general, which include the following:

- Saba'aween Tribe: those are originally from Bir El Sabe' area in Palestine and moved to Jordan during the Palestine-Israeli conflict, occupying the Wadi Araba Area in Jordan. They generally move to the project area during spring/summer time.
- Sa'edeen Tribe: a large tribe that generally occupies the south of Jordan such as Wadi Araba and Wadi Musa. They generally move to cooler areas during spring/summer time (such as the project site) as well as other area such as the Sharah mountains.

Both nomadic groups move around on a seasonal basis. They move to the project area during spring/summer time (between May and September) due to: (i) its cooler climate; (ii) productive lands in which they can undertake agricultural and/or grazing activities; and (iii) availability of water resources. Throughout this period they reside in the project area by setting tents in which they live (Figure 17). By the end of September, as the weather becomes colder, they move back to warmer areas (such as Wadi Araba). Transportation activities between project area and other areas are undertaken by trucks

Based on consultations, it was understood that the nomads in general occupy the area each year, but do not settle in the exact specific area each year. They generally reside in lands through verbal agreement with the land owner or on other available public lands in the area. Throughout this period, some of the nomads undertake grazing activities only. As discussed earlier, grazing can take place openly in any area as anyone is allowed to enter the lands without permission from the land owner. Other nomads undertake grazing activities (mainly limited to wheat and barley) in addition to agricultural activities (similar to the patterns of the local community this is undertaken mainly during May, June and July). Agricultural activities by the nomads are undertaken in agreement with the land owner or on other public lands in the area.



Figure 17: Nomadic Activity in the Project Area

11.2 Assessment of Potential Impacts

This section identifies and assesses the anticipated impacts from the project activities on the formal land use and actual land use. For each impact, a set of management measures (which could include mitigation measures, additional requirements, etc.) and monitoring measures have been identified to eliminate or reduce the impact to acceptable levels.

Given that the impacts from the project on land use are similar in nature throughout the various project phases, those have been discussed collectively throughout this section.

11.2.1 Impacts on Formal Land Use during the Planning and Construction Phase

This section identifies and assesses the anticipated impacts from the project activities on the formal land use. For each impact, a set of management measures (which could include mitigation measures, additional requirements, etc.) and monitoring measures have been identified to eliminate or reduce the impact to acceptable levels.

As discussed earlier the project site does not conflict with any of the relevant governmental entities' formal planning context and which includes the following:

- MOMA: the project site does not conflict with MOMA's land use plan, in fact the designated land use for the area allows for the development of such a project.
- MoEnv/RSCN: the project site does not conflict with the MoEnv's/RSCN's planning context as it is not located within established/planned reserves or important bird areas.
- MoA: The project site does not conflict with the MoA's planning context, specifically for grazing reserves and forest lands. However, there are additional requirements from the MoA which must be taken into account by the Developer – those are discussed below.

To this extent, there are no anticipated impacts from the project on the formal land use plans set for the area. However, there are additional requirements from the MoA which must be met and which are discussed below.

Additional Requirements

As discussed earlier, several forest trees were noted within the project site which are generally scattered throughout the site and which include trees such as Pine, Pistachio, Wild Almond, and Wild Prunes. Once a final detailed design has been prepared for the project components, and only if construction activities require any forest trees in the project site be removed, then the EPC Contractor must submit an application to the Ministry of Agriculture (Tafileh Agriculture Directorate) in order to obtain their approval.

The application must provide the final design details of the project, the expected number of trees that will be removed, along with a proper justification as to why they need to be removed (e.g. possible conflict with certain project components). The Directorate will review the application and officials would inspect the site. Such approvals are generally granted and it is highly likely that this will be the case for the project should it be required.

Monitoring and Reporting Requirements

Once obtained and if required, the EPC Contractor is required to submit the official letter of approval of the Ministry of Agriculture.

11.2.2 Impacts on Actual Land Use during the Construction and Operation Phase

Besides potential impacts on the formal land use context set for the area, there are other potential impacts on the actual (or informal) land use of the project site. Inappropriate selection of a project site could entail certain impacts on the local community and nomads given that such lands could provide certain value such as agricultural activities, grazing, etc. – whether it be the land owners or other local community members or nomads whom use the lands but do not necessary own it.

Taking all of the above into account, the potential impacts on the formal land use are discussed below on the potentially affected communities to include the local community grazers and farmers, as well as the nomads, all of which are discussed in details below.

- Land Owners: There are no impacts on land owners as they are willingly leasing their lands for the project development based on a mutually agreed and negotiated price. In addition, the leased lands for the project are generally vacant and there are no permanent structures which would result in any physical displacement.
- Local Community Grazers: grazing activities are not expected to be affected during construction and operation due to the following: (i) project footprint areas are very small and have been calculated to be around 4% of the total leased lands area and 1.4% of the entire project site boundary area; (ii) There is no key habitat for grazing that is restricted within the leased lands or the project site only. The habitat utilized for livestock grazing in the project area is widespread and can be found extensively throughout the region.
- Local Community Farmers: this includes either the land owner or other local community members whom harvest the land in agreement with the land owner or those whom work for the land owner. Such activities are unlikely to be affected during construction and operation. This is due to the fact that project footprint areas are very small and have been calculated to be around 4% of the total leased lands area and 1.4% of the entire project site boundary area.
- Nomadic groups are unlikely to be affected by the construction and operation activities of the project – whether it is in terms of settlement or the agricultural and grazing activities that are undertaken during their settlement in the area. This is due to the following: (i) project footprint areas are very small and

have been calculated to be around 4% of the total leased lands area and 1.4% of the entire project site boundary area.; (ii) Generally nomadic groups do not settle in the exact specific area each year. Therefore, even if some of the project components (which as discussed earlier are of a minimal footprint) are within an area in which a nomad is currently settling, in later years (during construction and operation) nomads could simply settle in other nearby areas.

Given all of the above, the potential impacts on actual land use would be of a short-term duration during the construction phase and of long term duration during the operation phase. Given that there are grazing and agricultural activities taking place by the local community and nomadic settlers in the area, the receiving environment is considered of medium sensitivity. However, the impacts will be of a negative nature, and low magnitude given the small limited footprint of land use that will be affected from the project development. Given all of the above, such an impact is considered to be of minor significance.

Mitigation Measures

The following identifies the mitigation measures to be applied by all involved entities to include the Developer and EPC Contractor during the construction phase and the project Operator during the operational phase unless stated otherwise:

Land Owners

- Developer must ensure that landowners (men and women) are provided with annual lease payments in accordance with the provisions of the land lease agreement. In the case where the land deed includes more than one owner, Developer will provide the payment to the land deed representative.

Land Users – Agricultural Activities

- Prior to construction, consultations will be undertaken with local community land users to develop a baseline in terms of agricultural activities undertaken on leased land areas by the users. The mapping exercise should aim to identify who undertakes agricultural activities in each leased land, their number, patterns, and type of agricultural crops. The Developer in coordination with the EPC Contractor will assign in details the exact areas within the leased lands that are expected to be affected by the project construction and operation – this will include the areas for the project footprint (to include but limited to the turbines, foundations, substation, roads, cables, etc.) and any additional areas required for construction activities such as areas for movement of vehicles and machinery, laydown areas, etc. Developer and EPC Contractor will ensure that such assigned areas are reduced to the greatest extent possible. It is recommended that the Developer allows land users to practice their activities within leased lands outside of construction and operation areas.
- Although highly unlikely, but should any of the agriculture users require assistance in allocating additional lands to undertake agriculture activities, the Developer will help such users to the greatest extent possible through coordination with other land owners in the area and/or on other available public lands.
- Prior to commencement of construction activities, the Developer will disclose to the local communities the information provided below. This will be undertaken through focus group discussions and information sheets in Arabic language at key local platforms where appropriate. This will include (i) the baseline mapping exercise for agricultural activities to verify its outcomes; (ii) announce construction and operation areas and emphasize that agriculture and/or grazing activities cannot take place in such assigned construction and operation areas; (iii) provide construction schedule and duration for which such construction activities will take place; (iv) emphasize that grazing and/or agriculture activities may take place outside of construction and operation areas at all times; (v) provide details on the relocation assistance if required by any agricultural user; and (vi) provide details on the grievance mechanism.

Nomads

- If required (although unlikely) the Developer should provide assistance to nomadic groups in assigning suitable areas outside of construction and operation areas for settlement through coordination with other land owners in the area and/or on other public lands.
- During the period in which nomads begin to settle in the area (April, May and June), Developer will undertake regular site visits to meet with nomadic groups whom arrive onsite. The objective will be to: (i) Announce construction and operation areas and emphasize that settlements as well as agriculture and/or grazing activities cannot take place in such assigned construction and operation areas; (ii) Provide construction schedule and duration for which such construction activities will take place; (iii) Emphasize that settlements as well as grazing and/or agriculture activities may take place outside of construction and operation areas at all times; (iv) Provide details on the relocation assistance if required by any agricultural user; and (v) Provide details on the grievance mechanism.

Monitoring and Reporting Requirements

The following identifies the monitoring and reporting requirements which are to be implemented by the Developer and EPC Contractor accordingly.

Land Owners

- Log with all payment slips signed by land deed representatives.

Land Users – Agricultural Activities

- Produce a comprehensive map which identifies who undertakes agriculture activities, pattern and type for each land parcel and which also assigns construction and operation areas
- If applicable, documentation of relocation assistance with photographs as appropriate to include number of farmers, identified relocated area, etc.
- Prepare disclosure report which includes information on focus group (venue, list of attendees, minutes of meeting, summary of outcomes) and areas where information sheets were posted with photographs as appropriate

Nomads

- Documentation of relocation assistance with photographs as appropriate to include number of nomads, identified relocated area, etc.
- Prepare disclosure report which includes names of nomads met, minutes of meeting, summary of outcomes.

12. GEOLOGY AND HYDROLOGY (SOIL & GROUNDWATER)

This chapter presents the baseline assessment of the project site in relation to geology and hydrology as well as an assessment of potential impacts during the various project phases. For each impact, a set of mitigation measures and monitoring requirements are identified.

12.1 Assessment of Baseline Conditions

This section discusses the methodology for the assessment of baseline conditions in relation to geology and hydrology and presents the outcomes and results of the assessment.

12.1.1 Baseline Assessment Methodology

The assessment of baseline conditions in relation to geology and hydrology is based on collection of secondary data from the relevant governmental entities – this mainly includes the Ministry of Water and Irrigation (MWI), Water Authority of Jordan (WAJ), Natural Resources Authority (NRA) and Department of Meteorology (DoM) for the relevant parameters to include climatic data, precipitation, geological and hydrogeological settings, etc.

12.1.2 Results

Presented below are the outcomes and results in details for geology, hydrology, and hydrogeology.

(i) Geology

The main geological formations that comprise the project site is presented in the figure below. The geological settings of Jordan comprise various geological units depending on the site of the study and the outcrops in the area. The study area lies in an area where Upper Cretaceous Wadi Sir Limestone (WSL) and recent Soil (S) units are the most dominant. The surroundings are covered with different geological units. WSL formation is the most abundant in the study area as a whole covering the biggest part of the area, while, the Upper Cretaceous Amman Silicified Limestone (ASL) is the second dominant formation; the formation consists of two subdivisions: a lower silicified limestone unit (30-100 m thick) and an upper phosphorite unit.

The silicified limestone was deposited on a shallow carbonate platform along the fringes of the Tethyan seaway. Cretaceous Wadi Ghudran (Wg) chalk formation covers parts in the northeastern and northern parts. Kurnub Sandstone (KS) formation outcrops in the southern parts. Upper Cretaceous Fuheis, Hummar, and Shuayb formations are also present; Fuheis Formation overlies the Naur Formation and is overlain by the Hummar Formation throughout most of north Jordan, with a maximum thickness of 80 m. It is composed of fossiliferous marl and marly limestone, and includes foraminifera, ostracods, gastropods and echinoids. The Hummar Formation is overlain by the Shuayb Formation, a prominent cliff-forming carbonate unit thinning rapidly south of Wadi Mujib, Central Jordan. The formation consists of gray limestone, dolomitic limestone and dolomite with relatively poor macrofossil content. The Shuayb Formation is early Turonian in age, and is overlain by the Wadi As Sir Formation. It consists of thinly bedded limestone and marly limestone, which is mostly fossiliferous, including ammonites and foraminifera that support the age.

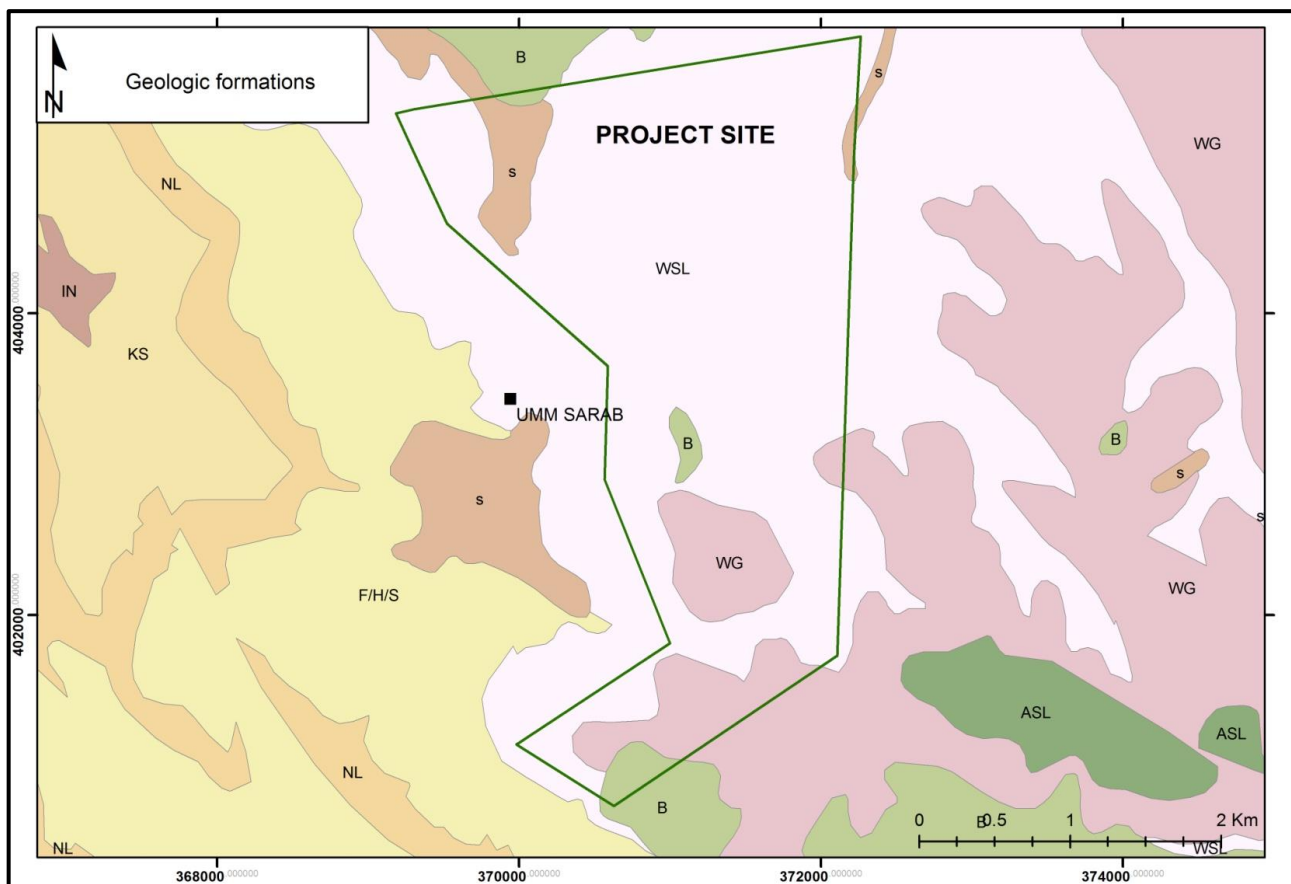


Figure 18: Geological formations of the area

(ii) Hydrology

The study area is located on the border between Hasa and North Wadi Araba surface water basins as noted in the figure below. Hasa surface water basin has an area of 2,530 km² and receives an average rainfall of 190 mm/a generating surface runoff collected in Hasa dam with a total capacity of 8 MCM. The North Wadi Araba (NWARABA) basin has a total area of 2,929 km² and receives an average rainfall of 220 mm/a. This basin discharges its flood water to the Jordan valley mainly through steep wadis trending East West and highly affected by the structure of the Jordan rift valley extending from the Red sea to the Tiberius lake.

As noted in Figure 20, a number of wadi systems run within the central and eastern part of the project site.

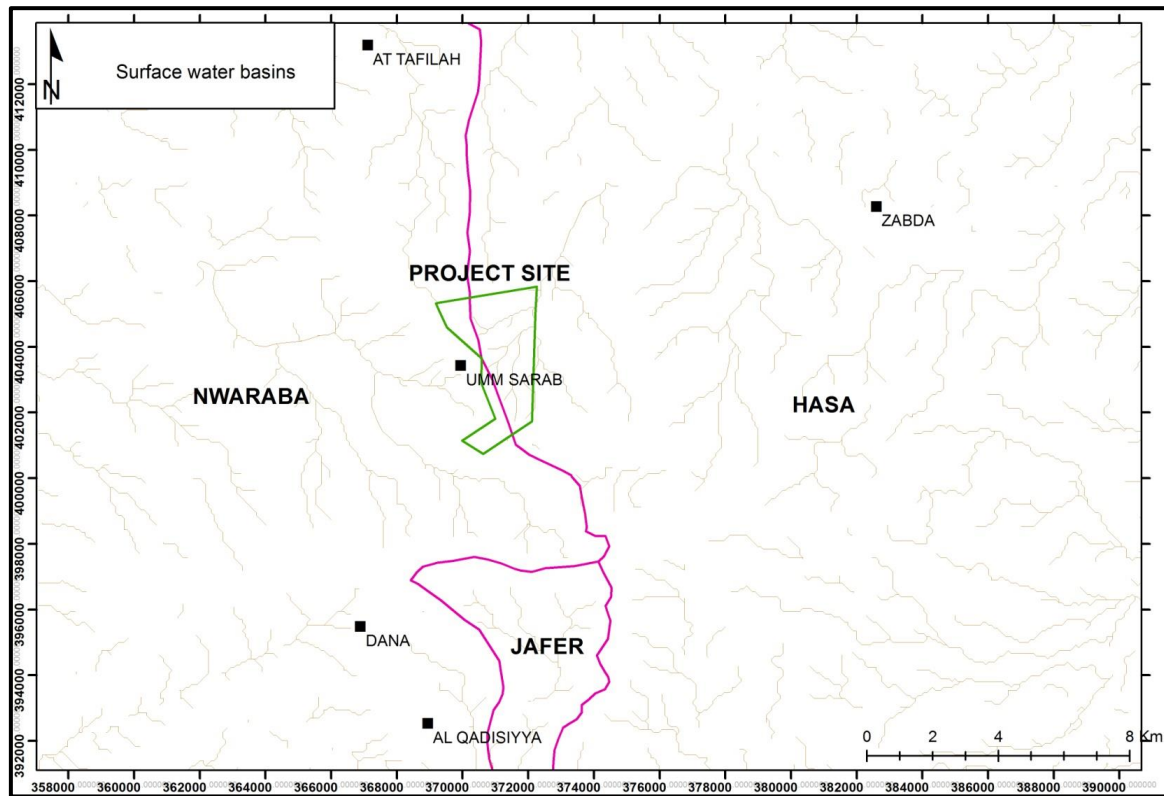


Figure 19: Surface water basins of the area

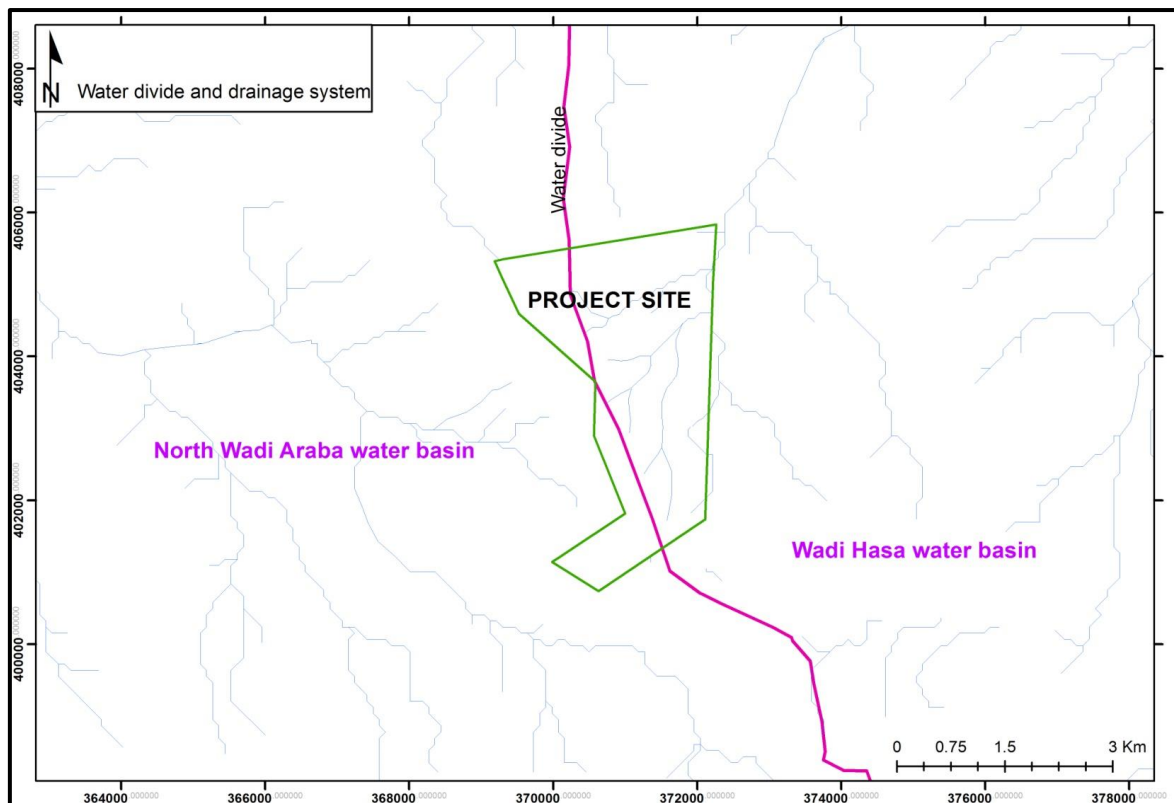


Figure 20: Drainage System for the project area

(iii) Hydrogeology

Hydrogeologically the area is located within the Mujib groundwater basin which is also called Dead Sea basin. The Mujib groundwater basin is located in the central western part of Jordan near the borders with a total area of approximately 6,874 km².

The high topographical gradient towards the Dead Sea, with a prevailing wind direction facing the slope, allow for the occurrence of sudden cloud uplift resulting in an average precipitation range of less than 100 mm/a in the Dead Sea area to more than 500 mm/a in the eastern highlands.

Due to relatively high precipitation rates in the east, groundwater flow is initiated. The groundwater flow regime in the B2A7 aquifer follows the topographic variation, with dominant flow direction from east to west.

The Dead Sea basin is a vital source of groundwater in the country as a result of its high productivity, supplying about 8% of the total water supply. The basin hosts the lowest-altitude natural reserve in the world—known as Mujib reserve—at 420 m.b.s.l. in the reserve's western parts. Annual groundwater pumping from this basin was about 79 MCM in 2013 with a recharge rate of 57 MCM/a.

Groundwater development in the Dead Sea basin began in the early '70s to cover local water needs. This development expanded to transboundary water pumping in the '90s with more than 500 wells drilled mainly in the upper cretaceous limestone aquifer—known locally as B2A7. Over-exploitation of the B2A7 aquifer system has resulted in a rapid plunge of the water table to more than 3.5 m in some areas, which affects wells' productivity, spring discharge, and related ecosystem services

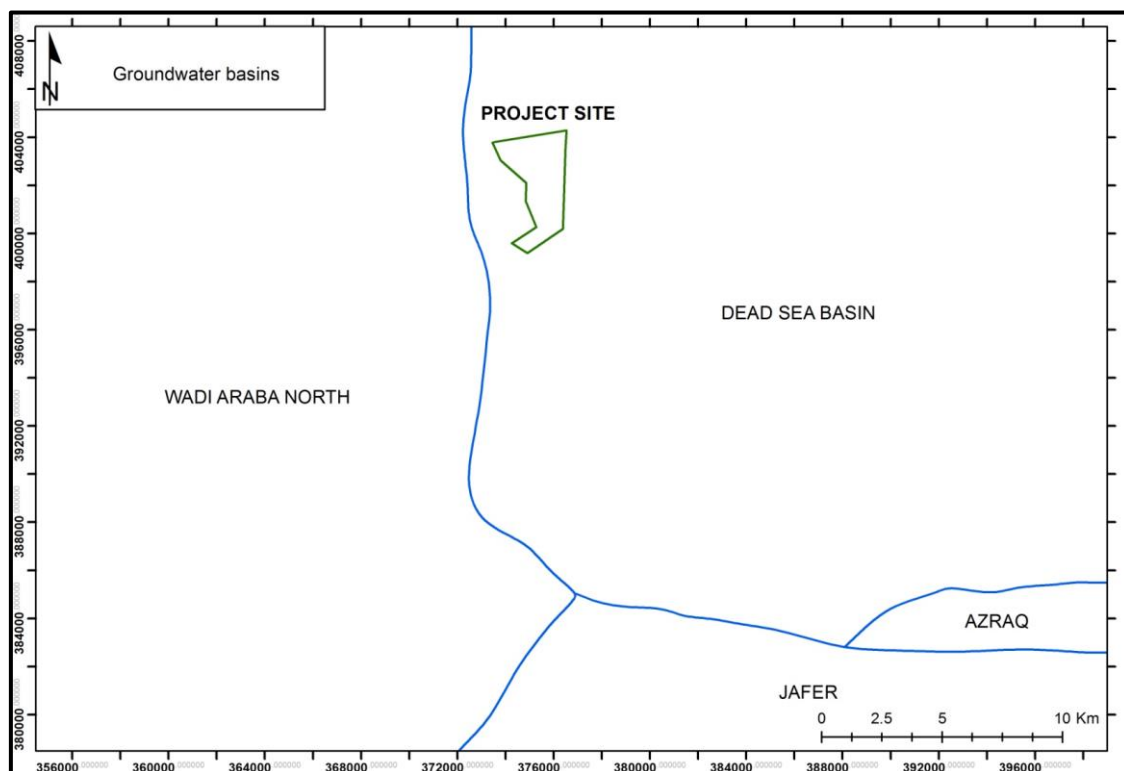


Figure 21: Groundwater basins of the area

12.2 Assessment of Potential Impacts

This section identifies the anticipated impacts on/from geology and hydrology (soil and groundwater) from/on the project activities during the planning and construction phase as well as the operation phase. In addition, for each impact a set of mitigation measures and monitoring requirements has been identified.

12.2.1 *Potential Impacts from Local Flood Hazards during the Planning and Construction Phase*

As discussed earlier, the project site is located on a water divide between the Hasa Surface water Basin and the North Wadi Araba Water Surface Water Basin. Given that, the project site is not considered to be located within any specific catchment area. Nevertheless, the drainage system within the project site consists of four interconnected minor wadis which start from the water divide and extend 2-3km downstream within the project area (Figure 20).

Such wadi systems could be subject to potential risks of local flood hazard during the rainy season and especially during flash flood events which in turn could affect the project components. Such risks must be taken into consideration throughout the planning phase of the project as they could inflict damage to the project and its various components.

Presented below is a preliminary flood risk assessment to investigate such risks and which is undertaken as part of the ESIA study. The flood risk assessment was based on the study of the catchment area, rainfall and runoff and flood flow. Results are discussed below.

a. Rainfall

Three rainfall stations are located in the area surrounding the project site – DD0001, DC0002, DE0001. Long term rainfall records have been collected from the three stations and are used for the analysis and prediction of flood risk. Data acquired from these stations are discussed below.

In addition, the spatial distribution of rainfall in the area was modelled based on the data from the three rainfall stations. The figure below presents spatial distribution of annual rainfall in the area – as noted the project site has an average annual rainfall between 195-205mm/year.

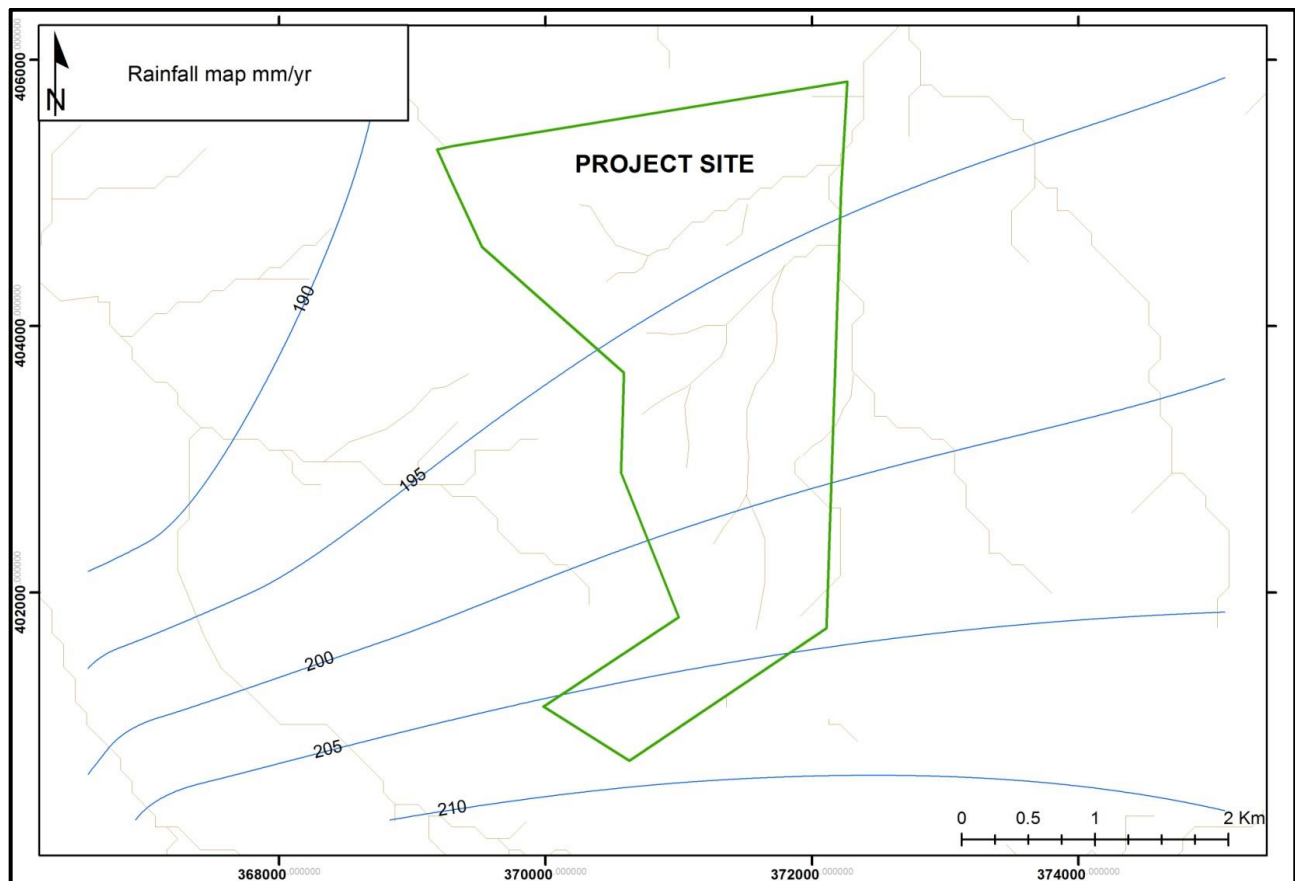


Figure 22: Rainfall stations around the project site

b. Runoff and Flood Flow

Generally flood risks are calculated by studying the characteristic of the catchment area as well as the rainfall runoff through flood hydrographs. However, this is not possible for the project site given that it is not located within any specific catchment area. As discussed earlier, the project site is located on a water divide in which flood risks are considered minor and minimal.

Generally, flood initiates at water divides and with time and distance accumulates downstream; therefore flood hazards are usually low upstream at water divides and increase downstream of catchments. This is true for the project site as well where the wadi systems within the project site have low flood risks. The drainage

system within the project area is composed of four minor wadis which start from the water divide and extend 2-3 km downstream – which is considered a very short distance to generate any significant floods. The expected flood would be less than 2 m³/s at the outlet of any wadi system within the project site.

Taking the above into account, the BI. At a distance of 10 m from such wadi systems there are no flood risks.

Given all of the above, the potential impacts from flood risks would be of a long-term duration. The impacts will be of a negative nature, and low magnitude given that the flood risk potential is low. In addition, the receiving environment is considered of medium sensitivity. Given all of the above, such an impact is considered to be of minor significance.

Mitigation Measures

The following identifies the mitigation measures to be applied by the EPC Contractor during the planning phase and which include:

- Flood risks within the project site are limited to the four minor wadi systems which run within the project site and in which flood risks are generally considered minor. At a distance of 10 m from such wadi systems there are no flood risks. Therefore, it is recommended that the EPC Contractor, as part of the design prepared for the project, avoid sitting any of the project components within a buffer distance of 10m from the wadi systems within the project site.
- Should the project require sitting any of its infrastructure elements (such as roads) within the wadi system then a detailed hydrological and flood risk study must be undertaken. Based on the preliminary and indicative study presented above, the expected flood will be less than 2 m³/s at the outlet of any wadi system within the project site. However, the above must be confirmed by a detailed hydrological and flood risk study which should determine the required engineering flood discharge structures to be considered as part of the detailed design (e.g. culverts) as per the expected flood.

Following the implementation of these mitigation measures, the significance of the residual impact can be reduced to not significant.

Monitoring and Reporting Requirements

The following identifies the monitoring and reporting requirements that must be adhered to by the EPC Contractor during the construction phase and which include:

- Submission and review of final detailed design which takes into account the required flood protection measures.

12.2.2 Potential Impacts from Improper Management of Waste Streams during Construction and Operation

Given the generic nature of the impacts for both phases of the project (construction and operation) those have been identified collectively throughout this section. Generally, this includes potential impacts from improper housekeeping practices (e.g. improper management of waste streams, improper storage of construction material and of hazardous material, etc.).

Improper housekeeping practices during construction and operation (such as illegal disposal of waste to land) could contaminate and pollute soil which in turn could pollute groundwater resources. This could also indirectly affect flora/fauna and the general health and safety of workers (from being exposed to such waste streams). Generally, such impacts can be adequately controlled through the implementation of general best practice housekeeping measures as highlighted throughout this section, and which are expected to be implemented by the EPC Contractor throughout construction phase and by the project Operator during the operation phase.

The potential impacts from improper management of waste streams could be of a long-term duration throughout the construction and operation phase. Such impacts are negative in nature, and are considered of low magnitude they are generally controlled through the implementation of general best practice housekeeping measures. The receiving environment is considered of medium sensitivity. Given all of the above, such an impact is considered to be of minor significance.

Following the implementation of the mitigation measures highlighted throughout this section, the residual significance can be reduced to not significant.

(iii) Solid Waste Generation

Solid waste is expected to be generated from construction and operational activities. Solid waste generated will likely include construction waste (such as debris) and municipal solid waste (during construction and operation such as cardboard, plastic, food waste, etc.). Municipal and construction waste generated will likely be collected and stored onsite and then disposed to the closest municipal approved landfill (Jurf Al Daraweesh Landfill).

Mitigation Measures

The following identifies the mitigation measures to be applied by all involved entities to include the EPC Contractor during the construction phase and the project Operator during the operational phase unless stated otherwise:

- Coordinate with Bseria Municipality or hire a competent private contractor for the collection of solid waste from the site to the municipal approved landfill (the closest landfill being Jurf Al Daraweesh Landfill);
- Prohibit fly-dumping of any solid waste to the land;
- Distribute appropriate number of properly contained litter bins and containers properly marked as "Municipal Waste";
- EPC Contractor only - during construction, distribute a sufficient number of properly contained containers clearly marked as "Construction Waste" for the dumping and disposal of construction waste. Where possible, the EPC Contractor must seek ways to reduce construction waste by reusing materials (for example through recycling of concrete for road base coarse);
- Implement proper housekeeping practices on the construction site at all times; and
- Maintain records and manifests that indicate volume of waste generated onsite, collected by contractor, and disposed of at the landfill. The numbers within the records are to be consistent to ensure no illegal dumping at the site or other areas.

Monitoring and Reporting Requirements

The following identifies the monitoring and reporting requirements that must be adhered to by all involved entities to include the EPC Contractor during the construction phase and the project Operator during the operational phase unless stated otherwise:

- Inspection of waste management practices onsite;
- Review of records and manifests for volume of waste generated to ensure consistency; and
- Regular environmental reporting on implementation of the waste management practices onsite.

(iv) Wastewater Generation

Wastewater is mainly expected to include black water (sewage water from toilets and sanitation facilities), as well as grey water (from sinks, showers, etc.) generated from workers during the construction and operation phase. Wastewater quantities are expected to be minimal. It is expected that wastewater will be collected and stored in fully contained septic tanks and then collected and transported by transportation tankers to be disposed at either Tafileh Waste Water Treatment Plant (WWTP) or Jurf Al Daraweesh Landfill.

Mitigation Measures

The following identifies the mitigation measures to be applied by all involved entities, to include the EPC Contractor during the construction phase and the project Operator during the operational phase, unless stated otherwise:

- Prohibit illegal disposal of wastewater to the land;
- Coordinate with Tafileh Water Directorate to hire a private contractor for the collection of wastewater from the site to either Tafileh WWTP or Jurf Al Daraweesh Landfill;
- Maintain records and manifests that indicate volume of wastewater generated onsite, collected by contractor, and disposed of at the WWTP. The numbers within the records are to be consistent to ensure no illegal discharge at the site or other areas;
- EPC Contractor only - ensure that constructed septic tanks during construction and those to be used during operation are well contained and impermeable to prevent leakage of wastewater into soil; and
- Ensure that septic tanks are emptied and collected by wastewater contractor at appropriate intervals to avoid overflowing.

Monitoring and Reporting Requirements

The following identifies the monitoring and reporting requirements that must be adhered to by all involved entities to include the EPC Contractor during the construction phase and the project Operator during the operational phase, unless stated otherwise:

- Inspection of wastewater management practices onsite;
- Review of records and manifests for volume of wastewater generated to ensure consistency; and
- Regular environmental reporting on implementation of the wastewater management practices discussed above.

(v) Hazardous Waste Generation

Hazardous waste is expected to be generated throughout both the construction and operation phase. This could include simple materials such as consumed oil, chemicals, paint cans, etc. Given the nature of the project, hazardous waste quantities are expected to be relatively low. Nevertheless, hazardous waste generated will likely be collected and stored onsite and then disposed at the 'Swaqa Hazardous Waste Treatment Facility' which is managed by the MoEnv.

Mitigation Measures

The following identifies the mitigation measures to be applied by all involved entities to include the EPC Contractor during the construction phase the project Operator during the operational phase, unless stated otherwise.

- Prohibit illegal disposal of hazardous waste to the land;
- Follow the requirements for management and storage as per the 'Instructions for Hazardous Waste Management and Handling of the Year 2003' of the MoEnv;

- Coordinate with the MoEnv and hire a private contractor for the collection of hazardous waste from the site to the Swaqa Hazardous Waste Treatment Facility;
- Ensure that containers are emptied and collected by the contractor at appropriate intervals to prevent overflowing; and
- Maintain records and manifests that indicate volume of hazardous waste generated onsite, collected by contractor, and disposed of at the Swaqa Facility. The numbers within the records are to be consistent to ensure no illegal discharge at the site or other areas.

Monitoring and Reporting Requirements

The following identifies the monitoring and reporting requirements that must be adhered to by all involved entities to include the EPC Contractor during the construction phase and the project Operator during the operational phase, unless stated otherwise:

- Inspection of hazardous waste management practices onsite;
- Review of records and manifests for volume of hazardous waste generated to ensure consistency; and
- Regular environmental reporting on implementation of the hazardous waste management practices onsite.

(vi) Hazardous Material

The nature of construction and operational activities entail the use of various hazardous materials such as oil, chemicals, and fuel for the various equipment and machinery. Improper management of hazardous material entails a risk of leakage into the surrounding environment either from storage areas or throughout the use of equipment and machinery.

Mitigation Measures

The following identifies the mitigation measures to be applied by all involved entities to include the EPC Contractor during the construction phase the project Operator during the operational phase, unless stated otherwise.

- Ensure that hazardous materials are stored in proper areas and in a location where they cannot reach the land in case of accidental spillage. This includes storage facilities that are of hard impermeable surface, flame-proof, accessible to authorized personnel only, locked when not in use, and prevents incompatible materials from coming in contact with one another. The provisions of the Jordanian Standard (JS) 431/1985 – General Precautionary Requirements for Storage of Hazardous Materials must be adhered to;
- Maintain a register of all hazardous materials used and accompanying Material Safety Data Sheet (MSDS) at all times. Spilled material should be tracked and accounted for;
- Incorporate dripping pans at machinery, equipment, and areas that are prone to contamination by leakage of hazardous materials (such as oil, fuel, etc.);
- Regular maintenance of all equipment and machinery used onsite. Maintenance activities and other activities that pose a risk for hazardous material spillage (such as refuelling) must take place at a suitable location (hard surface) with appropriate measures for trapping spilled material;
- Ensure that a minimum of 1,000 litres of general purpose spill absorbent is available at hazardous material storage facility. Appropriate absorbents include elite, clay, peat and other products manufactured for this purpose; and
- If spillage on soil occurs, spill must be immediately contained, cleaned-up, and contaminated soil disposed as hazardous waste.

Monitoring and Reporting Requirements

The following identifies the monitoring and reporting requirements that must be adhered to by all involved entities to include the EPC Contractor during the construction phase and the project Operator during the operational phase, unless stated otherwise.

- Inspection for storage of hazardous materials to include inspections for potential spillages or leakages; and
- Report any spills and the measures taken to minimize the impact and prevent from occurring again.

13. BIODIVERSITY

This Chapter first provides an assessment of baseline conditions within the project site and its surroundings in relation to biodiversity and then assesses the anticipated impacts from the project throughout its various phases. For each impact, a set of management measures (which could include mitigation measures, additional requirements, etc.) and monitoring measures have been identified to eliminate or reduce the impact to acceptable levels.

It is important to note that the biodiversity assessed in this chapter excludes birds (avi-fauna) and bats, which are discussed separately in “Chapter 14” and “Chapter 15” respectively.

13.1 Assessment of Baseline Conditions

This section discusses the methodology for the assessment of the baseline conditions in relation to biodiversity and presents the outcomes and results.

13.1.1 Baseline Assessment Methodology

The baseline assessment of the project site was based on a literature review and a field survey, each of which is discussed in details below.

(i) Literature Review

This was based on previous studies, data, surveys, and records available in published scientific papers, books, and journals on flora and fauna species recorded within the study region in general.

(ii) Field Survey

A field survey was undertaken at the project site during the spring of 2014 and 2016, since the season is the best time for flora and fauna. The biodiversity of the site is considered to be the highest during this period and thus would provide the best representation of the site. The field survey mainly included the following methods:

- Field observations: the site was examined carefully for the presence of active animals, animal signs and tracts, active burrows, remains or any other vital signs that indicate the activity of animals. In addition the site was surveyed for occurring plant species which were noted and recorded to include number of species, coverage interception per species, etc.;
- Trapping: Sherman rodent traps were used to trap small mammals. The distribution of the traps was opportunistic and were placed in areas where a high activity for small mammals was either observed or predicted;
- Line transects: transects in many areas of the project site of over 100 m long were undertaken for the detailed assessment of flora and fauna species. Observed species were recorded and photographed where possible; and
- Interviews with local people: local people of the area were interviewed and asked questions regarding well known fauna species that are likely to be present within the site. A book with illustrations and images of fauna species were shown throughout the process in order to accurately confirm their presence.

