ENVIRONMENT
& HEALTH

Intended for

LEBANON WIND POWER SAL

Document type

FINAL REPORT

Date

August 2019

VOLUME II.

APPENDICES

LEBANON WIND POWER WIND FARM, LEBANON

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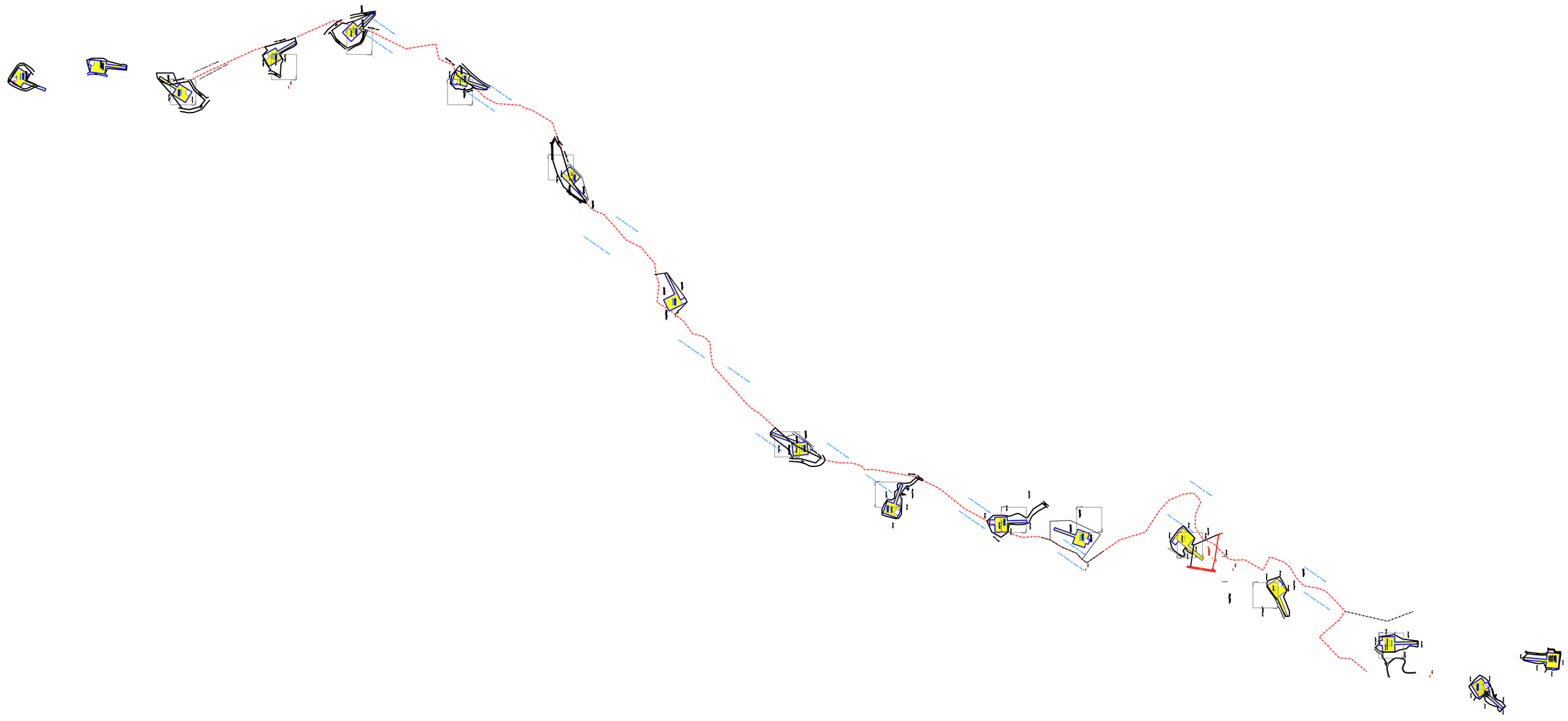
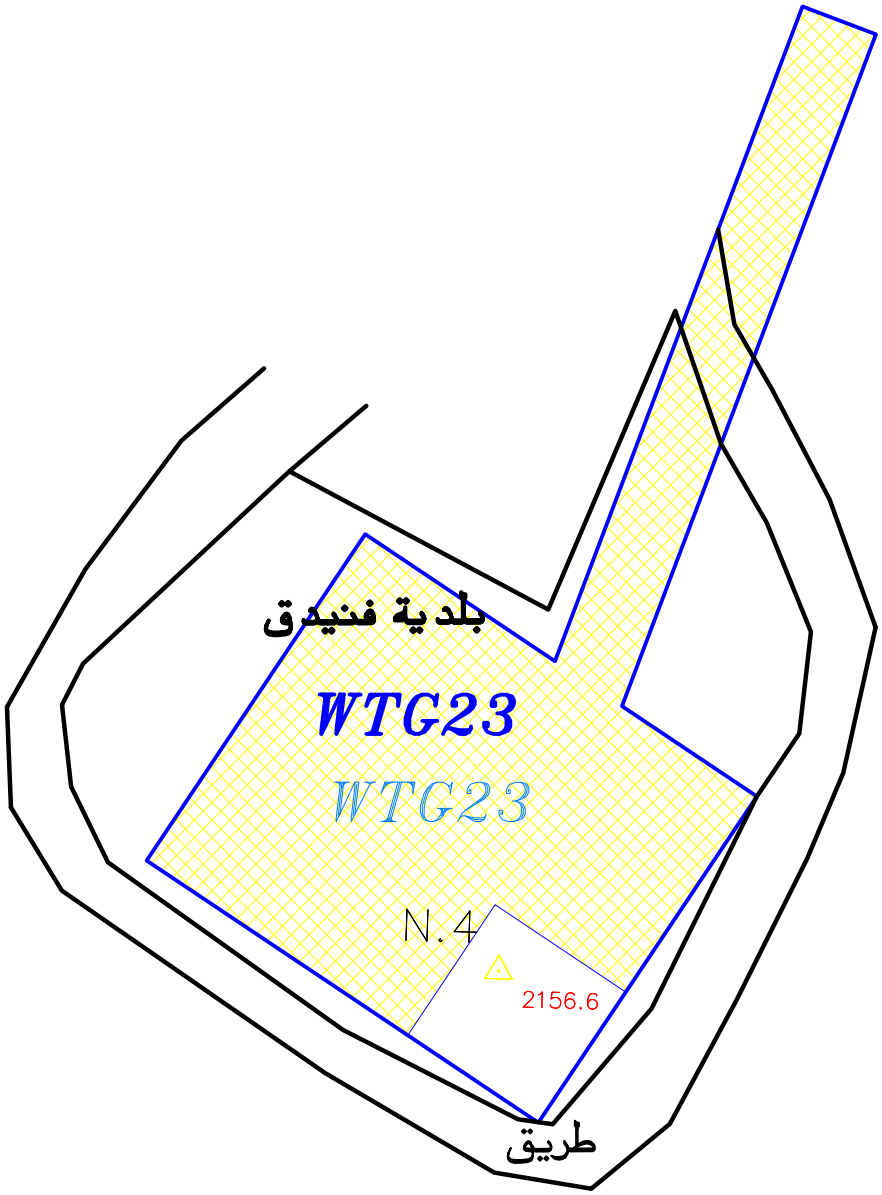
APPENDIX A
TURBINE LAYOUTS OF LAND PLOTS

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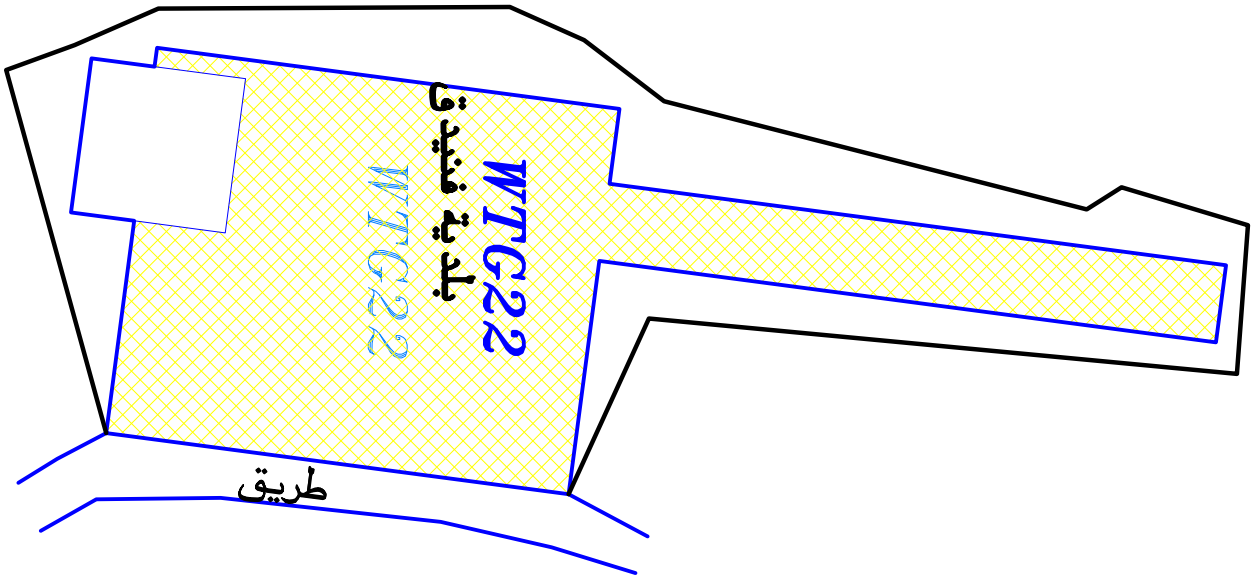
WTG23
WTG23
N.4
2156.6
طريق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WTG22
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Limite Fonciere de Karem Chbat
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X = −267100
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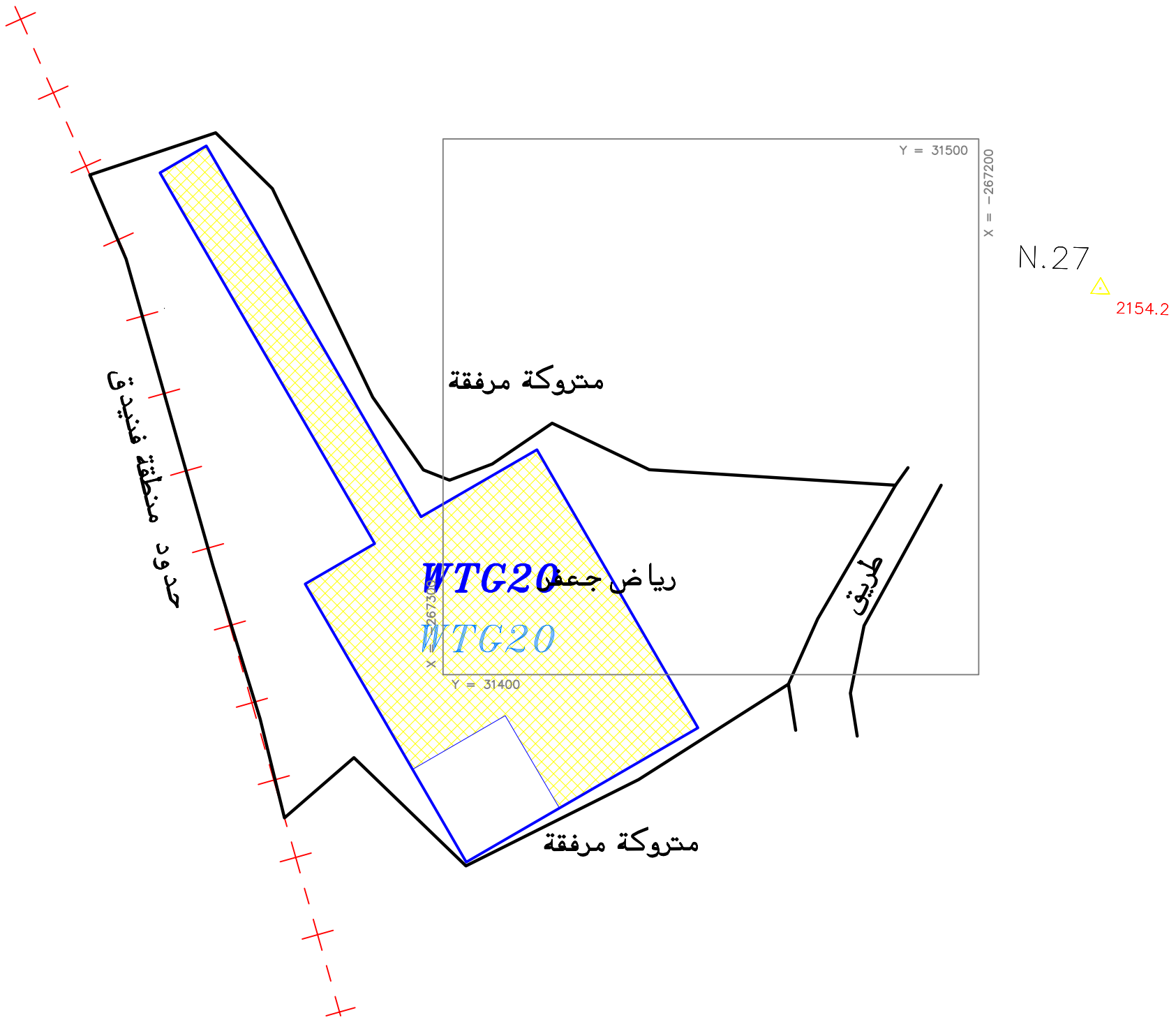
متروكة مرفقة
حسن جعفر
مجرى ماء
كريم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WTG20
طريق
Y = 31400
متروكة مرفقة

منطقة فنيدق
طريق
بناية فنيدق
Limite Fonciere de Fnaydek
حدود منطقة فنيدق
WTG19
WTG19
عونى جعفر
منطقة كرم شباط
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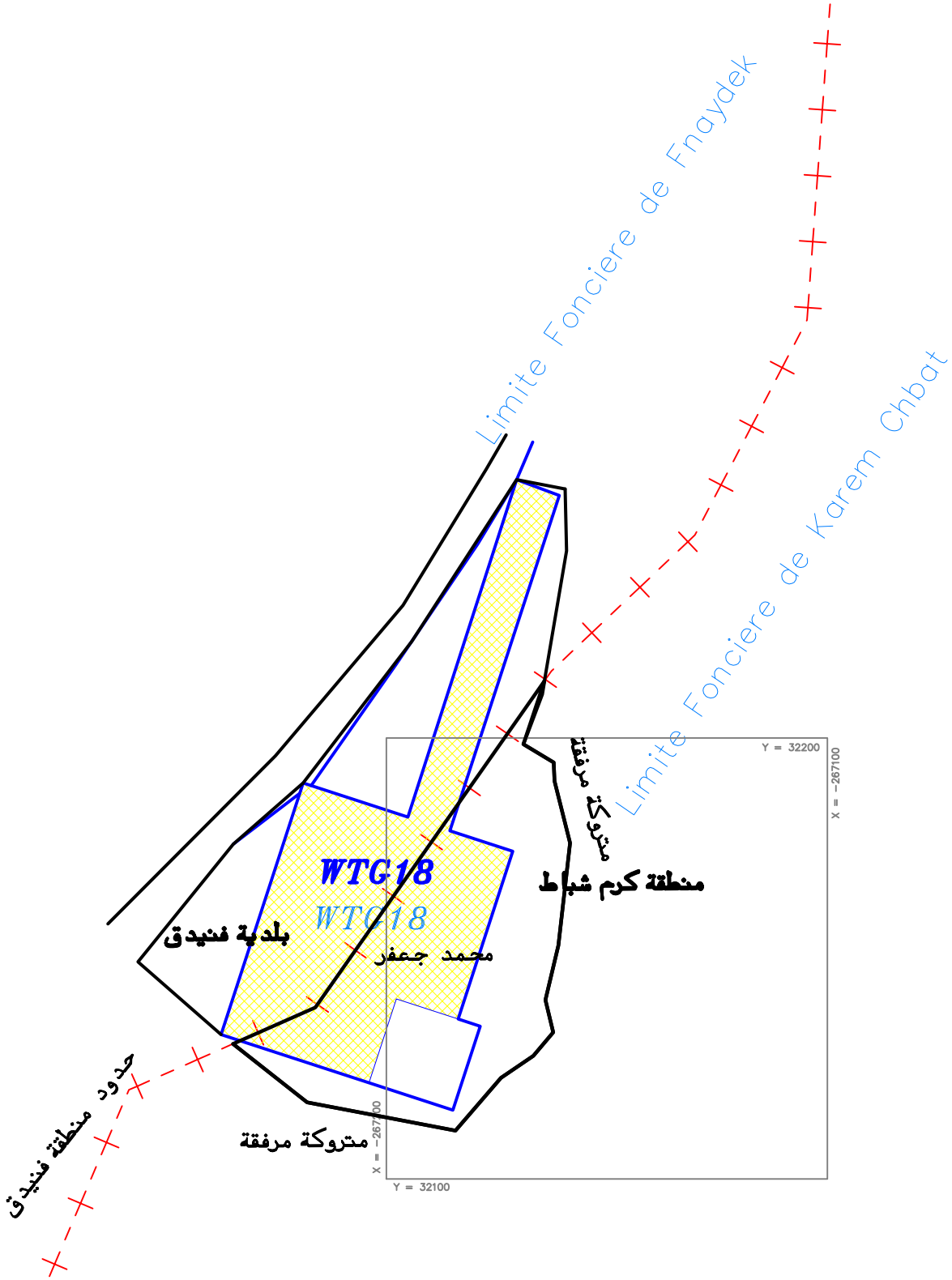
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محمد جعفر
منطقة كرم شباط
متروكة مرفقة
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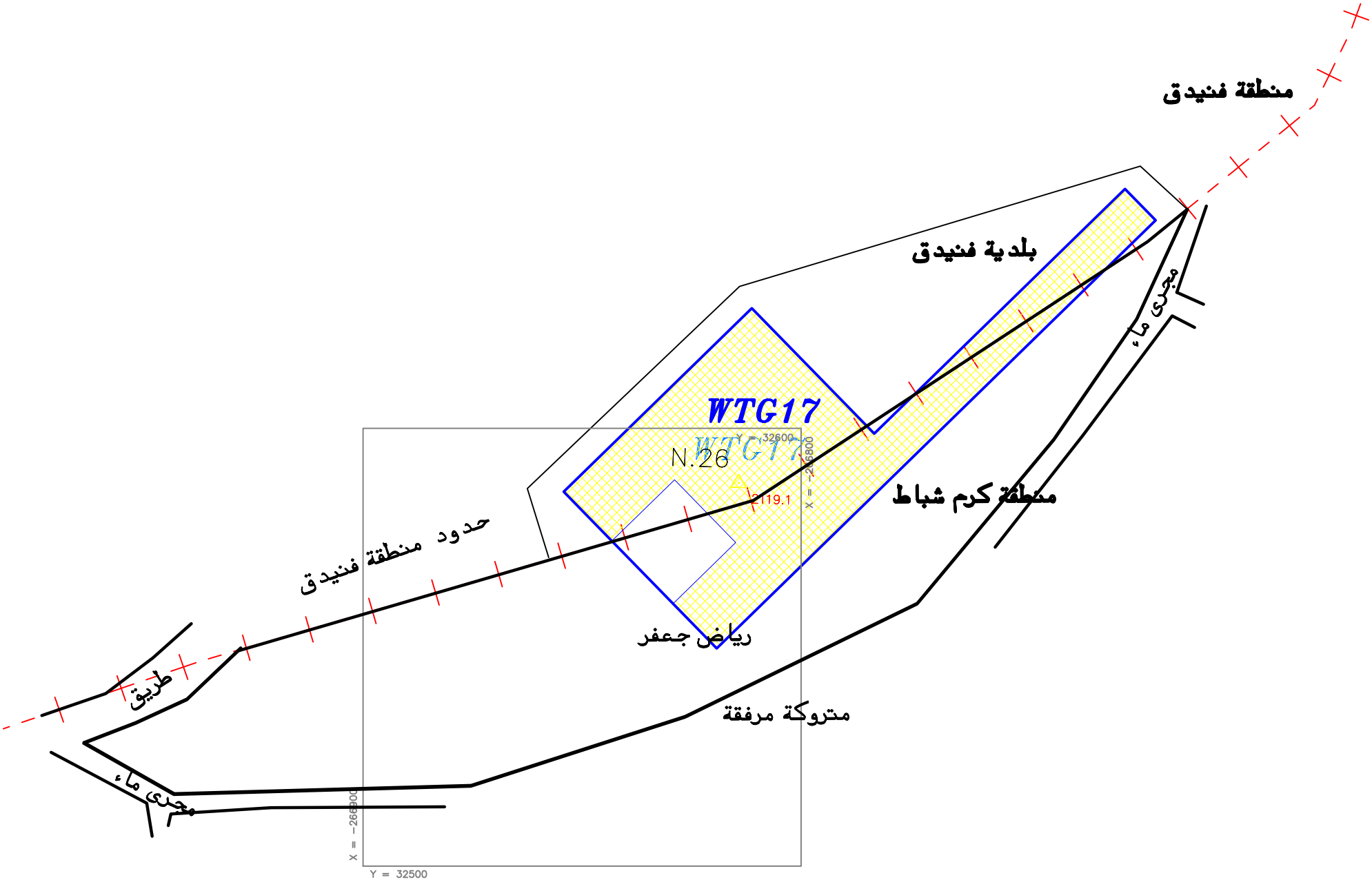
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بلدية فنيدق
مجرى ماء
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WTG17
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منطقة كرم شباط
حدود منطقة فنيدق
رياض جعفر
طريق
متروكة مرفقة
مجرى ماء
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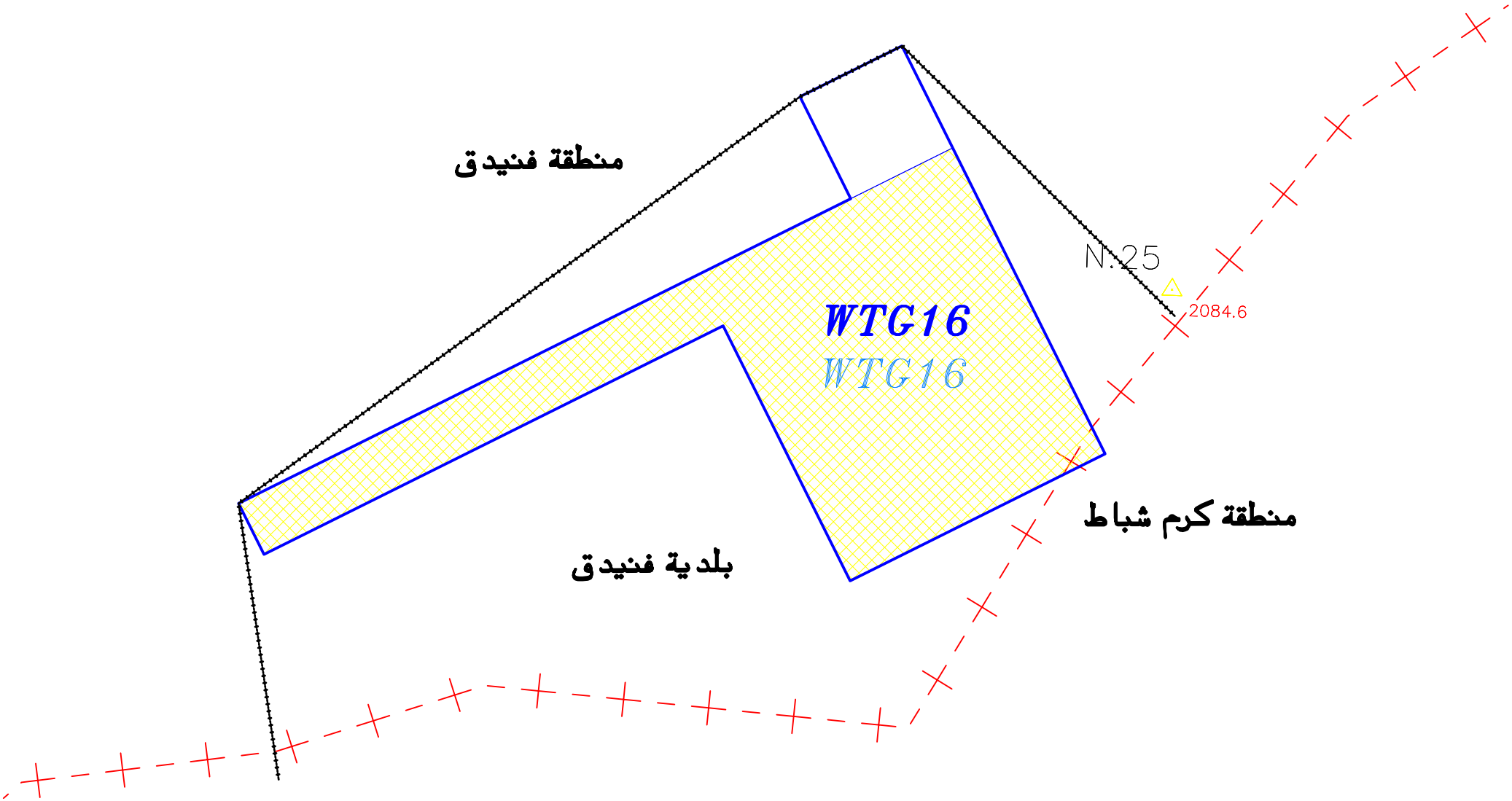
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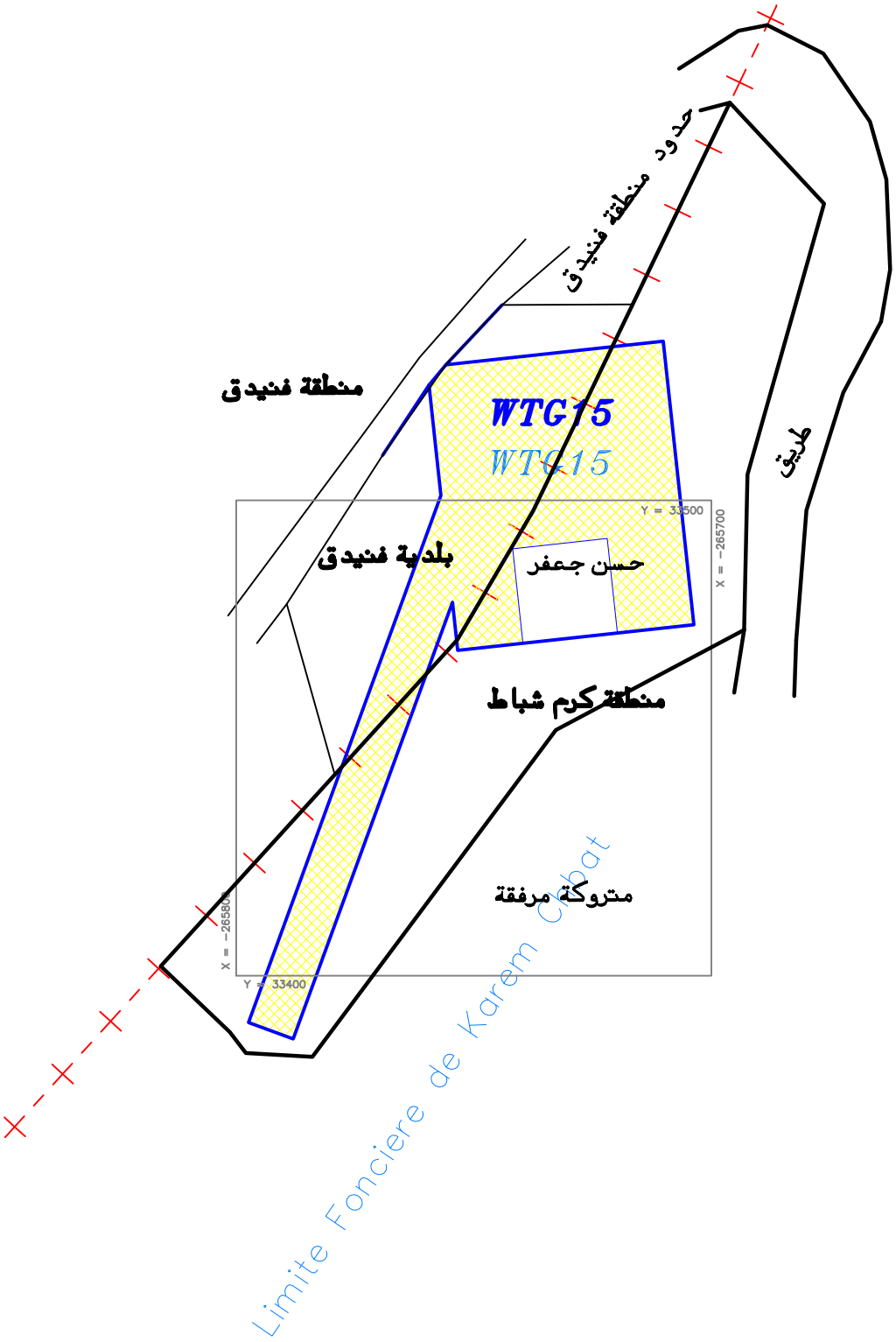
بلدية فنيدق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منطقة فنيدق
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بلدية فنيدق
حسن جعفر
طريق
منطقة كرم شباط
متروكة مرفقة
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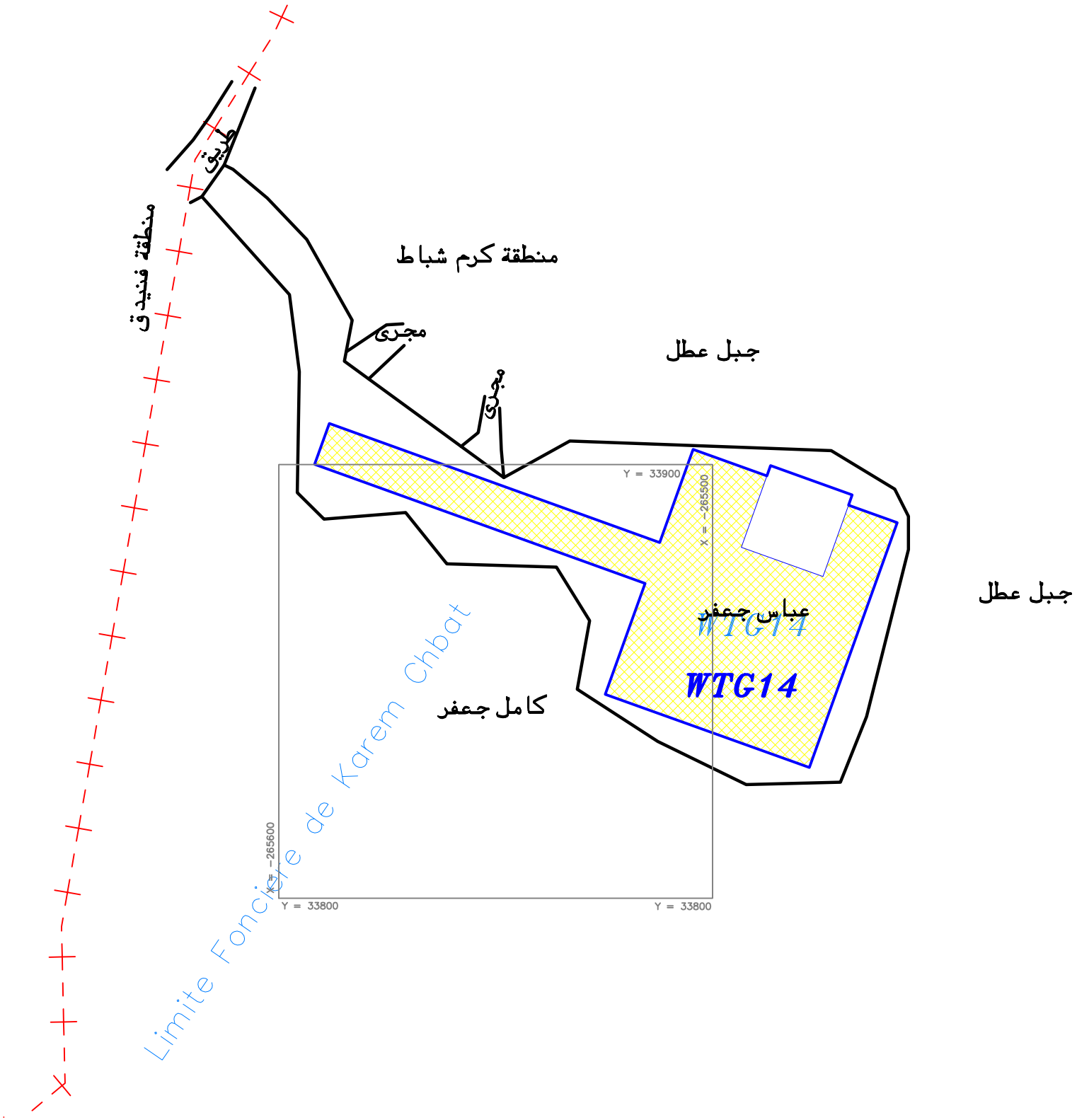
Limite Fonciere de Karem Cubat


طريق
منطقة فنيدق
منطقة كرم شباط
مجرى
مجرى
جبل عطل
جبل عطل
عباس جعفر
WTG14
WTG14
كامل جعفر
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X = -265600
Y = 33800
Y = 33800
Limite Foncière de Karem Chbat

طريق
جبل عطل
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WTG13
WTG13
كامل جعفر
Y = 343200
عباس جعفر
Y = 343400
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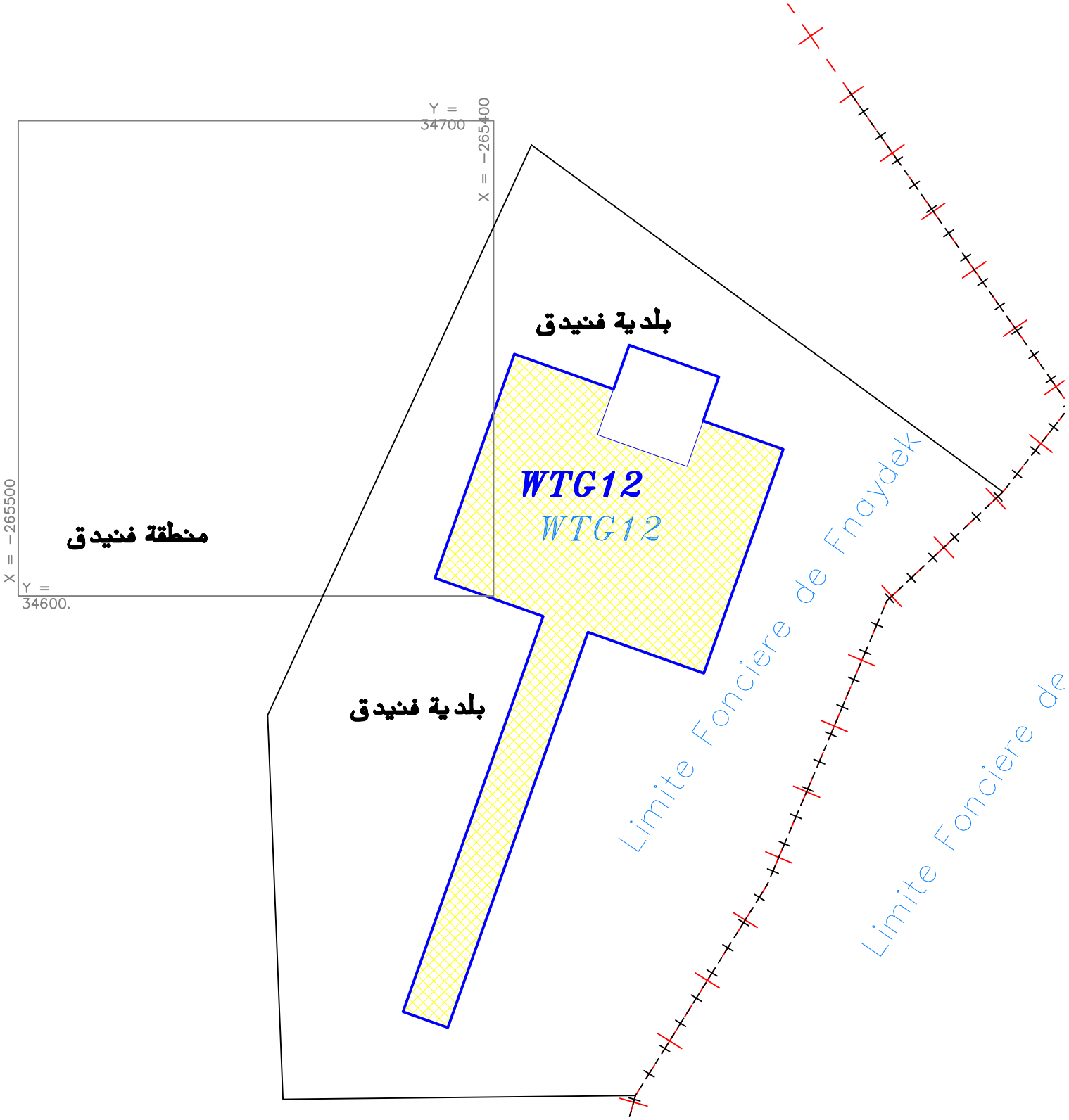
عباس جعفر
جبل عطل
وادي و مجرى
Limite Fonciere de Fnaydek
Limite Fonciere de Karem Chbat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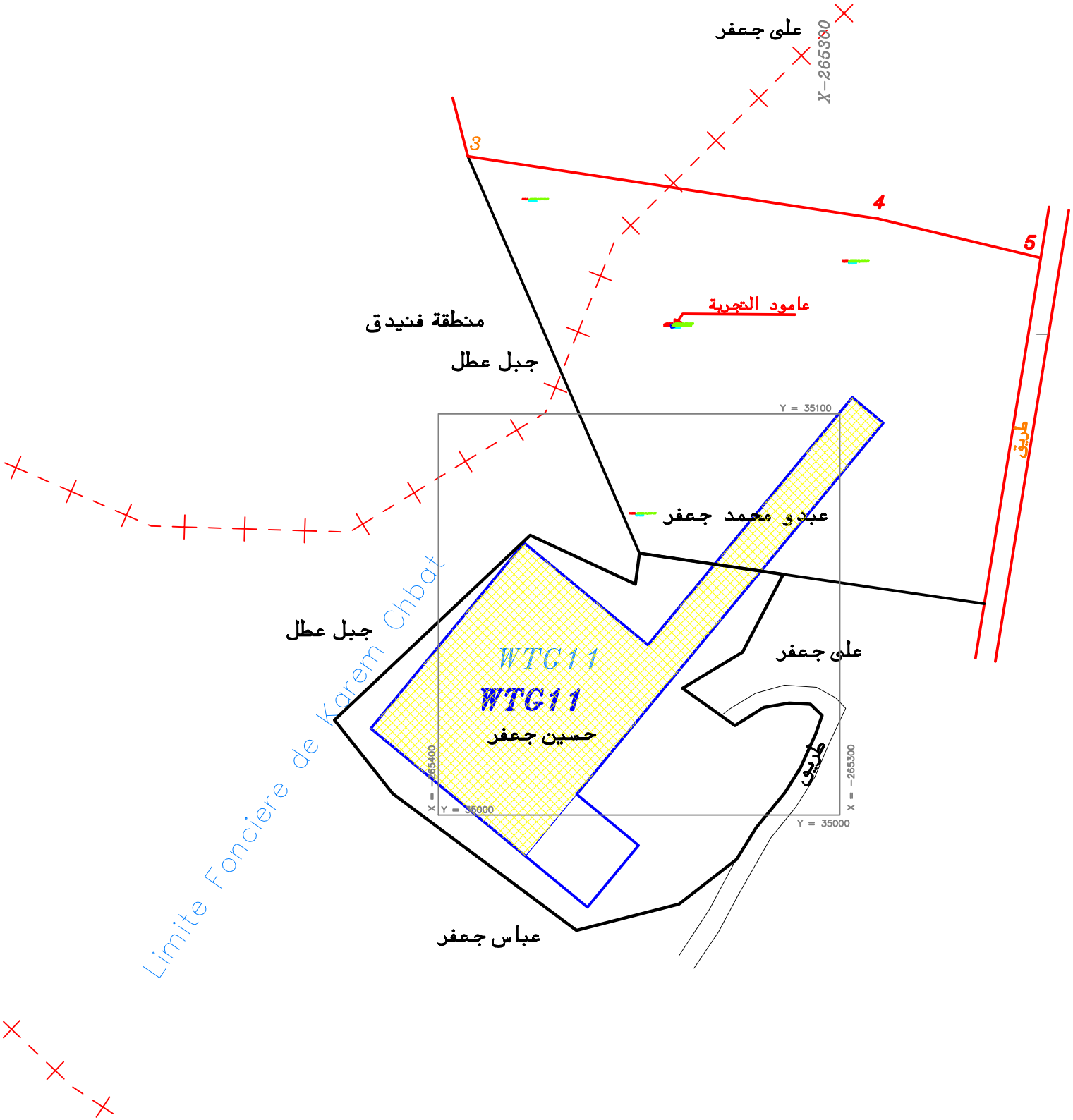
منطقة فنيدق
بلدية فنيدق
بلدية فنيدق
WTG12
WTG12
Limite Fonciere de Fnaydek
Limite Fonciere de


على جعفر
X-265300
3
4
5
عامود التجربة
منطقة فنيدق
جبل عطل
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طريق
عبدو محمد جعفر
جبل عطل
على جعفر
WTG11
WTG11
حسين جعفر
طريق
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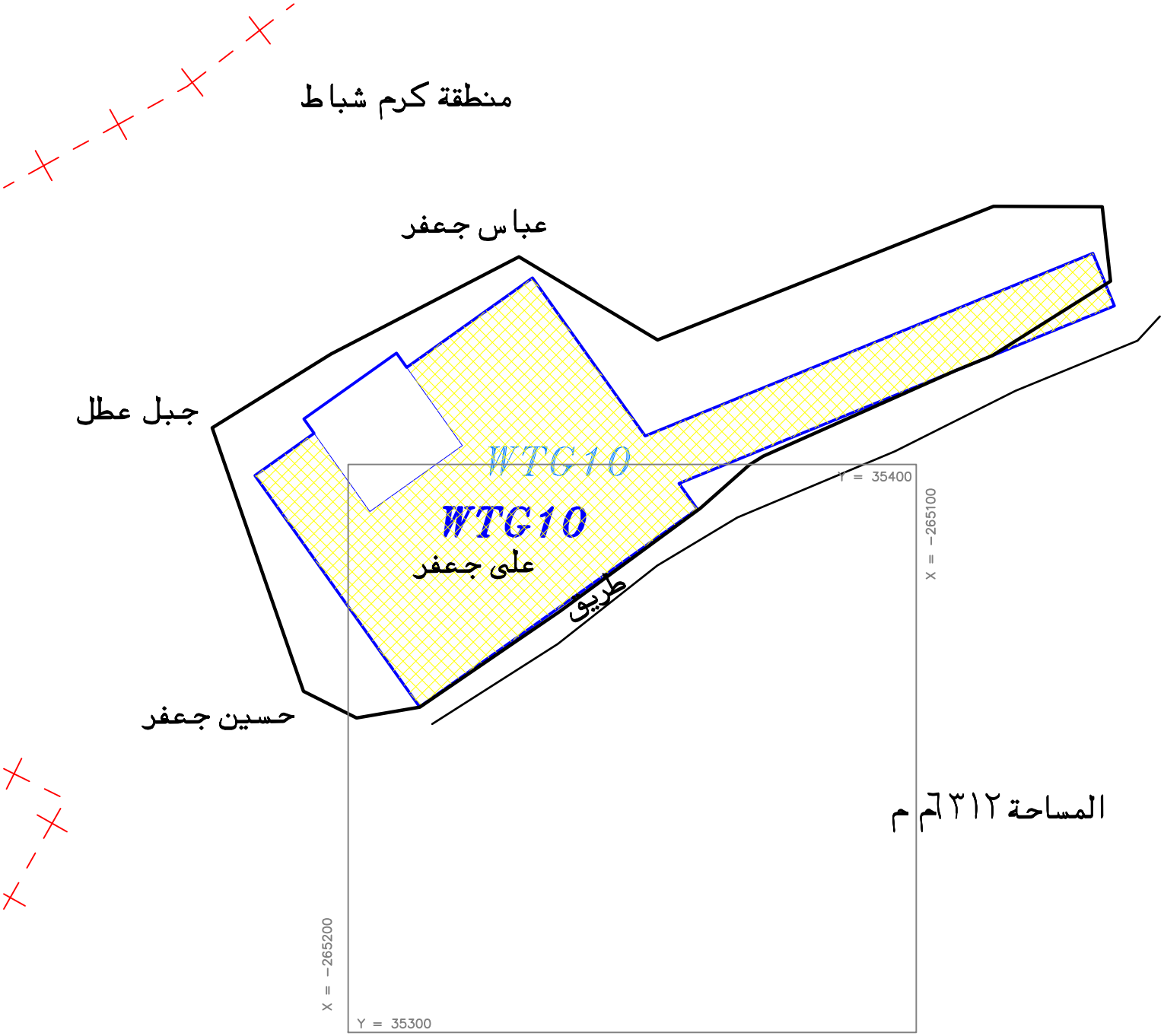
Y = 35000
عباس جعفر
Limite Fonciere de Karem Chbat


منطقة كرم شباط
عباس جعفر
جبل عطل
WTG10
WTG10
على جعفر
طريق
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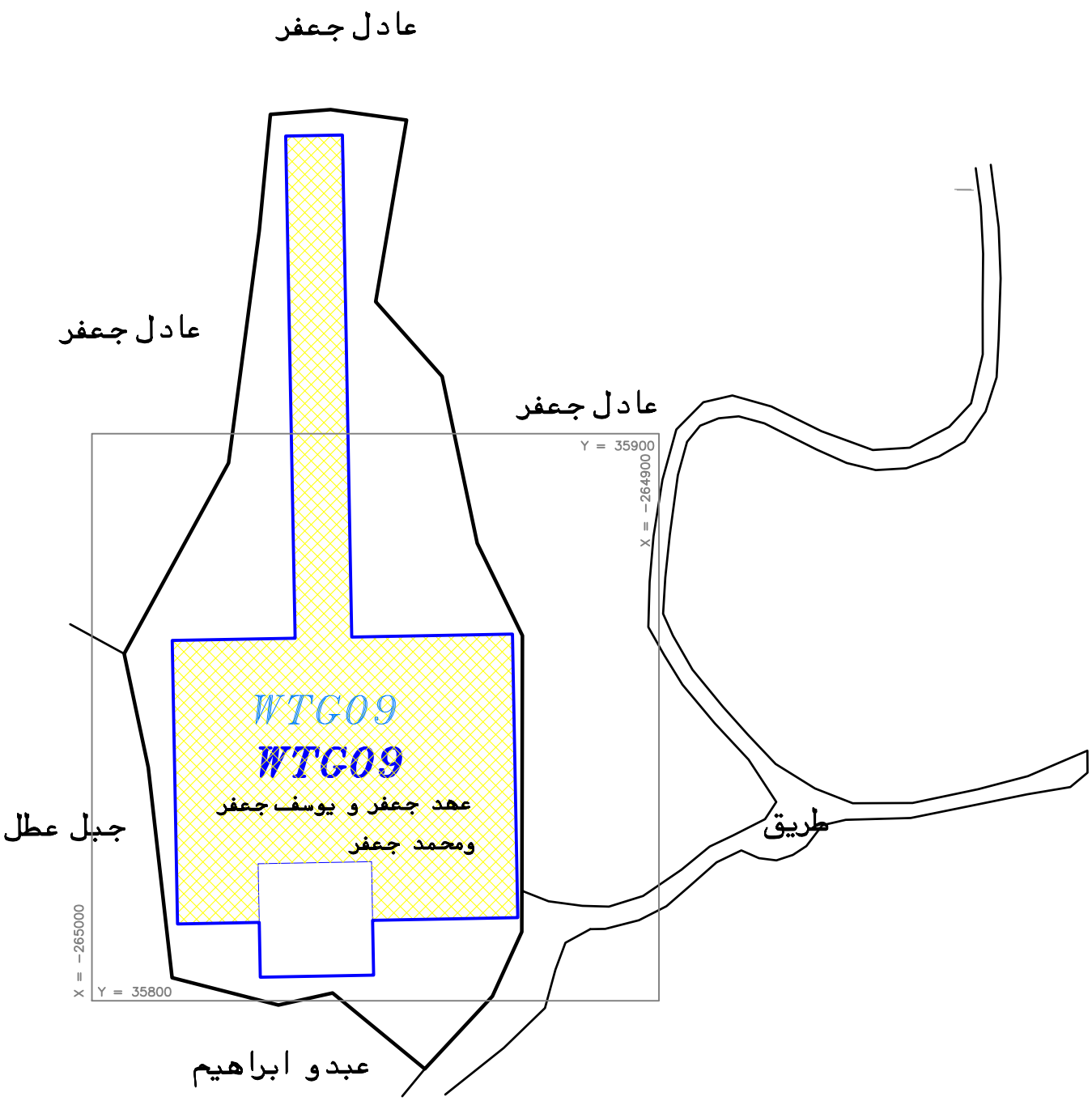
Y = 35300
المساحة ٦٣١٢م م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عادل جعفر
عادل جعفر
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WTG09
WTG09
عهد جعفر و يوسف جعفر
ومحمد جعفر
جبل عطل
طريق
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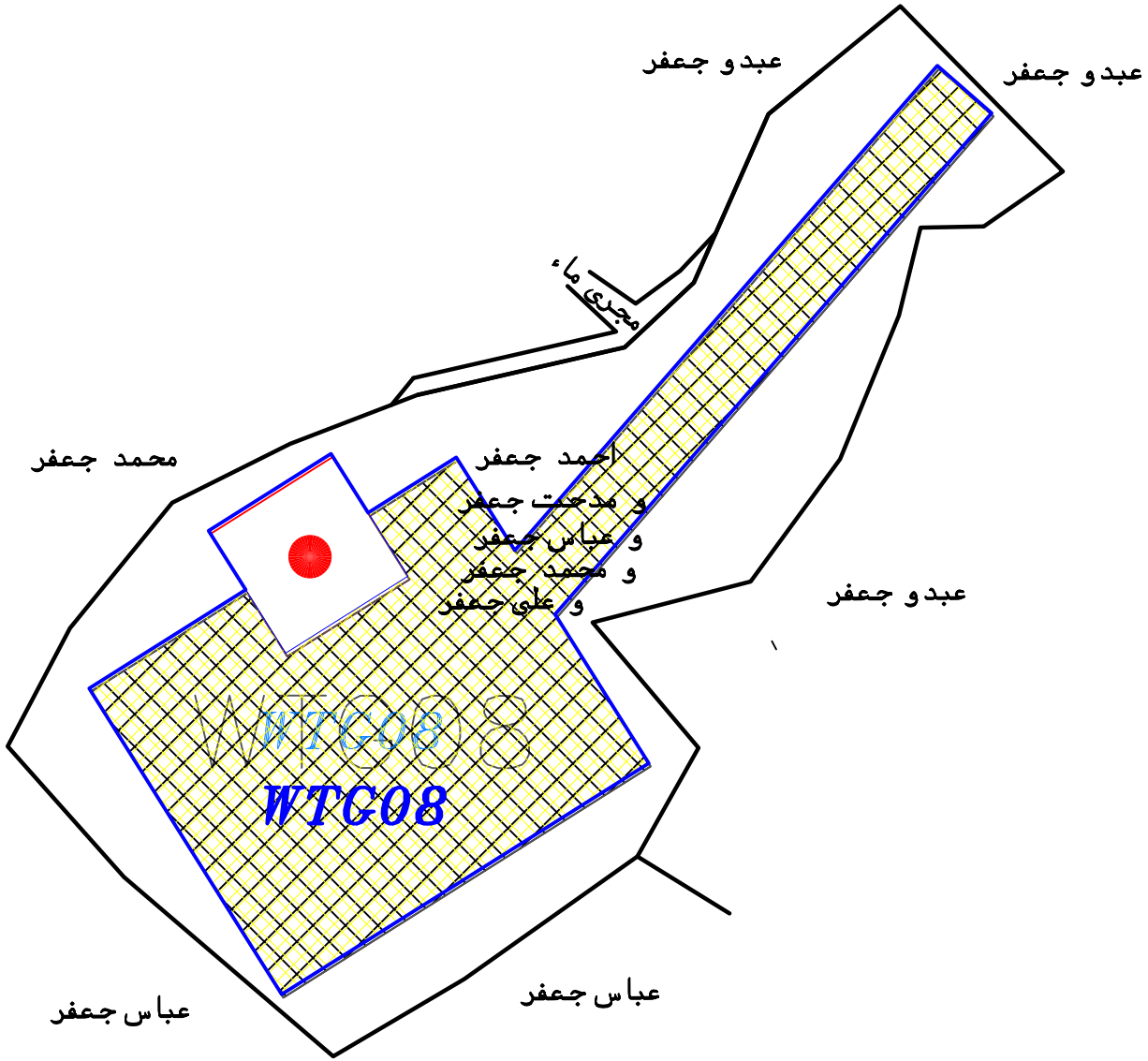
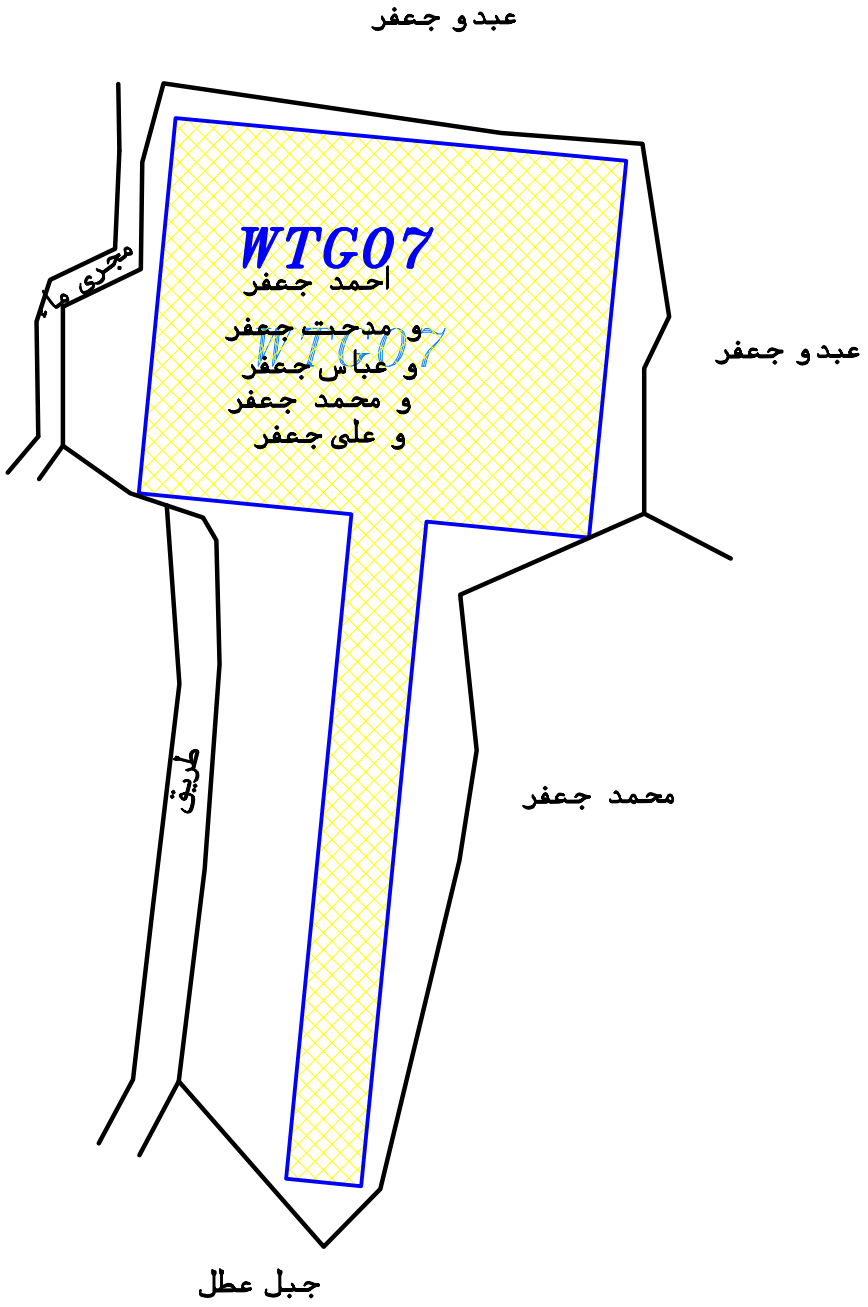
عبدو ابراهيم


عبدو جعفر
عبدو جعفر
مجرى ماء
محمد جعفر
احمد جعفر
و مدحت جعفر
و عباس جعفر
و محمد جعفر
و علي جعفر
عبدو جعفر
WTG08
عباس جعفر
عباس جعفر


عبدو جعفر
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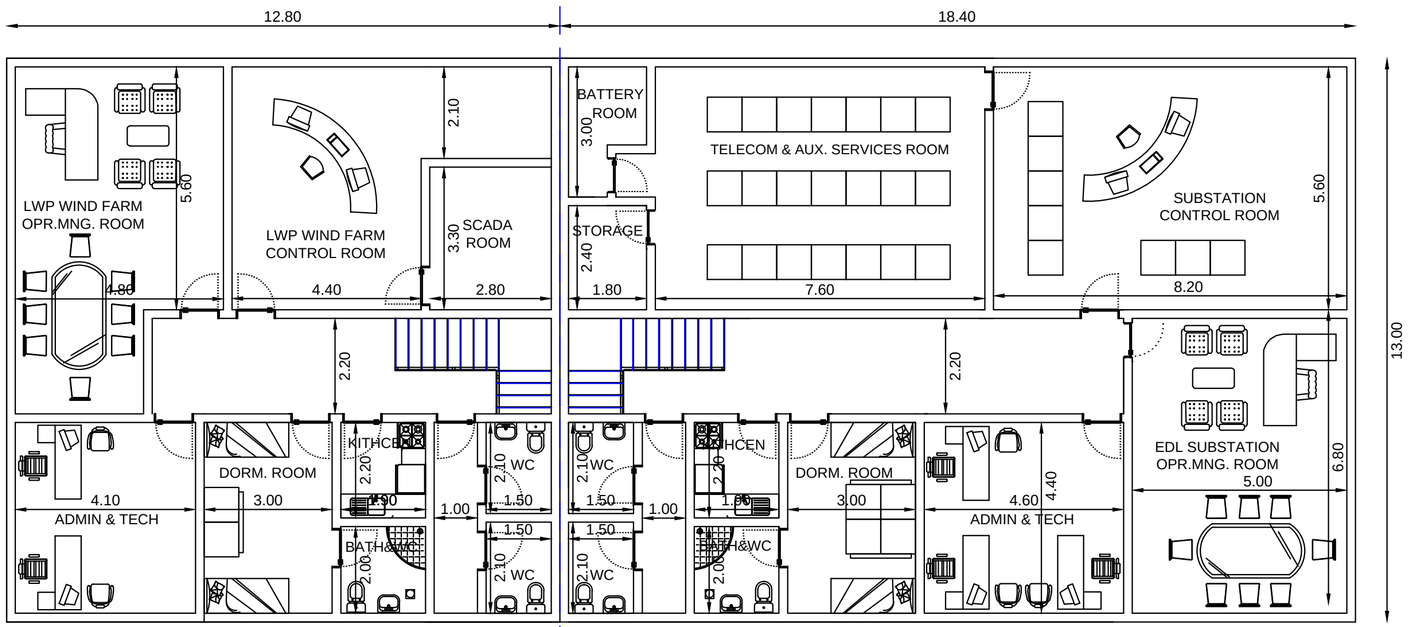
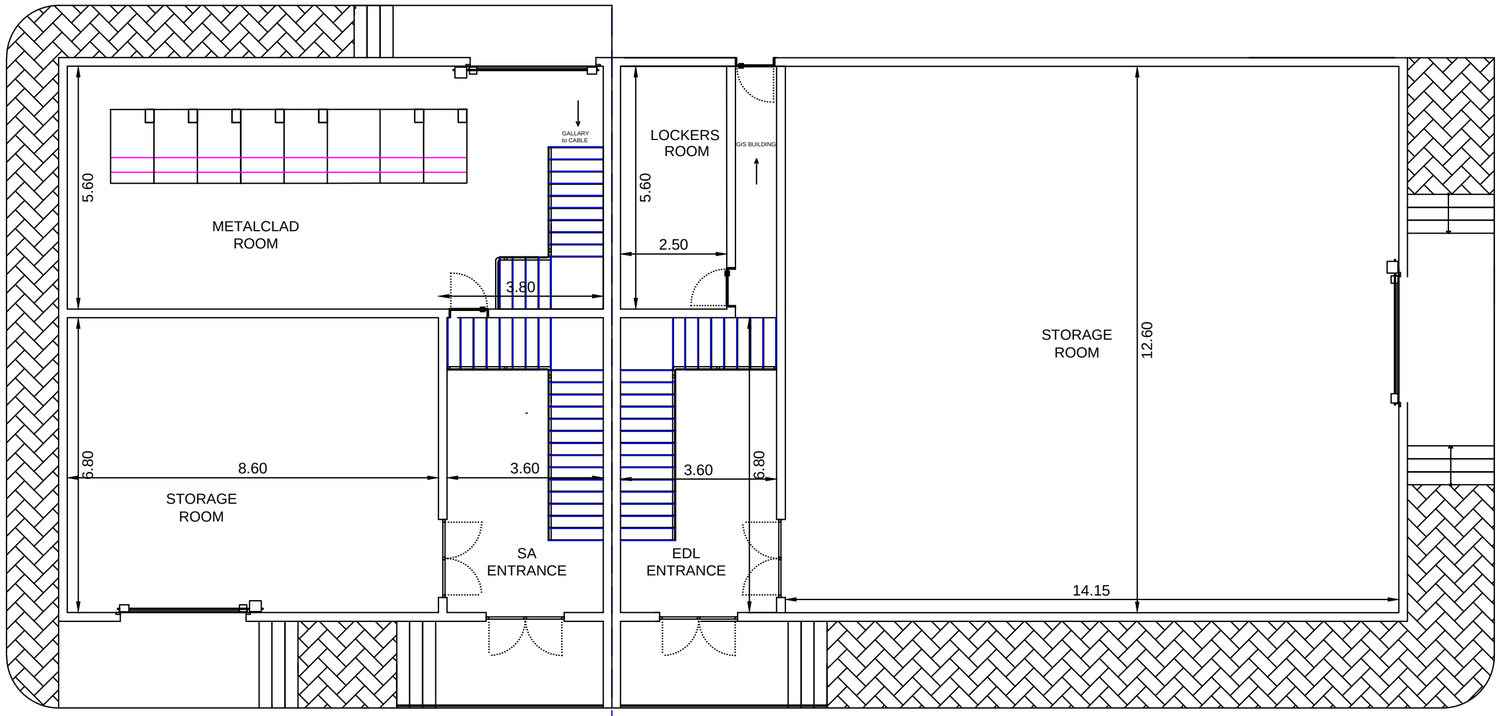
و مدحت جعفر
و عباس جعفر
و محمد جعفر
و علی جعفر
مجرى ماء
عبدو جعفر
طريق
محمد جعفر
جبل عطل

APPENDIX B

TRANSMISSION LINE AND SUBSTATION SINGLE LINE DIAGRAMS



FIRST FLOOR



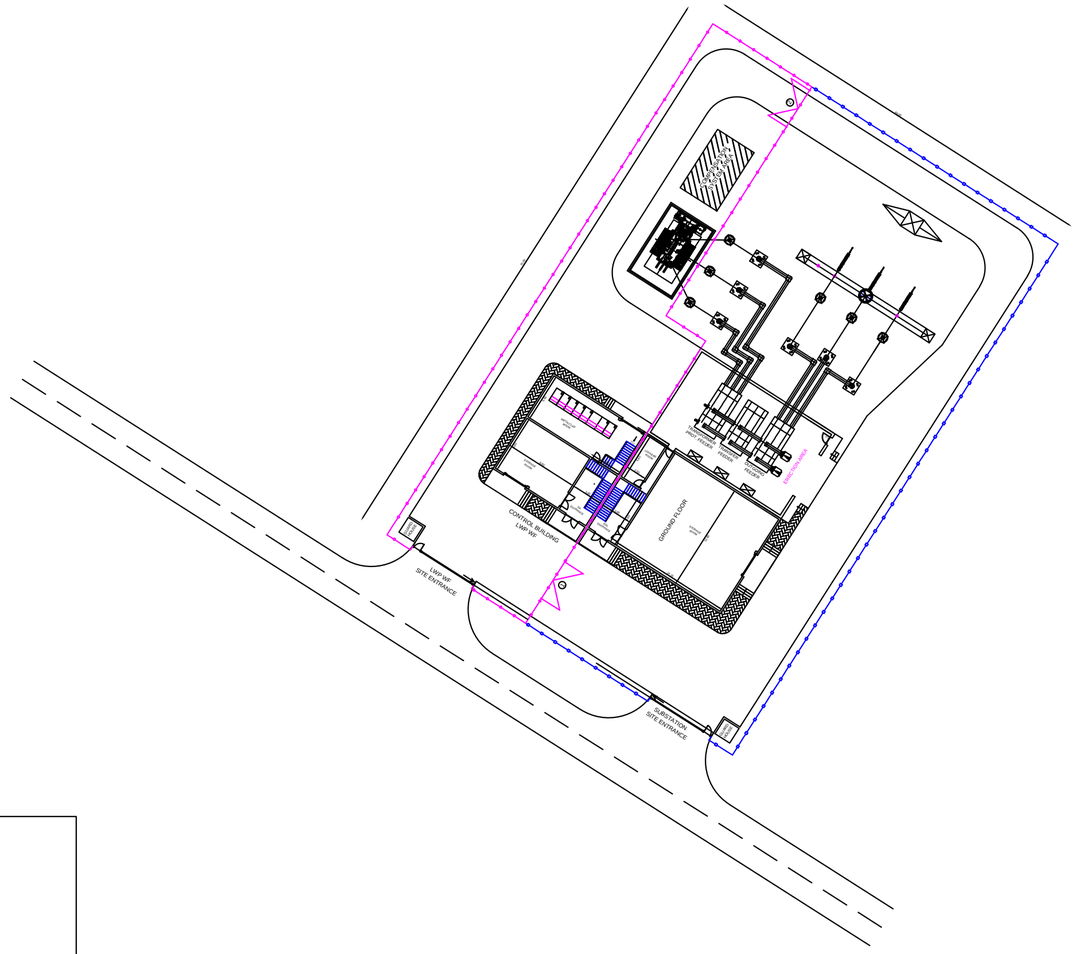
GROUND FLOOR

CONTROL BUILDING
LWP WF

EDL
SUBSTATION BUILDING

OWNER of THE PROJECT	LEBANON WIND POWER SAL		
PROJECT NAME	LWP WIND POWER PLANT		
DRAWING NAME	S.AKKAR WF CONTROL BUIDING & EDL 220kV GIS S/S BUILDING PRELIMINARY PLAN		
PREPARED by	tefirom Nenehatun St. No:98 Gaziosmanpaşa 06700 Çankaya / Ankara, Turkey	Drawing Dimension	594 x 420 (mm)
		Date	25.09.2018
		Scale	1/100
Drawing No.	LWP - EDL - 18 - 05	Revision No.	-

OWNER of THE PROJECT	LEBANON WIDN POWER SAL		
PROJECT NAME	LWP WIND POWER PLANT		
DRAWING NAME	220/36kV SUBSTATION PRELIMINARY GENERAL VIEW		
PREPARED by	tefirom Nenehatun St. No:98 Gaziosmanpaşa 06700 Çankaya / Ankara, Turkey	Drawing Dimension	594 x 420 (mm)
		Date	25.09.2018
		Scale	1/500
Drawing No.	LWP - EDL - 18 - 04	Revision No.	-



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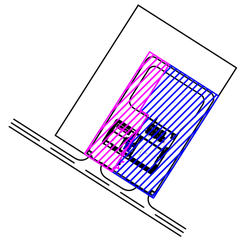


220kV SUBSTATION AREA

LWP WF AREA

SCALE 1/2500

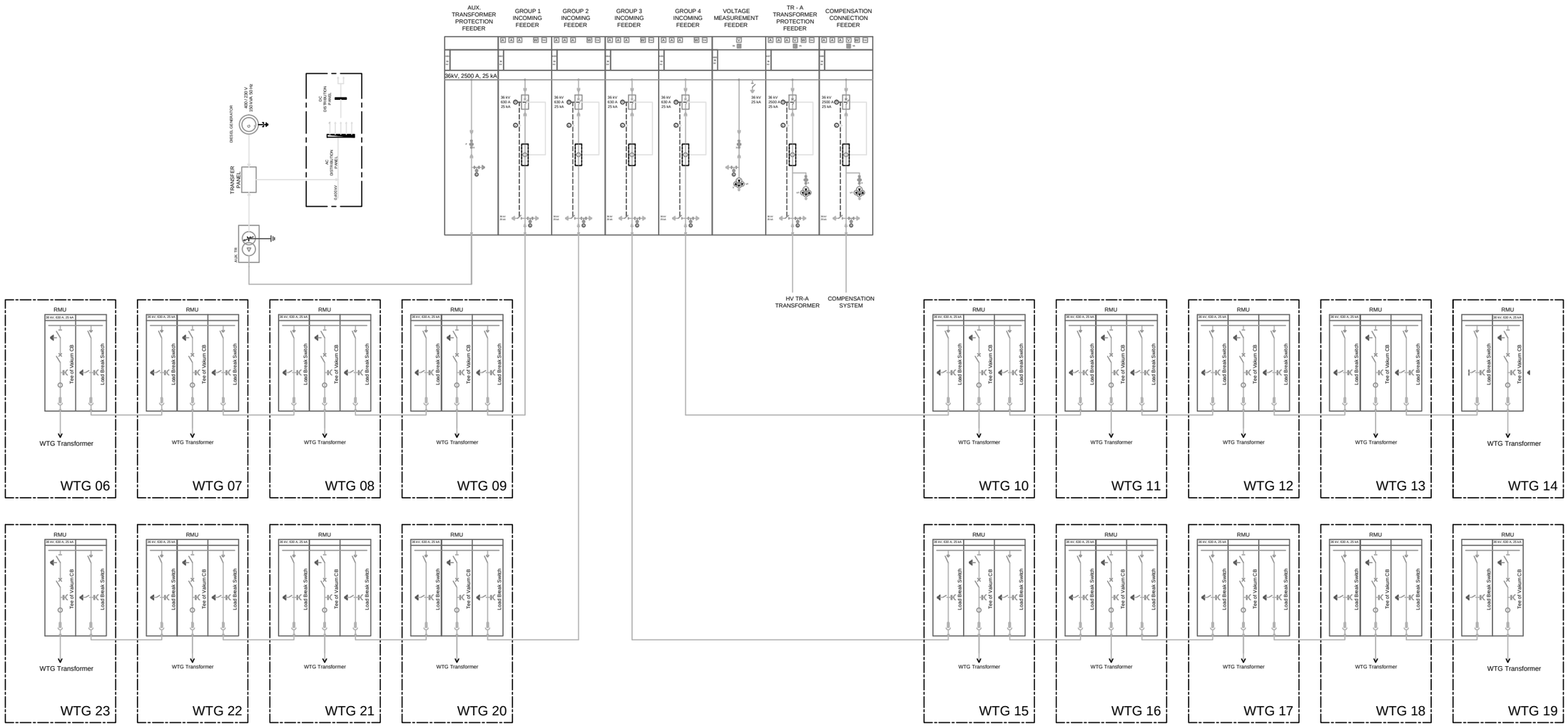
DOORS 1 and 2 are for temporary use in case of emergency or upon EDL approval for special conditions.

ALLOCATED LAND BOUNDARY for S/S

LWP WF FACILITY BOUNDARY

The remaining area will be allocated for EDL utilization.

OWNER of THE PROJECT	LEBANON WIDN POWER SAL		
PROJECT NAME	LWP WIND POWER PLANT		
DRAWING NAME	220/36kV SUBSTATION PRELIMINARY GENERAL LAYOUT PLAN		
PREPARED by	tefirom Nenehatun St. No:98 Gaziosmanpaşa 06700 Çankaya / Ankara, Turkey	Drawing Dimension	594 x 420 (mm)
		Date	25.09.2018
		Scale	1/500
Drawing No.	LWP - EDL - 18 - 03	Revision No.	-



OWNER of THE PROJECT	**LEBANON WIND POWER** Corniche n-Naher, Debbas Buildings, 3rd Floor, P.O.Box: 11-0125 Beirut-Lebanon		
PROJECT NAME	LWP WIND POWER PLANT		
DRAWING NAME	PRELIMINARY MV SINGLE LINE DIAGRAM (Assumption that all WTG Location will be used)		
PREPARED by	tefirom Nenehatun St. No:98 Gaziosmanpaşa 06700 Çankaya / Ankara, Turkey	Drawing Dimension	420 x 290 (mm)
		Date	01.10.2018
		Scale	-
Drawing No.	LWP - E - 18 - 02	Revision No.	