(iii) Fauna & Flora Species' status

Floral species recorded onsite generally had no international conservation status as they were not assessed by the International Union for the Conservation of Nature (IUCN). Therefore, the relevant reference in Jordan is the National Red List of Plants of Jordan Vol. 1 (Tafiour *et al*, 2014).

The fauna species status was assigned based on their conservation status in the IUCN Red List of Threatened Species (IUCN, 2016) and also based on the regional assessment of threatened species for the Mediterranean region (IUCN, 2016). In Jordan, currently there are no official assigned conservation status for faunal species (to include mammals, reptiles and amphibians). However, local conservation status of faunal species were assigned based on the expert's extensive experience, knowledge and studies undertaken with regards to the ecology and biodiversity of Jordan.

13.1.2 Results

In accordance with the methodology discussed above, the results below discuss the findings and outcomes for flora and fauna based on the literature review and the field survey.

(i) Flora

According to the biogeographical map of Jordan (Albert *et al.*, 2003), the project site is located in the Mediterranean biogeographical region (Figure 23).

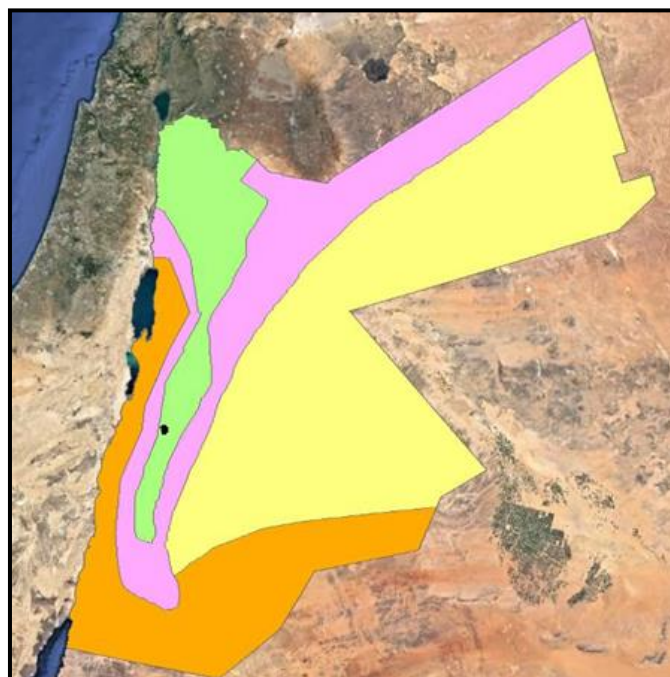


Figure 23: Biogeographical Regions in the project Site (Albert *et al.*, 2003).

According to Elsawi (1996), the Mediterranean Biogeographical region is characterized by having the highest rainfall in the country, which ranges from 400-600mm/year. It is also known for having the most fertile soil, the highest altitude the least summer temperature and the highest vegetation cover. The region includes almost all mountain ranges in the country.

According to vegetation classification types proposed by Albert *et al.* (2005), the project site is located in the Mediterranean Non-forest – Batha vegetation type. As the name implies, this vegetation type is located in the areas of the Mediterranean biogeographical region where forests do not exist naturally. According to Eisawi D. (1996), the most dominant species present in this vegetation type in southern Jordan is *Artemisia herba-alba*.

Typically, in areas such as the project site, the land is composed of a mosaic of natural vegetation, mainly dominated by shrub vegetation, and transformed agricultural lands. These agricultural lands are either

seasonally planted by wheat and barley which can be used as fodder for livestock or perennially planted by fruit trees such as grapes, olive and others.

A total of 120 plant species were recorded on the project site. According to the National Red List of Plants Vol. 1 (Taifour *et al*, 2014), 30 of these species were not evaluated while the remaining 90 species have a conservation status on the national level, based on the IUCN Regional Criteria of Threatened Species. 87 of the species are evaluated as Least Concern while the remaining three are evaluated as threatened; one Endangered and two as Vulnerable.

Table 29: Floral Species within the Site

Family	Species	Status in the National Red List of Jordan
Amaranthaceae	<i>Noaea mucronata</i>	Least Concern
Amaryllidaceae	<i>Allium aschersonianum</i>	Not Evaluated
Apiaceae	<i>Eryngium creticum</i>	Least Concern
	<i>Eryngium glomeratum</i>	Least Concern
	<i>Malabaila secacul</i>	Not Evaluated
Araceae	<i>Biarum olivieri</i>	Not Evaluated
	<i>Eminium spiculatum</i>	Vulnerable
Asparagaceae	<i>Bellevalia eigii</i>	Not Evaluated
	<i>Ornithogalum divergens</i>	Not Evaluated
Boraginaceae	<i>Alkanna tinctoria</i>	Least Concern
	<i>Anchusa strigosa</i>	Least Concern
	<i>Nonea melanocarpa</i>	Least Concern
	<i>Paracaryum intermedium</i>	Not Evaluated
	<i>Rochelia disperma</i>	Least Concern
Brassicaceae	<i>Alyssum homalocarpum</i>	Not Evaluated
	<i>Biscutella didyma</i>	Least Concern
	<i>Lepidium draba</i>	Least Concern
	<i>Clypeola jonthlaspi</i>	Least Concern
	<i>Diploaxis harra</i>	Least Concern
	<i>Hirschfeldia incana</i>	Least Concern
	<i>Isatis lusitanica</i>	Least Concern
	<i>Malcolmia africana</i>	Least Concern
	<i>Matthiola parviflora</i>	Least Concern
	<i>Silene colorata</i>	Least Concern
	<i>Silene conoidea</i>	Least Concern
Caryophyllaceae	<i>Gypsophila pilosa</i>	Least Concern
	<i>Gypsophila arabica</i>	Least Concern
	<i>Vaccaria hispanica</i>	Least Concern
Colchicaceae	<i>Coilchicum ritchii</i>	Endangered
Compositae	<i>Achillea fragrantissima</i>	Least Concern
	<i>Achillea cretica</i>	Not Evaluated
	<i>Artemisia sieberi</i>	Least Concern
	<i>Calendula tripterocarpa</i>	Least Concern
	<i>Carlina cureatum</i>	Not Evaluated
	<i>Carlina hispanica</i>	Not Evaluated

Family	Species	Status in the National Red List of Jordan
	<i>Carthamus glaucus</i>	Least Concern
	<i>Centaurea eryngioides</i>	Least Concern
	<i>Centaurea pallescens</i>	Least Concern
	<i>Chiliadenus iphionoides</i>	Least Concern
	<i>Cousinia moabitica</i>	Vulnerable
	<i>Crepis sancta</i>	Least Concern
	<i>Crupina crupinastrum</i>	Least Concern
	<i>Echinops glaberrimus</i>	Least Concern
	<i>Echinops polyceras</i>	Least Concern
	<i>Filago contracta</i>	Least Concern
	<i>Lactuca tuberosa</i>	Least Concern
	<i>Lactuca undulata</i>	Least Concern
	<i>Lasiopogon muscoides</i>	Least Concern
	<i>Launaea spinosa</i>	Least Concern
	<i>Notobasis syriaca</i>	Least Concern
	<i>Onopordum ambiguum</i>	Least Concern
	<i>Picnemon acarna</i>	Least Concern
	<i>Rhagadiolus stellatus</i>	Least Concern
	<i>Scorzonera psychrophila</i>	Least Concern
	<i>Senecio laucanthemifolius</i>	Not Evaluated
	<i>Teucrium polium</i>	Least Concern
	<i>Tragopogon collinus</i>	Least Concern
	<i>Urospermum picroides</i>	Least Concern
Euphorbiaceae	<i>Euphorbia hierosolymitana</i>	Least Concern
Geraniaceae	<i>Erodium cicutarium</i>	Least Concern
	<i>Erodium crassifolium</i>	Least Concern
	<i>Erodium malacoides</i>	Least Concern
	<i>Geranium rotundifolium</i>	Least Concern
	<i>Geranium tuberosum</i>	Least Concern
Iridaceae	<i>Gladiolus atrovioleaceus</i>	Least Concern
	<i>Moraea sisyrinchium</i>	Least Concern
	<i>Iris petrana</i>	Not Evaluated
Lamiaceae	<i>Ballota undulata</i>	Not Evaluated
	<i>Origanum syriacum</i>	Least Concern
	<i>Marrubium cuneatum</i>	Not Evaluated
	<i>Nepeta congesta</i>	Not Evaluated
	<i>Phlomis brachyodon</i>	Least Concern
	<i>Salvia ceratophylla</i>	Least Concern
	<i>Salvia multicaulis</i>	Not Evaluated
	<i>Salvia syriaca</i>	Least Concern
	<i>Teucrium polium</i>	Least Concern
	<i>Ziziphora capitata</i>	Least Concern
Leguminosae	<i>Astracantha bethlehemitica</i>	Not Evaluated

Family	Species	Status in the National Red List of Jordan
	<i>Astragalus asterias</i>	Least Concern
	<i>Astragalus caprinus</i>	Least Concern
	<i>Astragalus tribuloides</i>	Least Concern
	<i>Hippocrepis unisiliquosa</i>	Least Concern
	<i>Onobrychis kotschyana</i>	Least Concern
	<i>Ononis natrix</i>	Least Concern
	<i>Trigonella stellata</i>	Least Concern
	<i>Medicago astroites</i>	Not Evaluated
Liliaceae	<i>Gagea reticulata</i>	Least Concern
Papaveraceae	<i>Fumaria parviflora</i>	Least Concern
	<i>Glaucium grandiflorum</i>	Least Concern
	<i>Hypecoum pendulum</i>	Least Concern
	<i>Papaver hybridum</i>	Least Concern
	<i>Roemeria hybrida</i>	Least Concern
Plantaginaceae	<i>Anarrhinum forsskaolii</i>	Least Concern
	<i>Plantago ciliata</i>	Not Evaluated
Poaceae	<i>Avena barbata</i>	Least Concern
	<i>Avena sterilis</i>	Least Concern
	<i>Bromus syriacus</i>	Not Evaluated
	<i>Bromus tectorum</i>	Least Concern
	<i>Dactylis glomerata</i>	Least Concern
	<i>Echinaria capitata</i>	Least Concern
	<i>Herniaria hirsuta</i>	Least Concern
	<i>Hordeum mirinum</i>	Not Evaluated
	<i>Hordeum spontaneum</i>	Least Concern
	<i>Piptatherum blanchianum</i>	Not Evaluated
	<i>Poa bulbosa</i>	Least Concern
	<i>Stipa capensis</i>	Least Concern
Polygonaceae	<i>Polygonum equisetiforme</i>	Least Concern
Ranunculaceae	<i>Adonis aestivalis</i>	Least Concern
Resedaceae	<i>Reseda alba</i>	Least Concern
	<i>Reseda lutea</i>	Least Concern
Rhamnaceae	<i>Rhamnus palaestinus</i>	Not Evaluated
Rosaceae	<i>Prunus microcarpa</i>	Not Evaluated
	<i>Crataegus azarolus</i>	Not Evaluated
Rubiaceae	<i>Asperula arvensis</i>	Least Concern
	<i>Callipeltis cucullaria</i>	Not Evaluated
	<i>Rubia tenuifolia</i>	Least Concern
Scrophulariaceae	<i>Scropholaria xanthglossa</i>	Not Evaluated
	<i>Verbascum fruticosum</i>	Not Evaluated
	<i>Verbascum sinaiticum</i>	Not Evaluated
Solanaceae	<i>Hyoscyamus reticulatus</i>	Not Evaluated

(ii) Fauna

The specific outcomes of the field survey in relation to faunal species are discussed below and which includes mammals and reptiles and amphibians.

a. Mammals

The study site in particular was not studied in details in previous faunal studies. Therefore, scattered records from the area are scanty (Table 30). Small mammals and carnivores were recorded from the vicinity of the project site (Amr, 2012).

Table 30: Terrestrial Mammals recorded from the Vicinity of the Study Area

Family	Scientific name	Common name	Global IUCN status	Mediterranean IUCN status
Erinaceidae	<i>Erinaceus concolor</i>	Eastern European Hedgehog	Least Concern	Least Concern
Rhinolophidae	<i>Rhinolophus blasii</i>	Blasius's Horseshoe Bat	Least Concern	Near Threatened
Vespertilionidae	<i>Myotis nattereri</i>	Natterer's Bat	Least Concern	Least Concern
	<i>Plecotus christii</i>	Northeast African Long-eared Bat	Data Deficient	Data Deficient
Leporidae	<i>Lepus capensis</i>	Cape Hare	Least Concern	Least Concern
Muridae	<i>Gerbillus dasyurus</i>	Wagner's Gerbil	Least Concern	Least Concern
	<i>Meriones tristrami</i>	Tristram's jird	Least Concern	Least Concern
	<i>Meriones libycus</i>	Libyan jird	Least Concern	Least Concern
Canidae	<i>Vulpes vulpes</i>	Red fox	Least Concern	Least Concern
	<i>Canis lupus</i>	Gray Wolf	Least Concern	Least Concern
	<i>Hyaena hyaena</i>	Striped Hyena	Near Threatened	Vulnerable

Trapping yielded only three species of rodents (Table 31). The House Mouse, *Mus musculus* (Figure 24) was trapped from rocky area with fodder remains. This is an invasive species known to frequent farms and areas with agricultural activities. In the wild, this species does not exist and is considered as a pest.

Table 31: Small Mammals Recorded from the Study Site

Common Name	Scientific Name	Global IUCN status	Mediterranean IUCN Status
House Mouse	<i>Mus musculus</i>	Least Concern	Least Concern
Libyan Jird	<i>Meriones libycus</i>	Least Concern	Least Concern
Wagner's Gerbil	<i>Gerbillus dasyurus</i>	Least Concern	Least Concern

Red Fox, *Vulpes vulpes* was observed on several occasions during the various surveys that were carried out in the project site.



Figure 24: The House Mouse, *Mus musculus*.

b. Reptiles and Amphibians

Virtually no previous studies on the reptiles and amphibians were conducted within the boundaries of the project site (Table 32). However, scattered records of snakes and other reptiles can give an idea on the herpetology of the area (El-Oran et al., 1994; Disi et al., 2001; Amr & Disi, 2011). Apart from the IUCN Red List of Threatened Species, there are no relevant conservation assessments that were available for the reptile species. During the surveys, the globally threatened (Vulnerable) Spur-thighed Tortoise *Testudo graeca* was recorded in several locations in the project site.

Table 32: Reptilian Species Known to Occur within the Study Area

Family	Scientific name	Common name	Global IUCN status
Testudinidae	<i>Testudo graeca</i>	Spur-thighed Tortoise	Vulnerable
Gekkonidae	<i>Ptyodactylus guttatus</i>	Spotted Fan-footed gecko	Not Evaluated
Chamaeleonidae	<i>Chamaeleo chamaeleon</i>	Mediterranean Chameleon	Least Concern
Agamidae	<i>Stellagama stellio</i>	Starred agama	Least Concern
Lacertidae	<i>Acanthodactylus boskianus</i>	Bosk's fringe-toad lizard	Not Evaluated
	<i>Ophisops elegans</i>	Snake-eyed lizard	Not Evaluated
Scincidae	<i>Chalcides ocellatus</i>	Ocellated skink	Not Evaluated
Colubridae	<i>Dolichophis jugularis</i>	Large whip snake	Least Concern
	<i>Hemorrhois nummifer</i>	Coin snake	Not Evaluated
	<i>Eirenis rothi</i>	Roth's dwarf snake	Least Concern
	<i>Eirenis coronella</i>	Crowned dwarf snake	Least Concern
	<i>Malpolon insignitus</i>	Montpellier snake	Not Evaluated

Family	Scientific name	Common name	Global IUCN status
	<i>Telescopus nigriceps</i>	Black-headed cat snake	Least Concern

Three lizard species were observed in the study site (Table 33). The Small Spotted Desert Racer *Mesalina guttulata* was observed in gravelly areas in the eastern section of the study site, while *Ophisops elegans* was found more into the western section in milder habitats close to agricultural ploughed fields. The Starred Agama *Stellagama stellio* was confined to rocky areas around wadi beds.

Table 33: Reptiles Observed in the Study Area

Family	Scientific name	Common name	IUCN status
Agamidae	<i>Stellagama stellio</i>	Starred agama	Least Concern
Lacertidae	<i>Mesalina guttulata</i>	Small spotted desert racer	Not Evaluated
	<i>Ophisops elegans</i>		Not Evaluated

A road-killed Montpellier snake, *Malpolon insignitus*, was observed along the main road passing through the project site.

13.2 Assessment of Potential Impacts

This section identifies and assesses the anticipated impacts from the project activities on biodiversity during the various phases to include planning and construction phase and operation phase. For each impact, a set of management measures (which could include mitigation measures, additional requirements, etc.) and monitoring measures have been identified to eliminate or reduce the impact to acceptable levels.

13.2.1 Potential Impacts during the Construction Phase

Site preparation activities which are to take place onsite by the EPC Contractor for installation of the wind turbines and the various project components to include transmission cables, access roads and internal road network, buildings, etc. are expected to include land clearing activities, levelling, excavation, grading, etc.

Such activities are limited to the relatively small individual footprints of these facilities and the actual area of disturbance is relatively minimal. Nevertheless, such activities would likely result in the alteration of the site's habitat and thus potentially disturb existing habitats. Other impacts on the biodiversity of the site are mainly from improper management of the site which could include improper conduct and housekeeping practices by workers (i.e. hunting of animals, discharge of hazardous waste to land, etc.).

However, as discussed in the baseline section, generally the site is considered of low ecological significance due to its natural setting; characterized by having scattered vegetation cover in an arid environment. However, three nationally threatened plant species have been recorded on the project site. These species require special attention in order to avoid any negative impact on their distribution and presence on the project site. *Colchicum ritchii* (national Endangered) was recorded on several occasions in the central part of the project site, whereas *Eminium spiculatum* (nationally vulnerable) was recorded in the southern part of the project site, see Figure 25. Finally, *Cousinia moabitica* (nationally vulnerable) was recorded widely in various locations in the project site.



Figure 25: Locations of nationally threatened species in the project site; Location #1 for *Colchicum ritchii* and Location #2 for *Eminium spiculatum*

Additionally, the project site is located less than 2 km northeast of the Important Biodiversity and Bird Area of Dana, which includes Dana Biosphere Reserve. Given all of the above, the potential impacts on biodiversity created during the construction phase would be of a long-term duration as they would result in a permanent change in the natural biodiversity of the site. Such impacts are considered of negative nature and of a medium magnitude given that the change in the natural biodiversity of the site will be noticeable in limited individual footprints. However, as the site is considered of medium ecological significance, the receiving environmental is determined to be of a medium sensitivity. Given all of the above, such an impact is considered to be of moderate significance.

Additional Studies/Surveys and Mitigation Measures

The following identifies the additional studies and mitigation measures to be applied by the EPC Contractor during the construction phase and which include:

- Based on the final detailed design of the project, all areas where construction activities will take place and that will be disturbed will be identified. Before construction activities commence, the EPC Contractor must undertake a detailed survey (through an ecological expert) to identify the presence of any active tortoises as well as potential hibernation/aestivation sites (during summer and winter) within all assigned areas to be disturbed by construction. Should any tortoises be located, they should be relocated to distant areas (outside of construction active areas) with similar habitat characteristics to the species to ensure that they would not return to the project site, taking into account the home range for the species.

- Carry out a survey to identify any locations in the project where the various threatened floral species are located in order to provide instructions during the construction phase to avoid any damage to these threatened species. It should be taken into consideration that the survey for *Colchicum ritchii* should be carried out starting in late winter / early spring since the species is known to bloom earlier in the season. As for the other two species, spring season from March onwards, would be suitable to locate the species on the project site. A qualified ecologist/botanist who is familiar with the species should carry out the survey. In case of identification of locations of any of the species, the plants could be either marked and/or fenced so that construction activities would avoid their locations or relocated. Regarding *Colchicum ritchii* and *Eminium spiculatum*, plants could be relocated to areas away from the construction areas whereas *Cousinia moabtica* would need to be marked/fenced in order to avoid damage to the species.
- Should as part of the project any fencing be erected, it must be ensured that it allows for the natural movement of small faunal species within the area. This could include for example a fence with an appropriate gap between the ground level and the first rail or strand (around 30cm);
- Implement proper management measures to prevent damage to the biodiversity of the site. This could include establishing a proper code of conduct and awareness raising / training of personnel and good housekeeping which include the following:
 - Prohibit hunting of any wildlife at any time and under any condition by construction workers onsite;
 - Ensure proper storage, collection, and disposal of waste streams generated as discussed in detail in “Chapter 12”;
 - Restrict activities to allocated construction areas only, including movement of workers and vehicles to allocated roads within the site and prohibit off-roading to minimize disturbances; and
 - Avoid unnecessary elevated noise levels at all times. In addition, apply adequate general noise suppressing measures as detailed in “Chapter 20”.

Following the implementation of these mitigation measures, the significance of the residual impact is categorized as not significant.

Monitoring and Reporting Requirements

The following identifies the monitoring and reporting requirements that must be adhered to by the EPC Contractor during the construction phase and which include:

- A pre-construction flora survey report to be presented prior to construction activities.
- Reporting on outcomes of fauna survey and actions undertaken (e.g. relocation measures to areas outside of construction activities).
- Inspection of the works should be carried out at all times, specifically to ensure that no damage is caused to the threatened plant species.

13.2.2 Potential Impacts during the Operation Phase

The only impacts anticipated during the operation phase are related to improper management of the site as discussed earlier. This could include improper conduct and housekeeping practices by workers (i.e. hunting of animals, discharge of hazardous waste to land, etc.).

The potential impacts on biodiversity would be of a long-term duration throughout the operation phase of the project. Such impacts are of negative nature and of a medium magnitude. However, as the site is considered of medium ecological significance, the receiving environment is determined to be of medium sensitivity. Given all of the above, such an impact is considered to be of moderate significance.

Mitigation Measures

The following identifies the mitigation measures to be applied by the project Operator during the operation phase and which include:

- Monitoring of the distribution and abundance of the threatened plant species should be carried out for at least five years of the operational phase in order to assess the impact of the project on the three threatened species that were recorded in the project site.
- Implement proper management measures to prevent damage to the biodiversity of the site. This could include establishing a proper code of conduct and awareness raising / training of personnel and good housekeeping which include the following:
 - Prohibit hunting of any wildlife at any time and under any condition by workers onsite;
 - Ensure proper storage, collection, and disposal of waste streams generated as discussed in detail in “Chapter 12 “; and
 - Restrict activities to allocated areas only, including movement of workers and vehicles to allocated roads within the site and prohibit off-roading to minimize disturbances.

Following the implementation of these mitigation measures, the significance of the residual impact is categorized as not significant.

Monitoring and Reporting Requirements

The following identifies the monitoring and reporting requirements that must be adhered to by the project Operator during the operation phase and which include:

- Annual report of the distribution and abundance of the nationally threatened species present at the project site.
- Inspection of the works should be carried out at all times.

14. BIRDS (AVI-FAUNA)

This chapter first provides an assessment of baseline conditions within the project site and surroundings in relation to birds (avi-fauna) and then assesses the anticipated impacts from the project throughout its various phases. For each impact, a set of management measures (which could include mitigation and monitoring measures, additional requirements, etc.) have been identified to eliminate or reduce the impact to acceptable levels.

Before discussing the outcomes of the above, it is important to state that the potential impact of wind turbines on birds is considered one of the key issues related to wind farm developments which must be thoroughly addressed within the ESIA.

Specifically related to this project, such an issue has been a continuous learning process throughout the course of the project development since its inception in 2012 in all aspects related to the ESIA study – to include the baseline assessment and design of monitoring baseline surveys, assessment of potential impacts, design of mitigation and monitoring measures, etc. Such a learning process was challenging and complex, due to the fact that there are no wind farm developments in Jordan from which previous experiences can be learnt from and built on, the absence of local guidelines/procedures on such issues (to include baseline assessment and survey designs, assessment of impacts, design of mitigating and monitoring requirements, etc.), and the lack of international guidelines/procedures (e.g. IFC's EHS Guidelines for Wind Energy).

Summarized below is the learning process and the sequence of events which have occurred over the project development since its inception in relation to birds assessment. Those are important to understand and take into account before the main outcomes of the assessment are discussed throughout this chapter.

1. The first survey was carried out in spring 2013. At that time there were no local requirements or guidelines from any governmental or non-governmental entity for birds monitoring nor were there any international best practice guidelines which could be taken into account. Therefore, at that time the monitoring program was designed by a local expert based on available and established international avi-fauna survey methods for wind farm developments – i.e. the Scottish Natural Heritage (SNH) Guidelines. Such Guidelines require a minimum of 36 hours of observations at each vantage point for each season (breeding, non-breeding, migratory) (SNH, 2005). Since Jordan, unlike Scotland, is known to be located along one of the most important migration flyways in the world; Red Sea/Rift Valley Migration Flyway, it was decided to exceed the number of hours proposed by the SNH. 80 hours of observations were undertaken from a single vantage point inside the project site while 60 hours were covered from a vantage point outside the project site. At that time, the adoption of the SNH Guidelines was considered reasonable and sufficient given that project site is not considered within a highly sensitive area in terms of avi – fauna; the project site is not located in an IBA and is located at a distance from the rift valley and its margins – which is considered the main route for migratory birds passing through Jordan. In autumn 2013, a total of 160 hours of observation were covered equally in both vantage points. It should be mentioned that the location of the project site during that period of the project development was different from the current location and therefore the data obtained from both surveys is considered irrelevant for the scope of this document. The results of both surveys were presented in abstract numbers of the number of individuals recorded for each species and the percentage of which that were recorded at risk height. No duration of flights or directions were noted.
2. By spring 2014, the project has been moved to its current location. Due to the larger size of the project site and the conclusion that the whole project area should be covered by the survey, three vantage points were set. Twenty-two days were covered in each vantage point but those days were covered simultaneously. In total 176 hours were covered in each vantage point. In autumn 2014, the same vantage points were used to carry out the monitoring. However, the number of hours covered was half the number covered in spring. A total of ten days were covered throughout the season totalling 80 hours per vantage point. This was the first survey in which the data was analysed in details were not only the species and the number of individuals were recorded but additional observation regarding the birds behaviour and the durations they spend at the various heights bands was also noted. Weather conditions were also recorded and therefore more in-depth analysis was carried out on the data obtained. The only

major shortcoming of the survey was that the observations from the three vantage points were carried out simultaneously and therefore duplications could have occurred. Also, no detailed analysis on the level of the vantage point area was carried out and therefore the whole project was treated as one sample. Collision Risk Modelling was extrapolated since the survey only covered 10 days of the whole migration season of almost 90 days.

3. In late 2014, based on experiences and lessons learned from the first wind farm development project to be implemented in Jordan (the Tafileh Wind Farm project) a new modified methodology for bird survey was developed. Such a methodology was developed by international experts in the design of avi-fauna surveys for wind farm development projects (Natural Research projects Limited [NRP]). In addition, as part of another ongoing project being implemented by the IFC known as “Cumulative Effect Assessment of the Tafileh Region Wind Power projects”, such an adjusted methodology was discussed and agreed with local prominent avi-fauna experts as well as other local stakeholders (such as the RSCN and BirdLife International – Middle East Regional Office (Jordan).

The modified methodology takes into account the updated SNH Guidelines (SNH, 2014) but more importantly also takes into account the local context of Jordan and its importance for birds migrations within the Jordan Rift Valley. Ever since, such a modified methodology has been carried out for all proposed wind farm development sites in Jordan, and has become the main methodology for avi-fauna assessment. However, it is important to note that to date it has not been officially accepted by any governmental entity (such as the MoEnv).

4. In spring 2015, a spring migration survey was carried out based on the developed methodology. The locations of the previously used vantage points was reviewed and marginally modified to ensure a sufficient coverage of the proposed turbine layout for the project. This survey covered the whole migration season and a total of 144 hours was covered in each vantage point making up a total of 432 hours.

14.1 Assessment of Baseline Conditions

This section discusses the methodology for the assessment of the baseline conditions in relation to birds and presents the outcomes and results. As this section presents the outcomes in detail, “Section 14.2” presents a summary of the results and the main conclusions of baseline conditions in the project site.

14.1.1 Baseline Assessment Methodology and Results

The windfarm baseline assessment followed an evolutionary process in terms of survey design and implementation since 2013; due to the lack of national guidelines and novelty of wind energy development in Jordan. In addition, the developer had no specific safeguard policies related to impact of wind energy development on birds, which lead to a continued learning and enhancement process of the field methodology and techniques between spring 2013 and 2015.

Along the development course, the methodology was subject to improvements to meet Jordanian stakeholders’ and financiers requirements, of particular importance the IFC environmental, health and safety guidelines. As well, the project boundaries, turbines layout, and specifications were changed many times during this process, adding more complexity to the environmental impact assessment.

The first two seasons (spring and autumn 2013) were surveyed on a study site that is far from the current project location, and provide no coverage of the final turbines layout, hence the results obtained from these two seasons should be neglected.

The baseline assessments were conducted by Al RAWABI Environment & Energy Consultancies Co. for spring and autumn 2013, spring 2014, and autumn 2014 (REEC 2015a, REEC 2015b, and REEC 2015c). These surveys were characterized by insufficient coverage for the migration season and low standard field techniques, which was subject to long debate between developers, consultants, and financiers.

For spring 2015, a new methodology commissioned by IFC and developed by Natural Research projects Limited (NRP) was used (NRP 2015). The new methodology was discussed and agreed by all stakeholders at the national level and formed the new IFC standard methodology for impact assessment of wind energy development in Jordan. The NRP methodology provided more intensive and better stratified sampling of the migration season in spring 2015. For the report see Annex III.

Flight activity assessment

The Vantage Point (VP) watches technique were used to quantify resident and migratory soaring birds flight activity in and around the windfarm, according to the Scottish Natural Heritage (SNH, 2005) guidance, and in accordance with methodology described in Band et al (2007).

Despite the fact that vantage point technique was used in all seasons, still a high variability in the field methods, sampling, coverage and survey effort. Table 34 provides a brief comparison of methodologies used.

The documented methodologies used from spring 2013 to autumn 2014 were not consistent (REEC 2015a, REEC 2015b, and REEC 2015c), hence a detailed description of methodology used in each season is provided below.

Table 34: Comparison between Different Survey Methods and Procedures Used in Different Monitoring Seasons for the Windfarm Project

Season	Technique	Target species	Windfarm area	Spatial sampling				Temporal sampling				Duration of watches	Rest time
				Area sampling	Range of coverage	Turbine coverage	Field of coverage	Coverage of season	Hours of coverage	Division of seasonal effort	Time stratification		
Spring 2013	vantage point	passage and resident soaring birds	Not well defined	2 VPs	2km	NA	360°	March 17 - May 17	8 hours/day 16 days (10 for VP1, and 6 for VP2) total of 128 hours for all VPs	NA	NA	8 hours	NA
Autumn 2013	vantage point	passage and resident soaring birds	Not well defined But project boundaries changed from spring season	2 VPs simultaneous	2km	NA	360°	August 27 – November 5	8 hours/day 16 days (divided equally) total of 128 hours for all VPs	NA	NA	8 hours	NA
Spring 2014	vantage point	passage and resident soaring birds	New boundaries Different from previous seasons	3 VPs simultaneous Different from previous seasons (2013)	2km	All 16 turbines layout in spring 2014	360°	March 20 – May 15	8 hours/day 22 days	NA	NA	8 hours	NA
Autumn 2014	vantage point	passage and resident soaring birds	Same as spring 2014	3 VPs simultaneous Same as spring 2013	2km	All 16 turbines layout in spring 2014	360°	September 6 – October 31	10 days 72 hours for each VP	Vague	NA	8 hours	NA
Spring 2015	vantage point (NRP method statement)	Primary and secondary target species lists	Slightly changed	3 VPs Same as in 2014	2km	Changed All 16 turbines layout in spring 2015	180° based on view shed	March 30 – May 29	Total of 426hours Vp1- 143.5 Vp2-144 Vp3-138.5	High activity period Low activity period	Four daylight strata	maximum of three hours	At least 30 minutes

Spring and autumn 2013

During spring and autumn 2013, the location of the study site boundaries were not final yet, and the survey took place away from the final project location. The methodology is presented below for documentation only.

The avifaunal research focused on the passage and resident soaring birds. The main method applied was vantage point observation. Two vantage points were selected based on being the highest points in the surrounding landscape in order to provide the observer with the best view possible for soaring birds activity in the study area, Table 35.

Table 35: Vantage Points Coordinates and Elevation for Spring and Autumn 2013 Surveys

Vantage Point	UTM Coordinates		Elevation
	Northing	Easting	
VP1	3402481	756987	1540 m
VP2	3409532	757575	1338 m

Two vantage points were selected; one inside the study area and another outside it to the west in order to provide an additional data set for comparison in an area that is hypothetically to have a higher activity for soaring birds, being resident or on passage.

Each observation day in a vantage point lasted for at least eight hours. The start and end of each observation day ranged between 08.00 and 10.00 while consequently the end time was between 16.00 and 18.00. All soaring birds on passage or resident were recorded throughout the observation time.

A total of sixteen observation days were carried out in spring 2013. Eight of which were done in the vantage point inside the study area (VP1) whereas the other eight were carried out to the west of the study area in VP2. Raptor counts have been carried out on the site so far from one vantage point (the highest point a.s.l. on site).

In autumn 2013, a total of sixteen observation days (two observers, one at each VP 8x2=16 days) were carried out throughout the study. Eight of which were done in the vantage point inside the study area (VP1) whereas the other eight were carried out to the west of the study area in VP2. Raptor counts have been carried out on the site so far from one vantage point (the highest a.s.l. point on site).

Data recorded included the species, number of individuals on passage (if in flock), height of bird from substrate, direction, duration spent on site (in a radius of 2 km) and behaviour. Resident and passage passerine species were also recorded on site, including their number and behaviour. Exact time of observation is indicated in observation sheets.

Spring 2014

The avifaunal research focused on the passage and resident soaring birds. The main method applied was vantage point observation in accordance with the Scottish methodology. Three vantage points were selected based on being the highest points a.s.l. in the surrounding landscape in order to provide the observer with the best view possible for soaring birds' activity in the project area, and coordinates are shown in Table 36.

Table 36: Vantage Points Coordinates and Elevation for Spring 2014

Vantage Point	UTM Coordinates	
	Northing	Easting
VP1	3406565	753482
VP2	3404669	754277
VP3	3402383	753751

Each observation day in a vantage point lasted for eight hours. The start and end of each observation day ranged between 08.00 and 12.00 while consequently the end time was between 16.00 and 18.00. All soaring on passage or resident birds were recorded throughout the observation time. 66 days of migratory avifauna surveys and observations were done from 20th March and till 15th of May 2014. Surveyors were at the three vantage points at the same dates and time in order to follow closely migration patterns all over the site. 3 observers were at each VP; $22 \times 3 = 66$ days of observation.

Data recorded included the species, number of individuals on passage (if in flock), height of bird from substrate, direction, duration spent on site (in a radius of 2km) and behaviour. Resident and passage passerine species were also recorded on site, including their number and behaviour. The methods used are the most frequently used methods of studying avifauna and its migration. Migration in fall and winter is less voluminous than in spring in the region of the proposed wind farm project.

Autumn 2014

The survey team used the vantage point survey to comprise a series of watches from fixed locations to quantify the flight activity of birds at the proposed site. This method provides data to estimate the collision risks. The locations of the VPs were selected to meet International Finance Corporation (IFC) requirements.

Three vantage points were selected based on being the highest points a.s.l. in the surrounding landscape in order to provide the observer with the best view possible for soaring birds, see Table 36.

The survey team conducted a one day visit to evaluate the VP's for the observers to conduct the vantage point survey. Then ten a day survey with three observers on each day were conducted to cover a total of 72 hours from each vantage point. Each observation day in a vantage point lasted for at least eight hours. The start and end of each observation day ranged between 08.00 and 12.00 while consequently the end time was 16.00 and 17.00. All soaring, on passage or resident were recorded throughout the observation time. 10 days of migratory avifauna surveys and observation was done from 6th September till 31st October, 2014. Surveyors were at the three vantage points at the same dates and time in order to follow closely migration patterns all over the site.

The team used the following tools and equipment to conduct the survey:

1. Clipboard;
2. Monitoring sheets / map / pen;
3. Binoculars;
4. Spotting scope;
5. Stopwatch;
6. GPS
7. Camera with 300-500mm lens

The following information was recorded during monitoring:

1. Bird species;
2. Number of observations and number of birds observed for each species;
3. Time of observation;
4. Duration of observation;
5. Flight height;
6. Weather and site conditions (temperature, visibility distance, cloud cover, wind speed, wind direction, precipitation).

The survey team covered autumn migration season by choosing the best dates for observation depending on the available studies on migratory birds for Jordan, which most probably will be during September and October since the peak of migration for most species occur during these two months.

Spring 2015:

The monitoring methodology for this season was developed by Natural Research projects Limited (NRP) based on IFC guidance. The methodology is based on Vantage Point (VP) watches and aims at collecting data on primary target species that enable an estimation of frequency of occurrence in the windfarm area and flight time at rotor swept height, in addition of calculating an index of flight activity for secondary target species. The same vantage point locations as for the spring 2014 survey were used for this survey Table 36).

As part of the new survey design, the windfarm was considered as one unit with Xenel wind project. It used a unified survey protocol for all wind farm developments in the Tafileh region, using the same height bands regardless of site specific turbine specifications. The detailed survey design is explained below:

Target species

Primary and secondary target species are the species for which flight activity information is recorded for the time the the VP is watched. They are listed in table below together with the standard five-letter species codes.

1. *Primary target species* are species which have higher importance to impact assessment and therefore merit the recording of detailed data on their flight activity.
2. *Primary target species* are categorized in to *Category A* species (species of the highest importance to impact assessment) and *Category B* species. The information recorded for *Category A* and *Category B* species is exactly the same. The only difference is the preference of observing category A species, when of both categories one species is visible at the same time.
3. *Secondary target species* are species which have lower importance to impact assessment and therefore do not merit the recording of detailed data on their flight activity. *Secondary target species* include some common raptor species: by not collecting detailed data on these common species frees up time for the observer to focus on searching for and recording information on the flight activity of *primary target species*.

VP watch methods

Information is collected during timed watches from strategic vantage points (VPs) covering the defined survey area, which encompasses the turbine envelope and extends to 500 m beyond the outermost proposed turbines. In the majority of cases, a 500 m extension is sufficient to deal with inaccuracies of position for flight line observations.

Information is collected during timed watches from strategic vantage points (VPs) covering the defined survey area, which encompasses the turbine envelope and extends to 500 m beyond the outermost proposed turbines. In the majority of cases, a 500 m extension is sufficient to deal with inaccuracies of position for flight line observations.

1. It is important to minimize the observer's effect on bird behaviour. For this reason observers should try to position themselves inconspicuously so as to minimize their effects on bird movements. This often precludes the use of hill summits for VP observations.
2. It is advisable to physically mark the exact location of each VP on the ground (i.e. a pile of stones or a marked cane) to ensure consistency in observer position. The coordinates of VPs must be measured and recorded to the highest level of accuracy using a Global Position System (GPS) device.
3. Watches are undertaken at time periods between dawn and dusk by a single observer under conditions of good ground visibility (>2km).

4. Weather conditions (wind direction & strength, cloud cover, precipitation and visibility) should be recorded at start of watch, then at every subsequent hour. Ideally such observations should be made in a range of wind conditions. This is particularly important in the case of soaring birds when wind direction and strength is likely to affect migration behaviour and flight routes.
5. Each continuous watch session should last a maximum of three hours but can be suspended and then resumed to take account of changes in visibility (e.g. fluctuations in the cloud base) or short breaks. Experience from field trials shows that the performance of most observers declines after three hours, and some may prefer to conduct shorter watches. A gap of at least half an hour between watches is advisable to reduce fatigue. A shorter gap might be used if the watch is shorter than three hours.
6. Observers should constantly scan, using a combination of naked-eye and binoculars, a pre-defined arc of up to 180° from each VP until a *target species* is detected in flight. Larger arcs cannot be scanned efficiently.
7. During each VP watch two types of flight activity data should be recorded.
 - 5-minute summary data (Form 1)
 - Focal sampling data (Form 2)
8. For *primary target species* flights, focal sampling data are recorded for all flights.
9. For *secondary target species* flight activity is summarized qualitatively for each successive 5-minute period through the VP watch. For each 5-minute period the number of individuals of each species seen flying in the search area is recorded on Form 1.
 - a) Focal sampling. The search area is scanned until a *primary target species* is detected at which point it is followed until it ceases flying or is lost from view. The time the target bird was detected and the flight duration are recorded, in both cases to the nearest second. The flight route is plotted in the field onto 1:25 000 scale maps. The bird's flight height above ground level is estimated at the point of detection and then at 15-second intervals thereafter, with the aid of a count-down interval timer with an audible alarm. Flight heights should be classified as <30m, 30-50m, 50-100m, 100-150m or >150m above ground level; or other height bands reflecting rotor swept area as appropriate. Focal observations of *primary target species* take priority over completion of 5-minute activity summaries.

If during the course of recording the flight activity for a *Category B primary target species* a *Category A primary target species* (i.e. any vulture or eagle species) is seen, the observer should note the time, cease watching the *Category B* species and immediately switch to observing the *Category A* species. This is because information on *Category A* species has greater importance. It should be clearly stated on Form 2 if the recording of a *Category B* species flight was interrupted by the appearance of a *Category A* species.
 - b) 5-minute activity summaries. Each watch should be sub-divided into 5-minute periods, at the end of which the number and activity of all *secondary target species* observed should be recorded. Observers should record perched birds once only on arrival at the VP, and the area or site used marked on a map. Thereafter only flying birds and newly noticed perching birds should be included in the activity summaries. This allows greater time for focal sampling, rather than repeated observations of the same perched birds.

Data recording

Data are recorded on Form 1 and Form 2 and on a 1:25,000 scale field maps. Form 1 (5-minute activity summaries) must be completed for each watch, regardless of whether or not any *primary target species* are observed.

Form 1: *Effort, conditions and 5-minute activity summaries.*

- Use for recording data on watch effort, survey conditions, observer and 5-minute period activity summaries.
- Use approved species codes or, if in doubt use English name of species.
- If a *primary target species* flight is seen during the 5-min period, enter species in the appropriate column on Form 1. In the notes column enter details of the primary *target species* involved and the flight reference number(s).

Form 2: Primary target species flight details.

For each watch, number each observed flying bout consecutively. Cross-reference this number to the flight path plotted on the map.

- For each flying bout, record the time spent flying within the survey area to the nearest second.
- For each flying bout (a flight event involving a single bird or a flock of birds), tick the appropriate flying height for each 15s interval, starting at 0 (time of first detection).
- Recording information for flights by Category A species always takes priority over recording Category B species flights.
- Rule off under each flying bout.

Field map: flight routes of primary target species

- Mark the location of the VP used.
- Mark flight paths of *primary target species* and indicate direction of flight with a small arrow. Number each flying bout and cross reference with Form 2.
- Use additional map(s) to prevent information on maps becoming cluttered or confusing.
- Date each map and include the start/finish time of VP watch.

Table 37: Target Species to be Recorded by Flight Activity Surveys

Category A Primary Species	Category B Primary Species	Secondary Species
Egyptian Vulture	Barbary Falcon	Brown-necked Raven
Griffon Vulture	Black Kite	Common Kestrel
Bonelli's Eagle	Black Stork	Eurasian Sparrowhawk
Booted Eagle	Common Crane	Fan-tailed Raven
Eastern Imperial Eagle	Common Raven	Marsh Harrier
Golden Eagle	Crested Honey-buzzard	Rock Dove
Lesser Spotted Eagle	Steppe Buzzard	All bee-eater species
Short-toed Snake-eagle	Eleonora's Falcon	All sandgrouse species
Spotted Eagle	Hen Harrier	All swift species
Steppe Eagle	Hobby	All wader species
Verreaux's Eagle	European Honey-buzzard	All waterbird species
Long-legged Buzzard	Lanner	
	Lesser Kestrel	
	Levant Sparrowhawk	
	Montagu's Harrier	
	Osprey	
	Pallid Harrier	
	Peregrine	
	Red-footed Falcon	
	Saker Falcon	
	Sooty Falcon	

Spring and Autumn 2013

The field visits were conducted during spring 2013 from March 17th and till May 15th, 2013. A total of 1175 soaring birds were recorded in a total of 128 hours of raptor watch. The main species recorded was Steppe Buzzard *Buteo buteo vulpinus*, which represented more than 57% of the birds recorded (643 birds). Other species recorded included Steppe Eagle *Aquila nipalensis*, Lesser Spotted Eagle *Aquila pomarina*, and Black Kite *Milvus migrans*. Species of high conservation value that were recorded in the site included Egyptian Vulture *Neophron percnopterus*, which is globally Endangered and Pallid Harrier *Circus macrourus*, which is globally Near-Threatened. Results of the VPs monitoring are presented in Table 38.