APPENDIX C

PERMISSION FOR USE OF PUBLIC ROADS FROM TRIPOLI SEAPORT TO THE PROJECT

NOON Center for Translation & Typing
Juridical Translation – Legalization - Typing
Beirut - Corniche Al-Mazraa
Colombia Center - Block B - Ground Floor
Phone : 01/705167 – 03/838471
E-mail : nooncenter@hotmail.com

مركز نون للترجمة والطباعة
ترجمة قانونية - مصادقات - طباعة
بيروت - كورنيش المزرعة
كولومبيا سنتر - بلوك ب - الطابق الأرضي
هاتف : ٠١/٧٠٥١٦٧ - ٠٣/٨٣٨٤٧١
بريد الكتروني : nooncenter@hotmail.com

Traductrice Assermentée Sworn Translator

Sustainable Akkar S.A.L.
Lebanon Wind Power

Registration no. 4147

February 25, 2019

To the Kind Attention
of the Ministry of the Interior and Municipalities
in Lebanon

The Applicant :
Akkar Sustainable S.A.L. and Lebanon Wind Power S.A.L .

Subject :
Request to facilitate the passage and the use of the public roads between the Port of Tripoli to Mkaibleh Region.

Beirut, February 21, 2019

Dear Sirs,

Whereas Akkar Sustainable S.A.L. and Lebanon Wind Power S.A.L . Won the transaction related to the project of the production of the energy from the wind that was confirmed by the decision of the Council of Ministers held on 12/07/2017,

Whereas the studies that started in the site of the project to start the activities of construction in the mid of the year 2019, therefore, we come to ask from your kind attention to give us: **First** the permit to use the public roads to transport the fans of the production of electricity from the port of Tripoli to the site of the project in Mkaibleh Region, Akkar, since January 2020. **Second**, we ask from your kind attention, to accompany us by your honorable ministry and by the municipalities and the provinces of North Lebanon and Akkar to transport the tools, and to facilitate the passage from the port of Tripoli to the site of the project. Knowing that we will send a communication protocol to your honorable ministry that will put a frame to our cooperation with the competent parties during the phase of transporting the tools.

Thanking you for your understanding and cooperation.

Sincerely Yours,

Michel KORDAHI	**Salah M. TABBARA**
Chairman of Board of Directors	**Chairman of Board of Directors**
General Manager	**General Manager**
Lebanese Wind Power	**Sustainable Akkar S.A.L.**
Seal and Signature	**Seal and Signature**

Louisa Georges Maroun
Traductrice Assermentée Sworn Translator

Republic of Lebanon
Ministry of Interior and Municipalities

Document of Transfer

Object of the formality :
The request to facilitate the passage and the use of the public roads from the Port of Tripoli to Mkaibleh Region.

Registration number	Direction of sending and the reasons of transfer	Date and Signature
4147	**To the kind attention of the administrative department of the province of North Lebanon** **To the kind attention of the administrative department of the District of Akkar**	
	We do hereby attach herewith the claim submitted by **Akkar Sustainable S.A.L. and Lebanon Wind Power S.A.L .** registered at us under no. 4147 on 25/02/2019 related to the abovementioned subject, To be informed and to communicate with the two above-mentioned companies , and to offer the necessary facilities and to expose the difficulties in case they exist.	
	<u>A copy to be notified to :</u> - The Applicant - The General Directorate of Internal Security Forces / to be informed and to do the necessary formalities.	
	Minister of Interior and Municipalities **Raya HAFFAR HASSAN** **Seal and Signature** **March 07, 2019**	

NOTIFIED

***True translation of the Arabic text herewith attached.**

Louisa George Maroun
Traductrice Assermentée
Sworn Translator

رقم التسجيل ٤١٤٧
٢٥ شباط ٢٠١٩

LEBANON WIND POWER
Coming from the north to the south
Sustainable Akkar

جانب وزارة الداخلية والبلديات اللبنانية الكريمة

المستدعية: شركة عكار المستدامة ش.م.ل. وشركة ليبانون ويند باور ش.م.ل.

الموضـوع: طلب تسهيل مرور واستخدام الطرقات العامة من مرفأ طرابلس الى منطقة المقيبلة

بيروت، في ٢١ شباط ٢٠١٩

بعد التحية،

لما كانت شركة عكار المستدامة ش.م.ل. وشركة ليبانون ويند باور ش.م.ل. قد ربحنا المناقصة المتعلقة بمشروع إنتاج الطاقة من الرياح والذي تم إقراره بموجب قرار مجلس الوزراء المنعقد بتاريخ ٢٠١٧/٧/١٢،

وحيث أن الدراسات قد بدأت في موقع المشروع تمهيدًا لبدأ أعمال البناء في منتصف ٢٠١٩، لذلك نلتمس من جانبكم الكريم إعطاؤنا أولا رخصة باستخدام الطرقات العامة لنقل مراوح إنتاج الكهرباء من مرفأ طرابلس إلى موقع المشروع في منطقة المقيبلة، عكار، ابتداءً من شهر كانون الثاني ٢٠٢٠. ثانيا، نطلب من جانبكم الكريم، تأمين لنا مواكبة من قبل وزارتكم الكريمة ومن قبل البلديات ومحافظين لبنان الشمالي وعكار لنقل المعدات وتسهيل المرور من مرفأ طرابلس الى موقع المشروع. علماًبأننا بصدد إرسال "a communication protocol" إلى وزارتكم الكريمة الذي يضع إيطار لتعاوننا مع الأطراف المعنية خلال مرحلة نقل المعدات.

شاكرين لجانبكم تفهمكم وحسن تعاونكم.

وتفضلوا بقبول فائق الاحترام والتقدير

صلاح م. طبارة

رئيس مجلس الادارة – المدير العام

Sustainable Akkar

ميشال قرداحي

رئيس مجلس الادارة – المدير العام

LEBANON WIND POWER
Coming from the north to the south

سبغ

الجمهورية اللبنانية
وزارة الداخلية والبلديات

RS35795

وثيقة إحالة

موضوع المعاملة: طلب تسهيل مرور واستخدام الطرقات العامة من مرفأ طرابلس إلى منطقة المقيبلة.

رقم التسجيل	جهة الإرسال وأسباب الإحالة	التاريخ والتوقيع
٤١٤٧	**جانب محافظة لبنان الشمالي** **جانب محافظة عكار**	
	نودعكم ربطاً الاستدعاء المقدم من شركة عكار المستدامة ش.م.ل وشركة ليبانون ويند باور ش.م.ل المسجّل لدينا برقم ٤١٤٧ تاريخ ٢٠١٩/٢/٢٥ والمتعلق بالموضوع المذكور أعلاه، للاطلاع والتواصل مع الشركتين المذكورتين وتقديم التسهيلات اللازمة وعرض الصعوبات في حال وجودها%	
	وزير الداخلية والبلديات **ريا حفار الحسن** ٧ - آذار ٢٠١٩ وزارة الداخلية والبلديات	
	تبلغ نسخة لجانب: - الجهة المستدعية. - المديرية العامة لقوى الأمن الداخلي/ للاطلاع والمقتضى.	

APPENDIX D
EXECUTED LEASE CERTIFICATES

WTG 07

مديرية العامة لقوى الأمن الداخلي
وحدة الدرك الإقليمي
يادة منطقة الشمال الإقليمية
مكتب الخدمة والعمليات
دد: ٩٢٧٢/٢٠٦م٢/ع.ف
تاريخ ١/١١/٢٠١٨

الموضوع: تكليف

لحضرة محافظ عكار

تم إجراء المقتضى بموجب المحضر رقم ٢٠٤/٧٤٦ تاريخ ٢٠/١٠/٢٠١٨ المرفق ربطاً.

قائد منطقة الشمال الإقليمية

وزارة الداخلية والبلديات - محافظة عكار
الرقم التسلسلي: ٢٤٧٦
تاريخ الورود: ٥/١١

القلم
تسليم المستدعي العلم والخبر
لقاء توقيعه
٥/١١/٢٠١٨
محافظ عكار
عماد اللبكي

WTG 07

المديريه العامه لقوى الأمن الداخلي
وحـــدة الـــــدرك الإقليمي
قيادة منطقة الشمال الإقليمية
قيادة سرية حلبا الاقليمية

الموضوع : تكليف بشأن استدعاء مقدم من مدحت جعفر وشركائه من كرم شباط –عيدمون .

عدد : ٣٧٣٤ /٢٠٦ق٢ اع

نظر وقدم
من العقيـــــد إيـــــلي رفـــــول
قائد سرية حلبا الاقليمية وكالة
الى العقيد قائد منطقة الشمال الاقليمية
مكتب الخدمة والعمليات م٢اع

بعد الايجاب : اجري المقتضى من قبل مخفر القبيات بموجب المحضر رقم ٢٠٤/٧٤٦ تاريخ ٢٠١٨/١٠/٣٠ المرفق ربطا" حيث تم بموجبه استماع افادة المسنين ومختاري بلدة عيدمون الذين اكدوا جميعهم ان العقار للمستدعي مدحت جعفر وشركاه ولا توجد اية خلافات وتعذر استماع افادة الاعضاء الاختيارية لعدم وجودهم كما وتم التصحيح ووضع اسم المحلة على الخرائط .

يرجى الاطلاع

حلبا في ٢٠١٨/١٠/٣١

المديرية العامة لقوى الأمن الداخلي
الوحدة : الـــدرك الإقليمي
القطعة : قيادة منطقة الشمال الإقليمية
ورد في ٢٠١٨/١١/١
سجل تحت عدد ٢٠٦/٩٢٧٤

WTG 07

المديرية العامة لقوى الأمن الداخلي
وحـــــدة الـــــدرك
قيـــادة منطقـــة الشمال
قيـــادة سرية حلبـــا
فصيـــلة القبيـــات

عـــــدد : ٨٤٣٧/ ٢٠٦

الموضوع: تكليف .

نظـــر وقـــدم
من النقيب جـــــاك شـــــكور
آمر فصيلـــة القبـــيات
إلى العقيـــد قائـــد سرية حلبـــا

بعد الأطلاع أجري المقتضى من قبل مخفر القبيات بموجب المحضر رقم ٢٠٤/٧٤٦ تاريخ ٢٠١٨/١٠/٣٠ المرفق ربطاً حيث تم بموجبه استماع افادة المسنين ومختاري بلدة عيدمون الذين اكدوا جميعهم ان العقار للمستدعي مدحت محمد جعفر وشركاه ولا توجد اية خلافات وتعذر استماع افادة الاعضاء الاختيارية لعدم وجودهم كما وتم التصحيح ووضع اسم المحلة على الخرائط .

يرجى التفضل بالأطـــلاع

القبيات في ٢٠١٨/١٠/٣٠

المديرية العامة لقوى الأمن الداخلي
الوحدة : الدرك الإقليمي
القطعة : قيادة سرية حلبا
ورد في ٢٠١٨/١٠/٣١
سجل تحت عدد ٢٠٦/٣٧٣٤

WTG 07

المديرية العامة لقوى الأمن الداخلي
وحـــــدة الـــــدرك
قيـــادة منطقة الشمال
قيـــادة سرية حلبـا
فصيـــلة القبيات
مخفر القبيات

عـــــدد : ١١٧٩/ ٢٠٦

الموضوع : تكليف .

نظـــــر وقـــــدم
مـــن المؤهل اول ايليا ديب رقم ٢٥٨٨٦
رئيس مخفر القبيـــــات
إلى النقيب آمـــــر فصـــيلة القبيات

بعد الاطلاع اجري المقتضى بموجب المحضر رقم ٢٠٤/٧٤٦ تاريخ ٢٠١٨/١٠/٣٠ حيث تم بموجبه استماع افادة المسنين ومختاري بلدة عيدمون حيث اكدوا جميعهم ان العقار عائد للمستدعي مدحت محمد جعفر وشركاه ولا توجد اية خلافات وتعذر استماع افادة الاعضاء الاختيارية لعدم وجودهم كما وتم التصحيح ووضع اسم المحلة على الخرائط .

يرجى التفضل بالاطلاع .
القبيات في : ٢٠١٨/١٠/٣٠

المديرية العامة لقوى الامن الداخلي
الوحـــدة : الـــدرك
الفصيلة : فصيلة القبيات
ورد في ٣١ / ١٠ / ٢٠١٨
سجل تحت عدد ٢٠٧٨٤٢

WTG 07

المديرية العامة لقوى الأمن الداخلي

قيادة الدرك

منطقة الشمال

سرية حلبا

فصيلة القبيات

مخفر القبيات

عدد ٧٤٦/ ٠٤

تاريخ ٢٠/١٠/٢٠١٨

الموضوع

محضر بإستكمال جمع معلومات بالعلم والخبر المقدم من المستدعي مدعى محمد حفيظ وشركاه

النسخة الـ أصل

في الساعة السابعة من يوم الثلاثاء الموافق الثلاثين من شهر تشرين الأول عام ألفين و ثمانية عشر نحن المعاون أول فادي الشمار رقم ٦٩٥٤٠ والرقيب أول عدنان الرفاعي رقم ٤٧٠٨٨ من مخفر القبيات ومرتدين اللباس العسكري نشتي أننا وعطفاً على محضرنا رقم ٧٨/ ٠٤ تاريخ ٢٠/٩/٢٠١٨ بالعلم والخبر المقدم من المستدعي مدعى محمد حفيظ المبتشر من أهالي بلدة عقارب العين مجمع في مناطق بلدة عيدو بلدة ... من شاطئ البحر والمال مجدداً في جانب محافظة عكار برقم ٤٧٦/ ٠١٨ تاريخ ٢٤/١٠/٢٠١٨ الى جانب قيادة درك منطقة الشمال البترولية في قوى الأمن الداخلي تحت عبارة بعد البحث كما في الملف الإيعاز لنا بالبدء بإجراء التحقيق وإجراء كل ما يقتضي من التحقيقات الجنائية والتي بناء الى ذلك قمنا بإستماع بعض المستخدمين البلدية من ضمن الأشخاص العلم والخبر حيث يتبين أن المال الى جانب البلدية وهي تابعة لمنطقة الشمال الى تابعة برقم ٨٩٦٩/ ٠٦ تاريخ ٢٧/ ٠٨/ ٢٠١٨ الى القبيات بسبب ملبا الإطلاع وإجراء الكشف وفقاً لما هو مطلوب بتكليف سيادة محافظ عكار المرفقات والإجراءات وفق قيادة سرية حلبا برقم ٢٦١/ ٠٦ تاريخ ٢٤/١٠/٢٠١٨ الى القبيات من ضابط القبيات للكشف والإجراءات الميدانية وفق تقارير رقم ٢٧٩/ ٠٦ تاريخ ٢٥/١٠/٢٠١٨ الكشف والإجراءات الموثقة في تقرير مخفر رقم ١١٧٩/ ٠٦ تاريخ ٢٥/١٠/٢٠١٨ للنيابة نفسها وإليكم بالشرح المجاري على الشكل التالي:

وضعت أول ٤٧٠٨٨ معاون أول ٦٩٥٤٠

نظر ومحول من أجل الإطلاع والمتابعة

لحضرة ضابط الدرك

في ... / ... / ... سنة ٢٠١٨

WTG 07

المديريه العامه لقوى الامن الداخلي
وحـــــدة الـــــدرك
قيـــادة منطقـــة الشمال
قيـــادة سرية حلبـا
فصيـــلة القبيـــات

عـــــدد ٢٠٦/٨٢٠٩

الموضوع : تكليف
=======

نظـــر وأحيـــل

إلى رئيس مخفر القبيات
للعلم والإجراء

القبيات في ٢٥/١٠/٢٠١٨

المديرية العامة لقوى الامن الداخلي
الوحـــدة : الـــدرك
القطعـــة : مخفر القبيات
ورد في ٢٥/١٠/٢٠١٨
سجل تحت عدد ٢٠٦/١١٧٩

WTG 07

المديرية العامة لقوى الأمن الداخلي
وحدة الدرك الإقليمي
قيادة منطقة الشمال الإقليمية
مكتب الخدمة والعمليات

عدد : ٢٠٦/٨٩٦٩ م٢ أ ع
تاريخ : ٢٣/١٠/٢٠١٨

الموضوع : تكليف

المديرية العامة لقوى الأمن الداخلي
الوحدة : الدرك الإقليمي
القطعة : قيادة سرية حلبا
وارد في ٢٥/١٠/٢٠١٨
عدد ٢٠٦/٨٩٦٩

نظر وأحيل

إلى العقيد قائد سرية حلبا الإقليمية

المديرية العامة لقوى الأمن الداخلي
الوحدة : الدرك الإقليمي
القطعة : قيادة سرية حلبا
ورد في ٢٤/١٠/٢٠١٨
سجل تحت عدد ٢٠٦/٣٦١٠

للإطلاع وإجراء المقتضى وفقاً لما هو مطلوب بتكليف سعادة محافظ عكار المرفقة والإعادة حتى / / ٢٠١٨

م أ ع

نظر واحيل
إلى النقيب آمر فصيلة الفيحاء
- للمقتضى والإعادة.

قوى الأمن الداخلي
قيادة منطقة الشمال الإقليمية
العقيد يوسف درويش

قوى الأمن الداخلي
قائد السرية
قيادة سرية حلبا

WTG 07

الجمهوريـــة اللبـنانيـــة

وزارة الداخلية والبلديات

محـافظة عكـار

وثيقة احالة

- موضوعها :

رقم التسجيل	الجهة المرسل إليها	موضوع الاحـــالة
٢٤٧٦ / ٢٠١٨	جانب قيادة درك منطقة الشمال الإقليمية في قوى الأمن الداخلي	نعيد إليكم كامل الملف للإيعاز لمن يلزم لإعادة التحقيق وإعادة إستماع المخاتير والأعضاء الإختيارية إذا وجدوا واستماع بعد المسنين في البلدة تصحيح الخرائط والعلم والخبر بحيث يذكر اسم المحلة إلى جانب البلدة % محافظ عكار عماد اللبكي

قوى الأمن الداخلي
الشمال الإقليمي
٢٠١٨/١٠/٢٢
٢٠٦/٨٩٦٩

الجمهورية اللبنانية
محافظة عكار
وزارة الداخلية والبلديات

22 OCT. 2019

WTG 07

المديرية العامة لقوى الأمن الداخلي
وحدة الدرك الإقليمي
قيادة منطقة الشمال الإقليمية
مكتب الخدمة والعمليات

عدد: ٢٠٦م٢/أ.ع. / ٨٤٥
تاريخ: / /٢٠١٨

الموضوع: تكليف .

لحضرة محافظ عكار

ربطاً توضيح العقيد قائد سرية حلبا بموجب المحضر رقم ٨ ع/٢٠٤ تاريخ ٢ ع/ ٢٠١٨
المرفق ربطاً حيث تم بموجبه إجراء التحقيق.

التفضل بالإطلاع

وزارة الداخلية والبلديات - محافظة عكار
الرقم المتسلسل: ٢٤٧٦
تاريخ الورود: ٨/٢/

قائد منطقة الشمال الإقليمية
العقيد يوسف درويش

WTG 07

الموضوع : تكليف .

ألمديريه العامه لقوى ألأمن الداخلي
وحدة الدرك الاقليمي
قيادة منطقة الشمال الاقليمية
قيادة سرية حلبا الاقليمية

نظر وقدّم

من العقيد مصطفى الايوبي
قائد سرية حلبا الاقليمية

إلى العقيد قائد منطقة الشمال الاقليمية

عدد : ٣١١١ /٢٠٦ق٢/ أ٠ع مكتب الخدمة والعمليات م٢ /أ٠ ع

بعد الايجاب من قبل مخفر القبيات بموجب المحضر رقم ٢٠٤/٦٧٨ تاريخ ٢٠١٨/٩/٣٠ المرفق ربطا" وبنتيجة ما ورد بافادة المستدعي والمجاورين والمسنين اكدوا ان العقار للمستدعي تمت الموافقة على تاجيل الملف لغاية ٢٠١٨/١٠/٨ انفاذا" لامركم البرقي رقم ٤٦٢٠٧ تاريخ ٢٠١٨/٩/٢٤

يرجى الاطلاع

حلبا في ٢٠١٨/١٠/٣

المديرية العامة لقوى الأمن الداخلي
الشمال الإقليمية
٢٠١٨/١٠/٤
٢٠٦/ ٨٤٥٤

WTG 07

المديرية العامة لقوى الأمن الداخلي
قيادة وحدة الـــــــدرك
قيادة منطقة الشمـــــال
قيادة سرية حلبـــــا
فصيلة القبيـــــات

الموضوع : علـــم وخبـــر

عـــدد ٦٨٥٥/ ٢٠٦

نظـــر وقـــــدم
من النقيب جـــــاك شكـــــــور
امـــــر فصيلة القبيـــات
إلـــى العقيـد قـــــائد ســـرية حلبا

بعد الاطلاع والايجاب من قبل القطعة المعنية بموجب المحضر رقم ٢٠٤/٦٧٨ تاريخ ٢٠/ ٩/ ٢٠١٨ المرفق ربطاً وبنتيجة ما ورد بافادة المستدعي والمجاورين والمسنين ومختاري المحلة اكدوا ان العقار للمستدعي

يتمنى الموافقة على تأجيل تقديم الملف لغاية ٨/١٠/٢٠١٨ انفاذاً لكتاب البرقي رقم ١٩٢٦٢ تاريخ ٢٤/٩/٢٠١٨

يرجـــى التفضل بالاطـــــلاع

القبيات في ٢/ ١٠/ ٢٠١٨

المديرية العامة لقوى الأمن الداخلي
الوحدة : الدرك الإقليمي
المنطقة : قيادة سرية حلبا
١٨١٠٣
٢٠٦/٣١١١ ق ع

WTG 07

المديرية العامة لقوى الأمن الداخلي
وحـــــدة الـــــدرك
قيـــادة منطقـــة الشمال
قيـــادة سرية حلبـــا
فصيـــلة القبيـــات
مخفر القبيات
عـــــدد : ١٠٤٠/ ٢٠٦

الموضوع : تكليف .

نظـــر وقـــدم
من المؤهل اول ايليا ديب رقم ٢٥٨٨٦
رئيس مخفر القبيـــــات
إلـــى النقيب آمـــر فصـــيلة القبيـــات

بعد الاطلاع اجري المقتضى بموجب المحضر ٢٠٤/٦٧٨ تاريخ ٢٠١٨/٩/٣٠ حيث تم بموجبه اجراء الكشف واستماع افادة كل من المستدعي والشهود والمجاورين ومختاري البلدة المرفق ربطا .

تم الموافقة على تاجيل الملف لغاية ٢٠١٨/١٠/٥ بموجب برقيتكم رقم ٧٢٣٧ تاريخ ٢٠١٨/٩/٢٤ .

يرجى التفضل بالاطلاع
القبيات في ٢٠١٨/١٠/١ .

المديرية العامة لقوى الأمن الداخلي
الوحـــدة : الـــدرك
القطعـــة : فصيلة القبيات
ورد في ٢/١٠/٢٠١٨
سجل تحت عدد ٣٩/٦٨٥٥

WTG 07

المديرية العامة لقوى الأمن الداخلي

قيادة: الدرك

منطقة: الشمال

سرية: حلب

فصيلة: العيس

مخفر: العيس

عدد: ٦٧٨/ع.م

تاريخ: ٣٠/٩/٢٠١٨

الموضوع

محضر جمع معلومات بالعلم والخبر المقدم من المدعي مرعي صعفر

النسخة الأولى

في الساعة: الحادية عشرة من يوم: الأحد الموافق: للثلاثون

من شهر: أيلول عام ألفين و: ثمانية عشر

نحن: المصروف الأول حاكم الشرطة رقم ٢٦٩٥٤ والرقيب الأول عدنان الرفاعي رقم ٢٧٠٨٨ من مخفر العيس ومرتدين

اللباس: العسكري نشبه الى ربانا استدعاء العلم والخبر المقدم من المدعي مرعي صعفر من كان لديه شكوى للصادرة على حدود وملكية عقاره التي موقع تحت البيدر والمحال من جانب محافظة حلب برقم ٢٤٧٧/٢٠١٨ تاريخ ٣/٩/٢٠١٨ تحت عبارة الاطلاع لما يلزم بالكشف والتحقق للتثبت من:

- صحة الادعاء
- موقع العقار بالنسبة الى المنطقة العسكرية والطرقات العامة والأملاك.
- بيان ما اذا كان على العقار بناء وبيان تاريخ انجازه واذا كان مخالفاً ضبط المخالفة.
- أخذ أقوال المالكين والجيران ومختار الحي ومختار الشيخ من مخاتير البلدة حال وجودهم كشهود فقط.

وذلك وفقاً للعلم والخبر المرفق والاعادة ومصادرة منطقة الشمال برقم ٥٧٦٤/ع.م تاريخ ٣/٩/٢٠١٨ لا طلاع وابداء المعني وفقاً لما هو مطلوب باجراء معاينة على العقار والاعادة ومصادرة سرية حلب برقم ٥٧٠٨/ع.م تاريخ ١٠/٩/٢٠١٨ للموقف والاعادة ومراقبة مضبطة العيس برقم ٦٢٢٢/ع.م تاريخ ١٠/٩/٢٠١٨ للعلم والاعادة والورود في قيود مخفر برقم ١٤٤/ع.م تاريخ ١٠/٩/٢٠١٨ لتلقي الطلب وعليه باشرنا بجمع المعلومات عن الشكل التالي:

يفيد أول ٢٠٠٨ معاون الأول ٢٦٩٥٤

نظر ومحول من: الأمانة العامة لمحافظة حلب

في: ٣/١٠ سنة ٢٠١٨

WTG 07

ص "٣" تابع محضر الضبط رقم ٢٠٢٤/٢٧٨ تاريخ ٢٠٢٨/٩/٢٠

"إفادة شاهد أول"

اسمي: حسن جعفر بن محمد والدي رفعة جعفر مواليد ١٩٤٣ / جوال الشمال وسكنها شارع علي كرم شارع صيدا بعلى الصفا أوقع أمامي شاهل الى منطقة جوال الشمال الشرقي على ٢٠٠ م جوال الشمال هاتف ٠١٧٢٦٤٠٥٣ الشرقي مدحت جعفر عيد معا مع شركاه عباس محمد وأطراف جعفر بن ضاع سيد عيد موسى علي كرم شارط شارع الفتح والقوه بالاعتداءات ميا بينهم وبين أي شخص آخر الجاورين او غيرهم على حدود وملكية العقار وبحسب من الشمال عقار الملاء عبد جعفر ومن الشرق عقار عبد جعفر ومحمد جعفر ومن الجنوب جبل عطل ومن الغرب مجرى ماء وطريق وهذه إفادتي.

تحريرا عليها وضدها ووقعها معي.

شاهد أول رقم الهاتف ٤٧٠٨٨ مواليد ١٩٤٣

حسن محمد جعفر

"إفادة شاهد ثان"

اسمي: علي جعفر بن نعم والدتي آمنه جعفر مواليد ١٩٦١ البشات وسكان كرم شارط الرفعة علي كرم متعلم شاهل مزارع لبناني تم سجل ٢٠٢٤ البشات هاتف ٠١٧٢٦٤٠٥٣ أوجد أمامي الأخ مدحت جعفر عيد عقار مزروع في ضاع سيد عيد موسى علي كرم شارط مع شركاه ولا توجد أي نزاعات مشاكل بينه وبين أي شخص آخر من الجاورين او غيرهم على حدود وملكية العقار وبحسب من الشمال عقار الملاء عبد جعفر ومن الشرق عقار عبد جعفر ومحمد جعفر ومن الجنوب جبل عطل ومن الغرب مجرى ماء وطريق وهذه إفادتي.

تحريرا على إفادته وضدها ووقعها معي.

شاهد ثان

علي جعفر جعفر رقم الهاتف ٤٧٠٨٨ مواليد ١٩٦١

مواليد ١٩٦٩ عيدون وسكانها عالكي مقدم مخاتير بلدة
الحالي لبناني رقم ب.ا/عيدون هاتف ٠٦٥٩٠٥٠٢٠٠ أمية
لا أصادق على القلم والحبر موضوع هذا التحقيق والمتهم من
المختار بيت الشايع وذلك كون أم الحالة غير مذكورة على
خريطة المساحة والمرسومة الجوية وهذا افادتي
تليت عليه افادته فصدقها ووقعها معنا.

مختار بيات — رشيد ابن ٤٧٠٨٨ — معاون أول ٢٦٩٥٤

ملاحظات وضابطة عدم استئذان الرقيب مكتب
التحريات الجوابية في ٢٠١٨/٩/٢٦ تاريخ
"الكشف"

خاطر عيدون كريم شبلا الفتى ٣٠ هكتار
عقار الشرعي وهو عقار بيل سلخ بناء له وصف
أحلام البلاد وبعض أحلام الاشجار الكرمة "الزاب"
ولا يوجد بداخله شبكات هاتف او كهرباء او مجاري
مياه شفة وهذا ما شاهدناه

رشيد ابن ٤٧٠٨٨ — معاون أول ٢٦٩٥٤

نظم هذا المحضر في الساعة والتاريخ المذكورين أعلاه وقرئ
على الساعة عشرة بتاريخ ٢٠١٨/٩/٢٠ وتم تنظيمه تحت
الشرف مع العلم والخبر بأنه ما قلت فكان تسلسلاً ورد الافادة
للأزل

رشيد ابن ٤٧٠٨٨ — معاون أول ٢٦٩٥٤

WTG 07

المديرية العامة لقوى الأمن الداخلي
وحـــــدة الـــــدرك
قيـــادة منطقـــة الشمال
قيـــادة سرية حلبـــا
فصيـــلة القبيـــات

الموضوع : تكليف

عـــــدد : ٦٢٢٢ /٢٠٦

نظـــر و احـــيـــل

إلى رئيـــس مخفر القبيات

للعلم والإعادة لفائدة

٢٠١٨/٩/١٤

القبيات في ١٤ / ٩ /٢٠١٨

المديرية العامة لقوى الأمن الداخلي
الوحدة : الدرك
القطعة : مخفر القبيات
ورد في ١٤ / ٩ /٢٠١٨
سجل تحت عدد ١٠٩ /٢٠٦

WTG 07

المديرية العامة لقوى الأمن الداخلي
وحدة الدرك الإقليمي
قيادة منطقة الشمال الإقليمية
مكتب الخدمة والعمليات

عدد: ٢٥٦٥ / ٢٠٦ م٢ أ ع
تاريخ: / / ٢٠١٨

الموضوع : تكليف

المديرية العامة لقوى الأمن الداخلي
الوحدة : الدرك
القطعة : فصيلة القبيات
ورد في ١٠/٩/٢٠١٨
سجل تحت عدد ٢٠٦/٢٢٢

نُظر وأُحيل

إلى العقيد قائد سرية حلبا

للاطلاع واجراء المقتضى وفقا لما هو مطلوب باحالة محافظ عكار المرفقة والاعادة لغاية / / ٢٠١٨ .

المديرية العامة لقوى الأمن الداخلي
الوحدة : الدرك الإقليمي
القطعة : قيادة سرية حلبا
ورد في ١٠/٩/٢٠١٨
سجل تحت عدد ٢٠٦/٢٧٠٨

نظر واحيل
إلى النقيب آمر فصيلة القبيات
- للاقتضاء والاعادة لغاية ٢٤/٩/٢٠١٨

قائد منطقة الشمال الإقليمية
العقيد يوسف درويش

WTG 07

الجمهورية اللبنانية
وزارة الداخلية والبلديات

محافظة عكار

عدد : ٤٧٦ ص

حلبا في : ٢ / ٨ /٢٠١٨

حضرة قائد منطقة درك الشمال الإقليمية

الإيعاز لمن يلزم بالكشف والتحقيق للتثبت مما يلي :

١- صحة الملكية
٢- موقع العقار بالنسبة إلى المنطقة السكنية والطرقات العامة والكهرباء
٣- بيان ما إذا كان على العقار بناء وبيان تاريخ إنجازه وإذا كان مخالفاً ضبط المخالفة
٤- أخذ إفادة المالكين والمجاورين وبعض المسنين ومختارين إثنين من مخاتير البلدة في حال وجود أكثر من مختار.

وذلك وفقاً للعلم وخبر المرفق والإعادة

المديرية العامة لقوى الأمن الداخلي
الوحدة : الدرك الإقليمي
القطعة : قيادة منطقة الشمال الإقليمية
ورد في ٦ / ٩ / ٢٠١٨
سجل تحت عدد ٢٠٦ / ٥٢

محافظ عكار

عماد اللبكي

الجمهورية اللبنانية
محافظة عكار
وزارة الداخلية والبلديات

WTG 07

سعادة محافظ عكار المحترم

المستدعي: فرحت جعفر وشريك

رقم الهاتف: ٠٣/١٥٥٠٨٨

الموضوع: تصديق علم و خبر

ارجو الموافقة على تصديق العلم والخبر المرفق ربطا في بلدة ..... سير شبلي - سير قرن

وتفضلوا بقبول فائق الاحترام

٢٤٧٧
١٢/٩/٢

الجمهورية اللبنانية
وزارة المالية
المديرية العامة للشؤون العقارية

نموذج رقم
الشؤون العقارية

WTG 07

علم وخبر

القانون الصادر

أمانة السجل العقاري في ..... بالمرسوم الإشتراعي رقم 12 تاريخ 1930/2/28

_ المادة 12 _

المحافظة عكار القضاء عكار المنطقة العقارية عيدمرج المحلة كرم شباط / ثلة الطيب

رقم العقار في سجل مساحة لبنان القديم: ..... أو رقم عموم الويركو في الولايات: ..... مساحته: ٦٧٧١ م.م.

درهم ..... قيراط ..... حبة ..... سهم الى وسيحاه أمين وسعود

نوع العقار الشرعي (ملك أو أميري) .....

حدود العقار مع أسماء المالكين المجاورين

شمالاً: عيدمرج

شرقاً: عيدمرج - محمد جعفر

جنوباً: جبل عطا

غرباً: حرب حاج وحرايق

محتويات العقار بالتفصيل: ارض بيلر

طريقة اكتساب الحق: ..... المالك السابق .....

مدة وضع اليد على العقار: ..... (مصدر وضع اليد ..... ، .....)

الأشغال التي قام بها وضع اليد: .....

الغاية من طلب العلم وخبر (بيع، هبة، تأمين....) .....

المالك أو العاقد: الأسم الثلاثي ..... اسم الأم ..... رقم سجل النفوس ..... محل وتاريخ الولادة ..... محل الإقامة ..... عنوان السكن ..... توقيع العاقد

ورثة محمد جعفر - عبد جعفر - علي جعفر

المعقود له: الأسم الثلاثي محمد جعفر ..... اسم الأم رشيد ..... رقم سجل النفوس ..... محل وتاريخ الولادة ..... محل الإقامة الطاروع ..... عنوان السكن الطاروع ..... توقيع المعقود له

الحق المطلوب تسجيله أو الحصة: ..... القيمة أو الثمن ..... (ل.ل.)

أسماء وتواقيع الأعضاء الإختيارية

توقيع المختار وختمه

تصديق القائمقام

- نصادق على العلم والخبر رقم ١٨/٤٢٧٩ ص الصادر عن مختار عيدمرج
استناداً الى محضر تحقيق مختار القبيات رقم ٦٧٨/٢٠١٨ تاريخ ٢٠/٩/٢٠١٨
و ٧٤٦/٢٠١٨ تاريخ ٢٠/١٠/٢٠١٨

محافظ عكار
عماد اللبكي

٥/١١/٢٠١٨

WTG 07

الجمهورية اللبنانية

محافظة عكار

قضاء عكار

منطقة عيدمون (كرم شباط) العقارية

المحلة ثلة القبع

خريطة علم و خبر

مقياس 1/1000

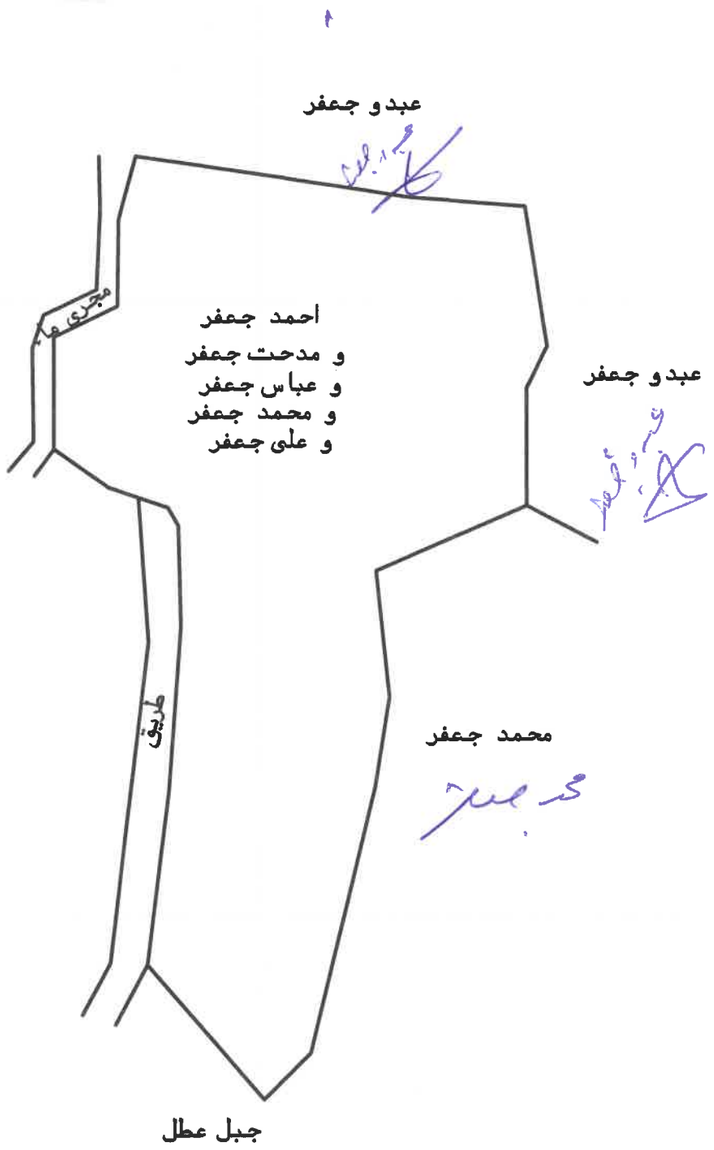
مصطلحات

—— حدود العقار

ختم و توقيع المهندس المساح

المهندس سلطان نعيم نعيم
هندسة مساحة

11/08/2018



يحده

شمالا عبدو جعفر

شرقا عبدو جعفر ومحمد جعفر

جنوبا جبل عطل

غربا مجرى ماء وطريق

المساحة ٦٧٧١ م م

جرى الكيل على مسؤوليتى وبالاستناد الى دلالة المجاورين و المالكين و المختار وعلى مسؤوليتهم

6771 m2

WTG 07

الجمهورية اللبنانية

محافظة عكار

قضاء عكار

منطقة عيدمون (كرم شباط) العقارية

المحلة شلاقبع

خريطة علم و خبر

مقياس 1/1000

مصطلحات

—— حدود العقار

ختم و توقيع المهندس المساح

المهندس سلطان نعيم نعيم
هندسة مساحة
ت: ٠٣/٣٤٩٤٠٢
الرقم النقابي ٥١١٥
11/08/2018

يحده

شمالا عبدو جعفر

شرقا عبدو جعفر ومحمد جعفر

جنوبا جبل عطل

غربا مجرى ماء وطريق

المساحة ٦٧٧١ م م

جرى الكيل على مسؤوليتى وبالاستناد الى دلالة المجاورين و المالكين و المختار وعلى مسؤوليتهم

6771 m2

WTG 08

المديرية العامة لقوى الأمن الداخلي

وحدة الدرك الإقليمي

قيادة منطقة الشمال الإقليمية

مكتب الخدمة والعمليات

عدد: ٩٢٧٢/ ٢٠٦م٢/أ.ع

تاريخ ١/١١/٢٠١٨

الموضوع: تكليف

لحضرة محافظ عكار

تم إجراء المقتضى بموجب المحضر رقم ٢٠٤/٧ع تاريخ ٢٠/ ١٠/ ٢٠١٨ المرفق ربطاً .

قائد منطقة الشمال الإقليمية

وزارة الداخلية والبلديات - محافظة عكار

الرقم المتسلسل: ٢٤٧٥/١٨

تاريخ الورود: ٢/١١/١٨

العام

تسليم المستند العام والنشر

لفاد تدقيقه

محافظ عكار

٥/١١/١٨

عماد اللبكي

المديريه العامه لقوى الأمن الداخلي
وحـــدة الـــدرك الإقليمي
قيادة منطقة الشمال الإقليمية
قيادة سرية حلبا الاقليمية

الموضوع : تكليف بشأن استدعاء مقدم من احمد جعفر وشركائه
من كرم شباط –عيدمون .

عدد : ٣٧٣٧ /٢٠٦ق٢ اع

نظر وقدم
من العقيـــــد إيـــــلي رفـــــول
قائد سرية حلبا الاقليمية وكالة
الى العقيد قائد منطقة الشمال الاقليمية
مكتب الخدمة والعمليات م٢اع

بعد الايجاب : اجري المقتضى من قبل مخفر القبيات بموجب المحضر رقم ٢٠٤/٧٤٥ تاريخ ٢٠١٨/١٠/٣٠ المرفق ربطا" حيث تم بموجبه استماع افادة المسنين ومختاري بلدة عيدمون الذين اكدوا جميعهم ان العقار للمستدعي احمد جعفر وشركائه ولا توجد اية خلافات وتعذر استماع افادة الاعضاء الاختيارية لعدم وجودهم كما وتم التصحيح ووضع اسم المحلة على الخرائط .

يرجى الاطلاع

حلبا في ٢٠١٨/١٠/٣١

المديرية العامة لقوى الأمن الداخلي
الوحدة : الـــدرك الإقليمي
القطعة : قيادة منطقة الشمال الإقليمية
ورد في ١ / ١١ / ٢٠١٨
سجل تحت عدد ٢٠٦/ ٩٢٧٢

م٢اع

المديرية العامة لقوى الأمن الداخلي
وحـــــدة الـــــدرك
قيـــادة منطقـــة الشمال
قيـــادة سرية حلبـــا
فصيـــلة القبيـــات

عـــــدد : ٨٤٣٩ /٢٠٦

الموضوع: تكليف .

نظـــر وقـــــدم
من النقيب جـــــاك شـــــــكور
آمر فصيلـــــة القبـــــيات
إلى العقيـــــد قائـــــد سرية حلبـــــا

بعد الأطلاع أجري المقتضى من قبل مخفر القبيات بموجب المحضر رقم ٢٠٤/٧٤٥ تاريخ ٢٠١٨/١٠/٣٠ المرفق ربطاً حيث تم بموجبه استماع افادة المسنين ومختاري بلدة عيدمون الذين اكدوا جميعهم ان العقار للمستدعي احمد جعفر وشركاه ولا توجد اية خلافات وتعذر استماع افادة الاعضاء الاختيارية لعدم وجودهم كما وتم التصحيح ووضع اسم المحلة على الخرائط .

يرجى التفضل بالأطـــلاع

القبيات في ٢٠١٨/١٠/٣٠

المديرية العامة لقوى الأمن الداخلي
الوحدة : الدرك الإقليمي
القطعة : قيادة سرية حلبا
ورد في ٢٠١٨/١٠/٣١
سجل تحت عدد ٢٠٦/٣٧٣٧

المديرية العامة لقوى الأمن الداخلي
وحـــــدة الـــــدرك
قيـــادة منطقة الشمال
قيـــادة سرية حلبـــا
فصيـــلة القبيات
مخفر القبيات

عـــــدد : ١١٨١/ ٢٠٦

الموضوع : تكليف .

نظـــــر وقـــــدم
مـــن المؤهل اول ايليا ديب رقم ٢٥٨٨٦
رئيس مخفر القبيـــــات
إلى النقيب آمـــــر فصـــــيلة القبيات

بعد الاطلاع اجري المقتضى بموجب المحضر رقم ٢٠٤/٧٤٥ تاريخ ٢٠١٨/١٠/٣٠
حيث تم بموجبه استماع افادة المسنين ومختاري بلدة عيدمون حيث اكدوا جميعهم ان العقار
عائد للمستدعي احمد جعفر وشركاه ولا توجد اية خلافات وتعذر استماع افادة الاعضاء
الاختيارية لعدم وجودهم كما وتم التصحيح ووضع اسم المحلة على الخرائط .

يرجى التفضل بالاطلاع .
القبيات في : ٢٠١٨/١٠/٣٠

المديرية العامة لقوى الأمن الداخلي
الوحـــدة : الـــدرك
الفصيلة : فصيلة القبيات
ورد في ٢٠ / ١٠ / ٢٠١٨
سجل تحت عدد ٢٠٦/٨٤٢٩

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المديرية العامة لقوى الأمن الداخلي

قيادة الدرك

منطقة الشمال

سرية حلبا

فصيلة العبدات

مخفر العبدات

عدد ص ع/ ٧٤ /٢٠١٨

تاريخ ٢٠/١٠/٢٠١٨

الموضوع

محضر بتجميع معلومات بالعلم والخبر المقدم من المدعي أحمد وفيق وشركاه

النسخة الأصلية

في الساعة السابعة من يوم الثلاثاء الموافق الثلاثين

من شهر تشرين الأول عام ألفين و ثمانية عشر

نحن المعاون أول فادي الشعار رقم ٢٦٩٠٤ والرقيب أول

عدنان الزيابي رقم ٤٧٠٨٨ من مخفر العبدات ومرتدين

اللباس العسكري نبلغ أنه بناءً على محضر تاريخ ٢٧/ ٢٠١٨/٠٤

تاريخ ٢٠/٩/٢٠١٨ بالعلم والخبر المقدم من المدعي أحمد

وفيق وشركاه المتضمن مداهمة ومطابقة عقارات الغير موقع

في تلة جبارة عيدو / محلة أم رشاط بيوت المربية والمحال

مجدداً في مباني مخالفات كما ورد بكتاب برقم ٤٧٥/ ٢٠١٨ تاريخ

٢٢/١٠/٢٠١٨ إلى مباني قيادة درك منطقة الشمال الإقليمية

في قرى الشيخ الخاضر تحت عبارة بناء البحث عن المالك الإيعاز

لمن يلزم ولبعبارة التحقيق مباني قيد البناء المخالفة والأدعاء

أن العبدات إنما هو بدواعي بناء بعض المسنين المالك

وتصحيح الخرائط والعلم والخبر بحث بذلك تم إحالة الحملة إلى

مباني المدعي وفي مباني قيادة منطقة الشمال الإقليمية

برقم ٢٩٧/ ٢٠١٦ في تاريخ ٢٢/١٠/٢٠١٨ إلى المقدم قاسم

سريت بالبلاغ وإجراء المقتضى وفقاً لما هو مطلوب

بتكليف عبارة مداهمة كما المرفقة والعبارة مرفق بقيادة

سريت طلباً برقم ٢٢٠٦/ ٢٠١٦ في تاريخ إلى النقيب مر

مخالفات العبدات المكلف والعبارة والبناء فإن قيادة

منطقة الشمال برقم ٢٧٠٦/ ٢٠١٦ تاريخ ٢٥/١٠/٢٠١٨ المرفق

والعبارة المدون في قيد مخفر برقم ١١٨١/ ٢٠١٦

تاريخ ٢٥/١٠/٢٠١٨ المفاتيح نضع بالعلم بالشأن

مع المعلومات على الشكل التالي:

رقيب أول ٤٧٠٨٨ معاون أول ٢٦٩٠٤

نظر ومحول من المقدم قاسم سريت

لحضرة ضابط عمليات سلسلة

في ٢٠١٨/١٠/٢٠

سنة

ملاحظات: يوجد مضاربين في بلاك جاك
نظم هذا المضارب الساعة الثانية المذكورة في مقدمة
وقت الساعة التاسعة تاريخ كل نوبتين تقدم الأولى
مع العلم كانت ملاحظات عكس الثانية المخطط:
نوبة أول ٤٧٨٨ نوبة أول ٤٦٩٥

WTG 08

المديريه العامه لقوى الامن الداخلي
وحـــــدة الـــــدرك
قيـــادة منطقـــة الشمال
قيـــادة سرية حلبـــا
فصيـــلة القبيـــات

عـــــدد : ٨٢٠٦/٢٠٦

الموضوع : تكليف

نظـــر وأحيـــل

إلى رئيس مخفر القبيات
للتقيد والإجراء

القبيات في ٢٥/١٠/٢٠١٨

المديرية العامة لقوى الامن الداخلي
الوحدة الدرك
القيادة منطقة الشمال
ورد في ٢٥/١٠/٢٠١٨
سجل تحت عدد ٢٠٦/١١٨١

المديرية العامة لقوى الأمن الداخلي
وحدة المدرك الإقليمي
قيادة منطقة الشمال الإقليمية
مكتب الخدمة والعمليات

عدد : ٨٩٧٠/٢٠٦ م٢ أ ع
تاريخ : ٢٤/١٠/٢٠١٨

الموضوع : تكليف

المديرية العامة لقوى الأمن الداخلي
الوحدة : المدرك
القطعة : قيادة الثبات
ورد في ٢٥/١٠/٢٠١٨
سجل تحت عدد ٢٠٦/٨٢٠٦

نظر وأحيل

إلى العقيد قائد سرية حلبا الإقليمية

المديرية العامة لقوى الأمن الداخلي
الوحدة : المدرك الإقليمي
القطعة : قيادة سرية حلبا
ورد في ٢٤/١٠/٢٠١٨
سجل تحت عدد ٢٠٦/٣٦٢٢ م٢ أ ع

للإطلاع وإجراء المقتضى وفقاً لما هو مطلوب بتكليف سعادة محافظ عكار المرفقة

والإعادة حتى / / ٢٠١٨

قائد منطقة الشمال الإقليمية
العقيد يوسف درويش

نظر واصل
الى العقيد آمر فصيلة الفيات
- للمقتضى والإعادة

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الجمهوريـــة اللبـنانيـة

وزارة الداخلية والبلديات

محـافظة عكـار

وثيقة احالة

ـ موضوعها :

رقم التسجيل	الجهة المرسل إليها	موضوع الاحـــالة
٢٤٧٥ / ٢٠١٨	جانب قيادة درك منطقة الشمال الإقليمية في قوى الأمن الداخلي	نعيد إليكم كامل الملف للإيعاز لمن يلزم لإعادة التحقيق وإعادة إستماع المخاتير والأعضاء الإختيارية إذا وجدوا واستماع بعد المسنين في البلدة تصحيح الخرائط والعلم والخبر بحيث يذكر اسم المحلة إلى جانب البلدة % محافظ عكار عماد اللبكي

قوى الأمن الداخلي
المركز الإقليمي
قيادة منطقة الشمال الإقليمية
ورد في ٢٢ / ١٠ / ٢٠١٨
سجل تحت عدد ٢٠٦/٨٩٧٠

الجمهورية اللبنانية
محافظة عكار
وزارة الداخلية والبلديات

22 OCT. 2019

المديرية العامة لقوى الأمن الداخلي
وحدة الدرك الإقليمي
قيادة منطقة الشمال الإقليمية
مكتب الخدمة والعمليات

عدد: ٢٠٦م٢/أ.ع. / ٨٤٥٢
تاريخ: / /٢٠١٨

الموضوع: تكليف

لحضرة محافظ عكار

ربطاً توضيح العقيد قائد سرية حلبا بموجب المحضر رقم ٢٠٤/٧٧٧ تاريخ ٢/٢/٢٠١٨ المرفق ربطاً حيث تم بموجبه إجراء التحقيق.

التفضل بالإطلاع

وزارة الداخلية والبلديات - محافظة عكار
الرقم المتسلسل ٦٤٤٦
التاريخ ٨/٢/٢٠١٨

قائد منطقة الشمال الإقليمية
العقيد يوسف درويش

المديرية العامة لقوى الأمن الداخلي
قيادة وحدة الـــــــــدرك
قيادة منطقة الشمـــــال
قيادة سرية حلبـــا
فصيلة القبيـــات

عـدد ٦٨٤١/ ٢٠٦

الموضوع : علـم وخبـــر

نظـــر وقـــــدم
من النقيب جـــــاك شكـــــــور
امـــــر فصيلة القبيـــات
إلـــى العقيـد قـــــائد ســـرية حلبا

بعد الاطلاع والايجاب من قبل القطعة المعنية بموجب المحضر رقم ٢٠٤/٦٧٧ تاريخ ٢٠/ ٩ /٢٠١٨ المرفق ربطاً وبنتيجة ما ورد بافادة المستدعي والمجاورين والمسنين ومختاري المحلة اكدوا ان العقار للمستدعي

- تم الموافقة على تأجيل تقديم الملف لغاية ٨/١٠/٢٠١٨ انفاذاً لكتابكم البرقي رقم ١٩٢٦٢ تاريخ ٢٢/٩/٢٠١٨

يرجـــى التفضل بالاطـــــلاع

القبيات في ٢/١٠/٢٠١٨

المديرية العامة لقوى الأمن الداخلي
الوحدة : الدرك الإقليمي
المنطقة : قيادة سرية حلبا
٣/١٠/١٨
٣١١٠ ق أ

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المديريه العامه لقوى الأمن الداخلي
وحدة الدرك الاقليمي
قيادة منطقة الشمال الاقليمية
قيادة سرية حلبا الاقليمية

الموضوع : تكليف .

نظر وقدّم

من العقيد مصطفى الايوبي

قائد سرية حلبا الاقليمية

إلى العقيد قائد منطقة الشمال الاقليمية

عدد : ٣١١٠ /٢٠٦ق٢/ أ٠ع مكتب الخدمة والعمليات م٢ /أ٠ ع

بعد الايجاب من قبل مخفر القبيات بموجب المحضر رقم ٢٠٤/٦٧٧ تاريخ ٢٠١٨/٩/٣٠ المرفق ربطا" وبنتيجة ما ورد بافادة المستدعي والمجاورين والمسنين اكدوا ان العقار للمستدعي تمت الموافقة على تاجيل الملف لغاية ٢٠١٨/١٠/٨ انفاذا" لامركم الرقمي رقم ٤٦٢٠٨ تاريخ ٢٠١٨/٩/٢٤

يرجى الاطلاع

حلبا في ٢٠١٨/١٠/٣

المديرية العامة لقوى الأمن الداخلي
الوحدة
قيادة الشمال الاقليمية
٢٠١٨/١٠/٤
٢٠٦/٨٤٥م

المديرية العامة لقوى الأمن الداخلي
وحـــــدة الـــــدرك
قيـــادة منطقـــة الشمال
قيـــادة سرية حلبـــا
فصيـــلة القبيـــات
مخفر القبيات
عـــــدد : ١٠٣٥ /٢٠٦

الموضوع : تكليف .

نظـــر وقـــدم
من المؤهل اول ايليا ديب رقم ٢٥٨٨٦
رئيس مخفر القبيـــــــات
إلـــى النقيب آمـــر فصـــيلة القبيـــات

بعد الاطلاع اجري المقتضى بموجب المحضر ٢٠٤/٦٧٧ تاريخ ٢٠١٨/٩/٣٠ حيث تم بموجبه اجراء الكشف واستماع افادة كل من المستدعي والشهود والمجاورين ومختاري البلدة المرفق ربطا .

تم الموافقة على تاجيل الملف لغاية ٢٠١٨/١٠/٥ بموجب برقيتكم رقم ٧٢٣٦ تاريخ ٢٠١٨/٩/٢٤ .

يرجى التفضل بالاطلاع
القبيات في ٢٠١٨/١٠/١ .

المديرية العامة لقوى الأمن الداخلي
الوحدة : الدرك
الفصيلة : فصيلة القبيات
٢٠١٨/١٠/٢
٢٠٦/٦٨٤١

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المديرية العامة لقوى الأمن الداخلي

قيادة الدرك

منطقة الشمال

سرية طرابلس

فصيلة الميناء

مخفر الميناء

عدد ٦٧٧/ ٠٤

تاريخ ٣٠/٩/٢٠١٨

الموضوع

محضر جمع معلومات بالعلم والخبر المقدم من ... مخفر ... الى النسخة الأولى

في الساعة ... من يوم الاحد الموافق للثلاثون من شهر أيلول عام ألفين وثمانية عشر نحن المعاون أول ... رقم ٢٦٩٥٤ والرقيب أول عدنان ... رقم ٤٧٠٨٨ من مخفر الميناء ومرتدين اللباس العسكري نثبت بموجب هذا المحضر بناء على استدعاء الإعلام والخبر المقدم من المستدعي أمين مخفر ... شركاه في بلدة ... الحاضر المتضمن في صحة ملكية عقار العين ... في بلدة ... شمالاً عين ... والمحال من محافظة عكار برقم ٦٧٤ تاريخ ٧/٩/٢٠١٨ الى مخفر الميناء قائد منطقة درك الشمال الإقليمية تحت عبارة الإيعاز لنا بالكشف والتحقيق المتضمن ما يلي: ان صحة الملكية ومقر العقار بالنسبة الى المنطقة السكنية والطرقات العامة والكهرباء والمياه ما إذا كان على العقار بناء وبيان تاريخ إنجازه وما إذا كان مخالفاً لضابط المخالفات أفدنا بأن الملكية والمواريث ومصطفى الحسين ومختار الميناء أثبتت في غاية البلدة في حال وجود أكثر من مختار ومن ثم وفقاً "العلم والخبر" المرفق والبيان عارضاً من منطقة الشمال الإقليمية برقم ٦/٥٧٧ تاريخ ٢٦/٩/٢٠١٨ الإطلاع وإجراء المقتضى وفقاً لما هو مطلوب بالملف محافظة عكار المرفق وبيان كتابة طلبنا برقم ٦/٧٧ تاريخ ٣٠/٩/٢٠١٨ المحتمل والبيانات وكتابتنا برقم ٦/٦٢٢٩ تاريخ ٢٢/٩/٢٠١٨ المحتمل والبيانات لغاية ٢٤/٩/٢٠١٨ والمدعو ... مختار برقم ٦/٨٢٥ تاريخ ٢٤/٩/٢٠١٨ لغاية تاريخه وعليه وبعد جمع المعلومات والتالي:

... ٤٧٠٨٨ ... ٢٦٩٥٤

... ٢٠١٨

نظر ومحول من ... لحضرة ... في ... / ... / ... سنة ٢٠١٨

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ص ٢ تابع محضر الضبط رقم ٧٧٧/٢٠٢٤ تاريخ ٢٠١٨/٩/٢٠

"إفادة مجاور من الجنوب والغرب"

أسمي: عباس جعفر بن سالم والذي نسبته جعفر مواليد معار الحشيش عام ١٩٥٥ وسكان بلدة القصر محلات المياه ملك والدي مقابل عازب مهنتي بائع هواتف لبناني رقم سجلي العائلي ب/معار الحشيش هاتف ٣٦٠٤٢٥/٧١ أعزب أبني أملك عقارين مجاورين في نفس البلدة عبد موسى محلة كرم شاط بجوار المدرسة يدعى العقارين المستدعيين من الجهتين الجنوبية والغربية ولا توجد أي خلافات أو نزاعات بيني وبينهم على حدود وملكية هذا العقار ولا مانع لدي من المصادقة على هذا العلم والخبر وهذه إفادتي.

تليت عليه إفادته فصدق عليها ووقع معنا

مجاور من الجنوب والغرب — صفية آل ٤٧٠٨٨ معارف آل ٢٦٩٥٤

عباس سالم جعفر — [illegible]

"إفادة مجاور من الشمال"

أسمي: محمد جعفر بن حسن والذي شهرته جعفر مواليد الحاكورة عام ١٩٤٠ وسكان بلدة القصر محلات المياه ملكي أعمل فلاح مزارع لبناني رقم سجلي العائلي ب/معار الحشيش هاتف ٣٦٠٤٢٥/٧١ أعزب أملك عقارين مجاورين في نفس البلدة عبد موسى محلة كرم شاط بجوار المدرسة يدعى العقار المستدعي من الجهة الشمالية ولا توجد أي نزاعات بيني وبينهم على حدود وملكية هذا العقار ولا مانع لدي من المصادقة على هذا العلم والخبر وهذه إفادتي.

تليت عليه إفادته فصدق عليها ووقع معنا

مجاور من الشمال — صفية آل ٤٧٠٨٨ معارف آل ٢٦٩٥٤

[illegible]

"إفادة شاهد من أول"

أسمي: حسن جعفر بن محمد والذي شهرته جعفر مواليد ١٩٤٢ معار الحشيش وسكان شاتيلا وسكان بلدة القصر محلات المياه صفية آل ٤٧٠٨٨ معارف آل ٢٦٩٥٤

حسن محمد جعفر — [illegible]

"٥" ص

تابع محضر فحص العقارات رقم ٦٧٧/٢٠٠٤ تاريخ ٢٠/٩/٢٠١٨

"إفادة مختار أول"

إسمي: زينب الحاج يوسف الحاج عبد الحق والدي تزوجت
مواليد عام ١٩٦٥ عيدون سكن بلكي مقيم محل
مختار بلدتي الحالي رقم سجل العائلة ٨ عيدون هاتف
١٠٧١٥٩٩٧٢٢ أتبين العقار المبين أعلاه ملكاً وحق
المستدعي أحمد جعفر وشركاه وأي مستدل كما حاجز
به لجهة الحدود والملكية ولا توجد بينه نزاعات فيما
بينهم وأن شخصاً غيره من الجوار يدعي أنه على حدود
وملكية هذا العقار علماً أن مكان العقار هو في أراضي بلدتنا
عيدون محلة أم سنا جامعة الحدود وهذه إفادتي
تليت عليه أفاد أنه سمعها وقرأها معنا

مختار أول رقم السجل ٤٧٠٨٨ مصادق الإمضاء ٢٦٩٥٤

"إفادة مختار ثاني"

إسمي: عمر عبد القادر محمد سعيد والدي مسجل مواليد
١٩٦٩ عيدون سكن بلكي مقيم محل مختار بلدتي الحالي
لبناني رقم سجل ٢٠ عيدون هاتف ٠٣١٥٩٠٢٩٨ أتبين العقار
بالإطلاع على هذا العمل والخريطة موضوع هذا التحقيق والمنظم
قبل المختار زينب الحاج المستدعي أحمد جعفر وشركاه كون
إسم المحلة غير مذكور بالتحديد على الخريطة المساحة والجهة
وهذه إفادتي

تليت عليه أفاد أنه سمعها وقرأها معنا

مختار ثاني رقم السجل ٤٧٠٨٨ مصادق الإمضاء ٢٦٩٥٤

Not مات وطالبة حقهم استناداً لإفادة مكتب المخاتير
الجوابية رقم ٢٢٤٤٢ تاريخ ١٨/٩/٢٠١٨

رقم السجل ٤٧٠٨٨ مصادق الإمضاء ٢٦٩٥٤

WTG 08

المديرية العامة لقوى الأمن الداخلي
وحـــــدة الـــــدرك
قيـــادة منطقـــة الشمال
قيـــادة سرية حلبـــا
فصيـــلة القبيـــات

عـــدد : ٦٢٢٩/ ٢٠٦

الموضوع : تكليف

نظـــر و احـــيـــل

إلى رئيـــس مخفر الشيباني

للبحث والإعادة لغاية ٢١/٩/٢٠١٨

القبيات في ٢٠١٨/٩/١٢

المديرية العامة لقوى الأمن الداخلي
الوحدة
الفصيلة : عسكر القبيات
ورد في ١٢ / ٩ / ٢٠١٨
سجل تحت عدد ٢٠٦١٢٥

WTG 08

الجمهورية اللبنانية
وزارة الداخلية والبلديات

محافظة عكار
عدد: ٢٤٧٦
حلبا في: ٣ / ٩ / ٢٠١٨

حضرة قائد منطقة درك الشمال الإقليمية

الإيعاز لمن يلزم بالكشف والتحقيق للتثبت مما يلي :

١- صحة الملكية
٢- موقع العقار بالنسبة إلى المنطقة السكنية والطرقات العامة والكهرباء
٣- بيان ما إذا كان على العقار بناء وبيان تاريخ إنجازه وإذا كان مخالفاً ضبط المخالفة
٤- أخذ إفادة المالكين والمجاورين وبعض المسنين ومختارين إثنين من مخاتير البلدة في حال وجود أكثر من مختار.

وذلك وفقاً للعلم وخبر المرفق والإعادة

المديرية العامة لقوى الأمن الداخلي
الوحدة: الدرك الإقليمي
المنطقة: قيادة منطقة الشمال الإقليمية
ورد في ٦ / ٩ / ٢٠١٨
سجل تحت عدد ٢٠٦/

محافظ عكار
عماد اللبكي

٢ / ٩ / ٢٠١٨

الجمهورية اللبنانية
محافظة عكار
وزارة الداخلية والبلديات

WTG 08

سعادة محافظ عكار المحترم

المستدعي: احمد جعفر وشرباه رقم الهاتف: ٠٣/١٥٥٠٨٨

الموضوع: تصديق علم و خبر

ارجو الموافقة على تصديق العلم والخبر المرفق ربطا في بلدة .....عيدمون

وتفضلوا بقبول فائق الاحترام

وزارة الداخلية والبلديات - محافظة عكار
الرقم التسلسلي ٢٤٧٥
تاريخ ٢/٩/٢٠٢٤

الجمهورية اللبنانية
وزارة المالية
المديرية العامة للشؤون العقارية

WTG 08

نموذج رقم
الشؤون العقارية

علم وخبر

القانون الصادر

أمانة السجل العقاري في ..... بالمرسوم الإشتراعي رقم 12 تاريخ 1930/2/28

_ المادة 12 _

المحافظة ..... القضاء ..... المنطقة العقارية ..... المحلة .....

رقم العقار في سجل مساحة لبنان القديم :.....أو رقم عموم الويركو في الولايات : ..... مساحته: .....

درهم .....قيراط.....حبة.....

نوع العقار الشرعي (ملك أو أميري).....

حدود العقار مع أسماء المالكين المجاورين

شمالاً : .....

شرقاً : .....

جنوباً : .....

غرباً : .....

محتويات العقار بالتفصيل .....

طريقة اكتساب الحق : ..... المالك السابق .....

مدة وضع اليد على العقار : .....(مصدر وضع اليد ..... ، .....)

الأشغال التي قام بها وضع اليد :.....

الغاية من طلب العلم وخبر (بيع، هبة، تأمين....) .....

المالك أو العاقد : الأسم الثلاثي .....اسم الأم ..... رقم سجل النفوس .....محل وتاريخ الولادة ..... محل الإقامة .....عنوان السكن.....توقيع العاقد

المعقود له : الأسم الثلاثي ..... اسم الأم ..... رقم سجل النفوس ..... محل وتاريخ الولادة ..... محل الإقامة ..... عنوان السكن ..... توقيع المعقود له

الحق المطلوب تسجيله أو الحصة : .....القيمة أو الثمن .....(ل.ل.)

أسماء وتواقيع الأعضاء الإختيارية

توقيع المختار وختمه

تصديق القائمقام

عماد اللبكي

WTG 08

الجمهورية اللبنانية

محافظة عكار

قضاء عكار

منطقة عيدمون (كرم شباط) العقارية

المحلة جورة المرجه

خريطة علم و خبر

مقياس 1/1000

مصطلحات

—— حدود العقار

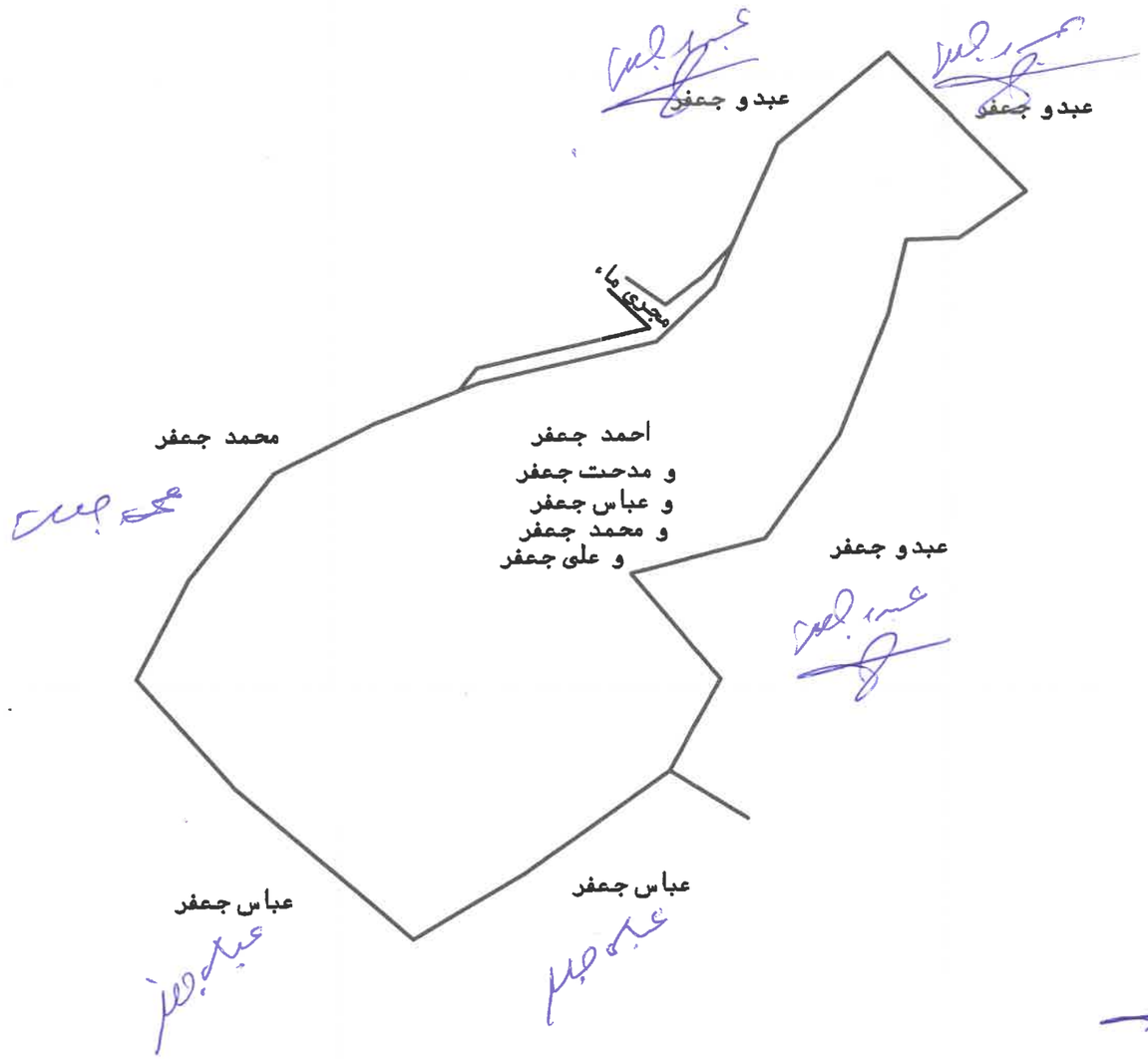
ختم و توقيع المهندس المساح

المهندس سلطان نعيم نعيم

مساحة

٠٣/٣٤٩٤٠٢

11/08/2018



يحده

شمالا عبدو جعفر و مجرى ماء و محمد جعفر

شرقا عبدو جعفر

جنوبا عباس جعفر و عبدو جعفر

غربا عباس جعفر

المساحة ٨.٣٦ م م

جرى الكيل على مسؤوليتى وبالاستناد الى دلالة المجاورين و المالكين و المختار وعلى مسؤوليتهم

8036 m2

WTG 08

جرى الكيل على مسؤوليتى وبالاستناد الى دلالة المجاورين و المالكين و المختار وعلى مسؤوليتهم

الجمهورية اللبنانية

محافظة عكار

قضاء عكار

منطقة عيدمون (كرم شباط) العقارية

المحلة جورة المريحة

خريطة علم و خبر

مقياس 1/1000

مصطلحات

—— حدود العقار

ختم و توقيع المهندس المساح

المهندس سلطان نعيم نعيم
هندسة ومساحة
٠٣/٣٤٤٠٠٩
رقم النقابي ٥١١٦

11/08/2018

يحده

شمالا عبدو جعفر و مجرى ماء و محمد جعفر

شرقا عبدو جعفر

جنوبا عباس جعفر و عبدو جعفر

غربا عباس جعفر

المساحة ٨.٣٦ م م

8036 m2

WTG 09

المديرية العامة لقوى الأمن الداخلي
وحدة الدرك الإقليمي
قيادة منطقة الشمال الإقليمية
مكتب الخدمة والعمليات
العدد: ١ /٩٢٧/ ٢٠١٦م٢/أ.ع

الموضوع: تكليف

لحضرة محافظ عكار

تم إجراء المقتضى بموجب المحضر رقم ٢٠٤/٧٤٤ تاريخ ٢٠/ ١٠/ ٢٠١٨ المرفق ربطاً .

وزارة الداخلية والبلديات - محافظة عكار
الرقم المتسلسل: ٢٤٧٤
تاريخ الورود: ٢٠١٨/١٠/٢٥

القلم
تسليم المستدعي المحاضر وإعلامه
لقاء توقيعه
٢٠١٨/١١/٥

قائد منطقة الشمال الإقليمية

محافظ عكار
عماد السبسبي

WTG 09

المديريه العامه لقوى الأمن الداخلي
وحـــدة الـــــدرك الإقليمي
قيادة منطقة الشمال الإقليمية
قيادة سرية حلبا الاقليمية

عدد : ٣٧٣٨ /٢٠٦ق٢ اع

الموضوع : تكليف بشأن استدعاء مقدم من محمد جعفر وشركائه من كرم شباط –عيدمون .

نظر وقدم
من العقيـــــد إيـــــلي رفـــــول
قائد سرية حلبا الاقليمية وكالة
الى العقيد قائد منطقة الشمال الاقليمية
مكتب الخدمة والعمليات م٢اع

بعد الايجاب : اجري المقتضى من قبل مخفر القبيات بموجب المحضر رقم ٢٠٤/٧٤٤ تاريخ ٢٠١٨/١٠/٣٠ المرفق ربطا" حيث تم بموجبه استماع افادة المسنين ومختاري بلدة عيدمون الذين اكدوا جميعهم ان العقار للمستدعي محمد عبدو جعفر وشركائه ولا توجد اية خلافات وتعذر استماع افادة الاعضاء الاختيارية لعدم وجودهم كما وتم التصحيح ووضع اسم المحلة على الخرائط .

يرجى الاطلاع

حلبا في ٢٠١٨/١٠/٣١

المديرية العامة لقوى الأمن الداخلي
الوحدة :الـــدرك الإقليمي
القطعة : قيادة منطقة الشمال الإقليمية
ورد في ١ / ١١ / ٢٠١٨
سجل تحت عدد ٩٢٧ /٢٠٦

WTG 09

المديرية العامة لقوى الأمن الداخلي
وحـــــدة الـــــدرك
قيـــادة منطقـــة الشمال
قيـــادة سرية حلبـــا
فصيـــلة القبيـــات

عـــــدد : ٨٤٤٠ /٢٠٦

الموضوع: تكليف .

نظـــر وقـــــدم
من النقيب جـــــاك شـــــــكور
آمر فصيلـــــة القبـــــيات
إلى العقيـــــد قائـــــد سرية حلبـــــا

بعد الأطلاع أجري المقتضى من قبل مخفر القبيات بموجب المحضر رقم ٢٠٤/٧٤٤ تاريخ ٢٠١٨/١٠/٣٠ المرفق ربطاً حيث تم بموجبه استماع افادة المسنين ومختاري بلدة عيدمون الذين اكدوا جميعهم ان العقار للمستدعي محمد عبدو جعفر وشركاه ولا توجد اية خلافات وتعذر استماع افادة الاعضاء الاختيارية لعدم وجودهم كما وتم التصحيح ووضع اسم المحلة على الخرائط .

يرجى التفضل بالأطـــلاع

القبيات في ٢٠١٨/١٠/٣٠

المديرية العامة لقوى الأمن الداخلي
التاريخ
الساعة :
الرقم : ١٨١٠ ٣١
٣٧٣٨

WTG 09

المديرية العامة لقوى الأمن الداخلي
وحـــــدة الـــــدرك
قيـــادة منطقة الشمال
قيـــادة سرية حلبـــا
فصيـــلة القبيات
مخفر القبيات

الموضوع : تكليف .

عـــدد : ٢٠٦/ ١١٨٠

المديرية العامة لقوى الأمن الداخلي
الوحـــدة : الدرك
الفصيلة : فصيلة القبيات
ورد في : ٢٠١٨/١٠/٣٠
سجل تحت عدد : ٢٠٦/٨٤٤

نظـــر وقـــدم
مـــن المؤهل اول ايليا ديب رقم ٢٥٨٨٦
رئيس مخفر القبيـــات
إلى النقيب آمـــر فصـــيلة القبيات

بعد الاطلاع اجري المقتضى بموجب المحضر رقم ٢٠٤/٧٤٤ تاريخ ٢٠١٨/١٠/٣٠ حيث تم بموجبه استماع افادة المسنين ومختاري بلدة عيدمون حيث اكدوا جميعهم ان العقار عائد للمستدعين محمد عبدو جعفر وشركاه ولا توجد اية خلافات وتعذر استماع افادة الاعضاء الاختيارية لعدم وجودهم كما وتم التصحيح ووضع اسم المحلة على الخرائط .

يرجى التفضل بالاطلاع .
القبيات في : ٢٠١٨/١٠/٣٠

WTG 09

المديرية العامة لقوى الأمن الداخلي

قيادة الدرك

منطقة الشمال

سرية حلبا

فصيلة العبدات

مخفر العبدات

عدد ٧٤٤/ ٢٠٠٤

تاريخ ٢٠/١٠/٢٠١٨

الموضوع

محضر استماع لمعلومات بالعلم والخبر المقدم من المستدعي محمد عبد وهبي وهدى عادل وهبي ويوسف علي وهبي

النسخة الـ الأولى

في الساعة السابعة من يوم الثلاثاء الموافق الثلاثون

من شهر تشرين الأول عام الفين و ثمانية عشر

نحن الملازم أول خالد الشعار رقم ٢٠٠٦٩٥ والرقيب أول عدنان الرفاعي رقم ٤٧٠٨٨ من مخفر العبدات ومرتدين اللباس العسكري نشتبه أنه بموجب مذكرة مخفرنا رقم ٧٧٦/ ٢٠٠٤ تاريخ ٢٠/٩/٢٠١٨ العلم والخبر المقدم من المستدعي محمد عبد وهبي وهدى عادل وهبي ويوسف علي وهبي للتثبت من صحة وطبيعة عقارهم الكائن في وادي خالد وبلدة عيدو وعلى أرض شاطئ بحيرة العبدات والمحال بدوراً من جانب محافظة عكار برقم ٤٤٧/ ٢٠١٨ تاريخ ٢٠/١٠/٢٠١٨ إلى جانب قيادة درك منطقة الشمال الإقليمية من مديرية الشرطة الداخلية تحت عبارة يعيد الكامل الملف الإيقاف لمن يلزم لإجراءات التحقيق وطلبات كل الحماية والمنافع والأضرار الاختيارية إنما وجدوا واستماع بعض المخاتير في البلدة وتطبيق الخرائط بالعلم والخبر حيث يذكر تسلم الحملة الى جانب البلدة وفقاً لقيادة منطقة الشمال الإقليمية برقم ٨٩٧٧/ ٢٠٠٦ ف أ تاريخ ٢٠/١٠/٢٠١٨ الإطلاع وإجراء اللازم وفقاً لما هو مطلوب بتكليف صادر عن محافظ عكار المرفق والإجراءات وفقاً لقيادة سرية حلبا الإقليمية برقم ٢٦١٨/ ٢٠٠٦ ف أ تاريخ ٢٠/١٠/٢٠١٨ إلى المنتسب آخر فصيلة العبدات للقبض والإجراءات وإلينا ما أمرت مطلبنا برقم ٢٧٠١/ ٢٠٠٦ تاريخ ٢٠/١٠/٢٠١٨ القبض والإجراءات والاستماع فقد مخفرنا برقم ١١٨٠/ ٢٠٠٦ تاريخ ٢٠/١٠/٢٠١٨ الغاية دفعنا وعليه باشرنا جمع المعلومات على الشكل التالي:

رقيب أول ٤٧٠٨٨ عدنان الرفاعي

رقيب أول ٢٠٠٦٩٥ خالد الشعار

نظر ومحول من مخفر العبدات

لحضرة قائمقام عكار

في ٢٠١٨/ ٢٠/ ١٠

العبدات

WTG 09

المديريه العامه لقوى الامن الداخلي
وحـــــدة الـــدرك
قيـــادة منطقـــة الشمال
قيـــادة سرية حلبـــا
فصيـــلة القبيـــات

عـــــدد ٨٢٠٧/٢٠٦

الموضوع : تكليف

نظـــر وأحيـــل

الى رئيس مخفر القبيات

للمتابعة والإجراء

القبيات في ٢٥/١٠/٢٠١٨

المديرية العامة لقوى الامن الداخلي
الوحدة : الدرك
الفصيلة : القبيات
ورد في ٢٥/١٠/٢٠١٨
سجل تحت عدد ١١٨٠/٢٠٦

WTG 09

المديرية العامة لقوى الأمن الداخلي
وحدة الدرك الإقليمي
قيادة منطقة الشمال الإقليمية
مكتب الخدمة والعمليات

عدد : ٢/٨٩٧/٢٠٦ م٢ أ ع
تاريخ : ٢٢/١٠/٢٠١٨

الموضوع : تكليف

المديرية العامة لقوى الأمن الداخلي
الوحدة : الدرك
القطعة : فصيلة قبيات
ورد في ٢٥/١٠/٢٠١٨
سجل تحت عدد ٢٠٦/٨٢٧

نظر وأحيل

إلى العقيد قائد سرية حلبا الإقليمية

للإطلاع وإجراء المقتضى وفقاً لما هو مطلوب بتكليف سعادة محافظ عكار المرفقة والإعادة حتى / / ٢٠١٨

المديرية العامة لقوى الأمن الداخلي
الوحدة : الدرك الإقليمي
القطعة : قيادة سرية حلبا
ورد في ٢٤/١٠/٢٠١٨
سجل تحت عدد ٢٠٦/٣٦/٨ م٢ أ ع

قائد منطقة الشمال الإقليمية
العقيد يوسف دروبي

نظر واحيل
إلى الرقيب أحمد فصيلة القبيات
للمقتضى والإعادة

WTG 09

الجمهوريـــة اللبـنانيـــة

وزارة الداخلية والبلديات

محـافظة عكـار

وثيقة احالة

ـ موضوعها :

رقم التسجيل	الجهة المرسل إليها	موضوع الاحـــالة
٢٤٧٢ / ٢٠١٨	جانب قيادة درك منطقة الشمال الإقليمية في قوى الأمن الداخلي م/ ١٠ / ٢٢ ٨٩٧٢	نعيد إليكم كامل الملف للإيعاز لمن يلزم لإعادة التحقيق وإعادة إستماع المخاتير والأعضاء الإختيارية إذا وجدوا واستماع بعد المسنين في البلدة تصحيح الخرائط والعلم والخبر بحيث يذكر اسم المحلة إلى جانب البلدة % محافظ عكار عماد اللبكي 22 OCT. 2019

WTG 09

المديرية العامة لقوى الأمن الداخلي
وحدة الدرك الإقليمي
قيادة منطقة الشمال الإقليمية
مكتب الخدمة والعمليات

عدد: ٨٤٥٥ / ٢٠٦م٢/أ.ع.
تاريخ: / /٢٠١٨

الموضوع: تكليف

لحضرة محافظ عكار

ربطاً توضيح العقيد قائد سرية حلبا بموجب المحضر رقم٦٧٦-/٢٠٤ تاريخ ٢٠/٩/٢٠١٨
المرفق ربطاً حيث تم بموجبه إجراء التحقيق.

وزارة الداخلية والبلديات - محافظة عكار
الرقم المتسلسل: ٢٤٤٥
تاريخ الورود: ٢٠/٩/٢٠١٨

التفضل بالإطلاع

قائد منطقة الشمال الإقليمية
العقيد يوسف قرويش

WTG 09

المديريه العامه لقوى الأمن الداخلي
وحدة الدرك الاقليمي
قيادة منطقة الشمال الاقليمية
قيادة سرية حلبا الاقليمية

الموضوع : تكليف .

نظر وقدّم

من العقيد مصطفى الايوبي

قائد سرية حلبا الاقليمية

إلى العقيد قائد منطقة الشمال الاقليمية

عدد :٣١٠٨/ ٢٠٦ق٢/ أ٠ع

مكتب الخدمة والعمليات م٢ /أ٠ ع

بعد الايجاب من قبل مخفر القبيات بموجب المحضر رقم ٢٠٤/٦٧٦ تاريخ ٢٠١٨/٩/٣٠ المرفق ربطا" وبنتيجة ما ورد بافادة المستدعي والمجاورين والمسنين اكدوا ان العقار للمستدعي تمت الموافقة على تاجيل الملف لغاية ٢٠١٨/١٠/٨ انفاذا" لامركم البرقي رقم ٤٦٢٠٩ تاريخ ٢٠١٨/٩/٢٤

يرجى الاطلاع

حلبا في ٢٠١٨/١٠/٣

WTG 09

المديرية العامة لقوى الأمن الداخلي
قيادة وحدة الـــــــــدرك
قيادة منطقة الشمـــــال
قيادة سرية حلبـــــا
فصيلة القبيـــــات

الموضوع : علـــم وخبـــــر

عـــدد ٦٨٥٤/ ٢٠٦

نظـــر وقـــــدم
من النقيب جـــــاك شكـــــــور
امـــــر فصيلة القبيـــات
إلـــى العقيـد قـــــائد ســـرية حلبا

بعد الاطـلاع والايجاب من قبل القطعة المعنية بموجب المحضر رقم ٢٠٤/٦٧٦ تاريخ ٢٠/ ٩/ ٢٠١٨ المرفق ربطاً وبنتيجة ما ورد بافادة المستدعي والمجاورين والمسنين ومختاري المحلة اكدوا ان العقار للمستدعي

- نهث الموافقة على تأجيل تقديم الملف لغاية ٨/١٠/٢٠١٧ انفاذاً لكتاب المرقم رقم ١٩٢٦٤ تاريخ ٢٤/٩/٢٠١٧

يرجـــى التفضل بالاطـــــلاع

٣/١٠/٢٠١٨
٢٠٦٣١٠٨

القبيات في ٢/١٠/٢٠١٧

WTG 09

المديرية العامة لقوى الأمن الداخلي
وحـــــدة الـــــدرك
قيـــادة منطقـــة الشمال
قيـــادة سرية حلبـــا
فصيـــلة القبيـــات
مخفر القبيات
عـــدد : ١٠٣٩/ ٢٠٦

الموضوع : تكليف .

نظـــر وقـــدم
من المؤهل اول ايليا ديب رقم ٢٥٨٨٦
رئيس مخفر القبيـــــات
إلـــى النقيب آمـــر فصـــيلة القبيـــات

بعد الاطلاع اجري المقتضى بموجب المحضر ٢٠٤/٦٧٦ تاريخ ٢٠١٨/٩/٣٠ حيث تم بموجبه اجراء الكشف واستماع افادة كل من المستدعي والشهود والمجاورين ومختاري البلدة المرفق ربطا .

١٩٢٦٤

تم الموافقة على تاجيل الملف لغاية ٢٠١٨/١٠/٥ بموجب برقيتكم رقم ٧٢٣٥ تاريخ ٢٠١٨/٩/٢٤ .

يرجى التفضل بالاطلاع

القبيات في ٢٠١٨/١٠/١ .

WTG 09

المديرية العامة لقوى الأمن الداخلي

قيادة: الدرك

منطقة: الشمال

سرية: طرابلس

فصيلة: الفيحاء

مخفر: الفيحاء

عدد: ٦٧٦/ع/٤

تاريخ: ٢٠/٩/٢٠١٨

الموضوع

محضر: هو معلومات بالعلم والخبر المقدم من المدعي محمد عبده جعفر

النسخة الأولى

في الساعة: العاشرة من يوم: الاحد الموافق: للثلاثون

من شهر: ايلول عام ألفين و: ثمانية عشر

نحن: المصرحان أدناه المأمور الضابط رقم ٢٦٩٥٥ والرقيب الأول عدنان الرفاعي رقم ٤٧٠٨٨ من مخفر الفيحاء ومرتدين

اللباس: العسكري بثياب مدنية لبيان ترعاء العلم والخبر المقدم من المدعي محمد عبده جعفر وعهد عادل جعفر ويوسف علي جعفر في بلدة الحيرت للتثبت من صحة ملكية عقارهم الذي يسمى في محلة كرم بناطا عبده والمحال من مالك ما نقلة عكار رقم ٤٢٧ تاريخ ٢/٩/٢٠١٨ الى حضرة قائد منطقة الشمال الاقليمية تحت عبارة الإيعاز لمن يلزم بالكشف والتحقيق للتثبت مما يلي: ان صحة ملكية عقار المقار بالنسبة الى المالكين والاطلاعات العامة والكهرباء وبيان ما اذا كان على العقار بناء وبيان تاريخ إجازة وما اذا كان مخالفا "خط المخالفة" من إدارة الملكية العقارية وبعد الكشف تخاطبنا إثنين من فعاليات البلدة في حال وجود أكثر من مختار وذلك وفقا للعلم والخبر المرفق والإيعاز ونفاذا لمنطقة الشمال الإقليمية برقم ٥٧٦٥/ع/٤ تاريخ ٦/٩/٢٠١٨ الإبلاغ وإجراء اللازم ونتائج الكشف وطلب بإحالة ما نقلة عكار المرفقة والإيعاز ونفاذا كتابة طلبنا برقم ٧٠٩/ع/٤ تاريخ ١٠/٩/٢٠١٨ للمقتضى والإيعاز وإلينا نفاذا برقم ٦٢٢٥/ع/٤ تاريخ ١٢/٩/٢٠١٨ للمقتضى والإيعاز لغاية ١٤/٩/٢٠١٨ والمأمور في مخفرنا برقم ١٠٧٩/ع/٤ تاريخ ١٤/٩/٢٠١٨ للغاية نفسها وبناء عليه رفع المعلومات كالآتي:

رقيب أول ٤٧٠٨٨ مأمور أول ٢٦٩٥٥

نظر ومحول من حضرة ضابط عدلي سلطة

في ... / ... / سنة ٢٠١٨

ملحق "٢" تابع محضر جمع البيانات رقم ٢٥٦/٢٠٠٤ تاريخ ٢/٩/٢٠١٢

"إقرار شاهد ثاني"

أنا علي جعفر بن نعمة من مواليد ١٩٥٠ في بلدة الرميثة شارع الإمام علي أتوقع إفادتي هذه أمام مراقب البناء وقسم التسجيل العقاري / البستان الأحمر هاتف لا يوجد أفيد بأن المستدعين الثلاثة محمد عبود جعفر وعادل جعفر ويوسف علي جعفر يملكون عقار غير مسجل في شارع بلدة عين دوك محلة الكرم شارع ٥ الرميثة يحده شمالاً عادل جعفر وجنوباً عبود إبراهيم جعفر وشرقاً طريق وغرباً جميل عطا وعادل جعفر وهو عقار بلا نزاع ولا تقييد أية خلافات أو نزاعات بشأنه وبيني وبين شركاء آخر على حدود وملكية هذا العقار وهذا إقرار مني

تليت عليه وأفاد بصحتها وصدقها وتوقيعها معنا

شاهد الإثبات — مختار البلدة — كاتب الضبط

"إقرار جار من الشمال والشرق والغرب"

أنا عادل جعفر بن إبراهيم من مواليد ١٩٥٠ في بلدة الرميثة حي الكرم محلة الحمري ملكي مقلم شاهد مصطفى وشارع الشهداء الوقتاعين لبناء رقم سجل العائلة ٢/٢ الحمري هاتف رقم ٢٧٠٩٨٥ أفيد بأنني أملك عقار غير مسجل في شارع بلدة عين دوك محلة الكرم شارع ٥ الرميثة يحده عقار المستدعين محمد عبود جعفر وعادل جعفر ويوسف علي جعفر من الجهات الشمالية والشرقية والغربية ولا توجد أية خلافات أو نزاعات بيني وبينهم على حدود وملكية هذا العقار وهذا إقراري

تليت عليه وأفاد بصحتها وصدقها وتوقيعها معنا

جار من الشمال والشرق والغرب — مختار البلدة — كاتب الضبط

عادل إبراهيم جعفر

WTG 09

ص "٥"

المديرية العامة لقوى الأمن الداخلي تابع لمحضر تحقيق الصبايا رقم ٦٧٦ / ٢٠٤ تاريخ ٢٠١٨/٩/٣٠

قيادة .....

منطقة .....

سرية .....

فصيلة .....

مخفر .....

عدد .....

تاريخ .....

في الساعة ..... من يوم ..... الموافق .....

من شهر ..... عام ألفين و .....

نحن .....

..... من ..... ومرتدين

اللباس الرسمي .....

"افادة"

الموضوع

محضر

النسخة الـ

نظر ومحول من .....

لحضرة .....

في ..... سنة ٢٠

نحن ضابط مدير عيدون - كرم شبلا - مورد الوحدة شاهدنا
عبد السلام وهو عطار - محل سلفيخ نشط بداخله
أجهزة البلاف وبعض أجهزة الاستجابة الى جهة "ذو الفقار"
لا يوجد بداخله أشخاص محددة كالاولاد بداخله أية
شبكات كهرباء او هاتف وهذا ما شاهدناه

رقم الـ ٤٧٠٨٨ معاون الـ ٢٦٩٥٤

تم هذا المحضر في الساعة والتاريخ المذكورين في
مقدمته وختم بتمام الساعة الساعة عشرين دقيقة
التاريخ على نسختين تقدم الاولى لجانب مرتكب
تسلمه والثانية للحفظ .

رقم الـ ٤٧٠٨٨ معاون الـ ٢٦٩٥٤

WTG 09

المديرية العامة لقوى الأمن الداخلي
وحدة الـــــدرك
قيـــادة منطقـــة الشمال
قيـــادة سرية حلبـــا
فصيـــلة القبيـــات

الموضوع : تكليف

عـــدد : ٦٢٢٥/ ٢٠٦

نظـــر و احـــيـــل

إلى رئيـــس مخفر القبيات

للسير والإجراء اللازم

٢١/٩/٢٠١٨

القبيات في ١٢/ ٩/ ٢٠١٨

المديرية العامة لقوى الأمن الداخلي
الوحدة : الدرك
الفصيلة : مخفر القبيات
ورد في ١٢ / ٩ / ٢٠١٨
سجل تحت عدد ١٢٩ / ٢٠١

WTG 09

المديرية العامة لقوى الأمن الداخلي
وحدة الدرك الإقليمي
قيادة منطقة الشمال الإقليمية
مكتب الخدمة والعمليات

عدد: ٢٠٦ م٢ أ ع
تاريخ: / / ٢٠١٨

الموضوع : تكليف

المديرية العامة لقوى الأمن الداخلي
الوحدة : الدرك
القطعة : فصيلة القبيات
ورد في ١٢/ ٩/ ٢٠١٨
سجل تحت عدد ٢٠٦/٦٢٢٥

نُظر وأُحيل

إلى العقيد قائد سرية حلبا

للاطلاع واجراء المقتضى وفقا لما هو مطلوب باحالة محافظ عكار المرفقة والاعادة لغاية ٢٠١٨/ / .

المديرية العامة لقوى الأمن الداخلي
الوحدة : الدرك الإقليمي
القطعة : قيادة سرية حلبا
ورد في ١٠/ ٩/ ٢٠١٨
سجل تحت عدد ٢٠٦/٢٧٠٩

نظر واحيل
إلى النقيب آمر فصيلة القبيات
للمقتضى والاعادة لغاية ٢٤/٩/٢٠١٨

قائد منطقة الشمال الإقليمية
العقيد يوسف درويش

طبق الأصل

WTG 09

الجمهورية اللبنانية
وزارة الداخلية والبلديات

محافظة عكار
عدد : ٢٤٧٢
حلبا في : ٢ / ٩ / ٢٠١٨

حضرة قائد منطقة درك الشمال الإقليمية

الإيعاز لمن يلزم بالكشف والتحقيق للتثبت مما يلي :

١- صحة الملكية
٢- موقع العقار بالنسبة إلى المنطقة السكنية والطرقات العامة والكهرباء
٣- بيان ما إذا كان على العقار بناء وبيان تاريخ إنجازه وإذا كان مخالفاً ضبط المخالفة
٤- أخذ إفادة المالكين والمجاورين وبعض المسنين ومختارين إثنين من مخاتير البلدة في حال وجود أكثر من مختار.

وذلك وفقاً للعلم وخبر المرفق والإعادة

المديرية العامة لقوى الأمن الداخلي
الوحدة : الدرك الإقليمي
القطعة : قيادة منطقة الشمال الإقليمية
ورد في ٢٠١٨/ ٩/ ٦
سجل تحت عدد ٢٠٦/٥ ٢٦

محافظ عكار
عماد اللبكي

٢ / ٩ / ٢٠١٨

٣ / ٩ / ٢٠١٨

عم ذ كم الملف ضربة المسافة

الجمهورية اللبنانية
محافظة عكار
وزارة الداخلية والبلديات

WTG 09

سعادة محافظ عكار المحترم

المستدعي: محمد عبدو جعفر + محمد عادل جعفر
يوسف علي جعفر
رقم الهاتف: ٠٣/١٨٧٩٨٥

الموضوع: تصديق علم و خبر

ارجو الموافقة على تصديق العلم والخبر المرفق ربطا في بلدة .....بيرشبعا - عيدمون

وتفضلوا بقبول فائق الاحترام

يوسف علي

وزارة الداخلية والبلديات - محافظة عكار
الرقم التسلسلي ٢٧٤٢
تاريخ ٢/٥/٢٠١١

WTG 09

الجمهورية اللبنانية
وزارة المالية
المديرية العامة للشؤون العقارية

نموذج رقم ٨
للشؤون العقارية

عدد ٤٢٢ تاريخ ٢٠١٨/٩/٨
٢٠١٨/٨٧٠٩٨٥

علم وخبر
القانون الصادر
بالمرسوم الاشتراعي رقم ١٢ تاريخ ٢٨ / ٢ / ١٩٣٠
- المادة ١٢ -

أمانة السجل القعاري في: .....

المحافظة : عكار ..... القضاء : عكار ..... المنطقة العقارية : حيدون ..... المحلة : كرم شباط / جورة الحرجه

رقم العقار في سجل مساحة لبنان القديم : ..... أو رقم عموم الويركو في الولايات : ..... مساحته : ٧٦٤٨ م.م

درهم : ..... قيراط : ..... حبة: .....

نوع العقار الشرعي (ملك أو أميري): .....

حدود العقار الشرعي مع أسماء : شمالاً : عادل جعفر

مع أسماء المالكين جنوباً : عبود ابراهيم ٧١/٦٨٤٤٧٥

شرقاً : طريق عادل جعفر

غرباً : جبل كفل - عادل جعفر

محتويات العقار بالتفصيل : ارض سلح

طريقة اكتساب الحق : .....

مدة وضع اليد على العقار : .....

الاشغال التي قام بها واضع اليد : .....

الغاية من طلب العلم والخبر (بيع،هبة،تأمين،...).....

المالك أو العاقد : الاسم الثلاثي محمد عبود جعفر / عبد عادل جعفر / يوسف علي جعفر ..... اسم الام : شهرزاد جعفر / كوثر جعفر / صبام ديب ..... رقم سجل النفوس : ٢٤ الحدث / الحدث ١٩٨٦ / الحدث ١٩٨٩ / الحدث ١٩٨٤ ..... توقيع العاقد : .....

محل وتارخ الولادة : ..... محل الاقامة : ..... عنوان السكن : .....

المعقود له : الاسم الثلاثي : ..... اسم الام : ..... رقم سجل النفوس : .....

محل وتارخ الولادة : ..... محل الاقامة : ..... عنوان السكن : ..... توقيع المعقود له : .....

الحق المطلوب تسجيله أو الحصة: ..... القيمة او الثمن : ..... (ل.ل.)

توقيع المختار وختمه

اسماء وتواقيع الاعضاء الاختيارية

تصديق القائمقام

- بصارف على العلم والخبر رقم ٤٢٧ تاريخ ٢٠١٨/٩/٥ الصادر لمختار كرم شباط / جورة الحرجه
١ استناداً الى محضر تحقيق تمهيدي رقم ٦٧٦ تاريخ ٢٠١٨/٩/٢٠ و ٧٢٤ تاريخ ٢٠١٨/٩/٢٤

مختار كرم شباط
عماد اللبكي
٢٠١٨/٩/٥

WTG 09

N.77

1885.9

الجمهورية اللبنانية

محافظة عكار

قضاء عكار

منطقة عيدمون (كرم شباط) العقارية

المحلة جورة المرجة

خريطة علم و خبر

مقياس 1/1000

مصطلحات

—— حدود العقار

ختم و توقيع المهندس المساح

المهندس سلطان نعيم نعيم
هندسة مساحة
ت ٠٣/٣٤٩٤٠٢
الرقم النقابي ٥١١٦

04/08/2018

يحده

شمالا عادل جعفر

شرقا طريق و عادل جعفر

جنوبا عبدو ابراهيم

غربا جبل عطل و عادل جعفر

جرى الكيل على مسؤوليتي وبالاستناد الى دلالة المجاورين و المالكين و المختار وعلى مسؤوليتهم

7634 m2

WTG 09

الجمهورية اللبنانية

محافظة عكار

قضاء عكار

منطقة عيدمون (اكرم شباط) العقارية

المحلة جورة المرجة

خريطة علم و خبر

مقياس 1/1000

مصطلحات

—— حدود العقار

ختم و توقيع المهندس المساح

المهندس سلطان نعيم نعيم
هندسة مساحة
ت: ٠٣/٣٤٩٤٠٢
الرقم النقابي ٥١١٦
04/08/2018

يحده

شمالا عادل جعفر

شرقا طريق و عادل جعفر

جنوبا عبدو ابراهيم

غربا جبل عطل و عادل جعفر

جرى الكيل على مسؤوليتي وبالاستناد الى دلالة المجاورين و المالكين و المختار وعلى مسؤوليتهم

7634 m2

مديرية العامة لقوى الأمن الداخلي
وحدة الدرك الإقليمي
يادة منطقة الشمال الإقليمية
مكتب الخدمة والعمليات
دد: ٩٢٦٦/٢٠٦م٢/أ.ع
تاريخ ١/١١/٢٠١٨

الموضوع: تكليف

لحضرة محافظ عكار

تم إجراء المقتضى بموجب المحضر رقم ٤٢/٧/٢٠٤ تاريخ ٢٠/١٠/ ٢٠١٨ المرفق ربطاً .

قائد منطقة الشمال الإقليمية

وزارة الداخلية والبلديات - محافظة عكار
الرقم المتسلسل: ٢٤٧١
تاريخ الورود: ٢/١١/٢٠١٨

القلم
تسليم المستدعي العلم والخبر
لإجراء مقتضاه
٥/١١/٢٠١٨

محافظ عكار
عماد اللبكي

WTG 10

المديريه العامه لقوى الأمن الداخلي
وحـــدة الـــــدرك الإقليمي
قيادة منطقة الشمال الإقليمية
قيادة سرية حلبا الاقليمية

عدد : ٣٨٣٩ /٢٠٦ق٢ اع

الموضوع : تكليف بشأن استدعاء مقدم من علي جعفر
من كرم شباط –عيدمون .

نظر وقدم
من العقيـــــد إيـــــلي رفـــــول
قائد سرية حلبا الاقليمية وكالة
الى العقيد قائد منطقة الشمال الاقليمية
مكتب الخدمة والعمليات م٢اع

بعد الايجاب : اجري المقتضى من قبل مخفر القبيات بموجب المحضر رقم ٢٠٤/٧٤٣ تاريخ ٢٠١٨/١٠/٣٠ المرفق ربطا" حيث تم بموجبه استماع افادة المسنين ومختاري بلدة عيدمون الذين اكدوا جميعهم ان العقار للمستدعي علي محمد جعفر ولا توجد اية خلافات وتعذر استماع افادة الاعضاء الاختيارية لعدم وجودهم كما وتم التصحيح ووضع اسم المحلة على الخرائط .

يرجى الاطلاع

حلبا في ٢٠١٨/١٠/٣١

المديرية العامة لقوى الأمن الداخلي
الوحدة :الـــدرك الإقليمي
القطعة : قيادة منطقة الشمال الإقليمية
ورد في ١ / ١١ / ٢٠١٨
سجل تحت عدد ٢٠٦/ ٩٢٦٦ م٢ اع

المديرية العامة لقوى الأمن الداخلي
وحـــــدة الـــــدرك
قيـــادة منطقـــة الشمال
قيـــادة سرية حلبـــا
فصيـــلة القبيـــات

عـــــدد : ٨٤٤١ /٢٠٦

الموضوع: تكليف .

نظـــر وقـــدم
من النقيب جـــــاك شـــــكور
آمر فصيلـــة القبـــيات
إلى العقيـــد قائـــد سرية حلبـــا

بعد الأطلاع أجري المقتضى من قبل مخفر القبيات بموجب المحضر رقم ٢٠٤/٧٤٣ تاريخ ٢٠١٨/١٠/٣٠ المرفق ربطاً حيث تم بموجبه استماع افادة المسنين ومختاري بلدة عيدمون الذين اكدوا جميعهم ان العقار للمستدعي علي محمد جعفر ولا توجد اية خلافات وتعذر استماع افادة الاعضاء الاختيارية لعدم وجودهم كما وتم التصحيح ووضع اسم المحلة على الخرائط .

يرجى التفضل بالأطـــلاع

القبيات في ٢٠١٨/١٠/٣٠

ورد في ٢٠١٨/١٠/٣١
سجل تحت عدد ٢٠٦/٨٣٩

WTG 10

المديريه العامه لقوى الامن الداخلي
وحـــــدة الـــــدرك
قيـــادة منطقـــة الشمال
قيـــادة سرية حلبـــا
فصيـــلة القبيـــات

عـــــدد : ٨٢١٠/٢٠٦

الموضوع : تكليف

نظـــر وأحيـــل

إلى رئيس مخفر الغيا

للعلم والمتابعة

القبيات في ٢٥/١٠/٢٠١٨

المديرية العامة لقوى الامن الداخلي
الوحدة : الدرك
القطعة : مخفر القبيات
ورد في ٢٥/١٠/٢٠١٨
سجل تحت عدد ١١٧٨/٢٠٦

المديرية العامة لقوى الأمن الداخلي
وحـــــدة الـــــدرك
قيـــادة منطقة الشمال
قيـــادة سرية حلبـا
فصيـــلة القبيات
مخفر القبيات

عـــــدد : ١١٧٨/ ٢٠٦

الموضوع : تكليف .

نظـــــر وقـــــدم
مـــن المؤهل اول ايليا ديب رقم ٢٥٨٨٦
رئيس مخفر القبيـــــات
إلى النقيب آمـــــر فصـــــيلة القبيات

بعد الاطلاع اجري المقتضى بموجب المحضر رقم ٢٠٤/٧٤٣ تاريخ ٢٠١٨/١٠/٣٠
حيث تم بموجبه استماع افادة المسنين ومختاري بلدة عيدمون حيث اكدوا جميعهم ان العقار
عائد للمستدعي علي محمد جعفر ولا توجد اية خلافات وتعذر استماع افادة الاعضاء
الاختيارية لعدم وجودهم كما وتم التصحيح ووضع اسم المحلة على الخرائط .

يرجى التفضل بالاطلاع .
القبيات في : ٢٠١٨/١٠/٣٠

المديرية العامة لقوى الأمن الداخلي
الوحـــدة : الـــدرك
الفصيلـــة : فصيلة القبيات
ورد في ٢٠١٨/١٠/٣٠
سجل تحت عدد ٢٠٦/٨٤٤١

WTG 10

المديرية العامة لقوى الأمن الداخلي

قيادة الدرك

منطقة الشمال

سرية حلبا

فصيلة القبيات

مخفر القبيات

عدد ٢٤٧/٢٠٤

تاريخ ٢٠/١٠/٢٠١٨

الموضوع

محضر إحالة مع معلومات بالعلم والخبر المقدم من المستدعي علي محمد حفص

النسخة الأولى

في الساعة السابعة من يوم الثلاثاء الموافق الثلاثين

من شهر تشرين الأول عام ألفين وثمانية عشر

نحن الجاويش أول خالد الشمار رتبة ٢٦٩٥٠٥ والرقيب أول عدنان الرفاعي رقم ٤٧٠٨٨ من مخفر القبيات ومرتدين اللباس العسكري نفيد بأننا وطبقاً لمحضر تاريخ ٢٠/٩/٢٠١٨ بالعلم والخبر المقدم من المستدعي علي محمد حفص المتضمن هدم وإزالة عقارات الغير صعب في ضاحية بلدة عيدمون محلة كرم رشا لا بهدم المرمة والمنازل مجدداً في مخالفة محافظة عكار برقم ٢٤١/٢٠١٨ تاريخ ٢٢/١٠/٢٠١٨ إلى مخافر قيادة درك منطقة الشمال الإقليمي وفرع الأمن الداخلي تحت إدارة الإيعاز لحضرة النائب العام الاستئنافي الجنائي وإدارة حماية الحدائق والأملاك العامة الإقليمية إننا وبعد الاستماع بعض المستدعين في البلدة وتطبيق الخرائط والعلم والخبر بحيث يتكون الحلة إلى جانب البلدة وفي قيادة منطقة الشمال الإقليمي برقم ٢٠١٦/٨٩٧٢ تاريخ ٢٧/١٠/٢٠١٨ إلى المفتش قائد سرية الإنقاذ وإجراء المقتضى وفقاً لما هو مطلوب بتكليف إدارة محافظة عكار المرفقة والإدارة ومديرية كسروان حالياً برقم ٢٠١٦/٢٦١١ تاريخ ٢٤/١٠/٢٠١٨ إلى المستدعي ومخفر القبيات للمقتضى والإدارة وإننا قمنا بإرسال كتاب برقم ٢٠١٦/٢٧١٠ تاريخ ٢٥/١٠/٢٠١٨ للمقتضى والإدارة والمدعو علي وقد حضر برقم ٢٠١٦/١١٧٨ تاريخ ٢٥/١٠/٢٠١٨ للمقابلة نفسها على ضوء جميع المعلومات حررت أعلاه الضابط التالي:

رقيب أول ٤٧٠٨٨ جاويش أول ٢٦٩٥٠٥

نظر ومحول من المديرية العامة لقوى الأمن الداخلي

لحضرة محافظ عكار بالسلك

في ٣٠/١٠/٢٠١٨

القبيات

المديرية العامة لقوى الأمن الداخلي
الوحدة الدرك الإقليمي
قيادة منطقة الشمال الإقليمية
مكتب الخدمة والعمليات

عدد : ٢ ٨٩٧/٢٠٦ م٢ أ ع
تاريخ : ٢٢/١٠/ ٢٠١٨

الموضوع : تكليف

المديرية العامة لقوى الأمن الداخلي
الوحدة : [illegible]
القطعة : [illegible]
ورد في ٢٥/١٠/٢٠١٨
سجل تحت عدد ٢٠٦/٨٢١٠

نظر وأحيل

إلى العقيد قائد سرية حلبا الإقليمية

للإطلاع وإجراء المقتضى وفقاً لما هو مطلوب بتكليف سعادة محافظ عكار المرفقة والإعادة حتى / / ٢٠١٨

المديرية العامة لقوى الأمن الداخلي
الوحدة : الدرك الإقليمي
القطعة : قيادة سرية حلبا
ورد في ٢٤/١٠/٢٠١٨
سجل تحت عدد ٢٠٦/٣٦١١

قائد منطقة الشمال الإقليمية
العقيد يوسف الحويري

نظر وأحيل
إلى النقيب آمر فصيلة الغيابات
- للعلم والإعادة.

WTG 10

الجمهوريـــة اللبـنانيـــة

وزارة الداخلية والبلديات

محـافظة عكـار

وثيقة احالة

- موضوعها :

رقم التسجيل	الجهة المرسل إليها	موضوع الاحـــالة
٢٤٧١/٢٠١٨	جانب قيادة درك منطقة الشمال الإقليمية في قوى الأمن الداخلي قوى الأمن الداخلي الوحدة المدرك الإقليمي القيادة قيادة منطقة الشمال الإقليمية وردت ٢٠١٨/١٠/٢٢ سجل ٢٠٦/٨٩٧٤	نعيد إليكم كامل الملف للإيعاز لمن يلزم لإعادة التحقيق وإعادة إستماع المخاتير والأعضاء الإختيارية إذا وجدوا واستماع بعد المسنين في البلدة تصحيح الخرائط والعلم والخبر بحيث يذكر اسم المحلة إلى جانب البلدة % محافظ عكار عماد اللبكي الجمهورية اللبنانية محافظة عكار وزارة الداخلية والبلديات 22 OCT. 2018

WTG 10

الموضوع: تكليف

المديرية العامة لقوى الأمن الداخلي
وحدة الدرك الإقليمي
قيادة منطقة الشمال الإقليمية
مكتب الخدمة والعمليات

عدد: ٢٠٦م٢/أ.ع/ ٢٤
تاريخ: / /٢٠١٨

لحضرة محافظ عكار

ربطاً توضيح العقيد قائد سرية حلبا بموجب المحضر رقم ح ٢٠٤/٧ تاريخ ٧/٩/٢٠١٨
المرفق ربطاً حيث تم بموجبه إجراء التحقيق.

التفضل بالإطلاع

قائد منطقة الشمال الإقليمية
العقيد يوسف درويش

الداخلية والبلديات - محافظة عكار
رقم التسلسل: ٢٦٧١
تاريخ الورود: ٧/٨

WTG 10

المديريه العامة لقوى الأمن الداخلي
وحدة الدرك الاقليمي
قيادة منطقة الشمال الاقليمية
قيادة سرية حلبا الاقليمية

الموضوع : تكليف .

نظر وقدّم
من العقيد مصطفى الايوبي
قائد سرية حلبا الاقليمية
إلى العقيد قائد منطقة الشمال الاقليمية
مكتب الخدمة والعمليات م٢ /أ٠ ع

عدد :٣١١٣/ ٢٠٦ق٢/ أ٠ ع

بعد الايجاب من قبل مخفر القبيات بموجب المحضر رقم ٢٠٤/٦٧٥ تاريخ ٢٠١٨/٩/٣٠ المرفق ربطا" وبنتيجة ما ورد بافادة المستدعي والمجاورين والمسنين اكدوا ان العقار للمستدعي تمت الموافقة على تاجيل الملف لغاية ٢٠١٨/١٠/٨ انفاذا" لامركم البرقي رقم ٤٦٢١١ تاريخ ٢٠١٨/٩/٢٤

يرجى الاطلاع

حلبا في ٢٠١٨/١٠/٣

قائمقامية حلبا

المديرية العامة لقوى الأمن الداخلي
الوحدة
التسلسلية
ورد
سجل تحت
٢٠١٨/١٠/٤
٨٢٥٠

المديرية العامة لقوى الأمن الداخلي
قيادة وحدة الـــــــدرك
قيادة منطقة الشمـــــال
قيادة سرية حلبـــا
فصيلة القبيـــات

عـدد ٦٨٤٩/ ٢٠٦

الموضوع : علـم وخبـــر

نظـــر وقـــدم
من النقيب جـــاك شكـــور
امـــر فصيلة القبيـــات
إلـى العقيـد قـــائد ســرية حلبا

بعد الاطلاع والايجاب من قبل القطعة المعنية بموجب المحضر رقم ٢٠٤/٦٧٥ تاريخ ٢٠/ ٩/ ٢٠١٧ المرفق ربطاً وبنتيجة ما ورد بافادة المستدعي والمجاورين والمسنين ومختاري المحلة اكدوا ان العقار للمستدعي

- نثبت الموافقة على تأجيل تقديم الملف لغاية ٨/٧/٢٠١٧ إنفاذاً لإذن مركم البرقي رقم ١٩٢٦ تاريخ ٢٢/٩/٢٠١٧

يرجـــى التفضل بالاطـــلاع

القبيات في ٢/١٠/٢٠١٧

مديرية العامة لقوى الأمن الداخلي
الوحدة : الدرك الإقليمي
المنطقة : قيادة سرية حلبا
الورد في ٣/١٠/٢٠١٧
تحت عدد ٣١١٣/٢٠٦

المديرية العامة لقوى الأمن الداخلي
وحـــــدة الـــــدرك
قيـــادة منطقـــة الشمال
قيـــادة سرية حلبـا
فصيـــلة القبيـــات
مخفر القبيات
عـــدد : ٢٠٦/ ١٠٣٤

المديرية العامة لقوى الأمن الداخلي
الوحدة : الدرك
الفصيلة : القبيات
وارد في ٢٠١٨/ ١٠/ ٢
٢٠٦/٦٨٩٩

الموضوع : تكليف .

نظـــر وقـــدم
من المؤهل اول ايليا ديب رقم ٢٥٨٨٦
رئيس مخفر القبيـــات
إلـــى النقيب آمـــر فصـــيلة القبيـــات

بعد الاطلاع اجري المقتضى بموجب المحضر ٢٠٤/٦٧٥ تاريخ ٢٠١٨/٩/٣٠ حيث تم بموجبه اجراء الكشف واستماع افادة كل من المستدعي والشهود والمجاورين ومختاري البلدة المرفق ربطا .

تم الموافقة على تاجيل الملف لغاية ٢٠١٨/١٠/٥ بموجب برقيتكم رقم ٧٢٣٣ تاريخ ٢٠١٨/٩/٢٤ .

يرجى التفضل بالاطلاع
القبيات في ٢٠١٨/١٠/١ .

WTG 10

المديرية العامة لقوى الأمن الداخلي

قيادة: الساحل

منطقة: الشمال

سرية: جبلة

فصيلة: الصبيات

مخفر: الصبيات

عدد: ٢٠٤/٦٧٥

تاريخ: ٢٠١٨/٩/٢٠

الموضوع

محضر جمع معلومات بالعلم والخبر المقدم من المدعي علي محمد جعفر

النسخة الأولى

في الساعة العاشرة من يوم الاحد الموافق للثلاثون من شهر أيلول عام ألفين وثمانية عشر

نحن المصادق أول مؤلف السرية ٢٦٩٥٤ والرقيب أول عدنان الرشاكي رقم ٤٧٠٨٨ من مخفر الصبيات ومرتدين اللباس الرسمي نثبت أنه وبناء لاستدعاء العلم والخبر المقدم من المدعي علي محمد جعفر من سكان كرم البلوط للمصادقة على حدود وملكية عقاره المفروز في نقل البيدر والحال من جريان محافظة عقار برقم ٢٠١٨/٢٤٧١ تاريخ ٢٠١٨/٩/١٢ تحت عبارة الإعمار لم يتم بالكشف والتحقيق للتثبت من:

- صحة الملكية
- بيان ما إذا كان على العقار بناء وبيان تاريخ إنجازه وإذا كان قائماً ضمن المخالفة
- صحة العقار بالنسبة إلى المنطقة السكنية والطرق العامة والأملاك البحرية.
- أخذ إفادة المالكين والمجاورين وبعض السكان ومختارين اثنين من مخاتير البلدة بحال وجود أكثر من مختار.

وذلك وفقاً للعلم والخبر المرفق والإعادة من قيادة منطقة الساحل برقم ٢٠١٨/٥٧٦٣ تاريخ ٢٠١٨/٩/٦ للإعلام وإجراء المقتضى وفقاً لما هو مطلوب بتشكيل لجنة من موظفي عقار والإعمار ومن قيادة سرية جبلة برقم ٢٠١٨/٢٣٤ تاريخ ٢٠١٨/٩/١٠ للكشف والإعادة ومن إدارة فصيلة الصبيات برقم ٢٠١٨/٦٢٤ تاريخ ٢٠١٨/٩/١٢ للكشف والإعادة والمثبت في قيود مخفرنا برقم ٢٠١٨/١٠٢٤ تاريخ ٢٠١٨/٩/١٢ لغاية الآن.

وعليه تم جمع المعلومات على الشكل التالي:

رقيب أول ٤٧٠٨٨ — مصادق أول ٢٦٩٥٤

نقل ومحول من المحضرة عقار سابقاً

الى الصبيات في ٢٠ / ٩ / ٢٠١٨ سنة

"ص ٢"

تابع محضر معاينة رقم ٢٧٥/٢٠١٨ تاريخ ٢٠/٩/٢٠١٨

وقد سجل الفاكس ٢٤/ الحبيب هاتف ٠٧٠٤٦٨٢٤ منذ ثلاث سنوات ملك عقاري مع ملك T5 شاطئ محلة بحر الكويت يحد عقار المستدعي في الجهتين الشرقية والغربية ① ولا توجد أية خلافات أو نزاعات بيني وبينه على حدود وملكية هذا العقار ولا توجد أي من المعارضات على هذا الملك والحد وهذه إفادتي تليت عليه إفادته فصدق قرأ ووقع معنا

① والجهة الشمالية مجاور عباس بهبهاني

مجاور من الشرق والغرب والشمال رقم سجل ٤٧٠٨٨٨ معاون ٢٦٩٥٠٤

عباس بهبهاني

رقم سجل ٤٧٠٨٨٨ معاون ٢٦٩٥٠٤

"إفادة شاهد أول"

يسمى: علي جعفر بن محمد والذي رفع جعفر محمد الحداد الحبشي عام ١٩٤٢ وسنه ثلاثة وستون شاطئ مالكي مقاول مقاول متقاعد الجنسية اللبناني رقم سجل العائلي ٤٥ محافظة الحبشي هاتف ٠٧٠٤٦٠٥٤ أقسم بأن المستدعي علي محمد جعفر يملك عقار عبارة عن مجمع في فرع بلدة عيدو محلة كرم شاطئ بحر الكويت يحده شمالاً عبد الله حسين جعفر وشرقاً فرانق وعبد الله حسين جعفر وجعفر أحمد فرانق وحسين محمد جعفر وغرباً جبل عطا وعبد الله حسين جعفر وهو عقار بعل ملك ولا توجد أية خلافات أو نزاعات بينه وبين أي شخص آخر على حدود وملكية هذا العقار وهذه إفادتي تليت عليه إفادته فصدق قرأ ووقع معنا

شاهد أول رقم سجل ٤٧٠٨٨٨ معاون ٢٦٩٥٠٤

علي جعفر

"إفادة شاهد ثاني"

يسمى: علي جعفر بن نعيم والذي أفاد جعفر محمد الحداد اللبناني عام ١٩٦١ وسنه بلدة الكويت T شاطئ مالكي رقم إفادة مقاول مزارع لبناني رقم سجل العائلي ٤٠ محافظة الأول هاتف لا يوجد أقسم بأن المستدعي علي محمد جعفر يملك عقار عبارة عن مجمع في فرع بلدة عيدو محلة كرم شاطئ بحر الكويت يحده شمالاً عبد الله حسين جعفر وشرقاً فرانق وعبد الله حسين جعفر وجعفر أحمد فرانق وحسين محمد جعفر وغرباً جبل عطا وعبد الله

شاهد ثاني رقم سجل ٤٧٠٨٨٨ معاون ٢٦٩٥٠٤

علي جعفر

WTG 10

ص "٥"

المديرية العامة لقوى الأمن الداخلي تابع محضر معلومات رقم ٢٠٠/٢٠١٨ تاريخ ٢٠/٩/٢٠١٨

قيادة .....

منطقة .....

سرية .....

فصيلة .....

مخفر .....

عدد .....

تاريخ .....

في الساعة ..... من يوم ..... الموافق .....

من شهر ..... عام ألفين و .....

نحن .....

..... من ..... ومرتدين

اللباس الرسمي .....

الموضوع

- الإفادة وضابطة تتهم استناداً لبرقية مكتب الجرائم المعلوماتية رقم ٢٤٨٩٨ تاريخ ١٦/٩/٢٠١٨ "الكشف"

محضر .....

- طالع سيادة عبدون كرم شمالاً - جورة المرجة شاهدنا عقار ١١ شرقي وهو عقار بعل سنيخ منشط قليلاً بداخله أعمدة البلان ولا يوجد بداخله أي آثار مخدرة أو مواد مخدرة ولا يوجد بداخله آبار ارتوازية أو أي شبكات مياه أو كهرباء أو غاز وهذا ما شاهدناه

رقيب أول ٤٧٠٨٨ معاون أول ٢٦٩٥٤

- تم هذا المحضر في اليوم والتاريخ المذكورين أعلاه وختم بتمام الساعة الساعة عشرين دقيقة من يوم الاثنين تقدم أول نجاب محافظة عكار تسلماً والتاريخ للحفظ.

رقيب أول ٤٧٠٨٨ معاون أول ٢٦٩٥٤

النسخة الـ .....

نظر ومحول من .....

لحضرة .....

في ..... سنة ٢٠

المديرية العامة لقوى الأمن الداخلي
وحـــــدة الـــــدرك
قيـــادة منطقـــة الشمال
قيـــادة سرية حلبـــا
فصيـــلة القبيـــات

عـــدد: ٦٢٤١/ ٢٠٦

الموضوع : تكليف
======

نظـــر و احـــيـــل

إلى رئيـــس مخفر القبيات

للبحث والاعادة لغاية ٢٠١٨/٩/١٢

القبيات في ١٢/ ٩/ ٢٠١٨

المديرية العامة لقوى الأمن الداخلي
الوحدة
القبيات
٢٠١٨/ ٩/ ١٢
٢٩/ ١٠٢٤

الموضوع : تكليف

المديرية العامة لقوى الأمن الداخلي
وحدة الدرك الإقليمي
قيادة منطقة الشمال الإقليمية
مكتب الخدمة والعمليات

عدد: ٥٧٦٣/ ٢٠٦م٢ أ ع
تاريخ: / / ٢٠١٨

المديرية العامة لقوى الأمن الداخلي
الوحدة :
القطعة : قيادة سرية حلبا
ورد في ١٠/ ٩/ ٢٠١٨
سجل تحت عدد ٢٠١/٢٤٠

نُظر وأُحيل
إلى العقيد قائد سرية حلبا

للاطلاع واجراء المقتضى وفقا لما هو مطلوب باحالة محافظ عكار المرفقة
والاعادة لغاية / / ٢٠١٨ .

المديرية العامة لقوى الأمن الداخلي
الوحدة : الدرك الإقليمي
القطعة : قيادة سرية حلبا
ورد في ١٠/ ٩/ ٢٠١٨
سجل تحت عدد ٢٠٦/٢٧٣٤

قائد منطقة الشمال الإقليمية
العقيد يوسف درويش

نظر واحيل
إلى النقيب آمر فصيلة القبيات
للاقتضاء والإعادة لغاية ٢٤/٩/٢٠١٨

WTG 10

الجمهورية اللبنانية

محافظة عكار

قضاء عكار

منطقة عيدمون (اكرم شباط) العقارية

المحلة جورة المرجة

المهندس سلطان نعيم نعيم
هندسة مساحة
الرقم النقابي ٥١١٦

خريطة علم و خبر

مقياس 1/1000

مصطلحات

—— حدود العقار

ختم و توقيع المهندس المساح

04/08/2018

يحده

شمالا عباس جعفر

شرقا طريق و عباس جعفر

جنوبا طريق و حسين جعفر

غربا جبل عطل و عباس جعفر

منطقة كرم شباط

عباس جعفر

جبل عطل

على جعفر

طريق

حسين جعفر

حسين جعفر

المساحة ٦٣١٢م م

Y = 35400

X = -265100

X = -265200

Y = 35300

إسادي كل طوابع المجاورين موقعة اصولاً
عن مختار عيدمون نسيم عبد الله يوسف الحاج
في ٢٠١٨/٨/٢٠

جرى الكيل على مسؤوليتي وبالاستناد الى دلالة المجاورين و المالكين و المختار وعلى مسؤوليتهم

6312 m2

WTG 10

الجمهورية اللبنانية

محافظة عكار

قضاء عكار

منطقة عيدمون (كرم شباط) العقارية

المحلة جورة المرجة

خريطة علم و خبر

مقياس 1/1000

مصطلحات

—— حدود العقار

ختم و توقيع المهندس المساح

04/08/2018

يحده

شمالا عباس جعفر

شرقا طريق و عباس جعفر

جنوبا طريق و حسين جعفر

غربا جبل عطل و عباس جعفر

جرى الكيل على مسؤوليتي وبالاستناد الى دلالة المجاورين و المالكين و المختار وعلى مسؤوليتهم

6312 m2

WTG 10

الجمهورية اللبنانية
وزارة الداخلية والبلديات

محافظة عكار

عدد : ٢٧٤

حلبا في : ٢ / ٩ / ٢٠١٨

حضرة قائد منطقة درك الشمال الإقليمية

الإيعاز لمن يلزم بالكشف والتحقيق للتثبت مما يلي :

١- صحة الملكية
٢- موقع العقار بالنسبة إلى المنطقة السكنية والطرقات العامة والكهرباء
٣- بيان ما إذا كان على العقار بناء وبيان تاريخ إنجازه وإذا كان مخالفاً ضبط المخالفة
٤- أخذ إفادة المالكين والمجاورين وبعض المسنين ومختارين إثنين من مخاتير البلدة في حال وجود أكثر من مختار.

وذلك وفقاً للعلم وخبر المرفق والإعادة

المديرية العامة لقوى الأمن الداخلي
الوحدة : الدرك الإقليمي
القطعة : قيادة منطقة الشمال الإقليمية
ورد في ٢٠١٨/٩/٧
سجل تحت رقم ٢٠٦/٥٧٦٢

محافظ عكار
عماد اللبكي

٢٠١٨/٩/٣

٢٠١٨/٩/٤

WTG 10

سعادة محافظ عكار المحترم

المستدعي: علي محمد جعفر رقم الهاتف: ٧١٨٢٢٢٠٤

الموضوع: تصديق علم و خبر

ارجو الموافقة على تصديق العلم والخبر المرفق ربطا في بلدة طرفا شباطا عيدون

وتفضلوا بقبول فائق الاحترام

وزارة الداخلية والبلديات - محافظة عكار
الرقم المتسلسل ٢٩٧١
تاريخ الورود ٢/٦/٢٠١٩

WTG 10

الجمهورية اللبنانية
وزارة المالية
المديرية العامة للشؤون العقارية

الشؤون العقارية

علم وخبر

القانون الصادر

أمانة السجل العقاري في ..... بالمرسوم الإشتراعي رقم 12 تاريخ 1930/2/28

_ المادة 12 _

المحافظة عكار القضاء عكار المنطقة العقارية عيدمون المحلة كرم صياط / حدود الرجوه

رقم العقار في سجل مساحة لبنان القديم: ..... أو رقم عموم الويركو في الولايات: ..... مساحته: 6212 م.م.

درهم ..... قيراط ..... حبة .....

نوع العقار الشرعي (ملك أو أميري) .....

حدود العقار مع أسماء المالكين المجاورين

شمالاً: عكاب جعفر

شرقاً: طريق + عكاب جعفر

جنوباً: طريق + عكاب جعفر

غرباً: جبل عطل + عكاب جعفر

محتويات العقار بالتفصيل: ارض سلمى

طريقة اكتساب الحق: ..... المالك السابق .....

مدة وضع اليد على العقار: ..... (مصدر وضع اليد ..... ، .....)

الأشغال التي قام بها وضع اليد: .....

الغاية من طلب العلم وخبر (بيع، هبة، تأمين....) .....

~~المالك أو العاقد~~ : الأسم الثلاثي ..... اسم الأم ..... رقم سجل النفوس ..... محل وتاريخ الولادة ..... محل الإقامة ..... عنوان السكن ..... توقيع العاقد

المعقود له: الأسم الثلاثي علي محمد جعفر اسم الأم انتصار رقم سجل النفوس 24/محمرة محل وتاريخ الولادة 1972 محل الإقامة الميزان عنوان السكن الميزان - 1 توقيع المعقود له

الحق المطلوب تسجيله أو الحصة: ..... القيمة أو الثمن ..... (ل.ل.)

أسماء وتواقيع الأعضاء الإختيارية

توقيع المختار وختمه

تصديق القائمقام

• وفقاً لقرار المعاملة رقم 2471/2018 الصادر عن مختار عيدمون استناداً لأحكام القرار رقم 2005/6 تاريخ 2018/9/20 و 2018/43 تاريخ 2018/10/20

محافظ عكار

عمر البكري

2018/12/5

WTG 11

مديرية العامة لقوى الأمن الداخلي
وحدة الدرك الإقليمي
يادة منطقة الشمال الإقليمية
مكتب الخدمة والعمليات
دد: ٩٢٧٠/٢٠٦م٢/أ.ع
تاريخ ١/١١/٢٠١٨

الموضوع: تكليف

لحضرة محافظ عكار

تم إجراء المقتضى بموجب المحضر رقم ٢٠٤/٧٤٢ تاريخ ٢٠/١٠/ ٢٠١٨ المرفق ربطاً .

وزارة الداخلية والبلديات - محافظة عكار
الرقم المتسلسل: ٢٤٧٢
تاريخ الورود: ٢/١١

قائد منطقة الشمال الإقليمية

القائم
تسليم المستند إلى الحاكم والخبر
لقاء ترقيته ٪
٥/١١

محافظ عكار
عماد الشيخي

WTG 11

المديريه العامه لقوى الأمن الداخلي
وحـــــدة الـــــدرك الإقليمي
قيادة منطقة الشمال الإقليمية
قيادة سرية حلبا الاقليمية

الموضوع : تكليف بشأن استدعاء مقدم من حسين جعفر
من كرم شباط –عيدمون .

عدد : ٣٨٤٠ /٢٠٦ق٢ اع

نظر وقدم
من العقيـــــد إيـــــلي رفـــــول
قائد سرية حلبا الاقليمية وكالة
الى العقيد قائد منطقة الشمال الاقليمية
مكتب الخدمة والعمليات م٢اع

بعد الايجاب : اجري المقتضى من قبل مخفر القبيات بموجب المحضر رقم ٢٠٤/٧٤٢ تاريخ ٢٠١٨/١٠/٣٠ المرفق ربطا" حيث تم بموجبه استماع افادة المسنين ومختاري بلدة عيدمون الذين اكدوا جميعهم ان العقار للمستدعي حسين محمد جعفر ولا توجد اية خلافات وتعذر استماع افادة الاعضاء الاختيارية لعدم وجودهم كما وتم التصحيح ووضع اسم المحلة على الخرائط .

يرجى الاطلاع

حلبا في ٢٠١٨/١٠/٣١

المديرية العامة لقوى الأمن الداخلي
الوحدة :الـــدرك الإقليمي
القطعة : قيادة منطقة الشمال الإقليمية
ورد في ١ / ١١ / ٢٠١٨
سجل تحت عدد ٢٠٦/ ٩٢٧٠ م/أ

المديرية العامة لقوى الأمن الداخلي
وحـــــدة الـــــدرك
قيـــادة منطقـــة الشمال
قيـــادة سرية حلبـــا
فصيـــلة القبيـــات

عـــــدد : ٨٤٤٣ /٢٠٦

الموضوع: تكليف .

نظـــر وقـــــدم
من النقيب جـــــاك شـــــــكور
آمر فصيلـــــة القبـــــيات
إلى العقيـــــد قائـــــد سرية حلبـــــا

بعد الأطلاع أجري المقتضى من قبل مخفر القبيات بموجب المحضر رقم ٢٠٤/٧٤٢ تاريخ ٢٠١٨/١٠/٣٠ المرفق ربطاً حيث تم بموجبه استماع افادة المسنين ومختاري بلدة عيدمون الذين اكدوا جميعهم ان العقار للمستدعي حسين محمد جعفر ولا توجد اية خلافات وتعذر استماع افادة الاعضاء الاختيارية لعدم وجودهم كما وتم التصحيح ووضع اسم المحلة على الخرائط .

يرجى التفضل بالأطـــلاع

القبيات في ٢٠١٨/١٠/٣٠

المديرية العامة لقوى الأمن الداخلي
الوحدة : الدرك الإقليمي
القلعة : قيادة سرية حلبا
ورد في ٢٠١٨/ ١٠ / ٣١
سجل تحت عدد ٢٠٦/٣٨٤

WTG 11

المديرية العامة لقوى الأمن الداخلي
وحـــــــدة الـــــــدرك
قيـــــادة منطقة الشمال
قيـــــادة سرية حلبـــا
فصيـــلة القبيات
مخفر القبيات

عـــــدد : ١١٨٢/ ٢٠٦

الموضوع : تكليف .

نظـــــر وقـــــدم
مـــن المؤهل اول ايليا ديب رقم ٢٥٨٨٦
رئيس مخفر القبيـــــات
إلى النقيب آمـــــر فصـــيلة القبيات

بعد الاطلاع اجري المقتضى بموجب المحضر رقم ٢٠٤/٧٤٢ تاريخ ٢٠١٨/١٠/٣٠

حيث تم بموجبه استماع افادة المسنين ومختاري بلدة عيدمون حيث اكدوا جميعهم ان العقار

عائد للمستدعي حسين محمد جعفر ولا توجد اية خلافات وتعذر استماع افادة الاعضاء

الاختيارية لعدم وجودهم كما وتم التصحيح ووضع اسم المحلة على الخرائط.

يرجى التفضل بالاطلاع .

القبيات في : ٢٠١٨/١٠/٣٠

المديرية العامة لقوى الأمن الداخلي
الوحـــدة : الـــدرك
القطعـــة : فصيلـة القبيات
ورد في ٢٠ / ١٠ / ٢٠١٨
سجل تحت عدد ٢٠٦/٨٤٤٢

WTG 11

المديرية العامة لقوى الأمن الداخلي

قيادة الدرك

منطقة الشمال

سرية طرابلس

فصيلة الميناء

مخفر الميناء

عدد ٤٤٧/٠٤

تاريخ ٢٠/١٠/٢٠١٨

في الساعة السابعة من يوم الثلاثاء الموافق الثلاثين

من شهر تشرين الأول عام الفين وثمانية عشر

نحن المعاون أول خالد الشعار رقم ٢٦٥٥٤ والرتيب أول

عدنان الرفاعي رقم ٤٧٠٨٨ من مخفر الميناء ومرتدين

اللباس العسكري نثبت أننا وصلنا إلى محلة رقم ٤/٦٧

تابع ٢٠/٩/٢٠١٨ بالعلم والخبر المقدم من المستدعي حسين

محمد وهبي المثبت لكمية وملكية عقار الفيرمي

في هذا وبالكشف وجدنا محلة [illegible] بشاطئ مرسى الميناء والمحال

محضر بجمع معلومات جديداً من مخابرات محافظة عكار برقم ٤٧٧/٢٠١٨ تاريخ ٢٠/١٠/

٢٠١٨ الى مخابرات فرع درك منطقة الشمال الإقليمية

في قوى الأمن الداخلي تحت إشراف سيد الكل الملف

للإيعاز لمن يلزم لإجراء التحقيق وإلقاء القبض على المتهمين

والذي هذا الإخبار يفيد بأنه وجد وبحوزة بعض المشتبه

في البدء بتصنيع الخمائر والعلم والخبر نثبت بذلك

المحلة الى مخابرات البدء في فرع منطقة الشمال

الإقليمية برقم ٨٩٧٤/٢٠١٦ تاريخ ٢٠/١٠/٢٠١٨

الى العقيد قائد سرية طرابلس الإقليمية للإطلاع وإجراء

المقتضى وفقاً لما هو واجب بتكليف مخابرات محافظة عكار

المرفقة الإجراءات وفيما يلي كتاب طلب برقم ٢٤٢٦/٢٠١٦

تاريخ ٢٠/١٠/٢٠١٨ الى النيابة العامة في محكمة الجنايات

للمقتضى والإجراءات القانونية كتاب النائب العام برقم ٢٠٠٨/٢٠١٦

تاريخ ٢٠/١٠/٢٠١٨ المتضمن الموافقة في منح

مخفر الميناء برقم ١٨٨/٢٠١٦ تاريخ ٢٠/١٠/٢٠١٨ للغاية نفسها

وعليه نرفع المعلومات جديداً على الشكل التالي:

رتيب أول ٤٧٠٨٨ معاون أول ٢٦٥٥٤

الموضوع

محضر بجمع معلومات جديداً من مخابرات محافظة عكار برقم ٤٧٧/٢٠١٨ تاريخ ٢٠/١٠/٢٠١٨ بالعلم والخبر المقدم من المستدعي حسين محمد وهبي

النسخة الأصلية

ينظر ويحول من المحكمة العسكرية الدائمة

لحضرة محافظ عكار

في ٢٠/١٠/٢٠١٨

الميناء

المديرية العامة لقوى الأمن الداخلي
وحـــــدة الـــــدرك
قيـــادة منطقـــة الشمال
قيـــادة سرية حلبـــا
فصيـــلة القبيـــات

عـــــدد ٢٠٦/٨٢٠٥

الموضوع : تكليف

نظـــر وأحيـــل

إلى ..... رئيس مخفر القبيات .....

..... للتنظيم والمتابعة .....

.....

.....

.....

القبيات في ٢٠١٨/١٠/٢٥

المديرية العامة لقوى الأمن الداخلي
الوحـــدة : الـــدرك
القطعـــة : مخفر القبيات
ورد في ٢٥/١٠/٢٠١٨
سجل تحت عدد ٢٠٦/١١٨٢

WTG 11

المديرية العامة لقوى الأمن الداخلي
وحدة الدرك الإقليمي
قيادة منطقة الشمال الإقليمية
مكتب الخدمة والعمليات

عدد : ٤ ٨٩٧/٢٠٦ م٢ أ ع
تاريخ : ٢٢/١٠/٢٠١٨

الموضوع : تكليف

المديرية العامة لقوى الأمن الداخلي
الوحدة : الدرك
القطعة : سرية حلبا
ورد في ٢٥ / ١٠ / ٢٠١٨
سجل تحت عدد ٢٠٦/٨٢٥

نظر وأحيل

إلى العقيد قائد سرية حلبا الإقليمية

للإطلاع وإجراء المقتضى وفقاً لما هو مطلوب بتكليف سعادة محافظ عكار المرفقة والإعادة حتى / / ٢٠١٨

المديرية العامة لقوى الأمن الداخلي
الوحدة : الدرك الإقليمي
القطعة : قيادة سرية حلبا
ورد في ٢٤ / ١٠ / ٢٠١٨
سجل تحت عدد ٢٠٦/٣٦٢٤

قائد منطقة الشمال الإقليمية
العقيد يوسف درويش

قائد السرية
قيادة سرية حلبا

نظر واحيل
إلى النقيب آمر فصيلة الفيات
- للمقتضى والإعادة.

WTG 11

الجمهوريـــة اللبـنانيـة

وزارة الداخلية والبلديات

محـافظة عكـار

وثيقة احالة

- موضوعها :

رقم التسجيل	الجهة المرسل إليها	موضوع الاحـــالة
٢٤٧٢ / ٢٠١٨	جانب قيادة درك منطقة الشمال الإقليمية في قوى الأمن الداخلي	نعيد إليكم كامل الملف للإيعاز لمن يلزم لإعادة التحقيق وإعادة إستماع المخاتير والأعضاء الإختيارية إذا وجدوا واستماع بعد المسنين في البلدة تصحيح الخرائط والعلم والخبر بحيث يذكر اسم المحلة إلى جانب البلدة % محافظ عكار عماد اللبكي 22 OCT. 2019

WTG 11

المديرية العامة لقوى الأمن الداخلي
وحدة الدرك الإقليمي
قيادة منطقة الشمال الإقليمية
مكتب الخدمة والعمليات
عدد: ٢٠٦/م٢/أ.ع.
تاريخ: / /٢٠١٨

الموضوع: تكليف

لحضرة محافظ عكار

ربطاً توضيح العقيد قائد سرية حلبا بموجب المحضر رقم ٢٠٤/م٧ تاريخ ٢/٩/٢٠١٨ المرفق ربطاً حيث تم بموجبه إجراء التحقيق.

وزارة الداخلية والبلديات محافظة عكار
الرقم المتسلسل: ٢٤٧٧
تاريخ الورود: ٧/٩/١٨

التفضل بالإطلاع

قائد منطقة الشمال الإقليمية
العقيد يوسف درويش

WTG 11

المديريه العامه لقوى الأمن الداخلي
وحدة الدرك الاقليمي
قيادة منطقة الشمال الاقليمية
قيادة سرية حلبا الاقليمية

الموضوع : تكليف .

نظر وقدّم

من العقيد مصطفى الايوبي

قائد سرية حلبا الاقليمية

إلى العقيد قائد منطقة الشمال الاقليمية

عدد :٣١٠٩ /٢٠٦ق٢/ أ٠ع مكتب الخدمة والعمليات م٢ /أ٠ ع

بعد الايجاب من قبل مخفر القبيات بموجب المحضر رقم ٢٠٤/٦٧٤ تاريخ ٢٠١٨/٩/٣٠ المرفق ربطا" وبنتيجة ما ورد بافادة المستدعي والمجاورين والمسنين اكدوا ان العقار للمستدعي تمت الموافقة على تاجيل الملف لغاية ٢٠١٨/١٠/٨ انفاذا" لامركم البرقي رقم ٤٦٢١٠ تاريخ ٢٠١٨/٩/٢٤

يرجى الاطلاع

حلبا في ٢٠١٨/١٠/٣

وزارة الداخلية والبلديات
قوى الأمن الداخلي
قيادة منطقة الشمال الاقليمية
ورد في ٢٠١٨/١٠/٤
سجل تحت عدد ٢٠٦/٨٤٥٤

المديرية العامة لقوى الأمن الداخلي
قيادة وحدة الـــــــــدرك
قيادة منطقة الشمـــــال
قيادة سرية حلبـــــا
فصيلة القبيـــات

الموضوع : علـم وخبـــر

عـــدد ٦٨٥٢/ ٢٠٦

نظـــر وقـــــدم
من النقيب جـــــاك شكـــــــور
امـــــر فصيلة القبيـــات
إلـــى العقيـد قـــــائد ســـرية حلبا

بعد الاطـلاع والايجاب من قبل القطعة المعنية بموجب المحضر رقم ٦٧٤/ ٢٠٤
تاريخ ٢٠/ ٩/ ٢٠١٨ المرفق ربطاً وبنتيجة ما ورد بافادة المستدعي والمجاورين
والمسنين ومختاري المحلة اكدوا ان العقار للمستدعي

تم الموافقة على تأجيل تقديم الملف لغاية ٨/١٠/٢٠١٨ إنفاذاً لكتابكم البريدي رقم ١٩٢٦٥ تاريخ ٢٤/٩/٢٠١٨

يرجـــى التفضل بالاطـــــلاع

القبيات في ٢/١٠/٢٠١٨

المديرية العامة لقوى الأمن الداخلي
الوحدة : الدرك الإقليمي
قيادة سرية حلبا
١٨١٠/٣
٣١٠٩ ق أ ع

WTG 11

المديرية العامة لقوى الأمن الداخلي
وحـــــــدة الـــــــدرك
قيـــادة منطقـــة الشمال
قيـــادة سرية حلبـــا
فصيـــلة القبيـــات
مخفر القبيات
عـــــدد : ١٠٣٧/ ٢٠٦

الموضوع : تكليف .

نظـــر وقـــدم
من المؤهل اول ايليا ديب رقم ٢٥٨٨٦
رئيس مخفر القبيـــــات
إلـــى النقيب آمـــر فصـــيلة القبيـــات

المديرية العامة لقوى الأمن الداخلي
الوحـــدة : الـــدرك
الفصيلة : فصيلة القبيات
ورد في ٢/١٠/٢٠١٨
سجل تحت عدد ٢٠٦/٦٨٥٢

بعد الاطلاع اجري المقتضى بموجب المحضر ٢٠٤/٦٧٤ تاريخ ٢٠١٨/٩/٣٠ حيث تم بموجبه اجراء الكشف واستماع افادة كل من المستدعي والشهود والمجاورين ومختاري البلدة المرفق ربطا .