Table 38: Raptor Counted during Spring Migration 2013

Scientific Name	Species	Total	Flying at risk height
<i>Buteo buteo vulpinus</i>	Steppe Buzzard	643	288
<i>Pernis apivorus</i>	Honey Buzzard	322	187
<i>Falco naumanni</i>	Lesser Kestrel	32	31
<i>Buteo rufinus</i>	Long-legged Buzzard	24	24
<i>Milvus migrans</i>	Black Kite	80	34
<i>Aquila nipalensis</i>	Steppe Eagle	48	15
<i>Aquila pomarina</i>	Lesser Spotted Eagle	4	1
<i>Circaetus gallicus</i>	Short-toed Eagle	8	7
<i>Gyps fulvus</i>	Griffon Vulture	3	1
<i>Neophron percnopterus</i>	Egyptian Vulture	2	2
<i>Circus macrourus</i>	Pallid Harrier	1	0
<i>Accipiter nisus</i>	Sparrow hawk	8	0

In autumn 2013, the field visits were conducted from August 27th till November 5th. A total of 1419 birds of prey were recorded in both VPs. A total of 545 birds of prey were recorded in a total of 60 hours of raptor watch in VP1 while a total of 874 birds were recorded in VP2.

The main species recorded was Steppe Buzzard *Buteo buteo vulpinus*, which represented more than 78% of the birds, recorded. Other species recorded included Steppe Eagle *Aquila nipalensis*, Black Kite *Milvus migrans* and Montagu's Harrier *Circus pygargus*. Most importantly, the species of high conservation value that was recorded in the site included seven individuals of Egyptian Vulture *Neophron percnopterus*, which is a globally endangered (IUCN, 2013).

All Egyptian vultures recorded were flying at risk height. One of the most important results of this study is the high number of birds of prey that pass over the study area and its surroundings at risk height (76% of all birds recorded). This could be mainly referred to the fact that the birds come from soaring heights to glide into the rift margins unlike during the spring when the species were coming high from the rift margins to glide into the eastern plains, see Table 39.

Table 39: Raptor Counted during Fall Migration

Scientific Name	Species	Total	Flying at risk height
<i>Buteo buteo vulpinus</i>	Steppe Buzzard	1106	883
<i>Pernis apivorus</i>	Honey Buzzard	87	75
<i>Buteo rufinus</i>	Long-legged Buzzard	6	6
<i>Milvus migrans</i>	Black Kite	75	67
<i>Aquila nipalensis</i>	Steppe Eagle	106	89
<i>Circaetus gallicus</i>	Short-toed Eagle	9	5
<i>Gyps fulvus</i>	Griffon Vulture	12	11
<i>Neophron percnopterus</i>	Egyptian Vulture	7	7
<i>Circus pygargus</i>	Montagu's Harrier	9	9
<i>Accipiter nisus</i>	Sparrow hawk	2	1

Spring 2014

The main species recorded was the Steppe Buzzard *Buteo buteo vulpinus*, which represented more than 52.6% of the birds recorded (759 birds). Other species recorded included Steppe Eagle *Aquila nipalensis*, and Black Kite *Milvus migrans*, see Table 40.

Species of high conservation value that were recorded in the site included Egyptian Vulture *Neophron percnopterus*, which is globally endangered and Pallid Harrier *Circus macrourus*, which is globally near-threatened. 409 individuals of the soaring birds recorded were flying at risk height which is around 28.3% of the total.

Table 40: Raptor Counted during Spring 2014 Migration

Scientific Name	Species	Total	Flying at risk height
<i>Buteo buteo vulpinus</i>	Steppe Buzzard	759	115
<i>Pernis apivorus</i>	Honey Buzzard	359	74
<i>Falco naumanni</i>	Lesser Kestrel	152	152
<i>Buteo rufinus</i>	Long-legged Buzzard	19	14
<i>Milvus migrans</i>	Black Kite	49	11
<i>Aquila nipalensis</i>	Steppe Eagle	41	6
<i>Circaetus gallicus</i>	Short-toed Eagle	14	4
<i>Gyps fulvus</i>	Griffon Vulture	12	6
<i>Neophron percnopterus</i>	Egyptian Vulture	2	2
<i>Circus macrourus</i>	Pallid Harrier	2	2
<i>Hieraetus pennatus</i>	Booted Eagle	7	0
<i>Ciconia ciconia</i>	White stork	16	12
<i>Falco tinnunculus</i>	Kestrel	11	11

Autumn 2014

The total number of birds that were recorded in the autumn survey was 2,137 birds, belonging to 20 of the target species. In a total of 322 records, including seventeen records of twenty two birds that could not be identified in detail, only into the genus level; *Aquila* sp. *Circus* sp., and *Buteo* sp. 97.8% of the birds recorded in the study (2,091 of 2,137 birds) were recorded inside the wind farm proposed location. The results of the autumn survey are summarized in Table 41 below.

Table 41: A Summary of Species Recorded and the Durations of Those Records

No.	Species (in alphabetical order)	Total No. of records	Total No. observed	Inside	Outside	Total time inside (seconds)	Min. No. recorded per observat ion	Max. No. recorded per observat ion
1	Black Kite <i>Milvus migrans</i>	26	34	32	2	1290	1	3
2	Booted Eagle <i>Hieraaetus pennatus</i>	1	1	1	0	45	1	1
3	Buzzard species <i>Buteo</i> sp.	8	12	7	1	390	1	3
4	Crane <i>Grus grus</i>	9	578	578	0	1110	18	168
5	Egyptian Vulture <i>Neophron percnopterus</i>	2	2	2	0	165	1	1
6	Eagle species <i>Aquila</i> sp.	4	4	4	0	180	1	1
7	Griffon Vulture <i>Gyps fulvus</i>	18	30	27	3	2130	1	3
8	Harrier species (ringtail) <i>Circus</i> sp.	5	6	5	1	345	1	2
9	Hobby <i>Falco subbuteo</i>	3	3	3	0	255	1	1
10	Honey Buzzard <i>Pernis apivorus</i>	6	24	4	20	270	1	19
11	Imperial Eagle <i>Aquila heliaca</i>	9	11	11	0	750	1	3
12	Kestrel <i>Falco tinnunculus</i>	61	77	76	1	4455	1	3
13	Lesser Kestrel <i>Falco naumanni</i>	1	1	1	0	75	1	1
14	Levant Sparrowhawk <i>Accipiter brevipes</i>	1	5	5	0	45	5	5
15	Long-legged Buzzard <i>Buteo rufinus</i>	27	29	29	0	1860	1	3
16	Marsh Harrier <i>Circus aeruginosus</i>	22	27	27	0	1890	1	4
17	Montagu's Harrier <i>Circus pygargus</i>	4	5	5	0	450	1	2
18	Osprey <i>Pandion haliaetus</i>	1	1	1	0	105	1	1
19	Pallid Harrier <i>Circus macrourus</i>	21	23	22	1	1050	1	3
20	Short-toed Eagle <i>Circaetus gallicus</i>	19	21	20	1	1755	1	2
21	Sparrowhawk <i>Accipiter nisus</i>	13	18	18	0	885	1	3
22	Steppe Buzzard <i>Buteo buteo</i>	51	1211	1211	0	3390	1	144
23	Steppe Eagle <i>Aquila nipalensis</i>	10	14	10	4	510	1	3

Spring 2015

The windfarm project area was surveyed from March 30th, to May 29th. A total of 426 hours of actual monitoring was covered in the survey, divided between the three VPs and covering 39 days of the season.

A total of 3850 birds were recorded in 398 observation records, throughout the monitoring survey, belonging to 19 species, of which three birds were not identified to species level, see (Table 42). Observation records represent the total number of observations of birds of a certain species that were recorded on a specific occasion, which would range from a single bird or a flock, whereas the term 'birds' in this context, represents the actual number of birds that were counted in observations.

The majority of all individuals belonged to European Honey-buzzard *Pernis apivorus* (66.6%) and Levant Sparrowhawk *Accipiter brevipes* (23%), other species occurred in relatively low numbers. The number of records revealed that Lesser Kestrel *Falco naumanni* (24.1%), Long-legged Buzzard *Buteo rufinus* (23%), and European Honey-buzzard *Pernis apivorus* (19.8%) were most frequently recorded.

Three globally threatened species were recorded; the endangered Egyptian Vulture *Neophron percnopterus* and Steppe Eagle *Aquila nipalensis*, and the vulnerable Eastern Imperial Eagle *Aquila heliaca*. One Near Threatened species (Pallid Harrier *Circus macrourus*) has also been recorded.

For the purpose of studying bird flight activity, Short-toed Snake-eagle *Circaetus gallicus* and Lesser Kestrel *Falco naumanni* were treated as resident species because they utilize the area for breeding in spring/summer, and behave like resident breeding species. The majority of recorded birds were migrants (92.4%, 3557 birds), while resident species comprised 7.6% of birds accounting for 293 birds. See Figure 26.

Table 42: Summary for Recorded Species Counts and Status

Common Name	Scientific Name	IUCN Red List Status ²	Status ³	Records	Birds
Common Crane	<i>Grus grus</i>	LC	PM	1	5
Black Stork	<i>Ciconia nigra</i>	LC	PM	2	3
White Stork	<i>Ciconia ciconia</i>	LC	PM	1	10
European Honey-buzzard	<i>Pernis apivorus</i>	LC	PM	79	2564
Egyptian Vulture	<i>Neophron percnopterus</i>	EN	PM	2	2
Short-toed Snake-eagle	<i>Circaetus gallicus</i>	LC	R/PM	23	24
Griffon Vulture	<i>Gyps fulvus</i>	LC	R	10	11
Lesser Spotted Eagle	<i>Clanga pomarina</i>	LC	PM	2	3
Steppe Eagle	<i>Aquila nipalensis</i>	EN	PM	33	35
Eastern Imperial Eagle	<i>Aquila heliaca</i>	VU	PM/WV	3	3
Golden Eagle	<i>Aquila chrysaetos</i>	LC	R/PM	1	1
Booted Eagle	<i>Hieraaetus pennatus</i>	LC	PM	6	6
Pallid Harrier	<i>Circus macrourus</i>	NT	PM/WV	2	2
Montagu's Harrier	<i>Circus pygargus</i>	LC	PM	2	3
Levant Sparrowhawk	<i>Accipiter brevipes</i>	LC	PM	23	881
Black Kite	<i>Milvus migrans</i>	LC	PM	17	36
Long-legged Buzzard	<i>Buteo rufinus</i>	LC	R/PM	91	104
Lesser Kestrel	<i>Falco naumanni</i>	LC	SB/PM	96	153
Peregrine	<i>Falco peregrinus</i>	LC	Pm/wv	1	1

² EN: Endangered, VU: Vulnerable, NT: Near Threatened, LC: Least Concern

³ PM: Passage Migrant, WV: Winter Visitor, R: Resident, SB: Summer Breeder

Common Name	Scientific Name	IUCN Red List Status ²	Status ³	Records	Birds
Eagle Species	<i>Aquila sp.</i>	-	-	1	1
Falcon Species	<i>Falco sp.</i>	-	-	1	1
Raptor		-	-	1	1
Total				398	3850

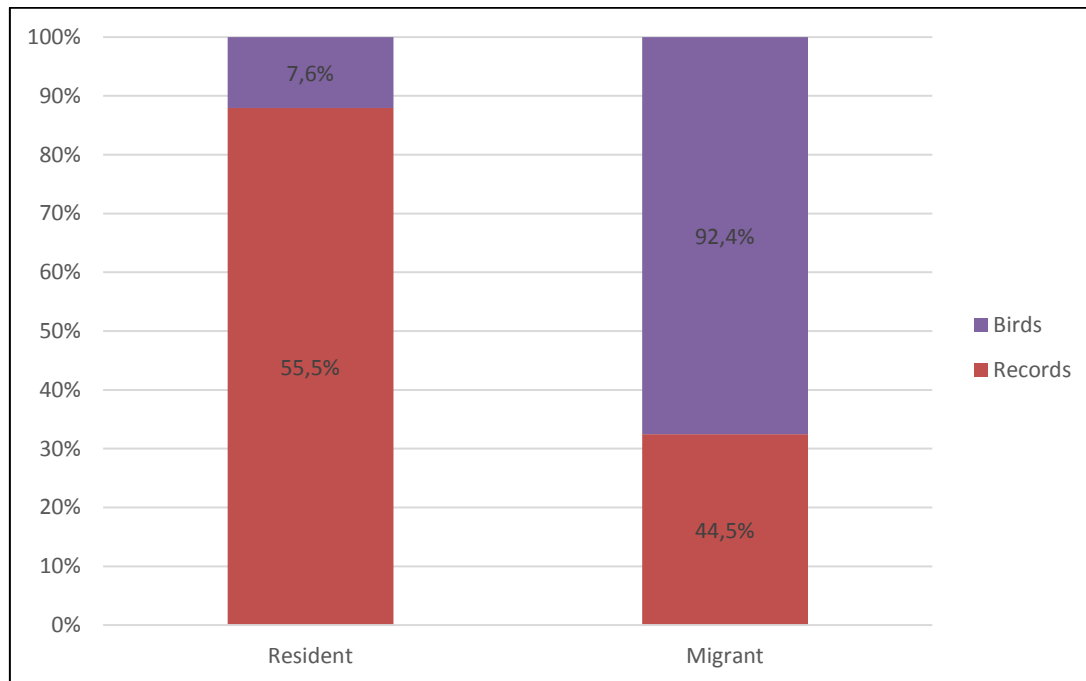


Figure 26: Percentage of Records / Birds for the Resident and Migrant Species Recorded in the Survey

More than half of the birds were recorded in VP-3, while VP-1 has the highest observation time accounting for 38.5% of all records. VP-2 has almost equal proportion of observation time and birds, see (Figure 27).

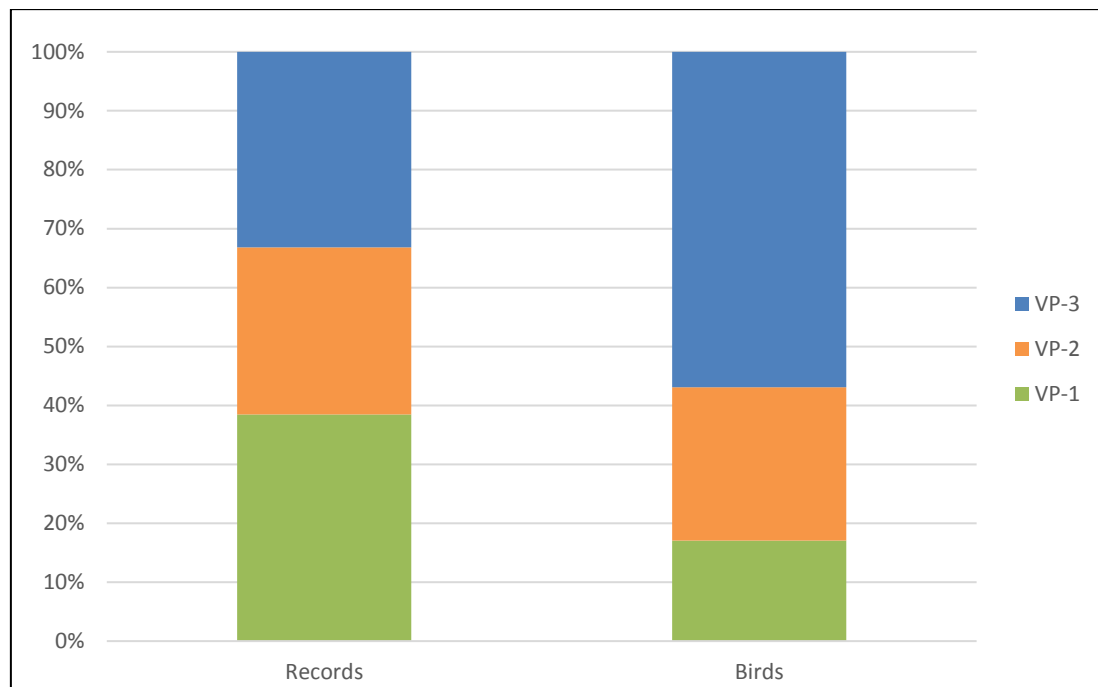


Figure 27: Percentage of Records / Birds Recorded in Each Vantage Point in the Windfarm Area

In terms of bird's observation rate (bird/hour) for both resident and migrant birds, the highest observation rate was at VP-1 (1.07), followed by VP-3 (0.95), and lastly VP-2 (0.78), see (Figure 28).

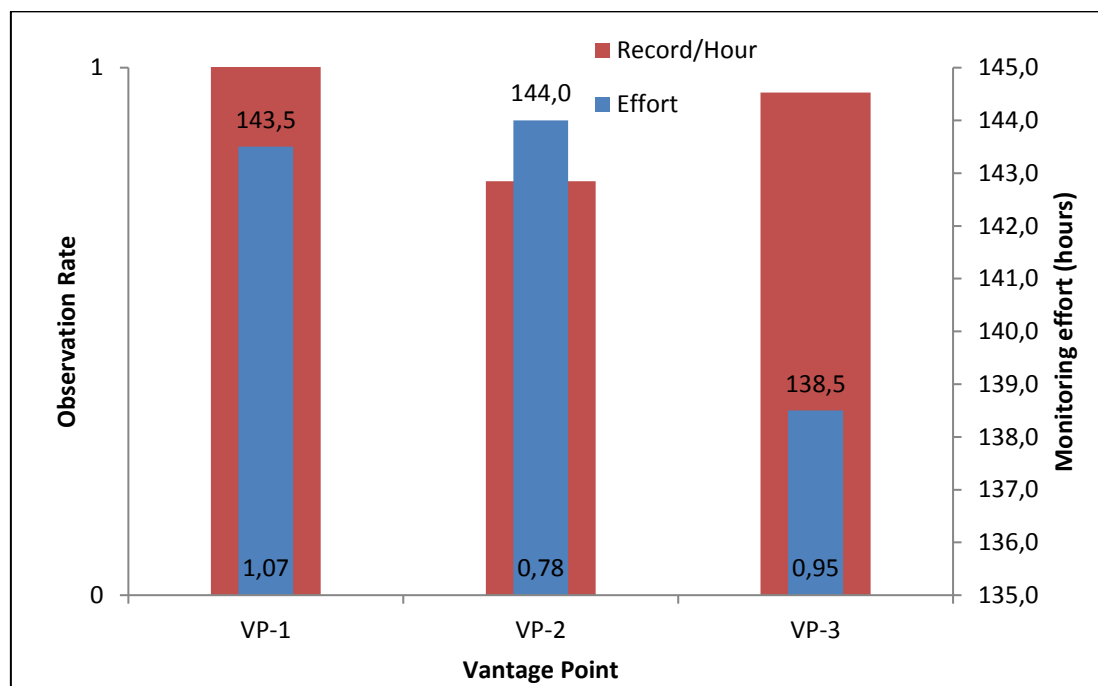


Figure 28: Monitoring Effort and Rate of Records per Hour for all Vantage Points

Bird Movement and Migration

The most frequently observed species, in terms of number of species daily record to the total number of survey days inside and outside wind farm area, are Long-legged Buzzard, Steppe Eagle, Lesser Kestrel, Short-toed Snake-eagle, and European Honey-buzzard.

Apart from the frequently recorded Steppe Eagle (53%), all of the globally threatened and near threatened species (Egyptian Vulture, Eastern Imperial Eagle, and Pallid Harrier,) had a frequency of occurrence of less than 10%, see (Figure 29).

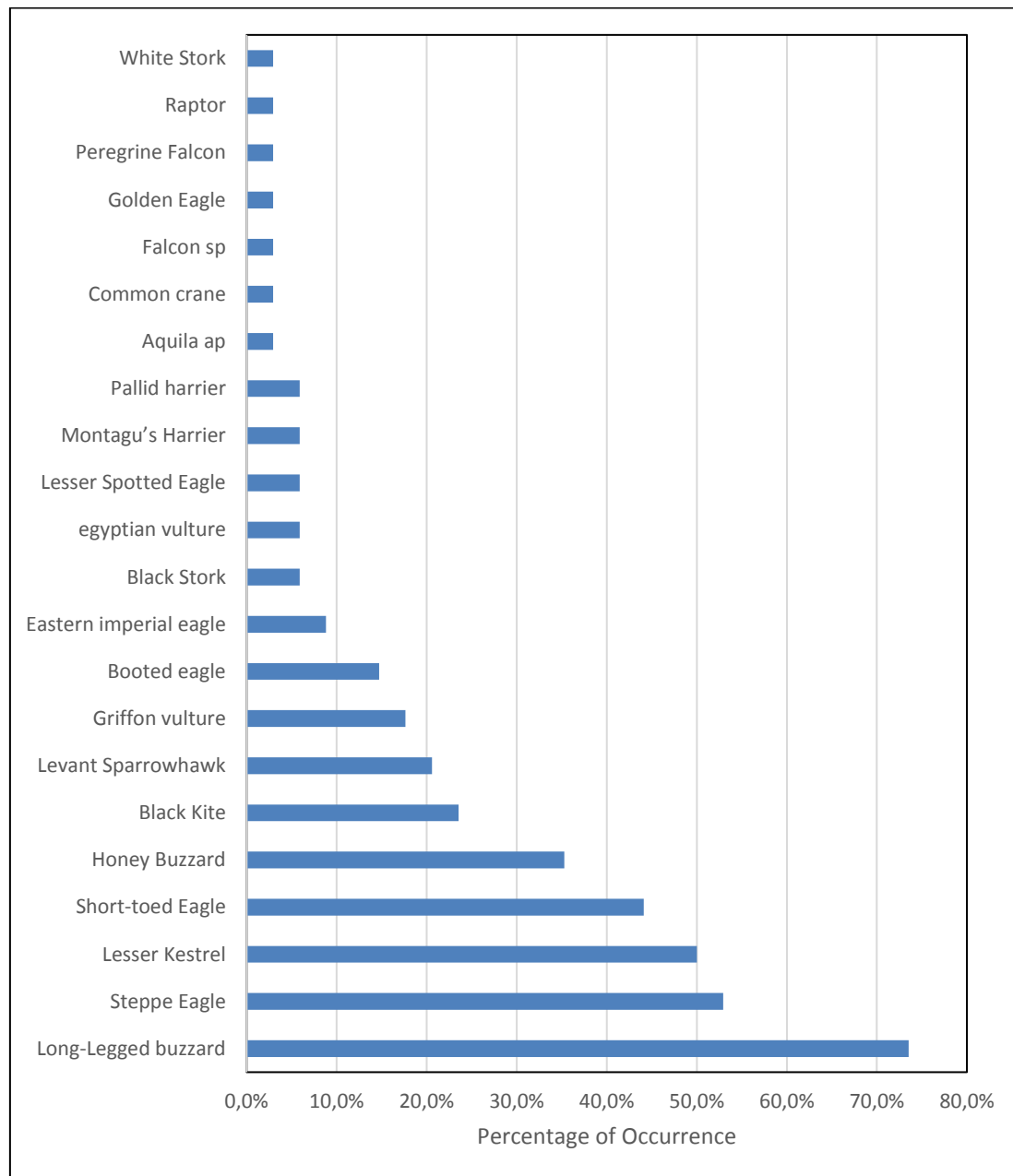


Figure 29: Frequency of Occurrence for all Observations Inside and Outside Windfarm Area

Migration phenology and resident species dynamics are plotted for the survey period. The peak resident species activity were recorded in week 15 where about 38% of birds were recorded. Apart from the peaks in April 5th and 6th, the resident species activity were fluctuating during the season and were declining with time due to nesting and feeding behaviors.

For migratory species, the peak migration was observed on April 30th, where 1,356 European Honey-buzzard and 688 Levant Sparrowhawk passed over the area in about three hours. The passage also continued on the next day forming about 65% of observed spring passage migration. Another smaller peak was formed due to European Honey-buzzard passage migration on May 16th.

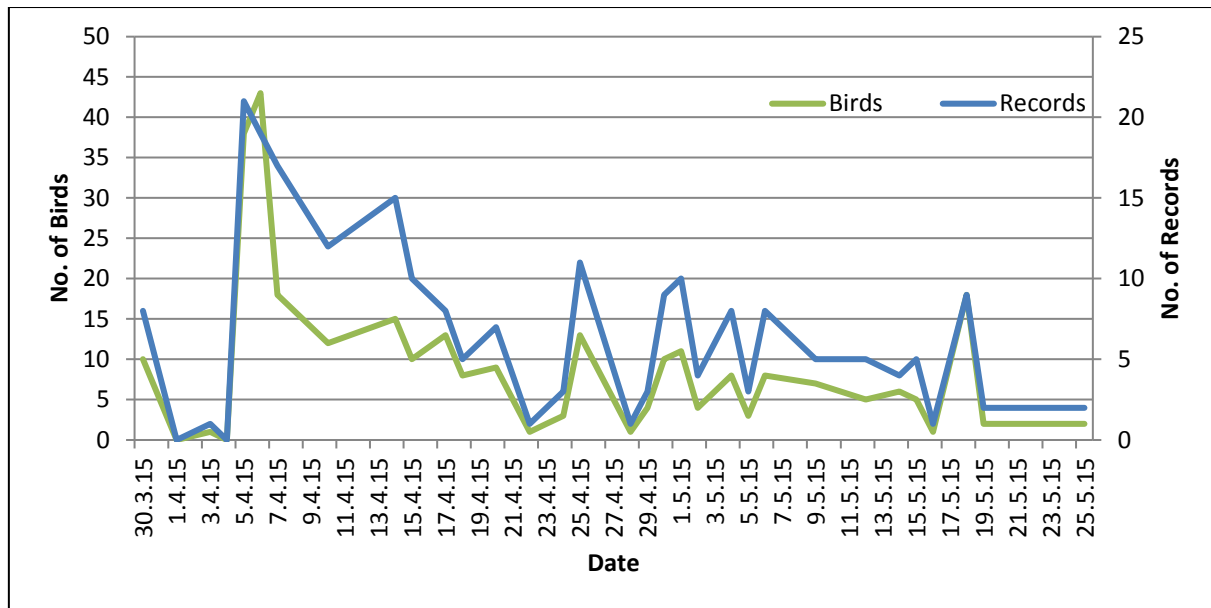


Figure 30: Seasonal Distribution of Resident Birds / Records for all Observations in the Windfarm Area

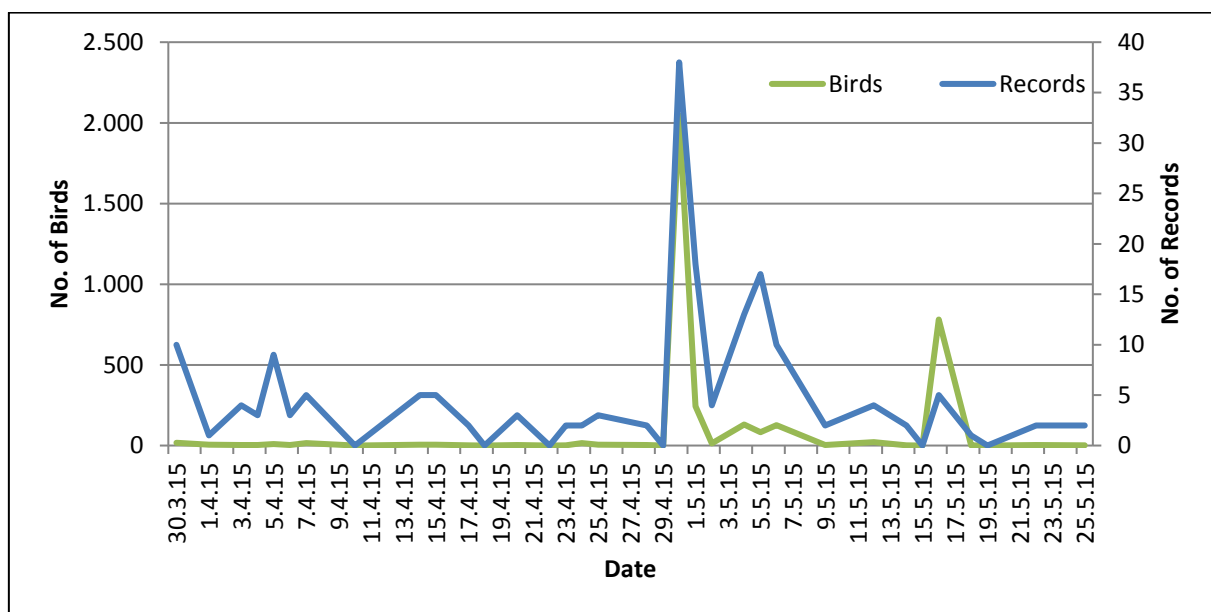


Figure 31: Seasonal Distribution of Migrant Birds / Records for all Observations in the Windfarm Area

Bird flight altitude and direction

The total flight time spent by all the species recorded during the whole period of monitoring is around 14h30m. Detailed flight altitudes of all species recorded inside windfarm area are provided in annex 1.

During the fieldwork, flight heights were classified as <30m, 30-50m, 50-100m, 100-150m or >150m above ground level, however these heights doesn't represent the updated turbine specifications in terms of rotor swept height which is now 40 – 180m above ground level.

The height bands were re-grouped into three bands (height band 1:<30m, height band 2: 30-150m, and height band 3: >150m) for best fit data analysis and easier presentation. The majority of resident and migrant observations, birds, and flight time were at rotor swept height. Resident species spent more time flying below 30m compared to migrants, which spend relatively more time above 150m.

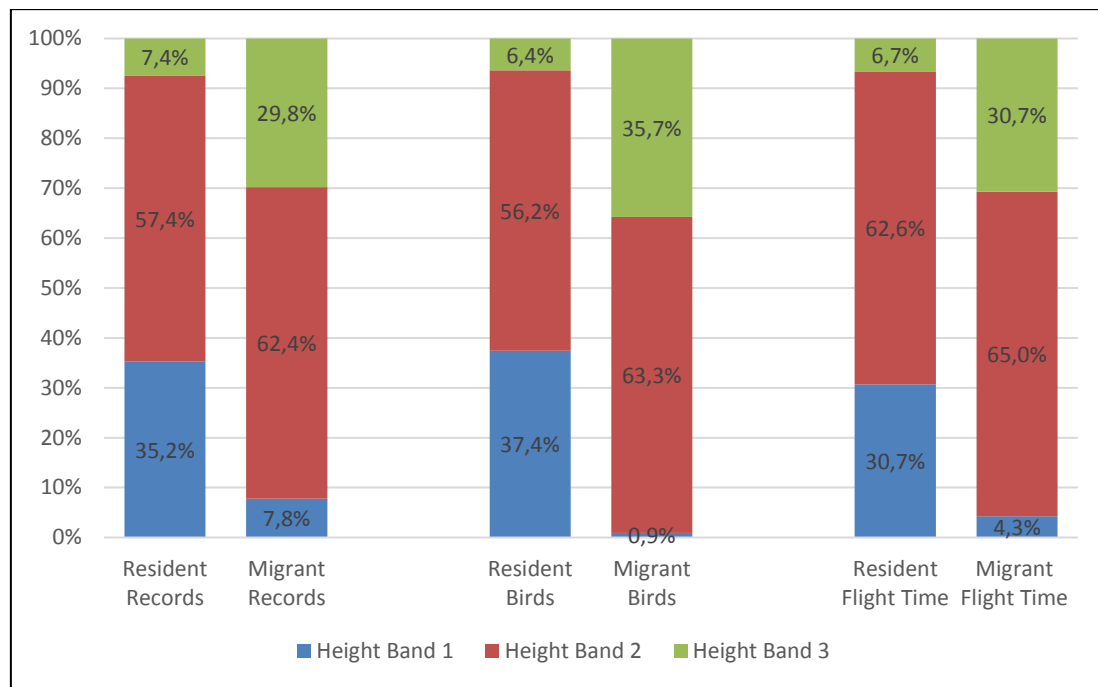


Figure 32: Percentage of Records, Birds, and Flight Time at Different Flight Altitudes for Resident and Migrant Species Recorded in the Windfarm Area

A comparison between bird flight altitudes at different vantage points showed that more than half of the records were for birds flying within collision height in all vantage points. However three quarters of individuals were flying above 150 m in VP-2, attributed mainly to the passage of the European Honey-buzzard. Flight time at different bands was in conformity with observation recorded, where more than half of the recorded time was spent in collision height in all vantage points (Figure 33).

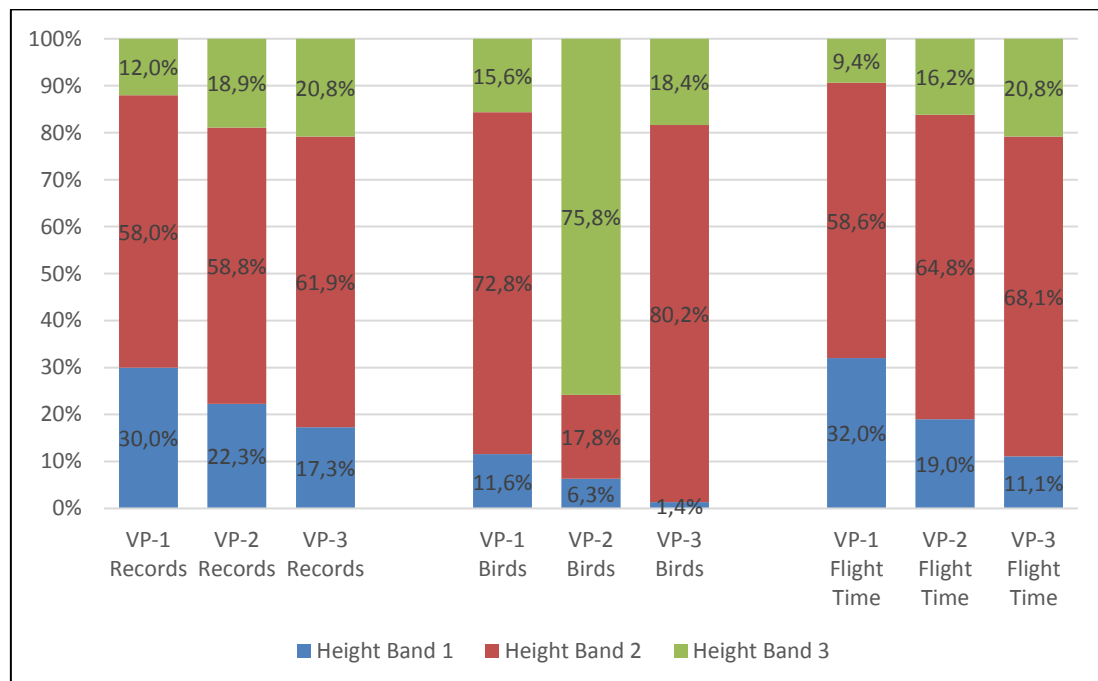


Figure 33: Percentage of Records, Birds, and Flight Time at Different Flight Altitudes for each Vantage Point Studies in the Windfarm Area

Collision Risk Model (CRM)

The results of the CRM are summarized in Table 43 and Table 44. Care needs to be taken in the interpretation of the results including bearing in mind to what extent the various assumptions made in the CRM are likely to have been met and how any violations to the assumptions might influence the outputs. . Although the CRM results are expressed to several decimal places this level of precision should not be misinterpreted as an indication of accuracy.

Table 43: Avoidance-rate adjusted CRM results expressed as the number of collision strikes predicted to occur each spring migration season.

Species	Avoidance Rate				
	95%	96%	97%	98%	99%
Griffon Vulture	0.034	0.028	0.021	0.014	0.007
Egyptian Vulture	0.001	0.001	0.001	<0.001	<0.001
Booted Eagle	0.026	0.021	0.016	0.011	0.005
Golden Eagle	0.001	0.001	0.001	<0.001	<0.001
Steppe Eagle	0.091	0.073	0.055	0.036	0.018
Long-legged Buzzard	0.305	0.244	0.183	0.122	0.061
Short-toed Eagle	0.130	0.104	0.078	0.052	0.026
Lesser Spotted Eagle	0.002	0.002	0.001	0.001	<0.001
Pallid Harrier	0.001	0.001	0.001	<0.001	<0.001
Montagu's Harrier	0.009	0.007	0.005	0.004	0.002
Lesser Kestrel	0.685	0.548	0.411	0.274	0.137
Black Kite	0.170	0.136	0.102	0.068	0.034
Honey Buzzard	4.568	3.655	2.741	1.827	0.914
Black Stork	0.016	0.013	0.010	0.007	0.003
Levant Sparrowhawk	3.887	3.110	2.332	1.555	0.777
Sooty Falcon	0.005	0.004	0.003	0.002	0.001

Table 44: Avoidance-rate adjusted CRM results expressed as the predicted number of spring migrations seasons of wind farm operation for one collision strike to occur

Species	Avoidance Rate				
	95%	96%	97%	98%	99%
Griffon Vulture	29.0	36.3	48.3	72.5	145.0
Egyptian Vulture	930.6	1163.3	1551.0	2326.5	4653.1
Booted Eagle	37.7	47.2	62.9	94.3	5036.3
Golden Eagle	1007.3	1259.1	1678.8	2518.2	5036.3
Steppe Eagle	11.0	13.8	18.3	27.5	55.0
Long-legged Buzzard	3.3	4.1	5.5	8.2	16.4
Short-toed Eagle	7.7	9.6	12.8	19.2	38.5
Lesser Spotted Eagle	420.2	525.3	700.4	1050.6	2101.1
Pallid Harrier	964.2	1205.3	1607.0	2410.6	4821.1
Montagu's Harrier	113.0	141.2	188.3	282.5	564.9
Lesser Kestrel	1.5	1.8	2.4	3.6	7.3
Black Kite	5.9	7.3	9.8	14.7	29.4
Honey Buzzard	0.2	0.3	0.4	0.5	1.1
Black Stork	61.2	76.5	102.0	152.9	305.9

Species	Avoidance Rate				
	95%	96%	97%	98%	99%
Levant Sparrowhawk	0.3	0.3	0.4	0.6	1.3
Sooty Falcon	2000.0	250.0	333.3	5000.0	1000.0

2.1.1.2 Avifaunal Breeding Survey

Throughout the breeding survey from March until May 2016, 43 species were recorded. Sixteen of the species recorded in the survey are considered as passage migrants and/or winter visitors and are not known to breed in the project area or even in southern Jordan. Out of those sixteen species, two are known to breed in the northern parts of the country but not in the south where the project area is located. Out of the remaining 27 species, 20 were recorded as at least probably breeding while the remaining seven species could not be confirmed as breeding although they are known to breed in southern Jordan and the vicinity of the project site, see (Table 45).

Table 45: Species Recorded in the Survey

Species	Status during survey	Local status	IUCN Red List Threatened Status (IUCN, 2016)	IUCN Red List of Breeding Birds of Arabia (Symes et al, 2015)
Booted Eagle <i>Hieraetus pennatus</i>	Uncommon passage migrant recorded on passage	Passage migrant	Not Applicable	Least Concern
Black Kite <i>Milvus migrans</i>	Passage migrant, one of the commoner passage migrants in Jordan, recorded on passage on site	Passage migrant	Least Concern	Least Concern
Steppe Buzzard <i>Buteo buteo vulpinus</i>	Passage migrant, considered to be the most common migratory soaring bird species that passes over Jordan	Passage migrant	Least Concern	Least Concern
Long-legged Buzzard <i>Buteo rufinus</i>	No breeding recorded in the project site but if not breeding there then it would be breeding in adjacent areas since it was recorded on regular basis foraging in the project site	Resident	Least Concern	Least Concern
Common Kestrel <i>Falco tinnunculus</i>	No confirmed breeding on site but was recorded regularly foraging on site and definitely confirmed to be breeding in the vicinity of the project site	Resident, passage migrant	Least Concern	Least Concern
Leasser Kestrel <i>Falco naumanni</i>	No confirmed breeding on site but was recorded foraging on site and it is confirmed to be breeding in the vicinity of the project site	Passage migrant, summer breeder	Least Concern	Near Threatened
Collared Dove <i>Streptopelia decaocto</i>	Breeding, several birds were recorded singing. Even if not breeding on site, the species breeds in the vicinity of the project site	Resident	Least Concern	Least Concern
Rock Dove / Feral Pigeons <i>Columba livia</i>	No breeding confirmed at project but is believed to be breeding in the vicinity of the project site	Resident	Least Concern	Least Concern
Eurasian Wryneck <i>Jynx torquilla</i>	Recorded on passage	Passage migrant	Least Concern	Not Applicable
Common Cuckoo <i>Cuculus canorus</i>	Probably breeding in site where it was heard singing. It is documented to be breeding in the vicinity of the project	Passage migrant, summer breeder	Least Concern	Near Threatened
Little Owl <i>Athene noctua</i>	No breeding confirmed but is probably a rare breeder at project site	Resident	Least Concern	Least Concern
Eurasian Hoopoe <i>Upupa epops</i>	Breeding confirmed in project site	Resident, summer breeder	Least Concern	Least Concern

Species	Status during survey	Local status	IUCN Red List Threatened Status (IUCN, 2016)	IUCN Red List of Breeding Birds of Arabia (Symes et al, 2015)
Common Swift <i>Apus apus</i>	No breeding, only recorded flying over on passage	Passage migrant	Least Concern	Least Concern
Pallid Swift <i>Apus pallidus</i>	No breeding, only recorded flying over on passage	Passage migrant, summer breeder	Least Concern	Least Concern
Woodchat Shrike <i>Lanius senator</i>	No breeding, recorded on passage	Passage migrant	Least Concern	Not Applicable
Masked Shrike <i>Lanius nubicus</i>	Probably breeding in the project site	Summer breeder, passage migrant	Least Concern	Least Concern
Brown-necked Raven <i>Corvus ruficollis</i>	Resident, recorded flying over although the site is definitely part of the breeding territories of the species	Resident	Least Concern	Least Concern
Pale Crag-martin <i>Hirundo obsoleta</i>	Breeding, recorded in pairs in flight display	Resident	Least Concern	Least Concern
Barn Swallow <i>Hirundo rustica</i>	Recorded on passage	Passage migrant	Least Concern	Least Concern
Calandra Lark <i>Melanocorypha calandra</i>	Breeding, heard singing on several occasions specifically from wheat and barley fields	Resident, passage migrant	Least Concern	Least Concern
Desert Lark <i>Ammomanes deserti</i>	Breeding, where it was recorded singing on a few occasions	Resident	Least Concern	Least Concern
Greater Short-toed Lark <i>Calandrella brachydactyla</i>	No confirmed breeding, recorded only feeding in barley fields	Passage migrant, summer breeder	Least Concern	Least Concern
Crested Lark <i>Galerida cristata</i>	Breeding all across the project area, where it was regularly recorded singing and in flight display	Resident	Least Concern	Least Concern
Skylark <i>Alauda arvensis</i>	Recorded calling on very few occasions	Passage migrant, winter visitor	Least Concern	Not Applicable
Common Redstart <i>Phoenicurus phoenicurus</i>	Recorded on passage	Passage migrant	Least Concern	Near Threatened
Black-eared Wheatear <i>Oenanthe hispanica</i>	Breeding – singing from perch	Summer breeder	Least Concern	Least Concern
Isabelline Wheatear <i>Oenanthe isabellina</i>	Breeding all across the project area where it was recorded singing from perch and showing territorial behavior.	Resident	Least Concern	Least Concern
Rufous-tailed Rock-thrush <i>Monticola saxatilis</i>	Recorded on passage	Passage migrant	Least Concern	Near Threatened
White-spectacled Bulbul <i>Pycnonotos xanthopygos</i>	Breeding, several birds recorded singing on site	Resident	Least Concern	Least Concern

Species	Status during survey	Local status	IUCN Red List Threatened Status (IUCN, 2016)	IUCN Red List of Breeding Birds of Arabia (Symes et al, 2015)
Blackcap <i>Sylvia atricapilla</i>	Recorded on passage	Passage migrant	Least Concern	Least Concern
Lesser Whitethroat <i>Sylvia curruca</i>	Recorded on passage	Passage migrant	Least Concern	Least Concern
Spectacled Warbler <i>Sylvia conspicillata</i>	Breeding confirmed with a few breeding pairs	Resident	Least Concern	Least Concern
House Sparrow <i>Passer domesticus</i>	Breeding, recorded singing regularly.	Resident	Least Concern	Least Concern
Spanish Sparrow <i>Passer hispaniolensis</i>	Breeding, recorded singing regularly, sometimes in large flocks	Resident	Least Concern	Least Concern
Rock Sparrow <i>Petronia petronia</i>	Breeding, most of the records were of flocks flying over but there were regular records of singing and also with birds carrying nesting material and food	Resident	Least Concern	Least Concern
Pale Rock Sparrow <i>Petronia brachydactyla</i>	Breeding, few individuals were recorded singing from perch in suitable breeding habitats	Summer breeder, passage migrant	Least Concern	Least Concern
Tawny Pipit <i>Anthus campestris</i>	Recorded singing and in display on several occasions	Summer breeder, passage migrant	Least Concern	Least Concern
European Greenfinch <i>Carduelis chloris</i>	Breeding, several birds were recorded singing from perch	Resident	Least Concern	Least Concern
Eurasian Linnet <i>Carduelis cannabina</i>	Breeding, few singing birds while most records were of birds flying over	Resident	Least Concern	Least Concern
Desert Finch <i>Rhodopechys obsoletus</i>	Breeding, most birds were recorded flying over in large flocks	Summer breeder	Least Concern	Least Concern
Ortolan Bunting <i>Emberiza hortulana</i>	Not breeding, recorded on passage	Passage migrant	Least Concern	Near Threatened
Cretzschmar's Bunting <i>Emberiza caesia</i>	Not breeding, recorded on passage	Passage migrant, summer breeder	Least Concern	Least Concern
Corn Bunting <i>Miliaria calandra</i>	Recorded singing from perch, probably breeding	Summer breeder	Least Concern	Least Concern

The most frequently recorded species in the project area was Eurasian Linnet *Carduelis cannabina*, followed by Crested Lark *Galerida cristata* and Isabelline Wheatear *Oenanthe isabellina*, which are the only three species in the survey that had more than 100 birds recorded, see (Table 46).