١٩٢٦٥

تم الموافقة على تاجيل الملف لغاية ٢٠١٨/١٠/٥ بموجب برقيتكم رقم ٧٢٣٤ تاريخ ٢٠١٨/٩/٢٤ .

يرجى التفضل بالاطلاع

القبيات في ٢٠١٨/١٠/١ .

WTG 11

المديرية العامة لقوى الأمن الداخلي

قيادة: الدرك

منطقة: الشمال

سرية: حلبا

فصيلة: العبدات

مخفر: العبدات

عدد: ٦٧٤/٢٠٤

تاريخ: ٢٠١٨/٩/٢٠

في الساعة: الواحدة من يوم: الاربعاء الموافق: للثلاثون

من شهر: ايلول عام الفين و: ثمانية عشر

نحن: المساعد اول ... الرقم ٢٦٩٥٤ والمتطوع اول ... الرقم ٤٧٠٨٨ من مخفر العبدات ومرتدين اللباس: الرسمي بناءً على نشرة الدورية لاستقاء العلم والخبر المقدم من المدعي حسين محمد جعفر بن ... على وجود ... عقارية ... في بلدة ... بناء مخالف على العقار رقم ... تاريخ ٢٠١٨/٩/٢٠ بحي عقارية الايطاليين بالكرنتينا والتحقيق للتثبت من:

- صحة المعلومة.
- موقع العقار بالنسبة الى المنطقة الاعتبارية والاطراف العائد والكهرباء.
- بيان ما اذا كان على العقار بناء وبيان تاريخ انجازه واذا كان مخالفاً ضبط المخالفة.

- اخذ افادة المالكين والجيران وبعض المسنين ومختارين اثنين من مخاتير البلدة بحال وجود اكثر من مختار.

وذلك وفقاً للعلم والخبر المرفق والاعادة ومن مديرية محافظة الشمال رقم ٥٧٦٦/٢٠٢٦ تاريخ ٢٠١٨/٩/٦ بالاطلاع والجري المصلحة وفقاً لما هو مطلوب بتكليف صادر عن محافظ عكار والاعادة ومن مديرية ... رقم ١٢٢٨/٢٠٢٦ قاع للمصلحة والاعادة ومن امانة ... العبدات رقم ١٢٢٩/٢٠٢٦ تاريخ ٢٠١٨/٩/١٢ للمصلحة والاعادة والمدعى عليه ... رقم ١٢٢٧/٢٠٢٦ تاريخ ٢٠١٨/٩/١٢ المرفق طيه وعليه تم جمع المعلومات على الشكل التالي:

رتيب اول ٤٧٠٨٨ مطابقة اول ٢٦٩٥٤

الموضوع

محضر جمع معلومات بالعلم والخبر المقدم من المدعي حسين محمد جعفر

النسخة الاولى -١-

نظر ومحول من: الدائرة اول رئيس مخفر العبدات

لمحضرة: محافظ عكار

سنة ٢٠١٨

WTG.11

ص "٢"

تابع محضر الضبط رقم ٢٠١٤/٦٧٤ تاريخ ٢٠١٨/٢/٩

أنني أملك عقار غير مسجل في بلدة [illegible] مساحة [illegible] م٢ محاط بحدود عقار المستدعي من الجهة الجنوبية والغربية وله تقريباً ثلاثة أعوام أنا وأبناء بنتي وبنت على حدود وملكية هذا العقار ولم يتعرض أحد من المعارضين على هذا الكلام والحدود هذا ما لدي تليت عليه إفادته فجاءت مطابقة لما دون معها

محاور من الجنوب والغرب رقم الهوية ٤٧٠١٨٨ مخابرات ٢٦٩٥٤

[illegible]

"إفادة شاهد أول"

اسمي: حسن جعفر بن محمد والدي جعفر مواليد ١٩٤٣ / حوران الشيخ وسكانها شقاره وكرم شباط حسيفا علكي متعلم متأهل مقيم عرفي الحسن البيانات سجل ٢٥ / حوران الشيخ هاتف ٠٧٧٦٢١٥٣ أقسم بالله العظيم أن حسين محمد جعفر عليان عقار غير مسجل في بلدة عيدون على حكم شباط ورثه عن والده ولا توجد بينه وبين الجارين أي نزاعات على حدود وملكية العقار وعقار العقار من الشمال عقار عبد جعفر ومحمد نايف وعلي جعفر ومن الشرق طريق وعقار علي جعفر ومن الجنوب عقار عبد جعفر وطريق ومن الغرب جبل عطل وعقار عبد حسين جعفر وهذه إفادتي

تليت عليه إفادته فصدقها ووقع معها

شاهد أول رقم الهوية ٤٧٠١٨٨ مخابرات ٢٦٩٥٤

حسن محمد جعفر

"إفادة شاهد ثاني"

اسمي: علي جعفر بن إبراهيم والدي أمه جعفر مواليد ١٩٦١ البشابشة وسكانها شقاره وكرم شباط حسيفا متعلم متأهل مزارع بياناتي سجل ٢٥ / البشابشة هاتف لا يوجد أقسم بالله العظيم أن حسين جعفر عليان عقار غير مسجل في بلدة عيدون حكم شباط ولا توجد أي نزاعات بينه وبين أي شخص آخر على حدود وملكية العقار وهذه إفادتي

تليت عليه إفادته فصدقها ووقع معها

شاهد ثاني رقم الهوية ٤٧٠١٨٨ مخابرات ٢٦٩٥٤

علي جعفر

WTG 11

"حرية"

المديرية العامة لقوى الأمن الداخلي

تابع محضر مخفر الصبيات رقم ٢٠٤/٦٧٤ تاريخ ٣٠/٩/٢٠١٨

قيادة .....

منطقة .....

سرية .....

فصيلة .....

مخفر .....

عدد .....

تاريخ .....

في الساعة ..... من يوم ..... الموافق .....

من شهر ..... عام ألفين و .....

نحن .....

..... من ..... ومرتدين

اللباس الرسمي .....

الموضوع

محضر .....

النسخة الـ

نظر ومحول من .....

لحضرة .....

في ..... سنة ٢٠

ملاحقات مختلفة بحقهم استناداً لبرقية مكتب العمليات الجوابية رقم ٢٠٨٩٨٦ تاريخ ١٣/٩/٢٠١٨ "الكشف"

خراج بلدة عيدمون - كرم شبال - جورة الرجة شاهدنا عقار المشتكى وهو عبارة عن سلخ منطقة بداخله أجرام البلاك وبعض أجرام من الأشجار الحرجية "اللزاب" ولا يوجد بداخله أي أشجار مثمرة أو أي شبكات مياه أو كهرباء أو بناء وهذا ما شاهدناه.

رقيب أول ٤٧٠٨٨ معاون أول ٢٦٩٥٤

[illegible]

نتيجة المحضر في الساعة والتاريخ المذكورين في مقدمته وتم بتمام الساعة الرابعة عشر من نفس التاريخ على نسختين تقدم الأولى لجانب محافظة عكار والثانية للحفظ

رقيب أول ٤٧٠٨٨ معاون أول ٢٦٩٥٤

[illegible]

المديرية العامة لقوى الأمن الداخلي
وحـــــدة الـــــدرك
قيـــادة منطقـــة الشمال
قيـــادة سرية حلبـــا
فصيـــلة القبيـــات

عـــدد: ٦٢٢٦/ ٢٠٦

الموضوع: ثالثة

نظـــر و احـــيـــل

إلى رئيـــس مخفر القبيات

للسعي والاعلام لغاية ٢١/٩/٢٠١٨

القبيات في ١٤/٩/٢٠١٨

المديرية العامة لقوى الأمن الداخلي
الوحدة: الدرك
الفصيلة: مخفر القبيات
ورد في ١٤/٩/٢٠١٨
سجل تحت عدد ٢٠٦/١٠٢٧

المديرية العامة لقوى الأمن الداخلي
وحدة الدرك الإقليمي
قيادة منطقة الشمال الإقليمية
مكتب الخدمة والعمليات

عدد: ٥٧٦٦ / ٢٠٦ م٢ أ ع
تاريخ: / / ٢٠١٨

الموضوع : تكليف

نُظر وأُحيل

إلى العقيد قائد سرية حلبا

المديرية العامة لقوى الأمن الداخلي
الوحدة : الدرك
القطعة : فصيلة القبيات
ورد في ٢٠١٨/٩/١٢
سجل تحت عدد ٢٠٧٦٢٢٦

للاطلاع واجراء المقتضى وفقا لما هو مطلوب باحالة محافظ عكار المرفقة والاعادة لغاية ٢٠١٨/٩/٢٤ .

المديرية العامة لقوى الأمن الداخلي
الوحدة : الدرك الإقليمي
القطعة : قيادة سرية حلبا
ورد في ١٠ / ٩ / ٢٠١٨
سجل تحت عدد ٢٠٦/٧٥٣٨

نظر وأحيل
إلى النقيب مرفصلة القبيات
للمقتضى واعادة لغاية ٢٠١٨/٩/٢٤

قائد منطقة الشمال الإقليمية
العقيد يوسف درويش

WTG 11

الجمهورية اللبنانية
وزارة الداخلية والبلديات

محافظة عكار
عدد: ٢٤٧٢
حلبا في: ٢/ ٩/ ٢٠١٨

حضرة قائد منطقة درك الشمال الإقليمية

الإيعاز لمن يلزم بالكشف والتحقيق للتثبت مما يلي :

١- صحة الملكية
٢- موقع العقار بالنسبة إلى المنطقة السكنية والطرقات العامة والكهرباء
٣- بيان ما إذا كان على العقار بناء وبيان تاريخ إنجازه وإذا كان مخالفاً ضبط المخالفة
٤- أخذ إفادة المالكين والمجاورين وبعض المسنين ومختارين إثنين من مخاتير البلدة في حال وجود أكثر من مختار

وذلك وفقاً للعلم وخبر المرفق والإعادة

المديرية العامة لقوى الأمن الداخلي
الوحدة: الدرك الإقليمي
القطعة: قيادة منطقة الشمال الإقليمية
ورد في ٦/ ٩/ ٢٠١٨
سجل تحت عدد ٥٧٦٦/ ٢٠٦

محافظ عكار
عماد اللبكي

٢/ ٩/ ٢٠١٨

الجمهورية اللبنانية
محافظة عكار
وزارة الداخلية والبلديات

WTG 11

سعادة محافظ عكار المحترم

المستدعي: حسين محمد جعفر

رقم الهاتف: ٠٣/١٩٤٩٢٥

الموضوع: تصديق علم و خبر

ارجو الموافقة على تصديق العلم والخبر المرفق ربطا في بلدة .....بيرة شيخ - عيرمون

وتفضلوا بقبول فائق الاحترام

وزارة الداخلية والبلديات - محافظة عكار
الرقم التسلسلي ٢٤٧٢
تاريخ الورود ٢/٨/٢٠٢٤

WTG 11

الجمهورية اللبنانية
وزارة المالية
المديرية العامة للشؤون العقارية

نموذج رقم
الشؤون العقارية

علم وخبر

القانون الصادر

بالمرسوم الإشتراعي رقم 12 تاريخ 1930/2/28

المادة 12

أمانة السجل العقاري في .....

المحافظة ..... القضاء ..... المنطقة العقارية ..... المحلة .....

رقم العقار في سجل مساحة لبنان القديم: ..... أو رقم عموم الويركو في الولايات: ..... مساحته: ..... م.م.

درهم ..... قيراط ..... حبة .....

نوع العقار الشرعي (ملك أو أميري) .....

حدود العقار مع أسماء المالكين المجاورين

شمالاً: .....

شرقاً: .....

جنوباً: .....

غرباً: .....

محتويات العقار بالتفصيل: .....

طريقة اكتساب الحق: ..... المالك السابق .....

مدة وضع اليد على العقار: ..... (مصدر وضع اليد ..... ، .....)

الأشغال التي قام بها وضع اليد: .....

الغاية من طلب العلم وخبر (بيع، هبة، تأمين....) .....

المالك أو العاقد: الأسم الثلاثي ..... اسم الأم ..... رقم سجل النفوس ..... محل وتاريخ الولادة ..... محل الإقامة ..... عنوان السكن ..... توقيع العاقد

المعقود له: الأسم الثلاثي ..... اسم الأم ..... رقم سجل النفوس ..... محل وتاريخ الولادة ..... محل الإقامة ..... عنوان السكن ..... توقيع المعقود له

الحق المطلوب تسجيله أو الحصة: ..... القيمة أو الثمن ..... (ل.ل.)

أسماء وتواقيع الأعضاء الإختيارية

توقيع المختار وختمه

تصديق القائمقام

محافظ عكار

عماد اللبكي

WTG 11

الجمهورية اللبنانية

محافظة عكار

قضاء عكار

منطقة عيدمون (اكرم شباط) العقارية

المحلة جورة المريحة

خريطة علم و خبر

مقياس 1/1000

مصطلحات

—— حدود العقار

ختم و توقيع المهندس المساح

04/08/2018

يحده

شمالا عبدو محمد جعفر و على جعفر

شرقا طريق و على جعفر

جنوبا طريق و عباس جعفر

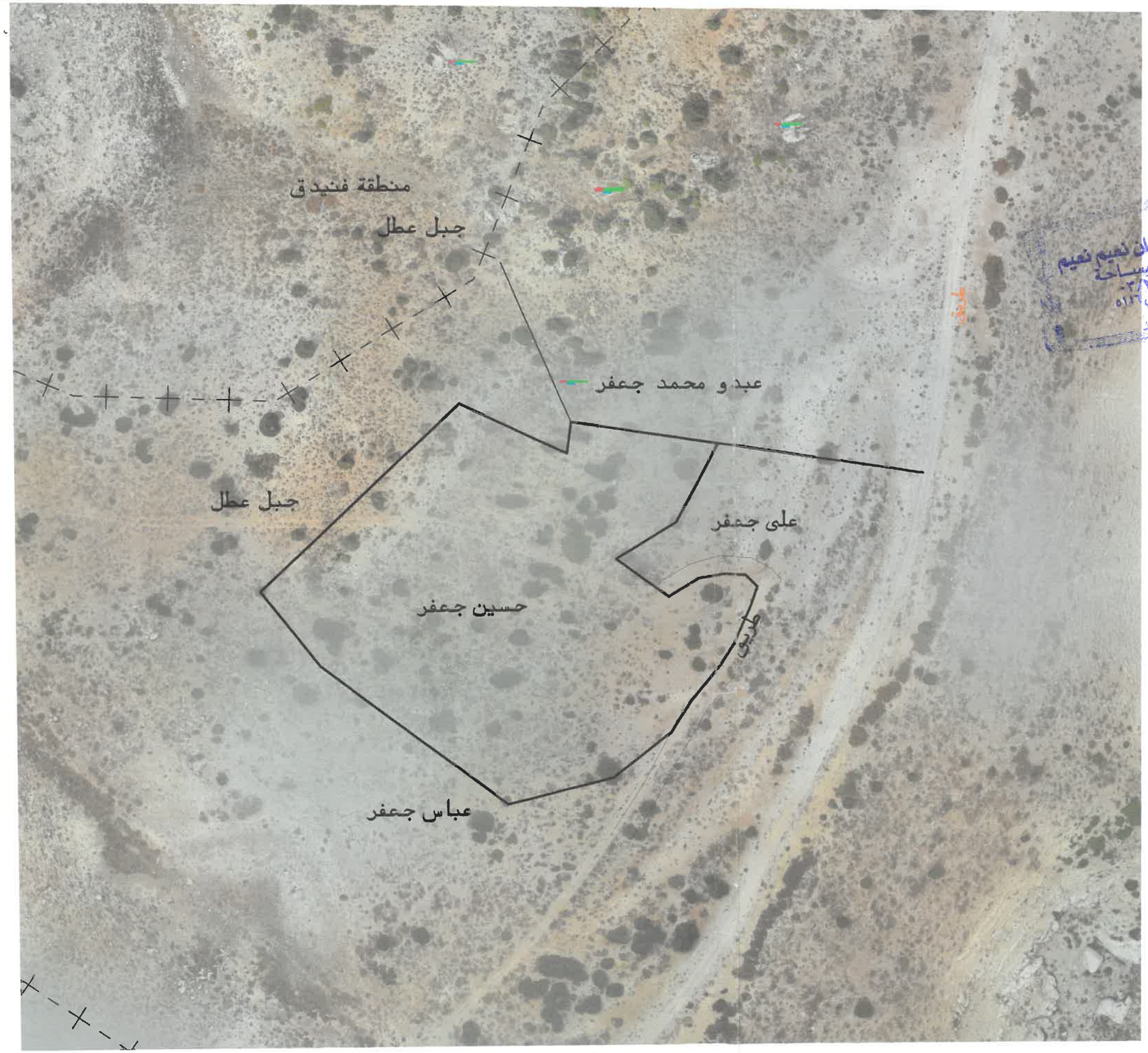
غربا جبل عطل و عباس جعفر

المساحة ٧٢٣٦م م

جرى الكيل على مسؤوليتى وبالاستناد الى دلالة المجاورين و المالكين و المختار وعلى مسؤوليتهم

7236 m2

WTG 11



الجمهورية اللبنانية

محافظة عكار

قضاء عكار

منطقة عيدمون (كرم شباط) العقارية

المحلة حوش

خريطة علم و خبر

مقياس 1/1000

مصطلحات

—— حدود العقار

ختم و توقيع المهندس المساح

المهندس سلطان نعيم نعيم
هندسة مساحة
٠٣/٣٤٩٤٠١
الرقم النقابي ٥١٢

المهندس سلطان نعيم نعيم
هندسة مساحة
٠٣/٣٤٩٤٠١
الرقم النقابي ٥١٢
04/08/2018

يحده

شمالا عبدو محمد جعفر و على جعفر

شرقا طريق و على جعفر

جنوبا طريق و عباس جعفر

غربا جبل عطل و عباس جعفر

المساحة ٧٢٣٦م م

جرى الكيل على مسؤوليتى وبالاستناد الى دلالة المجاورين و المالكين و المختار وعلى مسؤوليتهم

7236 m2

WTG 12

الجمهورية اللبنانية
وزارة المالية
المديرية العامة للشؤون العقارية

إفادة عقارية

القاضي العقاري في الشمال

بناءً على الطلب المقدم من السيد

تاريخ ١١/١٠/٢٠١٨

ولدى مراجعة قيود السجل العقاري أعطيت هذه الإفادة الشاملة - الجزئية

المنطقة العقارية فنيدق النوع العقاري: أميري

رقم العقار	اسم الموقع	محتويات ووصف العقار	الحقوق العينية والوقوعات	المساحة بالأمتار المربعة	الحصة		أسماء المالكين ومقدار الحصص باعتبار الكامل المين وأربعمائة سهم
					مرسهم	سهم	
٢٦	قرانة عن الفزوم	قطعة ارض بعل	سليمى	٢٤٠			بلدية فنيدق

هذا بعض الأسعار الحالية

إن هذا المخطط هو قيد الدراسة وهو عرضة لكل تعديل.

اعطيت هذه الافادة [illegible] التحديد الموقت
مع الإشارة الى [illegible] في ما بعد
حتى انتهاء [illegible] للقاضي
العقاري واعلانها [illegible] ثلاثون يوماً.

استوفي الرسم بموجب [illegible]

طرابلس في ١١/١٠/٢٠١٨ سنة

القاضي العقاري في
رئيس القلم
واغدة علدة

وزارة المالية

المديرية العامة لقوى الأمن الداخلي
وحدة الدرك الإقليمي
قيادة منطقة الشمال الإقليمية
مكتب الخدمة والعمليات
عدد: ٩٢٧٤/٢٠٦م٢/ع.

الموضوع: تكليف

لحضرة محافظ عكار

تاريخ ١/١١/٢٠١٨

تم إجراء المقتضى بموجب المحضر رقم ٢٠٤٧٤٠ تاريخ ٣٠/١٠/ ٢٠١٨ المرفق ربطاً .

قائد منطقة الشمال الإقليمية

العلم
تسليم المستند العام والمرفقات
لنظارة ترميمه
٥/١١/٢٠١٨
محافظ عكار
عماد اللبكي

WTG 13

المديريه العامه لقوى الأمن الداخلي
وحـــدة الـــدرك الإقليمي
قيادة منطقة الشمال الإقليمية
قيادة سرية حلبا الاقليمية

عدد : ٣٧٣٥ /٢٠٦ق٢ اع

الموضوع : تكليف بشأن استدعاء مقدم من كامل جعفر من كرم شباط –عيدمون .

نظر وقدم
من العقيـــد إيـــلي رفـــول
قائد سرية حلبا الاقليمية وكالة
الى العقيد قائد منطقة الشمال الاقليمية
مكتب الخدمة والعمليات م٢اع

بعد الايجاب : اجري المقتضى من قبل مخفر القبيات بموجب المحضر رقم ٢٠٤/٧٤٠ تاريخ ٢٠١٨/١٠/٣٠ المرفق ربطا" حيث تم بموجبه استماع افادة المسنين ومختاري بلدة عيدمون الذين اكدوا جميعهم ان العقار للمستدعي كامل محمد جعفر ولا توجد اية خلافات وتعذر استماع افادة الاعضاء الاختيارية لعدم وجودهم كما وتم التصحيح ووضع اسم المحلة على الخرائط .

يرجى الاطلاع

حلبا في ٢٠١٨/١٠/٣١

المديرية العامة لقوى الأمن الداخلي
الوحدة :الـــدرك الإقليمي
القطعة : قيادة منطقة الشمال الإقليمية
ورد في ١ / ١١ / ٢٠١٨
سجل تحت عدد ٩٢٧ /٢٠٦ ع اع

WTG 13

المديرية العامة لقوى الأمن الداخلي
وحـــــدة الـــــدرك
قيـــادة منطقـــة الشمال
قيـــادة سرية حلبـا
فصيـــلة القبيـــات

عـــــدد : ٨٤٣٨ /٢٠٦

الموضوع: تكليف :

نظـــر وقـــــدم
من النقيب جـــــاك شـــــكور
آمر فصيلـــــة القبـــــيات
إلى العقيـــــد قائـــــد سرية حلبـــا

بعد الأطلاع أجري المقتضى من قبل مخفر القبيات بموجب المحضر رقم ٢٠٤/٧٤٠ تاريخ ٢٠١٨/١٠/٣٠ المرفق ربطاً حيث تم بموجبه استماع افادة المسنين ومختاري بلدة عيدمون الذين اكدوا جميعهم ان العقار للمستدعي كامل محمد جعفر ولا توجد اية خلافات وتعذر استماع افادة الاعضاء الاختيارية لعدم وجودهم كما وتم التصحيح ووضع اسم المحلة على الخرائط .

يرجى التفضل بالأطـــلاع

القبيات في ٢٠١٨/١٠/٣١

المديرية العامة لقوى الأمن الداخلي
الوحدة : الدرك الاقليمي
القطعة : السرية حلبا
ورد في ٢٠١٨/١٠/٣١
سجل تحت ٢٠٦/٣٧٣٥

المديريه العامة لقوى الأمن الداخلي
وحـــــدة الـــــدرك
قيـــادة منطقة الشمال
قيـــادة سرية حلبـا
فصيـــلة القبيات
مخفر القبيات

عـــــدد : ٢٠٦/ ١١٨٣

المديرية العامة لقوى الأمن الداخلي
الوحـــدة : الـــدرك
الفصيلـــة : فصيلة القبيات
ورد في ٢٠١٨/١٠/٣٠
سجل تحت عدد ٢٠٦/٨٤٢٨

الموضوع : تكليف .

نظـــــر وقـــــدم
مـــن المؤهل اول ايليا ديب رقم ٢٥٨٨٦
رئيس مخفر القبيـــات
إلى النقيب آمـــــر فصـــيلة القبيات

بعد الاطلاع اجري المقتضى بموجب المحضر رقم ٢٠٤/٧٤٠ تاريخ ٢٠١٨/١٠/٣٠
حيث تم بموجبه استماع افادة المسنين ومختاري بلدة عيدمون حيث اكدوا جميعهم ان العقار
عائد للمستدعي كامل محمد جعفر ولا توجد اية خلافات وتعذر استماع افادة الاعضاء
الاختيارية لعدم وجودهم كما وتم التصحيح ووضع اسم المحلة على الخرائط .

يرجى التفضل بالاطلاع .
القبيات في : ٢٠١٨/١٠/٣٠

WTG 13

المديرية العامة لقوى الأمن الداخلي

قيادة: الدرك

منطقة: الشمال

سرية: حلبا

فصيلة: العبدات

مخفر: العبدات

عدد: ٤٠/٧/٤

تاريخ: ٢٠/١٠/٢٠١٨

في الساعة: السابعة من يوم: الثلاثاء الموافق: الثلاثين

من شهر: تشرين الأول عام الفين و: ثمانية عشر

نحن: المعاون أول فادي عمار رقم ٢٦٩٥٤ والرتيب أول

عدنان الرفاعي رقم ٤٧٠٨٨ من مخفر العبدات ومرتدين

اللباس العسكري بشكل قانوني وطنا على محضرنا رقم ٤٧/٢٠١٨

تاريخ ٢٠/٩/٢٠١٨ بالعلم والخبر المقدم من المدعي كامل محمد

حسن المشتكي من صحة وملكية عقاره الغير المسجل في

مخفر بلدة عبدات ملك كريم شباط ابنة الجبر والحال

جديداً من جانب محافظة عكار برقم ٤٧٠/٢٠١٨ تاريخ

٢٢/١٠/٢٠١٨ الى جانب قيادة درك منطقة الشمال

الإقليمية في قسم الدرك الداخلي نفت عمار حضر اليكم

كامل الملف للإيعاز لمن يلزم بإجراء التحقيق وإجراءات

إستماع الخاضعين والذين يفيد إليهم قيادة إذا وجدوا

وإستماع بعض الشهود في البلدة وتطبيق الخرائط والعلم

والخبر بذلك يتم الملف الى جانب البلدة وفصيلة

منطقة الشمال الإقليمية برقم ٨٩٧/٢٠١٨ وتاريخ

تاريخ ٢٣/١٠/٢٠١٨ الى الفصيلة قامت بالإطلاع

وإجراء المقتضى وفقاً لما هو مطلوب بتكليف سيارة

محافظة عكار المرفقة والإيعاز وفق قيادة

مراسلة برقم ٢٦٥٠٠/٢٠١٦ تاريخ ٢٢/١٠/٢٠١٨ للمقتضى

والإيعاز وإلتزام صورة مصلحتنا برقم ٢٠٨٠/٢٠١٦

تاريخ ٢٥/١٠/٢٠١٨ للمقتضى والإيعاز صالح وفي

حينه مرفقاً برقم ١١٨٢/٢٠١٦ تاريخ ٢٥/١٠/٢٠١٨

للغاية نفسها وعليه صار جمع المعلومات جديداً على

الشكل التالي:

رتيب أول ٤٧٠٨٨ معاون أول ٢٦٩٥٤

(توقيع) (توقيع)

① الموضوع

محضر جمع معلومات بالعلم والخبر المقدم من المدعي كامل محمد حسن

النسخة الأصلية

نظر ومحول من قيادة الدرك الإقليمي

لحضرة محافظ عكار

في ٢٠١٨/١٠/٣٠ سنة

قيادة الدرك الإقليمي

WTG 13

ملاحظات: لم يحضر أعضاء إضافيين في بلدية عيدون
نظم هذا المحضر في الساعة والتاريخ المذكورين في
مقدمته وفتح الساعة التاسعة تماما وقع تسليمه
للمدير الأول مع الملف لباب محافظة عكار والثانية
للخط.

بيت أول ٤٧.٨٨ معاذ أول ٥٦٩٥٥٤

المديرية العامة لقوى الأمن الداخلي
وحـــــدة الـــــدرك
قيـــادة منطقـــة الشمال
قيـــادة سرية حلبـــا
فصيـــلة القبيـــات

عـــــدد ٤ ٨٢٠/٢٠٦

الموضوع : تحليف

نظـــر وأحيـــل

إلى/ رئيس محفر القبيات

المحافظ والسلام

القبيات في ٢٥/١٠/٢٠١٨

المديرية العامة لقوى الأمن الداخلي
الوحدة : الدرك
الفصيلة : مخفر القبيات
ورد في ٢٥/١٠/٢٠١٨
سجل تحت عدد ١١٨٢/٢٠٦

المديرية العامة لقوى الأمن الداخلي
وحدة الدرك الإقليمي
قيادة منطقة الشمال الإقليمية
مكتب الخدمة والعمليات

عدد : ١/٨٩٧/٢٠٦ م٢ أ ع
تاريخ : / / ٢٠١٨

الموضوع : تكليف

المديرية العامة لقوى الأمن الداخلي
الوحدة : الدرك
التعليمة : فصيلة القبيات
ورد في ٢٤ / ١٠ / ٢٠١٨
سجل تحت عدد ٢٠٦/٨٢٠٤

نظر وأحيل

إلى العقيد قائد سرية حلبا الإقليمية

للإطلاع وإجراء المقتضى وفقاً لما هو مطلوب بتكليف سعادة محافظ عكار المرفقة والإعادة حتى / / ٢٠١٨

المديرية العامة لقوى الأمن الداخلي
الوحدة : الدرك الإقليمي
التعليمة : قيادة سرية حلبا
ورد في ٢٤ / ١٠ / ٢٠١٨
سجل تحت عدد ٢٠٦/٣٦٢٥ م أ ع

قائد منطقة الشمال الإقليمية
العقيد يوسف درويش

نظر وأحيل
إلى النقيب مركز فصيلة القبيات
- للاطلاع والإجراء اللازم.
حلبا ٢٤/١٠/١٨

WTG 13

الجمهوريـــة اللبـنانيـــة

وزارة الداخلية والبلديات

محـــافظة عكـــار

وثيقة احالة

- موضوعها :

رقم التسجيل	الجهة المرسل إليها	موضوع الاحـــالة
٢٤٧٠/٢٠١٨	جانب قيادة درك منطقة الشمال الإقليمية في قوى الأمن الداخلي	نعيد إليكم كامل الملف للإيعاز لمن يلزم لإعادة التحقيق وإعادة إستماع المخاتير والأعضاء الإختيارية إذا وجدوا واستماع بعد المسنين في البلدة تصحيح الخرائط والعلم والخبر بحيث يذكر اسم المحلة إلى جانب البلدة % محافظ عكار عماد اللبكي

قيادة الدرك لقوى الأمن الداخلي
الشمال الإقليمي
٢٠١٩/١٠/٢٢
٢٠٦/٨٩٧١

الجمهورية اللبنانية
محافظة عكار
وزارة الداخلية والبلديات

22 OCT. 2019

الموضوع: تكليف

المديرية العامة لقوى الأمن الداخلي
وحدة الدرك الإقليمي
قيادة منطقة الشمال الإقليمية
مكتب الخدمة والعمليات

عدد: / ٢٠٦م٢/أ.ع.
تاريخ: / /٢٠١٨

لحضرة محافظ عكار

ربطاً توضيح العقيد قائد سرية حلبا بموجب المحضر رقم ٢٠٤/٦٢٢ تاريخ ٢/٩/٢٠١٨
المرفق ربطاً حيث تم بموجبه إجراء التحقيق.

التفضل بالإطلاع

قائد منطقة الشمال الإقليمية
العقيد يوسف درويش

وزارة الداخلية والبلديات - محافظة عكار
رقم التسلسل: ٢٤٧
تاريخ الورود: ١٠/٨

WTG 13

الموضوع : تكليف .

المديريه العامه لقوى الأمن الداخلي
وحدة الدرك الاقليمـــــــي
قيادة منطقة الشمال الاقليمية
قيادة سرية حلبا الاقليمية

عدد :٣١١٢ /٢٠٦ق٢/ أ٠ع

نظر وقدّم
من العقيـــــد مصطفى الايوبـــــي
قائد سرية حلبا الاقليمية
إلى العقيد قائد منطقة الشمال الاقليمية
مكتب الخدمة والعمليات م٢ /أ٠ ع

بعد الايجاب من قبل مخفر القبيات بموجب المحضر رقم ٢٠٤/٦٧٢ تاريخ ٢٠١٨/٩/٣٠ المرفق ربطا" وبنتيجة ما ورد بافادة المستدعي والمجاورين والمسنين اكدوا ان العقار للمستدعي تمت الموافقة على تاجيل الملف لغاية ٢٠١٨/١٠/٨ انفاذا" لامركم البرقي رقم ٤٦٢٠٦ تاريخ ٢٠١٨/٩/٢٤

يرجى الاطلاع

حلبا في ٢٠١٨/١١/٣

٢٠١٨ ١٠ ٤
٨٤٥١

المديرية العامة لقوى الأمن الداخلي
قيادة وحدة الـــــــدرك
قيادة منطقة الشمـــــال
قيادة سرية حلبـــا
فصيلة القبيـــات

الموضوع : علـم وخبـــر

عـدد ٦٨ / ٢٠٦

نظـــر وقـــدم
من النقيب جـــاك شكـــور
امـــر فصيلة القبيـــات
إلـى العقيـد قـــائد ســـرية حلبا

بعد الاطـلاع والايجاب من قبل القطعة المعنية بموجب المحضر رقم ٢ ٦٧/ ٢٠٤
تاريخ ٢٠/ ٩ /٢٠١٧ المرفق ربطاً وبنتيجة ما ورد بافادة المستدعي والمجاورين
والمسنين ومختاري المحلة اكدوا ان العقار للمستدعي
- إنفاذاً لـ ؟مركم البرقي رقم ١٩٢٦١ تاريخ ٢٤/٩/٢٠١٧ تمت الموافقة على تأجيل تقديم الملف
٢٠١٧/

يرجـــى التفضل بالاطـــلاع

القبيات في ٢ / ١ / ٢٠١٨

المديرية العامة لقوى الأمن الداخلي
الوحدة : الدرك الإقليمي
الشعبة : قيادة سرية حلبا
٢٠١٨ / ١ / ٣
٢٠٦ / ٣ / ٦ / ٢

المديرية العامة لقوى الأمن الداخلي
وحـــــدة الـــــدرك
قيـــادة منطقـــة الشمال
قيـــادة سرية حلبـــا
فصيـــلة القبيـــات
مخفر القبيات
عـــدد : ١٠٣٨/ ٢٠٦

الموضوع : تكليف .

نظـــر وقـــدم
من المؤهل اول ايليا ديب رقم ٢٥٨٨٦
رئيس مخفر القبيـــــات
إلـــى النقيب آمـــر فصـــيلة القبيـــات

بعد الاطلاع اجري المقتضى بموجب المحضر ٢٠٤/٦٧٢ تاريخ ٢٠١٨/٩/٣٠ حيث تم بموجبه اجراء الكشف واستماع افادة كل من المستدعي والشهود والمجاورين ومختاري البلدة المرفق ربطا .

تم الموافقة على تاجيل الملف لغاية ٢٠١٨/١٠/٥ بموجب برقيتكم رقم ٧٢٣٨ تاريخ ٢٠١٨/٩/٢٤ .

يرجى التفضل بالاطلاع
القبيات في ٢٠١٨/١٠/١ .

WTG 13

المديرية العامة لقوى الأمن الداخلي

قيادة: الدرك

منطقة: الشمال

سرية: جبيل

فصيلة: القبيات

مخفر: القبيات

عدد: ٢٠٤/٢٧٢

تاريخ: ٣٠/٩/٢٠١٨

الموضوع

محضر جمع معلومات بالعلم والخبر المقدم من كامل محمد جعفر للتثبت من ملكية عقار في محلة الرمشاية

النسخة الـ

الأولى

في الساعة: العاشرة من يوم: الاحد الموافق: للثلاثون

من شهر: أيلول عام ألفين و: ثمانية عشر

نحن: المعاون أول جاد الشهابي ع ٢٦٩٥٤ والمسيح أول عدنان الرفاعي ع ٤٧٠٨٨ من: مخفر القبيات ومرتدين اللباس العسكري نثبت انه وبناء الطلب المقدم من المدعو كامل محمد جعفر موضوع بالعلم والخبر عن عقار غير مفرز في محلة أم شيط تلة المصبوب والحال في حدود محافظة عكار بتاريخ ٢/٩/٢٠١٨ الى حضرة قائد منطقة الشمال الاقليمية تحت عبارة الايعاز لمباشرة بالكشف والتحقيق للتثبت مما يلي: الى الملكية ع موقع العقار بالنسبة الى المنطقة الاثرية والطرقات العامة والكهرباء ٢٥ سنة ماذا كان في العقار بناء وسنة تاريخ انجازه واذا كان مخالفاً ضبط المخالفة واخذ افادة المالكين والجيران وبعض المسنين ومختارين اثنين من مخاتير البلدة في حال وجود اكثر من مختار وذلك وفقاً للعلم والخبر المرفق والاعادة الى قيادة منطقة الشمال الاقليمية برقم ٥٧٦٤/ت م أ ع تاريخ ٦/١٠/٢٠١٨ للاطلاع واجراء اللازم وفقاً لما هو مطلوب بالاضافة الى محافظ عكار العرفية ومنفذ سرية جبيل برقم ٤٧١/ت ق أ تاريخ ١٠/١٠/٢٠١٨ للاقتضاء والاعادة والينا من امر فصلنا برقم ٣٣٤/ت تاريخ ٢٠/١٠/٢٠١٨ للاقتضاء والاعادة لغاية ٢١/١٠/٢٠١٨ والمدعو كامل قيود مختار برقم ٢٢٤/ت للفاعلية نفتح عليه صار جمع المعلومات على الشكل التالي

/افادة مستدعي/

اسمي كامل جعفر بن محمد والدتي خديجة جعفر مواليد الهرمل ١٩٤٢ مسكن بلدة الريحة بالكي معلم متأهل موظف سابق لبناني في سجلي ٢٧/جبل الحشيش ط ق ٢٧٤٢٥/٢٠١

مستدعي

كامل جعفر

الموصل الى رئيس مخفر القبيات

نظر ومحول من

لحضرة محافظ عكار

في ٢٠١٨/١٠/٢٠

ملاحظة

ص "٢"

تابع محاضر محضر الجلسات رقم ٦٥٢/٢٠١٢ تاريخ ٢٠/٩/٢٠١٨

بجلسة التحقيق هالتت ٥٢ . ٦٥٢/٢٠١٢ تبين أن المستدعي كامل محمد جعفر يملك عقارين مزروعين في ضاحية بلدة عيدون محلة الـ T وشارع الأنابيب الجبور حده شمالاً عبد الله جعفر وطريق مشتركاً مجرى ماء وعبد الله جعفر وجنوباً جبل عطا ومنزلاً جبل عطا وطريق وهو مختار بلدة بلغ لا تتعدى أية فلانات بينه وبين أي شخص آخر على حدود وملكية هذا العقار وهذه إفادتي.

تليت عليه إفادته فأقر بها وختم معنا

شاهد أول — رقم الهوية ٩٧٠٨٨٨١١ — مواليد ١٩٦٥ — [illegible]

محمد جعفر

"إفادة شاهد ثان"

أنا: علي جعفر نديم والدي أحمد جعفر مواليد البلدة عام ١٩٦١ وسكان بلدة المروحين الـ T وشارع الأنابيب أوقع إفادتي هذه أنا أهل ضاعية لبنان رقم سجلي العائلي ٢٢ البلدة الأهل هالتت لا يعد جبل أن المستدعي كامل محمد جعفر يملك عقارين مزروعين في ضاحية بلدة عيدون محلة الـ T وشارع الأنابيب الجبور حده شمالاً عبد الله جعفر وطريق مشتركاً مجرى ماء وعبد الله جعفر وجنوباً جبل عطا ومنزلاً جبل عطا وطريق ولا تتعدى أية فلانات أو فلانات بينه وبين أي شخص آخر على حدود وملكية هذا العقار وهذه إفادتي.

تليت عليه إفادته فأقر بها وختم معنا

شاهد ثان — رقم الهوية ٩٧٠٨٨٨١١ — مواليد ١٩٦٥ — [illegible]

~~[illegible]~~

"إفادة مختار أول"

أنا: نسيم يوسف الحاج بن عبد الحق والدتي حنة مواليد بلدة ١٩٦٥ عيدون وسكان بلدة تعلبايا أهل مختار بلدة الأهلي رقم سجلي العائلي ٢٢ عيدون طريق ٢٢ ٩٩٠٥٩٩ أن المستدعي كامل محمد جعفر مختار أول — رقم الهوية ٩٧٠٨٨٨١١ — مواليد ١٩٦٥ — [illegible]

WTG 13

تابع محضر محضر العينات رقم ٦٧ / ٢٠٢٤ تاريخ ٢٠/٩/٢٠١٧

المديرية العامة لقوى الأمن الداخلي

قيادة .....

منطقة .....

سرية .....

فصيلة .....

مخفر .....

عدد .....

تاريخ .....

في الساعة ..... من يوم ..... الموافق .....

من شهر ..... عام ألفين و .....

نحن .....

..... من ..... ومرتدين .....

اللباس الرسمي .....

نظم هذا المحضر في الساعة والتاريخ المذكورين في مقدمته
وفي تمام الساعة السابعة من تاريخه على تسعين
متر الأولى من الطريق الجنوب لجانب محافظة عكار
تلة الثانية للمحافظ.
رقيب أول ٤٧٠٨٨ معاون أول ٤٩٥٠٤

الموضوع

محضر .....

النسخة الـ

نظر ومحول من .....

لحضرة .....

في ..... سنة ٢٠

المديرية العامة لقوى الأمن الداخلي
وحـــــدة الـــــدرك
قيـــادة منطقـــة الشمال
قيـــادة سرية حلبـــا
فصيـــلة القبيـــات

الموضوع : تكليف
======

عـــدد : ٦٢٢٤/ ٢٠٦

نظـــر و احـــيـــل

إلى رئيـــس مخفر القبات

للعلم والإعادة لفائدة
٢٠١٧/٩/٢١

القبيات في ٢٠١٨/ ٩/ ٢٤

المديرية العامة لقوى الأمن الداخلي
الوحدة الدرك
الفصيلة القبيات
ورد بتاريخ ٢٠١٧/٩/٢٠
معامل الوارد عدد ٢٠٦/١٠٢٨

الموضوع : تكليف

المديرية العامة لقوى الأمن الداخلي
وحدة الدرك الإقليمي
قيادة منطقة الشمال الإقليمية
مكتب الخدمة والعمليات

عدد: / ٢٠٦م٢ أ ع
تاريخ: / / ٢٠١٨

المديرية العامة لقوى الأمن الداخلي
الوحدة : الدرك
القطعة : فصيلة القبيات
ورد في ١٢/ ٩/ ٢٠١٨
سجل تحت عدد ٢٠٦/٦٢٢٤

نُظر وأُحيل
إلى العقيد قائد سرية حلبا

للاطلاع واجراء المقتضى وفقا لما هو مطلوب باحالة محافظ عكار المرفقة
والاعادة لغاية / / ٢٠١٨ .

المديرية العامة لقوى الأمن الداخلي
الوحدة : الدرك الإقليمي
القطعة : قيادة سرية حلبا
ورد في ١٠/ ٩/ ٢٠١٨
سجل تحت عدد ٢٠٦/٢٥١٠

قائد منطقة الشمال الإقليمية
العقيد يوسف درويش

نظر واحيل
إلى النقيب آمر فصيلة القبيات
للمتابعة والاعادة لغاية ٢٤/٩/٢٠١٨

WTG 13

الجمهورية اللبنانية
وزارة الداخلية والبلديات

محافظة عكار

عدد : ٢٤٧٠

حلبا في : ٢ / ٩ / ٢٠١٨

حضرة قائد منطقة درك الشمال الإقليمية

الإيعاز لمن يلزم بالكشف والتحقيق للتثبت مما يلي :

١- صحة الملكية
٢- موقع العقار بالنسبة إلى المنطقة السكنية والطرقات العامة والكهرباء
٣- بيان ما إذا كان على العقار بناء وبيان تاريخ إنجازه وإذا كان مخالفاً ضبط المخالفة
٤- أخذ إفادة المالكين والمجاورين وبعض المسنين ومختارين إثنين من مخاتير البلدة في حال وجود أكثر من مختار.

ذلك وفقاً للعلم وخبر المرفق والإعادة

المديرية العامة لقوى الأمن الداخلي
الوحدة: الدرك الإقليمي
المنطقة: قيادة منطقة الشمال الإقليمية
ورد في ٢٠١٨ ٩ ٦
سجل تحت عدد ٢٠٦/ ٥٢٦٢

محافظ عكار

عماد اللبكي

٢ / ١٨٢٠

WTG 13.

سعادة محافظ عكار المحترم

المستدعي: كامل محمد جعفر رقم الهاتف: ٧١٨٢٢٠٤

الموضوع: تصديق علم و خبر

ارجو الموافقة على تصديق العلم والخبر المرفق ربطا في بلدة .....كرم نبات - ميدوس

وتفضلوا بقبول فائق الاحترام

وزارة الداخلية والبلديات - محافظة عكار
الرقم المتسلسل: ٢٤٧٠
تاريخ الورود: ٢/٥/٢٠٢٠

WTG 13

الجمهورية اللبنانية
وزارة المالية
المديرية العامة للشؤون العقارية

نموذج رقم
الشؤون العقارية

علم وخبر

القانون الصادر

بالمرسوم الإشتراعي رقم 12 تاريخ 1930/2/28

المادة 12

أمانة السجل العقاري في .....

المحافظة عكار ..... القضاء عكار ..... المنطقة العقارية عيدمون ..... المحلة تل شاهد الملعوب .....

رقم العقار في سجل مساحة لبنان القديم :..... أو رقم عموم الويركو في الولايات : ..... مساحته: ٩٨٠٦ م.م.

درهم ..... قيراط ..... حبة ..... بشهادة الإفراز نهائية وسند ابن

نوع العقار الشرعي (ملك أو أميري) .....

حدود العقار مع أسماء المالكين المجاورين

شمالاً : بناء كمال جعفر ..... طريق

شرقاً : محمد علي عبد الخير بناء

جنوباً : جبل عقل .....

غرباً : جبل عقل ..... طريق

محتويات العقار بالتفصيل : ارض سلمى .....

طريقة اكتساب الحق : ..... المالك السابق .....

مدة وضع اليد على العقار : .....(مصدر وضع اليد ..... ، .....)

الأشغال التي قام بها وضع اليد : .....

الغاية من طلب العلم وخبر (بيع، هبة، تأمين....) .....

المالك أو العاقد : الأسم الثلاثي .....اسم الأم ..... رقم سجل النفوس .....محل وتاريخ الولادة ..... محل الإقامة ..... عنوان السكن.....توقيع العاقد

المالك

المعقود له : الأسم الثلاثي كامل محمد جعفر اسم الأم عايدة جعفر رقم سجل النفوس ٢٢٠ محل وتاريخ الولادة ١٩٢٤ محل الإقامة عيدمون عنوان السكن عيدمون ..... توقيع المعقود له

كامل محمد جعفر

الحق المطلوب تسجيله أو الحصة : ..... القيمة أو الثمن .....(ل.ل.)

أسماء وتواقيع الأعضاء الإختيارية

توقيع المختار وختمه

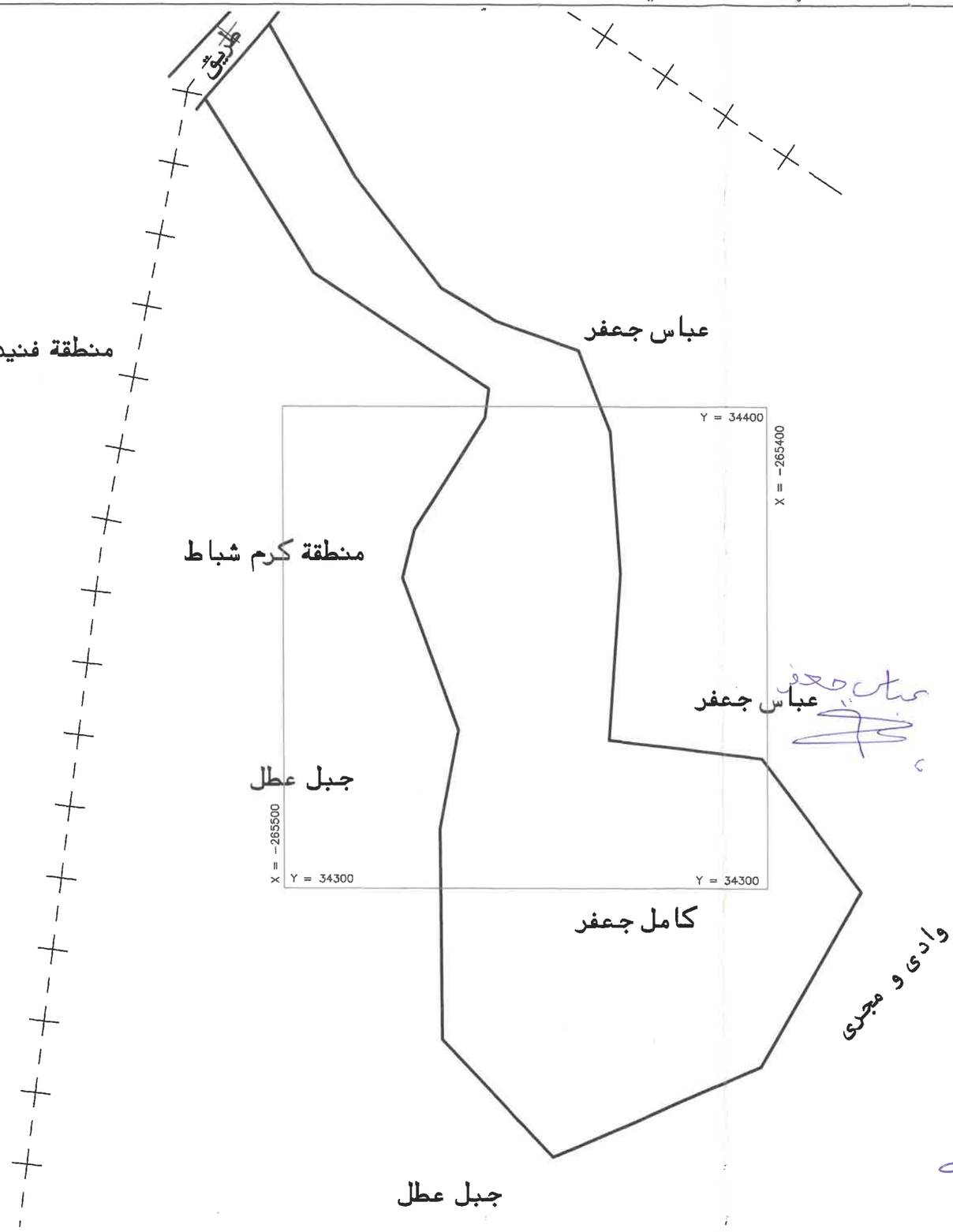
تصديق القائمقام

- نظرت على المعلم والبز رقم ٤٧٠ ك/ت الصادر عن مخفر عيدمون استناداً الى كتاب مخفر تحقيق ضفر الغبيات رقم ٦٧٢ ك/ت تاريخ ٢٠/٩/٢٠١٧ ٧٤٠

محافظ عكار

عماد اللبكي

WTG 13



الجمهورية اللبنانية

محافظة عكار

قضاء عكار

منطقة عيدمون (كرم شباط) العقارية

المحلة ذلة العبور

خريطة علم و خبر

مقياس 1/1000

مصطلحات

—— حدود العقار

ختم و توقيع المهندس المساح

04/08/2018

يحده

شمالا عباس جعفر و طريق

شرقا وادي مجرى و عباس جعفر

جنوبا جبل عطل

غربا جبل عطل و طريق

جرى الكيل على مسؤوليتي وبالاستناد الى دلالة المجاورين و المالكين و المختار وعلى مسؤوليتهم

المساحة ٩٨.٦ م م

9806 m2

WTG 13

الجمهورية اللبنانية

محافظة عكار

قضاء عكار

منطقة عيدمون (كرم شباط) العقارية

المحلة ثلة المعبور

خريطة علم و خبر

مقياس 1/1000

مصطلحات

—— حدود العقار

ختم و توقيع المهندس المساح

04/08/2018

يحده

شمالا عباس جعفر و طريق

شرقا وادى مجرى و عباس جعفر

جنوبا جبل عطل

غربا جبل عطل و طريق

جرى الكيل على مسؤوليتى وبالاستناد الى دلالة المجاورين و المالكين و المختار وعلى مسؤوليتهم

المساحة ٩٨٠٦ م م

9806 m2

WTG 14

المديرية العامة لقوى الأمن الداخلي
وحدة الدرك الإقليمي
قيادة منطقة الشمال الإقليمية
مكتب الخدمة والعمليات
عدد: ٥٧٩٢/٢٠٦م٢/ع.

الموضوع: تكليف

تاريخ ١/١١/٢٠١٨

لحضرة محافظ عكار

تم إجراء المقتضى بموجب المحضر رقم ٢٠٤/٧٤١ تاريخ ٢٠/ ١٠/ ٢٠١٨ المرفق ربطاً .

قائد منطقة الشمال الإقليمية
وكيله

وزارة الداخلية والبلديات - محافظة عكار
الرقم المتسلسل: ٢٤٧٩
تاريخ الورود: ٢/١١

العام
قسم المستدعيا العام والطرق
لغاية تتبعه/
٥/١١/ع

محافظ عكار
عماد اللبكي

WTG 14

المديريه العامه لقوى الأمن الداخلي
وحـــدة الـــــدرك الإقليمي
قيادة منطقة الشمال الإقليمية
قيادة سرية حلبا الاقليمية

الموضوع : تكليف بشأن استدعاء مقدم من عباس جعفر من كرم شباط –عيدمون .

عدد : ٣٧٣٦ /٢٠٦ق٢ اع

نظر وقدم
من العقيـــــد إيـــــلي رفـــــول
قائد سرية حلبا الاقليمية وكالة
الى العقيد قائد منطقة الشمال الاقليمية
مكتب الخدمة والعمليات م٢اع

بعد الايجاب : اجري المقتضى من قبل مخفر القبيات بموجب المحضر رقم ٢٠٤/٧٤١ تاريخ ٢٠١٨/١٠/٣٠ المرفق ربطا" حيث تم بموجبه استماع افادة المسنين ومختاري بلدة عيدمون الذين اكدوا جميعهم ان العقار للمستدعي عباس بسام جعفر ولا توجد اية خلافات وتعذر استماع افادة الاعضاء الاختيارية لعدم وجودهم كما وتم التصحيح ووضع اسم المحلة على الخرائط .

يرجى الاطلاع

حلبا في ٢٠١٨/١٠/٣١

قيادة سرية حلبا

المديرية العامة لقوى الأمن الداخلي
الوحدة : الـــدرك الإقليمي
القطعة : قيادة منطقة الشمال الإقليمية
ورد في ١ / ١١ / ٢٠١٨
سجل تحت عدد ٢٠٦/٩٢٧٥ م أ

WTG 14

المديرية العامة لقوى الأمن الداخلي
وحـــــدة الـــــدرك
قيـــادة منطقـــة الشمال
قيـــادة سرية حلبـــا
فصيـــلة القبيـــات

عـــــدد : ٨٤٤٢ /٢٠٦

الموضوع: تكليف .

نظـــر وقـــــدم
من النقيب جـــــاك شـــــــكور
آمر فصيلـــــة القبـــــيات
إلى العقيـــــد قائـــــد سرية حلبـــــا

بعد الأطلاع أجري المقتضى من قبل مخفر القبيات بموجب المحضر رقم ٢٠٤/٧٤١ تاريخ ٢٠١٨/١٠/٣٠ المرفق ربطاً حيث تم بموجبه استماع افادة المسنين ومختاري بلدة عيدمون الذين اكدوا جميعهم ان العقار للمستدعي عباس بسام جعفر ولا توجد اية خلافات وتعذر استماع افادة الاعضاء الاختيارية لعدم وجودهم كما وتم التصحيح ووضع اسم المحلة على الخرائط .

يرجى التفضل بالاطـــلاع

القبيات في ٢٠١٨/١٠/٣٠

مديرية العامة لقوى الامن الداخلي
وارد ٣١ / ١٠ / ٢٠١٨
سجل تحت رقم ٢٠٦/٣٧٢٦

WTG 14

المديرية العامة لقوى الأمن الداخلي
وحـــــدة الـــــدرك
قيـــادة منطقة الشمال
قيـــادة سرية حلبـــا
فصيـــلة القبيات
مخفر القبيات

الموضوع : تكليف .

عـــــدد : ٢٠٦/ ١١٧٧

نظـــــر وقـــــدم
مـــن المؤهل اول ايليا ديب رقم ٢٥٨٨٦
رئيس مخفر القبيـــــات
إلى النقيب آمـــــر فصـــيلة القبيات

المديرية العامة لقوى الأمن الداخلي
الوحـــدة : الـــدرك
الفصيلـــة : فصيلة القبيات
ورد في ٢٠ / ١٠ / ٢٠١٨
سجل تحت عدد ٢٠٦/٨٤٤٢

بعد الاطلاع اجري المقتضى بموجب المحضر رقم ٢٠٤/٧٤١ تاريخ ٢٠١٨/١٠/٣٠ حيث تم بموجبه استماع افادة المسنين ومختاري بلدة عيدمون حيث اكدوا جميعهم ان العقار عائد للمستدعي عباس بسام جعفر ولا توجد اية خلافات وتعذر استماع افادة الاعضاء الاختيارية لعدم وجودهم كما وتم التصحيح ووضع اسم المحلة على الخرائط .

يرجى التفضل بالاطلاع .

القبيات في : ٢٠١٨/١٠/٣٠

WTG 14

المديرية العامة لقوى الأمن الداخلي

قيادة الدرك

منطقة الشمال

سرية طرابلس

فصيلة القبيات

مخفر القبيات

عدد ٢٤١/ ٢٠٠٤

تاريخ ٢٠/١٠/٢٠١٨

الموضوع

محضر لإكمال جمع معلومات بالعلم والخبر المقدم من المستدعي بباب مصفر

النسخة الـ ١

في الساعة الرابعة من يوم الثلاثاء الموافق الثلاثين

من شهر تشرين الأول عام ألفين و ثمانية عشر

نحن الملازم أول خالد الشعار رقم ٢٦٩٥٤٢ والعريف أول

عدنان الرفاعي رقم ٤٧٠٨٨ من مخفر القبيات ومرتدين

اللباس العسكري نثبت أنه ورد طلباً على وصل تاريخ ٢٠٠٤/٦٧٢

تاريخ ٢٠/٩/٢٠١٨ بالعلم والخبر المقدم من المستدعي بباب

باب مصفر المثبت فيما يحتويه ملكية عقار الفيروز

في ضاحية بلدة عين عنا محلة آل شاهلا رئيس المجلس والمالك

مجدداً فإننا بناء على كتاب رقم ٢٤٤٢/٢٠١٨ تاريخ

٢٤/١٠/٢٠١٨ إلى جانب قيادة درك منطقة الشمال

الإقليمية في قضاء الشمال الداخلي تحت مادة دفن الجثث

بمحل آلاف الأيمان لنه يلزم لإعادة التحقيق وإعادة

إستماع المخابرة والاستماع إلى إفادة إضافية إيداع هذا

والاستماع بحق المشتبه في البلدة وتصحيح الخرائط والعلم

والخبر بحيث يذكر اسم المخلة إلى جانب البلدة وإعادة

منطقة الشمال الإقليمية برقم ٢٩٧٥/٢٠١٨ وفي

تاريخ ٢٧/١٠/٢٠١٨ إلى المفتش قيادة سرية طرابلس لإكمال

المعلومات وفقاً لما هو مطلوب بتكليف إعادة إكمال

المعلومات والإعادة وفقاً لكتاب سرية طرابلس الإقليمية برقم

٢٦٧٢/٢٠١٨ تاريخ ٢٤/١٠/٢٠١٨ إلى المفتش

مخفر القبيات المحقق والإعادة والاستماع وإفادة

برقم ٢٧١١/٢٠١٨ تاريخ ٢٥/١٠/٢٠١٨ المحقق والإعادة

والمدوناتي قيد مخفر القبيات برقم ٢٧٧٧/٢٠١٨ تاريخ ٢٥/١٠/

٢٠١٨ الثابت بناء عليه صار جمع المعلومات مجدداً

على النحو التالي:

رقم ٤٧٠٨٨ معاينة رقم ٢٦٩٥٤

نظر ومحول من الملازم أول رئيس مخفر القبيات

لحضرة قائمقام الشمال

في ٢٠/١٠/٢٠١٨ سنة

WTG 14

المديريه العامه لقوى الامن الداخلي
وحـــــدة الـــبدرك
قيـــادة منطقـــة الشمال
قيـــادة سرية حلبـــا
فصيـــلة القبيـــات

عـــــدد: ٨٢١/ ٢٠٦

الموضوع : تكليف

نظـــر وأحيـــل

إلى رئيس مخفر القبيات
للتحقيق والإجراء

القبيات في ٢٥/١٠/٢٠١٨

المديرية العامة لقوى الامن الداخلي
الوحدة : البدرك
القطعة : مخفر القبيات
ورد في ٢٥/١٠/٢٠١٨
سجل تحت عدد ١١٧٧/٢٠٦

WTG 14

المديرية العامة لقوى الأمن الداخلي
وحدة الدرك الإقليمي
قيادة منطقة الشمال الإقليمية
مكتب الخدمة والعمليات

عدد : ٨٩٧٥/٢٠٦ م٢ أ ع
تاريخ : ٢٢/١٠/٢٠١٨

الموضوع : تكليف

نظر وأحيل

إلى العقيد قائد سرية حلبا الإقليمية

المديرية العامة لقوى الأمن الداخلي
الوحدة : الدرك الإقليمي
القطعة : قيادة سرية حلبا
ورد في ٢٤/١٠/٢٠١٨
سجل تحت عدد ٣٦١/٢٠٦

للإطلاع وإجراء المقتضى وفقاً لما هو مطلوب بتكليف سعادة محافظ عكار المرفقة والإعادة حتى / / ٢٠١٨

نظر واحيل
إلى النقيب آمر فصيلة الفهود
للمقتضى والإعادة

قائد منطقة الشمال الإقليمية
العقيد يوسف درويش

المديرية العامة لقوى الأمن الداخلي
الوحدة
القطعة
ورد في ٢٥/١٠/٢٠١٨
سجل تحت عدد ٨٢١١/٢٠٦

الجمهوريـــة اللبـنانيـــة

وزارة الداخلية والبلديات

محـافظة عكـار

وثيقة احالة

ـ موضوعها :

رقم التسجيل	الجهة المرسل إليها	موضوع الاحـــالة
٢٤٧٤/٢٠١٨	جانب قيادة درك منطقة الشمال الإقليمية في قوى الأمن الداخلي	نعيد إليكم كامل الملف للإيعاز لمن يلزم لإعادة التحقيق وإعادة إستماع المخاتير والأعضاء الإختيارية إذا وجدوا واستماع بعد المسنين في البلدة تصحيح الخرائط والعلم والخبر بحيث يذكر اسم المحلة إلى جانب البلدة % محافظ عكار عماد اللبكي 22 OCT. 2018

WTG 14

المديرية العامة لقوى الأمن الداخلي
وحدة الدرك الإقليمي
قيادة منطقة الشمال الإقليمية
مكتب الخدمة والعمليات

عدد: / ٢٠٦م٢/أ.ع.
تاريخ: ٢/ ٩/ ٢٠١٨

الموضوع: تكليف

لحضرة محافظ عكار

ربطاً توضيح العقيد قائد سرية حلبا بموجب المحضر رقم ٢٠٤/٦٧٢ تاريخ ٢/٩/٢٠١٨ المرفق ربطاً حيث تم بموجبه إجراء التحقيق.

وزارة الداخلية والبلديات - محافظة عكار
الرقم التسلسلي: ٦٤٧٩
تاريخ الورود: ٨/١٠

التفضل بالإطلاع

قائد منطقة الشمال الإقليمية
العقيد يوسف درويش

WTG 14

المديريه العامه لقوى الأمن الداخلي
وحدة الدرك الاقليمي
قيادة منطقة الشمال الاقليمية
قيادة سرية حلبا الاقليمية

الموضوع : تكليف .

نظر وقدّم

من العقيد مصطفى الايوبي

قائد سرية حلبا الاقليمية

إلى العقيد قائد منطقة الشمال الاقليمية

عدد :٣١٠٧/ ٢٠٦ق٢/ أ٠ع مكتب الخدمة والعمليات م٢ /أ٠ ع

بعد الايجاب من قبل مخفر القبيات بموجب المحضر رقم ٢٠٤/٦٧٣ تاريخ ٢٠١٨/٩/٣٠ المرفق ربطا" وبنتيجة ما ورد بافادة المستدعي والمجاورين والمسنين اكدوا ان العقار للمستدعي تمت الموافقة على تاجيل الملف لغاية ٢٠١٨/١٠/٨ انفاذا" لامركم البرقي رقم ٤٦٢١٢ تاريخ ٢٠١٨/٩/٢٤

يرجى الاطلاع

حلبا في ٢٠١٨/١٠/٣

المديرية العامة لقوى الأمن الداخلي
التاريخ ٢٠١٨
٨٤٦١

WTG 14

المديرية العامة لقوى الأمن الداخلي
قيادة وحدة الـــــــــدرك
قيادة منطقة الشمـــــال
قيادة سرية حلبـــــا
فصيلة القبيـــــات

عـــدد: ٦٨٥٢/ ٢٠٦

الموضوع : علـــم وخبـــــر

نظـــر وقـــــدم
من النقيب جـــــاك شكـــــــور
امـــــر فصيلة القبيـــات
إلـــى العقيـد قـــــائد ســـــرية حلبا

بعد الاطـلاع والايجاب من قبل القطعة المعنية بموجب المحضر رقم ٢٠٤/٦٧٢ تاريخ ٢٠/ ٩ /٢٠١٨ المرفق ربطاً وبنتيجة ما ورد بافادة المستدعي والمجاورين والمسنين ومختاري المحلة اكدوا ان العقار للمستدعي

- نمشي الموافقة على تأجيل الملف لغاية ٨/١٠/٢٠١٢ انفاذاً لكتاب البرقية رقم ١٩٢٦٧ تاريخ ٢٤/٩/٢٠١٢

يرجـــى التفضل بالاطـــــلاع

القبيات في ٢ / ١٠ /٢٠١٨

ورد في ٣/١٠/٢٠١٨
سجل تحت عدد ٣١٠٧/٢٠٦

WTG 14

المديرية العامة لقوى الأمن الداخلي
وحـــــدة الـــــدرك
قيـــادة منطقـــة الشمال
قيـــادة سرية حلبـــا
فصيـــلة القبيـــات
مخفر القبيات
عـــــدد : ١٠٣٦/ ٢٠٦

الموضوع : تكليف .

نظـــر وقـــدم
من المؤهل اول ايليا ديب رقم ٢٥٨٨٦
رئيس مخفر القبيـــــات
إلـــى النقيب آمـــر فصـــيلة القبيـــات

بعد الاطلاع اجري المقتضى بموجب المحضر ٢٠٤/٦٧٣ تاريخ ٢٠١٨/٩/٣٠ حيث تم بموجبه اجراء الكشف واستماع افادة كل من المستدعي والشهود والمجاورين ومختاري البلدة المرفق ربطا .

١٩٢٦٧

تم الموافقة على تاجيل الملف لغاية ٢٠١٨/١٠/٥ بموجب برقيتكم رقم ٧٢٣٢ تاريخ ٢٠١٨/٩/٢٤ .

يرجى التفضل بالاطلاع

القبيات في ٢٠١٨/١٠/١ .

WTG 14

المديرية العامة لقوى الأمن الداخلي

قيادة: الدرك

منطقة: الشمال

سرية: [illegible]

فصيلة: الصبيات

مخفر: الصبيات

عدد: ٢٦٧٢/أ.ع

تاريخ: ٢٠١٨/٩/١٢

الموضوع

محضر جمع معلومات بالعلم والخبر المقدم من المدعي عباس جعفر

النسخة الأولى

في الساعة: الثامنة من يوم: الاحد الموافق: للثلاثون من شهر: ايلول عام الفين وثمانية عشر

نحن: المرؤوس المؤلف أدناه رقم ٢٦٩٥٤ والمفتاح أول عبدالله الرقيب رقم ٤٧٠٨٨ من مخفر الصبيات ومرتدين اللباس العسكري نثبت الاخبار للعلم والخبر المقدم من المدعي عباس جعفر المصادقة على حدود ممتلكات العقار العشر موضوع الحكم سابقاً والحالي من جهة محافظة عكار رقم ٢٠١٨/٢٤٧٤ تاريخ ٢٠١٨/٩/١٢ تحت عبارة الاخبار لما يلزم بالكشف والتحقيق لتثبت من:

- صحة الشكوى.
- موقع العقار بالنسبة الى المنطقة الحرجية والطرقات العامة والاملاك.
- بيان ما اذا كان على العقار بناء وبيان تاريخ انجازه واذا كان مخالفاً ضبط المخالفة.

أخذ افادة الكتبي والجاريين وبعض الاشخاص ومخاتير اثنين من مخاتير البلدة بحال وجود اكثر من مختار وذلك وفقاً للعلم والخبر المرفق والاحالة من مخفر منطقة الشمال الاقليمي رقم ٢٠١٨/٥٧٦٧ تاريخ ٢٠١٨/٩/٦ للاجراء واذا الاشخاص وفقاً لما هو مشهور بتكليف سعادة محافظ عكار والاشارة من قيادة سرية درك عكار رقم ٢٠١٨/٢٧٢٧ تاريخ ٢٠١٨/٩/١٠ للمقتضى والاشارة من قيادة فصيلة الصبيات برقم ٢٠١٨/٢٢٧٧ تاريخ ٢٠١٨/٩/١٥ للمقتضى والاشارة والمرفق في حدود محفوظة برقم ٢٠١٨/١٢٦ تاريخ ٢٠١٨/٩/١٥ لدقة التحقيق وعليه تم جمع المعلومات على الشكل التالي:

مفتاح أول ٤٧٠٨٨ مصدر الاخبار ٢٦٩٥٤

[illegible]

نظر ومحول من: المفتاح أول رئيس مخفر الصبيات

لمخفرة: [illegible]

في: [illegible] سنة ٢٠١٨

تابع محضر الجلسات رقم ٦٧٢ لسنة تاريخ ٢/٩/١٩٩٨

"إفادة شاهد أول"

اسمي: حسن جعفر بن محمد والدتي رضية جعفر مواليد مخفر الخشة عام ١٩٤٢ وسكان بلدة شاطا صيفاً بلكي متقلم متأهل مقاوم في الجيش اللبناني رقم سجلي العائلي في مخفر الخشة هاتف ٠٣/٠٧٠٠٢٠ أفيد أن المدعي علي بناء جعفر يملك عقار غير مسجل في قرية بلدة عيدمون محلة آل شاهد بالإرث من والده يده شمالاً جبل علي وجري باير مشرقاً جبل علي مارتي وجنوباً جبل علي وكامل جعفر وغرباً كامل جعفر وهذا العقار بعد سلخ لم تحدث بشأنه خلافات أو نزاعات بينه وبين أي شخص آخر على حدود وملكية هذا العقار وهذه إفادتي.

ثابت عليه إفادته فقد قرأ ووقع هنا

شاهد أول — مخاتير — ٤٧٠٠٨٨ — مخاتير — ٦٩٥٠٤

حسن جعفر — [illegible]

"إفادة شاهد ثاني"

اسمي: علي جعفر بن نديم والدتي آمنة جعفر مواليد التبانة عام ١٩٦٢ وسكان بلدة الرويسة كرم شاطا بلكي وقع إفادتي متأهل مزارع لبناني رقم سجلي العائلي في التبانة الأصل هاتف لا يوجد أفيد أن المدعي علي بناء جعفر يملك عقار غير مسجل في قرية بلدة عيدمون محلة آل شاهد بالإرث من والده يده شمالاً جبل علي وجري باير مشرقاً جبل علي مارتي وجنوباً جبل علي وكامل جعفر وغرباً كامل جعفر وهذا العقار بعد سلخ لم تحدث بشأنه خلافات أو نزاعات بينه وبين أي شخص آخر على حدود وملكية هذا العقار وهذه إفادتي.

ثابت عليه إفادته فقد قرأ ووقع هنا

شاهد ثاني — مخاتير — ٤٧٠٠٨٨ — مخاتير — ٦٩٥٠٤

علي جعفر — [illegible]

WTG 14

ص "٥"

تابع لمحضر ضبط رقم ٦٧٣/٢٠٢٤ تاريخ ٢٠١٨/٩/٣٠

المديرية العامة لقوى الأمن الداخلي

قيادة .....

منطقة .....

سرية .....

فصيلة .....

مخفر .....

عدد .....

تاريخ .....

في الساعة ..... من يوم ..... الموافق .....

من شهر ..... عام ألفين و .....

نحن .....

..... من ..... ومرتدين

اللباس الرسمي .....

أي شبكات هاتف أو كهرباء أو أي أبنية وهذا ما شاهدناه

الموضوع

محضر .....

رتيب أول ٤٧٠٨٨٨ معاون أول ٢٦٩٥٤

[illegible]

تم هذا المحضر في الساعة والتاريخ المذكورين في مقدمته وتم إتمام الساعة الرابعة عشر من يوم السبت الثاني على تحقق تقدم الأولى بجانب العاقطة على [illegible] والكاملة لوقائع

النسخة الـ

رتيب أول ٤٧٠٨٨٨ معاون أول ٢٦٩٥٤

[illegible]

نظر ومحول من .....

لحضرة .....

في ..... سنة ٢٠

WTG 14

المديرية العامة لقوى الأمن الداخلي
وحـــــدة الـــــدرك
قيـــادة منطقـــة الشمال
قيـــادة سرية حلبـــا
فصيـــلة القبيـــات

عـــــدد : ٦٢٢٧/ ٢٠٦

الموضوع : تكليف

نظـــر و احـــيـــل

إلى رئيـــس مخفر الشيـــاب

للعلم والإجراء لغاية
٢١/٩/٢٠١٨

القبيات في ١٤/٩/٢٠١٨

المديرية العامة لقوى الأمن الداخلي
الوحدة
القبيات
١٤/ ٩/ ٢٠١٨
٢٠٦/ ١٠٢٦

WTG 14

المديرية العامة لقوى الأمن الداخلي
وحدة الدرك الإقليمي
قيادة منطقة الشمال الإقليمية
مكتب الخدمة والعمليات

عدد: ٥٦٥ / ٢٠٦ م٢ أ ع
تاريخ: / / ٢٠١٨

الموضوع : تكليف

نُظر وأُحيل

إلى العقيد قائد سرية حلبا

المديرية العامة لقوى الأمن الداخلي
الوحدة : الدرك
القطعة : فصيلة القبيات
ورد في ٢٠١٨/٩/١٠
سجل تحت عدد ٢٠٦/٢٧٣٧

للاطلاع واجراء المقتضى وفقا لما هو مطلوب باحالة محافظ عكار المرفقة

والاعادة لغاية ٢٠١٨/٩/٢٧ .

المديرية العامة لقوى الأمن الداخلي
الوحدة : الدرك الإقليمي
القطعة : قيادة سرية حلبا
ورد في ٢٠١٨/٩/١٠
سجل تحت عدد ٢٠٦/٢٧٣٧

نظر واحيل
إلى العقيد آمر فصيلة القبيات حلبا في ١٨/٩/٢٤
للاقتضاء والاعادة لغاية ١٨/٩/٢٧

قائد منطقة الشمال الإقليمية
العقيد يوسف قروش

WTG 14

الجمهورية اللبنانية
وزارة الداخلية والبلديات

محافظة عكار
عدد : ٢٩٧٤
حلبا في : ٢ / ٩ / ٢٠١٨

حضرة قائد منطقة درك الشمال الإقليمية

الإيعاز لمن يلزم بالكشف والتحقيق للتثبت مما يلي :

١- صحة الملكية
٢- موقع العقار بالنسبة إلى المنطقة السكنية والطرقات العامة والكهرباء
٣- بيان ما إذا كان على العقار بناء وبيان تاريخ إنجازه وإذا كان مخالفاً ضبط المخالفة
٤- أخذ إفادة المالكين والمجاورين وبعض المسنين ومختارين إثنين من مخاتير البلدة في حال وجود أكثر من مختار.

وذلك وفقاً للعلم وخبر المرفق والإعادة

المديرية العامة لقوى الأمن الداخلي
الوحدة : الدرك الإقليمي
القطعة : قيادة منطقة الشمال الإقليمية
ورد في ٢٠١٨/٩/٦
سجل تحت عدد ٢٠٦/٥٧٦٧

محافظ عكار
عماد اللبكي

٢/٩/٢٠١٨

٢/٩/٢٠١٨

WTG 14

سعادة محافظ عكار المحترم

المستدعي: عباس جعفر

رقم الهاتف: ٧١/٦٦٠٤٦٥

الموضوع: تصديق علم و خبر

ارجو الموافقة على تصديق العلم والخبر المرفق ربطا في بلدة .....عرمشبا - عيدمون

وتفضلوا بقبول فائق الاحترام

٢٤٧٩

٢/٩/٢٠١٨

WTG 14

الجمهورية اللبنانية
وزارة المالية
المديرية العامة للشؤون العقارية

نموذج رقم
الشؤون العقارية

علم وخبر

القانون الصادر

بالمرسوم الإشتراعي رقم 12 تاريخ 1930/2/28

_ المادة 12 _

أمانة السجل العقاري في .....

المحافظة ..... القضاء ..... المنطقة العقارية ..... المحلة .....

رقم العقار في سجل مساحة لبنان القديم : ..... أو رقم عموم الويركو في الولايات : ..... مساحته: ..... م.م.

درهم ..... قيراط ..... حبة .....

نوع العقار الشرعي (ملك أو أميري) .....

حدود العقار مع أسماء المالكين المجاورين

شمالاً : .....

شرقاً : .....

جنوباً : .....

غرباً : .....

محتويات العقار بالتفصيل : .....

طريقة اكتساب الحق : ..... المالك السابق .....

مدة وضع اليد على العقار : ..... (مصدر وضع اليد ..... ، .....)

الأشغال التي قام بها وضع اليد : .....

الغاية من طلب العلم وخبر (بيع، هبة، تأمين....) .....

المالك أو العاقد : الأسم الثلاثي ..... اسم الأم ..... رقم سجل النفوس ..... محل وتاريخ الولادة ..... محل الإقامة ..... عنوان السكن ..... توقيع العاقد

المعقود له : الأسم الثلاثي ..... اسم الأم ..... رقم سجل النفوس ..... محل وتاريخ الولادة ..... محل الإقامة ..... عنوان السكن ..... توقيع المعقود له

الحق المطلوب تسجيله أو الحصة : ..... القيمة أو الثمن ..... (ل.ل.)

أسماء وتواقيع الأعضاء الإختيارية

توقيع المختار وختمه

تصديق القائمقام

محافظ عكار

عماد اللبكي

WTG 14

الجمهورية اللبنانية

محافظة عكار

قضاء عكار

منطقة عيدمون (كرم شباط) العقارية

المحلة راس المطبر

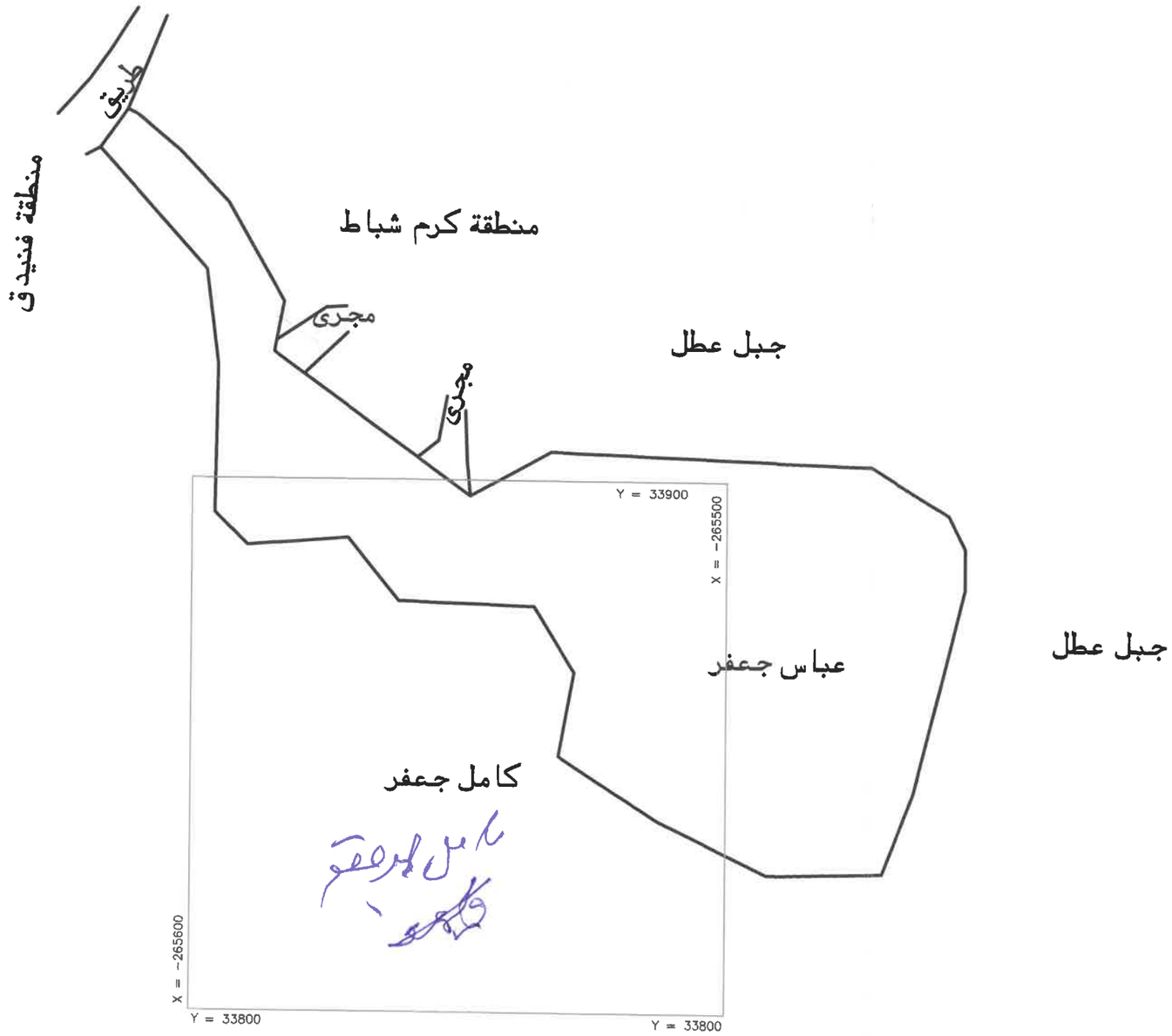
خريطة علم و خبر

مقياس 1/1000

مصطلحات

—— حدود العقار

ختم و توقيع المهندس المساح



04/08/2018

يحده

شمالا جبل عطل و مجرى

شرقا جبل عطل وادى

جنوبا جبل عطل كامل جعفر

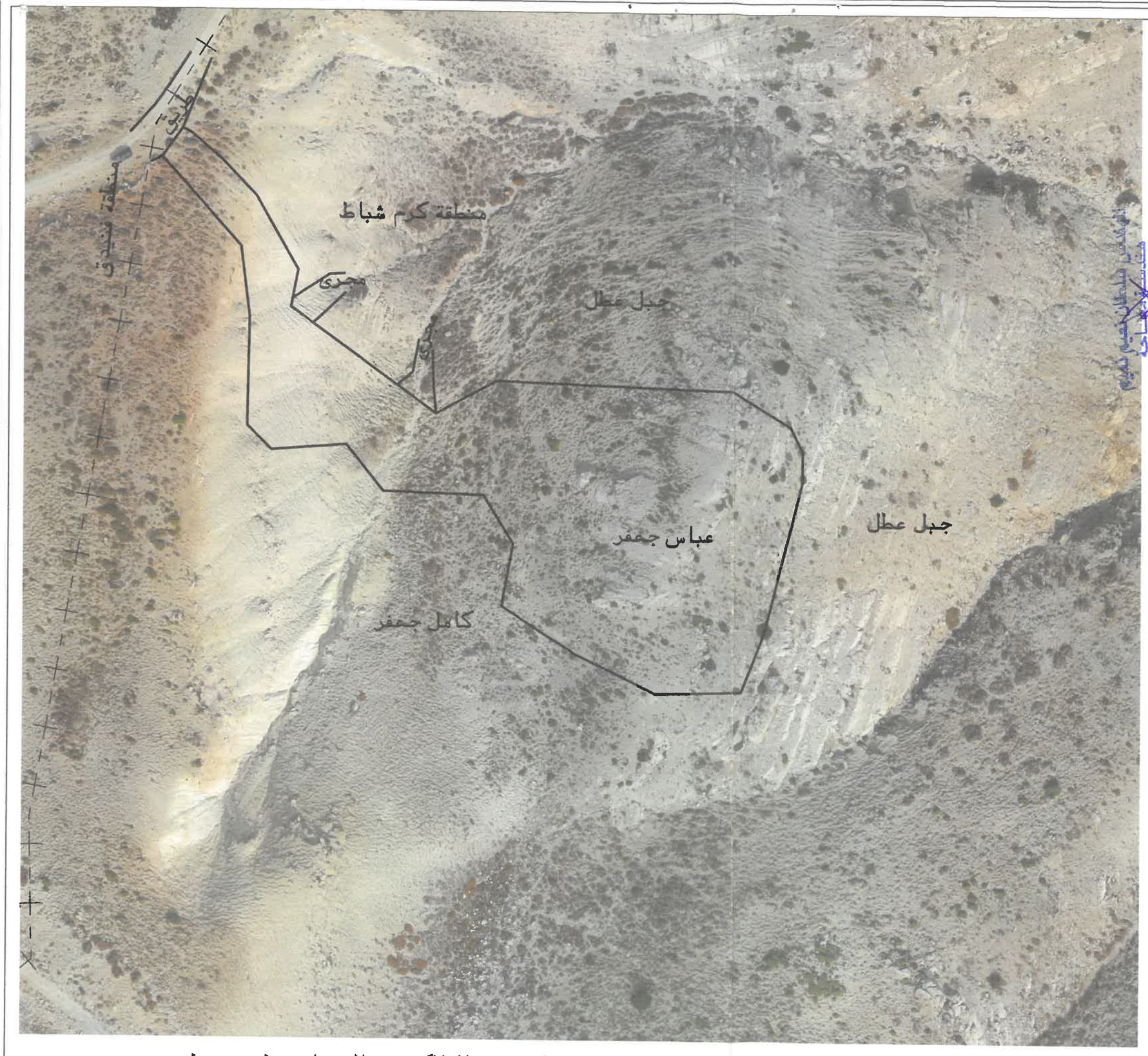
غربا كامل جعفر و طريق

المساحة ٧٤٠٩م م

جرى الكيل على مسؤوليتى وبالاستناد الى دلالة المجاورين و المالكين و المختار وعلى مسؤوليتهم

7409 m2

WTG 14



الجمهورية اللبنانية

محافظة عكار

قضاء عكار

منطقة عيدمون (كرم شباط) العقارية

المحلة رأس المعبور

خريطة علم و خبر

مقياس 1/1000

مصطلحات

—— حدود العقار

ختم و توقيع المهندس المساح

04/08/2018

يحده

شمالا جبل عطل و مجرى

شرقا جبل عطل وادى

جنوبا جبل عطل كامل جعفر

غربا كامل جعفر و طريق

المساحة ٧٤٠٩م م

7409 m2

جرى الكيل على مسؤوليتى وبالاستناد الى دلالة المجاورين و المالكين و المختار وعلى مسؤوليتهم

WTG 15

الجمهورية اللبنانية
وزارة المالية
المديرية العامة للشؤون العقارية

إفادة عقارية

القاضي العقاري في الشمال

بناءً على الطلب المقدم من السيد

وبعد مراجعة قيود السجل العقاري أعطيت هذه الإفادة الشاملة - الجزئية

بتاريخ ١١ / ١٠ / ٢٠١٨

المنطقة العقارية فيلدف - النوع الشرعي : أميري

رقم العقار	اسم الموقع	محتويات ووصف العقار	الحقوق العينية والوقوعات	المساحة بالأمتار المربعة	الحصة		أسماء المالكين ومقدار الحصص باعتبار الكامل المئة وأربعمائة سهم
					جزء سهم	سهم	
٢٨	فيل كفيان	قطعة ارض بعل سليم جزء	٢٤ بلدية فيدف				
		اشجار حرجية					
		إن هذا الحظر هو قيد الدراسة وهو عرضة للتعديل.					

أعطيت هذه الإفادة تلافياً من عنصر التحديد المؤقت
مع الإشارة الى ان [illegible] يحدث فيما بعد
حتى انتهاء [illegible] مساحة في المطار وتسليمها للقاضي
العقاري واعلانها ومرور مدة ثلاثون يوماً.

طرابلس في ١١ / ١٠ / ٢٠١٨

القاضي العقاري في

رئيس القلم
راغدة عدرة

استوفي الرسم بموجب لصق دمغة على الطلب

فاطمة [illegible]

WTG 16

الجمهورية اللبنانية
وزارة المالية
المديرية العامة للشؤون العقارية

إفادة عقارية

القاضي العقاري في الشمال

بناءً على الطلب المقدم من السيد

بتاريخ ١١/١٠/٢٠١٨

ولدى مراجعة قيود السجل العقاري أعطيت هذه الافادة الشاملة - الجزئية

المنطقة العقارية : فصيل ب - النوع الشرعي : أميري

رقم العقار	اسم الموقع	محتويات ووصف العقار	الحقوق العينية والوقوعات	المساحة بالأمتار المربعة	الحصة		أسماء المالكين ومقدار الحصص باعتبار الكامل العين وأربعمائة سهم
					مئة سهم	سهم	
٢٩	قرانة عين الفرج	قطعة أرض بعل سليخ فيها بعض أشجار حرجية		٢٤٠٠			بلدية فنيدق

إن هذا المخطط هو قيد الدراسة وهو عرضة لكل تعديل.

أعطيت هذه الافادة [illegible] والتحديد المؤقت
مع الإشارة الى [illegible] التي يحدث فيما بعد
حتى انتهاء [illegible] وتسليمها للقاضي
العقاري واعلانها [illegible] مدة ثلاثين يوماً

طرابلس في [illegible] ١٠/ سنة ٢٠١٨

القاضي العقاري في
رئيس القلم
[illegible]

استوفي الرسم بموجب لصق [illegible]
[illegible]

WTG 17

الجمهورية اللبنانية
وزارة المالية
المديرية العامة للشؤون العقارية

إفادة عقارية

القاضي العقاري في الشمال

بناءً على الطلب المقدم من السيد

بتاريخ ١١/١٠/٢٠١٨

ولدى مراجعة قيود السجل العقاري أعطيت هذه الإفادة الشاملة - الجزئية

المنطقة العقارية: ميدون - النوع الشرعي: أميري

رقم العقار	اسم الموقع	محتويات ووصف العقار	الحقوق العينية والوقوعات	المساحة بالأمتار المربعة	الحصة		أسماء المالكين ومقدار الحصص باعتبار الكامل المئين وأربعماية سهم
					مرسهم	سهم	
٢١	حقل كنعان	قطعة أرض بعل	سلفي	٢٤٠٠	بلدية	منذ	أشار حمية

إن هذا المحضر هو قيد الدراسة وهو عرضة لكل تعديل.

أعطيت هذه الإفادة خلال محضر التحديد المؤقت
مع الإشارة إلى التعديلات التي قد تحدث فيما بعد
حتى انتهاء أعمال المساحة في المنطقة وتسليمها للقاضي
العقاري وإعلانها وفق مدة ثلاثون يوماً

استوفي الرسم بموجب لصق طوابع على الأصل

في ١١/١٠/٢٠١٨

القاضي العقاري في

رئيس القلم
رواغدة عدرة

WTG 18

الجمهورية اللبنانية
وزارة المالية
المديرية العامة للشؤون العقارية

إفادة عقارية

القاضي العقاري في الشمال

بتاريخ ١١/١٠/٢٠١٨

بناءً على الطلب المقدم من السيد

ولدى مراجعة قيود السجل العقاري أعطيت هذه الافادة الشاملة - الجزئية

المنطقة العقارية: فنيدق - النوع الغرفي: امري

رقم العقار	اسم الموقع	محتويات ووصف العقار	الحقوق العينية والوقوعات	المساحة بالامتار المربعة	الحصة		اسماء المالكين ومقدار الحصص باعتبار الكامل العين واربعمائة سهم
					مئة سهم	سهم	
ثلاثون							
٣٠	قرانة عن الفردج - مقبل كنفان - قطعة أرض ٢٤٠٠ بلدية فنيدق بمل لبنى وضمن بعض الأشجار الحرجية						

إن هذا المحضر هو قيد الدراسة وهو عرضة لكل تعديل.

اعطيت هذه الافادة [illegible] التحديد الوقت مع الإشارة الى [illegible] فيما بعد حق انتهاء اعمال [illegible] تسليمها للقاضي العقاري واعلانها [illegible] مدة ثلاثون يوماً

طرابلس في ١٠/ ١١/ سنة ٢٠١٨

القاضي العقاري في

رئيس القلم
بالإنابة

استوفي الرسم بموجب لصق [illegible]

فاطمة [illegible]

WTG 19

الجمهورية اللبنانية
وزارة المالية
المديرية العامة للشؤون العقارية

إفادة عقارية

القاضي العقاري في الشمال

بتاريخ ١١/١٠/٢٠١٨

بناءً على الطلب المقدم من السيد

ولدى مراجعة قيود السجل العقاري أعطيت هذه الإفادة الشاملة - الحرفية

المنطقة العقارية: قميلحه - النوع الحرفي: امري

رقم العقار	اسم الموقع	محتويات ووصف العقار	الحقوق العينية والوقوعات	المساحة بالأمتار المربعة	الحصة جزء سهم	الحصة سهم	أسماء المالكين ومقدار الحصص باعتبار الكامل الفين واربعماية سهم
٢٢	المصور الابيض	قطعة ارض بعل سليخ خمر	أشجار	٢٤٠٠			بلدية فيدق هرجبة

إن هذا المخطط هو قيد الدراسة وهو عرضة لكل تعديل

أعطيت هذه الإفادة [illegible] التحديد المؤقت
مع الإشارة إلى [illegible] من بحوث فيما بعد
حتى انتهاء [illegible] في [illegible] وتثبيتها نهائي
العقاري واعلانها بمرور مدة ثلاثون يوماً

طرابلس في ١ / ١١ / سنة ٢٠١٨

القاضي العقاري في

رئيس القلم
رائدة صدرة

استوفي الرسم بموجب اصل [illegible]
فاطمة

WTG 20

مديرية العامة لقوى الأمن الداخلي
وحدة الدرك الإقليمي
يادة منطقة الشمال الإقليمية
مكتب الخدمة والعمليات

عدد: ٢٠٦/١٤٧م٢/أ.ع
تاريخ: ١١-١-٢٠١٩

الموضوع: تكليف

لحضرة محافظ عكار

تم إجراء المقتضى بموجب المحضر رقم ٢٠٤/٨٧٨ تاريخ ١٤/٧ / ٢٠١٨ المرفق ربطاً .

التفضل بالاطلاع

قائد منطقة الشمال الإقليمية
العقيد يوسف درويش

وزارة الداخلية والبلديات - محافظة عكار
الرقم المتسلسل: ١٣٦٤٦
تاريخ الورود: ١٤/١/٢٠١٩

العام
تسليم المستدعي العام والبر
لفاد تدقيق
١٤/١/٢٠١٩

محافظ عكار
عماد اللبكي

WTG 20

المديريه العامه لقوى الأمن الداخلي

وحـــــدة الـــــدرك الإقليمي

قيادة منطقة الشمال الإقليمية

قيادة سرية حلبا الإقليمية

الموضوع :تكليف بالاستدعاء المقدم من المدعو رياض جعفر من كرم شباط .

نظر وقدّم

من العقيـــــد مصطفى الأيوبـــــي

قائد سرية حلبا الاقليمية

إلى العقيد قائد منطقة الشمال الاقليمية

مكتب الخدمة والعمليات م٢اع

عدد : ٧٧ /٢٠٦ ق٢ اع

بعد الاطلاع والايجاب من قبل القطعة المعنية بموجب المحضر رقم ٢٠٤/٨٧٨ تاريخ ٢٠١٨/١٢/٢٧ المرفق ربطا" وبنتيجة ما ورد بافادة المستدعي والمجاورين والمسنين ومختاري المحلة اكدوا ان العقار للمستدعي .

يرجى الإطلاع

قائد سرية حلبا

٢٠١٩/١/٨

المديرية العامة لقوى الأمن الداخلي
الوحدة :الـــدرك الإقليمي
القطعة : قيادة منطقة الشمال الإقليمية
ورد في ١٠ / ١ / ٢٠١٩
سجل تحت عدد ١٤٧ /٢٠٦

م ا ع

WTG.20

المديرية العامة لقوى الأمن الداخلي
قيادة وحدة الـــــــــدرك
قيادة منطقة الشمـــــــال
قيادة سرية حلبـــــا
فصيلة القبيـــــات

الموضوع : عـلم وخبـــر

عـدد : ٥٢ / ٢٠٦

نظـــر وقـــدم
من النقيب جـــــاك شكـــــــور
امـــــر فصيلة القبيـــات
إلـــى العقيـد قـــــائد ســـــرية حلبا

بعد الاطـلاع والايجاب من قبل القطعة المعنية بموجب المحضر رقم ٨٧٨/ ٢٠٤
تاريخ ٢٧/ ١٢/ ٢٠١٧ المرفق ربطاً وبنتيجة ما ورد بافادة المستدعي والمجاورين
والمسنين ومختاري المحلة اكدوا ان العقار للمستدعي

يرجـــى التفضل بالاطـــــلاع
القبيات في ٣٠/ ١/ ٢٠١٩

المديرية العامة لقوى الأمن الداخلي
٤ / ١ / ١٩
٧٧ ق ٤ ع

WTG 20

المديرية العامة لقوى الأمن الداخلي
وحـــــــدة المـــــشترك
قيـــادة منطقـــة الشمال
قيـــادة سرية حلبـــا
فصيـــلة القبيـــات
مخفر القبيات
عـــــدد : ١٢٢ / ٢٠٦

الموضوع : علم و خبر

نظـــر وقـــدم
من المؤهل اول ايليا ديب رقم ٢٥٨٨٦
رئيس مخفر القبيـــــــات
إلـــى النقيب آمـــر فصـــيلة القبيـــــــات

بعد الاطلاع والايجاب بموجب المحضر رقم ٨٧٨/٢٠٤ تاريخ ٢٠١٨/١٢/٢٧ المرفق ربطا وبنتيجة ما ورد بافادة المستدعي و المجاورين والشهود ومختاري بلدة عيدمون اكدوا ان العقار للمستدعي .

يرجـــى التفضل بالاطلاع

القبيات في ٢٠١٨/١٢/٣١

المديرية العامة لقوى الأمن الداخلي
الوحـــدة : المشترك
الفصيلة : القبيات
ورد في ٢٠١٩/١/٣
سجل تحت عدد ٢٠٦/٥٢

WTG 20

المديرية العامة لقوى الأمن الداخلي

(٢)

قيادة : الدرك
منطقة : الشمال
سرية : جبلة
فصيلة : القنيات
مخفر : القنيات
رقم : ٨٧٨ / ٢٠٤
تاريخ : ٢٧/١٢/٢٠١٨

الموضوع
محضر معلومات بالعلم والخبر المقدم من المدعي ريا ضو على جفف الحمامات على حدود وملكية عقاره الفرمه في خراج بلدة عيدون كرم شام محلة البيضة والحال فدعانا محافظة عكار برقم ٢٦٤٧م تاريخ ١٦/١٢/٢٠١٨ تحت عبارة الإيعاز الذي يلزم بالكشف والحقيقة للتثبت من:
- صحة الملكية
- موقع العقار بالنسبة الى المناطق السكنية والطرقات العامة والكهرباء.
- بيان بناء قائم على العقار بناء وبيان تاريخ إنشائه وما اذا كان مخالفاً أضبط المخالفات.
- أخذ إفادات المالكين والمجاورين وبعض المسنين وفتاة إثنين من مخاتير البلدة في حال وجود أكثر من مختار.
وذلك وفقاً للعلم والخبر المرفق والإعارة ومكاتبة فرقة الشمال الإقليمية برقم ٢٠١٧/٢٠٦ م أ تاريخ ٢٧/١٢/٢٠١٨ للإطلاع وإجراء الكشف وفقاً لما هو مطلوب بتكليف عارة محافظ عكار والإعارة ومكاتبة سرية طرابلس برقم ١٤٥٠/٢٠٦ م أ تاريخ ٢٧/١٢/٢٠١٨ للكشف والإعارة وفوراً مرسلة فصيلة القنيات برقم ٢٠١٦/٩٢٦ تاريخ ١١/١٢/٢٠١٨ للكشف والإعارة والمدون في مقرر مخفر القنيات برقم ٢٠١٦/٢٢١ تاريخ ٢٧/١٢/٢٠١٨ لغاية الغاية وعليه تم جمع المعلومات على الشكل التالي:

في الساعة الثانية عشرة من يوم الخميس الموافق للسابع والعشرين من شهر كانون الأول عام الفين و ثمانية عشر

نحن المعاون أول حاتم السقا رقم ٥٦٩٥٤ والرقيب أول عدنان الرفاعي رقم ٤٧٠٨٨

من مخفر القنيات التابع فصيلة القنيات ومرتدين اللباس العسكري نبثت أنه وبناءً لاستدعاء العلم والخبر المقدم من المدعي ريا ضو على جفف الحمامات على حدود وملكية عقاره الفرمه في خراج بلدة عيدون كرم شام محلة البيضة والحال فدعانا محافظة عكار برقم ٢٦٤٧م تاريخ ١٦/١٢/٢٠١٨ تحت عبارة الإيعاز الذي يلزم بالكشف والحقيقة للتثبت من:

- صحة الملكية
- موقع العقار بالنسبة الى المناطق السكنية والطرقات العامة والكهرباء.
- بيان بناء قائم على العقار بناء وبيان تاريخ إنشائه وما اذا كان مخالفاً أضبط المخالفات.
- أخذ إفادات المالكين والمجاورين وبعض المسنين وفتاة إثنين من مخاتير البلدة في حال وجود أكثر من مختار.

وذلك وفقاً للعلم والخبر المرفق والإعارة ومكاتبة محافظة الشمال الإقليمية برقم ٢٠١٧/٢٠٦ م أ تاريخ ٢٧/١٢/٢٠١٨ للإطلاع وإجراء الكشف وفقاً لما هو مطلوب بتكليف عارة محافظ عكار والإعارة ومكاتبة سرية طرابلس برقم ١٤٥٠/٢٠٦ م أ تاريخ ٢٧/١٢/٢٠١٨ للكشف والإعارة وفوراً مرسلة فصيلة القنيات برقم ٢٠١٦/٩٢٦ تاريخ ١١/١٢/٢٠١٨ للكشف والإعارة والمدون في مقرر مخفر القنيات برقم ٢٠١٦/٢٢١ تاريخ ٢٧/١٢/٢٠١٨ لغاية الغاية وعليه تم جمع المعلومات على الشكل التالي:

رقيب أول ٤٧٠٨٨ معاون أول ٥٦٩٥٤

النسخة الأولى

بطل ويحول من لحضرة محافظ عكار / دار / في ٢٠١٩

WTG 20

تابع محضر حصر البيانات رقم ٨٧٨ / ٢٠٠٤ تاريخ ٢٥ / ٤ / ٢٠١٨

بلاد حمزة والعين الحالي رقم سجل ٢ / حمزة والعين هاتف ٨٧٢٨٨٤ / ٠٧
يفيد بأنه لا يملك عقار غير موضح في حمزة بلاد حميد وملك
أرض شاطئ بعقار المتوفي في الجهة الغربية ولا توجد
أي نزاعات بيني وبين على حدود وملكية هذا العقار ولا طاعن
لدي في الحدود والتوقيع على هذا العلم والخبر وهذه إفادتي.
تليت عليه إفادته فصدقها وقع معنا
عادل فهد الجنابي رقم الهاتف ٤٧٠٨٨٨ صالح الهاتف ٢٦٩٥٤

"إفادة ١٨ هيثم أول"
يسمى هيثم جعفر بن عبد الله بن جعفر ولد الحبيب
عام ١٩٥٦ م عراقي الجنسية مقيم مقر بلاد الحبيب
العالي رقم سجل ٢٠ / الحبيب هاتف ٠٧٩٦٣٧٢٤ يفيد بأن
المتوفى تاركاً على جعفر بلاد عقار غير موضح في حمزة
بلاد حميد وملك أرض شاطئ البصرة وهو عقار بطابق
يوجد شاغل عليه جعفر موظفاً من مستشفى جعفر شفاء
هاتف عام وغير محدود شرقاً وغرباً وشمالاً وجنوباً
ولا توجد أي نزاعات بيني وبين أي شخص آخر على حدود
وملكية هذا العقار وهذه إفادتي.
تليت عليه إفادته فصدقها وقع معنا
١٨ هيثم أول رقم الهاتف ٤٧٠٨٨٨ صالح الهاتف ٢٦٩٥٤

"إفادة ١٨ هيثم ثاني"
يسمى علي جعفر بن محمد بن عبد الله بن جعفر ولد ١٩٥٤
وساكن بلاد الرميلة الجديدة بالحي شارع تاهل متزوج
مقيم في الداخل رقم سجل ٢٠ / الحبيب هاتف ٠٧٨١٢٤٢٤٢ يفيد
بأن المتوفى تاركاً على جعفر بلاد عقار غير موضح في حمزة بلاد حميد وملك
أرض شاطئ البصرة وهو عقار بطابق يوجد شاغل عليه
جعفر وفيه أخوته فيني جعفر وسكنا طابق عام وغرفة
١٨ هيثم ثاني رقم الهاتف ٤٧٠٨٨٨ صالح الهاتف ٢٦٩٥٤
علي محمد جعفر
علي جعفر

ص ٥ تابع محضر ضبط رقم ٨٧٨/٢٠١٨ ع ق ٢٧/١٢/٢٠١٨

ملاحظات وضابطة تحت التحقيق اقوالهم استمرارا لمحضر
ضبط الجريمة الجنائية رقم ٤٤٥٨٤٦ تاريخ ٢٠/١٢/٢٠١٨
" الأنفية "

مفاد ان سيادة عميد مركز شرطة محافظة الجيزة تلقى
بلاغا شفهيا وهو عبارة عن مبلغ من عيال الطريق
الدائري باتجاه قليوب وبالبحث بالقاء القبض على
متهمين اوصيف لا يوجد بالقاء اية اجهزة هواتف
او كهربائي او سيارات مبلغ او مجرين اخرين شفويا
وهذا ما شاهدناه

رقيب (ا) ٤٧٠٨٨ معاون ا ٢٦٩٥٤

نظم هذا المحضر في الساعة والتاريخ المذكورين بغرفة
وفتح الساعة الرابعة عشر تم تحرير على نموذج
تحريات ولى مع استدعاء العلم والخبر لجانب محافظة
بكاملها والتابعة للمحافظة

رقيب ول ٤٧٠٨٨ معاون ول ٢٦٩٥٤

WTG 20

المديرية العامة لقوى الأمن الداخلي
وحـــدة الـــدرك الإقليمي
قيادة مـــنطقة الشمال الإقليمية
مكتب الخدمة والعمليات

عدد: ١٠١٣٢ / ٢٠٦ م٢ أ ع
تاريخ: ٧ / ١٢ / ٢٠١٨

الموضوع: تكليف

نُظر وأُحيل

إلى العقيد قائد سرية حلبا الاقليمية

المديرية العامة لقوى الأمن الداخلي
الوحـــدة : الـــدرك
القطعـــة : فصيلة القبيات
ورد في ١١ / ١٢ / ٢٠١٨
سجل تحت عدد ٢٠٦/٩٢٢

محفر القبيات
للمتابعة والإجراء

للاطلاع وإجراء المقتضى وفقا" لما هو مطلوب بتكليف سعادة محافظ عكار

والاعادة حتى / / ٢٠١٨.

المديرية العامة لقوى الأمن الداخلي
الوحـــدة : الـــدرك
القطعـــة : مفرزة القبيات
ورد في ١٢ / ١٢ / ٢٠١٨
سجل تحت عدد ١٢٢١

المديرية العامة لقوى الأمن الداخلي
وحدة الدرك الإقليمي
قيادة سرية حلبا
ورد في ١٠ / ١٢ / ٢٠١٨
سجل تحت عدد ٢٠٦/٤٥٠٢

قائد منطقة الشمال الإقليمية
العقيد يوسف درويش

قائد منطقة الشمال الإقليمية

نظر وأحيل
إلى العقيد آمر فصيلة القبيات
للمقتضى فاستكماله.

WTG 20

الجمهورية اللبنانية
وزارة الداخلية والبلديات

محافظة عكار
عدد : م/٣٦٩٧
حلبا في : ٦ / ٢ / ٢٠١٨

حضرة قائد منطقة درك الشمال الإقليمية

الإيعاز لمن يلزم بالكشف والتحقيق للتثبت مما يلي :

١- صحة الملكية
٢- موقع العقار بالنسبة إلى المنطقة السكنية والطرقات العامة والكهرباء
٣- بيان ما إذا كان على العقار بناء وبيان تاريخ إنجازه وإذا كان مخالفاً ضبط المخالفة
٤- أخذ إفادة المالكين والمجاورين وبعض المسنين ومختارين إثنين من مخاتير البلدة في حال وجود أكثر من مختار.

وذلك وفقاً للعلم وخبر المرفق والإعادة

محافظ عكار
عماد اللبكي

الجمهورية اللبنانية
محافظة عكار
وزارة الداخلية والبلديات

المديرية العامة لقوى الأمن الداخلي
القيادة: الدرك الإقليمي
الشعبة: قيادة منطقة الشمال الإقليمية
ورد في ٧ / ٢ / ٢٠١٨
مسجل تحت عدد ٢٠١٣٢ / ٢٠٦

WTG 20

سعادة محافظ عكار المحترم

المستدعي: رياض علي جعفر محمد رشبان رقم الهاتف:

الموضوع: تصديق علم و خبر

ارجو الموافقة على تصديق العلم والخبر المرفق ربطا في بلدة كرم شباط

وتفضلوا بقبول فائق الاحترام

رياض حمزة

وزارة الداخلية والبلديات - محافظة عكار
الرقم المتسلسل: ٩/٣٦٩٧
تاريخ الورود: ٢٠١٨/١٢/٦

WTG 20

عدد ٤٤٧ / ٢٠١٨

الجمهورية اللبنانية
وزارة المالية
المديرية العامة للشؤون العقارية

نموذج رقم ٨
للشؤون العقارية

علم وخبر
القانون الصادر
بالمرسوم الاشتراعي رقم ١٢ تاريخ ٢٨ / ٢ / ١٩٣٠
- المادة ١٢ -

أمانة السجل القعاري في:

المحافظة : عكار القضاء : عكار المنطقة العقارية عيدمون المحلة كرم شباط / محلة البيضة

رقم العقار في سجل مساحة لبنان القديم : أو رقم عموم الويركو في الولايات : مساحته : ٨٧٨٦ م.م

درهم : قيراط : حبة:

نوع العقار الشرعي (ملك أو أميري):

حدود العقار الشرعي مع أسماء : شمالاً : علي جعفر

مع أسماء المالكين جنوباً : محمد جعفر

شرقاً : طريق عام

غرباً : مصطفى عبد

محتويات العقار بالتفصيل : ارض سلخ

طريقة اكتساب الحق : - حكم صادر على العلم والخبر رقم ٣٦٤٧ ت.ع الصادر عن قضاء عيدمون استناداً الى محضر تحقيق مخزن القبيات رقم ٨٧٨ ت.ع تاريخ ١٢/٢٧ ت.ع

مدة وضع اليد على العقار :

الاشغال التي قام بها واضع اليد :

الغاية من طلب العلم والخبر (بيع،هبة،تأمين،...)

المالك أو العاقد : الاسم الثلاثي : رياض علي جعفر اسم الام : حليمة رقم سجل النفوس : ٢٨

محل وتاريخ الولادة البيبان ١٩٤٩ محل الاقامة فنيدق عنوان السكن : فنيدق توقيع العاقد :

المعقود له : الاسم الثلاثي : رقم سجل النفوس :

محل وتاريخ الولادة : محل الاقامة : السكن : توقيع المعقود له :

الحق المطلوب تسجيله أو الحصة: القيمة او ... (ل.ل.)

اسماء وتواقيع الاعضاء الاختيارية

تصديق القائمقام

توقيع المخمن وختمه

WTG 20

الجمهورية اللبنانية

محافظة عكار

قضاء عكار

منطقة كرم شباط العقارية

المحلة البيضة

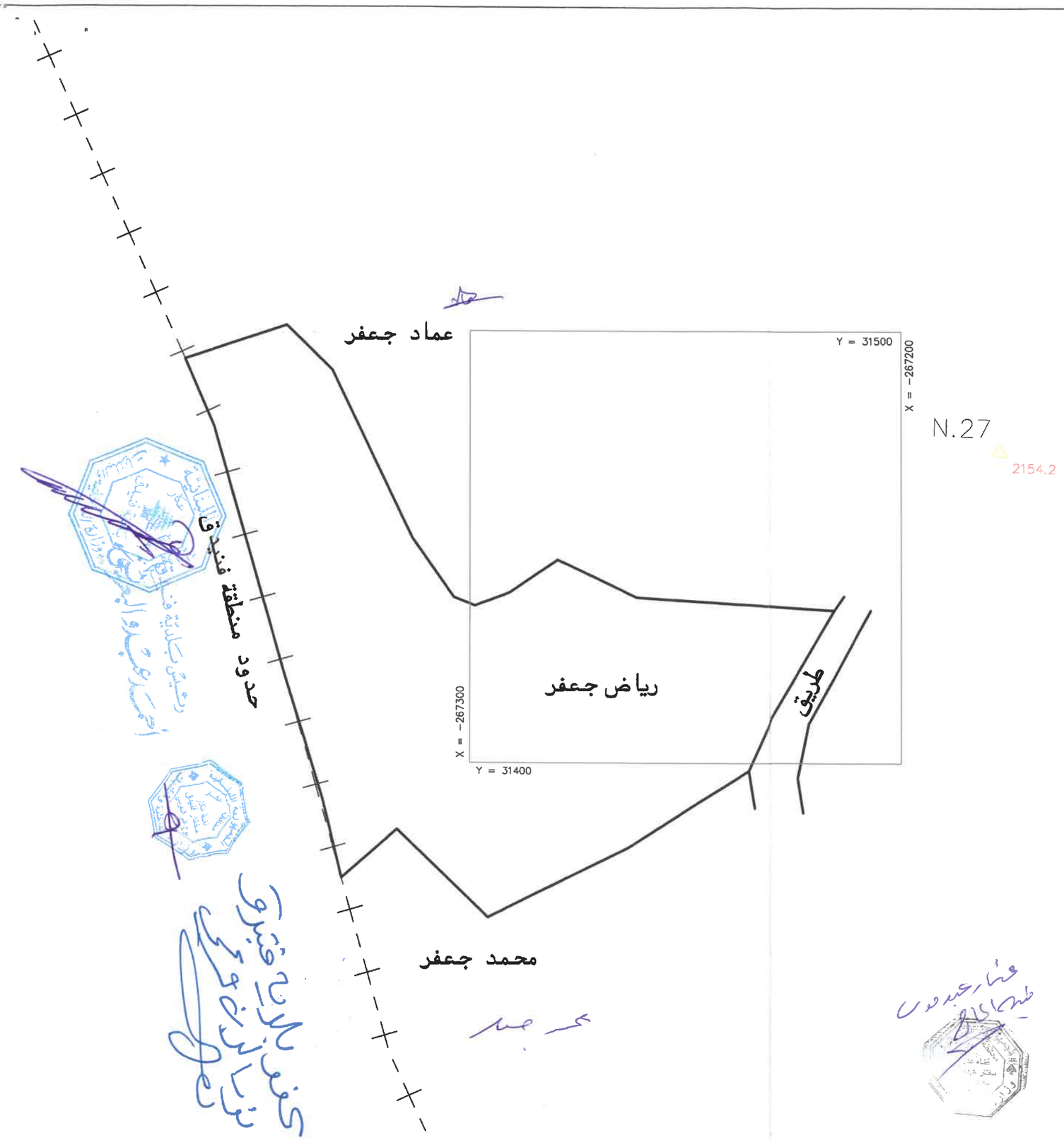
خريطة علم و خبر

مقياس 1/1000

مصطلحات

—— حدود العقار

ختم و توقيع المهندس المساح



06-10-2018

يحده

شمالا عماد جعفر

شرقا طريق عام

جنوبا محمد جعفر

غربا منطقة فنيدق

المساحة ٨٧٨٦ م م

جرى الكيل على مسؤوليتى وبالاستناد الى دلالة المجاورين و المالكين و المختار وعلى مسؤوليتهم

8786 m2

WTG 20

الجمهورية اللبنانية

محافظة عكار

قضاء عكار

منطقة كرم شباط العقارية

المحلة البيضة

خريطة علم و خبر

مقياس 1/1000

مصطلحات

—— حدود العقار

ختم و توقيع المهندس المساح

06-10-2018

يحده

شمالا عماد جعفر

شرقا طريق عام

جنوبا محمد جعفر

غربا منطقة فنيدق

المساحة ٨٧٨٦ م م

جرى الكيل على مسؤوليتي وبالاستناد الى دلالة المجاورين و المالكين و المختار وعلى مسؤوليتهم

8786 m2

WTG 21

إفادة عقارية

الجمهورية اللبنانية
وزارة المالية
المديرية العامة للشؤون العقارية

القاضي العقاري في الشمال

بتاريخ ١١/١٠/٢٠١٨

بناءً على الطلب المقدم من السيد

ولدى مراجعة قيود السجل العقاري أعطيت هذه الإفادة الشاملة - الجزئية

المنطقة العقارية: عميلة - النوع الشرعي: أميري

رقم العقار	اسم الموقع	محتويات ووصف العقار	الحقوق العينية والوقوعات	المساحة بالأمتار المربعة	الحصة جزء سهم	الحصة سهم	أسماء المالكين ومقدار الحصص باعتبار الكامل العين وأربعمائة سهم
٢٧	قرانة عين الفرح	قطعة أرض بعل	لبنى ٢٤ بلدية فيندق				

جزء بعض الاشجار المرحية -

إن هذا المحضر هو قيد الدراسة وهو عرضة لكل تعديل.

اعطيت هذه الافادة بلا من عدم التحديد المؤقت
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حتى انتهاء ... في ... تسليمها للقاضي
العقاري واعتبر ... مدة ثلاثون يوماً

طابق

في ١١/١٠/٢٠١٨

القاضي العقاري في
رئيس القلم
أعدة عدرة

استوفي الرسم بموجب لصق دمغة على الطلب
فاطمة فوزي

WTG 22

الجمهورية اللبنانية
وزارة المالية
المديرية العامة للشؤون العقارية

إفادة عقارية

القاضي العقاري في الشمال

بناء على الطلب المقدم من السيد

تاريخ ١١/١٠/٢٠١٨

ولدى مراجعة قيود السجل العقاري أعطيت هذه الإفادة الشاملة - الجزئية

المنطقة العقارية عميق - النوع الوقفي: أميري

رقم العقار	اسم الموقع	محتويات ووصف العقار	الحقوق العينية والوقوعات	المساحة بالأمتار المربعة	الحصة		أسماء المالكين ومقدار الحصص باعتبار الكامل العين وأربعمائة سهم
					جزء سهم	سهم	
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استوفي الرسم بموجب [illegible]

طرابلس في ١١/١٠/٢٠١٨

القاضي العقاري في
رئيس القلم
راغدة عدرة

6034 m2

الجمهورية اللبنانية
وزارة المالية
المديرية العامة للشؤون العقارية

إفادة عقارية

القاضي العقاري في الشمال

بتاريخ ٢٠١٨/١٠/١١

بناءً على الطلب المقدم من السيد

ولدى مراجعة قيود السجل العقاري أعطيت هذه الإفادة الشاملة - الجزئية

المنطقة العقارية : عميق ف - النوع الشرعي امري

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					سهم	جزء سهم	
٢٢	مرنة القاعوع	قطعة أرض بعل		٢٤٠٠	بلدية عيندا		

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طلب من ٢٠١٨/١٠/١١

القاضي رئيس القلم
واغدة عدرة

استوفي الرسم بموجب [illegible]
قاضي [illegible]