Table 46: Total Number of Observations, Relative Density (per hectare) and Frequency of Occurrence as Percent of Point Counts in each Block of Breeding Species

Species	Total no. of Observations	Total No. of Birds recorded	Frequency
Collared Dove <i>Streptopelia decaocto</i>	6	6	5.95
Little Owl <i>Athene noctua</i>	2	2	2.38
Eurasian Hoopoe <i>Upupa epops</i>	31	32	26.19
Masked Shrike <i>Lanius nubicus</i>	2	2	5.95
Pale Crag-martin <i>Hirundo obsoleta</i>	2	2	5.95
Calandra Lark <i>Melanocorypha calandra</i>	43	81	34.52
Desert Lark <i>Ammomanes deserti</i>	8	8	9.52
Crested Lark <i>Galerida cristata</i>	120	173	86.90
Black-eared Wheatear <i>Oenanthe hispanica</i>	18	19	17.86
Isabelline Wheatear <i>Oenanthe isabellina</i>	96	128	69.05
Spectacled Warbler <i>Sylvia conspicillata</i>	10	11	14.29
House Sparrow <i>Passer domesticus</i>	11	27	11.90
Spanish Sparrow <i>Passer hispaniolensis</i>	15	69	14.29
Rock Sparrow <i>Petronia petronia</i>	10	20	7.14
Pale Rock Sparrow <i>Petronia brachydactyla</i>	21	30	14.29
Tawny Pipit <i>Anthus campestris</i>	32	32	35.71
European Greenfinch <i>Carduelis chloris</i>	4	6	3.57
Eurasian Linnet <i>Carduelis cannabina</i>	76	272	75.00
Desert Finch <i>Rhodopechys obsoletus</i>	6	15	5.95
Corn Bunting <i>Miliaria calandra</i>	8	17	8.33

None of the species recorded are globally threatened. However, according to the threatened list of breeding birds of Arabia, which covers Jordan (Symes *et al*, 2015), five species are assessed as Near Threatened. The populations of these species that are Near Threatened are the breeding populations of these species in the region, while none of these species were recorded as breeding in the project site.

14.2 Assessment of Potential Impacts

This section identifies and assesses the anticipated impacts from the project activities on birds during the various phases to include planning, construction and operation phases. For each impact, a set of management measures (which could include mitigation measures, additional requirements, etc.) and monitoring measures have been identified to eliminate or reduce the impact to acceptable levels.

14.2.1 Potential Impacts during the Construction Phase

Site preparation activities which are to take place onsite by the EPC Contractor for the installation of the transmission line, including the right-of-way are expected to include land clearing activities, levelling, excavation, grading, etc.

Such activities in particular could impact the avi-fauna which use the site for foraging and as a breeding ground– to include soaring and non-soaring resident and migratory species. As discussed throughout the baseline section, several species of resident and visiting birds were recorded foraging within the site some of which are considered important at the national and regional levels.

Nevertheless, such construction activities would not result in any major alteration of the site's habitats and thus would not affect the foraging and feeding area of such species, given that such activities are limited to

the relatively small individual footprint of these facilities and where the actual area of disturbance is relatively minimal.

Being located in close proximity to the Important Bird and Biodiversity Area of Dana and the diversity of habitats that are present at the project site, the diversity of species recorded in the project site is relatively high.

On the other hand, there are additional potential impacts during the construction phase on breeding birds within the site. Construction activities could disturb existing habitats of birds breeding and/or nesting within the project site. Such potential impacts are created during the construction phase only and thus are of short-term duration. However, such impacts are considered of negative nature and of a low magnitude given that the construction activities' actual area of disturbance is relatively minimal. In addition, given that breeding activities are likely within the project site, the receiving environmental impacts is determined to be of a medium sensitivity. Given all of the above, such an impact is considered to be minor significance.

Additional Studies/Survey and Mitigation Measures

The following identifies the mitigation measures to be applied by the EPC Contractor during the construction phase. It includes:

- In order to avoid impacts on the populations of the breeding species, a breeding bird survey should be carried out before construction. If active breeding attempts of CEA priority birds or any other IUCN globally or regionally threatened species are confirmed, construction activities that could affect their breeding success must be delayed until these have either failed or young birds have fledged. Further annual breeding surveys are recommended if these categories of species are recorded using the site during the pre-construction phase, to inform a bird sensitive approach to operational phase activities.
- Implementation of proper housekeeping measures to reduce impacts including:
 - Based on the breeding bird survey that must be carried out in the spring prior to construction, avoid any activities in the sensitive areas for breeding birds.
 - Restrict activities to allocated construction areas only with no breeding activities, including movement of workers and vehicles to allocated roads within the site and prohibit off-roading to minimize disturbances.
 - Prohibit hunting of birds at any time and under any condition by construction workers onsite.
 - Implement proper measures, which would prevent attraction of birds to the site. This includes measures such as prohibiting illegal dumping and ensuring waste streams are disposed appropriately in accordance with the measures identified in "Chapter 122".
 - Avoid unnecessary elevated noise levels at all times. In addition, apply adequate general noise suppressing measures. This could include the use of well-maintained mufflers and noise suppressants for high noise generating equipment and machinery, developing a regular maintenance schedule of all vehicles, machinery, and equipment for early detection of issues to avoid unnecessary elevated noise level, etc.

Following the implementation of these mitigation measures, the significance of the residual impact can be reduced to not significant.

Monitoring and Reporting Requirement

The following summarizes the monitoring requirements for the project which must be undertaken and which include:

- EPC Contractor has to submit construction schedule and plan and demonstrate that construction is planned to avoid areas of concern during the breeding season.

- Provide a breeding bird survey report identifying key areas of breeding so that they can be avoided during construction.

14.2.2 Potential Impacts during the Operation Phase

Wind turbines are associated with impacts on birds from risks of collision and electrocution for both migratory soaring birds (which could pass over the site during the spring and fall migration seasons) and resident soaring birds in the area. This section provides a qualitative assessment of such impacts. As discussed previously, to determine the significance of an impact it is important to understand the sensitivity of the receiving environment and the magnitude of the impact both of which are discussed in further details below.

(i) Sensitivity of the Project Site

The baseline assessments have recorded moderate numbers of migratory soaring birds over the project site. Some of those recorded species have an important status on the international, regional and national levels. The baseline assessment concludes that the site is not considered within a moderately sensitive area in terms of avi-fauna. Comparing these results to other areas reveals that the project site is considered to be located adjacent to an intensive migration route. Taking all of the above into account, the receiving environment is considered of medium sensitivity.

(ii) Magnitude of the Impact

Collision of migratory and resident soaring birds with wind turbines are expected but with a higher probability for resident soaring birds that were documented to be using the area of the project site for foraging. Migratory soaring birds were noticed to be in much higher number in the southern part of the project site, including considerable numbers of globally threatened species such as Steppe Eagle *Aquila nipalensis* (Endangered) and Eastern Imperial Eagle *Aquila heliaca* (Vulnerable). However, the magnitude of such impacts differs from species to species. However, to determine the magnitude three main factors were considered to include the following:

1. The numbers of birds recorded within the project site;
2. The conservation status of the species (international IUCN status and local status and importance);
3. The avoidance behaviour and collision risk of recorded species. There is no data in Jordan on avoidance behaviour and collision risks of birds with wind turbines. Therefore, such information was based on experiences from Europe – mainly from Spain. The analysis was a comparative one in order to identify species that were recorded to have a higher number of collisions and electrocutions and compare them with the species recorded on the project site.

Out of all the species recorded, there are six species with a high impact magnitude. These include Egyptian Vulture *Neophron percnopterus* (Endangered), Steppe Eagle *Aquila nipalensis* (Endangered) and Eastern Imperial Eagle *Aquila heliaca* (Vulnerable), which are the globally threatened species that were recorded in the project site. The other high magnitude species are Short-toed Snake Eagle *Circaetus gallicus* (Regionally Threatened), Griffon Vulture *Gyps fulvus* (Regionally Endangered) and Long-Legged Buzzard *Buteo rufinus* since they are breeding species of national importance that were recorded in significant numbers on the project site, mainly foraging, at low heights, and are documented to have tendency to collide with wind turbines and powerlines based on studies in Europe.

Additionally, based on the Cumulative Impact Assessment (CEA) that was carried out for the wind farm project in Tafileh region, additional species to the ones mentioned above were identified as priority species that have a zero-fatality threshold target. Although, these species were not recorded during the in-flight assessments that were carried out for the project but that does not mean that these species do not pass and/or use the site, since they were recorded in adjacent project sites. The project flight monitoring datasets were included in a collective analysis during the CEA for Tafileh Region and the species that were identified

in it should be considered for all projects in the region. These species include an additional migratory species; Booted Eagle *Hieraetus pennatus*, and four other species that are known to breed in the vicinity of the project site. These are Golden Eagle *Aquila chrysaetos* (regionally endangered), Verreaux's Eagle *Aquila verreauxii* (regionally endangered), Bonelli's Eagle *Aquila fasciata* and Lesser Kestrel *Falco naumanni* (regionally near threatened)

In addition, there are additional eight species with a medium impact magnitude. These are Lesser Spotted Eagle *Clanga pomarina*, Black Kite *Milvus migrans*, European Honey-buzzard *Pernis apivorus*, Steppe Buzzard *Buteo buteo vulpinus* Pallid Harrier *Circus macrourus* (globally near threatened), Montagu's Harrier *Circus pygargus* and Levant Sparrowhawk *Accipiter brevipes*. The species were recorded in relatively low to moderate numbers on the project site and are documented to have a medium level to collide with wind turbines and powerlines, based on studies in Europe.

The remainder of the species are considered of low impact magnitude, as that they have no important international or local conservation status, have high avoidance rates, and were recorded in low numbers within the project site.

Therefore, the magnitude of the impact in general ranges between low – high depending on the species of concern as noted in the table below.

Table 47: Magnitude of Impacts on Bird Species

Species	Magnitude of Impact	Justification
▪ Egyptian Vulture ▪ Steppe Eagle ▪ Eastern Imperial Eagle ▪ Booted Eagle	High	▪ High collision rates of such species with powerlines ▪ Globally threatened ▪ Identified by CEA of WPP of Tafileh Region as priority species with Zero-fatality threshold target
▪ Short-Toed Snake Eagle ▪ Long-Legged Buzzard ▪ Griffon Vulture ▪ Golden Eagle ▪ Verreaux's Eagle ▪ Bonelli's Eagle ▪ Lesser Kestrel	High	▪ High collision rates of such species with powerlines ▪ Biological significance of a loss is very high due to its important local status ▪ Identified by CEA of WPP of Tafileh Region as priority species with Zero-fatality threshold target
▪ Lesser Spotted Eagle ▪ Black Kite ▪ Steppe Buzzard ▪ European Honey Buzzard ▪ Montagu's Harrier ▪ Pallid Harrier ▪ Levant Sparrowhawk	Medium	▪ Migrants in flocks with frequent passes. ▪ Observed collision rates of this species is medium-low ▪ May cause high number of fatalities in a single event
▪ Remaining species	Low	▪ All other species are considered of low impact magnitude, as that they have no important international or local conservation status, have high avoidance rates, and were recorded in low numbers within the project site.

Given all of the above, the potential impacts on birds created during the operation phase would be of a long-term duration as they are as long as the wind turbines are operating. Such impacts are considered of negative nature and range from a low magnitude to a high magnitude (high magnitude has been taken into account as a worst case scenario). However, the receiving environmental impact is determined to be of a medium sensitivity. Given all of the above, such an impact is considered to be of moderate significance.

Mitigation and Monitoring Measures

The following identifies the mitigation and monitoring measures to be applied during operation phase. A bird monitoring and mitigation plan to be implemented focusing on avoiding CEA priority birds colliding with turbine rotors. The plan should include methods/protocols for (i) in-flight priority bird monitoring, (ii) observer-led turbine shutdown on demand for priority birds, (iii) bird collision fatality 'carcass search' surveys for all bird species, (iv) calibration tests for carcass search surveys, and (v) livestock movement

monitoring. The monitoring and mitigation plan should follow recommendations in the ESIA and the Tafila Wind Power Projects CEA MMP. This mainly includes the undertaking of: (i) avi-fauna monitoring and (ii) onsite avi-fauna carcass search.

Following the implementation of these mitigation measures, the significance of the residual impact can be reduced to not significant.

(i) Avi-Fauna Monitoring and Turbine Shutdown

Monitoring during the operation of the wind farm must be completed in order to inform the actual impact caused by the wind farm on resident and migratory birds. The monitoring must be undertaken with the primary objective of collision avoidance but also secondary for migration monitoring behaviour.

Monitoring must take place during the spring migration season (from early March till end of May) and autumn migration season (from early September till mid-November). Throughout this period, monitoring must take place continuously on a daily basis where observers need to be located at suitable vantage points covering all rotor swept areas of all the turbines in the wind farm. As for the summer and winter seasons, the level of effort of monitoring could be minimized and a single observer could be located in a central vantage point in the wind farm, to be identified later after the construction phase.

Monitoring must be undertaken onsite by qualified ornithologists to observe all migrating and resident birds. It is anticipated that a minimum of three vantage points will be required to undertake such monitoring (however this can be determined and confirmed at a later stage based on onsite conditions when the turbines are in place).

Monitoring must take place to prevent potential collision of birds with the wind turbines, through individual shutdown of turbine(s) which pose an imminent collision risk to birds. Imminent risk is identified as (a) bird(s) flying at risk height and within a buffer distance of 500m from the turbine(s). However, this should be verified and confirmed during the actual operation of the project taking into account the actual turbine shutdown time as well as other onsite conditions.

Individual temporary turbine(s) shut-down will be enacted by the observers calling through to the control room once an imminent risk is identified and until the birds are out of the risk area. This should take place based on two main conditions and which include the following:

- a. **Condition 1:** the passage of an individual bird species of global or national significance will require the individual temporary shutdown of the concerned turbine(s). Species under this conditions were previously highlighted and include:

Common name	Scientific name
Globally threatened species	
Egyptian Vulture	<i>Neophron percnopterus</i>
Steppe Eagle	<i>Aquila nipalensis</i>
Eastern Imperial Eagle	<i>Aquila heliaca</i>
Booted Eagle	<i>Hoeraatues pennatus</i>
Species of national and/or regional significance	
Griffon Vulture	<i>Gyps fulvus</i>
Short-toed Snake-eagle	<i>Circaetus gallicus</i>
Long-legged Buzzard	<i>Buteo rufinus</i>
Golden Eagle	<i>Aquila chrysaetos</i>
Verreaux's Eagle	<i>Aquila verreauxii</i>
Bonelli's Eagle	<i>Aquila fasciata</i>
Lesser Kestrel	<i>Falco naumanni</i>

- b. **Condition 2:** the passage of ten or more individuals of the species provided below will require the individual temporary shutdown of the concerned turbine(s). Species under this conditions were previously highlighted and include:

Common name	Scientific name
Lesser Spotted Eagle	<i>Clanga pomarina</i>
European Honey-buzzard	<i>Pernis apivorus</i>
Steppe Buzzard	<i>Buteo buteo vulpinus</i>
Black Kite	<i>Milvus migrans</i>
Pallid Harrier	<i>Circus macrourus</i>
Montagu's Harrier	<i>Circus pygargus</i>
Levant Sparrowhawk	<i>Accipiter brevipes</i>

Observers must record in a log sheet the following: species involved, number/ID of turbines ordered for shutdown, time of dispatch of shutdown call, time of actual shutdown. After the risk situation is over the observer must also record the following: time of dispatch of operation resumption, time of actual operation resumption, outcome of event (collision or avoidance), and the avoidance behaviour of bird(s).

During monitoring, additional conditions that need to be documented, based on the CEA, include the following:

- An elevated risk situation, in which a temporary increase in the level of risk to priority birds in the vicinity of the turbines occurs as a consequence of change in human behaviour or environmental conditions. For example, increased activity of livestock grazing around turbines may result in an observed increase in vultures in the area, triggering an increase in monitoring effort and engagement with livestock owners. Regarding environmental conditions, an example would be an extreme rise in wind speed which could lead to a flush of birds along wadis at high speed into the project area which would require an increase in monitoring effort and precautionary shutdown of turbines to avoid collisions.
- A near-miss incident, in which no fatality occurred but monitoring and mitigation protocols failed to alleviate the risk of collision; for example, where a request to shut down a turbine in response to an approaching priority bird was not completed before the bird flew through the rotor-swept area, leading to a review and revision of monitoring and mitigation protocols.
- Livestock presence and movement to be documented since there is a direct relation between the movement and presence of livestock and the increased activity of some of the priority species such as vulture species and Steppe Eagle *Aquila nipalensis*.

Taking the above into account, a bi-annual report must be prepared with all the findings and outcomes based on all records for that year and shut-down events and their effectiveness. In addition, the report must also determine whether any changes on the frequency of the monitoring are required – to include effectiveness of the vantage points and observation hours.

In addition, as discussed earlier, the monitoring is also intended for migration monitoring behaviour. Therefore, the report must also detail all migratory and resident bird activity and patterns, numbers, etc., similar to pre-construction monitoring.

The above monitoring plan must be undertaken during the first three years of operation. After the third year the monitoring plan will be reviewed and re-evaluated. For example, based on the results it could be decided that summer and winter monitoring should be discontinued or its frequency reduced due to low risk of collisions onsite and good avoidance behaviour by bird species.

(ii) Avi-Fauna Carcass Search during Operation

During the operation phase, mortality rate surveys must be undertaken through carcass search surveys covering the entire wind farm. The carcass search will demonstrate the effectiveness of mitigation measures such as turbine shut down and allow an estimation of the annual number of bird deaths caused by the turbine.

a. Carcass Search Surveys

Carcass search surveys shall be carried out by the beginning of the operation phase on a weekly basis during the spring and autumn migration season and twice per month during the summer and winter season. A plot area of 150mX150m would be set around each turbine to search for carcasses. The plot will be covered with search transects 10 m apart, with the searcher looking 5 m on either side.

All found carcasses must be recorded in a log sheet with information to include the following: species, sex, age, condition, cause of death (to the greatest extent possible), coordinates, date, and photos as appropriate, condition (intact, scavenged, feather spots, etc.)

An annual report must be prepared with the results and outcomes to complement the report prepared for the migration monitoring as discussed earlier.

The above carcass search surveys must be undertaken during the first three years of operation. After the third year, the carcass search survey will be reviewed and re-evaluated. For example, based on the results it could be decided that autumn surveys should be discontinued or its frequency reduced due to absence of carcasses recorded.

b. Carcass Removal and Searcher Efficiency Bias Trials

Before commencement of the avi-fauna carcass search during the operation phase, two carcass removal and searcher efficiency trials must be undertaken. One trial must be conducted when nomadic livestock are present and one when they are not so that calibration of bird fatality rates is possible for these two potentially differing situations. The objective of this test is to factor and adjust for carcasses that are removed from the project site from external factors (such as animals that might feed on such carcasses) as well as for searcher efficiency in locating carcasses.

Also, a carcass removal and searcher efficiency bias trial shall be undertaken for the wind farm in order to assess the efficiency of the carcass search team. This trial shall also cover the overhead transmission line (OHTL) in order to factor and adjust for carcasses that are removed from the project site from external factors (such as animals that might feed on such carcasses) as well as for searcher efficiency in locating carcasses.

Carcasses will be placed and dispersed over the wind farm area as well as the OHTL route, avoiding saturation, which could attract animals to the site. They should be checked every day over fifteen days or until the entire carcasses have been removed if earlier.

At the same time, searchers should not be familiar with carcass location and will perform the carcass search annotating how many of the placed carcasses they find. After the trial of each person, the carcasses will be checked again to see if they are still there (and were not recorded by the searcher) or have been removed (by animals). Based on the above, the carcass removal and searcher efficiency rates can be calculated.

(iii) Onsite Carcass Search (other than birds)

The Project Operator must implement a carcass search plan (other than birds) for any carrion which could be present onsite to prevent attraction of birds to the site (such as the Griffon vulture, Egyptian vulture and Steppe Eagle which rely on livestock and medium-large size mammals to feed on). The plan should cover the entire project site and surrounding areas and must commence with the operation of the project. This should be undertaken on a monthly basis but particular attention should be paid during the season when nomads are in the area (from April till September). Nomads raise livestock and carcasses could be in the area

throughout such times. Such a plan should be implemented throughout the first two years of operation of the project after which it could be reviewed and reevaluated (e.g. if no carcasses are recorded during the first two years it can be discontinued).

(iv) Monitoring of the breeding bird species

The breeding bird assessment has indicated that the project site hosts a relatively large population of breeding birds and that the diversity of habitats in the project site are suitable for a variety of bird species. It is critical to monitor the impact of the project development and operation on the breeding species in the project site. This must be carried out for the first three years of the life of the project during the breeding season from March until June.

15. BATS

This Chapter first provides an assessment of baseline conditions within the wind farm and its surroundings in relation to bats and then assesses the anticipated impacts from the project throughout its various phases. For each impact, a set of management measures (which could include mitigation measures, additional requirements, etc.) and monitoring measures have been identified to eliminate or reduce the impact to acceptable levels.

15.1 Assessment of Baseline Conditions

This section discusses the methodology for the assessment of the baseline conditions in relation to bats and presents the outcomes and results.

15.1.1 Baseline Assessment Methodology

The baseline assessment of the project site was based on a literature review and a field survey, each of which is discussed in details below.

(i) Literature Review

This was based on previous studies, data, surveys, and records available in published scientific papers, books, and journals on bats of Jordan. All available data known in the study area and adjacent regions were tabulated.

(ii) Field Survey

Field survey was undertaken at the project site through the use of bat detectors. Three field surveys were undertaken in the project site. The first survey was carried out in summer/autumn 2013, the second in autumn 2014 while the third and last survey was carried out over five months from April until August 2016. This is regarded as the most suitable period of the year to assess bat activity as bats show higher activity during this period, which is directly related to the availability of prey (Benda *et al*, 2010). During this period, bats feed and reproduce giving birth in June and thereafter. In addition, throughout this period of the year the biodiversity of the site is the highest which would enable to assess the site's habitat in providing a feeding area for bats which is highly correlated in determining bat activity. In addition, the survey was undertaken during night-time as bats usually rest and sleep during the day and are active during night as they search for prey to feed on.

The first two surveys were undertaken using a BatBox III bat detector while the third survey was carried out using Titley Scientific ANABAT SD2 Active Bat Detector. Upon detecting bat activity, coordinates would be recorded using Garmin (GPSMAP 62S) global positioning device.

During the first survey in 2013, eight days were covered from June until September where each daily visit lasted for eight hours. Four locations in the project site were selected and they were visited to document any bat activity. During the second survey, a total of 30 points and 20 transect-routes were selected in the project site and they were visited regularly from June until August, where a total of 90 minutes was covered along each route-transect and a total of 30 minutes was covered at each point. As for the last survey in 2016, a series of 28 points were selected that cross through the project site and they were visited regularly from April to August 2016 with a total of 14 hours of monitoring per month equally distributed across the points, see Figure 34.

In addition, careful inspections were undertaken during the day throughout the project site to identify potential roosting sites which might be inhabited by bats during the day for rest and sleep and such areas were inspected for bat signs and remains or any other vital signs that indicate bat activity (e.g. fecal remains).

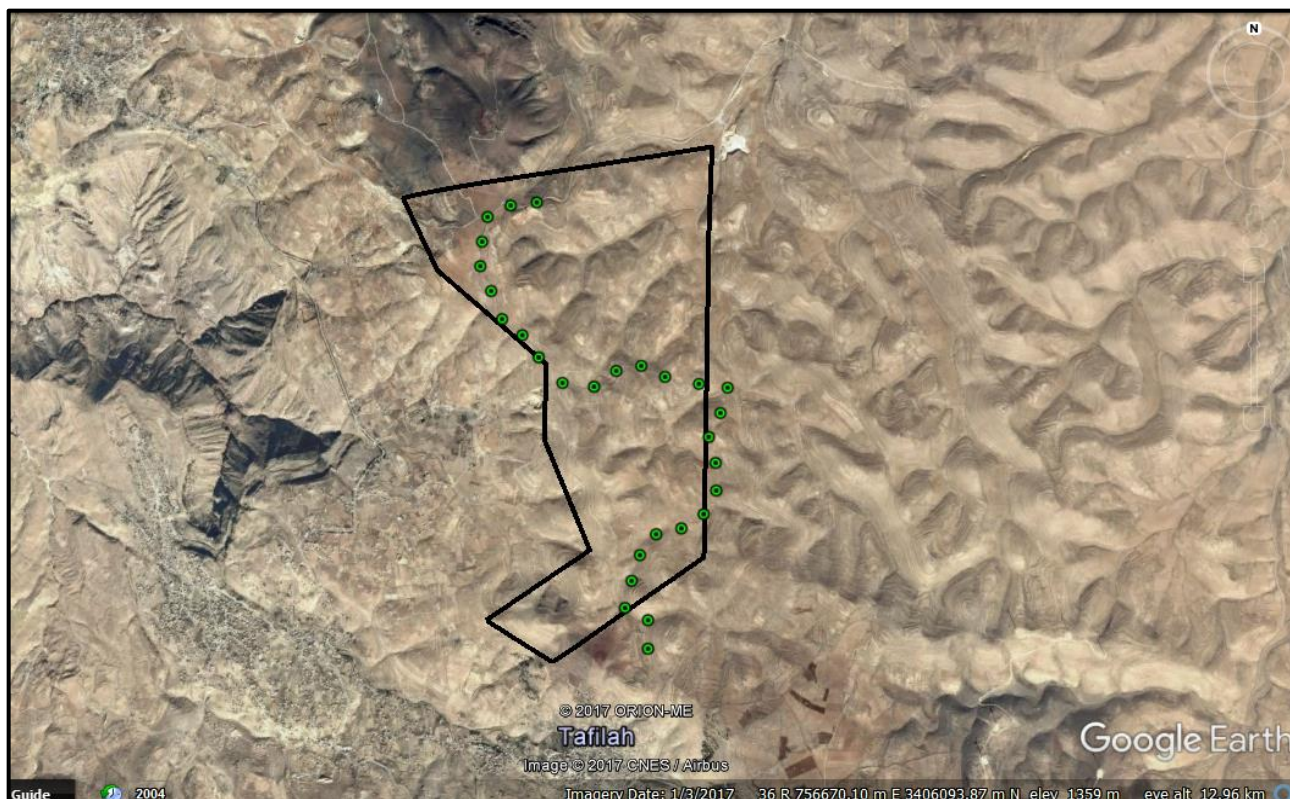


Figure 34: Location of Routes and Point Counts for the Bats and Breeding Bird Assessment

(iii) Bats Species' status

Bats species status was assigned based on their conservation status within the Mediterranean region according to the IUCN Red Data Books: "The Status and Distribution of Mediterranean Mammals" (Temple & Cuttelod, 2009). In addition, their local status was based on an assessment undertaken by the bats expert in collaboration with RSCN – where such an assessment was undertaken in accordance with IUCN criteria. However, the results for this assessment have not been published yet.

15.1.2 Results

Three bat species were recorded during the three surveys. During the first survey in summer/autumn of 2013, no species were recorded. In the survey of 2014, three species were recorded whereas two of those species were recorded again in 2016 but in lesser locations.

Table 48: Bat Species

Family	Scientific name	Common name	IUCN Red List	Mediterranean IUCN Regional Status
Molossidae	<i>Tadarida teniotis</i>	European Free-tailed Bat	Least Concern	Least Concern
Vespertilionidae	<i>Pipistrellus kuhlii</i>	Kuhls' Pipistrelle	Least Concern	Least Concern
	<i>Eptesicus bottae</i>	Botta's Serotine	Least Concern	Least Concern

15.2 Assessment of Potential Impacts

This section identifies and assesses the anticipated impacts from the project activities on bats during the various phases to include planning and construction phase and operation phase. For each impact, a set of management measures (which could include mitigation measures, additional requirements, etc.) and monitoring measures have been identified to eliminate or reduce the impact to acceptable levels.

15.2.1 *Potential Impacts during the Construction Phase*

Site preparation activities which are to take place onsite by the EPC Contractor for installation of the wind turbines and the various project components to include transmission cables, access roads and internal road network, buildings, etc. are expected to include land clearing activities, levelling, excavation, grading, etc.

Such activities are limited to the relatively small individual footprints of these facilities and the actual area of disturbance is relatively minimal. Nevertheless, such activities would likely result in the alteration of the site's habitat and thus potentially impacts bats; particularly through loss of hunting habitats for bats as well as roosting sites.

The three bat species recorded in the project are all of Least Concern conservation status according to both IUCN Red List of Threatened Species and the IUCN Mediterranean Regional Assessment. The three species are also common species in Jordan are not known to face any specific threats. Also, based on the CEA for Tafileh Region, none of the three species recorded in the project site are identified as priority species.

Given all of the above, the potential impacts on bats created during the construction phase would of a long-term duration as they would result in a permanent change in the natural biodiversity of the site. However, such impacts are considered of negative nature and of a low magnitude given that the site is not used by bats as a feeding ground and no roosting sites were recorded. In addition, given the very limited bat activity, the receiving environmental is determined to be of a low sensitivity. Given all of the above, such an impact is considered to be not significant. To this extent, no mitigation measures have been identified.

15.2.2 *Potential Impacts during the Operation Phase*

The potential impacts from the project during operation are mainly related to risk of bat strikes and collisions with rotors of the operating wind turbines.

Many reports have corroborated the findings of bat collisions with wind turbines; this includes reports in Germany (Dürr 2001; Trapp *et al.* 2002; Dürr & Bach 2004), Sweden (Ahlén, 2002) and Spain (Alcalde, 2003). Evidences that turbines do not only kill bats from local populations but also from populations at far distance were established (Voigt *et al.*, 2012). Moreover, there are reports with findings on collisions of bat species similar to that recorded onsite (Kuhl's Pipistrelle) from a wind farm project in Spain (Alcalde, 2003).

The three bat species recorded in the project are all of Least Concern conservation status according to both IUCN Red List of Threatened Species and the IUCN Mediterranean Regional Assessment. The three species are also common species in Jordan are not known to face any specific threats. Also, based on the CEA for Tafileh Region, none of the three species recorded in the project site are identified as priority species.

Given all of the above, the potential impacts on bats created during the operation phase would of a long-term duration. Such impacts are considered of negative nature and of a low magnitude given that a risk of collision of the species recorded does not entail any significant impacts (species recorded is very common and considered of least concern). In addition, given the very limited bat activity the receiving environmental is determined to be of a low sensitivity. Given all of the above, such an impact is considered to be not significant.

Additional Studies/Surveys and Mitigation and Monitoring Measures

Before commencement of operational activities, Project Operator is required to implement proper and adequate management measures for those sources which could attract bats to the project site to the greatest extent possible.

In addition, Implement a bat mortality monitoring plan. The plan should include bat collision fatality ‘carcass search’ surveys informed by bat ecology, and calibration tests for searcher efficiency and bat carcass removal by scavengers. The monitoring program for bats should follow recommendations in the ESIA and the Tafilal Wind Power Projects CEA MMP. The program must be undertaken by an expert and must include the following components:

- Bats mortality monitoring program would be carried out as part of the carcass search surveys that will be undertaken for birds, during the first 3 years of operation. After the third year, the carcass search survey, as a whole for birds and bats, will be reviewed and re-evaluated. For example, based on the results it could be decided that autumn surveys should be discontinued or its frequency reduced due to absence of carcasses recorded. No bat-specific carcass removal and searcher efficiency trials will be carried out and it will be done as part of the birds trials, and
- Based on the outcomes of the mortality monitoring program, should no issues of concern be identified then the mortality monitoring program can be discontinued (this is the most likely scenario to occur). In the highly unlikely event that any issues of concern are identified (high bats mortality recorded) then additional investigations must take place on the sources of attraction of bats to the site (which will most likely be from external sources) and based on that appropriate mitigation measures must be identified.

16. ARCHEOLOGY AND CULTURAL HERITAGE

This chapter first provides an assessment of baseline conditions within the project site and surrounds in relation to archaeology and cultural heritage and then assesses the anticipated impacts from the project throughout its various phases. For each impact a set of management measures (which could include mitigation measures, additional requirements, etc.) and monitoring measures have been identified to eliminate or reduce the impact to acceptable levels.

16.1 Assessment of Baseline Conditions

This section discusses the methodology for the assessment of the baseline conditions in relation to archaeology and cultural heritage and presents the outcomes and results.

16.1.1 Baseline Assessment Methodology

The baseline assessment of the project site was based on a literature review and a field survey, which is discussed below.

(i) Literature Review

Literature review included a comprehensive review of archives, publications, and studies on previous archaeological work and surveys undertaken in the area, which are available at the Department of Antiquities' (DoA) database. This also includes the search within the official register and database of all archaeological/cultural sites of Jordan, known as the Middle Eastern Geodatabase for Antiquities – Jordan (MEGA Jordan).

(ii) Field Survey

A field survey was undertaken by the DoA – the official governmental entity in Jordan responsible for the protection, conservation, and preservation of antiquities in accordance with the “Antiquities Law No. 21 for 1988 and its amendments No. 23 for 2004”.

The objective of the field survey was to ascertain the presence of any archaeological remains within the project site. The survey was undertaken from 27 April – 08 May 2016 for the entire project site boundary for a total area of around 9km². The survey area was divided into topographic zones: hilltops, plateau, hill slopes and Wadi bottoms. The ground was walked by a technical team from the DoA, spaced at an interval of approximately 100 m in order to inspect the entire ground surface, where each pass is referred to as a ‘transect’. Any sites of interest were recorded by sketch plans and /or a photograph as appropriate. Whilst walking these transects, information including the GPS coordinates, topography, and elevation of discovered archaeological sites were recorded. The results of the survey were analysed by categorizing the sites and assessing their significance. The result of the survey was a full listing of the archaeological sites, archaeological features, and survey results of the project area using maps and photographs where appropriate.

It is important to note that, at the time the field survey was undertaken by the DoA (April – May 2016), the project site boundary was different that that presented in this current report – the Developer changed the site boundary at a later stage by adding some land areas to the north, resulting in 2 turbines being located outside of the original land site boundary that was surveyed by the DoA. ECO Consult officially contacted the DoA stating that 2 turbines are now located outside of the original boundary that was surveyed by the DoA.

Based on discussions with the DoA it was stated that at that time, the survey did not cover the exact project site boundary but also included some areas outside. The DoA responded officially that they have no objection on the locations of the 2 turbines and there are no additional requirements to be considered in this case.

16.1.2 Results

In accordance with the methodology discussed above, the results first provide the outcomes of the literature review and the outcomes of the DoA survey.

(i) Literature Review

A review of MEGA Jordan identified only one recorded site within the project area as presented in the figure below. The area within the project site is registered as MEGA #4800, and is known as NN/TBAS Site 162 and has been recorded on 1 July 2010. No additional details were available on MEGA Jordan on this site such as its area, significance, characteristics, etc.

To this extent, the survey undertaken by the DoA aimed to assess the project site in general as well as further investigate the MEGA #4800 site and determine its characteristics and significance. The results of the survey are discussed in detail below.

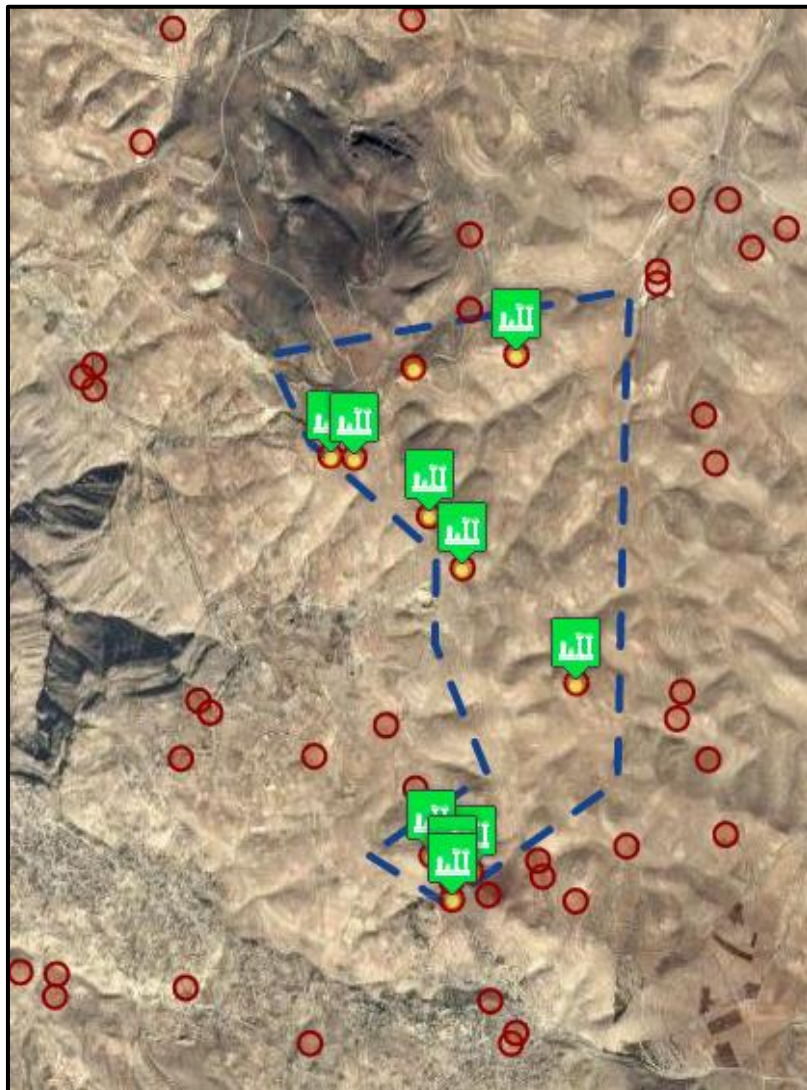


Figure 35: MEGA Jordan Search Results

(ii) Archaeological Assessment of the Project Site

Based on the results of the baseline assessment, the DoA identified ten (10) sites within the land of project site in addition to five (5) others located in close proximity to the project site. Mainly, these sites include archaeological features such as settlements, building structures, architectural elements, caverns, etc. which generally date back to the Nabataean, Roman, Edom, and Second Iron Ages. The table below provides a brief description of each of those sites, while Figure 36 presents a map with their locations. In addition, representative photos for the sites are illustrated in the figures that follow.

As noted in the table below, most of the sites are relatively small sites with the exception of site number 1. Given all of the above, such sites are regarded important considering their archaeological and cultural value and should be protected from potential damage or destruction throughout the various project activities. However, such sites can be found frequently especially in such mountainous areas which have most likely ancient/old human presence especially during the Nabataean/Roman and Edom era.

More importantly, the DoA has issued an official letter stating their approval of the project development. The approval states the DoA has no objection on the development of the project conditional that a 70m buffer zone is respected from each of the recorded sites and that the DoA is contacted should any archaeological remains be discovered during the development of the project.