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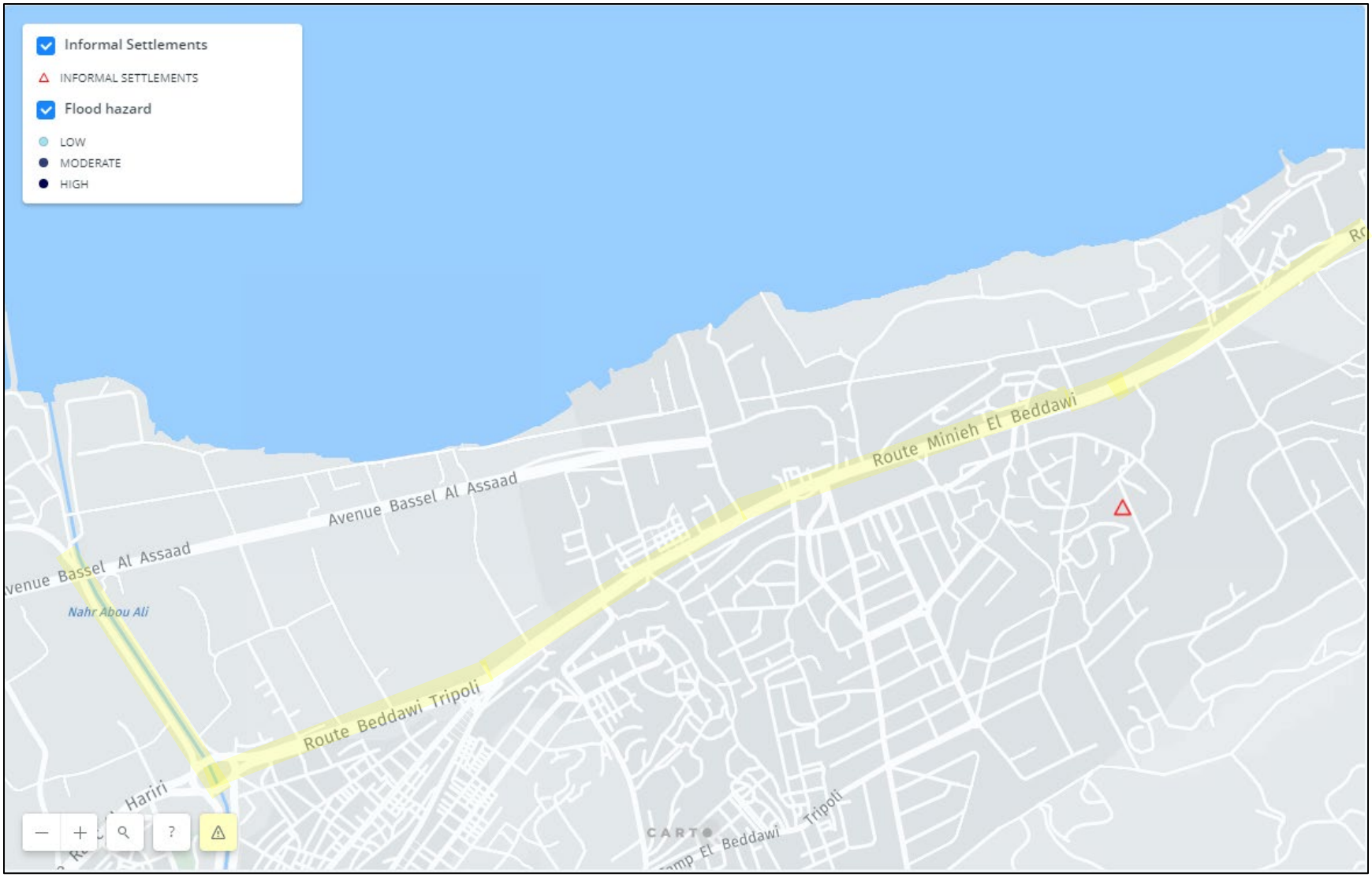
APPENDIX E
INFORMAL SETTLEMENTS MAPPING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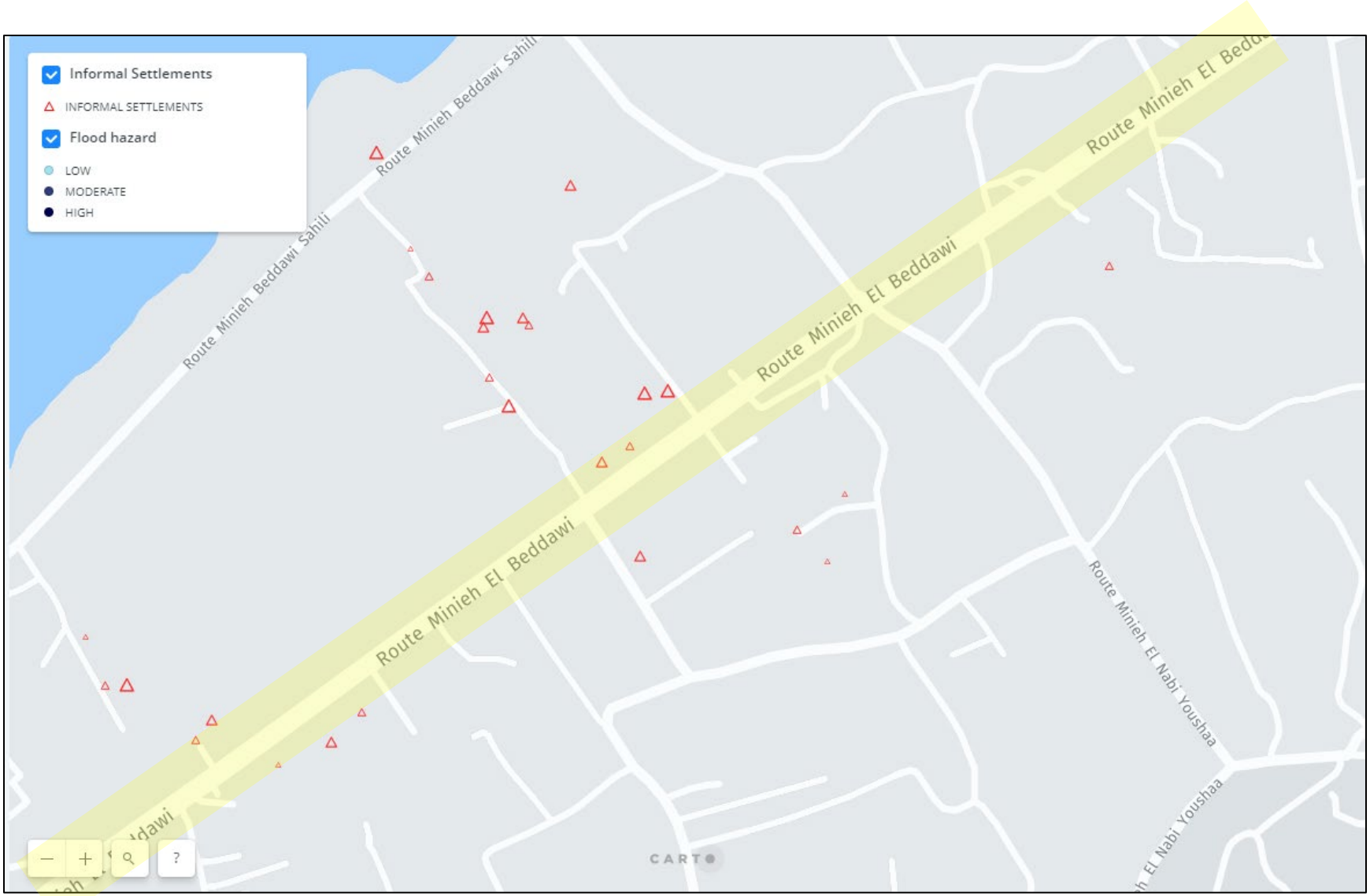
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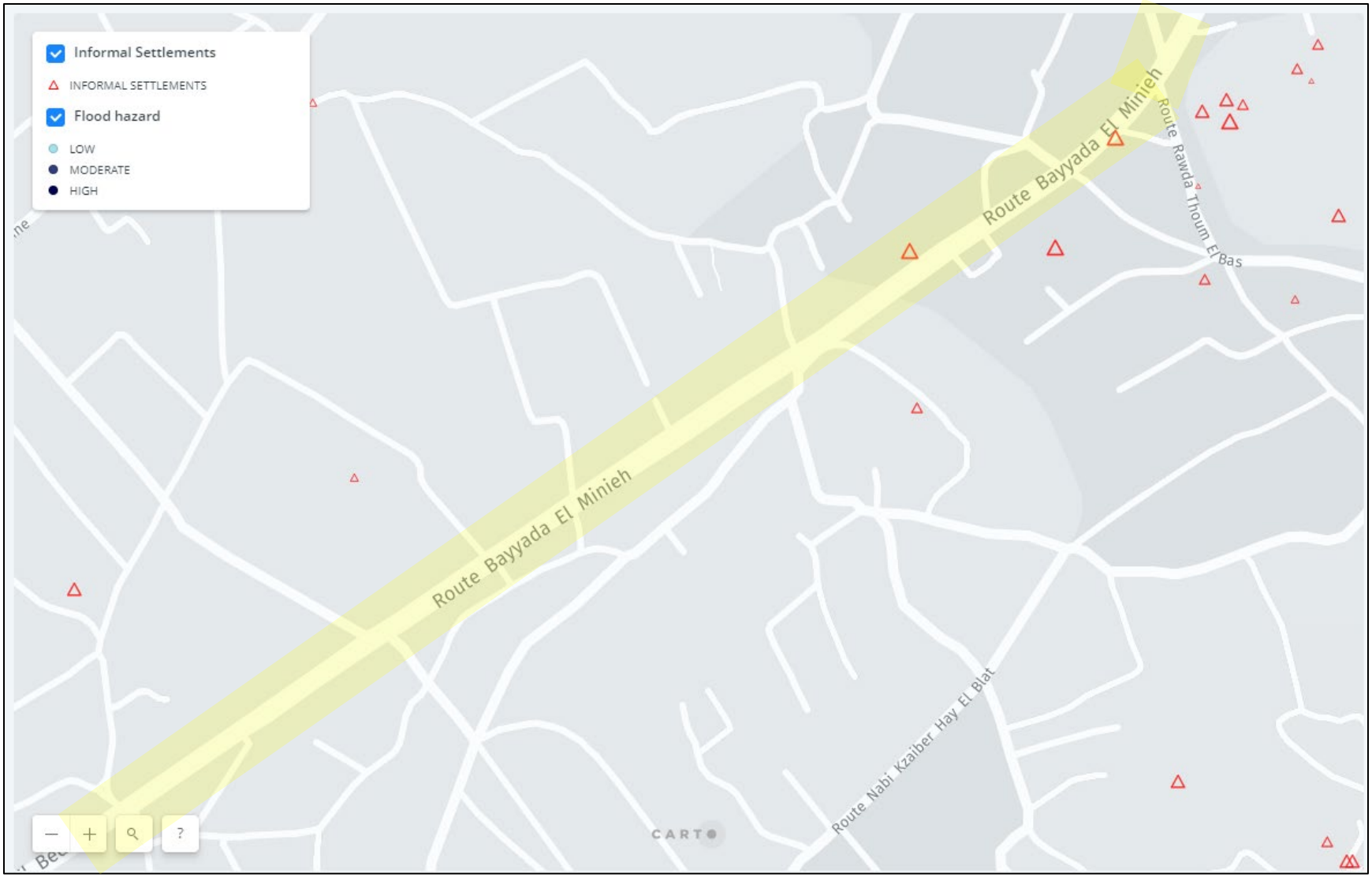
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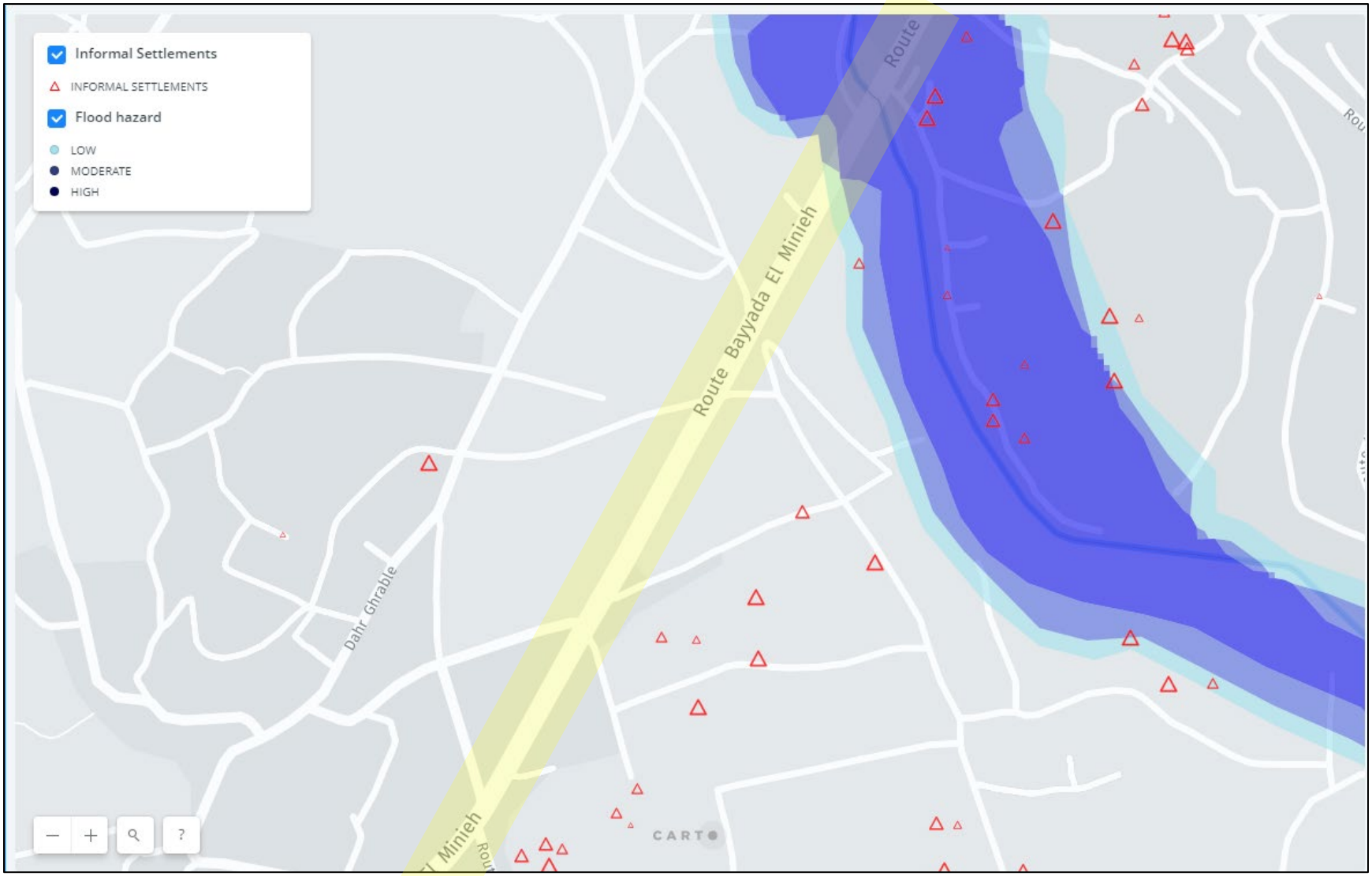
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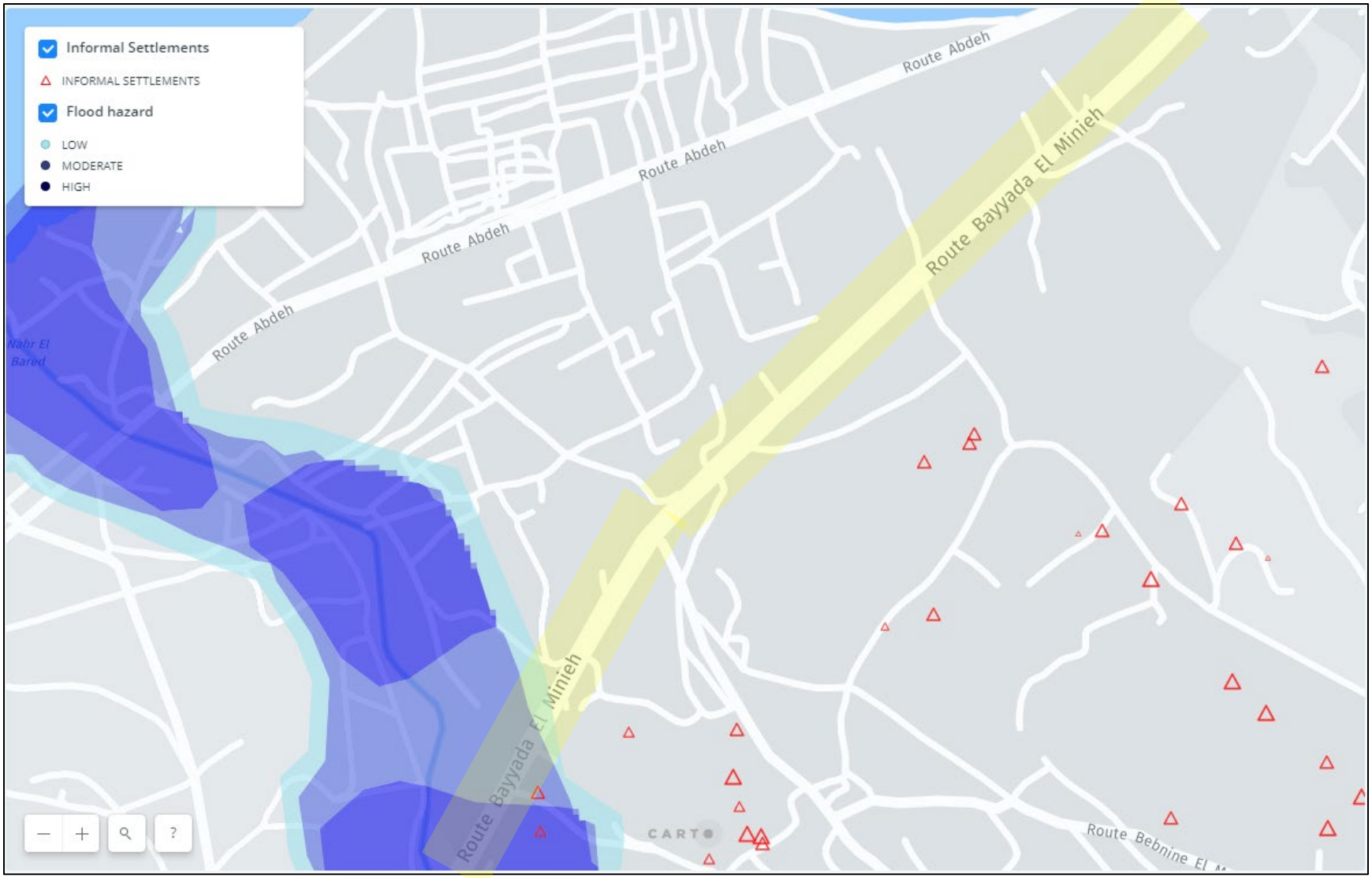
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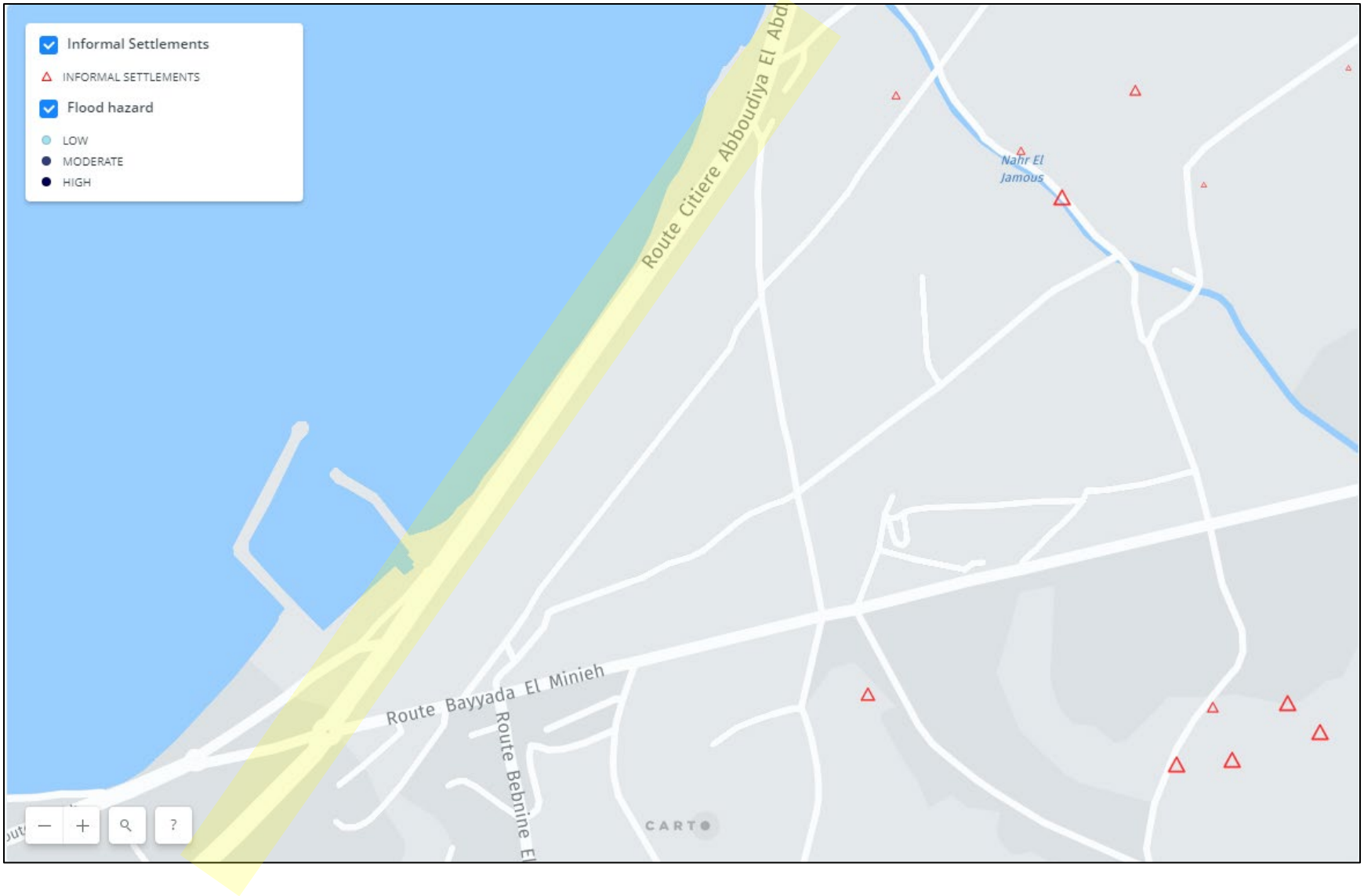
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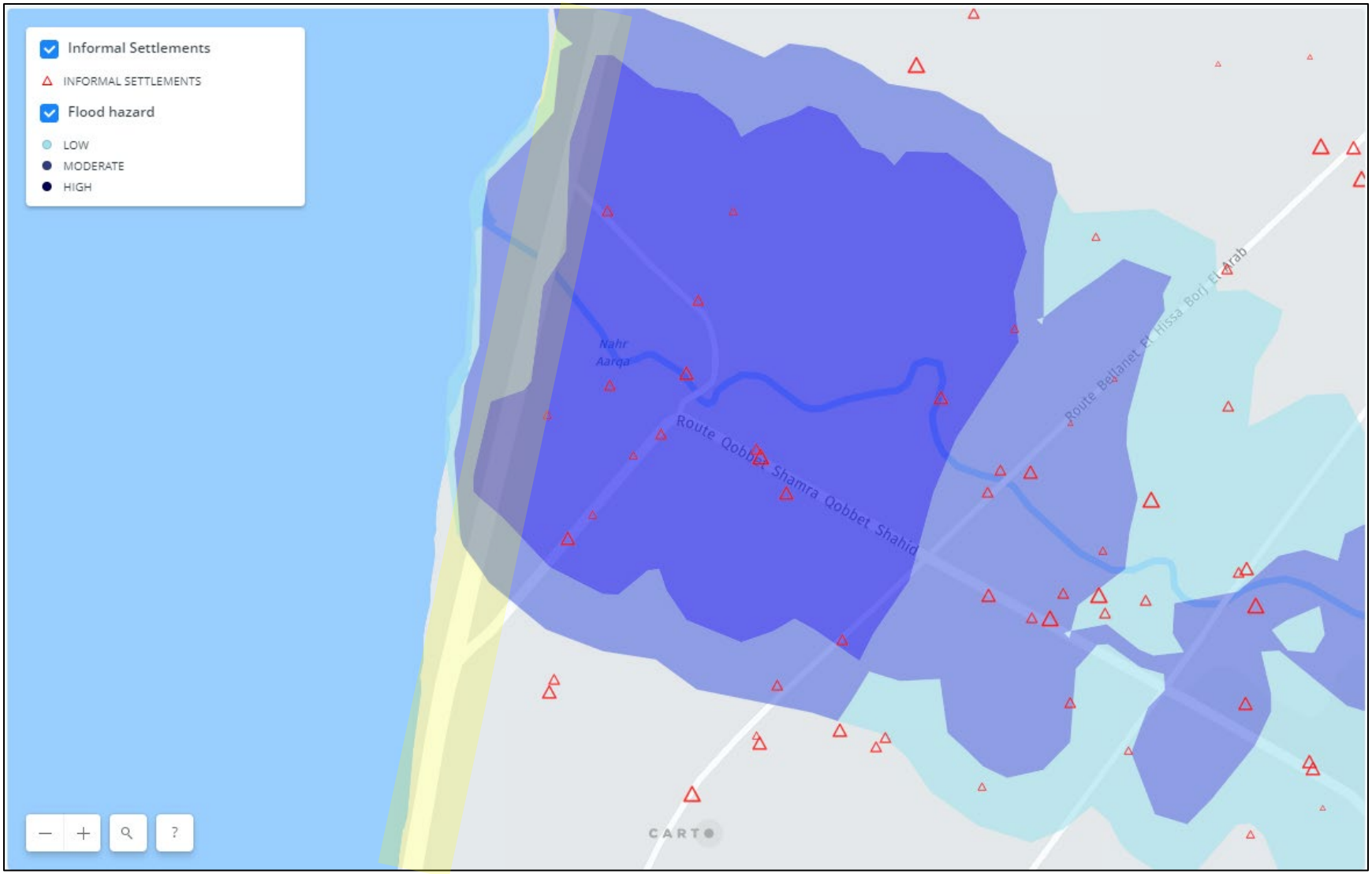
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Route Abboudiyeh El Abdeh
Route Meriata Heddara
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El Jdideh
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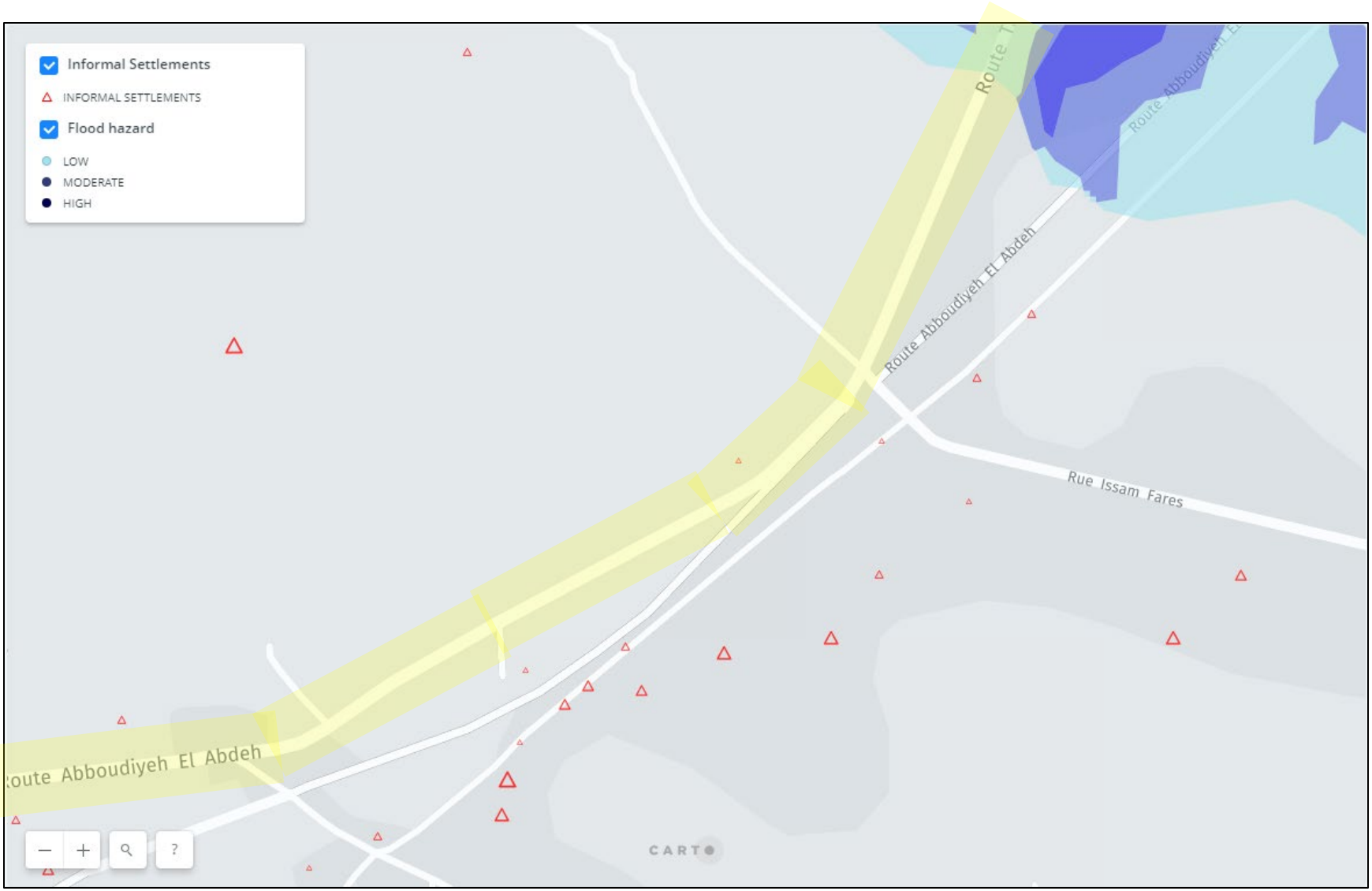
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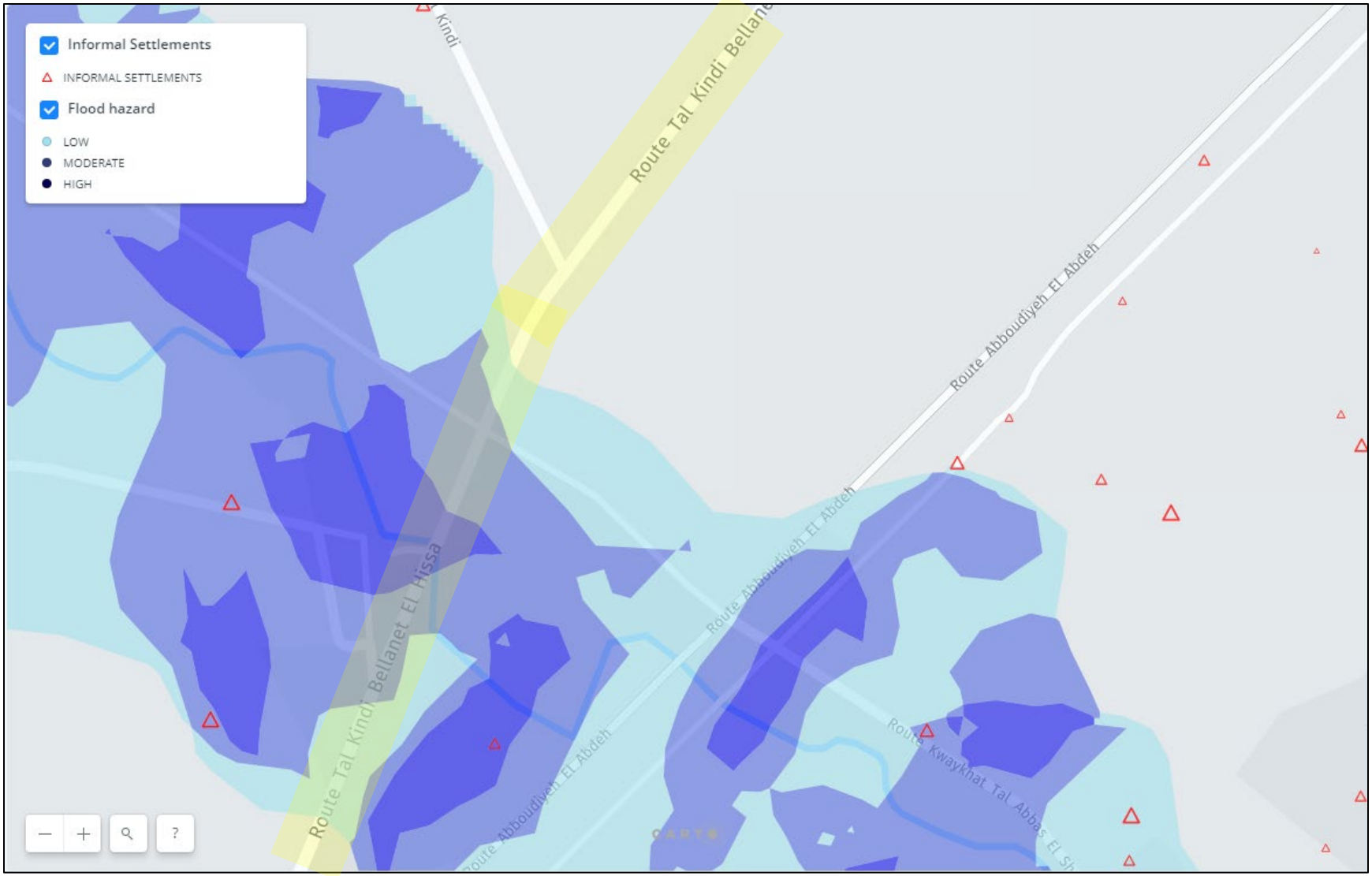
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Route Kwaykhat Tal Abbas El Sh
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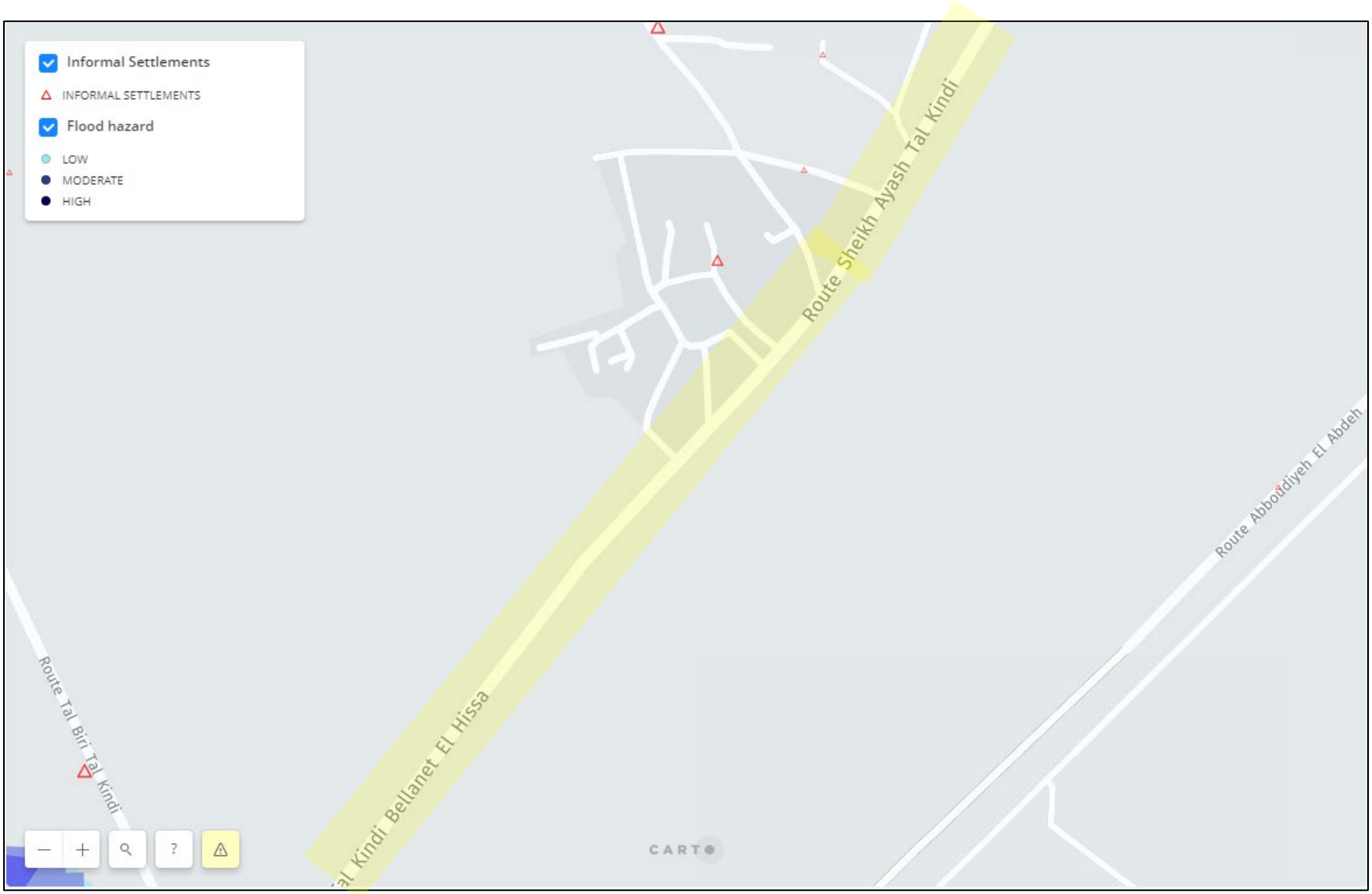
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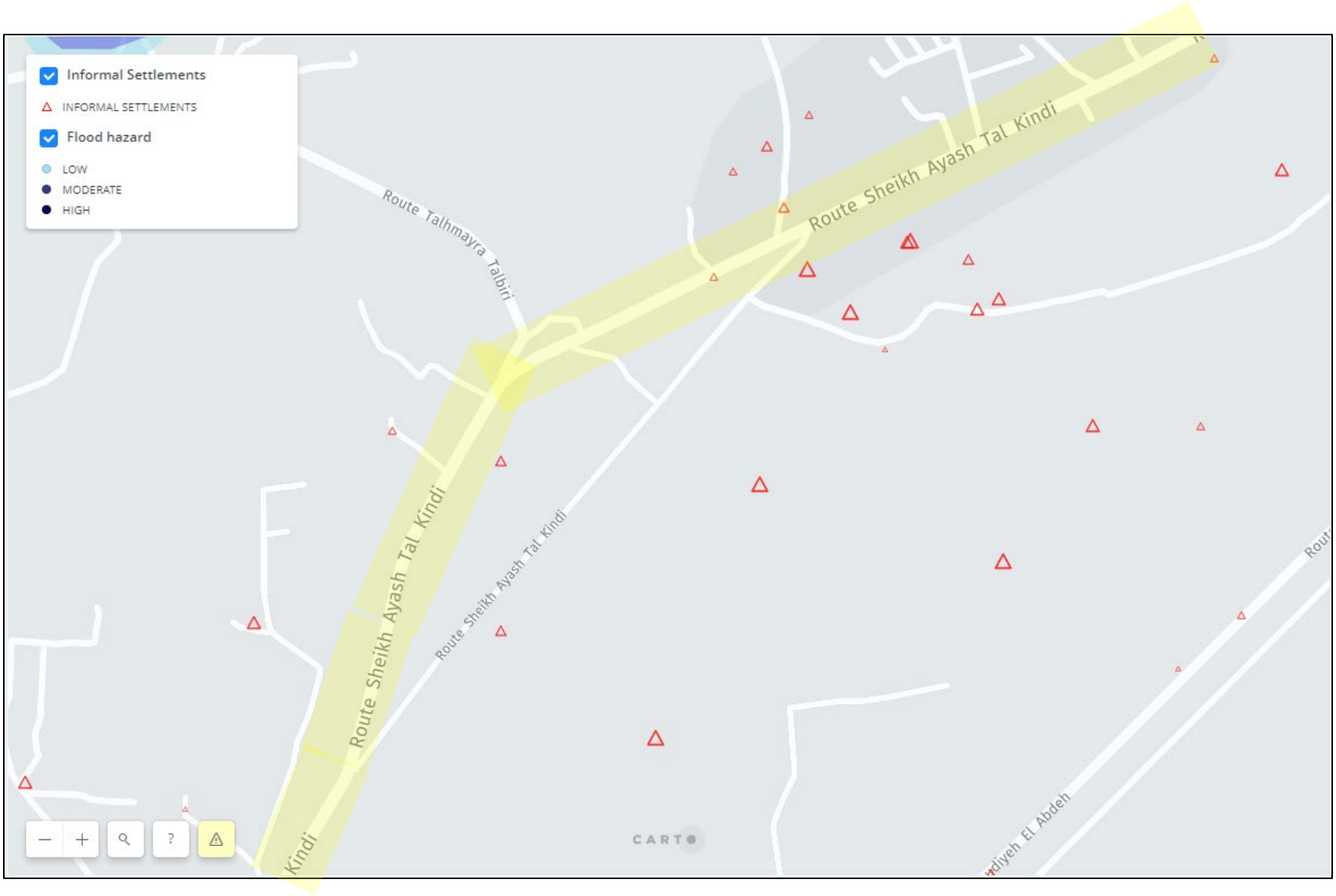
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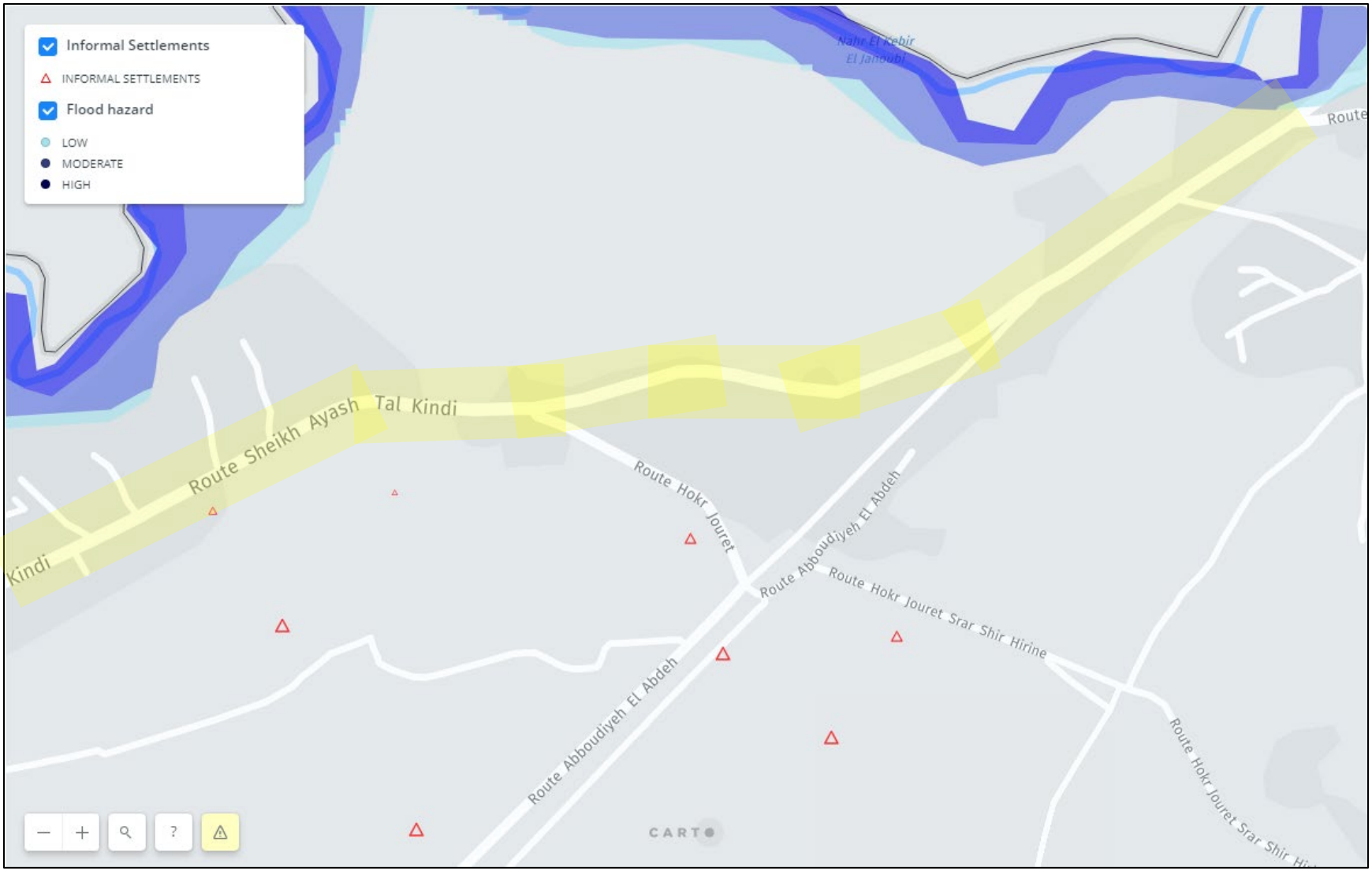
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Kindi
Route Hokr Jouret
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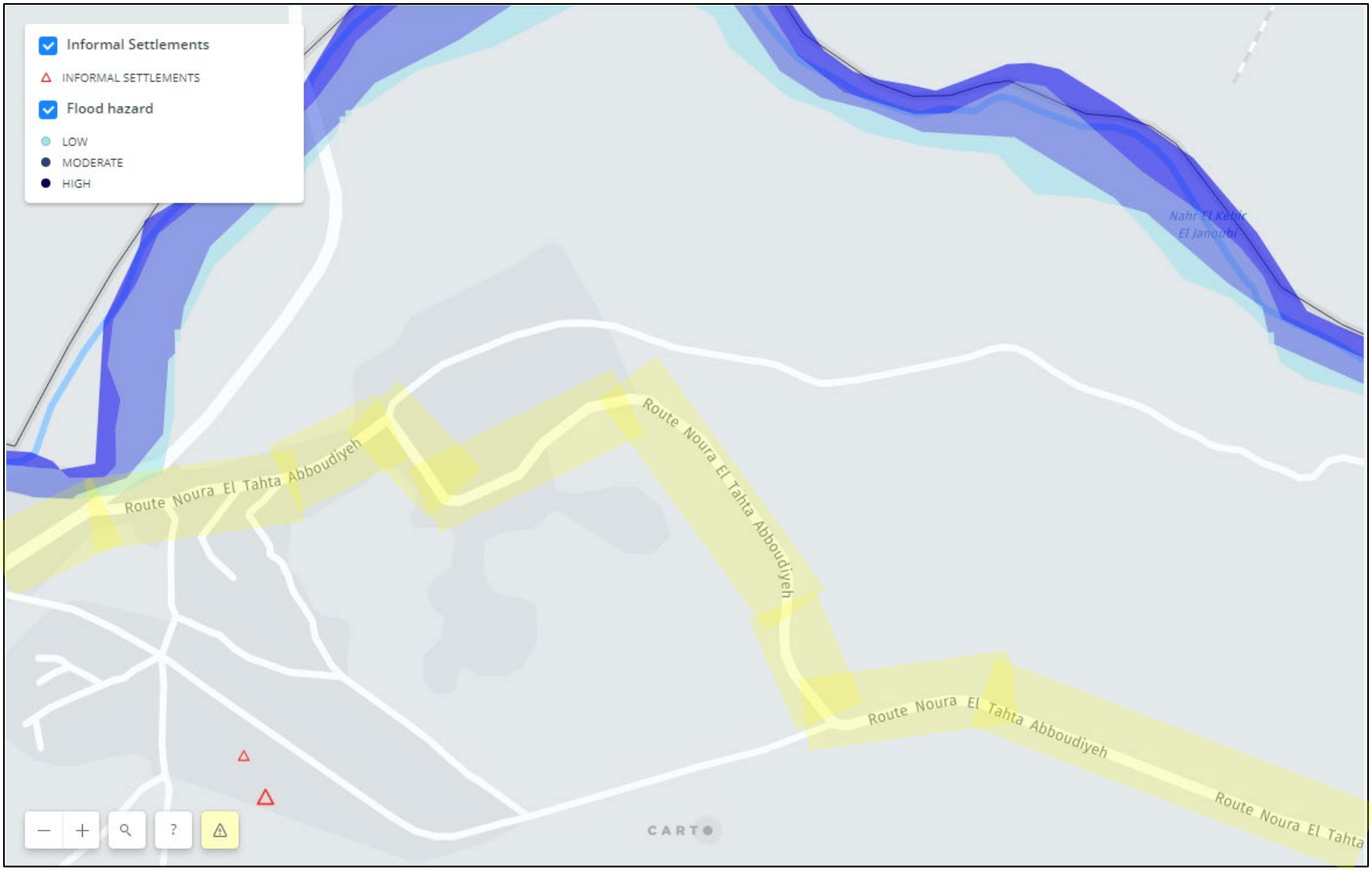
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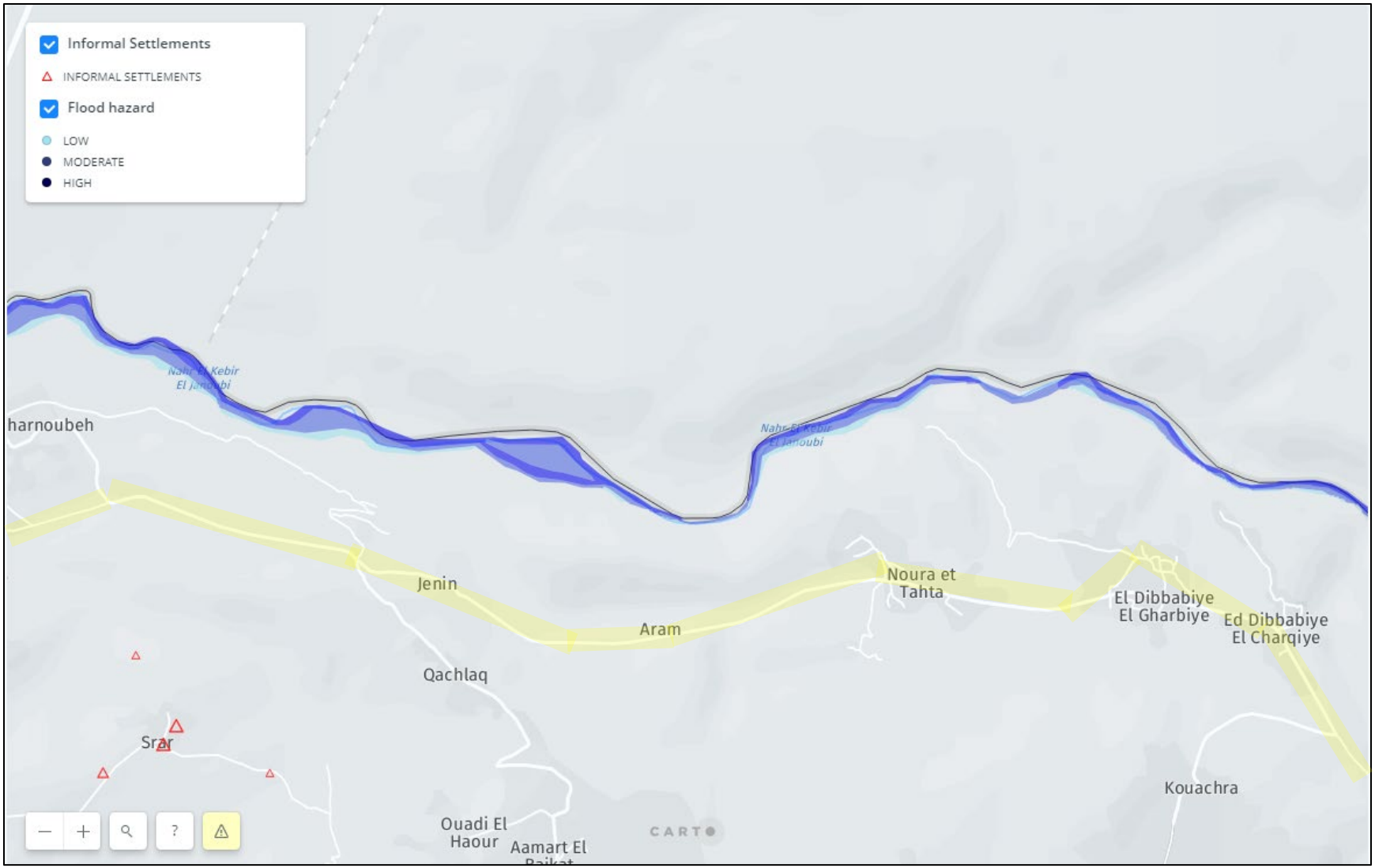
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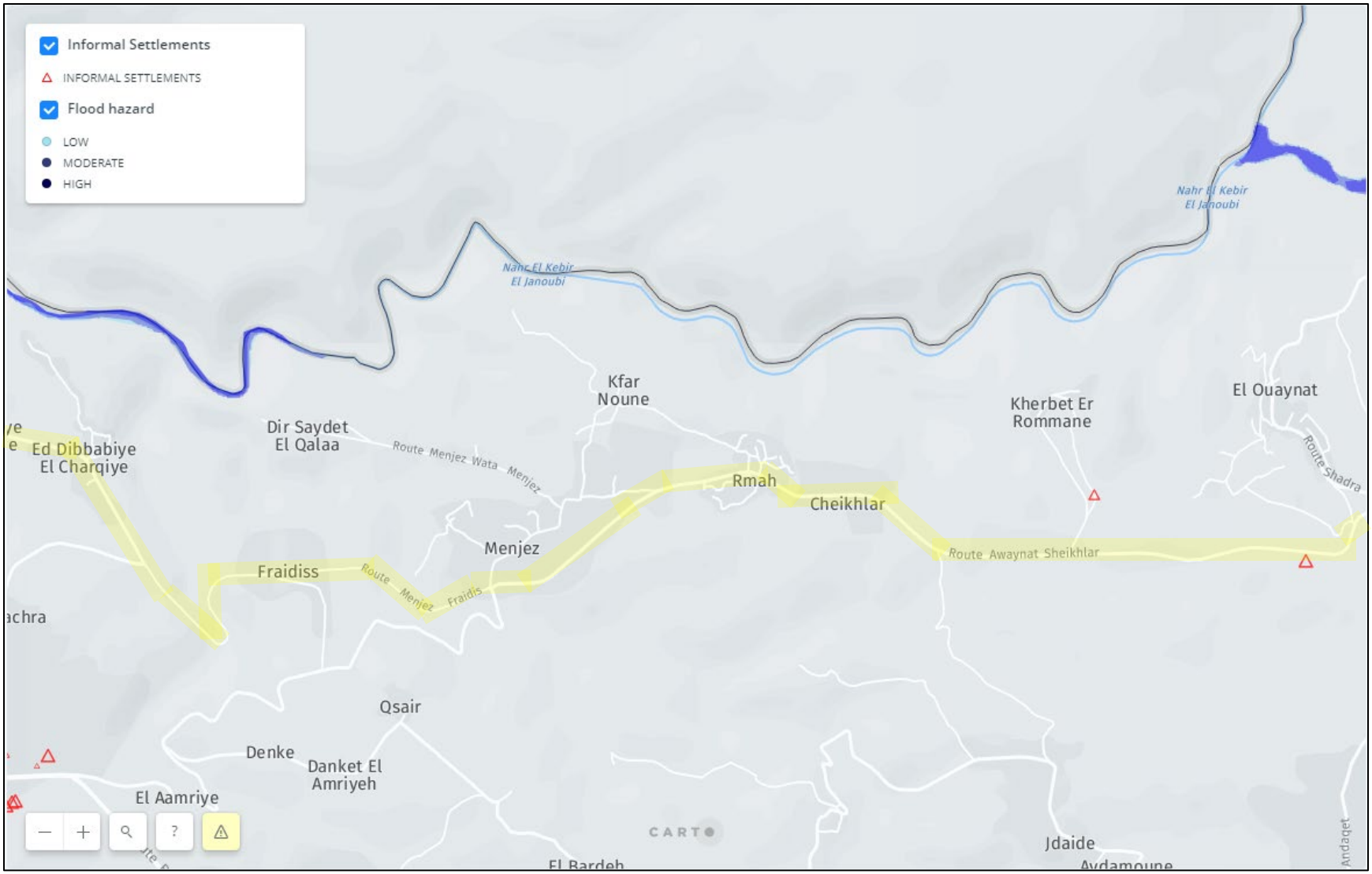
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Kherbet Er Rommane
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Dir Saydet El Qalaa
Ed Dibbabiye El Charqiye
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Rmah
Cheikhlar
Route Shadra
Menjez
Route Awaynat Sheikhlar
Fraidiss
Route Menjez Fraidis
Qsair
Denke
Danket El Amriyeh
El Aamriye
Jdaide
Andaqet

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Nahr es Safa
El Haiche
Route Amayer El Hishi
Route Awadeh El Hishi
El Aoud
Nahr el Kebir El Janoubi
Khalssa
Mqaible
Machta Hassan
Chadra
El Ouaynat
Kherbet Er Rommane
Route Shadra
El Awaynat
El Ouaychat
Er Rama
Kalkha
Db
CARTO

APPENDIX F

SCOPING REPORT AND MOE LETTER OF RESPONSE TO THE SCOPING REPORT

Consultancy Services

Scoping Report

Environmental and Social Impact Assessment for Lebanon Wind Power Project

Akkar – North Lebanon

Prepared by:

Sustainable Environmental Solutions sal

In partnership with:

Ramboll US

June 2018

DATE	VERSION	PREPARED BY	REVIEWED BY	APPROVED BY
1 June 2018	Final scoping report	Dr. Layale Abi-Esber Ms. Sara Hteit Ms Leila Morcos	Dr. Naji Chamieh	Dr Naji Chamieh

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List of Abbreviations

CDR	Council for Development and Reconstruction
CEDRO	Country Energy Efficiency and Renewable Energy Demonstration Project for the Recovery of Lebanon
dB(A)	'A' weighted decibel noise level
DGUP	Directorate General of Urban Planning
EDL	Electricite du Liban
ESIA	Environmental and Social Impact Assessment
EMP	Environmental Management Plan
HSE	Health, Safety and Environmental
IDAL	Investment Development Authority of Lebanon
IFC	International Finance Corporation
MoE	Ministry of Environment
MoEW	Ministry of Energy and Water
MoIM	Ministry of Interior and Municipalities
MoPWT	Ministry of Public Works and Transport
NOx	Nitrogen Oxides
O_2	Dioxygen
OSHA	Occupational Safety and Health Administration
PM10	Particulate Matter
PM2.5	Fine particulate matter
SES	Sustainable Environmental Solutions
SO_2	Sulfur Dioxide
UNDP	United Nations Development Program
VOC	Volatile Organic Compound
WHO	World Health Organization

1 Introduction

This document presents the scope for conducting an Environmental and Social Impact Assessment (ESIA) study for the construction and operation of a Wind Farm in the Akkar District in North Lebanon. The project proponent is Lebanon Wind Power SAL., and the current study is conducted in the context of the permitting process for the design, construction and operation of the wind farm.

Besides providing background information related to the project, the scoping report describes the proposed project and formulates a scope of work for the ESIA study including an assessment of the key potential environmental impacts which will be examined and their likely mitigation measures. Based on feedback from MoE regarding the adequacy of the proposed scope, the ESIA study will be developed with the intent to guide the final decision regarding the permitting for the wind farm.

2 Background Information

The parties involved in the ESIA study include the project proponent, Lebanon Wind Power SAL, and their environmental consultant, Sustainable Environmental Solutions (SES SAL) in partnership with Ramboll US. The profiles of the project proponent and their consultant SES SAL / Ramboll US are described below along with a discussion of the history, importance, and major components of the proposed project.

2.1 Lebanon Wind Power

Lebanon Wind Power is one of three proponent companies recently founded in Lebanon with the aim of developing wind farm projects in Lebanon. Lebanon Wind Power will be responsible of the design, development and operation of a 60 MW wind farm proposed in the region of Akkar, North Lebanon. The wind farm will be owned, operated and paid for by Lebanon Wind Power who in turn will sell the generated power to Electricite du Liban at an agreed rate. The company has signed for this purpose a Power Purchase Agreement (PPA) agreement with the MoEW in February 2018. Please see CoM Decision granting Lebanon Wind Power a license to establish and operate a wind farm in Akkar and selected pages from the related PPA agreement in **Appendix A**.

2.2 SES

SES is a leading environmental and energy consultancy, providing environmental solutions and services in the fields of environmental, civil, mechanical, electrical, electro-mechanical and agricultural engineering, business development, environmental and energy economics, waste management, and applied earth sciences. SES has completed numerous environmental assessment studies (Strategic Environmental Assessment (SEA), Environmental Impact Assessment (EIA), Initial Environmental Examination (IEE), Environmental Audits (EA), Economic and Social Impact Assessment (ESIA), and Environmental baseline studies on national and regional levels in accordance to Lebanese and international standard. SES is also a pre-qualified candidate at the Council for Development and Reconstruction (CDR) and the Ministry of Environment (MoE) for conducting the latter studies.

2.3 Ramboll US

Ramboll is a leading engineering, design and consultancy company founded in Denmark in 1945. They employ close to 13,000 experts and have a significant presence in the Middle East, Europe, North America and Asia. With close to 300 offices in 35 countries, their emphasis is on local experience combined with a global knowledge-base. Among other types of consultancies, Ramboll is one of the world's leading environmental consultancies, and has

extensive experience of working on IFC and EPIII compliant ESIAs, Environmental and Social Action Plans (ESAPs), Environmental and Social Management Plans (ESMPs), Environmental Master Planning, and Environmental Management and Monitoring Plans (EMMP) within the KSA, UAE, the wider Middle East region and globally.

Ramboll's International Impact Assessment Services team has provided environmental and social consulting services to financial institutions and project developers seeking financing for the past 20 years. In this regard, they provide strategic environmental and social support in the context of international good practice, including:

- The Equator Principles III (EP III, 2013).
- The International Finance Corporation's (IFC) Performance Standards (PSs) on Environmental and Social Sustainability (2012) and Environmental, Health and Safety (EHS) Guidelines (2007).
- The European Bank for Reconstruction and Development's (EBRD) Performance Requirements (PRs, 2014).
- The Inter-American Development Bank's (IDB) Environment and Safeguards Compliance Policy and
- Implementation Guidelines (2007); and
- The Organization for Economic Cooperation and Development (OECD) Recommendations for Common Approaches to the Environment (2012).

The team combines an extensive knowledge of Lender standards and broad sector experience, particularly in major infrastructure development, power, oil and gas, and mining, with a practical approach to resolving issues, thereby facilitating project compliance in a robust and cost-effective manner. Below is a list of some of the similar projects which Ramboll has been involved on:

- ESIAs, 3 Offshore Wind Farms, Energinet.dk
- EIA and Site Development for Offshore Wind Farm, Aarhus, Denmark
- EIA, Site Development and Strategic Environmental Assessment for Offshore Wind Farm,
- Djursland/Anholt, Denmark
- EIA of Proposed Wind Turbine Cluster, Perthshire, Scotland
- Environmental Screening and EIA for a Wind Farm, Poland
- Environmental and Social Due Diligence for a Wind Farm, Orla, Poland
- Cumulative EIA for Wind Farms, Stupsk, Poland
- International Portfolio Assessment for 30 Wind Projects around the World
- ESIA, EuroCape Wind Farm, Ukraine
- Chetwynd, Peace River, British Columbia, Canada

- Updated ESIA, Taiba N'Diaye Wind Farm, Senegal – 2014-2017
- Tangy III, Wind Farm, SSE Renewables, Scotland, 2014-2015
- Business Bay Gateway Towers, Dubai, RSP, 2017
- Environmental Analysis and Assistance, Wind Farm, Romania, EBRD, 2012
- ESIA TRESA Wind Farm, Transmision de Electricidad, S.A., Guatemala, 2014
- Project Galaxy Wind Farm, CDC Group, India, 2013
- EIA for Inverclyde Wind Farm, 2020 Renewables, United Kingdom, 2012
- EIA, Millenderdale Wind Farm, GreenPower Developments Limited, Scotland, 2012
- La Mer Ring Show, Samsung C&T, 2016
- Lu'Luat Al Raha Abu Dhabi, ICT, 2016
- Grand Hills, Dubai, GGICO, 2015
- Dubai Motorcity 5 Towers, Dubai, Agostine and Raphael Group, 2014

2.4 Project team

SES in partnership with Ramboll will assign a multidisciplinary team of experienced scientists and environmental professionals for the preparation of the Environmental and Social Impact Assessment (ESIA) study. The team will be comprised of:

- Project Director / Senior Environmental Expert / SES: Dr Naji Chamieh
- Project Manager / Senior Environmental Expert / SES: Dr Layale Abi-Esber
- Project Expert / Senior Environmental Expert / Ramboll: Ms Cary Ehrman
- Project Expert / Wind turbine management Expert / Ramboll: Mr Jonas Feja
- Project Expert / Biodiversity and Avifauna Expert / SES: Dr Ghassan Jaradi
- Project Expert / Socio-economic Expert / SES: Dr Imad Hamze
- Project Assistant / Environmental Expert / SES: Ms Sara Hteit
- Project Assistant / Environmental Expert / SES: Ms Leila Morcos

2.5 Project history, components and importance

In Lebanon, electricity is basically generated from thermal and hydroelectric power plants. Lebanon has embarked on the path of sustainable energy since the commitment launched in Copenhagen in 2009 by the Lebanese Government to develop renewable energy. In fact, according to MoEW (Ministry of Energy and Water)/LCEC (Lebanese Center for Energy Conservation) (2016), the average available electricity production capacity (including imports) was 1,500 megawatts (MW) by 2009 while the average demand was 2,000–2,100 MW. The instantaneous peak demand in the summer of 2009 was estimated at 2,450 MW. The total energy demand in 2009 was 15,000 gigawatt-hours (GWh) although the total produced energy (including imports) was 11,522 GWh. Accordingly, the electric energy deficit in Lebanon was estimated to be 3,478 GWh. More recent data indicate a higher

electricity deficit of 5,524 GWh in 2014 despite the start of power generation through rental floating power plants (Bouri and El Assad, 2016).

Approximately 7.5% of the total electricity production in 2009 was purchased from Syria (589 GWh) and Egypt (527 GWh) through regional interconnections. In addition to the deficit in electricity supply, the Lebanese electricity sector was facing several problems such as load shedding, technical losses, and the aging of power plants. This situation resulted in technical and financial impacts on customers, the Government, and the entire economy. The Lebanese end users were forced to rely on diesel generators to overcome the electricity shortages (MoEW/LCEC, 2016).

To overcome all these problems, MoEW published a comprehensive energy policy (the 2010 Policy Paper for the Electricity Sector) that was approved by the Council of Ministers (COM) on June 21, 2010. In addition to proposing a strategic solution to the electricity sector in Lebanon, the Policy Paper also built on the 12% commitment of renewable energy by 2020 to propose some future milestones. The year 2010 is then considered the turning point in the development of the electricity sector and, more specifically, renewable energy in Lebanon (MoEW/LCEC, 2016).

In the context, the MoEW signed in February 2018 the first PPA agreement for the energy sector with three Lebanese companies to establish wind farms in the northeastern Akkar region, Sustainable Akkar SAL, Hawa Akkar SAL, and Lebanon Wind Power SAL. The three wind projects will help satisfy 6% of Lebanon's total energy demand. Lebanon Wind Power SAL will be responsible for the development of the Lebanon Wind Power project which is the subject of the current ESIA study. Evidently, the proposed project is highly important for the project area and the whole country as it will assist in solving the problem of electricity shortage on the local and national scales all while assisting Lebanon in achieving their commitment to 12% supply of energy through renewable energy.

3 Objectives

The objective of the ESIA is to provide a sound basis for decision making about the design of project components that takes into account environmental considerations including social and economic impacts, ensures that the project is implemented with full awareness of environmental factors, provides mitigation measures for potentially negative impacts, and outlines environmental monitoring and management plans.

The ESIA will cover among others the assessment of the existing baseline physical, biological and socio-economic environment in the study area. The environmental and socio-economic impacts of developing the proposed wind farm will also be assessed and potential mitigation measures that would need to be implemented to protect the environment and ensure regulatory compliance will be identified and communicated to the project proponent.

Note that the ESIA scope will target the periods of **1- construction, 2- operation and 3- decommissioning** and will include in the assessment all project components including **1- the wind turbines, 2- the associated sub-station, 3- the transmission lines and 4- the road widening activities.** Also an assessment of the **cumulative impact from all three proposed wind projects** will be taken into account in the impact assessment activity as per the request of the MoE stipulated in Minster's Letter # 14175 dated 19/12/2017.

A strong collaboration is foreseen with the project proponent to ensure the integration of environmental considerations and abatement measures in the detailed design stage and later on during project implementation to ensure project sustainability.

4 ESIA Requirements

The ESIA study will be prepared based on the following:

- EIA decree 8633/2012: The EIA decree provides in its Annex 1 a list of project types requiring an EIA; included in this list are electric power generation projects. The decree also outlines the elements to be examined in a scoping and an EIA report, which are consistent with the scope of work described in the current report.
- International Finance Corporation (IFC) Performance Standards (PSs) on Environmental and Social Sustainability (2012) and Environmental, Health and Safety (EHS) Guidelines (2007).
- IFC EHS Guidelines for Wind Energy (2007).
- IFC EHS Guidelines for Toll Roads (2007).
- UNDP/CEDRO Environmental Impact Assessment for Wind Farm Developments Guideline Report (2012).
- World Bank Standards.
- The Equator Principles III (EPIII, 2013).
- International Best Practice.

5 Study Area

The spatial boundaries of the ESIA study include 1- the immediate study zone which comprises the land plots where the turbines are proposed; 2- the middle study zone which extends around 3 km from the project and includes the landscape elements and inhabited or attended territories near the project area; and 3- the furthest study zone which consists of the wider environment extending around 15 km from the project including sites and monuments of national importance potentially affected by project's visual impact. The temporal boundaries consist of the construction, operation and decommissioning phases.

Figures 5-1 and **5-2** present the location of the proposed wind farm in close proximity to the two other proposed wind farms.

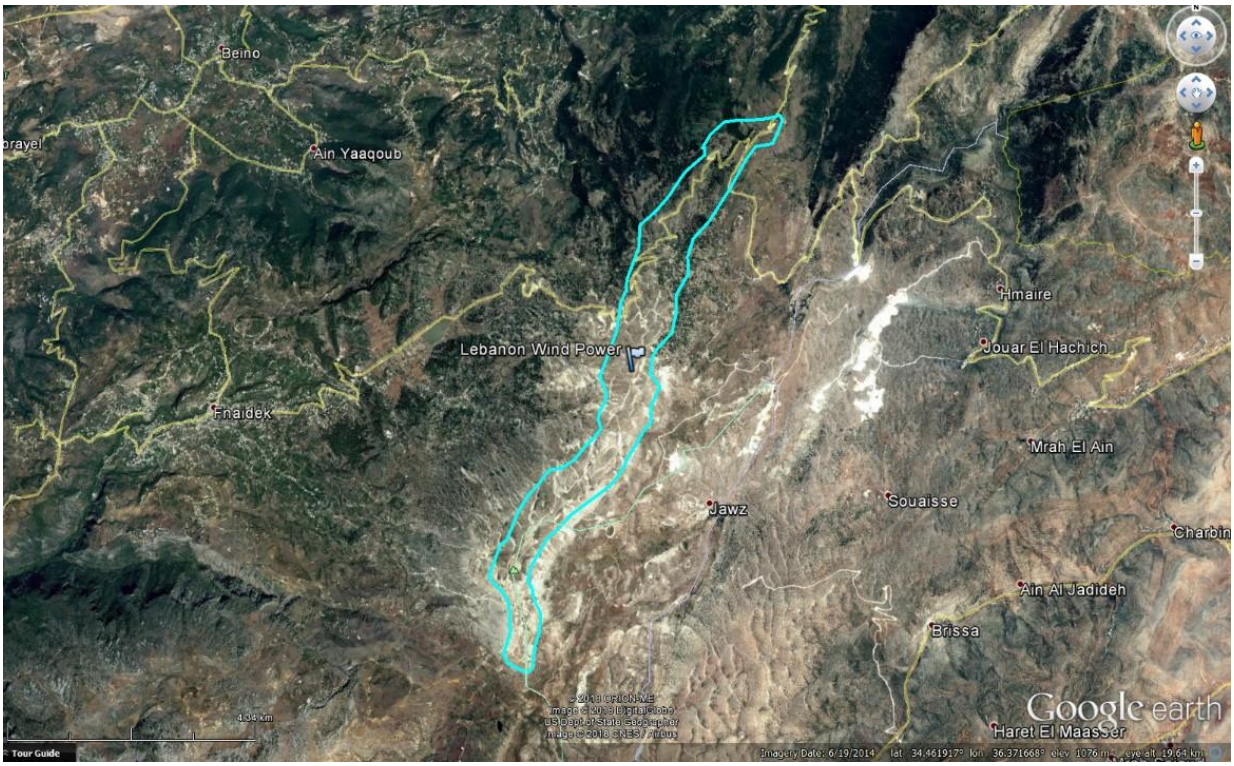


Figure 5-1. Close view of project site

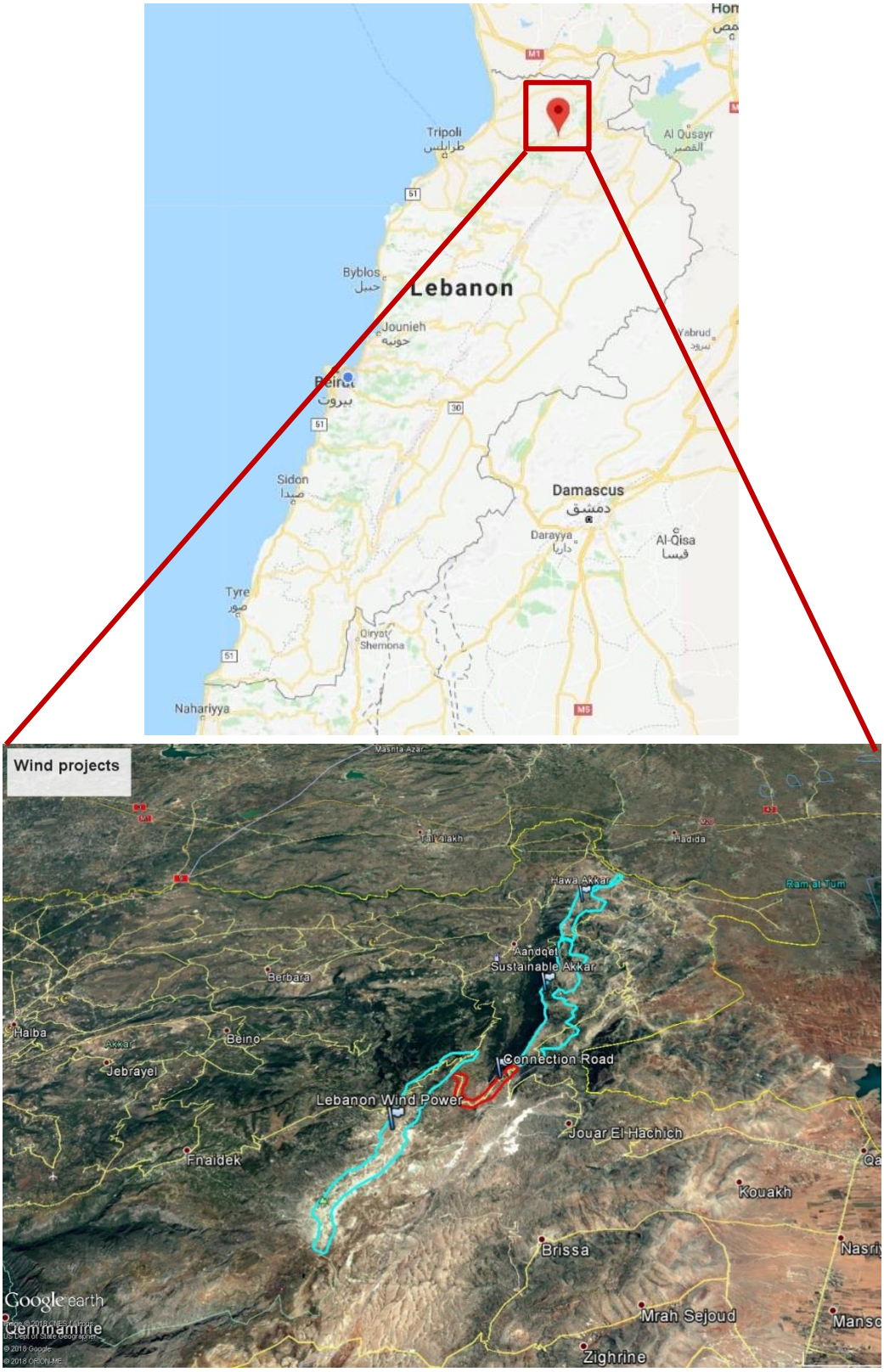


Figure 5-2. Location of proposed project (Lebanon Wind Power) and the two other proposed wind farms (Sustainable Akkar and Hawa Akkar)

6 Scope of Work

The ESIA study will predict positive and negative environmental impacts associated with the proposed project and will put forth an environmental management plan including mitigation measures for potential negative impacts and an environmental monitoring plan. The ESIA report will also shape the project to suit the site-specific environmental conditions and will present to decision-makers the predictions and possible management options.

The scope of work for conducting the ESIA will comprise the following tasks which are further described in the following sub-sections.

6.1 Policy, Legal and Institutional Framework

Existing legislations and policies and international conventions, treaties and protocols related to power generation and renewable energy will be reviewed and synthesized to identify provisions and requirements which are relevant to the proposed project. Relevant international treaties, conventions and protocols ratified by Lebanon will equally be reviewed. In addition, institutions that are directly and/or indirectly responsible of the supervision and/or enforcement of the implementation of existing regulations will be identified and their role analyzed.

Our preliminary assessment of the legal texts and international treaties governing the proposed project is provided in **Tables 6-1 and 6-2** below (MoE/UNDP, 2014).

Table 6-1. Relevant national legislation

Legislation	Organization	Date of Issue	Subject
LAWS			
Law 20	MoWE	29/3/1966	Establishment of Ministry of Water and Electrical resources
Law 69	DGUP	1983	Urban planning law.
Law 216	MoE	April 1993	Creation of Ministry of Environment (MoE) and its responsibility to develop a management strategy for solid waste.
Law 253	MoE	1993	Ratification of two treaties related to the ozone layer
Law 360	MoE	1994	Ratification of the United nation convention on Biological Diversity, signed at Rio de Janeiro.
Law 412	MoE	2002	Authorization for the Government to join the convention on Asian / African Migratory water birds.

Legislation	Organization	Date of Issue	Subject
Law 444	MoE	July 2002	Code of the environment indicating the necessity to conduct EIA and IEE for development projects.
Law 462	MoWE	2/9/2002	Organization of Electricity sector
Law 775 (No longer relevant)	MoWE	2006	Amendment of Law 462 of 2002
Law 221	MoWE	29/5/2009	Organization of water sector
The Energy Conservation Draft law	LCEC	2010	The 'Energy Conservation Draft Law' for the promotion of energy efficiency and renewable energy in Lebanon. This draft law has not yet been approved by the Lebanese Parliament. The draft law offers a legal framework for energy audits, energy efficiency standards and labels, financial incentives for energy efficient appliances and net-metering and the institutionalization of the LCEC.
Law 288	MoWE	2014	Replaced Law 775 of 2006 and is a temporary measure for "one year" and "two years" respectively during which the Council of Ministers shall be in charge of granting the production permits and licenses upon the proposal of the MoEW and the MoF, this until the members of the regulatory commission, described under Law No. 462, are appointed and start carrying out with their tasks
DECREES			
Decree 2866	GoL	1959	Tender regulation that applies to all State tenders over 25000L.L. except for those to the Ministry of Defense, Security Force and Public Security. (as amended by Decree 8703 of 1962 and Decree 13221 of 1963)
Decree 13472	DGUP	26/07/1963	Law on Urban Planning
Decree 16878	GoL	1964	Establishment of the Electricité du Liban (EDL) as an autonomous state-owned entity under the authority of the MoEW. This legislative text entrusts the generation, transmission and distribution of electricity across Lebanon to EDL. Article 4 of the Decree provides that no license, concession or permit generation, transmission or distribution of electricity may be granted to another entity.
Decree 7580	GoL	1974	Projects financing is mainly governed by EDL Investment System Regulation
Decree 2604	MoE	2009	Control of ozone depleting substances

Legislation	Organization	Date of Issue	Subject
Decree 2366	Presidency of the COM	June 2009	The national Physical Master Plan for the Lebanese Territory (NPMPLT) which was issued by the CDR in 205 and approved as a strategic development plan for the territory of Lebanon to which all public authorities are bound.
Decree 5305	COM	28/11/2010	Outlines mandatory standards for the Compact Fluorescent Lamp and the Solar Water Heating
EIA decree	MoE	March 2012	The EIA decree. It sets the requirements and procedures for the preparation of an EIA report.
Decree 8213	MoE	May 2012	SEA Decree. It sets the requirements and procedures for the preparation of an SEA report.
Decree 619	MoE	2017	Ratification of Tagoya protocol to access genetic resources and fair and equitable sharing of the benefits arising out of their utilization to the biodiversity agreement
Decree 620	MoWE	4/5/2017	Convention of the Statute of the International Renewable Energy Agency (IRENA)
Decree 810	MoWE	8/6/2018	Amendment of Decree No. 3750 dated 22/6/2016 concerning the conclusion of a memorandum of understanding between the Ministry of Energy and water and the General Directorate for Development Cooperation of the Ministry of Foreign Affairs and International Cooperation of Italy and the acceptance of a final grant for the project "Plan for integrated management of water walnut resources with a focus on the use of hydropower on a small scale.
Decree 2251	MoWE	8/2/2018	Ratification of the modified Decree 1543 dated 25/11/1978 of the draft establishment of hypertension line 66KV between the Al Bared plant and Halba plant for the acquired columns basis (Akkar Governorate – Akkar Caza)

Legislation	Organization	Date of Issue	Subject
DECISIONS			
Decision 52/1	MoE	July 1996	Decision by the Ministry of Environment for determining the standards and specific levels for limiting air, water and soil pollution.
Decision 176/1	MoE	2010	Mechanism for the review of projects under the Kyoto Protocol's Clean Development Mechanism
Decision 1	COM	21 June 2010	Consists of ten integrated and correlated strategic initiatives which are focused on remedying the problems of the energy sector in respect to infrastructure, supply and demand, and the legal framework.
Decision 26	COM	2011	National Energy Efficiency Action Plan for Lebanon 2011-2015 and 2010-2020 (NEEAP) includes 14 independent but interrelated national initiatives of energy efficiency and renewable energy proposals for enhancing the legal and regulatory framework
Decision 2	COM	9 March 2012	National Water Sector Strategy (NWSS) goal to ensure water supply, irrigation and sanitation services throughout Lebanon on a continual basis and optimal service levels with a commitment to environmental, economic and social sustainability.
CIRCULARS, LETTERS			
Circular 10/1	MoE	19/03/2011	Governs an informal structure for electricity subscription (private generators) which is provided by the private sector in the status of electricity supply shortage
Minister Letter 14175	MoE	19/12/2017	Stresses the requirement of ESIA study preparation for the three wind farms and describes the required scope for the three studies

Table 6-2. Treaties and conventions ratified by Lebanon

Convention Title	Year	Signature/ Adhesion/ Ratification/ Accession	Description
ENVIRONMENT			
Convention on Migratory Species of Wild Animals (CMS); Bonn Convention"	1979	Signed in 1979 Entered to force in 1983	Aims at conserving terrestrial, marine and avian migratory species throughout their range
Convention on Biological Diversity; Rio De Janeiro.	1992	Ratification: law n°360 dated 11/08/1994.	This convention aims to ensure conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of benefits arising from genetic resources.
Agreement on the Conservation of African-Eurasian Migratory Water Birds (AEWA).	2002	Adhesion: law n°412 dated 13/06/2002	The Agreement on the Conservation of African-Eurasian Migratory Water-birds (AEWA) is an intergovernmental treaty dedicated to the conservation of migratory water-birds and their habitats across Africa, Europe, the Middle East, Central Asia, Greenland and the Canadian Archipelago. Developed under the framework of the Convention on Migratory Species (CMS) and administered by the United Nations Environment Program (UNEP), AEWA brings together countries and the wider international conservation community in an effort to establish coordinated conservation and management of migratory water-birds throughout their entire migratory range.
Cartagena Protocol on Biosafety to the CBD.	2000	Ratification: law n°31 dated 16/10/2008.	This international treaty concluded and adopted in the framework of the Convention of Biological Diversity (CBD). The CBD has much broader aims regarding the conservation and sustainable use of biological diversity and the sharing of benefits arising from the use of genetic resources.
Convention on Wetlands of International Importance especially as Waterfowl Habitat – Ramsar.	1999	Adhesion: law n°23 dated 01/03/1999.	The Ramsar convention is an international treaty for the conservation and sustainable use on wetlands. Every three years, representatives of the contracting parties meet to administer the work of the convention and improve the way in which the Parties are able to implement its objectives.

Convention Title	Year	Signature/ Adhesion/ Ratification/ Accession	Description
CULTURAL AND NATURAL HERITAGE			
UNESCO Convention on the protection of Cultural and Natural Heritage.	1972	Adhesion: law n°19 dated 30/10/1990.	This convention links together in a single document the concepts of nature conservation and the preservation of cultural properties. It recognizes the way in which people interact with nature, and the fundamental need to preserve the balance between the two.
AIR and CLIMATE CHANGE			
Vienna Convention for the Protection of the ozone layer.	1985	Adhesion: law n°253 dated 30/03/1993.	The Vienna Convention, concluded in 1985, is a framework agreement in which States agree to cooperate in relevant research and scientific assessments of the ozone problem, to exchange information, and to adopt "appropriate measures" to prevent activities that harm the ozone layer. The obligations are general and contain no specific limits on chemicals that deplete the ozone layer.
Montreal Protocol on Substances that deplete the ozone layer.	1987	Adhesion: law n°253 dated 31/03/1993	The Montreal Protocol on Substances that Deplete the Ozone Layer was designed to reduce the production and consumption of ozone depleting substances in order to reduce their abundance in the atmosphere, and thereby protect the earth's fragile ozone Layer. The original Montreal Protocol was agreed on 16 September 1987 and entered into force on 1 January 1989. The Parties to the Montreal Protocol have amended the Protocol to enable, among other things, the control of new chemicals and the creation of a financial mechanism to enable developing countries to comply. Amendments must be ratified by countries before their requirements are applicable to those countries.
Amendment to the Montreal Protocol on Substances that deplete the ozone layer; London.	1990	Adhesion: law n°253 dated 31/03/1993.	This was to reinforce the measures laid down in the 1987 Montreal Protocol by extending its scope to new substances and establishing financial mechanisms. The Montreal Protocol aims to protect the ozone layer through enhanced international cooperation by taking precautionary measures to control equitably total global emissions of substances that deplete it.
Amendment to the Montreal Protocol on Substances that	1992	Adhesion: law n°120 dated 03/11/1999.	Indicates that for the adequate protection of the ozone layer a higher degree of control of chlorofluorocarbons, halons, carbon tetrachloride and 1,1,1-trichloroethane is required than that provided by the Montreal Protocol as

Convention Title	Year	Signature/ Adhesion/ Ratification/ Accession	Description
deplete the ozone layer; Copenhagen.			amended in 1990 (London Amendment). Additional controls should also be placed on methyl bromide, hydrobromofluorocarbons and hydrochlorofluorocarbons (the first Amendment to the Protocol was adopted on 29 June 1990 and subsequently approved on behalf of the Community).
United Nations Framework Convention on Climate Change aiming to fight global warming.	1992	Ratification: law n°359 dated 11/08/1994.	The UNFCCC entered into force on 21 March 1994. It is a "Rio Convention", one of three adopted at the "Rio Earth Summit" in 1992. Its sister Rio Conventions are the UN Convention on Biological Diversity and the Convention to Combat Desertification. The three are intrinsically linked. It is in this context that the Joint Liaison Group was set up to boost cooperation among the three Conventions, with the ultimate aim of developing synergies in their activities on issues of mutual concern. It now also incorporates the Ramsar Convention on Wetlands. Preventing "dangerous" human interference with the climate system is the ultimate aim of the UNFCCC. The Convention: - Recognized that there was a problem. - Sets a lofty but specific goal. - Puts the onus on developed countries to lead the way. - Directs new funds to climate change activities in developing countries. - Keeps tabs on the problem and what's being done about it. - Charts the beginnings of a path to strike a delicate balance. - Kicks off formal consideration of adaptation to climate change.
United Nations Convention to Combat Desertification; Paris.	1994	Ratification: law n°469 dated 21/12/1994.	This convention aims to combat desertification and mitigate the effects of drought through national action programs that incorporate long-term strategies by international cooperation and partnership arrangements. It is based on the principles of participation, partnership and decentralization- the backbone of Good Governance and Sustainable Development
Beijing Amendment of the Montreal Protocol.	1999	Adhesion: law n°758 dated 11/11/2006.	Under the amendment, countries have agreed to monitor the consumption and production of bromochloromethane which is an industrial solvent and a fire extinguisher under the name Halon-1011

Convention Title	Year	Signature/ Adhesion/ Ratification/ Accession	Description
Kyoto Protocol.	2005	Ratification: law n°738 dated 15/05/2006.	The Kyoto Protocol is an international agreement linked to the United Nations Framework Convention on Climate Change, which commits its Parties by setting internationally binding emission reduction targets. The Kyoto Protocol was adopted in Kyoto, Japan, on 11 December 1997 and entered into force on 16 February 2005. The detailed rules for the implementation of the Protocol were adopted at COP 7 in Marrakesh, Morocco, in 2001, and are referred to as the "Marrakesh Accords." Its first commitment period started in 2008 and ended in 2012.
International Renewable Agency (IRENA)	2009	Ratification: Decree n°620 dated 4/5/2017	Promotes the widespread adoption and sustainable use of all forms of renewable energy, including bioenergy, geothermal, hydropower, ocean, solar and wind energy in the pursuit of sustainable development, energy access, energy security and low-carbon economic growth and prosperity.
Euro-Mediterranean Energy Partnership HY-PA	2005	Partnership signed in 2009	The main objective of the HY-PA is to promote and stimulate the application of Renewable Energy and Hybrid Systems in Mediterranean Partner Countries (MPC) for the provision of sustainable energy services based on locally available resources and to support policy making activities in the field of Renewable Energies. The HY-PA comprises three competent actors from Europe: Germany, Greece and France, as well as four Mediterranean Partner Countries Jordan, Lebanon, Morocco and Tunisia.

6.2 Public Involvement and Participation

An announcement related to the project was prepared and filed at the municipalities of the villages which own lands in the study area, namely Qoubaiyat, Fnaidek and El Rweimeh (**Appendix B**) and was placed at the entrance door or on municipal boards. Note that El Rweimeh village has no municipality, as a result the announcement was placed at Jouar El Hachich nearby village as per the recommendation of a representative of the local people.

a- Qoubaiyat

b- Fnaidek

c- El Rweimeh / Jouar El Hachich

Figure 6-1. Placement of public announcements

The public consultation meeting was scheduled to take place on 15 May 2018. Also, the MoE, MoIM and MoEW were invited to the meeting through formally registered invitation letters (**Appendix C**). The meeting started at 10:30 am with project related discussions with the Head of the Municipality of Fnaidek and the other attendants. A seminar presentation was given by SES at 11:00 am (**Appendix D**) and included a description of the proposed project, the ESIA objective and scope and a summary of the major anticipated impacts and associated mitigation measures. The seminar was followed by a discussion whereby SES replied to the concerns of the attendants and committed to addressing them in the ESIA study. **Figure 6-2** shows photos taken during the meeting. **Table 6-3** summarizes the discussions which took place during and after the meeting. The list of attendants is provided in **Appendix E**.

Overall, a positive atmosphere prevailed and was incited by the plans for the inclusion of environmental and social management measures during all project phases and by the commitment of the project proponent to the implementation of the latter measures.

Figure 6-2. Photos taken during the public consultation meeting.

Table 6-3. Summary of discussions during and following public consultation seminar

Remark / Concern	Response
Mr. Majid Hachem, MoIM representative, was concerned about the status of the ownership of the parcels located at the top of the mountain i.e. whether they are public / municipal or private properties. He also advised that an official survey be implemented.	Mr. Ahmad Abdo Albaarini, Head of Municipality of Fneidek, replied that these are municipal properties. He explained that Fnaidek municipality on the west side of the mountain ridge and Al Jaafar families from the east side have agreed on the border between their respective properties. It is the line separating the water catchments on the eastern and western slopes of the ridge. Mr. Jules Assi noted that the lands for the project are not surveyed and have no title deeds. He added with the head of municipality of Fneidek that they are going to proceed with علم وخبر with the help of the local head of municipalities and mayors (مخاتير) as well as a surveyor and the police, then the documents would be filed for certifying at the governorate of Akkar.
Mr. Majid Hachem noted that SES will be looking at the impact of the wind farm on the existing facilities without considering the depreciated value of surrounding land.	Dr. Abi Esber replied that there are about 22 potential locations for the turbines and the latter will be compared to select the ones which have least impact on the surroundings all while considering electricity production potential in the assessment; once selected the land(s) which will be rented for the turbines span up to 3500 m^2 around the turbine which increase the compensation potential for land owners. She finally added that the fact that most of the lands are publicly owned decrease the significance of the depreciation impact and make this area particularly attractive for the proposed development.

Remark / Concern	Response
Mr. Jeff Gerges recommended that SES takes into consideration the obligations of Lebanon under the international conventions (CBD and AEWA) He also added that the significance of the impact in terms of bird casualties needs to be evaluated in comparison to international guidelines which are available in this respect He also enquired about the radar's mechanism and whether it can automatically shut down the relevant turbine	Dr. Abi Esber ascertained that all relevant signed / ratified conventions will be considered. With respect to bird casualties, Dr Abi-Esber explained that Dr Jaradi who is the project's avifauna expert is training the ESIA project team on the identification of birds in the study area which is instrumental for the implementation of monitoring activities during operation; the latter would identify any important bird casualties evidently taking into account the relevant international guidelines. Mr. Jules Assi replied that the radar will detect the birds' presence and flyways and based on the latter info, it will be determined when to shut off the turbines. Fast internet communication will be established between radar, management team and operation team (including representatives of international turbine supplier) so that the command to shut off the turbine is executed fast. A decision was made by the Lebanese Government to favor the shut down of the turbines during migration period. The decision stipulates that the Lebanese government will cover the financial losses from the shut off of turbines during migration periods in order to protect important migrating birds. Mr. Ahmad Abdo Al Baarini added that birds in the area commonly fly on the sides of the mountains not on the top which is very high making the risk on birds lower.
Mr. Majid Hachem enquired about the number of turbines and the total production capacity.	Dr. Abi Esber replied that based on the final layout of favorable locations, the number and size of turbines will be decided; only large turbines will be used (3-8 -4.2 MW) to minimize the environmental footprint.
Mr. Majid Hachem asked whether it is possible to disclose free of charge the meteorological data collected by the met masts.	Dr. Abi Esber replied that the data are the property of the project proponent and that access to data need to be negotiated with them. Mr Jules Assi added that not all types of meteorological data are collected, only those relevant for turbine operation i.e. wind speed and direction, pressure temperature and

Remark / Concern	Response
	humidity. Other essential meteo data like rainfall and cloud cover are not being collected.
Mr. Jeff Gerges asked for more info regarding the de-icing mechanism of turbines.	Mr Jules Assi mentioned that turbines which are located in snowy areas will be equipped with a de-icing mechanism which is more expensive but can ensure sound operation during snowy periods. Mr Bachir El Marj said that the technology resembles that used in airplanes.
Ms. Nathalie Karam stressed that the ESIA study under preparation needs to consider the following: • SEA for the renewable energy sector; • the letter sent from MOE to MoEW concerning the scope of the ESIA of the three wind farms; • an assessment of bats in addition to birds; • an assessment of floral species in the area indicating those with high ecological value; • the decommissioning phase; • the extended producer responsibility concept to be included in contracts with turbine suppliers in case of broken parts	Dr. Abi Esber replied that the preliminary studies done by Dr. Jaradi our bird expert has shown that there are no bats. She added that a complete site survey will be conducted where all kinds of fauna and flora will be recorded; the survey will be done when layout of proposed sites is finalized. Mr. Jules Assi assured that any defect or broken items will be the responsibility of the operating foreign company
Mr Jules Assi asked Ms. Nathalie Karam whether the Ministry would mind if the three ESIA consultants involved on the ESIA studies of the three proposed wind farms undertake a single cumulative impact study to avoid redundant efforts.	Ms Nathalie Karam ascertained that this is not a problem as long as findings from the cumulative study are reported within the three ESIA studies

6.3 Project Description

The proposed project falls on a mountain ridge of Jroud Akkar in the Akkar District (see Figures 5-1 and 5-2) where high wind speeds reaching 25 m/s are encountered. It consists of installing a number of wind turbines with a total power capacity of 60 MW which will be delivered to the public grid (conceptual layout showing 22 possible locations provided in **Appendix F**). The wind turbines will belong to the 3.8 to 4.2 MW platforms which are characterized by a hub height of 84 to 91.5 m, a blade length of 57.2 m with a maximum chord of 4 m, and a weight of up to 70 metric tons. Typical specifications of a representative 4.2 MW wind turbine are provided in **Appendix G**. The budgetary size of the project investment is USD 80 million including development, procurement, construction, and operation.

The total project area is around 2.6 km^2 with an actual installation area of around 62,000 m^2 which includes the turbines and their respective platforms. The project development activities will include 1- the widening of the access roads to be able to transport the turbines to the site; 2- the installation of a foundation structure for the turbines before installing the turbines themselves; 3- the installation of a substation and 4- the installation of transmission lines to connect the turbine output power to the public grid.

Each turbine and associated platform will occupy a surface area of 3000 to 3500 m^2. Next to turbine WTG9 in the layout provided in **Appendix G**, a new power sub-station is proposed to be established on an estimated footprint area of 10,000 m^2. Two possible design options are currently being studied and will be negotiated with Electricite du Liban consisting of either a 33 to 66 KV or a 33 to 220 KV sub-station to be connected to the neighboring 'Sustainable Akkar' Wind Farm Project sub-station in El Rweimeh village. Also, a transmission line will be established between the LWP sub-station and that of the neighbouring Sustainable Akkar Project which will run through a distance of 7 km through El Rweimeh village either underground if a 66 KV line is needed or above ground if a 220 KV line is needed. The electrical diagram of the wind farm is being developed by the company Tefirom and their proposed designs being reviewed by the Deutsch consultant Fichtner and EDL.

Project lands will be secured through long term lease agreements with the land owners. A subconsultant company, Skyline, was assigned the responsibility of investigating land ownership during the early project planning phases in order to incorporate land availability in layout development. Note here that the lands in the project area are not surveyed and property claims are ascertained through 'ilm w khabar' (علم وخبر) documents duly signed in the presence of the local mukhtar and a policeman. The latter documents will be submitted in the ESIA report.

A geotechnical / seismic study is also currently being conducted by the project proponent to determine any potential seismicity associated with the proposed turbine locations and to determine the soil conditions for the design and construction of the wind turbine foundations. The project proponent has also conducted a preliminary road survey to explore routes for transporting the equipment from the Tripoli seaport through Abboudieh, Fraidis-Khalsa road network arriving at the project area. Another detailed road development study is subcontracted to determine the required road development activities all while noting that no major road development is expected in the proposed project. Only road widening and small access roads (<300m) linking the existing road to the construction sites are expected.

The development of the layout of the wind turbines is expected to be completed in June 2018 along with the selection of the turbine make / supplier. Land preparation and road widening

works are expected to start in January 2019 and turbine mounting in January 2020. Start of operation is expected in June 2020.

The project description will include a detailed review of the Wind farm design and layout, in addition to land ownership, technology used and underlying costs. This section will also describe the Project in terms of the following phases:

- Construction. The ESIA report will describe (i) civil works including land clearance and excavation, (ii) equipment transport and installation, and (iii) electric works.
- Operation. The ESIA report will describe (i) maintenance and cleaning procedures, (ii) environment health and safety (EHS) measures including site access, and (iii) wind farm management. The operation is expected to last at least 25 years.
- Decommissioning. The ESIA report will describe the plan for the management of waste and land restoration during the decommissioning phase

6.4 Baseline Conditions

This chapter presents a description of the environmental and social setting of the study area to assess existing environmentally and socially significant factors necessary in the evaluation of potential impacts of the project. A preliminary assessment of relevant characteristics of the physical, biological and socio-economic environment of the study area is presented below.

6.4.1 Physical environment

6.4.1.1 Location

The proposed project falls on a mountain ridge of Jroud Akkar in the Akkar District at an altitude ranging between 1200 in the north of the project area and 2190 m in its south. It overlooks the villages of Fnaidek and Akkar Atika from West, Qoubaiyat from North, and El Rweimeh from East. There are no neighboring villages from South.

6.4.1.2 Climate

The climate in the study area is Mediterranean, and is characterized by hot summers and relatively cold winters. The dry period extends from May to September whereas most rainfall occurs between January and December. The warmest month is August with an average temperature peaking at 32°C, whereas the coldest month is January with an average temperature of 6°C. A rainfall map of the study area is provided in **Figure 6-3**.

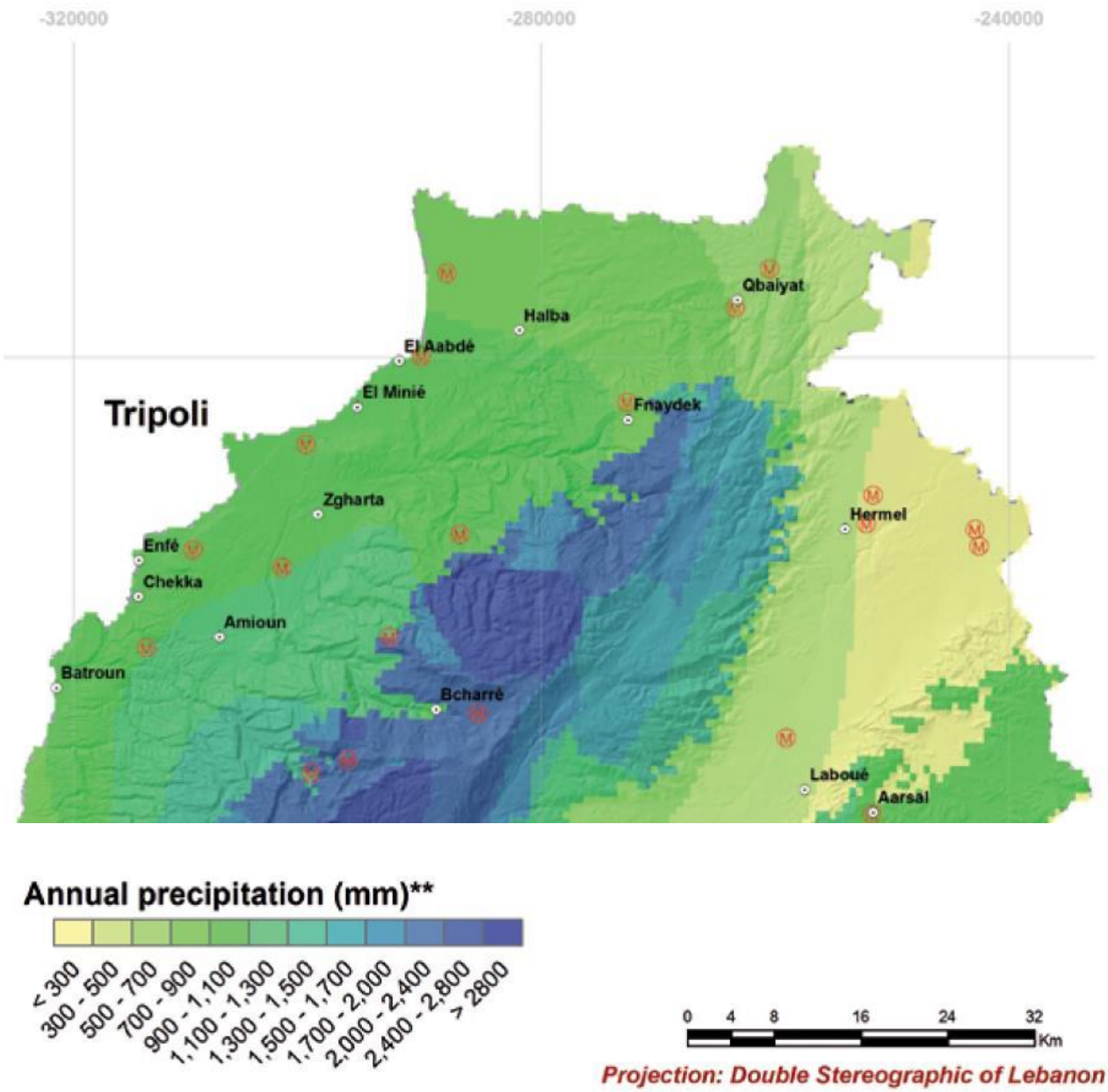


Figure 6-3. Rainfall map of the study area (MoE/UNDP, 2014)

High winds are encountered in the area blowing most of the time from a westerly origin. **Figure 6-4** illustrates the dominant wind direction as measured year round by the nearest met mast installed in the adjacent area of the 'Sustainable Akkar' project. Also year round pressure, humidity and temperature data from the same met mast are provided in **Figure 6-5**. Three met masts were installed in the Lebanon Wind Power project area and have been operational since October 2017. Readings from the latter stations will be provided in the ESIA report in the form of monthly wind roses.

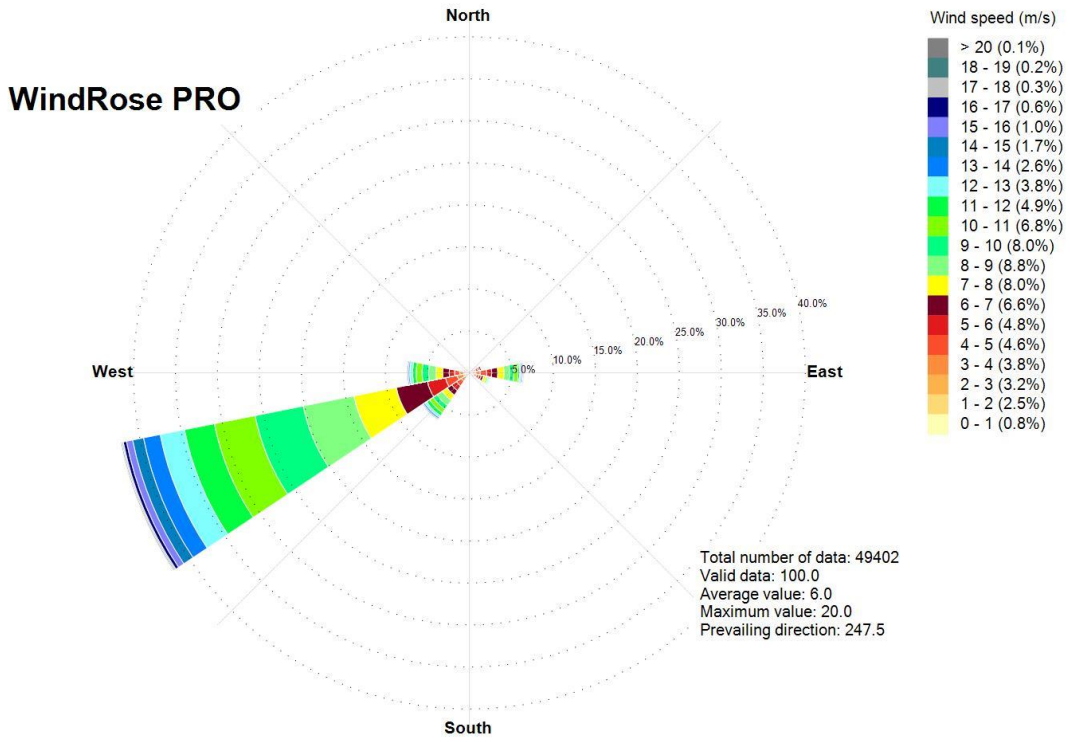
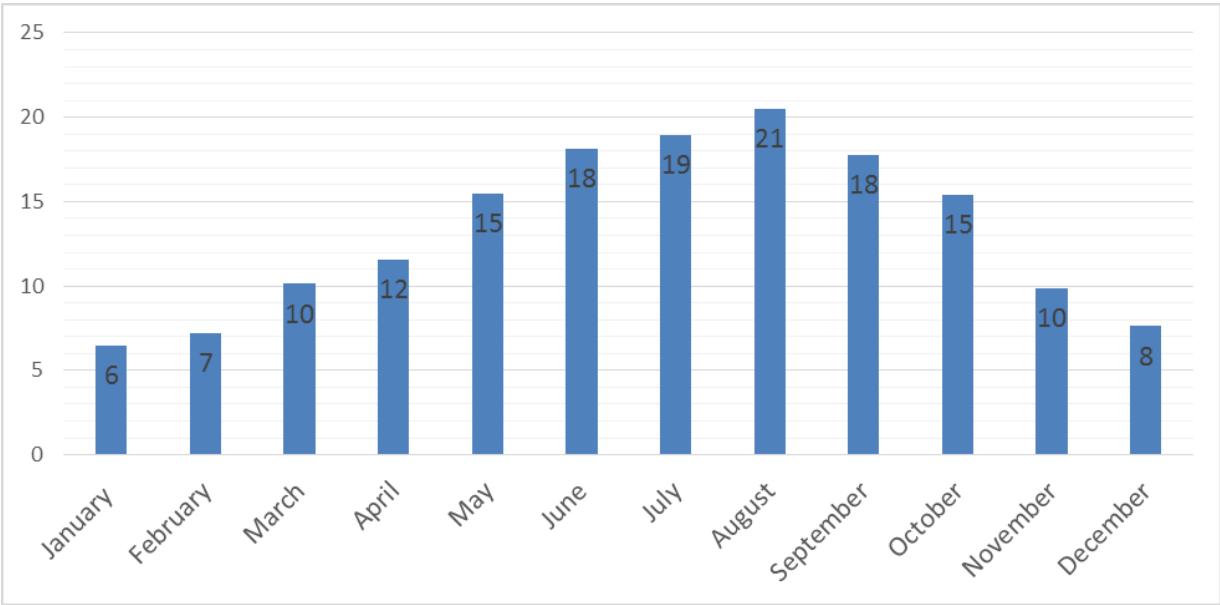
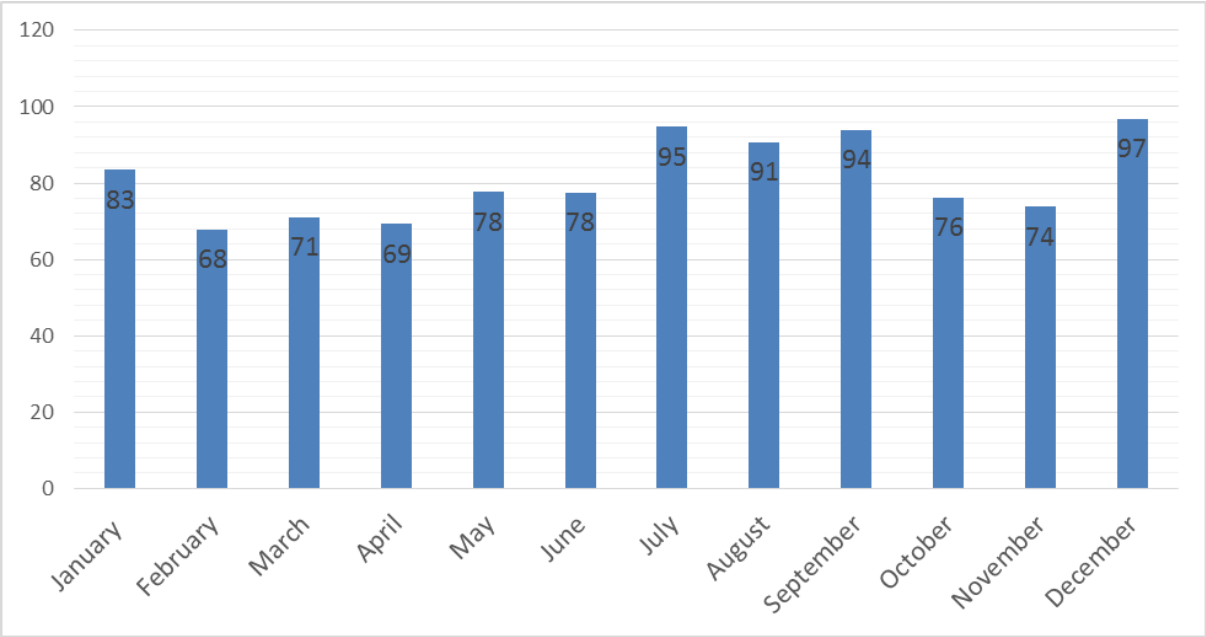


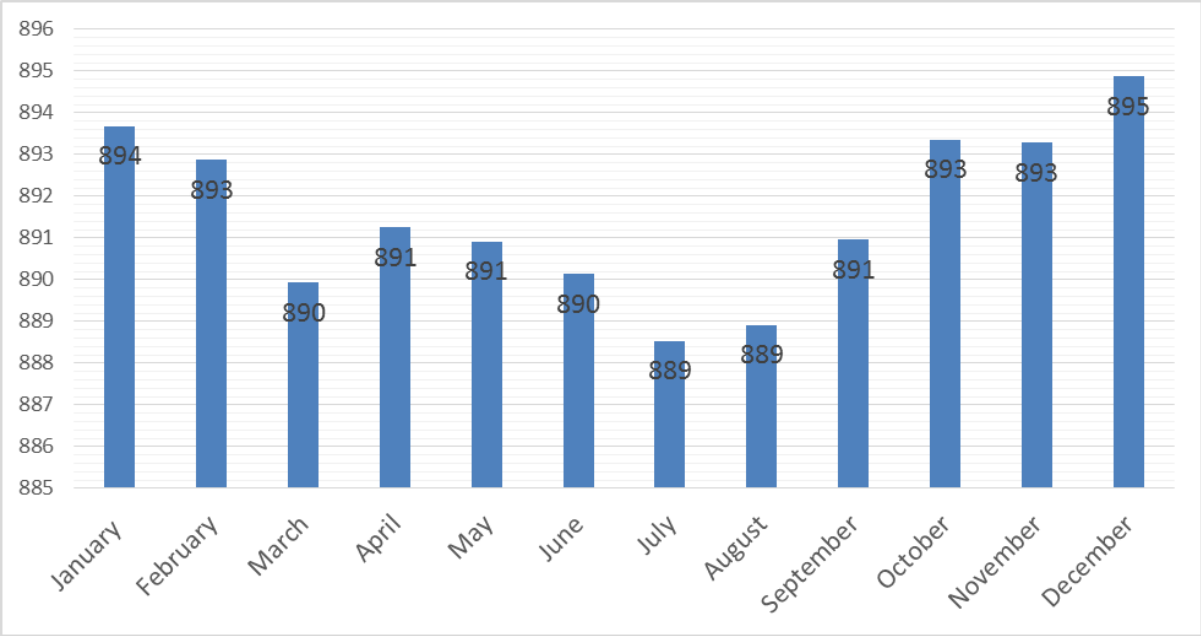
Figure 6-4. Wind Rose



a- Average temperature (°C)



b- Average humidity (%)



c- Average pressure (hPa)

Figure 6-5. Average temperature, humidity and pressure in neighboring Jabal Akroum for the year 2014

6.4.1.3 Geology and hydrology

Based on the assessment of groundwater resources in Lebanon made by MoE and UNDP in 2014, the study area falls on a cretaceous formation (Sannine Maameltein, C4-C5). The location and description of the latter formations are respectively provided in **Figure 6-6 and Table 6-4**. Onsite observations confirmed the prevalence of limestone rocks in the project area (**Figure 6-7**). A geological / seismic study is currently being implemented by the project proponents and its findings will be reported in the ESIA study.

The C4-C5 formation includes an exposed and highly karstified groundwater aquifer which constitutes a major water tower in Lebanon which is mostly recharged through snow melt. Rivers of the Akkar district include the Bared, Oustouan and Aarka rivers in addition to Al Kabeer river at the northern border with Syria. There are no major springs in the study area the closest being the Ras El Ain Spring in Hermel. There are however several small water springs as depicted in **Figure 6-8**.

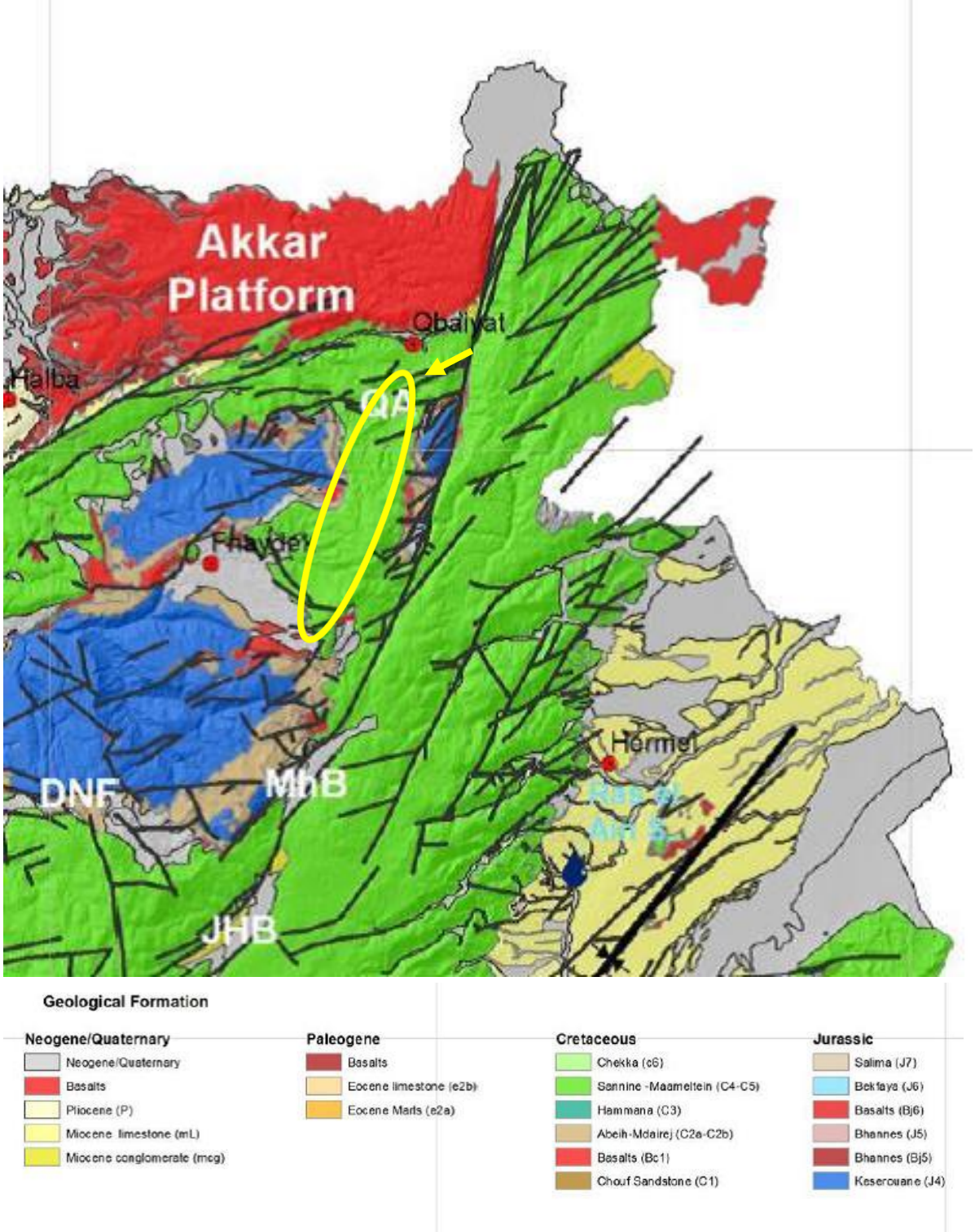
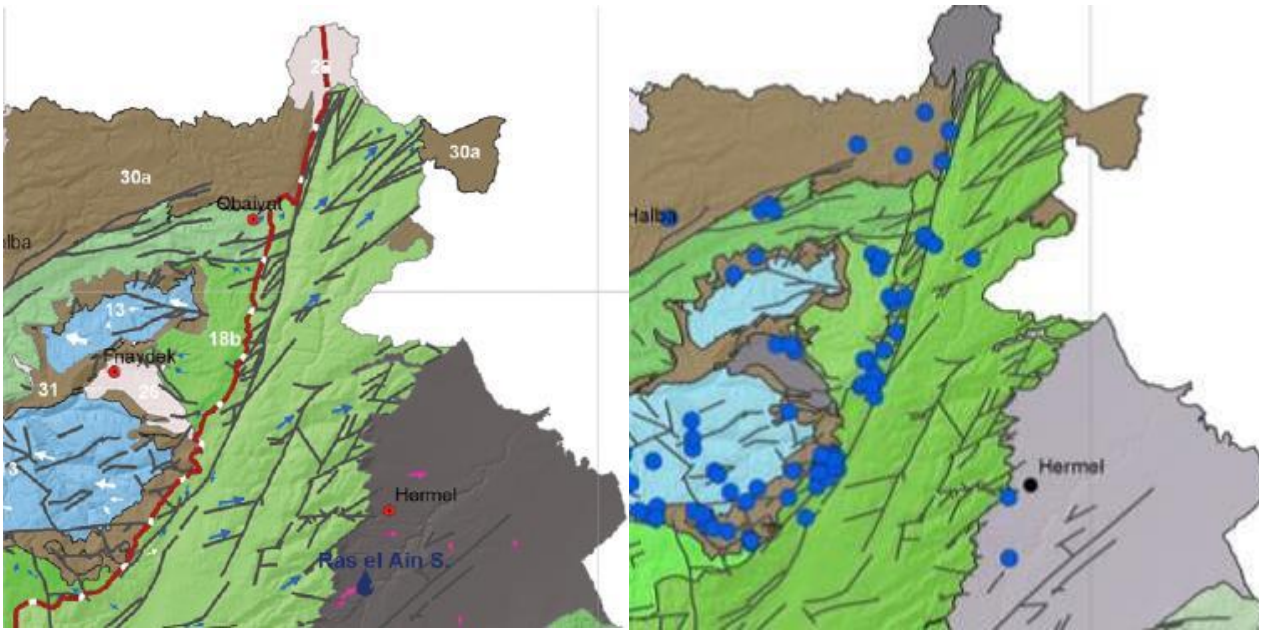


Figure 6-6. Geological formations of the study area indicated by yellow oval (MoE/UNDP, 2014)

Table 6-4. Description of formation encountered in project area

Formation name	Code	Description
Sannine	C4a, C4b, C4c	Pale gray, fractured fine an thick bedded limestone and marly limestone with geodes and chert
Maameltein	C5	Massive to thin bedded white gray limestone and marly limestone
Sannine-Maameltein	C4-C5	Combining the above limestone formations to create one of the major water towers in Lebanon, widely exposed and highly karstified, with major recharge coming from snow. Groundwater is stored and transmitted in fractures and conduits; upper Hammana Formation is part of the C4-C5 aquifer

Figure 6-7. Limestone in project area



a- Major springs of study area b- Other springs of study area

Figure 6-8. Major and other springs of the study area

6.4.1.4 Air quality

Regarding air quality, there are no long term ambient air quality data for the project area. Background sources of air pollution include quarrying activities to the east of the project which generate dust. Another source of air pollution is the transport sector emitting exhaust related pollutants such as particulate matter (PM), carbon monoxide (CO), nitrogen oxides (NO_x), sulfur oxides (SO_x) and hydrocarbons (HCs). However, the significance of the latter emissions on the project area is low and the site can be considered to be located in a relatively pristine area with clean air and low air pollution levels.

6.4.1.5 Road infrastructure

Existing status of road network and overall quality of access to project site will be assessed in the ESIA report.

6.4.2 Biological Environment

In terms of fauna, the study area is parallel to the major flyways of migrating birds in autumn and spring seasons. In fact, in spring, the major route used by migrating birds of prey and cranes is along the eastern flanks of the Mount Lebanon mountain range and the western half of the Beqaa Valley. In autumn, most soaring birds pass down the western slopes of Mount Lebanon while smaller numbers travel east of the mountain range ridge. These streams converge at times and congregate in large flocks (CEDRO, 2012). As a result, a baseline study

extending over a full year started to be implemented since August 2017. The study includes the observation and the recording of fall migratory and wintering species, summer breeding visitors, spring migratory, resident/sedentary, and nocturnal raptors.

The study will also a- locate transit routes and micro-routes of migration; b- measure the migratory flow (bird numbers per time unit); c- identify possible resting or roosting zone and sites of the mating/nesting; and d- assess the diversity of migratory patterns (e.g., the use of thermals updrafts by raptors, the use of natural valleys and screens for passerines, the pathways of water birds, etc.). For breeding birds, sampling points will be distributed over the area of possible wind turbines implementation (middle study zone), i.e., inside, outside and on the edge of the area, and be representative of the environmental diversity of the site. Field inventories will be done in different weather conditions (wind direction and speed). Collected data will be analyzed on one or more synthesis maps showing the routes by species groups or families (Finches, Ravens, Warblers, ducks ...) and the importance of the site for birds (breeding, feeding, transit, etc.).

In terms of flora, the vast majority of the project area is characterized with low vegetation (shrubs and grasses) in addition to sparse local trees probably due to high altitude and snow melt driven erosion (**Figure 6-9**). The ESIA study will include a detailed assessment of the floral species present at the proposed turbine sites, particularly in the northern area of the project where trees are more likely to occur due to the relatively lower altitudes.

Figure 6-9. Low vegetation cover at study area

6.4.3 Socio-economic Environment

Main economic activities in the Akkar area include agriculture, industry in addition to wholesale and retail trading, services, construction, materials and mining, vehicle sales & maintenance, and handicrafts. In terms of agriculture, 57% of the total surface area of Akkar is arable land, out of which 43% are irrigated. Around 38% of cultivated lands are used for the cultivation of cereals, followed by 25% for vegetables. More than 18% of olive oil production in Lebanon takes place in Akkar (mainly in Halba, Bkarzla, Baino, Minyara) making it a prominent location for agro food processing. Also, Akkar has a rich livestock production in particular for cattle accounting for 43% of total holdings of the country. In terms of industry, Akkar's strongest industrial sector is the agro-food sector (Food & Beverages) with a total of 8 firms. However the total number of industrial firms is 29 which is meager relatively to the size and potential of this district (IDAL, 2018).

In terms of education, Akkar District has one university located in Halba (Lebanese International University) with around 100,000 students the majority of whom are studying Business, Law or Engineering. Also, Akkar has the the 2nd highest share of technical schools in Lebanon.

A social baseline assessment study will be implemented as part of the ESIA study including the assessment of the social conditions (demographics, socio economic conditions, social organization and needs and values) of all groups potentially affected by the project. The study will include among others an identification of the sources of income of the latter groups to be able to assess whether they will be affected by the proposed project.

6.4.4 Mapping of sensitive receptors

Mapping of sensitive receptors will be implemented in ESRI GIS as part of the baseline assessment studies. The generated maps will constitute a key input for the modeling of impact from wind turbines, particularly with respect to noise, shadow flicker and visual impact. For this purpose, 1:20000 maps of the area extending 15 km from project site were acquired from the Directorate of Geographic Affairs of the Lebanese Army and will be used to assess the area's sensitive receptors including the following:

- Residential centers
- Hospitals
- Schools
- Sites of cultural importance
- Religious sites
- Nature reserves and environmental protection areas
- Etc.

Mapping of existing aviation radars, telecommunication systems and television broadcast systems to a distance of up to 15 km from project area will also be performed and the findings will be reported in the ESIA study.

6.5 Identification and Analysis of Key Potential Impacts

The identification and analysis of impacts shall be based on the baseline information available for the study area in addition to other data which will be collected within the scope of the current ESIA study. Impacts detected from similar projects, as sited by the literature, shall also be examined. After identifying the project impacts, their significance shall be evaluated using a receptor-specific analysis approach addressing the various sources of impacts from the project's different implementation phases. **Table 6-5** presents the scoping matrix that shall be used to identify significant impacts.

Table 6-5. Scoping matrix

		Sensitivity of receptors			
		High	**Medium**	**Low**	**Negligible**
Magnitude or Scale of impact	**Large**				
	Medium				
	Low				
	Negligible				
Legend		Significant impact	Likely to be significant impact	Insignificant impact	

Negligible impacts will be excluded from the ESIA whereas significant and likely to be significant impacts will be further assessed in the ESIA report and mitigation measures shall be proposed to minimize their impact. Residual impacts following the implementation of the proposed mitigation measures will also be assessed in the ESIA report.

6.5.1 Noise and Vibration

6.5.1.1 Baseline Information

The project site is characterized by very low noise levels in the range 30-40 dBA in the absence of high winds as the road leading to the site is rarely traveled and there are no existing developments onsite. The only existing source of noise in the project site are high winds when they occur. A digital map of noise sensitive areas will be developed based on Army maps and will be validated through field observations.

6.5.1.2 Key Construction and Decommissioning Impacts

During the construction phase, potential noise emissions are expected from the activities associated with the installation of turbines, transmission lines and sub-station and the road widening activities. The main sources of noise are associated with transportation activities and the delivery of raw materials and turbines and with the operation of excavation, leveling and construction equipment. However, the impacts are temporary in nature as they are limited to the construction phase and therefore are of low to medium significance. Similar impacts are expected during the decommissioning phase but their relative impact will be negligible.

6.5.1.3 Key Operation Impacts

Wind turbines produce noise through a number of different mechanisms which can be roughly grouped into mechanical and aerodynamic sources. The major mechanical components include gearbox, generator, and yaw motors in addition to fans and hydraulic motors. Mechanical noise is radiated by the surface of the turbine and by openings in the nacelle housing. The interaction of air and the turbine blades produces aerodynamic noise through a variety of processes as air passes over and past the blades (IFC, 2015). Potential health impacts from exposure to high noise levels range from stress, anxiety, chronic fatigue, gastrointestinal problems, high blood pressure, tinnitus (ringing in the ear) to hearing loss (OSHA).

Noise emissions analysis during operation will be undertaken by Ramboll / SES as follows:

- Determination of the significant noise sensitive areas (in the form of digital maps of land use and noise sensitive areas)
- Research of the noise levels of the relevant wind turbines
- Consideration of the cumulative impacts from the three planned projects
- Forecasting of the noise emissions for the significant noise sensitive areas based on the noise levels of the wind turbines and the international guideline ISO 9613-2 "Attenuation of sound during propagation outdoors"
- Assessment of the quality of the forecast
- Preparation of a noise map at requested dB-steps

For calculating the noise emissions, the DECIBEL module of the WindPRO 3.0 software package by the Danish company EMD International A/S will be used. WindPRO 3.0 is the world's most widely used software for planning and designing wind farm projects. More than 2,000 companies and institutions, including the world's leading turbine manufacturers, project developers, engineering companies, utilities and planning authorities and research institutions are using WindPRO 3.0. Ramboll has over 20 years of experience in forecasting noise emissions from wind farms with WindPRO 3.0.

6.5.1.4 Known receptors

Receptors include the security staff and the local communities in the surrounding area up to a distance of 2 km.

6.5.1.5 Summary of impacts

Impact	Receptor's importance sensitivity	Magnitude or scale of impact	Significance
Vehicles transporting raw materials and turbine parts and construction equipment	Low to High	Small/ short term	Insignificant
Operation of turbines	High	Low to Medium	Likely to be significant

6.5.1.6 Likely mitigation measures

Possible noise reduction methods include the below:

- Silencers on noise emitting equipment and ear protection equipment during construction
- Optimization of wind turbine design for reduced noise emissions levels if needed
- Noise barriers around potentially affecting buildings / houses

Additional mitigation measures (if any) will be assessed in the ESIA report.

6.5.2 Biodiversity

6.5.2.1 Baseline Information

In terms of flora, more than 90% of the project site is characterized by a low vegetation cover. Areas with dense trees are avoided in the process of selection of turbine locations by the client. Once the layout of turbines and concept power transmission line diagram and road widening requirements are finalized, a baseline assessment of all floral species present at affected sites will be implemented and documented in the ESIA report.

In terms of fauna, besides insect species which are endemic to the project area, birds and bats are the most important faunal receptors in wind turbine projects and a year round study to assess the baseline conditions for the latter species has started since August 2017 as described in section 6.4.2 and is currently on-going. The results of the study will be shared in the ESIA report.

6.5.2.2 Key construction and decommissioning impacts

During the construction phase, potential impacts on biodiversity may come from land clearing activities for the installation of turbines, associated transmission lines and sub-station and road widening activities. The combined effects of vegetation clearing, earth cutting, excavation, filling, runoff, and air and water pollutants include loss of biodiversity

and potential contamination of soil. However, since the biodiversity on the project plot is restricted to shrubs and herbs, and given the relatively small size of excavation works, the construction impact can be considered to be of low significance. Also, should a proper plan for the management of waste and re-instatement of a local vegetative cover (where feasible) be implemented during decommissioning, the associated impacts are reduced to an insignificant level.

6.5.2.3 Key Operation Impacts

Wind energy facilities have the potential for direct and indirect adverse impacts on biodiversity including bird and bat collision-related fatalities, bat fatalities due to the potential impact of pulmonary barotrauma, displacement of wildlife, and habitat conversion/degradation. Also the location of turbines may disrupt the daily movements of bats and birds (e.g. from feeding to roosting or breeding grounds), and may potentially represent a barrier to migratory birds. Adverse impacts may also result from associated infrastructure including overhead transmission lines, met masts and lighting (IFC, 2015). Preliminary results indicate however the absence of bats in the study area. Also, should the client install bird migration monitoring radars, and commit to shutting down the turbines during fall and spring migration period as confirmed during the public consultation meeting, the impact on bird fatalities can be reduced to a medium to low significance level. Consideration of proximity to sites of high biodiversity of the region in the site selection process can also further decrease the significance of the impact on birds' life and fatalities.

6.5.2.4 Known receptors

Receptors include the terrestrial fauna and flora.

6.5.2.5 Summary of impacts

Impact	Receptor's importance / sensitivity	Magnitude or scale of impact	Significance
Degradation of habitat during construction	Medium to High	Low / Short term	Likely to be significant
Impact on birds	Medium to high	Medium / Long-term	Significant
Waste and absent vegetative cover	Medium to high	Negligible / Short term	Insignificant

6.5.2.6 Likely mitigation measures

Mitigation measures include the below:

- Siting roads and support facilities to avoid critical terrestrial habitat if any
- Implementation of projects to mitigate the loss of habitat such as reinstatement of the vegetative cover wherever possible
- Installation of bird tracking radar (s)
- Shut down of wind turbines during bird migration events
- Monitoring of bird fatalities

Additional mitigation measures (if any) will be assessed in the ESIA report.

6.5.3 Shadow flicker

6.5.3.1 Baseline Information

Existing land morphology is hilly and there are several natural occurring shadow areas around the project sites. A digital map of shadow flicker sensitive areas will be developed based on Army maps and will be validated through field observations.

6.5.3.2 Key operation impacts

Shadow flicker occurs when the sun passes behind the wind turbine and casts a shadow. As the rotor blades rotate, shadows pass over the same point causing an effect termed shadow flicker. Shadow flicker may become a problem when potentially sensitive receptors (e.g. residential properties, health care facilities, etc.) are located nearby, or have a specific orientation to the wind energy facility (IFC, 2015). The probability of shadow flicker occurrence and the extent of its effects on the residents depend on a number of factors such as the direction of 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. Shadow flicker exposure decreases with increasing distance from the wind farm.

The shadow flicker analysis during operation will be undertaken by Ramboll / SES as follows:

- Determination of the shadow flicker sensitive areas
- Consideration of the cumulative impacts from the three planned wind projects in the vicinity to be included in the calculation
- Assessment of the shadow flicker times on the relevant sensitive areas following international best practice guidelines from Germany (i.e. the accumulated exposure on residential properties should not exceed a total of 30 hours per year and the exposure on residential properties should not be longer than 30 minutes per day)

- Calculation and mapping of shadow flicker areas using the WindPRO 3.0 software package for the closest receptors. The digital elevation model is based on SRTM-data to exclude areas shielded by the morphology.

The impact from shadow flicker is expected to be of medium to low significance due to the low number of settlements located in close vicinity to the proposed turbine locations.

6.5.3.3 Known receptors

Receptors include the residential areas in proximity to the project area up to 2 km away.

6.5.3.4 Summary of impacts

Impact	Receptor's importance / sensitivity	Magnitude or scale of impact	Significance
Shadow flicker	Medium to High	Low to Medium / Long-term	Likely to be significant

6.5.3.5 Likely mitigation measures

It is not possible to locate the wind energy turbines such that neighbouring receptors experience no shadow flicker effects; it is recommended that the predicted duration of shadow flicker effects experienced at a sensitive receptor not exceed 30 hours per year and 30 minutes per day on the worst affected day, based on a worst-case scenario. As a result the following prevention and control measures are possible:

- Site wind turbines appropriately to avoid shadow flicker being experienced or to meet limits on the duration of shadow flicker occurrence
- Program wind turbines to shut down at times when shadow flicker limits are exceeded

Additional mitigation measures (if any) will be assessed in the ESIA report.

6.5.4 Visual impact

6.5.4.1 Baseline Information

A digital map of sensitive areas (i.e. residential centres, environmental reserves, unique historical/cultural sites, popular religious destinations or other natural structures normally seen as valuable by human perception) will be developed based on Army maps and will be validated through field observations.

6.5.4.2 Key construction impacts

A negative visual impact is possible during construction due to land clearing activities and potential random storage of aggregate materials and excavation waste. However the latter impact is confined to the construction period and can be reduced to an insignificant level if a proper construction site management plan is used. Similarly, the visual impact associated with the decommissioning phase is expected to be insignificant should proper waste clearing activities be implemented in a timely manner.

6.5.4.3 Key operation impacts

The visual impact analysis during operation comprises an evaluation of sensitive areas (i.e. residential centres, environmental reserves, unique historical/cultural sites or other natural structures normally seen as valuable by human perception) and the assessment of the visual impact posed by the planned wind farms. The assessment of the zones of visual impact presents the visibility of the wind turbines in a surrounding area of 10 km around the wind farm on a topographical map. The visual impact assessment will be undertaken by Ramboll / SES as follows:

- Digital mapping of settlement and vegetation areas
- Acquisition of a topographical map of the area
- Determination of the average height of obstacles like settlement areas and vegetation
- Identification of the visual impact
- Cartographic presentation of the results in DIN A3 format
- Calculation of the respective view segments in hectare
- Creation of four visualizations of the planned turbines from different viewpoints. The turbines will be projected in photographs using WindPRO 3.0. Each visualization is comprised of the following:
    - Calibration of control points for localization of the camera positions with WindPRO 3.0.
    - Determination of the visualization data of the planned wind turbines.
    - Creation of a digital terrain model (SRTM-data will be used).
    - Creation of the visualization with WindPRO module PHOTOMONTAGE.

6.5.4.4 Known receptors

Receptors include the residential centres, environmental reserves, unique historical/cultural sites, popular religious destinations or other natural structures in proximity to the project area up to 10-15 km away.

6.5.4.5 Summary of impacts

Impact	Receptor's importance / sensitivity	Magnitude or scale of impact	Significance
Storage of aggregate materials, construction equipment, excavation waste	Medium to High	Negligible / Short-term	Insignificant
Turbines	Medium to High	Medium / Long-term	Likely to be significant
Waste storage during decommissioning	Medium to High	Negligible / Short-term	Insignificant

6.5.4.6 Likely mitigation measures

Likely mitigation measures include the below:

- Preserve topsoil and reuse it to re-instate vegetative cover around the turbines
- Erosion measures should be implemented and cleared land should be promptly re-vegetated with local seed stock of native species
- Maintain a uniform size and design of turbines
- Adhere to country specific standards for marking turbines including aviation requirements if available
- Minimize presence of ancillary structures on the site by minimizing site infrastructure

Additional mitigation measures (if any) will be assessed in the ESIA report.

6.5.5 Occupational Health and safety

Occupational health and safety hazards during construction, operation and decommissioning of wind farms include physical hazards from working at heights, working in confined spaces, working with rotating machinery, lifting operations and falling objects, in addition to the location in a remote area (IFC, 2015). Additional impacts during operation include the shadow flicker, noise emissions, and potential blade or ice throws from the turbines.

6.5.5.1 Known receptors

The receptors include the workers involved in the construction, operation and decommissioning of the wind farm.

6.5.5.2 Summary of impacts

Impact	Receptor's importance / sensitivity	Magnitude or scale of impact	Significance
Worker accidents, injuries, and emergency cases during construction and decommissioning	Low	Medium / Short term	Likely to be significant
Exposure to shadow flicker and noise, and possible blade and ice throws	Low	Medium to high / Medium to Long term	Likely to be significant

6.5.5.3 Likely mitigation measures

During construction and decommissioning, mitigation measures that can reduce potential health and safety impacts can be divided into the following main categories:

- Developing an HSE plan including the provision of personal protective equipment (PPEs), and the training of the workers on working at heights and the use of PPEs
- Using work equipment preventing falling and safety nets if feasible
- Ensuring that hoisting equipment is properly rated maintained and that hoist operators are properly trained
- Implementing site security and safety measures
- Regulating transportation
- Developing emergency/contingency plans, as well as
- Ensuring personnel protection.

During operation, likely mitigation measures include the following:

- Proper noise insulation of security rooms
- Proper orientation of windows of security personnel in case they spend a significant amount of time indoor at a nearby location
- Use of PPEs onsite including helmets
- Automatic monitoring of turbine part conditions and quick troubleshooting
- Using turbines with de-icing mechanisms at high altitudes

Additional mitigation measures (if any) will be assessed in the ESIA report.

6.5.6 Community Health and Safety

6.5.6.1 Baseline environment

A map of constructions falling in close vicinity to turbine sites will be developed. Also mapping of existing aviation radars, telecommunication systems and television broadcast

systems around the project area will also be performed and the findings will be reported in the ESIA study.

6.5.6.2 Key impacts

Community health and safety hazards during the construction and decommissioning phases include abnormal load transportation and public access to construction/decommissioning sites. During operation, besides the possibility of exposure due to shadow flicker and noise impacts (already discussed), other key hazards include potential blade and ice throw, aviation accidents, and electromagnetic interference. Blade and ice throw may reach a distance of up to 1.5 times the turbine height (tower + rotor radius). Aviation accidents are a concern when turbines are located near airports, aviation radars, in military low flying areas or on known flight paths. Electromagnetic interference with telecommunication and television broadcast systems is also possible due to path obstruction, shadowing, reflection, scattering or re-radiation (IFC, 2015). The significance of the impact depends on the location of the wind turbine relative to the transmitter and receiver, the characteristics of the rotor blades, the signal frequency receiver characteristics and radio wave propagation characteristics in the local atmosphere. Should proper 1- siting and 2- safety measures be implemented, the latter impacts can be reduced to a low significance level.

6.5.6.3 Known receptors

The local community living within the required setback distances depending on each impact (if any).

6.5.6.4 Summary of impacts

Impact	Receptor's importance / sensitivity	Magnitude or scale of impact	Significance
Blade or ice throw	High	Low / Long term	Likely to be significant
Aviation accidents	High	Low / Medium term	Likely to be significant
Electromagnetic interference	High	Medium / Long term	Significant

6.5.6.5 Likely mitigation measures

With respect to aviation accidents, preliminary contact with the Directorate of Civil Aviation indicates the feasibility and safety of the proposed location of turbines with respect to

common flights and associated heights. A formal permit is currently in the process of being acquired.

Other likely mitigation measures include the below:

- Optimize siting of turbines to avoid interference with communication systems
- Consultation with relevant aviation authorities to determine prevention and control measures including possible change of air traffic routes and relocation of any radar
- Use anti-collision lighting
- Install a directional antenna
- Modify the existing aerial
- Install an amplifier to boost the signal

Additional mitigation measures (if any) will be assessed in the ESIA report.

6.5.7 Socio-economics

6.5.7.1 Baseline environment

A baseline assessment of socio-economic situation in the study area will be implemented and reported in the ESIA report.

6.5.7.2 Key impacts

A positive impact on the socio-economics of the area is expected in view of the following:

- Absence of income activities on the plots where turbines are proposed to be installed
- Increase in employment opportunities during construction and operation
- Monetary benefit to land owners through long-term lease agreements
- Monetary benefit to municipalities from land lease and from taxes; benefits would be used for local development projects
- Improved lifestyle due to increased availability of power supply from a green source

6.5.8 Traffic and Transport

6.5.8.1 Baseline Information

The project site is easily accessible through already existing roads which were observed to be in a good condition and which was rarely travelled by vehicles. Minor road widening activities will be needed during construction phase to facilitate the transport of turbine parts. Road widening requirements are currently being studied by the project proponent and will be reported and accounted for in impact assessment and management in the ESIA study.

6.5.8.2 Key construction impacts

A slight increase in the road traffic is expected during the construction and decommissioning periods and will be related to staff of contractor, supervisor and essentially laborers as well as construction material and turbine parts' movements. However, the impact is of low significance given the temporary nature of construction and decommissioning activities.

6.5.8.3 Key operation impacts

An improvement in the local road network is expected during operation as a result of the planned road widening activities.

6.5.8.4 Receptors

Receptors include the local and general population using the road network.

6.5.8.5 Summary of impacts

Impact	Receptor's importance / sensitivity	Magnitude or scale of impact	Significance
Increase in road traffic during construction and decommissioning	Medium to High	Medium/Short term	Likely to be significant

6.5.8.6 Likely mitigation measures

Likely mitigation measures include the avoidance of peak traffic hours during the transportation of turbine parts from port to study area. Additional mitigation measures (if any) will be assessed in the ESIA report.

6.5.9 Air emissions

6.5.9.1 Baseline Information

As previously indicated, the study area can be considered as a relatively pristine area with low air pollution levels.

6.5.9.2 Key Construction Impacts

The construction works are likely to involve combustion emissions and dust generating activities such as ground excavation, material supply and handling and vehicle / equipment movements.

Potential combustion emission sources will include those emissions associated with the following:

- Construction equipment (mainly from fuel powered engines and generators);
- Excavation operations and
- Road vehicles and transportation activities.

The main air pollutants likely to be associated with these emission sources include: Dust, Oxides of Nitrogen (NO_X), Sulfur Dioxide (SO_2), Particulate Matter (PM_{10}, $PM_{2.5}$), Carbon Monoxide (CO), and Volatile Organic Compounds (VOCs).

However, it is worthy to note that the construction works will be temporary and therefore their impact is not expected to be of long term significance.

6.5.9.3 Key Operation Impacts

The operation of the wind turbines is not associated with increased air pollution levels. In contrast, wind turbines produce green energy which helps to satisfy the local demand without recourse to thermal power generation processes thus offsetting the air emissions associated with the latter processes.

6.5.9.4 Known receptors

Potential human receptors include the employees/workers and surrounding towns and villages. Among the latter, potential sensitive receptors may exist such as school students and hospital patients if high pollution levels are encountered at their locations. Other receptors include the terrestrial flora who may be affected by high levels of PM, SO_2 and NO_x.

6.5.9.5 Summary of impacts

Impact	Receptor's importance / sensitivity	Magnitude or scale of impact	Significance
Combustion and exhaust emissions from equipment and vehicles for raw materials and workers transport	Low	Medium/Short term	Insignificant
Dust generation from onsite excavations and construction activities	Low to High	Medium/Short term	Likely to be significant

6.5.9.6 Likely mitigation measures

Likely mitigation measures during construction include:

- Construction machinery and transportation vehicles should be equipped with emission control systems as applicable to the age, make, and model of the equipment, and should be suitably maintained;
- Construction site traffic should obey speed limits on unpaved roads to minimize dust generation
- Paving of widened roads

6.5.10 Solid waste generation

6.5.10.1 Baseline Environment

The project area is a remote area with very low solid waste generation activities if any.

6.5.10.2 Key Construction Impacts

Construction activities are inherently associated with the generation of wastes such as excavated sediment, construction debris and general refuse. The impact of the generated waste is dependent primarily on the management option that is adopted during the construction phase, but is expected to be insignificant if the waste is reused and/or disposed at locations which are approved by the local municipalities.

6.5.10.3 Key Operation Impacts

Domestic waste generated by the security workforce (20 people) will be low and therefore will not pose any pressure on the environment if properly managed.

6.5.10.4 Key decommissioning impacts

A study of the types and quantities of decommissioning waste will be implemented in the ESIA study including an assessment of any hazardous components in the resulting waste stream.

6.5.10.5 Known receptors

Receptors include the local and general population.

6.5.10.6 Summary of impacts

Impact	Receptor's importance / sensitivity	Magnitude or scale of impact	Significance
Generation of solid waste during construction	High	Negligible/Short term	Insignificant
Pressure on existing solid waste management infrastructure during operation	High	Negligible/ Long-term	Insignificant
Decommissioning waste	High	Medium/Short term	Likely to be significant

6.5.10.7 Likely mitigation measures

Likely mitigation measures include the following:

- Maximization of reuse of excavation materials in construction activities
- Disposal of excess excavation at licensed quarries or at locally approved dumpsites
- Development of a solid waste management plan for the facility
- Incorporation of producer responsibility principles with respect to management of waste from decommissioning phase in the agreement with the turbine suppliers

Additional mitigation measures (if any) will be assessed in the ESIA report.

6.6 Analysis of Alternatives

The project alternatives that will be assessed and compared in the ESIA study are:

- The no-project alternative
- Different turbine locations
- Different types of turbines
- Different access strategies

The alternatives will be compared based on their potential environmental impacts, economic costs and benefits, technical and institutional feasibility, monitoring and control requirements and suitability in the context.

6.7 Environmental and Social Management Plan

6.7.1 Mitigation Plan

The purpose of the mitigation plan is to eliminate or reduce the potentially negative environmental impacts of the proposed project. Both administrative and technical measures

will be presented. The development of mitigation measures will highly depend on the significance of the predicted impact and on its phase of occurrence.

6.7.2 Monitoring Plan

Depending on the outcomes of the impact analysis, a monitoring plan will be developed including the environmental parameters to be monitored with their corresponding locations as well as the frequency and duration of the monitoring. Equipment, skills and training requirements for the implementation of the monitoring plan will also be defined.

6.7.3 Institutional Strengthening Requirements

The action plan will identify plans for work supervision and future environmental evaluation studies along with responsibilities and a timeframe for implementation. The purpose of these plans is to ensure the continuous implementation of environmental management during the various phases of the project.

Qualifications and responsibilities of key personnel will be defined. Training requirements in the context of the project will also be defined in order to ensure sound environmental management during the implementation of the proposed activities.

7 Preparation of an ESIA report

An ESIA report will be prepared and submitted to the Ministry of Environment (MoE) for review. The report will be finalized upon receiving the comments of the MoE. The final ESIA report will include the following sections:

- Executive summary
- Table of contents
- Introduction
- Policy, legal and administrative frameworks
- Public participation
- Description of the proposed project
- Description of the surrounding environment of the project
- Potential environmental impact of the project
- Analysis of alternatives
- Environmental and Social management plan
- Conclusion
- Appendices

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Appendix A

Licensing Decision and PPP agreement

ن.ر /س.غ

الجمهورية اللبنانية
مجلس الوزراء
الامانة العامة

رقم المحضر : ٥١
رقم القرار : ٤٢
سنة : ٢٠١٧

من محضر جلسة مجلس الوزراء

المنعقدة في : السراي الكبير يوم : الخميس الواقع في : ٢٠١٧/١١/٢

الموضوع: عرض وزيري الطاقة والمياه والمالية موضوع إنتاج الكهرباء من طاقة الرياح.

المستندات: قانون المحاسبة العمومية وتعديلاته.

- القانون رقم ٤٦٢ تاريخ ٢٠٠٢/٩/٢ (تنظيم قطاع الكهرباء).
- القانون رقم ٢٨٨ تاريخ ٢٠١٤/٤/٣٠ الممد بالقانون رقم ٥٤ تاريخ ٢٠١٥/١١/٢٤ المتعلق باعطاء اذونات وتراخيص انتاج الطاقة من الرياح.
- قرارات مجلس الوزراء رقم ١ تاريخ ٢٠١٠/٦/٢١(ورقة سياسة قطاع الكهرباء) ورقم ٦ تاريخ ٢٠١٦/٤/٢٧ (تقرير اللجنة المكلفة دراسة وفض العروض التقنية والمالية لمناقصة انتاج الطاقة من الرياح) ورقم ٥٨ تاريخ ٢٠١٧/٦/٢١ (تاجيل البحث بالموضوع الى الجلسة المقبلة) ورقم ٢ تاريخ ٢٠١٧/٧/٥ (تأجيل البحث بالموضوع) ورقم ٦٢ تاريخ ٢٠١٧/٧/١٢ (الموافقة المبدئية على عرض وزيري الطاقة والمياه والمالية موضوع انتاج الكهرباء من طاقة الرياح وتكليف وزير الطاقة والمياه التفاوض مع الشركات من أجل خفض السعر وذلك خلال مهلة ثلاثة أسابيع ورفع النتيجة الى مجلس الوزراء، لاتخاذ القرار بشأنه.
- الكتاب المشترك لوزيري الطاقة والمياه والمالية موضوع ايداع وزارة المالية رقم ١٨٦٤ تاريخ ٢٠١٧/٦/١٩ ومرفقاته.
- كتاب وزارة الطاقة والمياه رقم ٣٦٦٤/و تاريخ ٢٠١٧/١٠/٣١ ومرفقاته.

قرار المجلس

اطلع مجلس الوزراء على المستندات المذكورة اعلاه ،

وقد تبين منها انه سبق لمجلس الوزراء بقراره رقم ٦٢ تاريخ ٢٠١٧/٧/١٢ أن وافق مبدئياً على عرض وزيري الطاقة والمياه والمالية موضوع انتاج الكهرباء من طاقة الرياح وتكليف وزير الطاقة والمياه التفاوض مع الشركات من اجل خفض السعر وذلك خلال مهلة ثلاثة اسابيع ورفع النتيجة الى مجلس الوزراء، لاتخاذ القرار بشأنه .

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وبناء على قرار مجلس الوزراء رقم ٦٢ تاريخ ٢٠١٧/٧/١٢ ، تم دعوة ممثلي الشركات الثلاثة ، وأبلاغهم خلاصة القرار وان تخفيض السعر اساسي وضروري لاستمرارية السير بالملف .

وان ممثي الشركات الثلاث قدموا مداخلات قائمة على عدم القدرة على تخفيض السعر استناداً الى النماذج المالية التي يرتكزون اليها في تحديد السعر ومنها دراسة تحديد المخاطر وعوامل الاستثمار والتمويل والأمن والاستقرار الاقتصادي والتضخم .

عندها طلب وزير الطاقة والمياه على الفريق الاستشاري عقد ورشة عمل لدراسة النماذج المالية المعتمدة لدى الشركات وتقييم وزن كل عامل من حيث التأثير النسبي على السعر النهائي للكيلووات ساعة الواحد .

أدت ورشة العمل الى نتائج مباشرة حيث وافقت شركة SUSTAINABLE AKKAR على تخفيض السعر من ١١,٣٠ سنتاً الى ١٠,٨٥ سنتاً للكيلووات ساعة الواحد .

كما وافقت شركة LEBANON WIND POWER SAL على تخفيض السعر من ١١,٣٠ سنتاً الى ١٠,٨٥ سنتاً للكيلووات ساعة الواحد .

في حين ان شركة HAWA AKKAR S.A.L بقيت على موقفها .

ولما كانت عملية التفاوض يجب ان تبنى على قواعد فنية ومالية موضوعية ، فقد كلّف وزير الطاقة والمياه المركز اللبناني لحفظ الطاقة بالاستعانة مرة اخرى ومن موازنته بخبراء ماليين واقتصاديين من الشركة الاستشارية العالمية MOTT MACDONALD مع تحضير نماذج مالية علمية لاجراء الدراسة المطلوبة حول اسس تخفيض السعر والعوامل التي ينبغي احتسابها وفق الاسعار والقواعد العالمية المعتمدة من خلال معادلة حسابية تظهر الواقع النهائي للسعر ، وعليه ، وبعد عدة جلسات مع الخبير المنتدب من قبل الشركة الاستشارية العالمية فقد كانت النتيجة ان السعر العادل للشركات هو ١٠,٧٥ سنت لكل كيلووات ساعة واحد .

عقد وزير الطاقة والمياه اجتماعاً مع الفريق الاستشاري والخبير الدولي واطلع تفصيلياً على النموذج المالي الذي اعتمدته شركة MOTT MACDONALD والشفافية المطلقة في احتساب كافة العوامل المؤثرة على السعر .

ثم عرض وزير الطاقة والمياه على ممثلي الشركات الثلاث النتائج التي توصل اليها الاستشاري العالمي ووعد بعرض الموضوع على أقرب جلسة لمجلس الوزراء في حال قبولهم تخفيض السعر الى ١٠,٧٥ سنت .

وعليه ، وبعد إعلان ممثلي الشركات الثلاث التزامهم بالسعر النهائي ١٠,٧٥ سنت لكل كيلوات ساعة الواحد ، بموجب كتب خطية فان وزارة الطاقة والمياه تعرض الموضوع على مجلس الوزراء لاتخاذ القرار المناسب مع ضرورة تبني خارطة الطريق التالية :

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تاريخ القرار : ٢٠١٧/١١/٢

١. إعطاء رخصة لانتاج الكهرباء حصرا من طاقة الرياح لشركة LEBANON WIND POWER SAL بحسب العرض المقدّم من قبلها وذلك لفترة ٢٠ عاماً على ان يتم ربط الانتاج الكهربائي على شبكة مؤسسة كهرباء لبنان مقابل سعر ثابت للكيلووات ساعة الواحد وقدره ١٠,٧٥ سنتاً اميركياً .
٢. اعطاء رخصة انتاج الكهرباء حصرا من طاقة الرياح لشركة HAWA AKKAR S.A.L بحسب العرض المقدم من قبلها وذلك لفترة ٢٠ عاما على ان يتم ربط الانتاج الكهربائي على شبكة مؤسسة كهرباء لبنان مقابل سعر ثابت للكيلووات ساعة الواحد وقدره ١٠,٧٥ سنتاً اميركياً .
٣. اعطاء رخصة لانتاج الكهرباء حصرا من طاقة الرياحً لشركة SUSTAINABLE AKKAR بحسب العرض المقدم من قبلها وذلك لفترة ٢٠ عاما على ان يتم ربط الانتاج الكهربائي على شبكة مؤسسة كهرباء لبنان مقابل سعر ثابت للكيلووات ساعة الواحد وقدره ١٠,٧٥ سنتاً اميركياً .
٤. تفويض وزير الطاقة والمياه توقيع عقد شراء الطاقة النهائي PPA بين الحكومة اللبنانية والشركات الثلاثة المؤهلة كل على حدى بعد إدخال التعديلات اللازمة على النموذج الحالي الاولي لعقد شراء الطاقة بما فيها ملاحظات مؤسسة كهرباء لبنان ليكون ملائماً لمتطلبات التمويل الدولية والمعايير العالمية .
٥. تفويض وزيري الطاقة والمياه السعي للحظ تخفيض اضافي على السعر في حال وافق المصرف المركزي على توفير التمويل للمشاريع الثلاثة بالفائدة المدعومة التي تتناسب وسعر الفائدة الممنوحة لقروض الطاقة والبيئة .
٦. اعطاء مهلة ثلاثة اشهر لكل شركة من الشركات الثلاثة التي حصلت على رخصة الانتاج بالتفاوض مع فريق العمل الفني والقانوني الذي يكلفه وزير الطاقة والمياه لادخال التعديلات المقبولة على عقد شراء الطاقة الاولي تمهيداً لاصداره بالشكل النهائي والتوقيع عليه والا تصبح الرخص لاغية بعد مرور المدة المشار اليها .
٧. بعد توقيع عقود شراء الطاقة الثلاثة بصيغتها النهائية ، تعطى الشركات الثلاثة مهلة ١٨ شهراً من تاريخ التوقيع لتأمين كافة المستندات اللازمة التي يجب استيفاؤها حتى يصبح عقد شراء الطاقة نافذاً ، علماً انها بمثابة شروط اساسية لضمان ان تكون ملفات الشركات مطابقة للمعايير الدولية لمشروعات انتاج الطاقة من الرياح .

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٨. اعطاء مهلة ١٨ شهراً من تاريخ نفاذ العقد للشركات التي قامت بتأمين الشروط المنوصوص عنها في البند (٦) لاستكمال كافة الاعمال الانشائية والتنفيذية وربط محطات الرياح على شبكة مؤسسة كهرباء لبنان واستيفاء شروط التشغيل التجاري وصولاً الى مرحلة انتاج وبيع الطاقة (تاريخ التشغيل التجاري).

٩. تفويض وزير الطاقة والمياه تشكيل لجنة من الفنيين والقانونيين في وزارة الطاقة والمياه ، مؤسسة كهرباء لبنان ، والمركز اللبناني لحفظ الطاقة لمتابعة مراحل عملية التنفيذ ورفع التقارير اللازمة لوزير الطاقة والمياه .

١٠. الطلب الى وزير الطاقة والمياه رفع تقارير نصف سنوية من ضمن التقرير الدوري لمتابعة تطوّر اعمال ورقة سياسة قطاع الكهرباء الى مجلس الوزراء كل ستة اشهر لاحاطة المجلس بتطوّر المشروع وفقاً للمهل .

بناء عليه ،

وبعد المداولة ،

قرر المجلس الموافقة على اقتراح وزير الطاقة والمياه الآنف الذكر .

أمين عام مجلس الوزراء
فؤاد فليفل

الجمهورية اللبنانية
فرع الشؤون الوزارية
رئاسة مجلس الوزراء
نسخة طبق الاصل
الاسم علي الحاج شحادة
التوقيع

يبلغ لجانب :

- السادة الوزراء
- وزارة الطاقة والمياه
  - مؤسسة كهرباء لبنان
  - المركز اللبناني لحفظ الطاقة
- وزارة المالية
- المديرية العامة لرئاسة الجمهورية
- المديرية العامة لرئاسة مجلس الوزراء
- مؤسسة المحفوظات الوطنية
- مركز المعلوماتية
- المحفوظات

بيروت في ٢٠١٧/١١/٣

وزارة الطاقة والمياه
مكتب الوزير
الرقم ٤٦٢٨/و
التاريخ ٢٠١٨/٢/١

Power Purchase Agreement – Wind Power Project

The Government of Lebanon duly represented by the Minister of Energy and Water (by virtue of the decision of the Council of Ministers No. 43 dated 2 November 2017).

Lebanon Wind Power Sal, representing the Joint-Venture composed of Lebanon Wind Power Sal, Debbas Holding Sal, and Plambeck

LEBANON WIND POWER S.A.L.

REPUBLIC OF LEBANON
THE MINISTER
MINISTRY OF ENERGY & WATER

Signing page

Executed as an Agreement

CLIENT

The Government of Lebanon duly represented by the Minister of Energy and Water (by virtue of the decision of the Council of Ministers No. 43 dated 2 November 2017) having its main address at Corniche du Fleuve, Beirut, Lebanon

César Abi Khalil
Minister of Energy and Water

SELLER

Lebanon Wind Power Sal, having its main address Corniche An Nahr, Debbas Building, 3rd Floor, Beirut, Lebanon, representing the Joint-Venture composed of **Lebanon Wind Power Sal, Debbas Holding Sal, and Plambeck**

LEBANON WIND POWER S.A.L.

Robert Debbas
Chairman – General Manager

Appendix B

Announcement letters

SES Sustainable Environmental Solutions

RAMBOLL

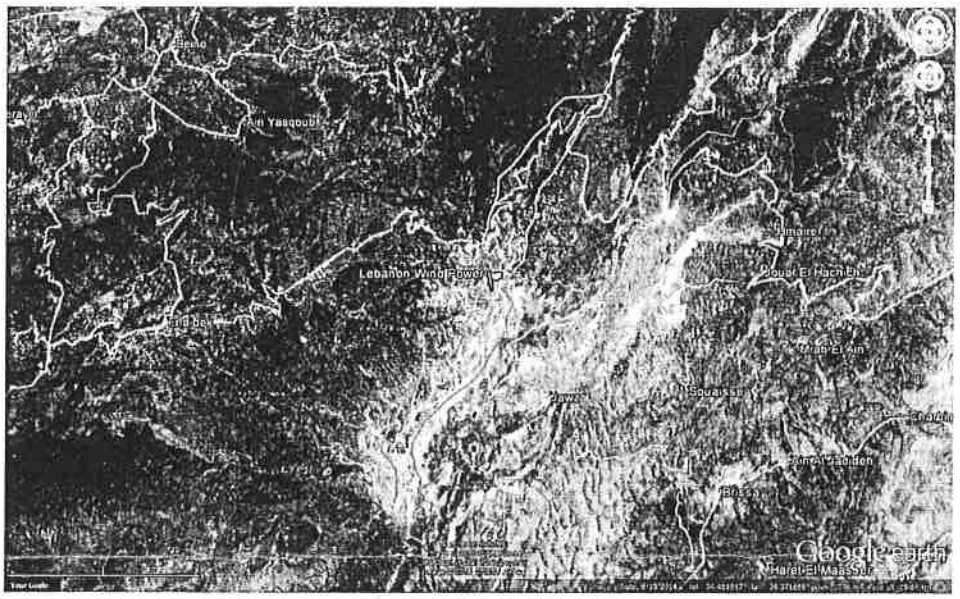
LEBANON WIND POWER
Coming from the north to the south

٢٠١٨/٤/٣٠

الموضوع: طلب وضع اعلان لمشروع إنشاء مزرعة رياح بطاقة ٦٠ ميجاوات في محافظة عكار
المرجع: مرسوم ٨٦٣٣ الصادر عن وزارة البيئة في عام ٢٠١٢ المتعلق بأصول تقييم الأثر البيئي

جانب رئيس بلدية القبيات المحترم،

لقد كُلّفت شركة الحلول البيئية الدائمة SES - بالتعاون مع شركة رامبول Ramboll بالقيام بدراسة تقييم الاثر البيئي لمشروع (Lebanon Wind Power) الذي يهدف الى إنشاء مزرعة رياح بطاقة ٦٠ ميجاوات في المنطقة المبينة في الصورة أدناه من محافظة عكار والمجاورة لبلدة القبيات.



وبما أن المادة السابعة من المرسوم ٨٦٣٣ تنصّ على ضرورة قيام البلدية بالاعلان عن المشروع القائم في جوار البلدة وذلك ضمن عملية دراسة تقييم الاثر البيئي، نرجو من سعادتكم وضع الاعلان المرفق ربطاً لغاية ١٥ يوماً على لوحة الاعلانات العمومية الخاصة بالبلدية.

ولكم جزيل الشكر،
د ناجي شامية
مدير شركة الحلول البيئية الدائمة

SES Sustainable Environmental Solutions

وزارة الداخلية والبلديات
بلدية القبيات
رقم التسجيل : ٢٤٩
رقم الورود : ٢٠١٨/٤/٣٠

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RAMBOLL

LEBANON WIND POWER
Caring from the north to the south

٢٠١٨/٤/٣٠

الموضوع: طلب وضع اعلان لمشروع إنشاء مزرعة رياح بطاقة ٦٠ ميجاوات في محافظة عكار
المرجع: مرسوم ٨٦٣٣ الصادر عن وزارة البيئة في عام ٢٠١٢ المتعلق بأصول تقييم الأثر البيئي

جانب رئيس بلدية فيسان المحترم،

لقد كُلفت شركة الحلول البيئية الدائمة SES - بالتعاون مع شركة رامبول Ramboll بالقيام بدراسة تقييم الاثر البيئي لمشروع (Lebanon Wind Power) الذي يهدف الى إنشاء مزرعة رياح بطاقة ٦٠ ميجاوات في المنطقة المبينة في الصورة أدناه من محافظة عكار والمطلة على بلدة فيسان.

وبما أن المادة السابعة من المرسوم ٨٦٣٣ تنص على ضرورة قيام البلدية بالاعلان عن المشروع القائم في جوار البلدة وذلك ضمن عملية دراسة تقييم الاثر البيئي، نرجو من سعادتكم وضع الاعلان المرفق ربطاً لغاية ١٥ يوماً على لوحة الاعلانات العمومية الخاصة بالبلدية.

ولكم جزيل الشكر،
د ناجي شامية
مدير شركة الحلول البيئية الدائمة

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رئيس بلدية جوار الحشيش
ياسين علي جعفر

SES Sustainable Environmental Solutions

RAMBOLL

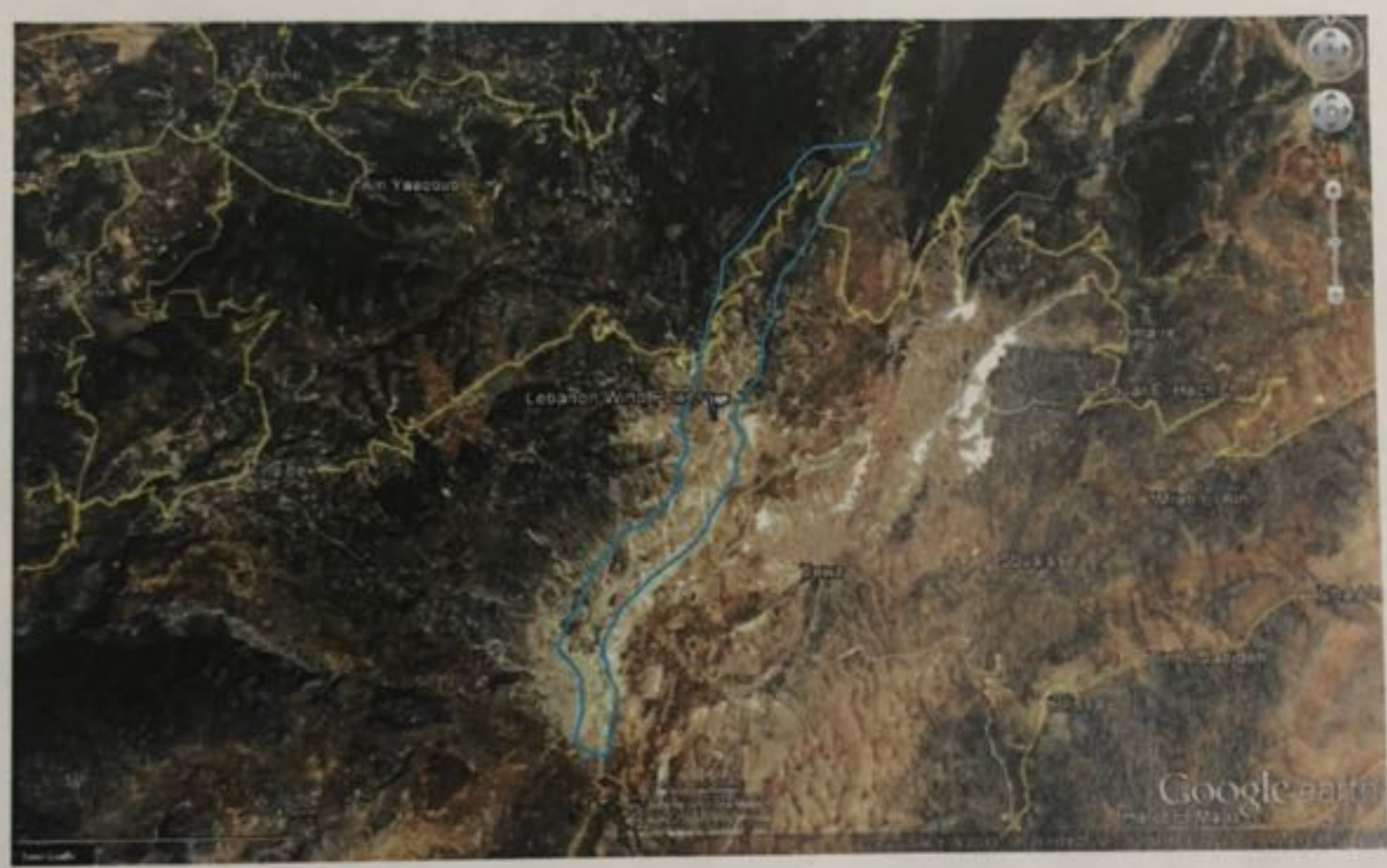
LEBANON WIND POWER
Coming from the north to the south

٢٠١٨/٤/٣٠

الموضوع: طلب وضع اعلان لمشروع إنشاء مزرعة رياح بطاقة ٦٠ ميجاوات في محافظة عكار
المرجع: مرسوم ٨٦٣٣ الصادر عن وزارة البيئة في عام ٢٠١٢ المتعلق بأصول تقييم الأثر البيئي

جانب رئيس بلدية الفنيدق المحترم،

لقد كُلّفت شركة الحلول البيئية الدائمة SES - بالتعاون مع شركة رامبول Ramboll بالقيام بدراسة تقييم الاثر البيئي لمشروع (Lebanon Wind Power) الذي يهدف الى إنشاء مزرعة رياح بطاقة ٦٠ ميجاوات في المنطقة المبينة في الصورة أدناه من محافظة عكار [redacted] لبلدة الفنيدق.