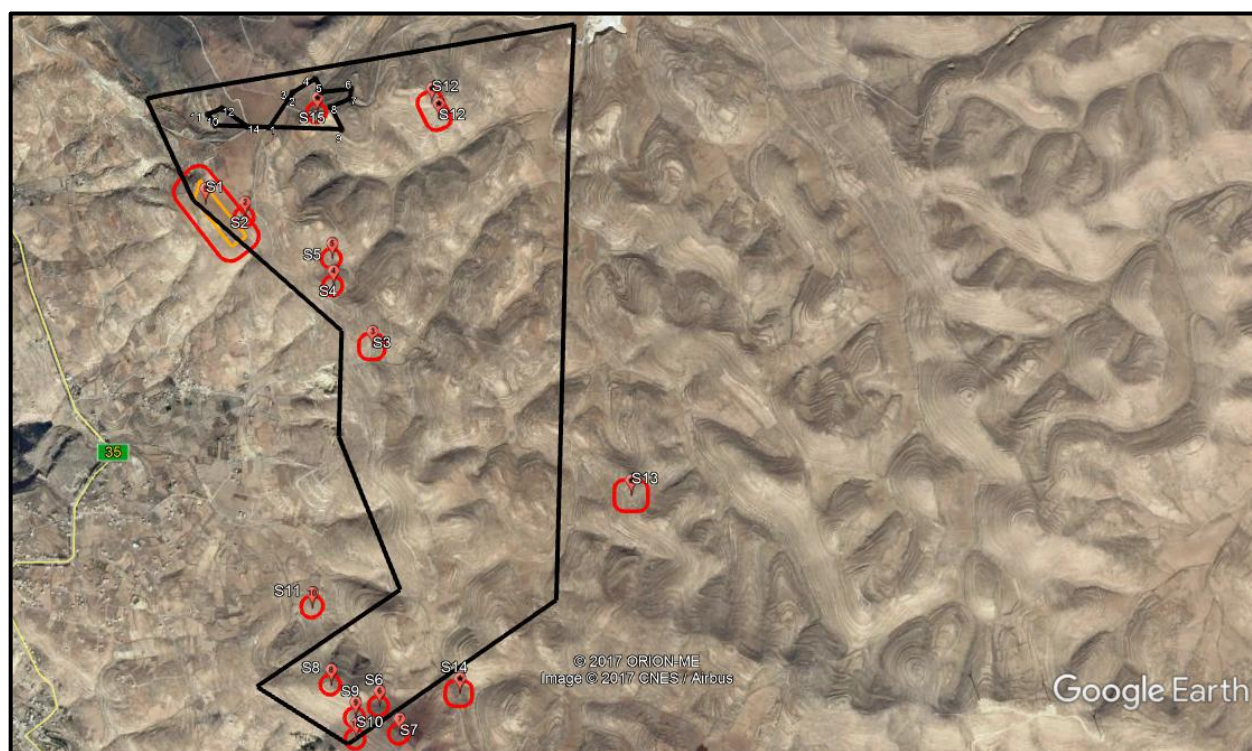


Figure 36: Archaeological Sites Recorded within the Area by the DoA

Table 49: List of Archaeological Sites Recorded within the Project Area

Site	Period	Brief Description	Area (m ²)
1	Late Roman, Nabataean and Second Iron Age	The site consists of eight (8) circular stone piles of 7-10m diameter and one elliptical pile that is 12m long, 5m wide and 2m in height, in addition to a straight wall extending 100m towards the south connecting the piles together. Such piles spread over an area of 10,000m ² (10 Dunums) and consist of large Basalt stones which are likely formed as a result of land reclamation activities undertaken during the Edom era.	199,320
2	Late Roman, Late Bronze, Nabataean and Second Iron Age	A small cave carved in Calcite rocks with a wide opening extending west as well as a small carved-in-rock wash-basin on top of it that is 30cm in diameter and 25cm deep.	14,520

Site	Period	Brief Description	Area (m ²)
3	Late Roman, Nabataean and Second Iron Age	Remains of a settlement which consists of rectangular calcite and flint stones, which are destroyed and indefinite in shape. In addition, several caves and rainfall water harvesting wells were recorded in this site.	30,000
4	Second Iron Age	A cave with an area of 6m ² craved in Calcite rocks with a small opening extending east.	15,390
5	Nabataean and Second Iron Age	A cave (40m ²) craved in Calcite rocks with a wide opening extending south that is located within a sharply-descending rock section.	15,390
6	Second Stone Age	A stone circle that is 8m in diameter and which consists of large and impervious Basalt stones.	15,390
7	Second Stone Age	An ancient cave with an elliptical inner shape and a wide opening extending east.	15,390
8	Nabataean, Late Roman, Late Islamic and Second Stone Age	Remains of a disturbed rectangular building that is made of large Basalt and Calcite rock. This structure was most likely used as a watchtower in the past due to its high altitude.	15,390
9	Second Stone Age	An ancient Cave (25m ²), irregular in shape and carved within a rock section of Calcite which descends sharply towards the south.	15,390
10	Nabataean, Late Roman and Second Iron age	The site features a circular pile 12m in diameter consisting of black Basalt stones situated 3m above the surrounding area as well as remains of a rectangular building structure (3×6 m) constructed from Calcite stone. This site has most likely been used as a watchtower in the Edom Era.	15,390
11	Nabataean and Second Iron Age	A settlement located on a low slope mountainside extending northwest. The site features debris of scattered disturbed buildings constructed from impermeable Calcite stone.	19,105
12	Nabataean / Roman and Edom Age	The site is known by the local community as 'Khirbet Al-Malafees'. The site is situated on a hillside extending east with an area of 6,000m ² (6 Dunums). The site features remains of large buildings as well as several caves and rainfall water harvesting wells, which likely date back to the Edom, Late Roman and Nabataean Ages.	50,000
13	Edom Era, Nabataean, Late Roman, Byzantine and Late Islamic Age	The site is known as 'Khirbet Al-Sharre'a' situated on a relatively flat mountain top with an area of approximately 8,000m ² (8 Dunums). The site features remains of various indistinct large buildings which date back to the Edom Era, Nabataean, Late Roman, Byzantine and Late Islamic Age in addition to several caverns and wells. There is also a square house that is 9m long and 3m high built from trimmed Calcite stone with two arches that were used to support the ceiling, which dates back to the mid-20 th century.	52,000
14	Edom, Nabataean, Late Roman and Byzantine Age	The site is known as 'Khirbet Abu Shatta' situated in agricultural lowland. The site features building remains from untrimmed Calcite stone in addition to remains of a square building structure to the north of the project site which likely date back to the Edom Era, Nabataean, Late Roman and Byzantine Age	34,000
15	Edom Era, Nabataean and Late Islamic Age	A cavern known as 'Al Hala Cavern'. The cavern is 150m long and 2.25m high, craved in a vertical rock section and has a regular rectangular inner shape (6×5×2m) with a wide opening extending north as well as a stone terrace (90cm wide and 70cm high) engraved into the Calcite inner wall of the cavern. In addition, a well is found to the northeast of the cavern. The site also features some unique architectural finds and pottery remains which date back to the Edom Era, Nabataean and Late Islamic Age.	15,390

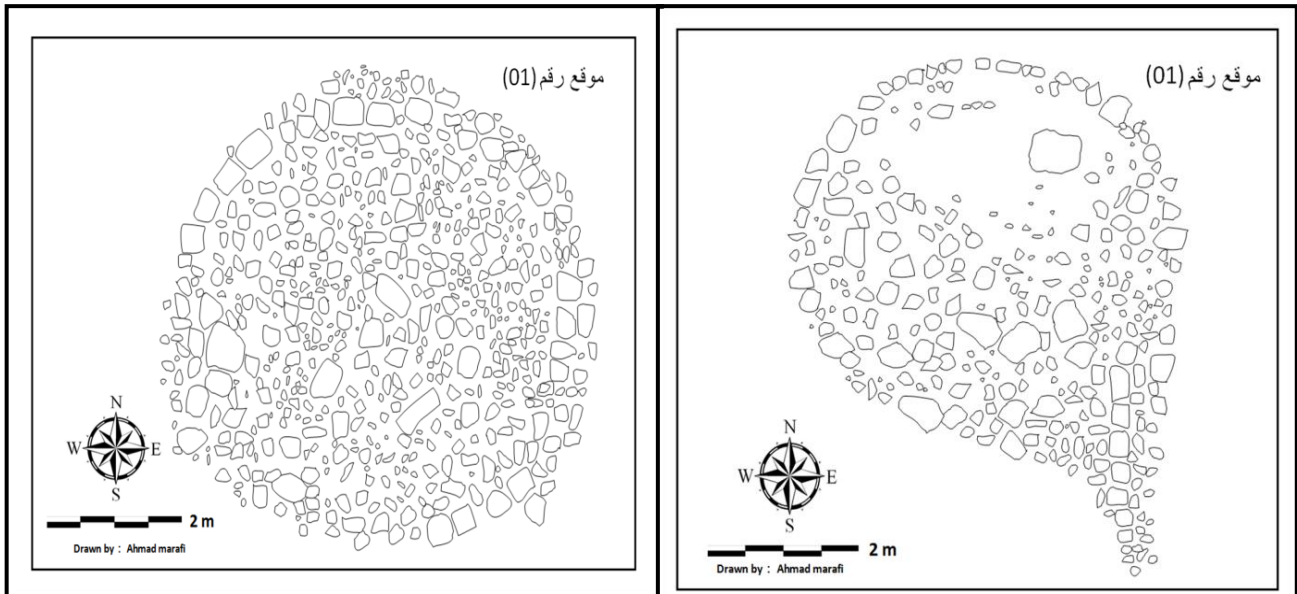


Figure 37: illustration of Site 1

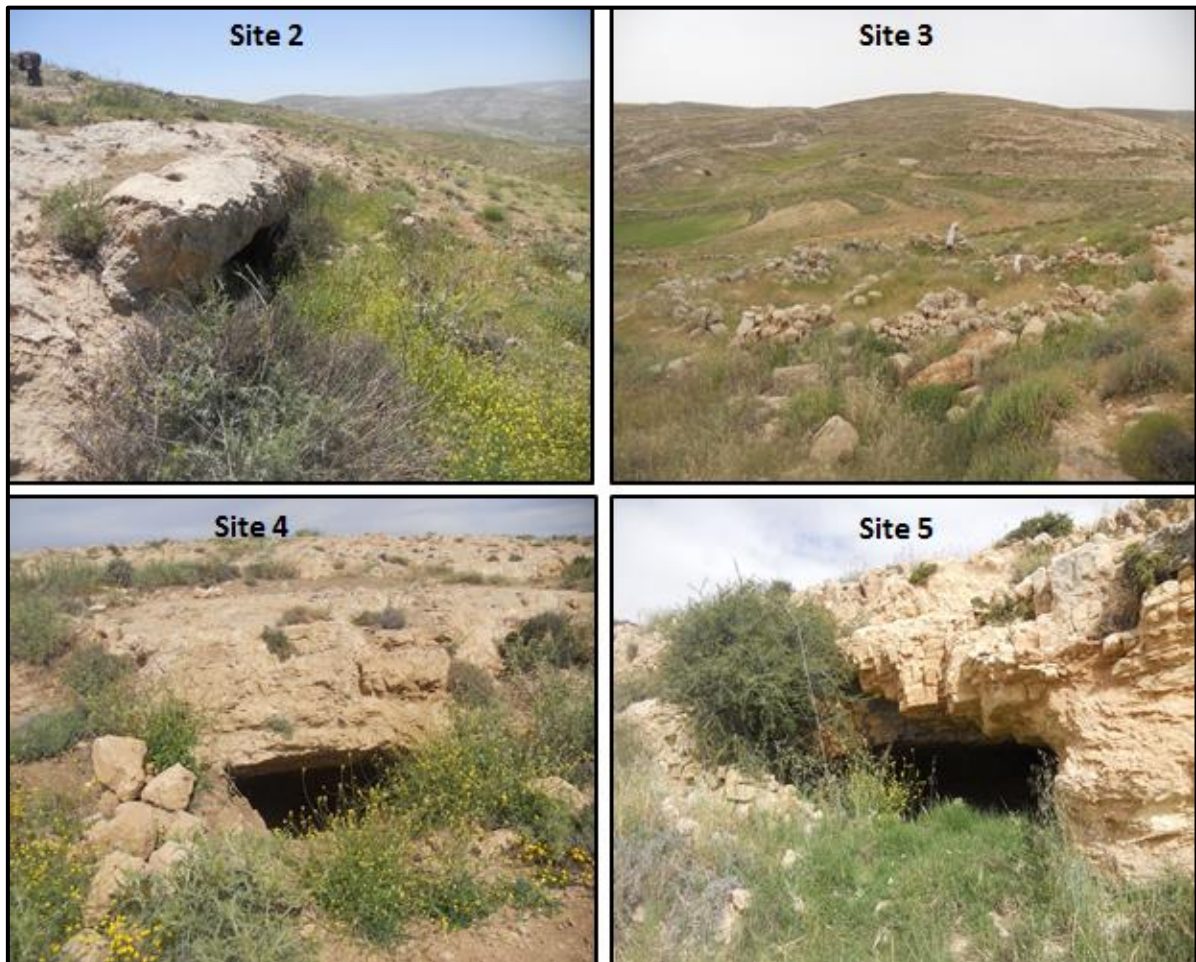


Figure 38: Sites 2 - 5

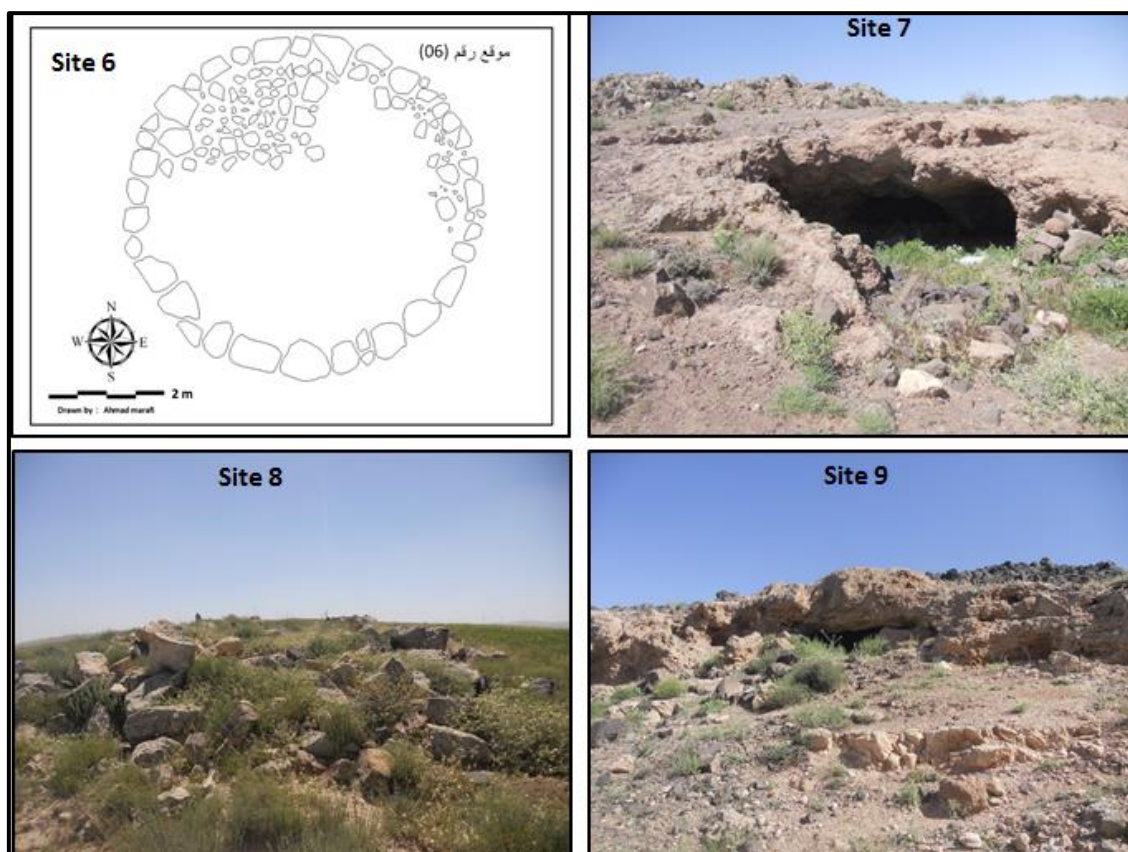


Figure 39: Sites 6 – 9

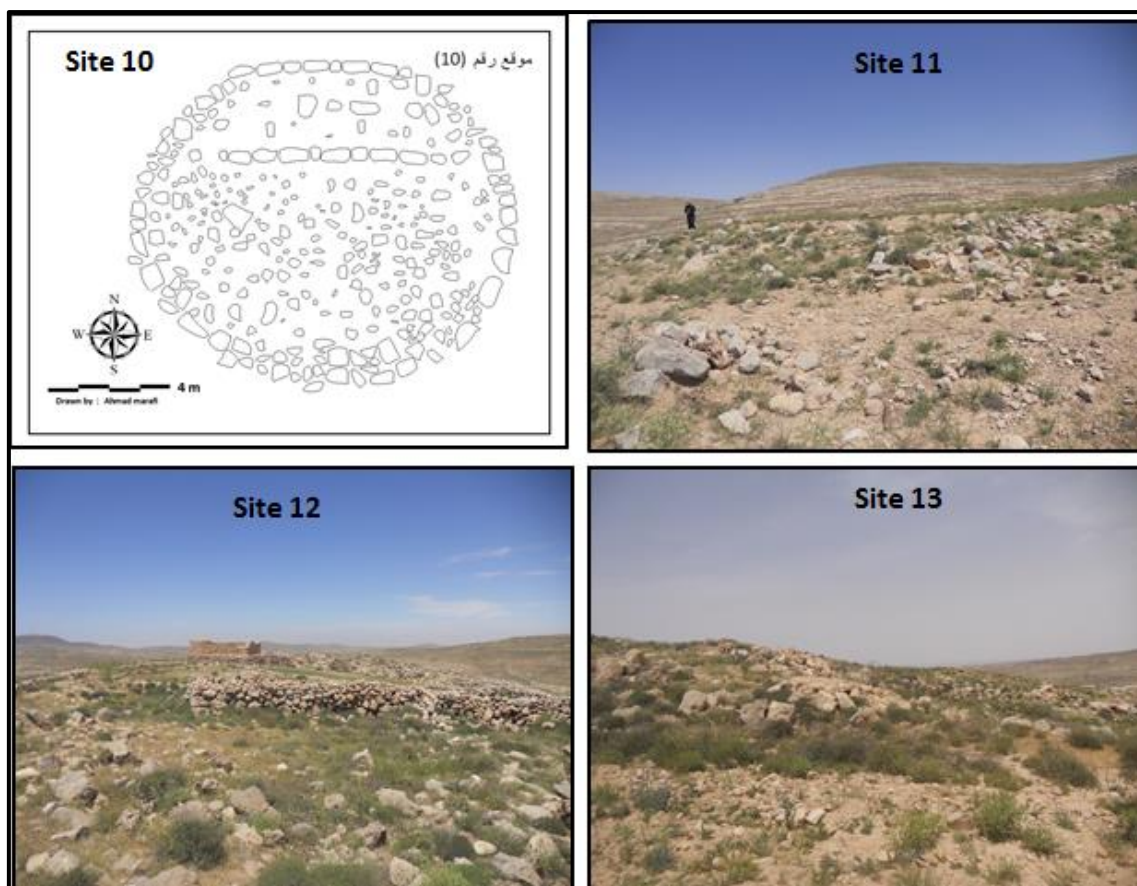


Figure 40: Sites 10 -13

16.2 Assessment of Potential Impacts

This section identifies and assesses the anticipated impacts from the project activities on archaeology and cultural heritage during the various phases including planning, construction and operation. For each impact, a set of management measures (which could include mitigation measures, additional requirements, etc.) and monitoring measures have been identified to eliminate or reduce the impact to acceptable levels.

16.2.1 *Potential Impacts during the Construction Phase*

Site preparation activities which take place onsite by the EPC Contractor for installation of the wind turbines and the various project components including transmission cables, access roads and internal road network, buildings, etc. are expected to include land clearing activities, levelling, excavation, grading, etc.

Although such activities are limited to the relatively small individual footprints of these facilities and the actual area of disturbance is relatively minimal, if such activities are improperly managed they could damage or disturb archaeological remains present on the surface of the project site. As discussed in the baseline section (refer to “Section 16.1”), there were 15 archaeological sites recorded within the project area.

Such sites recorded (refer to Figure 36) are considered important given their archaeological and cultural value, and should be protected from potential damage or destruction throughout the various project activities. However, they are not considered unique nor distinctive archaeological features and most importantly would not affect the project development; such sites can be found extensively especially in the mountainous areas which have most likely had ancient/old human presence especially during the Nabataean/Roman era due to its agricultural potential.

In addition, there is a chance that throughout such construction activities, archaeological remains buried in the ground are discovered. Improper management (if such sites are discovered) could potentially disturb or damage such sites, which could potentially be of archaeological importance.

Given all of the above, the potential impacts on archaeology created during the construction period would of a short-term duration as they are limited to the construction phase only. The impacts will be of a negative nature and medium magnitude if improperly managed, as it is possible that once a site is damaged or disturbed it cannot be restored. In addition, given the presence of archaeological remains in the project area, the receiving environment is considered of medium sensitivity. Finally, such an impact is considered to be of moderate significance.

Mitigation Measures

The following identifies the mitigation measures to be applied by the EPC contractor during the construction phase:

- The final detailed design prepared by the EPC Contractor should avoid sitting any of the project components (including turbines, roads, transmission lines, warehouses, etc.) within such delineated areas of archaeological importance. Taking into account a 70m buffer area from each site as required by the DoA (Figure 36 presents those sites with a 70m buffer area). Exact coordinates of these areas have been provided in AUTOCAD format for the EPC Contractor to take into account during the detailed design of the project.
- Submission of the final detailed design to the Department of Antiquities to demonstrate that such sites have been avoided.
- Before commencement of any construction activities, the identified sites must be properly demarcated with appropriate signage (fences, flag poles or other) so that the sites are clearly visible to all workers during construction.
- Properly plan construction activities which take into account the identified archaeological locations to ensure they are protected from any potential damage. This could include for example proper movement

of vehicles and machinery into/out of the site to avoid those areas, ensure that all vehicles are on established roads and prohibit off-roading, prohibit movement of vehicles near those areas during the various construction activities, etc.

- Ensure that the Code of Conduct, awareness raising, and training developed for construction workers and personnel involved in the construction phase of the project to emphasize the presence of archaeological locations in the area - this could include providing information on their locations, prohibit any improper conduct which could disturb/ damage those locations, etc.
- Implement appropriate chance find procedures. Throughout the construction phase and as the case with any project development that entails such construction activities there is a chance that potential archaeological remains in the ground are discovered. It is expected that appropriate measures for such chance find procedures are implemented which are standard requirements by the DoA as required by the “Antiquities Law No. 21 for 1988 and its amendments No. 23 for 2004”. Those mainly require that construction activities be halted in the specified area of findings and the area fenced, while immediately notifying the DoA. No additional work will be allowed before the department assesses the found potential archaeological site and grants a clearance to resume the work. Construction activities can continue at other parts of the site if no potential archaeological remains were found. If found, same procedures above apply.

Following the implementation of these mitigation measures, the significance of the residual impact can be reduced to not significant.

Monitoring and Reporting Requirements

The following identifies the monitoring and reporting requirements that must be adhered by the EPC contractor during the construction phase:

- Submission of proof of coordination for submission of final detailed design to the DoA.
- Inspections of construction activities to ensure that archaeological locations are avoided throughout the construction activities and proper code of conduct is enforced.
- Inspection of actions taken in case of new discoveries, including fencing, limiting access to site, and contacting the DoA. Report should be prepared and submitted to the DoA in such a case which details the above.

16.2.2 Potential Impacts during the Operation Phase

Potential impacts during the operation phase are limited to improper management of operation activities which could potentially disturb or damage the archaeological locations identified as discussed earlier. This could include for example improper movement of vehicles and machinery into/out of the site, improper conduct by operation workers, etc.

Given all of the above, the potential impacts on archaeology are of a long -term duration throughout the project operation phase. The impacts will be of a negative nature, and medium magnitude if improperly managed as it is possible once a site is damaged or disturbed it cannot be restored. However, operation and maintenance activities are expected to occur at designated areas only (turbine locations, substation, etc.) using access roads established during the construction phase, therefore the receiving environment is considered of low sensitivity. Given all of the above, such an impact is considered to be of minor significance.

Mitigation Measures

The following identifies the mitigation measures to be applied by the project operator during the operation phase:

- Properly plan operation and maintenance activities to take into account the identified archaeological locations to ensure they are protected from any potential damage. This could include for example proper movement of vehicles and machinery into/out of the site to avoid those areas, ensure that all vehicles are on established roads and prohibit off-roading, prohibit movement of vehicles near those areas during the various operation and maintenance activities, etc.
- Ensure that the Code of Conduct, awareness raising, and training developed for workers and personnel involved in the operation phase of the project to emphasizes the presence of archaeological locations in the area – this could include providing information on their locations, prohibit any improper conduct which could disturb/ damage those locations, etc.

Following the implementation of these mitigation measures, the significance of the residual impact can be reduced to not significant.

Monitoring and Reporting Requirements

The following identifies the monitoring and reporting requirements that must be adhered to by the project operator during the operation phase:

- Continuous monitoring of operation activities to ensure that a proper code of conduct is enforced.

17. AIR QUALITY

This chapter provides an assessment of anticipated impacts on air quality from the project throughout its various phases. For each impact, a set of management measures (which could include mitigation measures, additional requirements, etc.) and monitoring measures have been identified to eliminate or reduce the impact to acceptable levels.

17.1 Assessment of Baseline Conditions

Assessment of baseline conditions is considered unnecessary (i.e. measurements of air pollutants), due to the nature of anticipated impacts from the project – which are mainly related to dust generation. Such impacts can be adequately controlled through appropriate mitigation and monitoring measures as discussed in further details below.

17.2 Assessment of Potential Impacts

This section identifies and assesses the anticipated impacts from the project activities on air quality during the construction phase. A set of management measures (which could include mitigation measures, additional requirements, etc.) and monitoring measures have been identified to eliminate or reduce the impact to acceptable levels. It is important to note that there are no foreseen impacts on air quality during the operation phase.

17.2.1 *Potential Impacts on Air Quality during the Construction Phase*

Site preparation activities which are to take place onsite by the EPC Contractor for installation of the wind turbines and the various project components to include transmission cables, access roads and internal road network, buildings, etc. are expected to include land clearing activities, levelling, excavation, grading, etc.

Such activities are limited to the relatively small individual footprints of these facilities and the actual area of disturbance is relatively minimal. Nevertheless, such activities will likely result in an increased level of dust and particulate matter emissions, which in turn will directly and temporarily impact ambient air quality. If improperly managed, there is a risk of nuisance and health effects to construction workers onsite and to a lesser extent to the nearby surrounding receptors from windblown dust (such as the residents of the village). In addition, construction activities will likely entail the use of vehicles, machinery and equipment (such as generators, compressors, etc.) which are expected to be a source of other pollutant emissions (such as SO₂, NO₂, CO, etc.) which would also have minimal direct impacts on ambient air quality.

The above impacts are anticipated to be temporary and of short-term nature as they are limited to the construction period only. Such impacts are of a negative nature, and will be noticeable and therefore of medium magnitude. However, the impacts will be dispersed and are reversible as air quality would revert back to baseline conditions after construction works is completed and thus the receiving environment is considered of low sensitivity. Given the above such an impact is considered of minor significance.

Mitigation Measures

The following identifies the mitigation measures to be applied by the EPC Contractor during the construction phase:

- Based on inspections and visual monitoring undertaken, if dust or pollutant emissions were found to be excessive due to construction activities, the source of such emissions should be identified and adequate control measures must be implemented;

- Comply with the Occupational Safety and Health Administration (OSHA) requirements and the Jordanian Codes to ensure that for activities associated with high dust and noise levels, workers are equipped with proper Personal Protective Equipment (e.g. masks, eye goggles, breathing masks, ear muffs, etc.);
- Apply basic dust control and suppression measures which could include:
 - Regular watering of roads for dust suppression in periods of high traffic;
 - Proper planning of dust causing activities to take place simultaneously in order to reduce the dust incidents over the construction period.
 - Proper management of stockpiles and excavated material (e.g. watering, containment, covering, bundling).
 - Proper covering of trucks transporting aggregates and fine materials (e.g. through the use of tarpaulin).
 - Adhering to a speed limit of 15km/h for trucks on the construction site.
- Develop a regular inspection and scheduled maintenance program for vehicles, machinery, and equipment to be used throughout the construction phase for early detection of issue to avoid unnecessary pollutant emissions.

Following the implementation of these mitigation measures, the significance of the residual impact is categorized as not significant.

Monitoring and Reporting Requirements

The following identifies the monitoring and reporting requirements that must be adhered to by the EPC Contractor during the construction phase and which include:

- Inspection and visual monitoring of the works should be carried out at all times. In addition, periodic inspections should be conducted at nearby sites (e.g. villages) to determine whether harmful levels of dust from construction activities exist; and
- Reporting of any excessive levels of pollutants/dust or noise and the measures taken to minimize the impact and prevent it from occurring again.

18. INFRASTRUCTURE AND UTILITIES

This chapter first provides an assessment of baseline conditions within the project site and surrounds in relation to infrastructure and utilities and then assesses the anticipated impacts from the project throughout its various phases. For each impact, a set of management measures (which could include mitigation measures, additional requirements, etc.) and monitoring measures have been identified to eliminate or reduce the impact to acceptable levels.

18.1 Assessment of Baseline Conditions

This section discusses the methodology for the assessment of the baseline conditions in relation to infrastructure and utilities as well as the outcomes and results.

The components discussed in relation to infrastructure and utilities include the following: (i) water resources; (ii) wastewater services; (iii) solid waste services; (iv) hazardous waste services; (v) aviation, telecommunication and television & radio link; (vi) road safety each of which is discussed separately below.

18.1.1 Baseline Assessment Methodology

The baseline assessment was based on collection of secondary data and plans available as well as discussions and consultations mainly with representatives from various governmental authorities and utility service providers as discussed in details throughout this section.

18.1.2 Water Resources

The water sector in Jordan is mainly governed by the Ministry of Water and Irrigation (MWI) and the Water Authority of Jordan (WAJ). MWI is the official body responsible for the overall monitoring of the water sector, water supply and wastewater system, and the formulation of national water strategies and policies. WAJ assumes all responsibilities related to water and wastewater structures including design, construction, operation, maintenance and administration. Within Tafileh Governorate, Tafileh Water Directorate is the responsible entity representing WAJ.

According to the “Strategic Master Plan for Municipal Water Infrastructure” (USAID, 2015), three water systems supply water to the various localities within the Tafileh Governorate that include:

- The Tafileh Main Water System; which is the main water system that covers most of the Tafileh Governorate;
- Al Hasa Al Balad Water System; which is a small water system that covers Al Hasa Area;
- Jurf Al Darwish Water System; which is also a small water system that covers Jurf Al Darwish Area.

The closest Water System to the project site is the Tafileh Main Water System which is the main water system in the Governorate that serves the City of Tafileh and surrounding areas (including Bseira District). The water supplied by this water system for the year 2015 is 5.0MCM that is collected from Al Hasa and Zabda well fields. There are six (6) wells in Al-Hasa Well Field with a total water production of 500 cubic meters per hour and six (6) wells in Zabda Well Field with a total water production of 240 cubic meters per hour. The total served population by the Tafileh Main Water System is 96,809 and therefore the per capita supply is around 143 liters per capita per day. The Water System also includes seven (7) pump stations which include pumping and booster stations and sixteen (16) storage tanks with an overall capacity of 18,940 cubic meters. Finally, the total length of this water network system is about 568km long.

Table 50, Figure 41 and Figure 42 present the main components of the Tafileh Main Water System.

Table 50: Total Supply of the Tafileh Main Water System

Groundwater Well	Number of Wells	Pumpage Annual (m ³ /year)
Well Fields		
Zabda Well field	6	1,192,607
Al Hasa Well field	6	3,847,726
Total (m³/year)		5,040,333

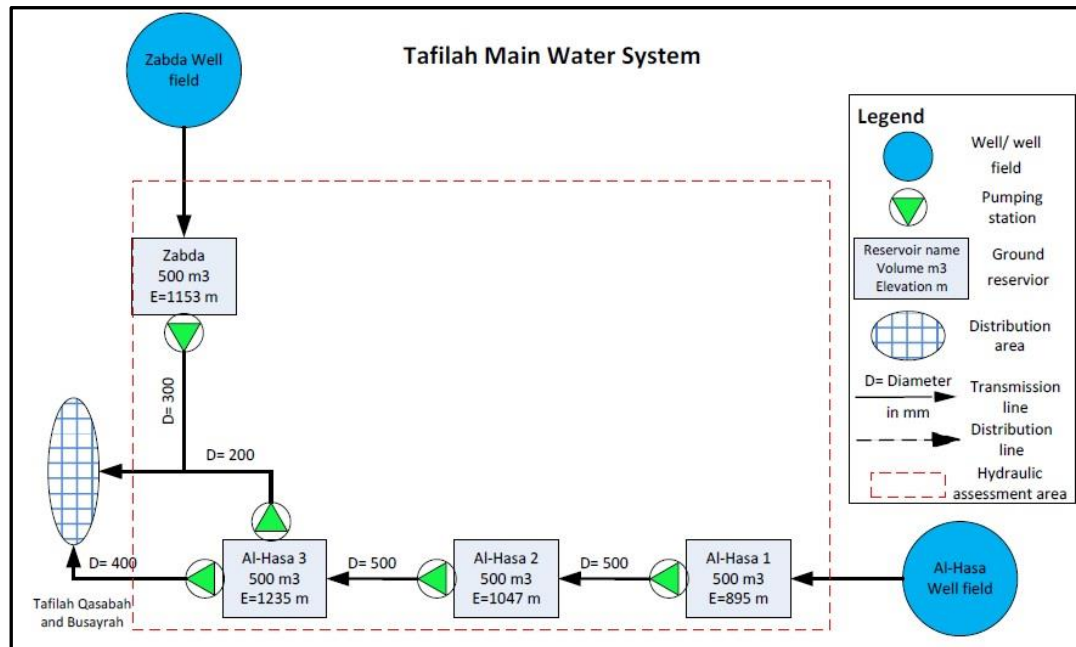


Figure 41: Schematic of the Tafileh Main Water System

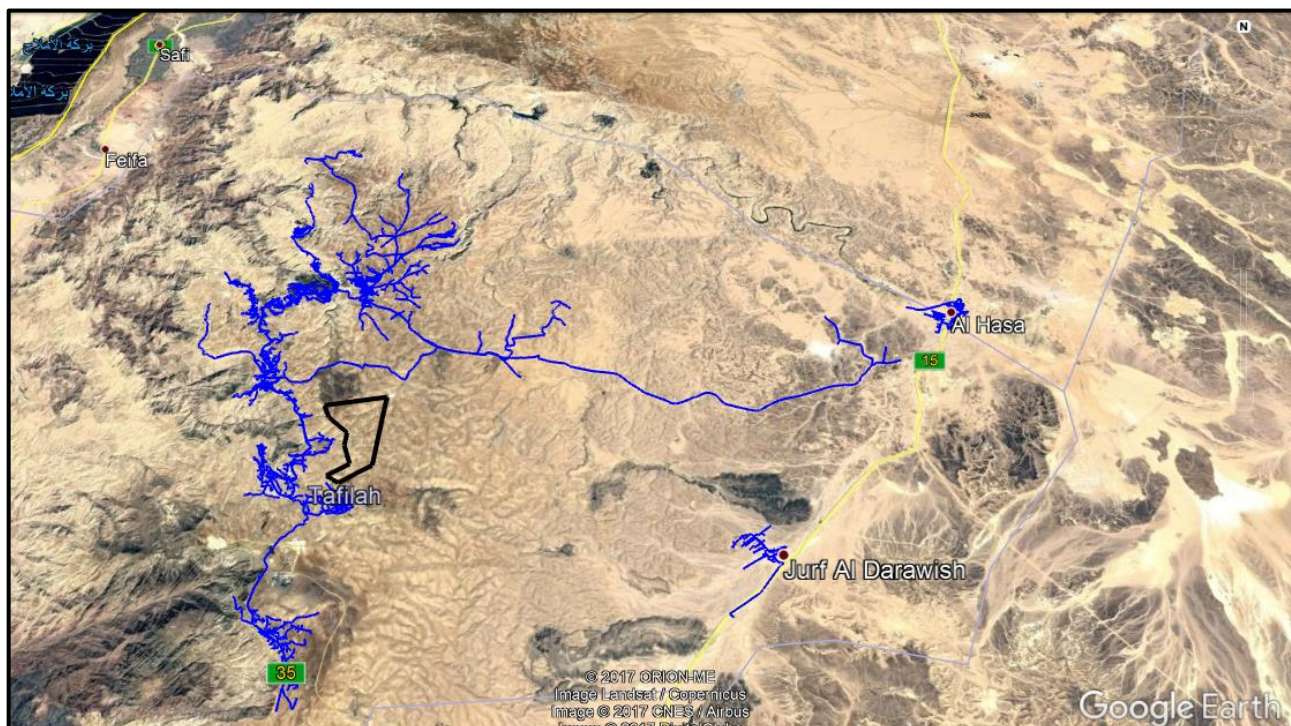


Figure 42: Water Networks in Tafileh Governorate relative to the Project Site

18.1.3 Wastewater Services

The same entities that govern the water sector are responsible for the wastewater as well. MWI is the official body responsible for the overall monitoring of the water sector, water supply and wastewater system, and

the formulation of national water strategies and policies. WAJ assumes all responsibilities related to wastewater structures, and within Tafileh Governorate, Tafileh Water Directorate is the responsible entity representing WAJ.

There is only one existing wastewater treatment plant in Tafileh Governorate known as the Tafileh Wastewater Treatment Plant (WWTP). The WWTP was constructed in 1988 has a design capacity of 1600 cubic meters per day and a trickling filter technology. Currently, the WWTP receives about 1,575 cubic meters per day, i.e. about 98% of the design hydraulic load. Negotiations are underway for the expansion and improvement of the WWTP to raise the design flow capacity to 7500 cubic meters per day. All wastewater flows in Tafileh Governorate are directed to the WWTP or Jurf Al Daraweesh Landfill (discussed in further details later).

Within Tafileh Governorate, Tafileh city and its surroundings (mainly Ruwaym and Eis) as well as the Tafileh Technical University are the only localities served with a wastewater network. The remaining localities are served by septic tanks.

The figure below presents the location of the Tafileh WWTP in relation to the project site.

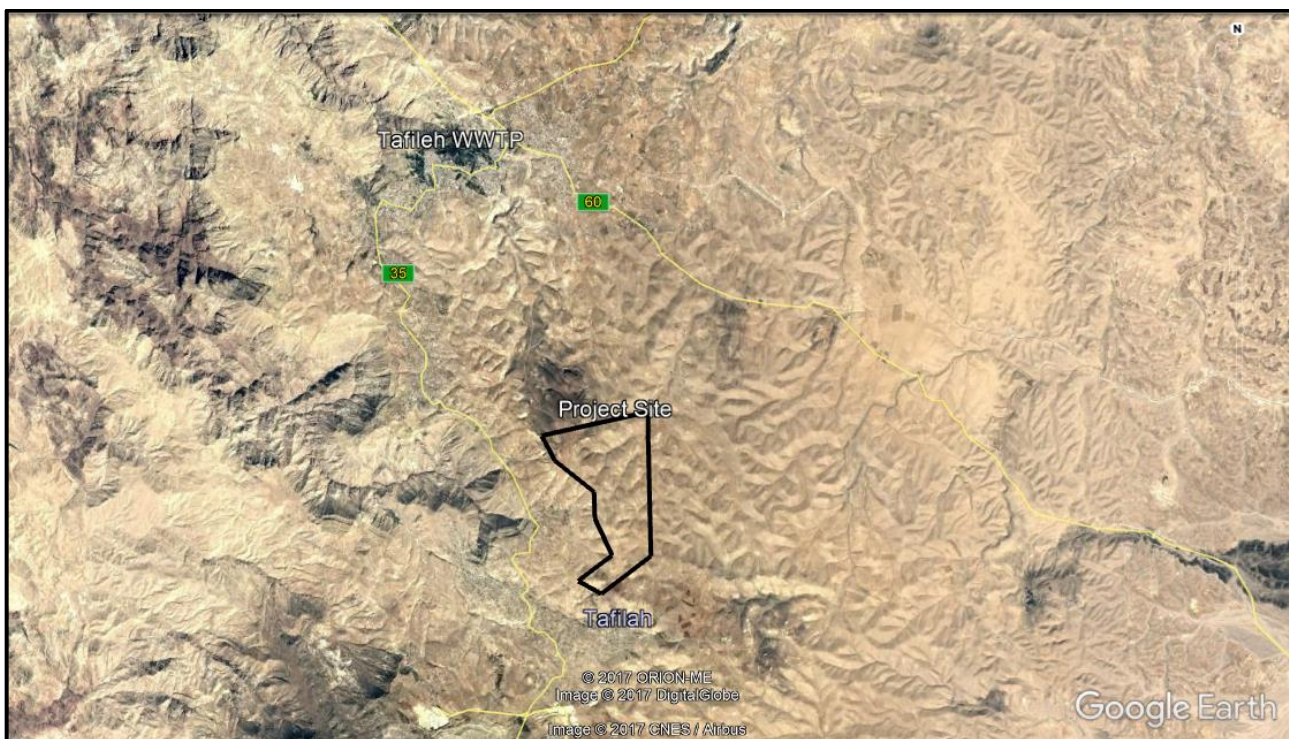


Figure 43: Location of the Tafileh WWTP in relation to the Project Site

18.1.4 Solid Waste Services

In Jordan, solid waste management is undertaken primarily by the public sector. Solid waste is managed through the operation of landfills (or dumpsites). In accordance with the “Municipalities Law No. (41) of 2015”, solid waste management is the responsibility of local municipalities as well as the Joint Service Council (JSC) which falls under the umbrella of the Ministry of Municipal Affairs (MoMA). JSCs are regulated through Joint Services Councils Regulation No. 75/2009 and are responsible for the establishment of landfills and waste disposal sites. On the other hand, municipalities are responsible for the collection and transportation of municipal solid waste to be disposed to landfills (or dumpsites).

The project site is not located within defined municipal boundaries. Therefore, solid waste is managed by the nearest municipalities (being Bseira Municipality) to include collection and transportation of solid waste

using municipality trucks and disposing it to the only authorized landfill for solid waste in Tafileh Governorate known as Jurf Al Darwish landfill.

Jurf Al Darwish landfill was established in 1985 and is the only authorized landfill in Tafileh Governorate. The landfill is located around 15 km to the east of the project site. According to discussions with Tafileh JSC, the landfill has an area of approximately 450 Dunums and receives around 100 tons of solid waste per day in addition to approximately 100m³/day of wastewater. Solid waste is disposed in trenches after which the trench is covered with soil. Figure 44 presents the location of the landfill in relation to the project site.

According to discussions with the JSC, the landfill is under the responsibility of Tafileh JSC, and is currently active and has sufficient capacity to handle solid waste generated by the project. In addition, the landfill can accept the disposal of construction debris.



Figure 44: Location of Jurf Al Darwish Dumpsite in relation to the Project Site

18.1.5 Hazardous Waste Services

In accordance with the “Environmental Protection Law No.(52) of the year 2006” and the “Instruction for Management and Handling of Hazardous Waste of 2003”, hazardous waste must be transported and disposed at landfills which are approved by the MoEnv.

In Jordan, there is currently one landfill for disposal of hazardous waste – the Swaqa Hazardous Waste Treatment Facility. The facility is located in Al-Karak Governorate, around 70km south of the capital city of Amman and about 80km to the northeast of the project site. The facility is operated and managed by the MoEnv.

According to discussion with the “Hazardous Substances and Waste Management Directorate” of the MoEnv, the facility is located on an area of around 8,500 Dunums and receives around 8-10 tons per day of hazardous waste. Currently disposal of hazardous waste is undertaken through either land-filling of stabilized and inert hazardous waste in specially lined cells, while for other types of waste which require physical-chemical treatment or incineration they are stored in safe storage spaces.

Currently, there are no additional plans by the MoEnv for hazardous waste management in Jordan.

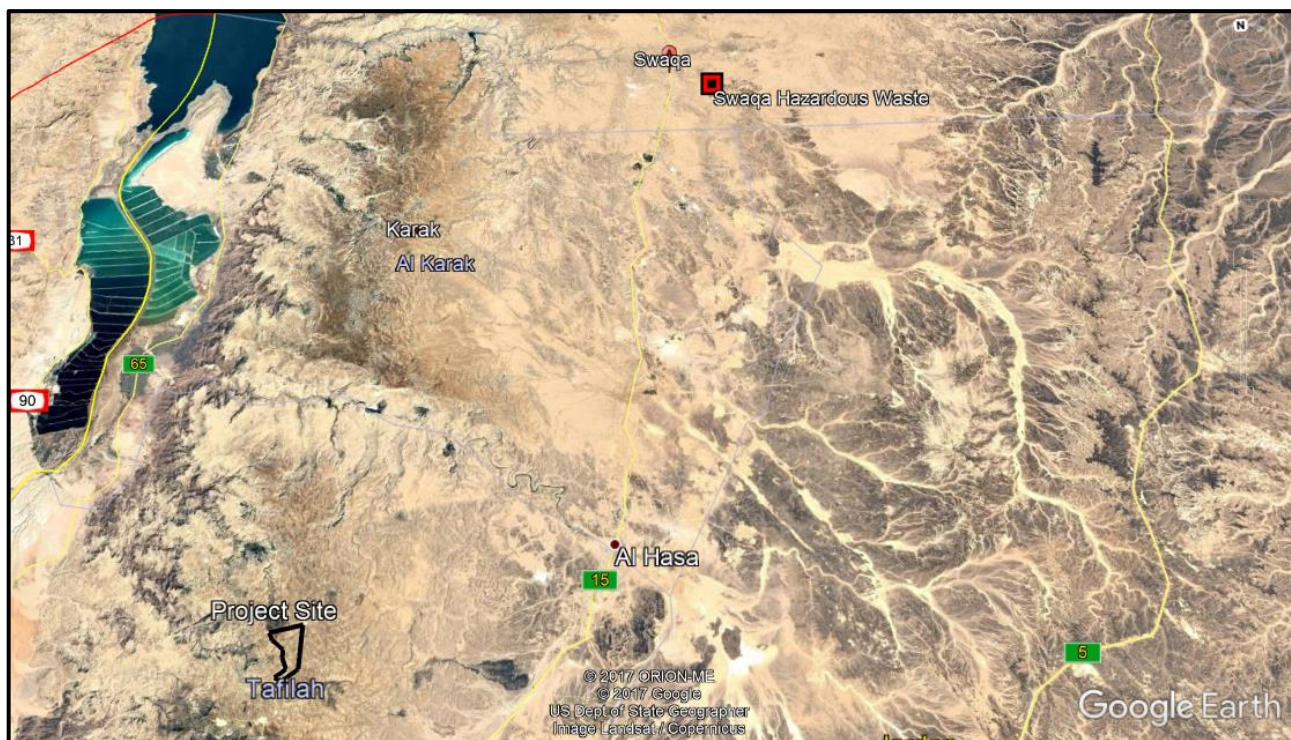


Figure 45: Location of Swaqa Hazardous Waste Facility in relation to the Project Site

18.1.6 Aviation, Telecommunication and Television & Radio Links

In order to understand what infrastructure related to aviation, telecommunication and television & radio within the Project area in general, official communications were established with the relevant governmental entities that govern the subject matter and which include the following:

- **Civil Aviation Regulatory Commission (CARC)/ Royal Jordanian Air Force (RJAF):** CARC is the official governmental authority responsible for the development of civil aviation safety and security and environmental regulatory compliance; whereas the RJAF is responsible for all military air bases in Jordan;
- **Telecommunication Regulatory Commission (TRC):** the TRC is the official entity for regulating the telecommunications and information technology services in the Kingdom to guarantee the provision of high-standard information and communications technology services to end users; and
- **Jordan Radio and Television Corporation (JRTV):** JRTV is the state broadcaster of Jordan for radio and television transmission.

Presented below are the infrastructure elements in the project area in relation to aviation, telecommunication, and television and radio links respectively.

(i) Aviation (Civil and Military)

The closest civil airport in the area is the Queen Alia International Airport located north in Amman around 110km from the project site. In addition, with regards to military air bases, in the south of Jordan there is only one military airport located within Ma'an Governorate at Al-Jafr area, known as King Feisal Airbase. This air base is located around 65km to the southeast of the project site. For security reasons, information on radars in the area was not provided neither by CARC nor RJAF.

(ii) Telecommunication Links

Information was collected from the TRC and all three (3) Jordanian telecommunication companies to include Zain, Orange, and Umniah on telecommunication links and broadcasting towers in the area. The information provided is summarized in the table and figure below accordingly.

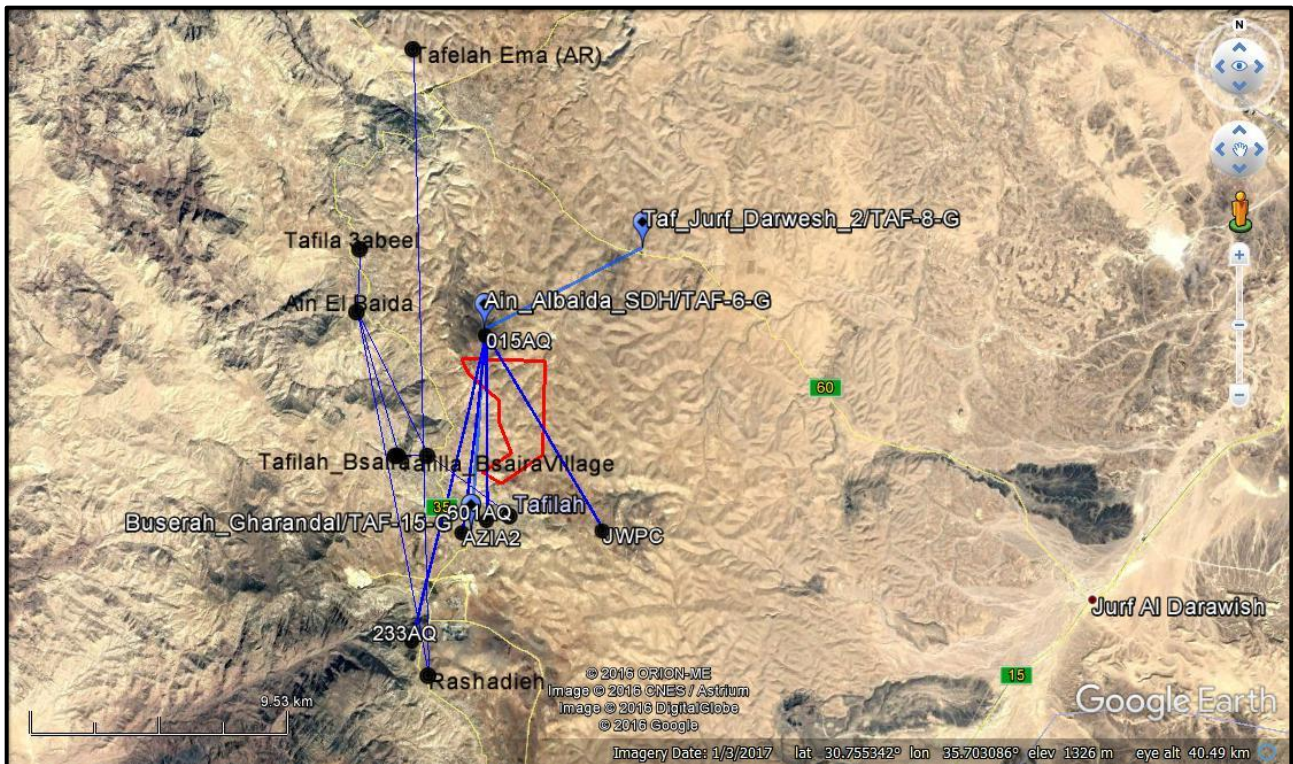


Figure 46: Telecommunication Links in the Project Area

Table 51: Broadcasting Towers in the Area

Operator	Main Broadcasting Tower	Connecting Tower	Link Length (km)	LONG	LAT	Center Frequency (GHz)	Frequency band (GHz)	Tower height (m)	ANT height	Service Provided
Orange	015AQ			35.64331111	30.77201					
		601AQ	6.5	35.64350759	30.71345139	14907 14417	15	50	48	MOBILE (2G, 3G & 4G)
		JWPC	8	35.68620556	30.71042222	14907 14417	15	6	6	Internet leased line
		AZIA2	7	35.634537	30.709633	14952.50 14462.50	15	25	9	Internet leased line
		233AQ	12	35.61639276	30.67558606	11337 10807	11	12	10	MOBILE (2G, 3G)
Zain	Ain_Albaidda_SDH/ TAF-6-G			35.642600°	30.700720°	14.907000, 18.902500	15 18	60	30,35	2G, 3G, 4G
		Buserah_Gharandal/TAF-15-G - (LoS)	7.05	35.637600°	3.710300°	14.417000	15	60	25	2G, 3G, 4G
		Taf_Jurf_Darwesh_2/TAF-8-G	6.28	35.700720°	30.799810°	17.892500	18	60	30	2G, 3G, 4G
Umniah	Tafilla_Gharandal			35.652028	30.71498	31885	32	15m building + 16m Tower	21	2G, 3G
		Tafilah_Bseira	3.6	35.62154	30.73391	22655.5	23	45	40	2G, 3G

(iii) Television and Radio Links

Based on official communications with JRTV, the television and radio networks in the area are summarized in the table below.

Table 52: Television and Radio Towers in the Project Area

No.	Station Name	Tower Height (m A6L)	Transmission Type	DMS
1	Rashadiyeh (Qadissiyeh)	40 m	UHF	E 35° 37' 19.17"
				N 30° 39' 51.3"
2	Aima 1	45 m	UHF	E 35° 36' 6.23"
			VHF	N 30° 52' 7.51"
3	Hala	52 m	UHF	E 35° 38' 34.73"
				N 30° 46' 19.03"

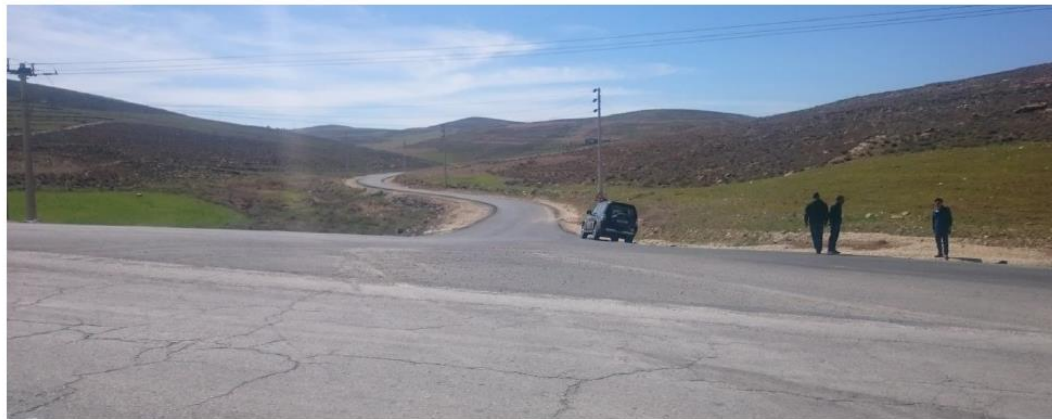
18.1.7 Road Networks

The transportation of the WTGs and the majority of the used material and equipment will be done mainly during the construction period via HGV (Heavy Goods Vehicle). The goods will arrive at the port of Aqaba and will be transported to the wind farm area via the existing road network with only minor modifications or improvement being required. It is the EPC Contractor's responsibility to establish a traffic management plan prior to the construction phase and to arrange for the measures to ensure both, safe transportation and public safety. Typical minor modifications are mobilisation of traffic signs or broadening of narrow curves.

Partly dirt roads already exist on the wind farm site. These are mainly used for accessing the fields and livestock. The existing tracks on the wind farm site do have extremely low baseline traffic. Further to these existing roads the project will require appropriate roads for access and hauling of WTG during construction and operation. These approximately 5 meters wide roads will be constructed of gravel. In order to reduce the environmental impact, the existing tracks will be used where possible.

According a preliminary internal route survey carried out by Kuehne & Nagel in March 2016 some adjustments/improvements of internal roads at the wind farm site have to be done. Some examples will be shown in the following figures:

Latitude	30°48'3.95"N
Longitude	35°41'11.57"E
Note	Sharp Left Turn
Intervention	Civil Work Widen Road and Increase Radius curvature of the Turn



18.2 Assessment of Potential Impacts

This section identifies and assesses the anticipated impacts from the project activities on infrastructure and utilities during the various phases to include planning and construction phase and operation phase. For each impact, a set of management measures (which could include mitigation measures, additional requirements, etc.) and monitoring measures have been identified to eliminate or reduce the impact to acceptable levels.

18.2.1 Potential Impacts on Water Resources during the Construction and Operation Phase

It is expected that the project throughout the construction and operation phase will require water for potable usage (drinking, personal cleaning, etc.) and non-potable usage (e.g. cleaning of turbines).

During the construction phase, the potable water requirements for around 70 workers onsite is not expected to exceed 50 litres per capita per day for a duration of 18 months. Thus, the daily water consumption is likely to be around 3,500 litres per day – or 3.5m³ per day. In addition, during the construction phase water for non-potable usage will be required which has been estimated to be around 1.5m³/ day – this will be required for cleaning of component and utilities, dust control, roads and platforms compacting, concrete for foundations, etc..

Therefore, the total water requirements during the construction phase are likely to be around 5m³/ day. The water requirements throughout the construction phase will be required temporary (for construction period only) and are considered minimal and not significant.

In addition, water will be required during the operation phase and mainly for drinking and other personal use of onsite staff (around 10 personnel). Similarly, potable water requirements for the onsite workers is not expected to exceed 50 litres per capita per day – thus a daily water consumption is likely to be around 500 litres per day – or 0.5m³ per day.

During operation, water will also be required for the cleaning of the blades. According to information provided by the EPC Contractor, and based on previous experiences from projects in areas of similar habitats, it is expected that this will not amount to more than 0.1m³ per day on average. Therefore, the total water consumption during operation is likely to be around 0.6m³/day for a duration of 20 years.

Putting things into perspective, the total annual water supplied by the Tafileh Main Water System is 5MCM, while the water requirements of the project during the construction phase is around 5m³ per day and for the operation phase is around 0.6m³ per day.

Taking all of the above into account, the anticipated impacts on the local water resources and utilities are considered of short-term duration during the project construction phase and of long-term duration during the operation phase. Such impacts are of a negative nature, and are expected to be of low magnitude and of low sensitivity given the minimal water requirements of the project. To this extent, the impact is considered not significant.

To this extent, there are no mitigation measures to be applied. However, there are additional requirements that must be taken into account as detailed below.

Additional Requirements

The following identifies additional requirements to be taken into account by the EPC Contractor and Project Operator during the construction and operation phase respectively and which include:

- Coordinate with the Tafileh Water Directorate to secure the water requirements of the project, which are considered to be minimal amounts.

Monitoring and Reporting Requirements

The following identifies the monitoring and reporting requirements to be applied by the EPC Contractor and the Project Operator during the construction and operation phase respectively and which include:

- Submit report with proof of coordination with authorities discussed above.

18.2.2 Potential Impacts on Wastewater Disposal Utilities during the Construction and Operation Phase

The project is expected to generate wastewater during both the construction and operation phases to include black water (sewage water from toilets and sanitation facilities) and grey water (from sinks, showers, etc.). Wastewater quantities generated are expected to be minimal and not significant at all during both phases of the project.

Generally, the approximate estimated wastewater to be generated from the project can accounted as follows. Throughout the construction phase, 70 construction workers are expected, whereas during the operation phase 10 workers are expected. The water requirements per capita during the construction and operation is not expected to exceed 50 litres per day; and taking into account an 80% wastewater generation factor per capita – then the anticipated wastewater to be generated during construction and operation is around 2,800 l/d and 400l/d (2.8m³/d and 0.4m³/d).

The wastewater generated will most likely be collected by tankers from the project and disposed at either Tafileh WWTP or Jurf Al Darwish landfill. Taking all of the above into account, the anticipated impacts on wastewater utilities are considered of short-term duration during the project construction phase and of long-term duration during the Operation phase. Such impacts are of a negative nature, and are expected to be of low magnitude given the minimal wastewater quantities generated, and of low sensitivity. Given the above impact is considered not significant.

To this extent, there are no mitigation measures to be applied. However, there are additional requirements that must be taken into account as detailed below.

Additional Requirements

The following identifies the mitigation measures to be applied by the EPC Contractor and Project Operator during the construction and operation phase respectively and which include:

- Coordinate with the Tafileh Water Directorate for disposal of wastewater at either Tafileh WWTP or Jurf Al Darwish landfill.

Monitoring and Reporting Requirements

The following identifies the monitoring and reporting requirements to be applied by the EPC Contractor and the Project Operator during the construction and operation phase respectively and which include:

- Submit report with proof of coordination with authorities discussed above.

18.2.3 Potential Impacts on Solid Waste Disposal Utilities during the Construction and Operation Phase

The project is expected to generate solid waste during both the construction and operation phases to include construction waste (mainly during construction to include dirt, rocks, debris, etc.) as well as general municipal waste (such as food, paper, glass, bottles, plastic, etc.). Solid waste quantities generated are expected to be minimal and not significant at all during both phases of the project and are likely to be easily handled by Jurf Al Darwish landfill.

The approximate estimated municipal solid waste to be generated from the project can accounted as follows. Throughout the construction phase, 70 construction workers are expected. The average theoretical municipal solid waste generation in Jordan is 0.85kg/capita/day (SWEEPNET, 2010) (this number is rather high but can be assumed as a worst case scenario). Thus, the anticipated municipal solid waste is estimated to be around 60kg/day. In addition, construction waste is likely to be around 100kg/day to include waste such as cables, metal, wood, etc.

Similarly, during operation solid waste will mainly include municipal waste. Around 10 workers are expected and based on the average theoretical municipal solid waste generation in Jordan (0.85kg/capita/day) (SWEEPNET, 2010) the estimated municipal solid waste is 10kg/day for a duration of 20 years.

Comparing those numbers to the daily amount of solid waste currently handled by Jurf Al Darwish landfill reveals that such quantities are negligible and are expected to be easily handled by the Landfill.

Taking all of the above into account, the anticipated impacts on solid waste utilities are considered of short-term duration during the project construction phase and of long-term duration during the Operation phase. Such impacts are of a negative nature, and are expected to be of low magnitude given the minimal solid waste quantities generated, and of low sensitivity as they will be easily handled by the landfill. Given the above impact is considered not significant.

To this extent, there are no mitigation measures to be applied. However, there are additional requirements that must be taken into account as detailed below.

Additional Requirements

The following identifies additional requirements to be taken into account by the EPC Contractor and Project Operator during the construction and operation phase respectively and which include:

- Coordinate with Bseira Municipality for the collection of solid waste from the site to Jurf Al Darwish landfill.

Monitoring and Reporting Requirements

The following identifies the monitoring and reporting requirements to be applied by the EPC Contractor and the Project Operator during the construction and operation phase respectively and which include:

- Submit report with proof of coordination with authorities discussed above.

18.2.4 Potential Impacts on Hazardous Waste Disposal Utilities during the Construction and Operation

The exact quantities of hazardous waste that will be generated from the project are not determined, but given the nature of construction and operation they are expected to be minimal and not significant at all during both project phases. Such hazardous waste streams include simple types of waste such as oil, chemicals, and fuel for the various equipment and machinery. Hazardous waste quantities are likely to be easily handled by the Swaqa Hazardous Waste Treatment Facility; which is the major and only hazardous waste landfill in Jordan.

Taking all of the above into account, the anticipated impacts on hazardous waste utilities are considered of short-term duration during the project construction phase and of long-term duration during the Operation phase. Such impacts are of a negative nature, and are expected to be of low magnitude given the minimal hazardous waste quantities generated, and of low sensitivity as they will be easily handled by the landfill. Given the above impact is considered not significant.

To this extent, there are no mitigation measures to be applied. However, there are additional requirements that must be taken into account as detailed below.

Additional Requirements

The following identifies additional requirements to be taken into account by the EPC Contractor and Project Operator during the construction and operation phase respectively and which include:

- Coordinate with MoEnv to hire a competent private contractor for the collection of hazardous waste from the site to the Swaqa Hazardous Waste Treatment Facility.

Monitoring and Reporting Requirements

The following identifies the monitoring and reporting requirements to be applied by the EPC Contractor and the Project Operator during the construction and operation phase respectively and which include:

- Submit report with proof of coordination with authorities discussed above.

▪

18.2.5 Potential Impacts on Aviation, Telecommunication and Television & Radio Links during the Planning and Construction Phase

Improper planning and site selection of the project could impact and affect infrastructure elements related to aviation, telecommunication and television & radio links in the surrounding area. Those are discussed in further details below.

(i) Aviation

Any tall structure could impact aircraft safety if located near airports or known flight paths. In addition, such structures could potentially interfere with certain electromagnetic transmissions associated with air transport, for example primary radar and secondary surveillance radar. Wind turbines have the potential to impact the surveillance systems used to detect and identify aircraft approaching, overlying or leaving Jordanian airspace and for which a Recognized Air Picture (RAP) is produced.

In order to safeguard aerodromes and/or airports, the 'ESIA Team' established formal communications with the official governmental authorities responsible for the development of civil aviation safety and security and environmental regulatory compliance; the Civil Aviation Regulatory Commission (CARC). In accordance with the "Civil Aviation Law No. 41 of the year 2007", Article 27(e) requires that any entity which intends to construct a facility of a height greater than 40m obtain the approval of CARC.

The 'ESIA Team' submitted an application to CARC as required for the project. The application included preliminary information available to include location, components, preliminary layout, as well as project site boundary points from the Royal Jordanian Geographic Centre (RJGC). The application also included (as required by CARC) the specifications for the navigational lights (required by CARC to include 1 medium intensity light on the nacelle) and blade painting as provided by the EPC Contractor. CARC provided an official letter of approval for the development of the project.

As for RJAF, a similar application has been submitted and is currently being reviewed by RJAF.

To this extent, there are no impacts associated from the project on aviation safety. However, there are additional requirements which must be taken into account by the Developer and EPC Contractor as highlighted below.

Additional Requirements

As discussed earlier, although there are no impacts from the project on aviation safety, there are additional requirements which must be taken into account by the EPC Contractor. This includes the following:

- Follow up with RJAF and obtain official approval permit
- Provide CARC with final layout of wind turbines once finalized
- Foresee red stripes at the tip of the blades
- Install aviation lights at the nacelles of the WTGs

(ii) Telecommunication and Television & Radio Links

For the assessment of a potential impact on the transmission functions of the telecommunication links which may eventually derive from the WTGs, the principles of transmission functionality need to be taken into account.

According to physicist Augustin-Jean Fresnel there is an ellipsoid formed zone around the line of sight between two towers used for signal transmission. The radius of this called "Fresnel zone" increases with distance to the towers and has its maximum in the middle of the line of sight. This zone is to be kept free of any obstacles to minimize interference of the radio signals.

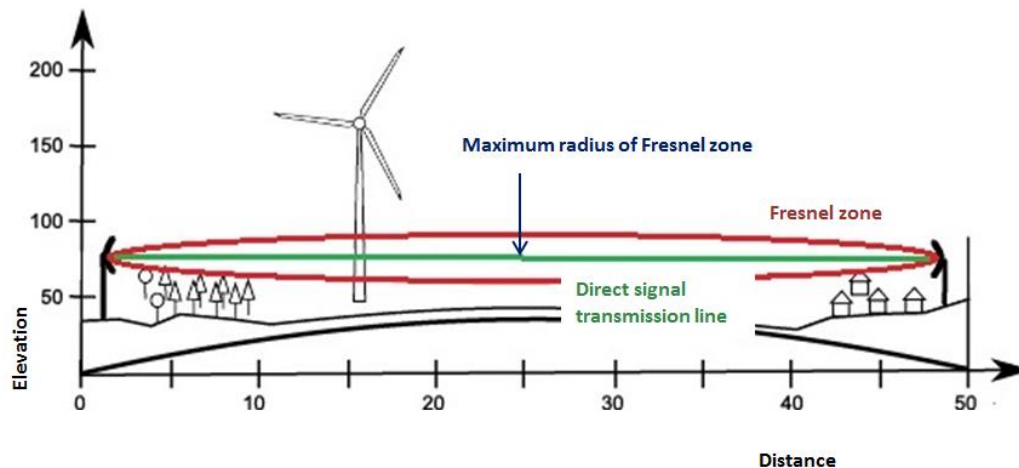


Figure 47: Telecommunication Links in the Project Area

The present assessment is based on the above described principles: as long as neither the WTG towers nor the blades reach into the Fresnel zone of the adjacent transmission lines, any interference or signal disturbance deriving from the WTGs can be excluded. In case the Fresnel zone cannot be kept free of obstacles, further measures would have to be considered.

The following information is required for the assessment of potential interference between WTGs and signal transmission:

- Position of the broadcasting towers
- Distance between sender and receiver
- Frequency of the transmitted signal
- Height of sender and receiver
- WTG coordinates
- WTG hub height
- Rotor diameter of the WTG

Taking the geometric information of the WTG type into account, it can be stated that the transmission of any signals is not affected by the WTG rotor blades within the rotor swept area up to a height of 44.0 m above the ground. Above this height, the area is potentially affected by the rotating blades of the WTGs and as a result signal transmission may be disturbed.

Furthermore the maximum radius of the Fresnel zone for the telecommunication links as well as the minimum horizontal distance between the WTGs and the telecommunication links that should be kept free of obstacles were assessed.

The evaluation results for the horizontal distances are presented in the following table.

Table 53: Assessment telecommunication links

No	Operating company	tower 1	tower 2	Height of the antenna tower 1 [m]	Height of the antenna tower 2 [m]	Distance [km]	Center frequencies [GHz]	Maximum radius of the fresnel zone [m]	Required minimum distance of WKA to transmission line [m]	closest distance of WKA to transmission line [m]	#WTG	Conclusion
1	Orange	015AQ	601AQ	48	48	6,5	14,9	5,715823377	73,72	155	1	no impact due distance of WTG
							14,4	5,812145487	73,81			
2	Orange	015AQ	JWPC	50	6	8	14,9	6,341136698	74,34	99	6	no impact due distance of WTG
							14,4	6,447996485	74,45			
3	Orange	015AQ	AZIA2	25	9	7	15,0	5,922657567	73,92	all WTGs >200	n/a	no impact due distance of WTG
							14,5	6,022157217	74,02			
4	Orange	015AQ	233AQ	35	10	12	11,3	8,905510037	76,91	all WTGs >200	n/a	no impact due distance of WTG
							10,8	9,121269654	77,12			
5	Zain	Ain_Albaida_SDH/TAF-6-G	Buserah_Gharandal/TAF-15-G - (LoS)	30,35	25	7,05	14,4	6,053051334	74,05	all WTGs >200	n/a	no impact due distance of WTG
6	Zain	Ain_Albaida_SDH/TAF-6-G	Taf_Jurf_Darwesh_2/TAF-8-G	30,35	30	6,28	17,9	5,12815988	73,13	all WTGs >200	n/a	no impact due distance of WTG
7	Umniah	Tafilla_Gharandal	Tafilla_Bsaira	31	40	3,6	8,0	22,655	90,66	all WTGs >200	n/a	no impact due distance of WTG

The results of the assessment show that none of the WTG location is expected to interfere with the telecommunication links because the horizontal minimum distance between the WTGs and the telecommunication links is kept. Furthermore, if the actual location of the rotor area is considered the distances to the links are even bigger. Consequently, mitigation measures are not required.

However, the Developer or EPC Contractor shall submit the final coordinates to the providers.

18.2.6 Potential Impacts on Road Networks during the Planning and Construction Phase

The main impact is to be expected during the construction. Operation will, however, have a much smaller impact than construction and decommission. The frequency and type of maintenance vehicles will not have a noticeable effect on the total number of vehicles or stress on the roadways. HGV will appear on site only in exceptional cases such as when main components of the wind farm need to be replaced or repaired. Consequently, the assessment will focus on the construction phase.

Traffic during construction phase will mainly be generated due to transport of:

- concrete for foundations: about 50 deliveries (depending on the volume of the truck) for each foundation will be necessary, 750 in total
- reinforcement steel for foundations: ca. 3,5 deliveries for each foundation will be necessary, 53 in total
- gravel for internal roads: number of trips is depending on the road length and improvement measures. Assuming to build a new road (5m width, 0,5m thick) one truck (25 m²) is necessary for every 10m road length.
- crane for erection: min 30 trips will be necessary in order to bring and remove all necessary cranes and ballast to/of the site
- turbines: each turbine (tower sections, blades, nacelle, generator etc.) will need 55-65 deliveries, 825 – 975 in total

Aqaba has been considered as harbor for the delivery of turbines, as it is the nearest harbor for landing the turbines. The exceptional loads will be transported in convoys escorted by the police to warn ongoing traffic of the advancing loads. In case the transport must pass under or very closely near overhead electrical lines,

the representative from the owner of the electrical lines will also escort the convoy. In relation to the traffic volume on main routes the additional volume is very low.

On roads near the wind farm site or within the wind farm site the current HGV baseline is very low, so any small increase in HGV traffic volumes is likely to result in a large percentage increase.

The traffic increase at the wind farm site may have a slight increase in severance related issues but is limited to the time of the concrete delivery. On average 80-100 HGV movements per day are predicted as peak flow during the construction stage. Severance may apply for shepherds moving livestock. These effects are assessed as having a low significant effect. The additional traffic on main roads will be minor, therefore no significant effect is expected on this route.

Driver delay is possible during the delivery of the WTG components when roads are temporally blocked by the police in order to negotiate difficult sections of the transport route. These effects are expected as having a low significant effect as the transportation of the main components will be scheduled to take place during low traffic, to avoid exactly this impact.

During the construction phase, particularly at the time when concrete pouring takes place, as shown above, the traffic volume on the internal wind farm roads will be high and therefore driver delay can occur for farmers accessing their fields and livestock. However, the concrete delivery is limited to a few days. In the rest of the construction period and in the operational phase the farmers will benefit from improved access roads. Consequently, no significant negative impact is assessed.

There is a possibility that livestock will be scared by the increased construction traffic. Therefore, it is proposed to set a speed limit of 30 km/h for the internal wind farm roads. At sharp bends and blind summits the speed should be reduced even more.

The operational traffic and transport impacts associated with the wind farm will mainly be limited to those arising from occasional maintenance trips using light goods vehicles and are considered to be negligible. HGV will appear on site only in exceptional cases like in cases where main components of the wind farm need to be replaced or repaired. Therefore no further assessment is included.

The predicted lifespan of the wind farm is 20 years. The decommissioning phase will require fewer vehicles than the construction phase and as such the traffic and transport impact of the construction phase is estimated to be less in the decommissioning phase.

19. OCCUPATIONAL HEALTH AND SAFETY

Vestas will be the EPC contractor for the construction works. Vestas is certified according to the applicable guidelines and its human resources policies will be applied throughout the construction which are summarized in the section below. In addition to the regulations given by these policies the conditions and obligations defined in the OHS plan are binding as well.

According to Vestas' Code of Conduct humans are the most critical element in maintaining a safe workplace. To minimize this risk each Vestas employee is therefore obliged to:

- Participate in all mandatory safety trainings;
- Only undertake work for which he or she is trained, competent and fit;
- Follow Vestas' safety rules and procedures at his or her workplace, including the use of all relevant standards and instructions;
- Demonstrate safe working practices, and stop any work that is potentially unsafe;
- Help to make sure that other people who work with them – employees, contractors and other third parties – follow Vestas' safety rules and procedures;
- Not undertake work when his or her performance is impaired by illness, alcohol, or any other drug, legal or illegal, prescribed or otherwise.

Moreover Vestas ensures for any of its employees that it:

- Does not use compulsory or forced labor in any of its operations;
- Does not use child labor in any of its operations;
- Maintains a framework of fair and just remuneration, fair working hours, sick leave and parental leave;
- Respects freedom of association and the right to collective bargaining for Vestas employees, according to the laws or practices of the countries in which it operates.

Vestas seeks to support a single common culture. This culture is one of inclusion and mutual trust, however, in which everyone who works for Vestas is treated equally with dignity and respect regardless of race, color, religion, political conviction, gender, age, national origin, sexual orientation, marital status or disability, or any other characteristic protected by national or local laws. Vestas will not tolerate discriminatory treatment of any kind. Every Vestas workplace should be characterized by mutual trust and respect. Therefore Vestas does not tolerate:

- Sexual harassment;
- Any other kind of harassment, whether direct or indirect, physical or psychological, verbal or non-verbal;
- Any other kind of abuse of its employees.

19.1 Assessment of Baseline Conditions

19.1.1 Baseline Assessment Methodology

Technical standards of modern turbines are designed to determine lowest impacts during the operation on public safety. A general overview of safety measures in modern turbines is given in the following sections.

19.1.2 Results

The components of a WTG are designed to last for at least 20 years. Therefore, they must survive more than 150,000 operating hours, often under stormy weather conditions. Large wind turbines are equipped with a number of safety devices to ensure safe operation.

Industrial-scale wind turbines are tested and certified for their safe design and operation according to the applicable international standards as the IEC 61400-22 or other standards as set by organizations such as IEC, DNV- GL, etc. This ensures public safety throughout the turbine lifetime.

Detailed safety instructions will be developed published in the turbine and supplied to the staff and client in form of the construction and operation health and safety manuals.

The following sections are taken from the “Health, Safety & Environment” manual.

19.2 Potential Impacts due to WTG

19.2.1 Organization of safety-related work

Safety meetings

The responsible HSE manager must conduct regular safety meetings with employee safety representatives and representatives from relevant subcontractors and other co-operation partners at the site. Issues to be discussed at the safety meetings must be listed on the agenda for the meetings. The agenda must, as a minimum, address the following issues:

- Follow-up on problems and solutions since the last safety meeting;
- Results from inspections;
- Incidents of lack of compliance with laws and regulations;
- Safety alerts;
- Summary of incident reports (e.g. reported industrial injuries and near misses) and investigation reports;
- Activities not covered by the current occupational health and safety (OHS) plan and risk assessment.

Planning of work

The responsible safety manager must be informed of any turbine-related task that is carried out on the site, and the manager must give permission before the task can be carried out.

Before starting any task, the person in charge of the task must discuss the task in detail with all persons involved. This will ensure that employees have a good understanding of what they are permitted to do, and the risks involved in each task.

The status of the tasks in progress will be discussed on a daily basis to ensure coordination of all the parties involved. In the event of a serious accident, all the involved parties must be informed of the accident and involved in the efforts to prevent similar incidents from happening. “Near misses,” incidents where no person or property was injured, but would have been if events had happened just slightly differently, are also recorded, discussed and acted upon to prevent future re-occurrence.

19.2.2 Safety training requirements

General

All employees, subcontractors and other relevant cooperation partners must have the necessary competences to be allowed to carry out a specific task. The safety manager is responsible for ensuring that competences are evaluated and that documentation for competences are available before starting the work.

All Vestas service technicians must be trained sufficiently in proper use of safety equipment, climbing equipment, fire extinguishers, first aid equipment and descent equipment.

All Vestas service and installation technicians and other Vestas employees performing work in the turbines are required to complete the Basic Safety Training program before they can start the work. The Basic Safety Training program consists of four modules:

- Basic safety training, theory;
- First aid;
- Fire Fighting and fire prevention;
- Fall arrest and rescue from heights.

When the basic safety training program is completed the technician is required to pass the basic safety test. When the test is passed the technician will receive a certificate. All training, induction to the OHS plan, certificates and licenses required to perform the task must be recorded.

Employees working at heights

Before any employee starts to work at heights the employee must complete the following courses:

- Safety course (course in the use of a full body harness, a lanyard with energy absorber, a work positioning rope and a fall arrester);
- Course in rescue from heights (use of descent device). As a minimum, the rescue course must be renewed every fourth year.

Employee working with electricity and high voltage

Before any employee starts to work with electricity and high voltage, the following training must be completed:

- The person must have completed supplementary training courses and be authorized to work with high voltage/low voltage (>1000/1500 AC/DC volt / <1000/1500 AC/DC volt – the limits may vary in different countries).

19.2.3 Training on-site

The safety manager is responsible for ensuring that all personnel, including salaried employees, hourly-paid employees, subcontractors and visitors are introduced to the safety guidelines, and the emergency response plan for the sites.

The induction must, as a minimum, consist of the following, for groups of visitors and others:

Visitors

Any visitor that enters the site during the construction period shall be instructed by the responsible site or HSE manager to observe the following:

- Safety rules of the site;
- Safety equipment on the site;
- Restricted areas;
- Emergency response plan.

Employees, subcontractors and other relevant co-operation partners

Any employee, subcontractor or other co-operation partner that enters the site shall be instructed by the responsible site or HSE manager to observe the following:

- Safety rules of the site;
- Safety equipment of the site;
- Restricted areas;
- Emergency response plan;
- Driving rules (on the site and off the site);
- Hazardous substances;
- The importance of complying with environment and health & safety procedures;
- Responsibilities in general.

The safety manager is responsible for the maintenance. Training on the site is a continuous activity which must be supplemented when required.

19.2.4 Safety inspection on construction site

The safety manager must ensure regular inspection of the relevant environment, health & safety issues and procedures on the site, including the scope of work by subcontractors and other co-operation partners. Some of the essential issues are described below:

- Waste storage, waste handling and cleaning of the site;
- Hazardous substances (including hazardous waste) must be inspected for correct storage and handling on-site. It must be inspected that Material Safety Data Sheet (MSDS) for the specific chemicals and oils are available on-site.
- The established marking of the restricted areas;
- The location and condition of spill kits for environmental emergencies;
- That the personnel is wearing the correct personal protective equipment (PPE);
- Location, condition and quality of fire extinguishers;
- Is climbing, electrical, lifting and safety equipment and safety devices inspected on a regular basis? Is defective equipment found in service?

19.2.5 Safety alerts

When a serious and acute safety concern is identified, a 'Safety Alert' is issued by the responsible manager. Safety alerts must be complied with and safety alerts supersede any other work instruction and remain in effect until the risk is eliminated or reduced to an acceptable level.

19.2.6 Risk assessments

The safety manager is responsible for the implementation of risk assessments before performing installation and maintenance tasks that are not identified in work instructions, transport, installation and service manuals and if any irregular conditions are related to the work to be carried out. A work instruction must be developed on the basis of the risk assessment. It is not allowed to perform a task of this nature until both the risk assessment and the work instruction are complete.

Activities, which have been evaluated to involve an unacceptable risk, must be avoided until a safe procedure or work method has been developed.

19.2.7 Two person teams

- Tasks are usually assigned to teams of at least two competent persons;
- It is important to prevent the isolation of any team member;
- If team members work in isolation from each other and do not have visual contact during the work, there must be a clear procedure about communication among team members;
- Team members must be in possession of two-way communication equipment which as a minimum has battery capacity for the duration of the work;
- A team member must never stop a work task or leave the work area without informing the other team members;
- Work in the hub requires that at least one person stays in the nacelle until the person working in the hub is finished and back in the nacelle.

19.2.8 Weather conditions

Before Starting-up any Work

- An updated weather forecast must be checked before starting any work on the turbine site or inside the wind turbine;
- Local circumstances and local regulations must always be taken into consideration.

During Work

- Be particularly aware of changing weather conditions;
- Note that site locations can determine weather conditions. For example, special gusts of wind can arise in mountainous areas.

19.3 Potential other Impacts

This chapter is about miscellaneous impacts which could occur during the con-/destruction phases and the operation phase. It is shown which mitigation measures are available to avoid such impacts. The number of impacts is just a selection and not a complete list. A complete list has to be provided by the health-and safety-manager.

Table 54: Potential impacts and mitigation measures

	Impact	Mitigation Measure
Construction Site Equipment	Sanitation	Provision of toilets
	Sheltering	Provision of construction site trailer
	First aid	Provision of alert plan, escape plan, first-aid-kit, definition of first-aider
	Fire protection	Provision of fire extinguisher or fire fighting water
	Injury	Personal protective equipment (safety boots, eye protection, ear protection, helmet etc.)
	Accident due to traffic	Official Traffic rules valid on private ground, banksman
	Dropping down	Provision of staging and rope up protection
	Accidents due to machines	Briefing of workers
Con- struction /destruction of infrastructure	Fall into trenches and pits	installation of fences and caps
	Access excavation	Provision of ladder or ramp
	Dropping down	Provision of staging and rope up protection
	Downfalling items	Personal protective equipment (helmet), barriers
	Electric shock	Works to be executed only by electrical engineer
Operation	Dropping down	Provision of staging and rope up protection
	Downfalling items	Personal protective equipment (helmet), barriers
	Electric shock	Works to be executed only by electrical engineer
	Fire protection	Provision of fire extinguisher
	First aid	Provision of alert plan, escape plan, first-aid-kit

20. COMMUNITY HEALTH, SAFETY AND SECURITY

20.1 Potential Impacts from Noise of Wind Turbines during Operation

Please see chapter “Noise”

20.2 Potential Impacts from Low Frequency Noise, Infrasound and Vibration of Wind Turbines during Operation

Low-frequency noises are noises with a predominant energy share within the frequency range below 90 Hz. Sound within the frequency range below 20 Hz is referred to as infrasound. Infrasound is not audible in the proper sense, as a differentiated pitch perception is not possible for the human ear anymore. Therefore, infrasound is often perceived as “pressure on one’s ears” or as pulsating sensation. The perception threshold is approximately between 70 and 100 dB depending upon the frequency and thus at very high level values.

The hearing impression of wind turbines is that of a “deep” noise, which however results from the audible noise components between about 100 and 400 Hz. Thus, only the hearing impression of wind turbines neither indicates the presence of relevant low-frequency noises nor infrasound. Measurements of different federal environmental agencies and renowned measuring institutes have frequently proved that infrasound can emanate from wind turbines, but it clearly is below the human perception threshold, often even below the infrasound level of the ambient noise up to no longer detectable. This is particularly due to vortex shedding occurring at the end of the rotor blades and further to turbulences, which occur because of edges, gaps and struts. The rotor blades, which the air circulates around, create similar noises to the wings of an airplane. Investigations have shown that the generated infrasound shares in the area of immission are significantly below the human hearing threshold (viz. below 20 Hz). Infrasound below the sensing threshold does not trigger any health impairment. All currently available subsonic noise measurements consistently show that the infrasound of wind turbines is considerably below the human hearing threshold and thus also clearly below a conceivable impact threshold, even in the immediate area around the turbines (100-250m distance).

In the case of wind turbines, it additionally must be taken into account that wind itself also is a significant source of infrasound, whereby the wind-induced infrasound level is wrongly associated with the wind turbines. Further typical sources of subsonic noise are traffic (interior vehicle noise also contains parts of infrasound) or domestic sources such as washing machines and dishwashers. Infrasound therefore is an ubiquitous phenomenon and not a specific characteristic of wind turbines at all.

20.3 Potential Impacts from Shadow Flicker of Wind Turbines during Operation

Please see chapter “

Shadow flicker”

20.4 Potential Impacts from Blade and Tower Glint of Wind Turbines during Operation

When the sun is shining, disturbing reflections of the sunlight can occur at a wind turbine, similar to other reflecting surfaces such as transparent window panes. Such light emissions can trigger relevant annoyance

at the reference- / emission location, if the light intensity and exposure time are appropriate. Furthermore, reflections at the operating rotor of the wind turbine can attract attention due to the light reflexes, which are periodically modulated with triple rotation frequency (trifoliate rotor). The reflections can be perceived from the reference- / emission location, as far as the radiation's angle of incidence and – reflection from and to the respective wind turbine conform to a reflecting component of the rotor.

In a simplified consideration of an exemplary evaluation scenario it was determined that light reflections due to astronomical circumstances take place at an appropriate solar altitude above the horizon at a point of immission respectively once in the morning- and afternoon throughout most of the year. However, this can only be expected for a short-term (several minutes) because of the sun's movement in the sky. It only occurs, depending on the geographical location and its climate, in ca. 10 - 20 % of the astronomically possible cases, which have an impact upon the concrete perceptibility, due to the relevant meteorological impacts of cloudiness and the wind direction affecting the rotor position.

The intensity of the light reflexes of a wind turbine primarily depends upon the reflection characteristics of its rotor surface. This concerns the gloss level of the rotor surface and the reflectivity of the selected colour. The describes "disco effect" can reduced significantly by the use of medium reflecting colours for the tower- and rotor coating such as RAL 7035-HR and matt gloss levels according to DIN 67530 / ISO 2813-1978.

Taking all of the above into account, the anticipated impacts on the people living close to the project is limited to very specific weather conditions. Such potential impacts are of a negative nature, and are expected to be of low magnitude. Applying medium reflecting colours can reduce the impact to not significant.

Mitigation:

In order to reduce blade and tower glint effects a paint with matt gloss levels should be used for the tower and the blades.

20.5 Potential Impacts from Blade/Ice Throws during Operation

As with any structure, wind turbines can accumulate ice under certain atmospheric conditions, such as ambient temperatures near freezing (0°C) combined with high relative humidity, freezing rain, or sleet.

The accumulation of ice is highly dependent on local weather conditions and the turbine's operational state. Any ice that is accumulated may be shed from the turbine due to both gravity and the mechanical forces of the rotating blades. An increase in ambient temperature, wind, or solar radiation may cause sheets or fragments of ice to loosen and fall, making the area directly under the rotor subject to the greatest risks. In addition, rotating turbine blades may propel ice fragments some distance from the turbine.

Falling ice may cause damage to structures and vehicles, and injury to site personnel and the general public, unless adequate measures are put in place for protection.

Risk Mitigation

Warning signs should to be placed for the protection of site personnel and the public.

Turbine Deactivation:

WTGs will be remotely switching off when site personnel detect ice accumulation.

Operator Safety:

Restricting access to turbines by site personnel while ice remains on the turbine structure. If site personnel absolutely must access the turbine while iced, safety precautions may include remotely shutting down the turbine, yawing to place the rotor on the opposite side of the tower door, parking vehicles at a distance of at least 100 m from the tower, and restarting the turbine remotely when work is complete. As always, standard protective gear should be worn.

20.6 Potential Impacts from Public Access during Operation

As the wind farm area is accessible by third parties and partly public roads are used for the wind farm exploitation, several safety measures need to be implemented to avoid injuries or accidents to third parties.

Due to the size of the project area and the fact that public roads are passing through, a fencing of the whole wind farm is not possible. To ensure that third parties cannot access areas which may cause injuries for untrained persons among others the following measures are foreseen:

- Fencing and guarding of substation area;
- Clear signaling in dangerous areas;
- Placing of warning tapes around dangerous areas (such as excavation areas);
- Securing of areas where dangerous activities are performed (such as WTG erection activities)

21. SOCIO-ECONOMIC CONDITIONS

This chapter first provides an assessment of baseline conditions within the project site and surrounds in relation to the socio-economic conditions and then assesses the anticipated impacts from the project throughout its various phases. For each impact, a set of management measures (which could include mitigation measures, additional requirements, recommendations, etc.) and monitoring measures have been identified to eliminate or reduce the impact to acceptable levels.

21.1 Assessment of Baseline Conditions

This section discusses the methodology for the assessment of the baseline conditions in relation to socio-economic conditions as well as the outcomes and results.

21.1.1 *Baseline Assessment Methodology*

The socio-economic conditions were investigated for those local communities within the project area as presented in the figure below, and which includes Bseira, Um Sarab, Gharandal, and Ain Baidha (those have been referred to as ‘local communities’ throughout this chapter).

Socio-economic conditions have been established based on a review of secondary statistical data available mainly from the Department of Statistics (DoS). Available data was collected and reviewed for certain indicators in order to characterize and describe the socio-economic conditions. However, it is important to note that the majority of the socio-economic data from DoS is only available at the governorate level; no data is available at the district level or specifically for the local communities near the project area.

Therefore, additional socio-economic studies were collected and reviewed to compliment statistical data and provide additional insights for the socio-economic situation within the project area, in general and of the nearby local communities, to the greatest extent possible. Such data mainly included: (i) “Socio-Economic Situation of Tafileh Governorate (SDU, 2016), and (ii) “Comprehensive Operating Local Economic Development Strategy Document for Tafileh Governorate” (PLEDJ, 2016).

In addition, as discussed earlier in “Section 6.5.2”, a local community consultation session as well as onsite consultation were undertaken with the objective of verifying to the greatest extent possible and where relevant the socio-economic conditions of those local communities based on the secondary data collected above.



Figure 48: Local Communities to the Project Area

21.1.2 Results

This section presents the results of the socio-economic conditions in relation to (i) population and demographics, (ii) livelihood and employment, (iii) income, unemployment, and poverty and (iv) education and health services.

(i) Population and Demographics

According to DoS the population of Tafileh Governorate was estimated at 96,291 with an annual average population increase of 2.3% over the last decade. The population of the governorate represents around 1% of the total population of the kingdom.

Generally, the governorate has a similar gender distribution ratio of approximately 1:1, and an average household size of around 5.3 members. As expected, the majority of the population of the governorate lives in the major district (Tafileh Qasabah District at around 62.3%) where the capital city is located (Tafileh city). Within this district Ain Baida village is located with a population of 10,448. The other nearby villages to include Bseira, Gharandal and Um Essarab are located within Bseira District with a population of 10,587, 4,680 and 744 respectively.

The governorate has a population density of around 42.3 people/km², which is lower than the national average of 75 people/km², given to the relatively large area and the fact that the majority is relatively unpopulated. A summary of the governorate is presented in Table 55 below while the population breakdown is presented in Table 56. No additional details were available at the District level or specifically for the local communities near the project area.

Table 55: Summary of Tafileh Governorate

Statistic	Tafileh Governorate	National Average
Population	96,291	9,531,712
Average Household Size	5.3	5.1
Number of households	18,168	1,868,963
Population Density (people/km ²)	42.3	75.2
% Living in Major District	62.3%	N/A
% of Male /Female	1:1	52/48

Table 56: Population Breakdown of Tafileh Governorate

Governorate	District	Population
Tafileh	Tafileh Qasabit District	60,803
	Ain Baida	10,448*
	Bseira District	25,245
	Bseira Gharandal Um Essarab	10,587* 4,680* 744*
Hasa District		10,243
Total		96,291

*those have been accounted for within the Tafileh Qasabit District or Bseira District population count

In general, Tafileh Governorate is characterized by two major social environments; these are the city style and the village style. The city style is represented mainly by Tafileh city. In spite of that, the simple village life style is dominant in the villages and small settlements scattered along the governorate (including the local communities near the project site), which are still the base that governs all social relations in Tafileh Governorate.

The communities of Tafileh Governorate in general identify themselves primarily in terms of tribal affiliations, and each village belongs to a distinct tribe or sub-group of a tribe. The tribal affiliations for the local communities near the project site are summarized in the table below.

Table 57: Tribe/Affiliations of Local Communities in the Area

Community	Tribe/Affiliation
Ain Baida	The local community of Ain Baida belongs mainly to the Bani Hamida (Al-Hamaydeh) tribe whom occupy primarily the southern Governorates of Karak and Tafileh. Al-Hamaydeh have fled to Tafileh a long time ago from Sayyah valley in Hijaz in the present day Saudi Arabia. They are also considered one of the biggest tribes in Tafileh, and one of the major tribes in Jordan.
Bseira, Um Essarab and Gharandal	These local communities mainly belong to Al-Saudi tribe. There are many sub-groups to this tribe which occupy these villages but the most important include Al-Rfou, Zydannean and Msaedin. Al-Saudi tribe are also considered one of the biggest tribes in Tafileh and only of the major tribes in Jordan. .

(ii) Livelihood and Employment

The section below discusses the main employment sectors in Tafileh Governorate and the local communities to the greatest extent possible. This mainly includes: public services, industry and commerce, and agriculture.

a. Public Services

According to DoS, the public service constitutes the highest percentage of the working population, accounting for 48.5% of the population in Tafileh Governorate. This sector mainly entails working for armed forces, police, and public administration offices and civilian central government. On the other hand, the education sector accounts for 19.9% of the working force (mostly in schools operated and managed by the Ministry of Education). The staff mainly includes teachers and administrative personnel, whom are mostly females. Together these two sectors constitute around two thirds of the working population in Tafileh Governorate, indicating that the majority of the workforce work for the government and in the public sector.

Within the nearby communities a similar trend is also evident; however it is believed to be at a much higher percentage. Based on discussions with the local community representatives, it was stated that the majority of the working population in the local communities are in the public sector – the majority of which are in the Jordanian Armed Forces and minority of which are in public administration offices and civilian central government as well as education (mostly in schools operated and managed by the Ministry of Education).

b. Industry and Commerce

Industry and commerce forms an important part of the employment sector in Tafileh Governorate that accounts for approximately 20% of the workforce. According to DoS, in 2011 (latest statistic) there were approximately 1,709 active economic establishments in Tafileh Governorate. The breakdown for the major active economic establishments that represent around 97% of the total active establishments is presented in the table below.

Table 58: Major Economic Establishments in Tafileh Governorate

Economic Establishment	Number of Establishments	Comment
Retail trade, except of motor vehicles and motorcycles	1007	Mainly retail sale in non-specialized stores with food, beverages or tobacco Predominating and retail sale of food in specialized stores
Wholesale and retail trade and repair of motor vehicles and motorcycles	100	Mainly maintenance and repair of motor vehicles
Other personal service activities	100	Mainly hairdressing and other beauty treatment
Food and beverage service activities	101	Mainly restaurants and mobile food service activities
Manufacture of food products	52	Mainly Bakery
Manufacture of fabricated metal products, except machinery and	48	Mainly manufacture of structural metal products

Economic Establishment	Number of Establishments	Comment
equipment		
Manufacture of other non-metallic mineral products	34	Mainly manufacture of articles of concrete, cement and plaster
Repair of computers and personal and household goods	33	Mainly repair of household appliances and home and garden equipment, Repair of consumer electronics and repair of footwear and leather goods
Manufacture of wearing apparel	28	Mainly manufacture of wearing apparel, except fur apparel
Human health activities	25	Mainly medical and dental practice activities
Manufacture of furniture	23	
Sports activities and amusement and recreation activities	16	Mainly activities of sports clubs and other amusement and recreation activities
Legal and accounting activities	15	Mainly legal activities
Wholesale trade, except of motor vehicles and motorcycles	15	Mainly wholesale of food, beverages and tobacco
Education	14	Cultural education
Computer programming, consultancy and related activities	12	Engaged mainly in information technology and computer service activities
Social work activities without accommodation	11	Mainly social work activities without accommodation for the elderly and disabled
Rental and leasing activities	10	Mainly renting and leasing of other personal and household goods
Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	10	Mainly manufacture of builders' carpentry and joinery
Manufacture of textiles	9	Mainly manufacture of made-up textile articles, except apparel
Total	1663	

It can be concluded that the majority of economic establishments in the governorate are those that engage in retail trade of commodities (food, beverage, clothing, and household appliances) all of which are considered to be small establishments. There is a limited number of economic establishments which have a registered capital greater than 1 million JD and which include the Jordan Phosphate Mining Company – engaged in Al-Hasa Phosphate Mines, Al Rashadiyeh cement factory, and Tafileh Wind Farm Project (117MW).

Within the local communities of the project site, job opportunities in this sector are very limited and mainly include small scale establishments like retail shops. In addition, the local communities in general have not benefited from employment opportunities in large scale economic establishments as those discussed above.

c. Agriculture and Livestock

This sector constitutes the lowest percentage of the working population, accounting for 0.5%. Although agricultural activity is rather an important sector in Tafileh Governorate, it is largely employed by foreign workers.

However, generally in Jordan where local communities are dominated by a village lifestyle, livestock and agricultural activities are considered an important constituent to the economic base of the local communities but mainly for self-sufficiency purposes and less so as a source of income.

(iii) Income, Unemployment, and Poverty

The section below discusses the income, unemployment, and poverty in Tafileh Governorate and the nearby communities to the greatest extent possible.

According to DoS, the average annual income per household in Tafileh Governorate was around 9,000 JD, lower than the national average of 9,258 JD. This translates into 750 JD per month for the entire household (which averages around 5.3 members). In addition, around 61% of the income is generated from employment, 23% from transfers (which in general are in the form of pensions, subsidy transfers from the government and transfers from expatriates), 5.2% from own business, and 10.6% from rent. Similarly, the average annual income per household member in Tafileh Governorate is 1,712 JD which is lower than the national average of 1,857, which translates into less than 143 JD per month.

Taking all of the above into account and comparing those figures to the national averages clearly reveals that households in Tafileh Governorate in general are poorer and at a lower standard of living compared to the average of Jordanian households. No detailed information was available for those of the local communities.

With regards to employment, in Tafileh Governorate around 41% of the population of age 15 and above were economically active, of which 34.9% are working and 6.5% are seeking a job, whereas 58.6% are economically inactive. The high rate for the inactive population is due to the fact that they are mostly students (28.4% of the inactive) and housewives (53.4% of the inactive). It is worth mentioning that the majority of the economically inactive that can work but do not, believe that there are no job opportunities in the market and/or a suitable job is not available for them.

Taking into account the statistics for population, labour, and age breakdown gives insights about the human resources that are capable of being producers, of age 15 – 60+, in the community (economically active but cannot find a job); estimated at 6,073. The majority of the workforce, more than 50%, is between the age of 25 years old and 39 and around 32% are between 20-24 and 40-49. A very low percentage of the workforce is between the age of 15-19, 50-59 and 60+ (around 10%). Assuming a similar distribution among the unemployed, then projects targeting men and women in their twenties and thirties would have the highest impact on employment.

In addition, in this age group (15 – 60+), approximately two thirds of all the unemployed are female: women thus face even higher obstacles to entering the labour market. The higher age groups account for a lower number of the unemployed. This might either be due to better job opportunities or quite conversely due to limited prospects.

Figure 49 below presents the unemployment rate of Tafileh Governorate during the last 10 years compared to the national average. All statistics were based on DoS figures. The trend indicates a decreasing unemployment rate from around 21.6% to around 15.7% during the last 10 years; although from year to year it varies and most notable it increases from 2011 till 2012 from 17.5% to 19.6%. Nevertheless, the gap between the national figure and that of Tafileh Governorate clearly decreases throughout the last decade as presented in the figure below. However, although unemployment rate has improved throughout the last 10 years, it still remains higher than the national average, estimated at 13% in 2015, compared to 15.7% in Tafileh. No additional details were available for the local communities near the project site.

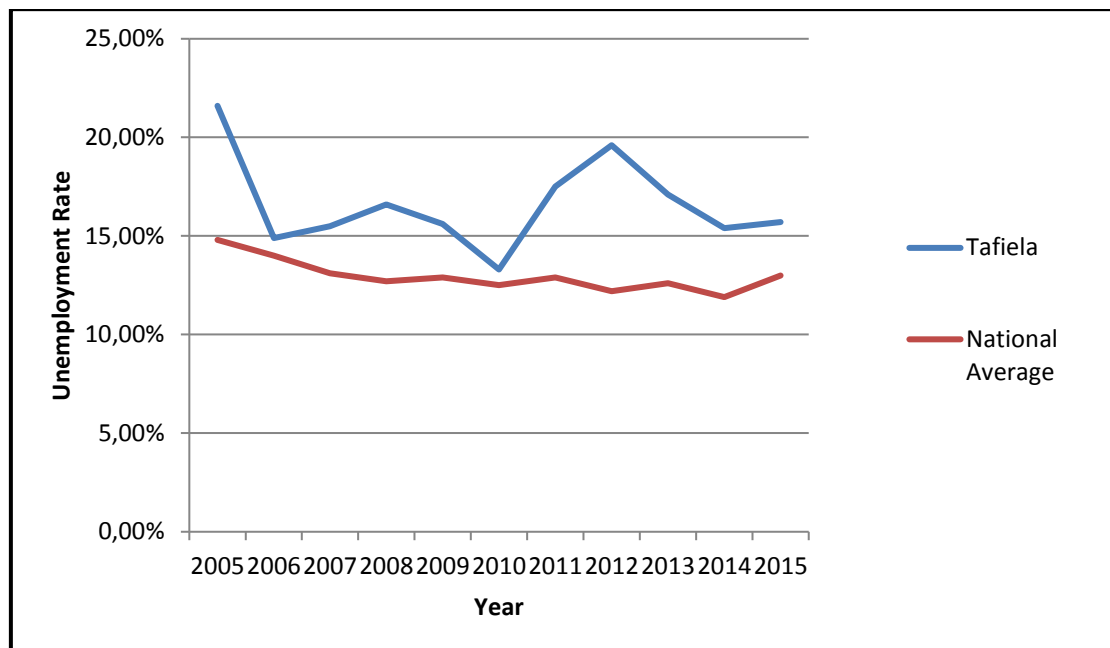


Figure 49: Unemployment in Tafileh Governorate vs. National Average from 2005-2015

Figure 50 below presents the poverty rates for the governorate for 2008 and 2010 compared to the national average (only statistics available). Similarly, all statistics were based on DoS figures. Poverty rate accounts for the percentage of residents who spend less than the national absolute poverty line. The absolute poverty line, also known as the general poverty line, is the required level of income or expenditure for an individual to secure the basic nutritional needs along with other basic non-nutritional needs related to housing, clothing, education, health, and transportation. In 2008, the absolute national average poverty line for the Kingdom was estimated at 680 JD and increased to 814JD in 2010.

The numbers in the figure below indicate that poverty rates in Tafileh are significantly higher than that of the national average in 2008 and 2010; around 21% compared to 13% and around 17% compared to 14% respectively. Tafileh ranked third (after Mafraq and Ma'an) in 2008 and seventh in 2010.

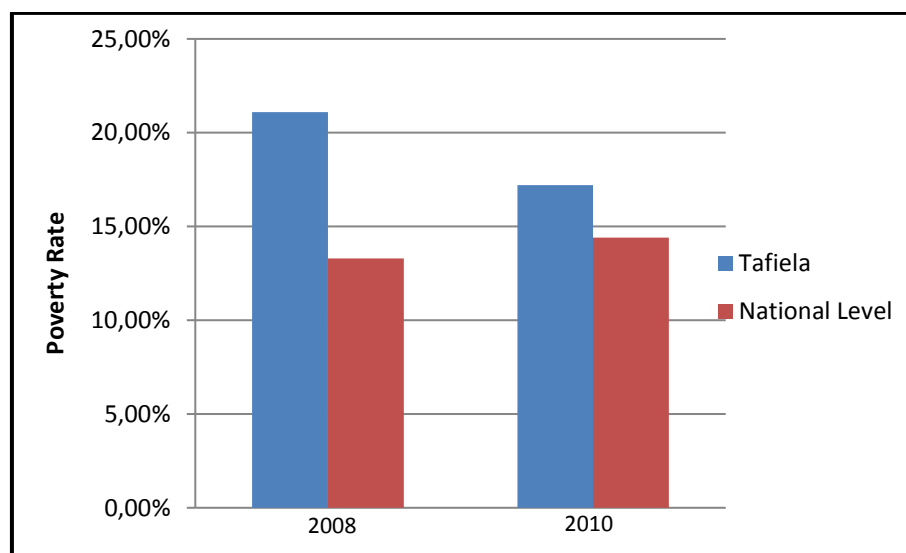


Figure 50: Poverty Rate in Tafileh vs. National Average for 2008 and 2010

According to the report 'Poverty Situation in Jordan' (DoS, 2010 and 2012) (which was based on 2008 and 2010 data respectively), the increase in poverty is likely attributed to the reduction in the purchasing power due to inflation throughout the years which has reflected on the actual expenditure of individuals in those areas. However, generally poverty rates can be considered rather constant in Jordan as it is constant in those

governorates with the highest population numbers where more than two-thirds of the population of the kingdom is concentrated.

The poverty statistics above are consistent with the listings of poverty pockets within Tafileh Governorate. Poverty pockets are the sub-districts in Jordan where poverty rate equals or exceeds 25%. According to DoS, in 2008 Tafileh Governorate had one poverty pocket (Bseira District at 31.4% - which includes Bseira, Gharandal and Um Essarab) in which poverty decreased slightly in 2010 down to 30.0%.

Table 59 below provides the poverty rate in 2010 within each of the sub-districts of Tafileh Governorate. Detailed poverty statistics for the local communities are not available.

Table 59: Poverty Rates within Bseira District

Sub-district	Poverty Rate
Bseira	30.0%
Al-Hasa	15.0%
Tafileh Qasabah	13.1%

With regards to the local community in specific, there are no available statistics on unemployment and poverty levels. Nevertheless, based on discussions with local community representatives, it is understood that unemployment rates are currently considered high and poverty levels are also considered an issue of concern. This is attributed to the following reasons:

- General difficult economic conditions in the kingdom as a whole along with a reduction in the purchasing power due to inflation throughout the years which has been reflected on the actual expenditure;
- Local communities mainly work in the public sector and in military jobs which are considered low income professions;
- The lack of governmental and private sector investment projects that can employ labour and thus positively impact unemployment and poverty levels; and
- The investment and development projects/programs that were targeted for Tafileh generally failed to employ local community members as such employment opportunities were generally targeted for people outside of the local communities.

(iv) Education and Health Services

a. Education

Tafileh Governorate has 148 schools (39 secondary schools, 91 primary schools, and 18 kindergartens) with a total of 2,545 teachers whom educate a total of 27,043 students. More than 60% of the schools are distributed within the communities of Tafileh District. In addition, specifically within Bseira district, there are 42 schools (8 secondary schools, 29 primary schools, and 5 kindergartens) with a total of 654 teachers whom educate a total of 7,037 students.

Within Ain Baida there are 14 schools (2 secondary schools, 10 primary schools and 2 kindergartens) while within Bseira village there are 14 schools (1 secondary school, 9 primary schools and two kindergartens), also within Gharandal village there are 8 schools (2 secondary schools and 6 primary schools) and finally within Um Essarab village there is only one primary school.

With regards to higher education, within Tafileh Governorate there is one university which is the Tafila Technical University (TTU).

Illiteracy rate within Tafileh Governorate is around 9.5%; higher than the national average of 7%. However, throughout the last decade illiteracy has generally been improving due to vast improvements in education awareness and education services within those local communities.

b. Health Services

Within the Tafileh Governorate there is one (1) military hospital only known as Prince Zaid Bin Al-Hussein Military Hospital located within Tafileh district (in Wadi Zaid). The following table summarizes the profile of the hospital.

The local communities within the Tafileh Governorate are also served with six (6) comprehensive health centres of which four (4) are located within Tafileh Qasabit district while the others are located in Al-Hasa district, and Bseira district. In addition, spread throughout the Governorate are 11 primary health centres, 6 secondary health centres, 15 dentistry centres, 17 maternity and child care centres, 14 pharmacies, 3 laboratories, and 1 radiology laboratory in the Prince Zaid Bin Al-Hussein Military Hospital.

Table 60: Summary of the Hospitals within Tafila Governorate

Name	Bed Capacity	Services Provided (Medical Specialties)
Prince Zaid Bin Al-Hussein Military Hospital	106	Anaesthesia, ICU & Pain Management, Cardiology, Dentistry, Ear Nose Throat (ENT), Gastroenterology & Hepatology, Health Care, Nuclear Medicine (Radiology), Paediatric, Physiotherapy, Psychological...

21.2 Assessment of Potential Impacts

Given the generic nature of the impacts on socio-economic development for both phases of the project (construction and operation) those have been identified collectively throughout this section. During the construction and operation phases, the project is expected at a minimum to provide job opportunities for local communities. The project will create the following job opportunities based on preliminary information provided by the Developer:

- Around 70 job opportunities during the construction phase for a duration of approximately 16 months. This will mainly include skilled job opportunities (such as engineers, technicians, management professionals, etc.), and unskilled job opportunities (such as labourers and security personnel). All unskilled and partially skilled job opportunities will be prioritised to the local communities around the project site and/or Jordanian residents (with required qualifications and skills).
- Around 10 job opportunities during the operation phase for a duration of 20 years. This will include skilled job opportunities (such as engineers, technicians, administrative employees, etc.) and unskilled job opportunities (such as security personnel, drivers, etc.). All unskilled and partially skilled job opportunities will be prioritised to the local communities around the project site and/or Jordanian residents (with required qualifications and skills).

The above could also entail other indirect positive benefits to the local community from increase in demand for local services, supplies, and businesses. This could include for example possible engagements for supplies and services (accommodation services, food, household products, etc.). Such demands could improve the existing local economic activities and impact certain sectors, such as wholesale/retail trade.

Taking all of the above into account, this to some extent could contribute to enhancing the living environment for its inhabitants. The creation of job opportunities in specific is of crucial importance especially because, as discussed earlier, the local community in general suffers from high unemployment rates and lacks governmental and private sector investment projects which can employ labour and thus positively impact unemployment levels.

Consultations with the local community focused on the importance of the project to Jordan. However, they also emphasized the important role of the developer in engaging and building trust with the local community members in the project to the greatest extent possible through providing job opportunities and social development. In particular, the main outcomes and expectations of the local community (based on the consultation undertaken) include the following:

- Priority for all job opportunities (skilled and unskilled) should be for the local community;

- There must be a transparent recruitment procedure for the local community members which provides an equal opportunity for all;
- Given the local community's general lack of qualifications for expected skilled job opportunities for the project during construction and operation, they suggested that a training and capacity building program is implemented for the local community to be involved in skilled job opportunities for the project.
- The local community has several expectations from the Developer in implementing additional social responsibility actions and/or programs. Generally, it was agreed that such actions should be based on the priority needs of the village. Several suggestions were raised such as installation of PV systems for local community facilities (such as governmental buildings, mosques, schools, hospitals, etc.) and provide scholarship programs for students.

From the onset of the project, the developer has shown commitment and responsibility towards local community development and engagement. Since the inception of the project, the following social development measures were undertaken by the developer:

- Donation for installation of a 30kW solar PV system for Tafila Technical University in 2015
- Donation for installation of a 8kW solar PV system for the Tafileh Sports club in 2016
- Donation for installation of a 8kW solar PV system for the Tafileh Disabled Children School in 2017
- Donation of food services for people in need during the Holy Month of Ramadan in 2017

Taking the above into account, proper planning and local community engagement from the start is crucial to understand issues and opportunities which in turn would enable the project build true sustainable links which will bring maximum benefits to the local communities. Given the above, such impacts are anticipated to be positive.

Recommendations

As the impacts discussed are mainly positive, no mitigation measures have been identified. This section provides recommendations which aim to enhance such positive impacts anticipated from the project throughout the construction and operation phases to the greatest extent possible.

From the onset of the project, it is recommended that the developer adopt and implement a community integration plan. The community integration plan must demonstrate how the local communities will be involved and integrated in the project in terms of job opportunities and other indirect socio-economic benefits (e.g. accommodation services). The plan must conform to the requirements of the recently issued "Regulation for Obligatory Employment of Jordanian Workforce from Surrounding Communities in Development Projects No. (131) for the year 2016". The regulation requires the obligatory employment of local communities within development projects to include fresh graduate engineers, technicians, labourers, etc. and specifies requirements for training as well as giving priority for local contractors. The number of job opportunities is specified based on the investment amount of the development projects. The Plan must also demonstrate providing priorities to local communities starting at the municipal level, district level, and finally at the governorate level.

Taking the above into account, it is recommended that the plan include the following:

- Manage expectations so that local communities are realistic about opportunities from the project;
- Identify the number of skilled and unskilled job opportunities targeted to the local community throughout the construction and operation phases. The developer is expected to provide in details the qualifications and skills required for each job opportunities as well as the limitations and constraints of local community members and how and to which extent those could be addressed through training and capacity building. Taking this into account, the developer could consider a training and capacity building program in collaboration with the EPC contractor in the nearby communities for the required skilled job opportunities during both the construction and operation phase;

- Present transparent recruitment procedures for the local community, to be adopted and implemented in the various construction and operation contracting arrangements. Such procedures must provide equal opportunities for all, including females;
- Detail additional areas where local community members can benefit or be involved besides job opportunities provided they have the required skills and expertise needed to meet the development standards. For example, during construction the project shall consider local sourcing of materials and supplies (if available);
- Ensure timely and continuous communication and dissemination of information between the developer and the local community members to alleviate potential sense of social marginalization and improve their understanding and perception of the benefits associated with development. Communication should also include information and updates on the projects development, number of employment opportunities, the bidding process for project components, construction plans, etc.
- Consider allocating funds for social responsibility programs to be implemented for the local communities. The mechanism for such a fund needs to be developed in greater details and must take into account the requirement for undertaking a detailed needs assessment of the local communities and also considering managing such a fund through an independent entity to provide a transparent and systematic method for allocating funds which in turn would ensure maximum benefits to the local communities. This could include for example an Advisory Board formed by various representatives of the local communities with the developer to include municipality, elder representatives of tribal groups of the village, youth and unemployed, private sector, etc.

22. SUMMARY OF ANTICIPATED IMPACTS

Table 61, Table 62, and Table 63 below present a summary of the anticipated impacts during the planning and construction, operation, and decommissioning phase of the project. The information in the tables includes:

- Key and generic environmental attributes (e.g. air quality, noise);
- Impact (textual description);
- Nature of impact (negative or positive);
- Duration (long-term or short-term);
- Reversibility (reversible or irreversible);
- Magnitude (high, medium, or low);
- Sensitivity (high, medium, or low);
- Significance (major, moderate, minor, or not significant);
- Management action – generally management actions describe whether an impact can be mitigated or not. Management actions include: (i) mitigation measures; (ii) compensation measures; (iii) additional requirements which must be implemented at a later stage and which could be required by a governmental entity; (iv) for positive impacts recommendations have been provided which aim to enhance the impact; and
- Residual significance after management actions are implemented (major, moderate, minor, or not significant).

Table 61: Summary of Anticipated Impacts during the Planning and Construction Phase

Environmental Attribute	Likely Impact – Planning and Construction Phase	Impact Assessment							
		Nature	Duration	Reversibility	Magnitude	Sensitivity	Significance	Management Action	Residual Significance
Land Use	Project could conflict the formal assigned land uses set by the various governmental entities.	There are no anticipated impacts.							Additional Requirements
	Construction activities could disturb and affect the actual land use of the site as it could provide value to local stakeholders such as local communities and nomads (for agriculture, grazing, etc.).	Negative	Long – Term	Reversible	Low	Medium	Minor	Mitigation available	Not Significant
Geology and Hydrology	There are various wadi systems which run within the project site. If not taken into account there could be potential for flood risks which could affect the various project components.	Negative	Long – Term	Could be irreversible	Low	Medium	Minor	Mitigation Available	Not Significant
	Risk of soil and groundwater contamination during the various construction activities from improper housekeeping activities, spillage of hazardous material, random discharge of waste and wastewater.	Negative	Long – Term	Could be irreversible	Low	Medium	Minor	Mitigation Available	Not Significant
Biodiversity	Construction activities would disturb existing habitats (flora and fauna). In addition, other impacts could be from improper management of the site (e.g. improper conduct and housekeeping practices).	Negative	Long – Term	Could be irreversible	Medium	Medium	Moderate	Mitigation Available/ Additional Studies	Not Significant
Birds (Avi-Fauna)	Construction activities could disturb existing habitats of birds breeding and/or nesting within the project site.	Negative	Short – Term	Could be irreversible	Low	Medium	Minor	Mitigation Available/ Additional Studies	Not Significant
Bats	Construction activities would alter the site's habitat and potentially affects bats particularly through loss of hunting habitats as well as removal of roosting sites.	Negative	Long – Term	Could be irreversible	Low	Low	Not significant	No Mitigation Required	Not Significant
Archaeology and Culture Heritage	Improper management of construction activities could disturb/damage the archaeological locations recorded within the area as well as potential archaeological remains which could be buried in the ground (if any).	Negative	Short – Term	Could be irreversible	Medium	Medium	Moderate	Mitigation Available	Not Significant
Air Quality	Construction activities will likely result in an increased level of dust, particulate matter and pollutant emissions which in turn will directly impact ambient air quality.	Negative	Short - Term	Reversible	Medium	Low	Minor	Mitigation Available	Not Significant
Infrastructure and Utilities	Water Resources – water requirements of the project could entail constraints on the existing resources users such as the local communities.	Negative	Short - Term	Reversible	Low	Low	Not significant	Additional Requirements	Not Significant
	Wastewater Utilities – it is important to ensure that existing utilities would be able to handle the amount of wastewater generated from the project during the construction phase.	Negative	Short - Term	Reversible	Low	Low	Not significant	Additional Requirements	Not Significant
	Solid Waste Utilities – it is important to ensure that existing utilities would be able to handle the amount of solid waste generated from the project during the construction phase.	Negative	Short - Term	Reversible	Low	Low	Not significant	Additional Requirements	Not Significant
	Hazardous Waste Utilities – it is important to ensure that existing utilities would be able to handle the amount of hazardous waste generated from the project during the construction phase.	Negative	Short - Term	Reversible	Low	Low	Not significant	Additional Requirements	Not Significant
	Aviation, Telecommunication, and TV & Radio Links – Improper planning and site selection of the project could impact aircraft safety and/or could potentially interfere with certain electromagnetic transmissions associated with air transport, telecommunications, and radio/television systems in the area.	There are no anticipated impacts.							Additional Requirements
	Road Networks – if transportation activities of the various project components to the site are not properly managed beforehand, they could entail risk of damage to the existing roads and could be of public safety concerns to other users on the road.	Negative	Short - Term	Reversible	Low	Low	Not significant	Additional Requirements	Not Significant
Occupational Health and Safety	During construction impacts/accidents due to fire, traffic, dropping items, down falling, electricity, machines etc. are possible. There will be some generic risks to workers health and safety from working on decommissioning sites, as it increases the risk of injury or death due to accidents.	Negative	Short - Term	Could be irreversible	Medium	High	Moderate	Mitigation Available	Not significant
Community Health, Safety and Security	During construction a minor impact could cause due to increased traffic. This could cause accidents or noise pollution.	Negative	Short - Term	Reversible	Low	Low	Not Significant	Additional Requirements	Not Significant
	Possible noise emissions to the environment from the construction activities which will likely include the use of machinery and equipment such as generators, hammers, and compressors and other activities	Negative	Short - Term	Reversible	Low	Medium	Not Significant	Recommendations provided	Not Significant
Socio-Economic Conditions	The project is expected at a minimum to provide job opportunities for local communities. This, to some extent, could contribute to enhancing the living environment for its inhabitants, elevate their standards of living, and bring social and economic prosperity to local communities.	Positive	Not applicable					Recommendations provided	Not applicable

Table 62: Summary of Anticipated Impacts during the Operation Phase

Environmental Attribute	Likely Impact – Operation Phase	Impact Assessment							
		Nature	Duration	Reversibility	Magnitude	Sensitivity	Significance	Management Action	Residual Significance
Landscape and Visual	Visibility of the turbines in the nearby settlements.	Negative	Long – Term	Reversible	Large-none	High-Low	Moderate	Mitigation available	Moderate
Land Use	Operational activities could disturb and affect the actual land use of the site as it could provide value to local stakeholders such as local communities and nomads (for agriculture, grazing, etc.).	Negative	Long – Term	Reversible	Low	Medium	Minor	Mitigation available	Not Significant
Geology and Hydrology	Risk of soil and groundwater contamination during the various construction activities from improper housekeeping activities, spillage of hazardous material, random discharge of waste and wastewater	Negative	Long – Term	Could be irreversible	Low	Medium	Minor	Mitigation Available	Not Significant
Biodiversity	Improper management of the site could disturb existing habitats (e.g. improper conduct and housekeeping practices).	Negative	Long –Term	Could be irreversible	Medium	Medium	Moderate	Mitigation Available	Not Significant
Birds (Avi-Fauna)	Wind turbines are associated with impacts on birds from risks of strikes and collision on both migratory and resident soaring birds. Such impacts depend on several factors but could affect the population levels of certain species especially those with international/national critical conservation status.	Negative	Long –Term	Could be irreversible	High	Medium	Moderate	Mitigation Available	Not Significant
Bats	The potential impacts from the project during operation are mainly related to risk of bat strikes and collisions with rotors of the operating wind turbines	Negative	Long – Term	Could be irreversible	Low	Low	Not Significant	Mitigation Available/Additional Studies	Not Significant
Archaeology and Culture Heritage	Improper management of operational activities could disturb/damage the archaeological locations recorded within the project area.	Negative	Long – Term	Could be irreversible	Medium	Low	Minor	Mitigation Available	Not Significant
Infrastructure and Utilities	Water Resources – water requirements of the project could entail constraints on the existing resources users such as the local communities.	Negative	Long – Term	Reversible	Low	Low	Not significant	Additional Requirements	Not Significant
	Wastewater Utilities – it is important to ensure that existing utilities would be able to handle the amount of wastewater generated from the project during the operation phase.	Negative	Long – Term	Reversible	Low	Low	Not significant	Additional Requirements	Not Significant
	Solid Waste Utilities – it is important to ensure that existing utilities would be able to handle the amount of solid waste generated from the project during the operation phase	Negative	Long – Term	Reversible	Low	Low	Not significant	Additional Requirements	Not Significant
	Hazardous Waste Utilities – it is important to ensure that existing utilities would be able to handle the amount of hazardous waste generated from the project during the operation phase.	Negative	Long – Term	Reversible	Low	Low	Not significant	Additional Requirements	Not Significant
	Road Networks – due to improvement of existing roads or building new roads people are able to use those comfortable roads	Positive	Not Applicable						
Occupational Health and Safety	During operation impacts/accidents due to fire, dropping items, down falling, electricity, etc. are possible. But only service teams will be affected. There will be some generic risks to workers health and safety from working on sites, as it increases the risk of injury or death due to accidents.	Negative	Long - Term	Could be irreversible	Medium	High	Moderate	Mitigation Available	Not Significant
Community Health, Safety and Security	In certain weather conditions ice may cause damage to structures and vehicles, and injury to site personnel and the general public. In addition, although very unlikely rotating turbine blades may propel ice fragments some distance from the turbine.	Negative	Long – Term	Reversible	Low	Low	Minor	Mitigation Available	Not Significant
	The moving shadow (shadow flicker) can be annoying for residents of nearby dwellings.	Negative	Long – Term	Reversible	Medium	Medium	Moderate	Mitigation Available	Not Significant
	Possible noise emissions from the operation activities could be an annoyance and disturbance to people living near the project.	Negative	Long – Term	Reversible	Low	Medium	Minor	Mitigation Available	Not Significant
	Disturbing reflections (disco effect) of the sunlight can occur at a wind turbine.	Negative	Long – Term	Reversible	Low	Low	Minor	Mitigation Available	Not Significant
Socio-Economic Conditions	The project is expected at a minimum to provide job opportunities for local communities. This, to some extent, could contribute to enhancing the living environment for its inhabitants, elevate their standards of living, and bring social and economic prosperity to local communities.	Positive	Not applicable					Recommendations provided	Not applicable

Table 63: Summary of Anticipated Impacts during the Decommissioning Phase

Environmental Attribute / Issue	Likely Impact – Operation Phase	Impact Assessment							
		Nature	Duration	Reversibility	Magnitude	Sensitivity	Significance	Management Action	Residual Significance
Geology and Hydrology	Risk of soil and groundwater contamination during the various decommissioning activities from improper housekeeping activities, spillage of hazardous material, random discharge of waste and wastewater	Negative	Long – Term	Could be irreversible	Medium	Low	Minor	Mitigation available	Not significant
Air Quality	Decommissioning activities will likely result in an increased level of dust and particulate matter emissions which in turn will directly impact ambient air quality.	Negative	Short term	Reversible	Medium	Low	Minor	Mitigation available	Not significant
Community Health and Safety	Possible noise emissions to the environment from the decommissioning activities which will likely include the use of machinery and equipment such as generators, hammers, and compressors and other activities	Negative	Short term	Reversible	Medium	Low	Minor	Mitigation available	Not significant
Occupational Health and Safety	There will be some generic risks to workers health and safety from working on decommissioning sites, as it increases the risk of injury or death due to accidents.	Negative	Short Term	Could be irreversible	Medium	High	Moderate	Mitigation Available	Not significant

23. ASSESSMENT OF CUMULATIVE IMPACTS

This section investigates the cumulative impacts which could result from incremental impacts from other known existing and/or planned developments in the area based on currently available information.

Within the project area and its surrounding there are two existing wind farms and six planned wind farm development projects, which are at different stages of development. These projects are the following and which are presented in Figure 51 below.

1. Tafileh Wind Farm Project: a 117MW project that is located around 3km southeast of the project site. project is owned by Jordan Wind Power Company (JWPC) and started commercial operation in third quarter of 2015. The wind farm was part of the IFC's CEA;
2. Xenel Wind Farm Project: a 50MW project that is located around 3km northeast of the project site. project is owned by Xenel. This project is part of the Direct Proposal projects that have been shortlisted by MEMR, and has been recently approved by the government but it is yet unclear at this stage what is the timeframe for the project development. The wind farm was part of the IFC's CEA;
3. MASS Wind Farm Project: a 100MW project that is located around 10km east of the project site. The project is owned by Mass Group Holding and its construction is expected in late 2017 while operation is not expected before the beginning of 2019;
4. LAMSA Wind Farm Project: a 99MW project that is located around 7km southwest of the project site. The project is owned by LAMSA Investments LLC but the status of the project is unknown at this moment. It should be mentioned though that this project was included in the Cumulative Effect Assessment that was carried out by IFC (IFC, 2017), mentioned earlier;
5. Fujeij Wind Farm Project: a 90MW project that is located around 16km south of the project site. The project is owned by MEMR. The project started construction activities in second quarter of 2017 and operation is expected in late 2018. The wind farm was part of the IFC's CEA;
6. Alcazar Shobak Wind Farm: a 50MW project that is located around 25km south of the project site. The project is owned by Alcazar Energy. The project is at the ESIA preparation stage which is expected to be ready by the third quarter of 2017. Operation is expected to start in 2019;
7. Ma'an Wind Farm Project: a 75MW project that is located around 45km to the south of the project site. The project is owned by MEMR and started commercial operation in third quarter of 2015, and;
8. Rajif Wind Farm Project: an 82MW project that is located around 60km to the south of the project site. Project is owned by Alcazar Energy. The project is at the construction phase and it is expected to commence operation by the second half of 2018.

The key cumulative impacts that are relevant include: (i) biodiversity, bats and avi-fauna; (ii) shadow flicker; (iii) noise and (iv) landscape and visual each of which is discussed below.



Figure 51: Wind Farm Projects in the Area

(i) Biodiversity, Bats and Avi-Fauna

The International Financing Corporation (IFC) has published recently the Tafila Region Wind Power Projects Cumulative Effect Assessment (CEA), of which the Project was part off in addition to Tafileh, Xenel, LAMSA, and Fujeij.

The overall objective of the CEA was to identify the potential cumulative effects of the Wind Power Projects on birds, bats and habitats in the study area of Tafila Region and propose mitigation, monitoring and other management measures to address the highest risks. Risks were identified with respect to Valued Social and Environmental Components (VECs). The CEA's scope was on three major biodiversity elements; birds, bats and habitats.

The focus of IFC's CEA was on five wind farm projects in the Tafila Region as mentioned earlier. The Project site is located inside the IFC's CEA area and the findings of the assessment are applicable to the Project.

Of particular importance would be the potential cumulative impacts on avi-fauna during the operation phase. The general area of the Project site along with the other adjacent wind farm projects is known to be part of the Red Sea/Rift Valley Migration Flyway, which is known to be the second most important bird

migration flyway in the world. The cumulative impacts could occur mainly from strikes and collision of birds with operating wind farms. For example, given the migration route of birds during spring there could be impacts on migratory birds from the Project which could result in fatalities on certain priority species identified in the CEA. As birds continue with their migration route north or south, depending on the migration season, there could be impacts from other projects (such as the existing Tafileh Project and any other project that could be operational in the future).

The results of the CEA started with an initial list of 171 species populations that were identified as potentially at risk. This list was reduced through the CEA process to 13 species which were defined as priority bird VECs that were assessed to be at highest risk through the CEA process. Out of these 13 species populations, nine were recorded in the Project site. Four of these are migratory soaring bird populations; Egyptian Vulture *Neophron percnopterus*, Steppe Eagle *Aquila nipalensis*, Eastern Imperial Eagle *Aquila heliaca* and Booted Eagle *Aquila fasciata*, while the remaining five are resident or summer-breeding bird populations; Short-toed Snake-eagle *Circaetus gallicus*, Griffon Vulture *Gyps fulvus*, Golden Eagle *Aquila chrysaetos*, Long-legged Buzzard *Buteo rufinus* and Lesser Kestrel *Falco naumanni*. Additionally, it would be impossible at this stage to confirm that additional priority species, other than the ones that were previously recorded in the Project site, will not be recorded during the operational phase of the project.

Regarding bats, the results of the CEA started with an initial list of 18 species populations that were identified as potentially at risk. This list was reduced through the CEA process to 2 species which were defined as priority bat VECs that were assessed to be at highest risk through the CEA process. In the project site, three bat species were recorded but none of them is a priority species, according to the CEA.

It is believed that cumulatively along with the other adjacent projects, avian in-flight monitoring during the operational phase is needed, in order to avoid any negative impacts on the priority species highlighted by the CEA, which has highlighted that the bird-fatality threshold of these species populations is zero. In other words, the project will work collectively to avoid any fatalities for any individual of the thirteen species populations identified by the CEA. Based on the location of the Project, the results and recommendations of the IFC's CEA should be adopted during the operational phase of the Project.

The main outcome of the CEA was management measures to be implemented throughout the construction and operation phase for the area. Such management measures were reflected and included within the impact assessment sections in this ESIA for biodiversity, bats and avi-fauna as well as the ESMP that follows.

The same level of assessment undertaken for the 5 projects covered in the CEA cannot be undertaken for remaining wind farm projects (which mainly include Mass, Alcazar, Ma'an and Rajif) due to the following: (i) inconsistent level of data between the other sites; (ii) assessment will require a huge and extensive level of analysis over a long period of time; (iii) unavailable data for some of the sites.

Nevertheless, a detailed and project specific baseline and impact assessment has been undertaken for each of the remaining projects not covered in the CEA as part of the project specific ESIA studies and a project specific ESMP has been developed. It is expected that as part of the ESMP a bird monitoring plan for observer-led turbine(s) shutdown on both migratory and resident birds will be required. With the implementation of such measures, the cumulative impacts on avi-fauna are anticipated to be not significant.

(ii) Shadow Flicker

Due to the large distance to the other known existing and/or planned developments in the area, there will be no overlapping shadow areas from the turbines of the Kospo Wind Farm and the turbines of the other projects. Therefore, cumulative impacts can be ruled out for shadow flicker.

(iii) Noise

The JWPC windfarm is located approximately 3,500 m (distance between closest WTGs) southeast of the planned Kospo Wind Farm. Due to this large distance between these projects significant cumulative impacts are not expected. However, the existing JWPC turbines were considered in the noise prediction. Since there was no detailed information available (wind farm layout, turbine type) for the Xenel Wind Farm Project, a noise calculation including the Xenel Wind Farm was not conducted. However, since there are no dwellings northeast of the Kospo Wind Farm and due to the large distance between these two Projects, no significant cumulative impacts are anticipated.

(iv) Landscape and Visual

Due to the lack of information (wind farm layout, turbine type) for the Xenel Wind Farm Project the cumulative assessment was focused on the Kospo and the JWPC Wind Farm. All other known planned wind farms are located in a large distance and therefore not relevant for the assessment.

Inter-visibility between wind farms is normally found to be highest in those areas between the developments. However, the actual pattern of cumulative inter-visibility (CIV) is dependent on the land-cover, land-use and landform of the area subjected to combined visibility. Since the area between the JWPC and the Kospo Wind Farm is hardly populated, there is only a small impact on the landscape and the visual amenity. Even in Gharandal, the closest town, south of the Kospo Project and west of the JWPC Project, the visibility of both developments will be very limited due to the existing topography. Consequently, there are only small negative cumulative impacts on the landscape and the visual amenity of *moderate to minor significance*.

24. ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN (ESMP)

24.1 Institutional Framework and Procedural Arrangement for ESMP Implementation

Generally, two main pillars govern the successful implementation of any Environmental and Social Management Plan (ESMP):

1. Proper identification of roles and responsibilities for the entities involved; and
2. Effective control of the process.

All management practices are interlinked, and this section describes how these two pillar criteria could be fulfilled, which in turn helps ensure that the overall objectives of the ESMP are met.

Defining roles and responsibilities of the involved entities in any ESMP identifies where and when each entity should be engaged, their degree of involvement, and the tasks expected of the entity. This in turn eliminates any overlap of jurisdiction or authority and ensures proper communication and effective management of ESMP components. Control processes mainly include training and awareness for entities involved and control of non-conformances that might occur throughout the process.

The objective is to ensure that the ESMP recommendations are implemented in practice, during construction and operation, and assess how environmental resources are affected.

Table 64 below summarizes the overall proposed institutional and procedural arrangement for the implementation of the ESMP, while Table 65 discussed in details the roles and responsibilities of each of the entities involved in implementation of the ESMP.

Generally, a self-compliance approach is advocated, whereby the body responsible for the causative action should ensure that the objectives and requirements stipulated within the ESMP are met – this mainly includes the appointment of a competent HSE Officer by the EPC Contractor during the Construction Phase, while during the Operation Phase this is to be undertaken through the appointment of a competent staff member of the Project Operator Team – there is no need to appoint a separate HSE Officer during operation due to the limited and simple mitigation/monitoring measures detailed within the ESMP (with the exception of the avi-fauna management and monitoring measures which must be undertaken by an expert in this field).

In addition, the Developer is required to review the reporting requirements as per the ESMP and undertake auditing exercises to ensure that the EPC Contractor and Project Operator meets the requirements stipulated within the ESMP. This could be undertaken through the appointment of a competent HSE Officer as part of the Developer Team or through a third party Employer Representative. It is recommended to undertake the auditing exercises on a monthly basis during the construction phase and on a quarterly basis during the operation phase.

Finally, in accordance with the “EIA Regulation No. (37) of 2005”, the Regulator (being MoEnv), will be responsible for undertaking compliance monitoring to ensure that the responsible entity is adhering to the ESMP requirements.

Table 64: Overall proposed institutional and procedural arrangement for ESMP Implementation

Issue	Self-Compliance	Review/Checks	Compliance Inspection	Monitoring/
Construction Phase				
Compliance with ESMP Requirements	EPC Contractor – HSE Officer	Project Developer – HSE Officer or third party Employer Representative (monthly basis)	MoEnv	
Compliance with environmental legislations	EPC Contractor – HSE Officer	Project Developer – HSE Officer or third party Employer Representative (monthly basis)	MoEnv	
Operation Phase				
Compliance with ESMP Requirements	Project Operator – Project Staff Member	Project Developer – HSE Officer or third party Employer Representative (on a quarterly basis)	MoEnv	
Compliance with environmental legislations	Project Operator – Project Staff Member	Project Developer – HSE Officer or third party Employer Representative (on a quarterly basis)	MoEnv	

Table 65: Roles and Responsibilities of Entities Involved in ESMP

Designation	Entity	Project Role	Environmental and Social Responsibilities
Project Developer	Korean Southern Power Co. (KOSPO)	Project Owner and Developer	- Selection of EPC Contractor and Project Operator; - Implement mitigation and monitoring requirements as detailed in the ESMP; and - Appoint a competent HSE Officer or Third Party Employer representative to review the reporting requirements as per the ESMP and undertake auditing exercises to ensure that the EPC Contractor and Project Operator conform to the requirements of the ESMP. Auditing is to be undertaken on a monthly basis during the construction phase and on a quarterly basis during the operation phase.
Engineering, Procurement, and Construction (EPC) Contractor	Vestas	Undertake detailed design and construction of the project	- Appoint a competent HSE officer responsible for implementing the ESMP. - Implement mitigation and monitoring requirements as detailed in the ESMP; - Prepare and submit reporting requirements to Project Developer as detailed in the ESMP; - Implement corrective action measures in case of non-compliance incidents and submit non-conformance report to Project Developer whom in turn will submit to MoEnv.
Project Operator	TBD	Operation and maintenance of the Project	- Due to the limited and simple mitigation/monitoring measures detailed within the ESMP for the Operation Phase, a staff member of the Project Operator Team must be appointed to implement the requirements detailed within the ESMP; - Appoint avi-fauna expert to implement the management and monitoring measures required as per the ESMP. - Prepare and submit reporting requirements to Project Developer as detailed in the ESMP; and - Implement corrective action measures in case of non-compliance incidents and submit non-conformance report to Project Developer whom in turn will submit to MoEnv.
Environmental Regulator	Ministry of Environment	Granting environmental clearance to the Project	Undertake compliance monitoring

24.2 Training and Awareness Raising

Effective and efficient implementation of any ESMP requires that all personnel involved in the Project (construction/operation staff across all levels) understand its objectives and requirements. A proper training

and awareness program ensures that applying mitigation measures is more of a sense of responsibility rather than an enforcing protocol.

Training and awareness is an ongoing process, but most importantly must take place before the commencement of any activity in any phase of the Project. The EPC Contractor and Project Operator are responsible, each for his own staff, for conducting inductions, training requirements and awareness raising which should include at a minimum the following:

- Ensure that staff understand all requirements, measures, and protocols stipulated within the ESMP;
- Ensuring that all personnel engaged in activities that may have an impact on the environment are competent to carry out their duties, or, where necessary, arrange for suitable training to be undertaken;
- Cultural change towards environmental perception;
- Waste, wastewater, and hazardous waste management practices as identified throughout the ESMP;
- Occupational health and safety; and
- Emergency response procedures.

24.3 Control of Non-Compliances

In case any incidents of non-compliance with the ESMP or relevant environmental legislations were noted by MoEnv, as part of their compliance monitoring, then the responsible entity (EPC Contractor or Project Operator) is responsible for issuing a Non-Compliance Report to be submitted to the MoEnv. The report would identify the nature of the problem, the proposed corrective action, action taken to prevent recurrence of the problem and verification that the agreed actions have been carried out. Normally, a Non-Compliance Report should be submitted within 24 hours of the identification of the non-compliance. However, in cases that demand an immediate response to address the non-compliance incident, the MoEnv should verbally notify the Contractor of the non-compliance. The Contractor should then take all necessary measures to address the non-compliance.

24.4 Compilation of Environmental and Social Management Plan

Table 66 and Table 67 below present the ESMP for the planning and construction, operation, and decommissioning phase respectively and which include the following:

- The environmental attribute (e.g. air quality) that is likely to be impacted;
- A summary of the potential impact and/or likely issue;
- The identified management measures that aim to eliminate and/or reduce the potential impact to acceptable levels. Management measures include mitigation actions, further requirements, additional studies, and compensation measures;
- Monitoring actions to ensure that the identified mitigation measures are implemented. Monitoring actions include: inspections, review of reports/plans, reporting, etc.;
- The frequency for implementing the monitoring actions, which include: once , continuously throughout the construction/operation period (depending on the mitigation measure identified this could include daily, weekly, or monthly), or upon occurrence of a certain issue;
- The responsible entity for implementing the mitigation measures and monitoring actions identified; and
- The relevant legislation that must be adhered to and which govern the environmental attribute or likely issue identified.

Table 66: ESMP for the Planning and Construction Phase

Environmental Attribute	Potential Impact	Management Action (mitigations, additional requirements, additional studies, compensation measures, etc.)	Type of Action	Monitoring Action	Frequency	Responsible Entity	Legal Requirements
Landscape and Visual	No significant effects on the landscape in this project stage.	-	-	-	-	-	- Environmental Protection Law No. 52 of 2006
Land Use	Project could conflict with formal land use set at the planning level for the area.	Once a final detailed design has been prepared for the Project components, and only if construction activities require any forest trees in the Project site be removed, then an application must submit an application to the Ministry of Agriculture (Tafileh Agriculture Directorate) in order to obtain their approval.	Additional Requirement	Submit official letter of approval from Ministry of Agriculture (Tafileh Agriculture Directorate)	Once; before construction commences	Developer or EPC Contractor	- Agriculture Law No. 13 for the year 2015
	Construction activities could disturb actual land use of the site as it is used by the local community or nomads.	Land Owners - Ensure landowners (men and women) are provided with annual lease payments in accordance with the provisions of the land lease agreement. In the case where the land deed includes more than one owner, Developer will provide the payment to the land deed representative	Mitigation	Log with all payment slips signed by land deed representatives	Continuous	Developer	- Environmental Protection Law No. 52 of 2006
		Land Users – Agriculture. Prior to construction, consultations to take place with local community land users to develop a baseline in terms of agricultural activities undertaken on leased land areas. In addition, assign in detail the exact areas within the leased lands that are expected to be affected by the Project construction and operation. Ensure that such assigned areas are reduced to the greatest extent possible. It is recommended that the Developer allows land users to practice their activities within leased lands outside of construction and operation areas.	Mitigation	Produce comprehensive map which identifies agriculture activities and which also assigns construction and operation areas	Once; before construction commences	Developer and EPC Contractor	
		Land Users – Agriculture. Although highly unlikely, but should any of the agriculture users require assistance in allocating additional lands to undertake agriculture activities, assist such users to the greatest extent possible through coordination with other land owners in the area and/or on other available public lands.	Mitigation	Documentation of relocation assistance with photographs as appropriate	Upon occurrence	Developer	
		Land Users – Agriculture. Prior to commencement of construction activities, the Developer will disclose to the local communities the following through focus group discussions and information sheets : (i) the baseline mapping exercise for agricultural activities; (ii) announce construction areas and emphasize that agriculture and/or grazing activities cannot take place in such assigned construction areas; (iii) provide construction schedule and duration for which such construction activities will take place; (iv) emphasize that grazing and/or agriculture activities may take place outside of construction areas at all times; (v) provide details on the relocation assistance if required by any agricultural user; and (vi) provide details on the grievance mechanism.	Mitigation	Prepare and submit disclosure report with outcomes	Once; before construction commences	Developer	
		Nomads. If required (although unlikely) provide assistance to nomadic groups in assigning suitable areas outside of construction areas for settlement through coordination with other land owners in the area and/or on other public lands.	Mitigation	Documentation of relocation assistance with photographs as appropriate	Upon occurrence	Developer	
		During the period in which nomads begin to settle in the area (April, May and June), undertake regular site visits to meet with nomadic groups whom arrive onsite. The objective will be to: (i) Announce construction areas and emphasize that settlements as well as agriculture and/or grazing activities cannot take place in such assigned areas; (ii) Provide construction schedule and duration for which such construction activities will take place; (iii)Emphasize that settlements as well as grazing and/or agriculture activities may take place outside of construction areas at all times; (iv) Provide details on the relocation assistance if required by any agricultural user; and (v) Provide details on the grievance mechanism.	Mitigation	Prepare and submit disclosure report with outcomes	Continuously	Developer	
Geology and Hydrology	Wadi systems within the Project site could entail flood risks which could affect the Project components.	It is recommended that the EPC Contractor, as part of the design prepared for the Project, avoid sitting any of the Project components within a buffer distance of 10m from the wadi systems within the Project site.	Mitigation	Review final detailed design	Once – as part of detailed design phase	Developer and EPC Contractor	- Environmental Protection Law No. 52 of 2006
		Should the Project require sitting any of its infrastructure elements (such as roads) within the wadi system then a detailed hydrological and flood risk study must be undertaken which should determine the required engineering flood discharge structures to be considered as part of the detailed design (e.g. culverts) as per the expected flood .	Mitigation	Submission of detailed study	Once – as part of detailed design phase	Developer and EPC Contractor	
	Improper management of solid waste	Coordinate with Bseira Municipality or hire a competent private contractor for the collection of solid waste from the site to Jurf Al Daraweesh Landfill.	Mitigation	Review contract with contractor	Once; before operation commences	EPC Contractor	- Environmental Protection Law No. 52 of 2006

Environmental Attribute	Potential Impact	Management Action (mitigations, additional requirements, additional studies, compensation measures, etc.)	Type of Action	Monitoring Action	Frequency	Responsible Entity	Legal Requirements
		Prohibit fly-dumping of any solid waste to the land.	Mitigation	Inspection	Continuous	EPC Contractor	- Solid Waste Management Regulation No. (27) of 2005
		Distribute appropriate number of properly contained litter bins and containers properly marked as "Municipal Waste".	Mitigation	Inspection	Continuous	EPC Contractor	
		Implement proper housekeeping practices on the construction site at all times.	Mitigation	Inspection	Continuous	EPC Contractor	
		Maintain records and manifests that indicate volume of waste generated onsite, collected by contractor, and disposed of at the landfill. The numbers within the records are to be consistent to ensure no illegal dumping at the site or other areas	Mitigation	Review manifests to ensure consistency	Continuous	EPC Contractor	
	Improper management of wastewater	Coordinate with Tafileh Water Directorate to hire a private contractor for the collection of wastewater from the site to Tafileh WWTP or Jurf Al Darwish landfill	Mitigation	Review contract with contractor	Once; before operation commences	EPC Contractor	- Environmental Protection Law No. 52 of 2006 - Public Health Law No. 47 for 2008
		Prohibit illegal disposal of wastewater to the land	Mitigation	Inspection	Continuous	EPC Contractor	
		Ensure that septic tanks are emptied and collected by wastewater contractor at appropriate intervals to avoid overflowing	Mitigation	Inspection	Continuous	EPC Contractor	
		Maintain records and manifests that indicate volume of wastewater generated onsite, collected by contractor, and disposed of at the Tafileh WWTP or Jurf Al Darwish landfill. The numbers within the records are to be consistent to ensure no illegal discharge at the site or other areas	Mitigation	Review manifests to ensure consistency	Continuous	EPC Contractor	
	Improper management of hazardous waste	Coordinate with the MoEnv and hire a private contractor for the collection of hazardous waste from the site to the Swaqa Hazardous Waste Treatment Facility	Mitigation	Review contract with contractor	Once; before operation commences	EPC Contractor	- Environmental Protection Law No. 52 of 2006 - Management, Transportation, & Handling of Harmful & Hazardous Substances Regulation No. (24) of 2005, - Instruction for Management and Handling of Consumed Oils for 2003, - Instruction for Hazardous Waste Management for the year 2003
		Follow the requirements for management and storage as per the 'Instructions for Hazardous Waste Management and Handling of the Year 2003' of the MoEnv	Mitigation	Inspection	Continuous	EPC Contractor	
		Prohibit illegal disposal of hazardous waste to the land	Mitigation	Inspection	Continuous	EPC Contractor	
		Ensure that containers are emptied and collected by the contractor at appropriate intervals to prevent overflowing	Mitigation	Inspection	Continuous	EPC Contractor	
		Maintain records and manifests that indicate volume of hazardous waste generated onsite, collected by contractor, and disposed of at the Swaqa Facility. The numbers within the records are to be consistent to ensure no illegal discharge at the site or other areas	Mitigation	Review manifests to ensure consistency	Continuous	EPC Contractor	
	Improper management of hazardous material	Ensure hazardous materials are stored in proper areas and in a location where they cannot reach the land in case of accidental spillage. This includes storage facilities that are of impermeable surface, accessible to authorized personnel only, prevent incompatible materials from coming in contact, etc.	Mitigation	Inspection	Continuous	EPC Contractor	- Environmental Protection Law No. 52 of 2006 - Jordanian Standard 431/1985 – General Precautionary Requirements for Storage of Hazardous Materials
		Maintain a register of all hazardous materials used and accompanying MSDS must present at all times. Spilled material should be tracked and accounted for.	Mitigation	Inspection	Continuous	EPC Contractor	
		Incorporate dripping pans at machinery, equipment, and areas that are prone to contamination by leakage of hazardous materials (such as oil, fuel, etc.).	Mitigation	Inspection	Continuous	EPC Contractor	
		Regular maintenance of all equipment and machinery used onsite. Maintenance activities and other activities that pose a risk for hazardous material spillage must take place at a suitable location (hard surface) with appropriate measures for trapping spilled material.	Mitigation	Inspection	Continuous	EPC Contractor	
		Ensure that a minimum of 1,000 litres of general purpose spill absorbent is available at hazardous material storage facility.	Mitigation	Inspection	Continuous	EPC Contractor	
		If spillage occurs, spill must be immediately contained, cleaned-up, and contaminated soil disposed as hazardous waste.	Mitigation	Inspection	Upon occurrence	EPC Contractor	
Biodiversity	Construction activities would disturb existing habitats (flora and fauna). In addition, other impacts could be from improper management of the site (e.g. improper conduct and housekeeping practices).	Undertake a detailed survey to identify the presence of any active tortoises as well as potential hibernation/aestivation sites within all assigned areas to be disturbed by construction. Should any tortoises be located, they should be relocated to distant areas with similar habitat characteristics to the species to ensure that they would not return to the Project site, taking into account the home range for the species.	Additional Requirement	Submit survey report	Once; before construction commences	Developer or EPC Contractor	- Environmental Protection Law No. 52 of 2006 - Agriculture Law No. 13 of 2015 - Regulation for Categorizing Wild Birds and Animals Banded from Hunting No.43 of 2008.
		Undertake a survey to identify any locations in the project where the various threatened floral species are located in order to provide instructions during the construction phase to avoid any damage to these threatened species. In case of identification of locations of any of the species, the plants could be either marked and/or fenced so that construction activities would avoid their locations or relocated	Additional Requirement	Submit survey report	Once; before construction commences	Developer or EPC Contractor	

Environmental Attribute	Potential Impact	Management Action (mitigations, additional requirements, additional studies, compensation measures, etc.)	Type of Action	Monitoring Action	Frequency	Responsible Entity	Legal Requirements
		Should as part of the Project any fencing be erected, it must be ensured that it allows for the natural movement of small faunal species within the area. This could include for example a fence with an appropriate gap between the ground level and the first rail or strand (around 30cm).	Mitigation	Inspection	Once	EPC Contractor	
		Implement proper management measures to prevent damage to the biodiversity of the site. This could include establishing a proper code of conduct and awareness raising / training of personnel (e.g. with respect to prohibiting hunting) and good housekeeping (e.g. keeping the site orderly and clean).	Mitigation	Inspection	Continuous	EPC Contractor	
Birds (avi-fauna)	Construction activities could disturb existing habitats of birds breeding and/or nesting within the Project site.	A breeding bird survey should be carried out right before construction in order to identify key breeding locations and avoid disturbance and damage to these areas.	Additional Requirement	Submit breeding survey report	Once; before construction commences	Developer or EPC Contractor	- Environmental Protection Law No. 52 of 2006 - Agriculture Law No. 13 of 2015 - Regulation for Categorizing Wild Birds and Animals Banded from Hunting No.43 of 2008.
		Implementation of proper housekeeping measures to reduce impacts including avoiding any activities in the sensitive areas for breeding birds, restrict activities to allocated construction areas only, prohibit hunting of birds at any time and avoid unnecessary elevated noise levels at all times.	Mitigation	Inspection	Continuous	EPC Contractor	
Archaeology and Cultural Heritage	Improper management of construction activities could disturb/damage the archaeological locations recorded in the Project area as well as potential archaeological remains which could be buried in the ground (if any).	Ensure that the final prepared detailed design avoids sitting any of the Project components (to include the turbines, roads, transmission lines, warehouses, etc.) within such delineated areas of archaeological importance which takes into account a 70m buffer area from each site as required by the DoA.	Mitigation	Inspection on Final Detailed Design	Once; before construction commences	Developer and EPC Contractor	- Antiquities Law No. 21 of 1988 and its amendments No. 23 for 2004
		Provide Department of Antiquities with final detailed design demonstrating that sites with archaeological importance have been avoided.	Mitigation	Submit final detailed design to DoA	Once; before construction commences	Developer and EPC Contractor	
		The identified sites must be properly demarcated (with fences or flag poles or other as appropriate) with appropriate signage so that the sites are clearly visible to all workers during construction.	Mitigation	Inspection	Once; before construction commences	EPC Contractor	
		Properly plan construction activities to take into account the identified archaeological locations to ensure they are protected from any potential damage. This could include proper movement of vehicles and machinery into/out of the site to avoid such areas, ensure that all vehicles are on established roads and prohibit off-roading, prohibit movement of vehicles near those areas, etc.	Mitigation	Inspection	Continuous	EPC Contractor	
		Ensure that the Code of Conduct, awareness raising, and training developed for construction workers and personnel to emphasize the presence of archaeological locations in the area.	Mitigation	Inspection	Continuous	EPC Contractor	
		Implement appropriate measures for chance find procedures which mainly require that construction activities be halted and the area fenced, while immediately notifying the DoA. No additional work will be allowed before the Department assesses the found archaeological site and grants a clearance to resume the work. Construction activities can continue at other parts of the site if no potential archaeological remains were found. If found, same procedures above apply.	Mitigation	Inspection	Upon Occurrence	Developer and EPC Contractor	
				Report prepared and submitted to the DoA	Upon occurrence	Developer and EPC Contractor	
Air Quality	Construction activities will likely result in an increased level of dust, particulate matter and pollutant emissions which in turn will directly impact ambient air quality.	If dust or pollutant emissions are found to be excessive due to construction activities, the source of such excessive emissions must be identified and adequate control measures must be implemented.	Mitigation	Inspection and visual monitoring to include periodic inspections at nearby sites to determine whether harmful levels of dust from construction activities exist.	Continuous	EPC Contractor	- Environmental Protection Law No. 52 of 2006 - Air Protection Regulation No. 28 for 2005 - Instruction for Reduction and Prevention of Noise for 2003 - JS 1140-2006 Ambient Air Quality
				Reporting of any excessive levels of pollutants and measures taken to minimize impact.	Upon occurrence	EPC Contractor	
		Comply with the OSHA requirements and the Jordanian Codes to ensure that for activities associated with high dust levels, workers are equipped with proper protective equipment (e.g. masks, eye goggles, etc.).	Mitigation	Inspection and Visual Monitoring	Continuous	EPC Contractor	
		Apply basic dust control and suppression measures which could include: regular watering of roads during periods of high traffic, proper management of	Mitigation	Inspection and Visual Monitoring	Continuous	EPC Contractor	

Environmental Attribute	Potential Impact	Management Action (mitigations, additional requirements, additional studies, compensation measures, etc.)	Type of Action	Monitoring Action	Frequency	Responsible Entity	Legal Requirements
		stockpiles/excavated material, proper covering of trucks transporting aggregates and fine materials, adhering to a speed limit of 15 km/h for trucks on construction sites, etc. Develop a regular inspection and scheduled maintenance program for vehicles, machinery, and equipment to be used throughout the construction phase for early detection of issue to avoid unnecessary pollutant emissions.	Mitigation	Inspection	Continuous	EPC Contractor	
Infrastructure and Utilities	Water Resources – it is important to ensure that the water requirements of the Project would not affect the existing users and resources in the area.	Coordinate with the Tafileh Water Directorate to secure the water requirements for the Project.	Additional requirement	Submit report with proof of coordination	Once; before construction commences	EPC Contractor	- Environmental Protection Law No. 52 of 2006 - Instruction for Hazardous Waste Management for the year 2003 - Water Authority Law No. 18 for 1988 and it's amendments thereof - Groundwater Control Regulation No. 85 for 2002 and its amendments thereof - Municipalities Law No. Law No. 13 of year 2011 - Traffic Law No. 49 for 2008 - Regulations for the Registration and Licensing of Vehicles No. 104 for 2008 - Instructions for Allowable Speed Limits for 2002 - Civil Aviation Law No. 41 of the year 2007 - Telecommunications Law No.21 for the year 2011
	Wastewater Utilities – it is important to ensure that existing utilities would be able to handle the amount of wastewater generated from the Project.	Coordinate with the Tafileh Water Directorate for disposal of wastewater at Tafileh WWTP or Jurf Al Darwish landfill	Additional requirement	Submit report with proof of coordination	Once; before construction commences	EPC Contractor	
	Solid Waste Utilities – it is important to ensure that existing utilities would be able to handle the amount of solid waste generated from the Project.	Coordinate with Bseira Municipality for the collection of solid waste from the site to Jurf Al Darwish landfill.	Additional requirements	Submit report with proof of coordination	Once; before construction commences	EPC Contractor	
	Hazardous Waste Utilities – it is important to ensure that existing utilities would be able to handle the amount of hazardous waste generated from the Project.	Coordinate with MoEnv to hire a competent private contractor for the collection of hazardous waste from the site to the Swaqa Hazardous Waste Treatment Facility.	Additional requirements	Submit report with proof of coordination	Once; before construction commences	EPC Contractor	
	Road Networks – if transportation activities are not properly managed, they could entail risk of damage to the existing roads and could be of public safety concerns to other users on road.	Traffic management plan has to be established before start of construction	Additional requirements	Submit plan	Once; before construction commences	EPC Contractor	
	Aviation, Telecommunication and Television & Radio Links - Improper sitting of the wind farm could impact aviation, telecommunication and radio links in the area.	Provide CARC with final detailed design along with the coordinates of the turbines.	Additional requirement	Submit official approval letter of CARC	Once; before construction commences	Developer	
		Follow up with RJAF to obtain approval letter for the Project	Additional requirement	Submission of RJAF approval	Once; before construction commences	Developer	
		The turbines need to be equipped with aviation safety lights at the top of the nacelle. The tips of the blades will be painted orange or red, to improve visibility during daytime.	Additional requirement	Inspection	Once; before construction commences	EPC Contractor	
Occupational Health and Safety	During construction impacts/accidents due to fire, traffic, dropping items, down falling, electricity, machines etc. are possible. There will be some generic risks to workers health and safety from working on decommissioning sites, as it increases the risk of injury or death due to accidents.	Health & Safety plan has to be established before start of construction	Additional requirements	Submit Health& Safety plan	Once; before construction commences	EPC Contractor	- Labor Law No. 8 for the Year 1996 and its amendments
Community Health, Safety and Security	Possible noise emissions to the environment from the construction activities which will likely include the use of machinery and equipment such as generators, hammers, and compressors and other activities	Limiting the working hours from Saturday to Thursday 7 a.m. to 7 p.m., if possible	Recommendation	Inspection	Continuous	Project Developer and EPC Contractor	- Environmental Protection Law No. 52 of 2006 - Instruction for Reduction and Prevention of Noise for 2003 - Public Health Law No. 47 for 2008

Environmental Attribute	Potential Impact	Management Action (mitigations, additional requirements, additional studies, compensation measures, etc.)	Type of Action	Monitoring Action	Frequency	Responsible Entity	Legal Requirements
Socio-economic	The Project is expected at a minimum to provide job opportunities for local communities. This, to some extent, could contribute to enhancing the living environment for its inhabitants, elevate their standards of living, and bring social and economic prosperity	It is recommended that the Developer adopt and implement a Community Integration Plan for working with the local community members during the construction phase in coordination with the EPC Contractor. The plan should aim to support the local community stating its aims and objectives and should acknowledge the importance of building a strong socio-economic relationship with the local community through a participatory planning program (in which the local community can express their concerns, strengths and limitations) even before the development is in place.	Recommendation	Regular reporting on outcomes of Action Plan implementation	Continuous	Project Developer and EPC Contractor	- Regulation for Obligatory Employment of Jordanian Workforce from Surrounding Communities in Development Projects No.(131) for the year 2016

Table 67: ESMP for the Operation Phase

Environmental Attribute	Potential Impact	Management Action (mitigations, additional requirements, additional studies, compensation measures, etc.)	Type of Action	Monitoring Action	Frequency	Responsible Entity	Legal Requirements
Landscape and Visual	Visibility of the turbines in the nearby settlements.	The turbines and all the other aboveground structures will be removed at the end of the operational lifetime.	Mitigation	Inspection	Once	Project Operator	- Environmental Protection Law No. 52 of 2006
Land Use	Operational activities could disturb and conflict with actual land use as it could provide value to locals.	Land Users – Agriculture. Although highly unlikely, but should any of the agriculture users require assistance in allocating additional lands to undertake agriculture activities, assist such users to the greatest extent possible through coordination with other land owners in the area and/or on other available public lands.	Mitigation	Documentation of relocation assistance with photographs as appropriate	Upon occurrence	Developer or Operator	- Environmental Protection Law No. 52 of 2006
		Land Users – Agriculture. Prior to commencement of operational activities, the Developer will disclose to the local communities the following through focus group discussions and information sheets : (i) the baseline mapping exercise for agricultural activities; (ii) announce operational areas and emphasize that agriculture and/or grazing activities cannot take place in such assigned areas; (iii) emphasize that grazing and/or agriculture activities may take place outside of operational areas at all times; (iv) provide details on the relocation assistance if required by any agricultural user; and (v) provide details on the grievance mechanism.	Mitigation	Prepare and submit disclosure report with outcomes	Once; before operation commences	Developer or Operator	
		Nomads. If required (although unlikely) provide assistance to nomadic groups in assigning suitable areas outside of operational areas for settlement through coordination with other land owners in the area and/or on other public lands.	Mitigation	Documentation of relocation assistance with photographs as appropriate	Upon occurrence	Developer or Operator	
		During the period in which nomads begin to settle in the area (April, May and June), undertake regular site visits to meet with nomadic groups whom arrive onsite. The objective will be to: (i) Announce operational areas and emphasize that settlements as well as agriculture and/or grazing activities cannot take place in such assigned areas; (ii)Emphasize that settlements as well as grazing and/or agriculture activities may take place outside of operational areas at all times; (iv) Provide details on the relocation assistance if required by any agricultural user; and (v) Provide details on the grievance mechanism.	Mitigation	Prepare and submit disclosure report with outcomes	Continuously	Developer or Operator	
Geology and Hydrology	Improper management of solid waste	Coordinate with Bseira Municipality or hire a competent private contractor for the collection of solid waste from the site to Jurf Al Daraweesh Landfill	Mitigation	Review contract with contractor	Once; before operation commences	Project Operator	- Environmental Protection Law No. 52 of 2006 - Solid Waste Management Regulation No. (27) of 2005
		Prohibit fly-dumping of any solid waste to the land.	Mitigation	Inspection	Continuous	Project Operator	
		Distribute appropriate number of properly contained litter bins and containers properly marked as "Municipal Waste".	Mitigation	Inspection	Continuous	Project Operator	
		Implement proper housekeeping practices on the construction site at all times.	Mitigation	Inspection	Continuous	Project Operator	
		Maintain records and manifests that indicate volume of waste generated onsite, collected by contractor, and disposed of at the landfill. The numbers within the records are to be consistent to ensure no illegal dumping at the site or other areas	Mitigation	Review manifests to ensure consistency	Continuous	Project Operator	
	Improper management of wastewater	Coordinate with Tafileh Water Directorate to hire a private contractor for the collection of wastewater from the site to Tafileh WWTP or Jurf Al Darwish landfill	Mitigation	Review contract with contractor	Once; before operation commences	Project Operator	- Environmental Protection Law No. 52 of 2006

Environmental Attribute	Potential Impact	Management Action (mitigations, additional requirements, additional studies, compensation measures, etc.)	Type of Action	Monitoring Action	Frequency	Responsible Entity	Legal Requirements
		Prohibit illegal disposal of wastewater to the land	Mitigation	Inspection	Continuous	Project Operator	- Public Health Law No. 47 for 2008
		Ensure that septic tanks are emptied and collected by wastewater contractor at appropriate intervals to avoid overflowing	Mitigation	Inspection	Continuous	Project Operator	
		Maintain records and manifests that indicate volume of wastewater generated onsite, collected by contractor, and disposed of at the Tafileh WWTP or Jurf Al Darwish landfill. The numbers within the records are to be consistent to ensure no illegal discharge at the site or other areas	Mitigation	Review manifests to ensure consistency	Continuous	Project Operator	
	Improper management of hazardous waste	Coordinate with the MoEnv and hire a private contractor for the collection of hazardous waste from the site to the Swaqa Hazardous Waste Treatment Facility	Mitigation	Review contract with contractor	Once; before operation commences	Project Operator	- Environmental Protection Law No. 52 of 2006 - Management, Transportation, & Handling of Harmful & Hazardous Substances Regulation No. (24) of 2005, - Instruction for Management and Handling of Consumed Oils of 2003, - Instruction for Hazardous Waste Management of 2003
		Follow the requirements for management and storage as per the ‘Instructions for Hazardous Waste Management and Handling of the Year 2003’ of the MoEnv	Mitigation	Inspection	Continuous	Project Operator	
		Prohibit illegal disposal of hazardous waste to the land	Mitigation	Inspection	Continuous	Project Operator	
		Ensure that containers are emptied and collected by the contractor at appropriate intervals to prevent overflowing	Mitigation	Inspection	Continuous	Project Operator	
		Maintain records and manifests that indicate volume of hazardous waste generated onsite, collected by contractor, and disposed of at the Swaqa Facility. The numbers within the records are to be consistent to ensure no illegal discharge at the site or other areas	Mitigation	Review manifests to ensure consistency	Continuous	Project Operator	
	Improper management of hazardous material	Ensure hazardous materials are stored in proper areas and in a location where they cannot reach the land in case of accidental spillage. This includes storage facilities that are of impermeable surface, accessible to authorized personnel only, prevent incompatible materials from coming in contact, etc.	Mitigation	Inspection	Continuous	Project Operator	- Environmental Protection Law No. 52 of 2006 - JS 431/1985 – General Precautionary Requirements for Storage of Hazardous Materials
		Maintain a register of all hazardous materials used and accompanying MSDS must present at all times. Spilled material should be tracked and accounted for.	Mitigation	Inspection	Continuous	Project Operator	
		Incorporate dripping pans at machinery, equipment, and areas that are prone to contamination by leakage of hazardous materials (such as oil, fuel, etc.).	Mitigation	Inspection	Continuous	Project Operator	
		Regular maintenance of all equipment and machinery used onsite. Maintenance activities and other activities that pose a risk for hazardous material spillage must take place at a suitable location (hard surface) with appropriate measures for trapping spilled material.	Mitigation	Inspection	Continuous	Project Operator	
		Ensure that a minimum of 1,000 litres of general purpose spill absorbent is available at hazardous material storage facility.	Mitigation	Inspection	Continuous	Project Operator	
		If spillage occurs, spill must be immediately contained, cleaned-up, and contaminated soil disposed as hazardous waste.	Mitigation	Inspection	Upon occurrence	Project Operator	
				Reporting of incident and measures taken to minimize impact			
Biodiversity	Improper management of the site could disturb existing habitats (e.g. improper conduct and housekeeping practices).	Monitoring of the distribution and abundance of the threatened plant species should be carried out for at least five years of the operational phase in order to assess the impact of the project on the three threatened species that were recorded in the project site.	Additional Requirement	Submit annual report	Annually	Project Operator	- Environmental Protection Law No. 52 of 2006 - Agriculture Law No. 44 of 2002 - Regulation for Categorizing Wild Birds and Animals Banded from Hunting No.43 of 2008.
		Implement proper management measures to prevent damage to the biodiversity of the site. This could include establishing a proper code of conduct and awareness raising / training of personnel (e.g. with respect to prohibiting hunting) and good housekeeping (e.g. keeping the site orderly and clean).	Mitigation	Inspection	Continuous	Project Operator	
Birds (avi-fauna)	Wind turbines are associated with impacts on birds from risks of strikes and collision on both migratory soaring birds and resident soaring birds in the area. Generally, such impacts depend	Implement an avi-fauna monitoring and turbine shutdown plan, avi-fauna carcass search during operation, onsite carcass search plan (other than birds), and monitoring of the breeding bird species. Refer to 14.2.2 for additional details.					- Environmental Protection Law No. 52 of 2006 - Agriculture Law No. 44 of 2002

Environmental Attribute	Potential Impact	Management Action (mitigations, additional requirements, additional studies, compensation measures, etc.)	Type of Action	Monitoring Action	Frequency	Responsible Entity	Legal Requirements
	on several factors but could affect the population levels of certain species especially those with international/national critical conservation status.						- Regulation for Categorizing Wild Birds and Animals Banded from Hunting No.43 of 2008.
Bats	The potential impacts from the Project during operation are mainly related to risk of bat strikes and collisions with rotors of the operating wind turbines.	Bats mortality monitoring program during first 3 years of operation (this must take into account that the hibernation period for bats lasts from December to March after which they are active from early May till late November). Refer to 15.2.2 f for additional details.					- Environmental Protection Law No. 52 of 2006
Archaeology	Improper management of operational activities could disturb/damage archaeological locations recorded in the Project area	Properly plan operation and maintenance activities to take into account the identified archaeological locations to ensure they are protected from any potential damage. This could include for example proper movement of vehicles and machinery into/out of the site to avoid those areas, ensure that all vehicles are on established roads and prohibit off-roading, prohibit movement of vehicles near those areas during the various operation and maintenance activities, etc.	Mitigation	Inspection	Continuous	Project Operator	- Antiquities Law No. 21 of 1988 and its amendments No. 23 for 2004
		Ensure that the Code of Conduct, awareness raising, and training developed for operation workers and personnel to emphasize the presence of archaeological locations in the area.	Mitigation	Inspection	Continuous	Project Operator	
Infrastructure and Utilities	Water Resources – it is important to ensure that the water requirements of the Predict would not affect the existing users and resources in the area.	Coordinate with the Tafileh Water Directorate to secure the water requirements for the Project.	Additional requirement	Submit report with proof of coordination	Once; before operation commences	Project Operator	- Environmental Protection Law No. 52 of 2006 - Instruction for Hazardous Waste Management of 2003 - Water Authority Law No. 18 for 1988 and its amendments Groundwater Control Regulation No. 85 for 2002 and its amendments - Municipalities Law No. Law No. 13 of year 2011
	Wastewater Utilities – it is important to ensure that existing utilities would be able to handle the amount of wastewater generated from the Project.	Coordinate with the Tafileh Water Directorate for disposal of wastewater at Tafileh WWTP or Jurf Al Darwish landfill	Additional requirements	Submit report with proof of coordination	Once; before operation commences	Project Operator	
	Solid Waste Utilities – it is important to ensure that existing utilities would be able to handle the amount of solid waste generated from the Project.	Coordinate with Bseira Municipality for the collection of solid waste from the site to Jurf Al Darwish landfill.	Additional requirements	Submit report with proof of coordination	Once; before operation commences	Project Operator	
	Hazardous Waste Utilities – it is important to ensure that existing utilities would be able to handle the amount of hazardous waste generated from the Project.	Coordinate with MoEnv to hire a competent private contractor for the collection of hazardous waste from the site to the Swaqa Hazardous Waste Treatment Facility.	Additional requirements	Submit report with proof of coordination	Once; before operation commences	Project Operator	
Occupational Health and Safety	During operation impacts/accidents due to fire, dropping items, down falling, electricity, etc. are possible. But only service teams will be affected. There will be some generic risks to workers health and safety from working on sites, as it increases the risk of injury or death due to accidents.	Health & Safety plan has to be established before start of construction Operation Manual (mostly provided by the turbine manufacturer) has to be established before start of operation	Additional requirements	Submit Health& Safety plan and Operation Manual	Once; before construction commences respectively before start operation	Project owner respectively turbine manufacturer	- Labor Law No. 8 for the Year 1996 and its amendments
Community Health, Safety and Security	The moving shadow (shadow flicker) can be disturbing for residents of nearby dwellings.	Installation of shadow flicker (shut down) modules in those turbines responsible for shadow flicker at the dwellings west of the project.	Mitigation	Inspection	Continuous	Project Operator	- Environmental Protection Law No. 52 of 2006 - Instruction for Reduction and Prevention of Noise for 2003 - Public Health Law No. 47 for 2008
	Possible noise emissions from the operation activities could be a disturbance to people living near the project.	In the latest (case 5c) layout the distances between the WTGs and the houses have been increased, therefore no noise reduction of the turbines is required. A new turbine layout would require an update of the noise assessment.	Mitigation	Inspection	Continuous	Project Operator	
	Disturbing reflections (disco effect) of the sunlight can occur at a wind turbine.	A paint with matt gloss levels should be used for the tower and the blades.	Mitigation	Inspection	Once; before construction commences	Project Developer and EPC Contractor	

Environmental Attribute	Potential Impact	Management Action (mitigations, additional requirements, additional studies, compensation measures, etc.)	Type of Action	Monitoring Action	Frequency	Responsible Entity	Legal Requirements
	Falling ice may cause damage to structures and vehicles, and injury to site personnel and the general public.	Placing warning signs as appropriate for the protection of site personnel and the public. Remotely switching off the turbine when site personnel detect ice accumulation.	Mitigation	Inspection	Continuous	Project Operator	
Socio-economic	The Project is expected at a minimum to provide job opportunities for local communities. This, to some extent, could contribute to enhancing the living environment for its inhabitants, elevate their standards of living, and bring social and economic prosperity	It is recommended that the Developer adopt and implement a Community Integration Plan for working with the local community members during the construction phase. The plan must aim to support the local community stating its aims and objectives and should acknowledge the importance of building a strong socio-economic relationship with the local community through a participatory planning program (in which the local community can express their concerns, strengths and limitations) even before the development is in place.	Recommendation	Regular reporting on outcomes of Action Plan implementation	Continuous	Project Developer and Operator	- Regulation for Obligatory Employment of Jordanian Workforce from Surrounding Communities in Development Projects No.(131) for the year 2016

Table 68: ESMP for the Decommission Phase

Environmental Attribute	Potential Impact	Management Action (mitigations, additional requirements, additional studies, compensation measures, etc.)	Type of Action	Monitoring Action	Frequency	Responsible Entity	Legal Requirements
Geology and Hydrology	Risk of soil and groundwater contamination during the various decommissioning activities from improper housekeeping activities, spillage of hazardous material, random discharge of waste and wastewater	Refer to mitigation and monitoring actions for improper management of waste streams within construction table.				Developer or MEMR as appropriate	Refer to legal requirements within construction table.
Air quality	Decommissioning activities will likely result in an increased level of dust and particulate matter emissions which in turn will directly impact ambient air quality.	Refer to mitigation and monitoring actions for air quality within construction table.				Developer or MEMR as appropriate	Refer to legal requirements within construction table.
Occupational health and safety	There will be some generic risks to workers health and safety from working on decommissioning sites, as it increases the risk of injury or death due to accidents.	Refer to mitigation and monitoring actions for occupational health and safety within construction table.				Developer or MEMR as appropriate	Refer to legal requirements within construction table.
Community Health, Safety and Security	Possible noise emissions to the environment from the decommission activities which will likely include the use of machinery and equipment such as generators, hammers, and compressors and other activities	Refer to mitigation and monitoring actions for Community Health, Safety and Security within construction table.				Developer or MEMR as appropriate	Refer to legal requirements within construction table.

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26. ANNEXES

Annex I: Noise and shadow flicker calculations (case 5c layout)

Annex II: Visual and landscape impact: (case 5c layout)

Annex III: Report on Bird Flight Activity Survey, Spring Migration Period 2015, Natural Research Projects