وبما أن المادة السابعة من المرسوم ٨٦٣٣ تنصّ على ضرورة قيام البلدية بالاعلان عن المشروع القائم في [redacted] البلدة وذلك ضمن عملية دراسة تقييم الاثر البيئي، نرجو من سعادتكم وضع الاعلان المرفق ربطاً لغاية ١٥ يوماً على لوحة الاعلانات العمومية الخاصة بالبلدية.

ولكم جزيل الشكر،
د ناجي شامية
مدير شركة الحلول البيئية الدائمة

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استلمت
رئيس بلدية فنيدق
أحمد عبدو البعريني

الجمهورية اللبنانية
بلدية فنيدق
وزارة الداخلية والبلديات

Appendix C

Ministries' invitation letters

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LEBANON WIND POWER
Coming from the north to the south

بيروت في ٢٠١٨/٥/٨

وزارة البيئة
٨ أيار ٢٠١٨

وزارة البيئة
مبنى العازارية، الطابق السابع
بيروت، لبنان

الموضوع: دعوة لحضور جلسة عامة لتحديد نطاق الأثر البيئي العائد لمشروع إنشاء مزرعة رياح بطاقة ٦٠ ميجاوات في منطقة جرود عكار.

تحية طيبّة وبعد،

تفيدكم شركة الحلول البيئية الدائمة، المصنّفة من قبل مجلس الإنماء والإعمار لإعداد دراسات بيئية وفقًا لقرار وزير البيئة رقم ٧/١ الصادر في العام ٢٠٠٣، أنها بصدد إعداد دراسة تقييم أثر بيئي لمشروع (Lebanon Wind Power) الذي يهدف الى إنشاء وتشغيل مزرعة رياح بطاقة ٦٠ ميجاوات في منطقة جرود عكار.
وفي هذا السياق وتطبيقاً للمرسوم ٢٠١٢/٨٦٣٣، ندعوكم للمشاركة في جلسة عامة لتحديد نطاق الدراسة وعرض المشروع ومناقشة أهم المسائل البيئية المرتبطة بالمشروع وذلك

يوم الثلاثاء الواقع في ١٥ أيار ٢٠١٨ في تمام الساعة العاشرة والنصف صباحاً في مطعم بيدروز (Pedro's) في ساحة القبيات.

تتلخّص أهداف الجلسة بما يلي:

١- فهم نطاق المشروع (وبالأخص متطلّبات المشروع وكيفية إدارته)
٢- تحديد المسائل البيئية الأساسية المرتبطة بالمشروع
٣- نقاش

لمزيد من المعلومات، الرجاء الإتصال بنا على الرقم ٠١٣٧١٢٨٤.

نشكر لكم حسن تعاونكم.

د. ناجي شامية
المدير العام

SES Sustainable Environmental Solutions

RAMBOLL

LEBANON WIND POWER
Coming from the north to the south

بيروت في ٢٠١٨/٥/٨

وزارة الطاقة والمياه
بيروت – كورنيش النهر

الموضوع: دعوة لحضور جلسة عامة لتحديد نطاق الأثر البيئي العائد لمشروع إنشاء مزرعة رياح بطاقة ٦٠ ميجاوات في منطقة جرود عكار.

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لمزيد من المعلومات، الرجاء الإتصال بنا على الرقم ٠١٣٧١٢٨٤.

نشكر لكم حسن تعاونكم.

د. ناجي شامية
المدير العام

الجمهورية اللبنانية

وزارة الداخلية والبلديات

إيصال بإستلام المعاملة

المستدعي/المصدر : شركة الحلول البيئية الدائمة ش م ل

العنوان : بيروت **رقم الهاتف:** ٠٣/٣٨٢٠٦٧

نوع المعاملة : دعوة لحضور جلسة

رقم المصدر : **تاريخ المصدر:** ٢٠١٨/٠٥/٠٨

موضوع المعاملة : دعوة لحضور جلسة عامة لتحديد نطاق الاثر البيئي العائد لمشروع انشاء مزرعة رياح بطاقة ٦٠ ميغاوات في منطقة جرود عكار بتاريخ ١٥-٥-٢٠١٨ في مطعم بيدروز- القبيات

سجل الطلب بتاريخ ٢٠١٨/٠٥/٠٨ **تحت رقم** ١١٠٠٩/ودب٢٠١٨

ملاحظات :

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LEBANON WIND POWER
Coming from the north to the south

بيروت في ٢٠١٨/٥/٨

وزارة الداخلية والبلديات
الحمراء – الصنائع
بيروت، لبنان

الموضوع: دعوة لحضور جلسة عامة لتحديد نطاق الأثر البيئي العائد لمشروع إنشاء مزرعة رياح بطاقة ٦٠ ميجاوات في منطقة جرود عكار.

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٢- تحديد المسائل البيئية الأساسية المرتبطة بالمشروع
٣- نقاش

لمزيد من المعلومات، الرجاء الإتصال بنا على الرقم ٠١٣٧١٢٨٤.

نشكر لكم حسن تعاونكم.

د. ناجي شامية
المدير العام

Appendix D

Seminar presentation

Consultancy Services

مشروع إنشاء مزرعة رياح في عكار
Lebanon Wind Power

دراسة تقييم الأثر البيئي

١٥ أيار ٢٠١٨

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البرنامج

- وصف المشروع
- دراسة تقييم الأثر البيئي
- مخطط الآثار المحتملة وتدابير التخفيف المقترحة
- المناقشة العامة: توصيات وملاحظات

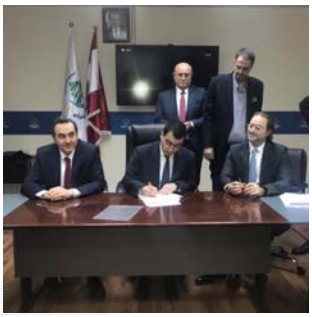
مقدمة

- صاحب المشروع: شركة Lebanon Wind Power.
- الإستشاري البيئي SES بالتعاون مع شركة Ramboll.
  - التشريعات المحلية
  - معايير أداء مؤسسة التمويل الدولية (IFC) بشأن الإستدامة البيئية والإجتماعية (٢٠١٢)، وبشأن البيئة والصحة والسلامة (٢٠٠٧)، طاقة الرياح (٢٠٠٧)، الطرقات (٢٠٠٧)
  - المبادئ التوجيهية لتقييم الأثر البيئي لمزارع الطاقة من قبل برنامج الأمم المتحدة الإنمائي / دعم تحسين كفاءة إستهلاك الطاقة المتجددة في لبنان، سيدرو (CEDRO، ٢٠١٢)
  - أفضل الممارسات الدولية

معلومات مرجعية

- أبرزت دراسة لوزارة الطاقة والمياه بالتعاون مع المركز اللبناني لحفظ الطاقة أن العجز في القدرة عل تأمين الطاقة الكهربائية قد بلغ ٣٤٧٨ جيغواط-ساعة في العام ٢٠٠٩
- عام ٢٠٠٩، التزم لبنان على أعقاب الجلسة الخامسة عشرة للبلدان المشاركة بإتفاقية الامم المتحدة الإطارية لتغير المناخ بتأمين ١٢% من الحاجة إلى الطاقة عام ٢٠٢٠ من المصادر المتجددة
- إن المشروع المقترح **يساعد** لبلوغ هذه الغاية

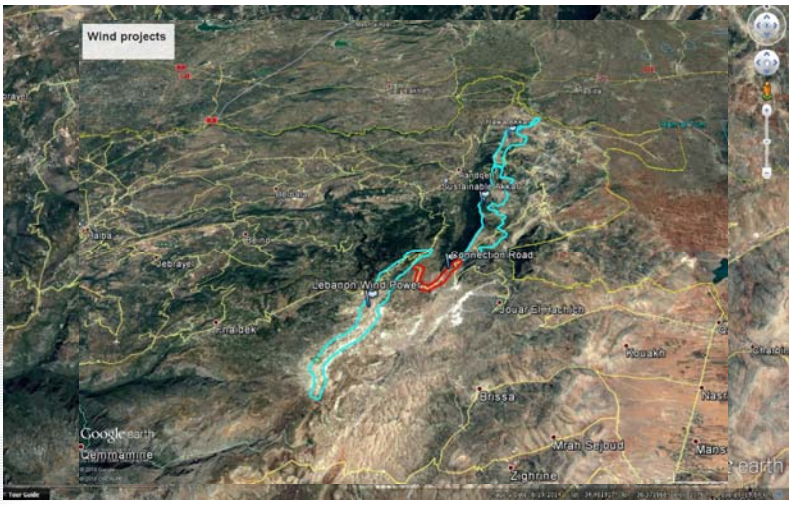
معلومات مرجعية



- قرار مجلس الوزراء الرقم ٤٣ تاريخ ٢/١١/٢٠١٧ الذي وافق بموجبه على منح ثلاثة تراخيص لانتاج الطاقة من الرياح بقدرة ٢٠٠ ميغاواط
- تم توقيع في شباط ٢٠١٨ عقد شراء طاقة مع ممثلي الشركات الثلاث المؤهلة وهي **Lebanon Wind Power SAL**، Hawa Akkar SAL و Sustainable Akkar

وصف المشروع

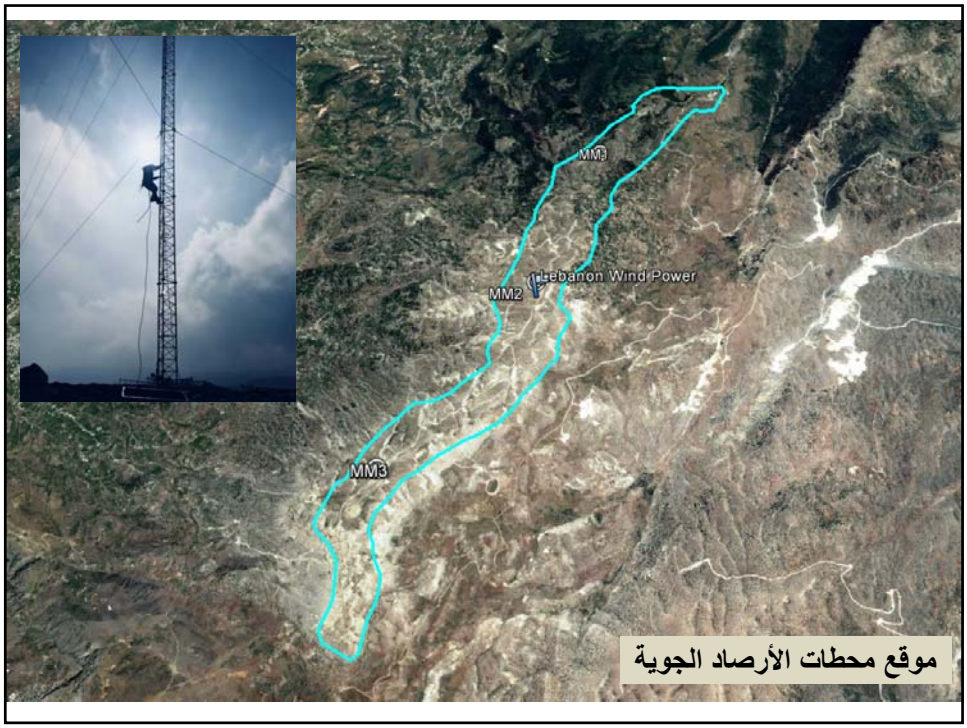
- موقع المشروع: جرود عكار.



وصف المشروع

- ٢٢ موقع محتمل للمراوح الهوائية ذات قدرة إنتاجية تتراوح بين من ٣,٨ إلى ٤,٢ ميجاوات (٣٠٠٠-٣٥٠٠ متر مربع)
- توصيل ٦٠ ميجاواط بالشبكة العامة
- محطة فرعية واحدة (١٠٠٠٠ متر مربع)
- خطوط النقل (٧ كم)
- ٣ محطات أرصاد جوية (مثبتة حالياً)
- توسيع بعض الطرقات

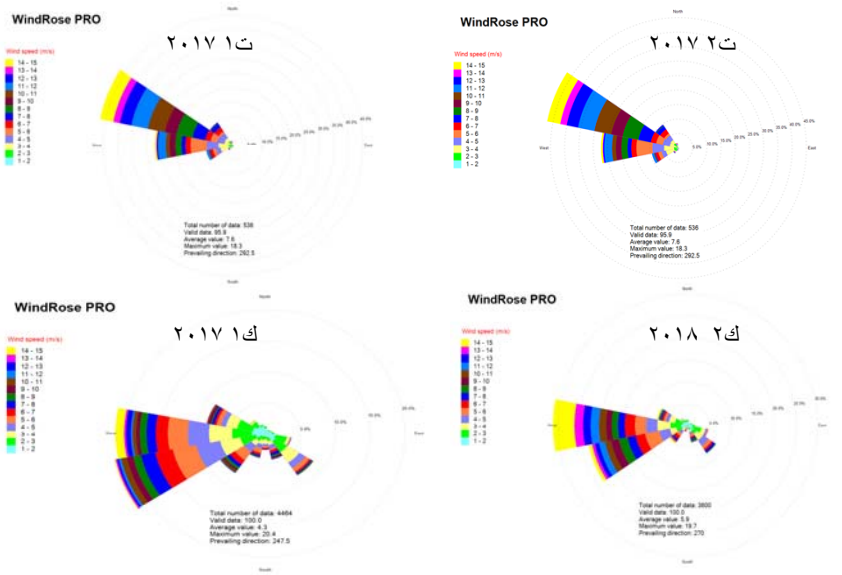
- **الإعتبارات لإختيار الموقع:**
  - **محاكاة إنتاجية المراوح في المواقع المحتملة**
  - **كثافة الغطاء النباتي**
  - **طوبوغرافية الارض**



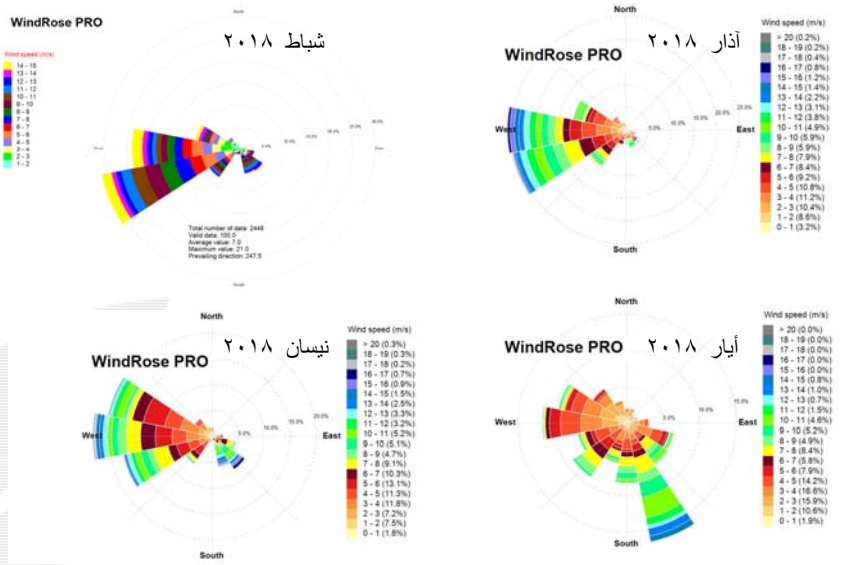
وصف المشروع

- **البرنامج**
  - حزيران ٢٠١٨- نهاية التشاورات حول الاراضي
  - حزيران ٢٠١٨- اختيار الشركة المنتجة للتوربينات
  - كانون الثاني ٢٠١٩- تحضير الموقع والطرقات
  - كانون الثاني ٢٠٢٠- التجهيز
  - حزيران ٢٠٢٠- بدء التشغيل

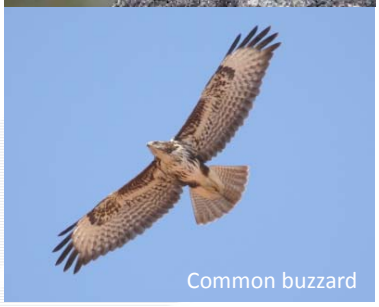
البيئة المحيطة - الهواء



البيئة المحيطة - الهواء



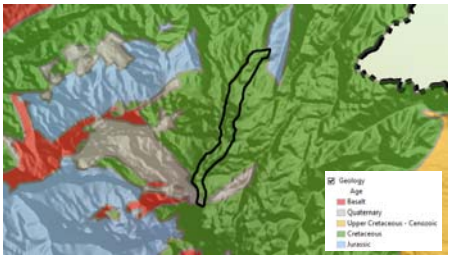
البيئة المحيطة - الفونا



- دراسة للطيور على مدار السنة
- الزيارات الميدانية تزداد كثافتها اثناء فترة هجرة الطيور
- أنواع التقييم:
  - الطيور الدائمة، والموسمية (الصيفية والشتوية)، والمهاجرة (الخريف ، الربيع)، وطيور جارحة ليلية
  - الطيور الشائعة، والنادرة، والمهددة بالانقراض
  - عدد ، موقع، خط العبور أوالهجرة
  - علو التحليق
  - مواقع التزاوج والتعشيش
- الإدارة البيئية بما في ذلك متطلبات المراقبة

البيئة المحيطة - الفلورا

البيئة المحيطة - الجيولوجيا



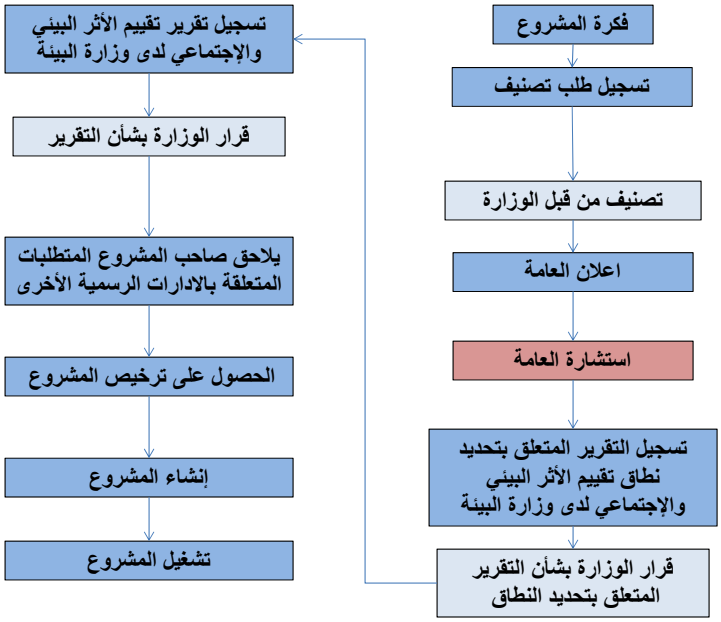
- التشكيل الجيولوجي في المنطقة يعود إلى العصر الكريتاسي.
- تطغى على الموقع الأحجار الرملية والكلسية.
- دراسة جيولوجية / زلزالية

البيئة المحيطة – المرافق الحساسة

- الإستحصال على خرائط ١/٢٠٠٠٠ من الجيش اللبناني للمنطقة الممتدة على مسافة ١٥ كم من المشروع:
  - المناطق السكنية
  - الأبنية
  - الغابات
  - المعالم السياحية
  - المراكز الدينية
  - المدارس، المستشفيات
  - الخ

دراسة تقييم الأثر البيئي

- **دراسة تقييم الأثر البيئي:**
  - استعراض القوانين والمعايير البيئية المطبقة على المشروع
  - تقييم لمنطقة الدراسة واصفا الظروف الفيزيائية والبيولوجية والاجتماعية والاقتصادية
  - مشاركة المجتمع المحلي
  - تحديد و تقييم الآثار البيئية والاجتماعية
  - تحليل البدائل
  - وضع خطة الإدارة البيئية والتدابير التخفيفية
    - تدابير التخفيف لمراحل الإنشاء والتنفيذ
    - برنامج رصد و مراقبة



لوزارة البيئة ٨٦٣٣ بحسب المرسوم

الآثار البيئية والإجتماعية-الإقتصادية المحتملة

- مستوى الضجيج
- التنوع البيولوجي
- تحليل وميض الظل
- الأثر البصري

- التأثير على صحة وسلامة العامة والعمّال
- التأثير الاقتصادي الاجتماعي
- حركة النقل
- نوعية الهواء
- إنتاج النفايات الصلبة

الآثار على مستوى الضجيج

- **مصادر الضجيج:**
  - الضجيج من تحضير الأراضي، كالحفر ومعدات الإنشاء
  - الضجيج الميكانيكي والهوائي من المراوح أثناء التشغيل
  - سوف يتم دراسة المرافق الحساسة ضمن مسافة ٢ كم (١٠٥ دسيبل حد أقصى، يصبح ٥٥ دسيبل على بعد ١٠٠م)

- **بعض التدابير التخفيفية المقترحة:**
  - استخدام كاتم صوت على الآلات خلال الإنشاء
  - تعديل تصميم المراوح لعزل الضجيج
  - رصد مستوى الضجيج خلال التشغيل بشكل دوري

تحليل مستوى الضجيج

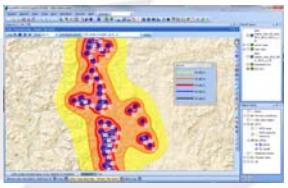
Input

- المرافق الحساسة
- مستويات الضوضاء من مراوح الهواء المستعملة
- محاكاة الأثر المتراكم للمزارع الثلاث المقترحة

WindPRO 3.0

Output

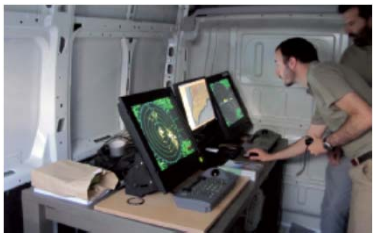
- وضع التجاوزات المحتملة خاصة في المناطق والمرافق الحساسة بواسطة وحدة DECIBEL

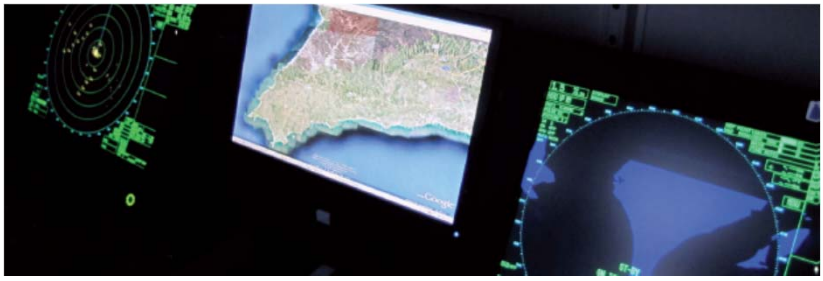


خريطة الضوضاء حسب مستويات dB المطلوبة

الآثار على التنوع البيولوجي

- **مصادر الآثار على التنوع البيولوجي:**
  - فقدان بعض النباتات في الموقع أثناء الحفر وتحضير الأراضي
  - إحتمال فقدان مواطن التعشيش للطيور الدائمة
  - تغيير المسار الطبيعي للطيور
  - ارتطام الطيور (اهمية الأثر متعلقة بأهمية الطيور، وبعلو ومسار تحليقها، وإحتمال الضباب)
- **بعض التدابير التخفيفية المقترحة:**
  - مواطن تعشيشية محاذية
  - تفادي المناطق ذات الغطاء النباتي الكثيف
  - المسافة بين المراوح أكثر من ٢٠٠ متر
  - وقف المراوح خلال مواسم الهجرة وخلال ساعات الهواء الخفيفة
  - وضع ردار لرصد الوجود الكثيف للطيور ودراسة مسارها
  - توزيع مراوح الهواء على خط موازي لمسار الهجرة للطيور





تحليل وميض الظل

- **الآثار المحتملة:**
  - يحدث وميض الظل عندما تعبر أشعة الشمس خلف التوربينات وتلقي بالظل على مسافة من المشروع
  - سوف يتم دراسة المرافق الحساسة ضمن مسافة ٢ كم (لا أهمية للأثر على مسافة أبعد من عشر مرات طول الشفرة)

- **بعض التدابير التخفيفية المقترحة:**
  - دراسة الموقع
  - وقف التوربينات عند تعدي الحدود المسموحة

تحليل وميض الظل

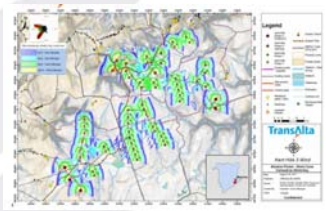
Input

- المرافق الحساسة
- نموذج الارتفاع الرقمي لاستبعاد مناطق الظل الطبيعية
- معلومات تقنية:
  - إتجاه الشرفات
  - البعد عن التوربينات
  - إرتفاع التوربين وقطر الشفرات
  - سرعة دوران الشفرة
  - الوقت من اليوم والوقت من السنة
- محاكاة الأثر المتراكم للمزارع الثلاث المقترحة

WindPRO 3.0

Output

- تحديد أوقات ومدة حدوث وميض الظل في المناطق الحساسة
- لا ينبغي أن يكون التعرض على المرافق الحساسة أطول من ٣٠ دقيقة في اليوم و ٣٠ ساعة في السنة



تحليل التأثير البصري

- **الآثار على المناظر الطبيعية:**
  - إزالة الغطاء النباتي خلال الإنشاء
  - سوف يتم دراسة التأثير البصري للمشروع ضمن مسافة ١٥ كم من المشروع

- **بعض التدابير التخفيفية المقترحة:**
  - التسلسل السليم لعملية الإنشاء وإعادة الغطاء النباتي
  - استعمال تصميم موحد للتوربينات
  - إضاءة التوربينات حسب المعايير المحلية/الدولية
  - تخفيض قدر المستطاع عدد الطرقات والبنى/المنشآت الظاهرة

تحليل التأثير البصري

Input

- خريطة لمناطق السكن والمرافق الحساسة (المواقع التاريخية / الثقافية، المحميات البيئية)
- متوسط إرتفاع الحواجز
- صور فوتوغراقية لموقع المشروع من عدد من المرافق الحساسة

WindPRO 3.0

Output

- التأثير البصري على المرافق الحساسة التي تم إختيارها
- عرض النتائج على خرائط (DIN A3)
- خلق تصورات لمزارع الهواء بواسطة وحدة PHOTOMONTAGE

الآثار على صحة وسلامة العامة والعمّال

- **الآثار على صحة وسلامة العامة والعمّال:**
  - الحوادث المحتملة أثناء الإنشاء
  - الآثار المحتملة أثناء التشغيل:
    - حركة الطيران (إذن اولي مبدئي)
    - القاء شفرة أو ثلج (على بعد ١,٥ مرات طول الشفرة)
    - لا أثر بيولوجي نتيجة الحقل الإلكترومغناطيسي بحسب منظمة الصحة العالمية
    - إحتمال تأثير على أنظمة الإرسال

- **بعض التدابير التخفيفية المقترحة:**
  - اعتماد تدابير السلامة المهنية أثناء الإنشاء وتدريب العمال لفهم المخاطر وسبل الوقاية
  - تأمين المسافة المطلوبة بين المروحة وأقرب منشأة أونظام إرسال
  - الإستحصال على موافقة المديرية العامة للطيران المدني
  - إضاءة التوربينات حسب المعايير المحلية / الدولية
  - تزويد التوربينات بالقدرة على تذويب الثلج (de-icing mechanism)

الآثار الإقتصادية والإجتماعية

- **مصادر التأثيرات على العوامل الاجتماعية والاقتصادية:**
  - لا يوجد إستعمالات أخرى للأراضي، مثلاً زراعة أو صناعة
  - توظيف العمال خلال مرحلة الإنشاء والتشغيل
  - المردود لمالكي الأراضي من عقود الإيجار الطويلة الامد
  - المردود للبلديات الممكن استثماره في مشاريع تنموية
  - تحسين في جودة الحياة نتيجة توفر الكهرباء من مصدر نظيف

الآثار على حركة النقل

- **مصادر الزحمة:**
  - إحتمال زحمة في السير نتيجة نقل التوربينات من الميناء الى منطقة المشروع خلال الإنشاء
  - تحسن في الطرقات المحلية نتيجة توسيعها

- **بعض التدابير التخفيفية المقترحة:**
  - تفادي ساعات الذروة المرورية في عملية النقل

الآثار على نوعية الهواء

- **مصادر تلوث الهواء:**
  - الغبار والإنبعاثات الناتجة عن أعمال الإنشاء
  - إنخفاض في الإنبعاثات من المولدات الخاصة نتيجة الزيادة في تأمين الكهرباء

- **بعض التدابير التخفيفية المقترحة:**
  - توفير غطاء على مواد البناء ونفايات الحفر أثناء نقلها أو تخزينها
  - تطبيق الحد الأدنى من سرعة حركة المرور
  - صيانة الآلات والمركبات المستعملة خلال مرحلة الإنشاء
  - السيطرة على التلوث من خلال إستعمال وصيانة فلاتر الهواء على الآلات والمركبات والمداخن
  - رش المياه وتعبيد الطرقات

إنتاج النفايات الصلبة

- **مصادر النفايات الصلبة:**
  - المواد المستخرجة خلال تجهيز الموقع خلال الإنشاء
  - النفايات المنزلية خلال الإنشاء والتشغيل

- **بعض التدابير التخفيفية المقترحة:**
  - حظر حرق النفايات
  - إعادة استخدام المواد المستخرجة كالردم خلال إنشاء المشروع

برنامج الرصد وتعزيز القدرة المؤسساتية

- سوف يتم وضع برنامج لمراقبة الإنبعاثات والآثار المحتملة
- توكيل موظَف للإشراف على تطبيق خطة الإدارة البيئية وبرنامج الرصد بالتعاون مع الإستشاريين المتخصصين، بما في ذلك التدريبات الدورية، وحفظ التقارير المتعلقة بالخطة البيئية، والحوادث التي تطرأ في الموقع.

نقاش

Appendix E

List of Attendants

LEBANON WIND POWER
Coming from the north to the south

RAMBOLL

SES Sustainable Environmental Solutions

تقييم الأثر البيئي العائد لمشروع إنشاء مزرعة رياح في عكار Lebanon Wind Power

الزمان: الثلاثاء ١٥ أيار ٢٠١٨

المكان: مقهى بيدروز في القبيات

Attendance Sheet - لائحة الحضور

التوقيع Signature	البريد الاكتروني Email	تلفون Tel	المهنة Profession	الإسم Name
	ja@sustainableKkar	70-300611	Project coordinator	Jules Assi
		٠٣٢٨٧٦٤٠	رئيس بلدية قنيورج	احمد عبده البعرشي
		٧٠/١٤٥٢٠١	موظف بلدية	عصمت مراد
	bashir.marj@live.com	70786300	Mech. eng. SES	Bashir Marj
	jam@sustainablekkar.com	70 667100	Assistant proj coordinator	Joe Abi Mansoor
		03877756	ماجستير العلوم	جنان الإزي
	lobiecber@ses-lb.com	01-374287	Env specialist SES	ليال أبي اسبر
	majid.hachem@hotmail.com	03/214671	Civil eng. MOIM Tech dept	مجيد هاشم

LEBANON WIND POWER
Coming from the north to the south

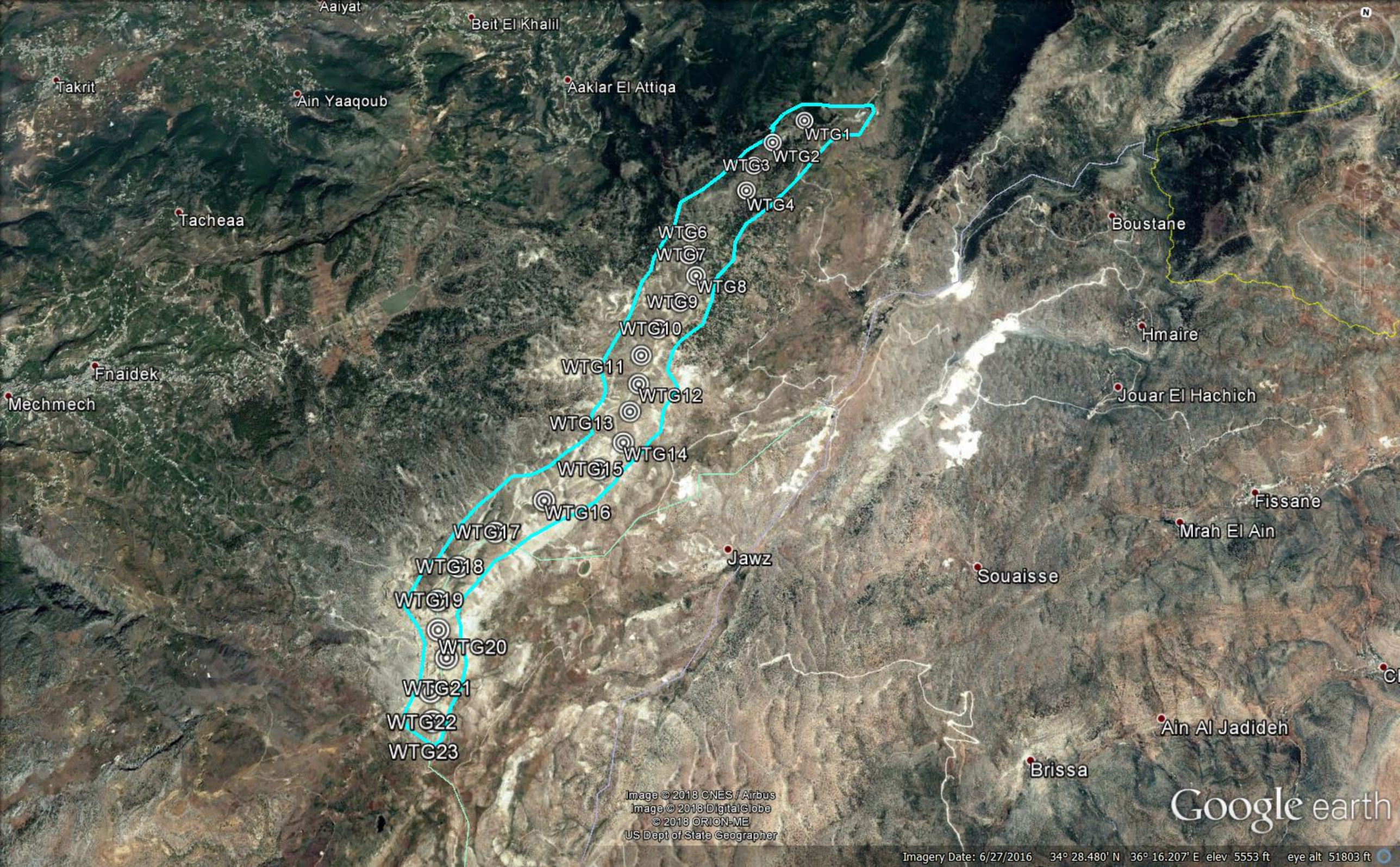
RAMBOLL

SES Sustainable Environmental Solutions

التوقيع Signature	Email البريد الاكتروني	Tel تلفون	Profession المهنة	Name الإسم
	Lmorcos@ses-lb.com	76 830 360	Environmental consultant SES	ليلى مرقص
	n.karam@moe.gov.lb	70.147755	Environmental Engineer	Nathalie Karam
	J.gergs@moe.gov.lb	70.836592	Environmental Specialist	Jeff gergs
		71-634567	Retired Captain	Samir Boutros
		70-570722		Jean Zaccour

Appendix F

Conceptual layout showing 22 possible turbine locations


Aaiyat
Beit El Khalil
Takrit
Ain Yaaqoub
Aaklar El Attiqa
WTG1
WTG2
WTG3
WTG4
Tacheaa
Boustane
WTG6
WTG7
WTG8
WTG9
WTG10
Hmaire
WTG11
Fnaidek
WTG12
Mechmech
Jouar El Hachich
WTG13
WTG14
WTG15
WTG16
Fissane
Mrah El Ain
WTG17
Jawz
WTG18
Souaisse
WTG19
WTG20
WTG21
WTG22
WTG23
Ain Al Jadideh
Brissa
Image © 2018 CNES / Airbus
Image © 2018 DigitalGlobe
© 2018 ORION-ME
US Dept of State Geographer
Google earth
Imagery Date: 6/27/2016 34° 28.480' N 36° 16.207' E elev 5553 ft eye alt 51803 ft

Appendix G

Typical specifications of a representative 4.2 MW wind turbine

V117-4.2 MW™ IEC IB/IEC IIA/IEC S
Facts & figures

POWER REGULATION	Pitch regulated with variable speed

OPERATING DATA	
Rated power	4,000 kW/4,200 kW
Cut-in wind speed	3 m/s
Cut-out wind speed	25 m/s
Re cut-in wind speed	23 m/s
Wind class	IEC IB/IEC IIA/IEC S

Standard operating temperature range from -20°C* to +45°C with de-rating above 30°C (4,000 kW)

*subject to different temperature options

SOUND POWER	
Maximum	106 dB(A)**

**Sound Optimised Modes dependent on site and country

ROTOR	
Rotor diameter	117 m
Swept area	10,751 m²
Air brake	full blade feathering with 3 pitch cylinders

ELECTRICAL	
Frequency	50/60 Hz
Converter	full scale

GEARBOX	
Type	two planetary stages and one helical stage

TOWER	
Hub heights	91.5 m (IEC IB) 84 m (IEC IIA)

NACELLE DIMENSIONS	
Height for transport	3.4 m
Height installed (incl. CoolerTop*)	6.9 m
Length	12.8 m
Width	4.2 m

HUB DIMENSIONS	
Max. transport height	3.8 m
Max. transport width	3.8 m
Max. transport length	5.5 m

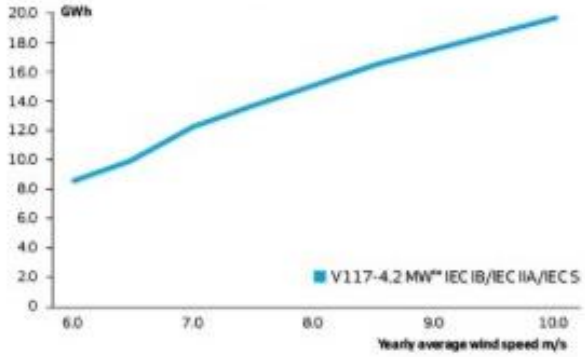
BLADE DIMENSIONS	
Length	57.2 m
Max. chord	4 m

Max. weight per unit for transportation	70 metric tonnes

TURBINE OPTIONS

- High Wind Operation
- 4.2 MW Power Optimised Mode (site specific)
- Load Optimised Modes down to 3.6 MW
- Condition Monitoring System
- Service Personnel Lift
- Vestas Ice Detection
- Vestas De-Icing
- Low Temperature Operation to - 30°C
- Fire Suppression
- Shadow detection
- Increased Cut-In
- Aviation Lights
- Aviation Markings on the Blades
- Vestas IntelliLight*

ANNUAL ENERGY PRODUCTION



Assumptions
One wind turbine, 100% availability, 0% losses, k factor =2,
Standard air density = 1.225, wind speed at hub height

Appendix H

Curriculum Vitaes

Dr. Naji Chamieh

Position Title and No.	Managing Partner- Senior Environmental Advisor
Name of Expert:	Naji Chamieh
Date of Birth:	7th of March 1960
Country of Citizenship/Residence	Lebanese and US

Education:

Institution University of California at Los Angeles, USA
Date (year) to (year) 1985 to 1990
Degree or Diploma PhD in Geotechnical Civil Engineering
Thesis Title: Experimental Investigation of the Behavior and Stability of Granular Soils at High Pressures

Institution University of California at Los Angeles (Extension Program) USA
Date (year) to (year) 1983 to1985
Degree or Diploma Construction Management

Institution University of California at Los Angeles, USA
Date (year) to (year) 1979 to 1983
Degree or Diploma Master and Bachelor of Science, in Civil Engineering, with Structural Engineering Major

Employment Record:

Date from – to	2007 to present
Location	Beirut, Lebanon
Company	Sustainable Environmental Solutions (SES)
Position	Senior Environmental Advisor and Managing Partner
Description	▪ Senior Environmental Expert for Environmental Studies: ▪ Joint venture with Dar Al Handasah in the Supervision of the Costa Brava sanitary landfill design and construction in Beirut along with its relative environmental aspects. ▪ Team Leader in the supervision of the construction of new sanitary landfill in Ghazzeh as well as the rehabilitation of the existing one, project financed and managed by UNDP.

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	▪ Team leader for an Environmental audit of Lebanon Fruit and Juice Company (Bonjus, Taanayel Dairy Farms, and F&B), Fanar Implementing an environmental audit at the facility with the purpose of ensuring regulatory compliance and issuance of environmental certificate consistent with the 2016 guidelines of the Ministry of Environment regarding environmental audit reports (Decision 189/1 of 2016). The facility includes the production of dairy products and ice cream in addition to power generation. The audit also included the design of a wastewater treatment plant for the treatment of facility's process wastewater. ▪ Conceptual design of a wastewater treatment system for a milk house (milk collection facility) in Jdita, Bekaa ▪ Consultant for the Lebanese Ministry of Environment for the development of "Environmental Compliance Guidelines for the meat processing industry, cattle farms, dairy industries and slaughterhouses" (Funded by World Bank). The reports included potential environmental impacts and proposal of mitigation measures including treatment of wastewater and management of solid waste. ▪ Director of a Solid Waste Management Consultancy project rewarded by UNICEF, which focuses on conducting Audit of the current Solid Waste Management System in place at 24 Municipalities in North Lebanon and Bekaa in order to assess the needs in supplies and equipment and recommend measures to increase the capacity and improve solid waste collection and disposal in these municipalities based on an environmental friendly and sustainable approach. ▪ Team Leader in assisting the Union of Jezzine municipalities in the Improvement of their Solid Waste Management system, project which is financed by the EU and Managed by the Union of Jezzine Municipalities. ▪ Director of a Solid Waste Management Consultancy project rewarded by UNICEF, which focuses on conducting Audit of the current Solid Waste Management System in place at Fnaydiq and Wadi el Jamous Municipalities in Akkar region and recommending measures to improve the later system. ▪ Team Leader in developing a management plan for improving the operational system of the proposed waste treatment facility in Ain Baal. ▪ Team Leader in conducting a complete assessment of the Solid Waste Collection System for the "Sabra and Shatila" Palestinian refugee camp in Ghobeiry-Beirut.

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	▪ Team Leader in the preparation for the Ministry of Environment of a study on "Economic Instruments to Create Incentives for Recycling in Lebanon". ▪ Preparation of Environmental Guidelines for the Dairy, Meat Processing, Slaughter House, and Cattle farm sectors for MOE. ▪ Assist SES staff in the final review of environmental studies (EIAs, IEEs, Audits), especially EIA studies for solid waste management projects including feasibility studies, in particular sanitary landfill and sorting-composting plants, as well as the operation and maintenance of such facilities. ▪ Conduction of public consultation meetings in the context of EIAQ studies or other similar studies. ▪ Assist MOE to develop new Environmental Impact Assessment guidelines for the preparation of EIAs (UNDP Funded Contract) ▪ Assist MOE as an external technical consultant in the review of two Dam EIA Projects, namely Janneh and Musailaha. ▪ Intensive training course on reviewing EIAs specifically for the Oil and Gas sector (Ministerial staff from the Iraqi Ministry of Environment) ▪ External monitoring of the Irrigation Restoration and Development Project (IRDP), Afghanistan (On-going at SES, funded by the Ministry of Energy and Water through the World Bank): ▪ Participating as environmental expert in the implementation of SES responsibilities as external monitoring agency on implementation of environmental and social management plans across canal and dam sub-projects of the IRDP. Responsibilities include review of compliance with Environmental and Social Safeguard Framework, EMP and EIA report reviews and field monitoring of implementation of mitigation plans including land acquisition and resettlement action plans in the field. ▪ Environmental Assessment of cooling alternatives to be applied in the Kingdom of Saudi Arabia (2014, Prepared for SES, Funded by Booz): assisted in conducting an indicator-based environmental assessment for twelve different cooling technologies with the intent to identify the one which is most suitable to apply in the context of Saudi Arabia ▪ Environmental Impact Assessment (EIA) for the Sarafand Hospital, Eden Rock Resort, New Crusher for Cimenterie Nationale, Installation of an Autoclave Unit at Gemmayzeh Hospital, Pico-Hydro mechanism, Solid Waste Facility in Jezzine etc. in Lebanon

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	▪ Initial Environmental Examination (IEE) for the Anfeh Plastic Factory, Concrete Brick Facility, Adventure Park at Bentael Nature Reserve, New Garage at Cimenterie Nationale, Hraiche Gas Station, Tayyar Gas Station etc. in Lebanon. ▪ Environmental Impact Assessment (EIA) studies for Sugar Factory, Doha, Qatar; and New Fishing Port, Abu Dhabi, UAE. ▪ Environmental Audit study for Seven Fishing Port in Abu Dhabi, UAE. ▪ Initial Environmental Examination (IEE) for a Residential "Canadian Town" Development, Mount Lebanon, Lebanon. ▪ Consultant for major international, regional, and local firms on the following issues: ▪ Development of Feasibility Studies for PET and Tire Solid Waste Recycling facilities. ▪ Developed the first PV drip irrigation system using thermoelectric modules. ▪ Renewable Energy such as Biodiesel, Ethanol, Energy Farming, Renewable Energy (wind and solar) ▪ Carbon trading with the development of PINs and PDDs for CDM Projects in the Middle-East with EcoSecurities. ▪ Assist in Energy Audits and Carbon Foot Print Calculations. ▪ Develop Strategies for Sustainable Eco-Tourism for the Ministry of Displaced in Lebanon. ▪ Developed the first biodiesel company in the Middle-east using waste oil. ▪ Assist in developing a Bioenergy strategy proposal for Lebanon.

Date from –to	2000 to 2007
Location	Beirut, Lebanon
Company	Envirotech
Position	General Manager & Head of Planning Department
Description	In charge of the general management and planning of the Beirut office for a regional environmental, energy, and planning consultancy firm with offices in Lebanon, Syria, Egypt, and Kuwait. Responsible for the overall technical and operation of the company, including the development of technical and financial proposals in the field of environment, civil engineering, rural development and municipal management. Under my direct supervision, Envirotech successfully completed various projects funded or managed by international donors in the following fields:

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	Environmental and Social Assessment/Environmental Impact Assessment: ▪ EIA for 2000 Habitants Deep Shaft Wastewater Treatment Plant, Batroun-Lebanon ▪ 500 Ramliye Sewerage Wastewater Plant, Ramliye Lebanon ▪ EIS for Beirut WaterFront Development Project, Beirut, Lebanon ▪ Environmental Impact Assessment (EIA) for a Wastewater Treatment Plant for the Municipality of Qornayel in Mount-Lebanon Caza of Baabda. ▪ EIA for Barte Wastewater Project, Lebanon ▪ Initial Environmental Examination: Recycling of Building Waste for the Jean Abi Jaoude Enterprise at their existing works in Nahr El Mott, Lebanon ▪ EIA for Disposal of Clinical Wastes at Rayak Hospital, Bekaa Valley. ▪ EIA for the clinical waste management strategy for Beirut Hospitals, Lebanon ▪ EIS for a PET fiber recycling factory at Ryyak – Caza of Baalbeck, Lebanon ▪ EIA for a polyester fiber processing factory at Manara – Caza of West Bekaa, Lebanon ▪ EIA for the clinical waste management strategy for Zahle Hospitals, Lebanon ▪ EIA for a 1000 tons/dat Solid Waste Transfer Station, Teheran ▪ Treatment and Disposal of Clinical Wastes using Mobile Reprocessing Units, Beirut, Lebanon ▪ Initial Environmental Impact Assessment (IEIA) for a recreational Country Club at AnaterZbeide in Mount Lebanon – Caza of Baabda ▪ Assessment of a quarry site in Nabatieh, Lebanon for compliance with new quarries Decree ▪ EIA for a Lead Smelting Plant, Beirut Lebanon ▪ EIA for a 5,000,000 m^2 mountain resort at AinZhalta, Mount Lebanon – Caza of Chouf ▪ EIA for a beach village at Byblos – Caza of Jbeil, Lebanon ▪ EIA for the Landmark Project, Down Town Beirut, Lebanon ▪ EIA for an Oil and Gas Extraction Field, Syria ▪ IEE for Lead Extraction from used Batteries, Beirut Lebanon *Supervision Works:* ▪ Saida Wastewater Project: Supervision of construction of treatment works and outfalls, Lebanon

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	▪ Batroun wastewater project: Supervision of construction of treatment works, EU-SMAP 98 Project: Integrated Coastal Zone Management between Jbeil-Amsheet (Lebanon) and Latakia (Syria) *Carbon Fund/Waste to Energy:* ▪ Feasibility Study for Optimized Gas Extraction & Rehabilitation of BourjHammoud Dump Site, Lebanon ▪ Economic, Market and Institutional Analysis for the BourjHammoud Landfill Gas Optimization Project ▪ Preparation of a Carbon Reduction Analysis and a Project Idea Note (PIN) for the largest operational landfill in Kahrizak, Teheran. *Awareness:* ▪ Enhancing the environmental awareness unit located at the Lebanese Ministry of Environment. EC-life/UNDP. ▪ Public awareness activities in Conservation and Sustainable Use of Agro-Biodiversity in the Drylands, UNDP. *Eco-tourism:* ▪ El-Khiam Tourism Project, Ministry of Tourism, Lebanon ▪ Sustainable Tourism Development in Tannourine, Lebanon ▪ Eco-tourisn in Enfeh, Lebanon, EU-SMAP 98 Project: Integrated Coastal Zone Management between Jbeil-Amsheet (Lebanon) and Latakia (Syria) *Environmental, Health and Safety (EHS) Audits:* ▪ EHS Audit for Adams/Cadbury Factory, Zouk Michael, Lebanon ▪ Environmental Audit for a Secondary Lead Smelting Factory, Beirut Lebanon ▪ Preliminary Environmental Audit for a Sugar Beet Processing Factory, Bekkaa Lebanon ▪ Environmental Audit for a Battery Lead Smelting Factory, Tripoli, Lebanon ▪ Environmental Audit for a Biscuit Factory, Bekkaa, Lebanon *Trade and Environment:*

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	▪ Effects of Trade Liberalization on Agriculture with Special Focus on Products where Methyl Bromide is Used. ▪ Free - Trade and the Environment in Lebanon: Case Study on the Chemicals and Agro- Food Industries. *Other Environmental Projects:* ▪ Management Support Consultant, Investment Planning Program MSC-IPP Environment, MOE Lebanon ▪ Management Support Consultant, Investment Planning Program MSC-IPP Energy, Ministry of Energy and Water Lebanon ▪ Sectoral Plan (SP) for the Reduction of Pollution of the Mediterranean Sea from land based sources, Lebanon. Prepared for UNEP. ▪ Integrated Solid Waste Management Plan (ISWMP) for Tyre Caza, Lebanon ▪ Environmental NGOs Monitoring throughout Lebanon, Ministry of Environment ▪ Feasibility Study for the Relocation of all Lebanese Tanneries to a Dedicated Industrial City in Lebanon, MOE *Senior Advisor for the World Bank and the EU:* ▪ Acted as a Freelance Environmental Consultant for the World Bank in the preparation and review of an EIA for two 7000 tons/day mega-landfills in Kahrizak and Houshang-Abad Teheran. Review and Assess the EIA for a landfill site in Jebeil, Lebanon. ▪ Conducted training seminars for over 200 municipalities throughout Lebanon on various solid waste management issues funded by the EU.

Date from – to	1999 to 2000
Location	Lebanon
Company	Council for Development and Reconstruction (CDR)
Position	Resident Team Leader
Description	▪ Team Leader on the World Bank Solid Waste Environment Management Project (SWEMP). Managed a team of twelve engineers, environmental specialists, procurement specialists, and finance experts in monitoring and supervising the implementation of a $55 Million World Bank Loan on Integrated Solid Waste Management.

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	▪ Reviewed design and operational documents for sanitary landfills, preparation of tender documents for remediation of old dumps, reviewing cost recovery plans, and assisting the government in drafting new policies for solid waste management.

Date from – to	1997 to 1999
Location	Beirut, Lebanon
Company	Ministry of Environment
Position	World Bank Consultant
Description	▪ Set up and managed an environmental unit for planning and programming financed by the Mediterranean Environmental Technical Assistance Program (METAP) for the Lebanese Ministry of Environment. ▪ Supervised major environmental projects and planned their next phase of implementation. ▪ Formulated and prepared new environmental project proposals based on the World Bank's Environmental Strategy Framework. ▪ Conducted studies in industrial pollution control using decision support systems. ▪ Conducted training seminars in Environmental Management. Assisted the Ministry in developing a national environmental code and environmental impact assessment guidelines. ▪ Assisted the World Bank in reviewing technical tender documents for the design and construction of new sanitary landfills. Recommended alternative remediation plans for existing old dumps. ▪ Assisted the Ministry of Environment in developing environmental awareness campaigns and in the assessment of future landfill sites in old quarries. Developed a national training program for Solid Waste Management for local municipalities. ▪ Advised the Minister of Environment on solid waste management issues.

Date from – to	Summers of 1996 and 2001
Location	Beirut
Company	Lebanese American University at Byblos, and Balamand University
Position	Part-time Assistant Professor
Description	▪ Taught Courses in Construction Management that included Scheduling using Bar Charts, CPMS, and PERT methods, Cost Control, Planning and Organization, Preparation of Construction and Bidding Packages, Construction Safety, and Value Engineering.

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Date from – to	1995 to 1996
Location	Beirut, Lebanon
Company	ISSA Consulting
Position	Environmental Engineering Consultant
Description	*Developed the following environmental and civil engineering proposals and research projects:* ▪ Design, construction, and remediation of sanitary landfills in Lebanon (submitted to CDR and Ministry of Environment); ▪ Environmental Issues in Lebanon: Design, construction, remediation & rehabilitation of municipal & hazardous landfills, disposition and recycling of waste oil; and supervision, monitoring & procurement of incinerators (submitted to CDR, and Ministry of Environment); ▪ Creation of a water system industry in Lebanon (submitted to Investment Development Agency of Lebanon- IDAL); ▪ Alleviation of Traffic in Lebanon: Quick, simple, and inexpensive solutions to alleviate traffic along the Lebanese coastal highways and in the cities (submitted to IDAL and CDR); ▪ Waste Management in Lebanon – Critical review of proposed solutions: Incineration & Landfilling. A study and cost analysis to solve the waste management problem in Lebanon for the next 30 years (submitted to CDR, and Ministry of Environment); ▪ Strategic vision for making the business of water a source of prosperity in Lebanon: Presented paper at the Third International Conference on Computer Methods and Water Resources and also published in The Al-Nahar and Eco-News newspapers (submitted to CDR, IDAL, and Ministry of Hydraulic Resources); ▪ Co Treatment: An alternative solution for cost effective waste management in Lebanon (BOOT proposal, submitted to CDR, IDAL, Ministry of Environment, and the European Community); ▪ Policy Research Study and Analysis on the Environment in Lebanon: Study sponsored by the Lebanese Center for Policy Studies (LCPS) in association with NOVIB; and ▪ Proposal to Develop an Economical, Effective, and Sustainable Recycling Program in Lebanon (submitted to LCPS and Mouawad Foundation).

Date from – to	1991 to 1999
Location	Walnut Creek, California, USA

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Company	GeoSyntec Consultant,
Position	Senior Staff Engineer
Description	*Project Management Work:* ▪ Hillsborough Coastal Landfill (San Diego County, California). Oversaw and coordinated project staff from three different companies participating in the final closure design analysis and report preparation. ▪ Vasco Road Sanitary Landfill (Alameda County, California): Managed the preparation of a bid package for construction of a new disposal unit. *Field Work:* ▪ Keller Canyon Landfill (Contra Costa County, California): Worked on all phases of landfill grading including mass grading and liner placement. Analyzed field and laboratory tests to evaluate performance of soil structures as well as approved keyways for toe berm construction. Performed field observations to ensure project adherence to specifications. Acted as liaison officer between local officials and other design/construction team members. Supervised Quality Assurance and Quality Control technicians and monitored their reports. Recommended test programs to field engineers. Oversaw the installation of over 3,000,000 ft2 of geomembrane materials, including installation of low-permeability clay components, bentonite mat materials, geotextile cushion, filter materials, and appurtenant structures. Field duties also included field nuclear density and sand cone testing, daily equipment calibration, and visual monitoring of operations. ▪ Vasco Sanitary Landfill (Alameda County, California): Performed quarterly water sampling, conducted continuous geotechnical core logging and monitored geophysical logging and packer tests on ground-water monitoring wells. *Laboratory Work:* ▪ Keller Canyon Landfill (Contra Costa County, California): Procured of laboratory testing equipment for the setup and operation of a permanent on-site laboratory testing facility. Trained technicians in performing various ASTM testing methods such as compaction curves, Atterberg limits, sieve analyses, Wash 200's, moisture determination, shelby tube sampling, and double ring infiltrometer data logging.

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	Design Work: ▪ Guayanaho Landfill (Puerto Rico): Performed stability analysis on the lining system, including the stability analysis of the geosynthetic with and without the protective cover. ▪ Vasco Road Sanitary Landfill (Alameda County, California): Designed the leachate collection system and the underdrain system. Performed structural strength and stability analyses of leachate collection pipes. Developed an excavation and grading plan for an expansion area, including the drafting of construction specifications and a construction quality assurance plan. Reviewed static and dynamic slope stability analysis on a visual berm/embankment. ▪ Hillsborough Sanitary Landfill (San Diego County, California): Designed the gas collection and monitoring systems. Performed waste settlement analysis and slope stability analysis on the cover system. ▪ High Acres Landfill Expansion (Pennsylvania): Reviewed the design of the water surface management system. Designed swales, permanent ditches, culverts, and sedimentation basins. Calculated runoffs using SCS TR55 methods and the Engineering Field Manual for Conservation Practices. ▪ ACME Sanitary Landfill (Contra Costa County, California): Performed a detailed cover performance analysis on different closure cover systems to evaluate infiltration rates, leachate cost treatment, and cover construction costs while meeting State and Federal (Subtitle D) prescriptive final cover standards. The analysis involved using the HELP model and Giroud et al.'s method for estimating leakage rates. *Innovative Work:* ▪ Developed performance standards and design charts for daily, intermediate and final cover systems for the California Integrated Waste Management Board. ▪ Developed a leachate/coarse tailing compatibility testing program for the Eagle Mountain Landfill in California. ▪ Consulted in the remediation of one highly stressed leachate collection pipe for the Azusa Landfill in California.

Date from – to	1984 to1990
Location	USA
Company	UCLA - Civil Engineering Department

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Position	Research and Teaching Assistant
Description	▪ Developed and maintained a computer-controlled high-pressure triaxial testing facility with automated data acquisition and processing. ▪ Instructed students in the use of various geotechnical testing apparatus (DS, CU, CD, Sieve, moisture density, and Atterberg limits). ▪ Prepared laboratory manuals for experimental work. ▪ Instructed various civil engineering courses including soil mechanics, solid mechanics, steel design and concrete design. ▪ Developed computer codes for utilization in engineering analysis.

Countries of work experience:

Country	Date from - Date to
Lebanon	1995-Present
Syria	2000-2006
Saudi Arabia	2007-Present

Key qualifications:

Experience encompasses: environmental studies, project design and development, technical implementation and contract management of solid waste, wastewater, environmental, geotechnical, civil, and allied engineering projects in the US, Middle-East, and other countries. Expertise includes the following:

Institutional Development	▪ Formulated new solid waste management policies for the Lebanese Ministry of Environment and the Ministry of Municipal & Rural Affairs. ▪ Co-authored a policy paper on the environment published for the Lebanese Center for Policy Studies. ▪ Assisted the Lebanese Ministry of Environment and the World Bank in Developing and reviewing the Environmental Framework Law (Code de l'Environnement).
Project and Contract Management	▪ Formulated environmental and development plans for industries and municipalities. ▪ Prepared project proposals for the private sector and non-governmental organizations (NGO). ▪ Project Design and Development. ▪ Preparation of Contracts and Tender Documents. ▪ Preparation of TORs and Supervision of Contracted Consultants.

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Language Skills: (1-excellent, 5-basic)

Language	Reading	Speaking	Writing
English	1	1	1
French	1	1	1
Arabic	1	1	1

Expert's contact information:

E-mail: nchamieh@ses-lb.com,Phone: 00961-3-832281

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Dr. Layale Abi Esber

Position Title and No.	Senior Environmental Expert
Name of Expert:	Layale Abi-Esber
Date of Birth:	22nd of September 1980
Country of Citizenship/Residence	Lebanese

Education:

Institution	American University of Beirut, Lebanon
Date (year) to (year)	2009 to 2014
Institution	University of Southampton, United Kingdom
Date (year) to (year)	2007 to 2009
Degree or Diploma	**PhD in Environmental and Water Resources Engineering**
Institution	American University of Beirut, Lebanon
Date (year) to (year)	2002 to 2005
Degree or Diploma	MS Environmental Technology
Institution	Lebanese University, Lebanon
Date (year) to (year)	2002
Degree or Diploma	BS in Electronics

Employment record:

Date from – to	February 2014 – Present
Location	Beirut, Lebanon
Company	Sustainable Environmental Solutions - SES
Position	Senior Environmental Consultant
Description	*Water and Wastewater management* ▪ Conceptual design of a wastewater treatment system for Lebanon Fruit Juice Company (Bonjus, Taanayel Les Fermes) in Fanar, Mount Lebanon (On-going at SES, funded by Lebanon Fruit Juice Company) Contributed to the preparation of a conceptual design for the wastewater generated by a large scale dairy product industry producing, labneh, laban, cheese, ice cream and various types of desserts. The industry used CIP for cleaning of production lines. The proposed technology is cored around buffering followed by a chemically assisted aeration process. Developing at present a

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	corresponding offer to be submitted to the client in the form of a turnkey project including detailed design, execution and commissioning. ▪ Turn-key project of wastewater treatment for Pastel Paints, Mazraat Yachouh (On-going at SES, funded by Pastel Paintsl) Contributing to the design and installation of a wastewater treatment system for the process wastewater stream from a solvent and water based paint production facility. The process is based on chemical treatment. ▪ Turn-key project of wastewater treatment for the Arcenciel infectious healthcare waste treatment centers at Jisr El Wati and Zahleh (On-going at SES, funded by Arcenciel) Contributing to the design and installation of a wastewater treatment system for the mixed wastewater stream (sewage, cleaning and process wastewater) generated at an infectious healthcare waste treatment center. The system includes a homogenization tank followed by a sequencing batch reactor. Commissioning and regular maintenance will be part of the work including the implementation of an environmental management plan for the facility. ▪ Detailed design of a wastewater treatment system for the Medecins Sans Frontieres proposed Hospital in Bekaa region (On-going at SES, funded by Medecins Sans Frontieres) Contributed to the preparation of two conceptual designs for the treatment of wastewater from a hospital in Bekaa using 1- a hybrid fixed and mobile media bed system and 2- sequencing batch reactors. The activity included the assessment of environmental management requirements and the inclusion of related measures in the operation and maintenance schedule. One of the systems was selected for detailed design. ▪ Conceptual design of a wastewater treatment system for a milk house (milk collection facility) in Jdita, Bekaa (On-going at SES, funded by Bonjus) Contributed to the preparation of a conceptual design for the wastewater generated at a milk house using CIP. The system is based on the sequencing batch reactor technology. ▪ External monitoring of the Irrigation Restoration and Development Project (IRDP), Afghanistan (On-going at SES, funded by the Ministry of Energy and Water through the World Bank) Participating as environmental expert in the implementation of SES responsibilities as external monitoring agency on implementation of environmental and social management plans across canal and dam sub-projects of the IRDP. Responsibilities include review of compliance with Environmental and Social Safeguard Framework, EMP and EIA report reviews and field monitoring of implementation

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	of mitigation plans including land acquisition and resettlement action plans in the field *Environmental Impact Assessment* ▪ Environmental Impact Assessment for the Lebanon Wind Power Project (On-going, prepared for SES, funded by Lebanon Wind Power) Developing an ESIA study for the proposed 60 MW Lebanon Wind Power Project in Akkar, North Lebanon. The project includes the installation of 23 tubine on a mountain ridge in Akkar along with associated road widening and power transmission requirements. The ESIA will be developed based on national guidelines and on World Bank IFC, EBRD and UNDP/CEDRO guidelines. ▪ Environmental Impact Assessment for solid waste management facility in Binnaye, Aley (On-going, prepared for SES, funded by TETCO) Developing an EIA study for the construction and operation of a new solid waste management facility in Binnaye, Aley. The facility can treat up to 50 tons/day of domestic solid waste and will serve the municipalities that are member of the Union of Municipalities of Ghareb Aala and Shahar. The process inside the facility is based on sorting followed by additive assisted aerobic digestion to produce liquid and solid fertilizers and RDF as by-products. ▪ Environmental Impact Assessment for solid waste management facility in Kfardebian, Mount Lebanon (On-going, prepared for SES, funded by Bureau d'Etudes Alain Joseph et Associes) Developing an EIA study for the construction and operation of a new solid waste management facility in Kfardebian, Mount Lebanon. The facility can treat up to 200 tons/day of domestic solid waste and will serve several municipalities of the Metn and Keserwan Cazas. The process inside the facility is based on manual and mechanical sorting followed by additive assisted and mechanical aerobic digestion using latest advanced technologies. The project also includes a space for hydroponic agriculture, an eco-friendly restaurant and a yard for cultural events which will host concerts and farmers' markets. ▪ Environmental Impact Assessment for the proposed Jounieh Touristic Cruise Port (On-going, prepared for SES, funded by the Ministry of Public Works and Transport) Implementing in partnership with Seatec an EIA study for the touristic port of Jounieh. The project is divided into two parts: the cruise port (where up to 5000 passenger cruise ships will berth) and the marina (where up to 400 smaller boats and yachts will berth), in addition to 4 parking lots, the harbor Master and the terminal building. A 2.2m breakwater with an elevation of 9.5m above the Mean Sea Level (MSL) is proposed to protect the cruise port and the

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	marina against waves and to ensure a safe anchorage and mooring operation. Also, each of the cruise port and the marina has an entrance channel, berthing basin, turning basin and wharves. In addition, the marina has jetties and rectangular wet docks. ▪ Environmental Impact Assessment for the proposed asphalt and ready mix concrete plant for Geitani Ekhwan, Mejdlaya, Zgharta (On-going, prepared for SES, funded by Geitani Ekhwan) Developing an EIA study for a proposed asphalt and ready mixed concrete production facility with respective capacities of 140 tons/hour and 2 m3/hour, including the design of the most appropriate air pollution control system. ▪ Environmental Impact Assessment for the Upgrading and Operation of the Infectious Healthcare Waste Treatment Center Zgharta-Lebanon (On-going, prepared for SES, funded by Arcenciel) Developed an amended EIA study for the above project including the development of an environmental mitigation plan consistent with the 2015 guidelines of the ministry of environment regarding EIA reports (Decision 261/1 of 2015) ▪ Environmental Impact Assessment for the addition of a new kiln and associated facilities and the expansion of the power generation scheme at Cimenterie Nationale, Chekka, North Lebanon (2016, prepared for SES, funded by Cimenterie Nationale) Cimenterie Nationale intends to increase its production capacity to improve the availability of cement and clinker products in Lebanon and to enhance their export capacity. Following the scoping phase, an EIA report was developed including the analysis of the impact on health and safety, air, noise, traffic, water quality, solid waste management and socio economics; the identification and analysis of alternatives as well as the development of a mitigation, monitoring and institutional strengthening plan. The analysis of the impact on air quality includes an air dispersion modeling component. ▪ Environmental Impact Assessment for the relocation of eight tanneries in Saida (On-going, prepared for SES, funded by Municipality of Saida and UNDP) Participating as team leader to an EIA study for the relocation of the tanneries within locations of Saida. The municipality intends to relocate eight tanneries located at the southern coast of Saida. The scope of work includes four levels: field investigation, collection of wastewater samples from the existing facilities and its assessment, investigation of different cleaner production systems, preliminary design of wastewater and solid waste treatment facilities and preparation of the EIA report. The report will include the collection of legal documents, description of project, analysis of the impact on health and safety, air, noise, traffic, water quality, solid waste

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	management and socio economic, identification and analysis of the alternatives as well as development of the mitigation, monitoring and management plan. The project will also include a public consultation phase. ▪ Environmental Impact Assessment for M1's Saadiyat Residential project in Dahr El Moghara, Saadiyat (2015, prepared for SES, funded by M1 Real Estate) Participating as a team member in the preparation of an EIA study for the Saadiyat Residential project in Dahr El Moghara. The project involves the development of an area of 284,000 m2 for residential and commercial purposes and will comprise villas, low rise apartments and hybrid neighborhoods. The report will include the collection of legal documents, description of project, analysis of the impact on health and safety, air, noise, traffic, water quality, solid waste management and socio economic, identification and analysis of the alternatives as well as development of the mitigation, monitoring and management plan. The project will also include a public consultation phase. ▪ Environmental Impact Assessment for construction of Zakroun project in Koura (2015, prepared for SES, funded by Nour Fonciere) Participating as a team member in the preparation of an EIA study for the Zakroun residential project in Koura. The project involves the development of an area of 800,000 m2 for residential purposes. The report will include the collection of legal documents, description of project, analysis of the impact on health and safety, air, noise, traffic, water quality, solid waste management and socio economic, identification and analysis of the alternatives as well as development of the mitigation, monitoring and management plan. The project will also include a public consultation phase. ▪ Environmental Impact Assessment for the Sarafand Public Hospital (2014, Prepared for SES, funded by CDR): assisted in the preparation of the response to the reviews and comments of the Ministry of Environment) *HSE Auditing* ▪ Environmental Audit of Rotoflexopress Company for the production and printing of different types of packages, labels and bags, Choueir – Mount Lebanon (2017, prepared for SES, funded by Rotoflexopress) Implemented an HSE audit at Rotoflexopress consistent with the 2016 guidelines of the Ministry of Environment regarding environmental audit reports (Decision 189/1 of 2016). The facility produces a range of industrial packages and shopping bags made from polyethylene (PE), PET (polyethylene terephthalate or polyester), PVC (polyvinyl chloride), PP and OPP (polypropylene and

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	oriented polypropylene), PA (polyamide or nylon) in addition to aluminum and are often multi-layered specifically when intended for the food industry. ▪ Environmental audit of Lebanon Fruit and Juice Company (Bonjus, Taanayel Dairy Farms, and F&B), Fanar (2017, prepared for SES, funded by Lebanon Fruit and Juice Company) Implementing an environmental audit at the facility with the purpose of ensuring regulatory compliance and issuance of environmental certificate consistent with the 2016 guidelines of the Ministry of Environment regarding environmental audit reports (Decision 189/1 of 2016). The facility includes the production of dairy products and ice cream in addition to power generation. The audit will include the design of a wastewater treatment plant for the treatment of facility's process wastewater ▪ Environmental audit of Arcenciel Centers for the treatment of infectious healthcare wastes (2016, prepared for SES, funded by Arcenciel) Implemented environmental audits at Saida, Jisr El Wati, and Zahleh infectious healthcare waste treatment centers run by Arcenciel. The facilities use hydroclaves (H100) and an autoclave (ECODAS T1000). The projects included meetings and discussions with relevant employees, facility inspection, photographic documentation, noise, and wastewater sampling, testing of emissions from generator and boiler stacks. The project also included the development of an EMP and a timeframe for its implementation consistent with the 2016 guidelines of the Ministry of Environment regarding environmental audit reports (Decision 189/1 of 2016) ▪ Environmental Audit at a facility for the fabrication of frozen potatoes, Ansariyeh, South Lebanon (2016, prepared for SES, funded by Tayyebat) Conducted an HSE audit at the industry including meetings and discussions with relevant employees, facility inspection, photographic documentation, noise and wastewater (domestic and process) sampling, testing of emissions from generator and boiler stacks; the project will be concluded by the development of an EMP and a timeframe for its implementation. ▪ Environmental audit of a steel product manufacturing facility (2015, funded by Spec) The factory produces generator silencers, electrical control panels, prefabricated houses, etc. and is located in Chabrakyet Tabet, Bekaa; conducted an HSE audit at the industry including meetings and discussions with relevant employees, facility inspection, photographic documentation, air, noise, water (domestic and drinking) and wastewater sampling, testing of emissions from

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	generator stacks. The project also included the development of an EMP and a timeframe for its implementation. ▪ Environmental Audit of a steel profile and pipe manufacturing industry (2015, prepared for SES, funded by Profile Tic) Participating in the implementation of an environmental, health and safety audit at the factory including the inspection of all plant sections and associated activities, monitoring of air and wastewater discharges and noise levels and the preparation of an environmental audit report in line with national guidelines including an action plan for the improvement of regulatory compliance at the plant. ▪ Environmental Audit for a steel product manufacturing industry (2014, under preparation for SES, funded by Dalal Steel Industries): the factory produces hangars, cranes, prefabricated houses, and other metallic products and is located in Taanayel, Bekaa; conducted an HSE audit at the industry including meetings and discussions with relevant employees, facility inspection, photographic documentation, air, noise, water (domestic and drinking) and wastewater sampling, testing of emissions from generator stacks ▪ Environmental Audit for a cosmetics manufacturing facility (2014, prepared for SES, funded by ARD Cosmetics): the factory produces creams and lotions and is located in Tripoli, North Lebanon; reviewed the audit report prior to submission to the Ministry of Environment ▪ Environmental Audit for an adhesive and grout production facility (2014, prepared for SES, funded by Unisupply): the factory produces adhesives and grouts through mixing of a range of raw materials and is located in Bauchrieh, Mount Lebanon; conducted an HSE audit at the industry including meetings and discussions with relevant employees, facility inspection and photographic documentation, and preparation and submission to the Ministry of Environment of a final audit report ▪ Environmental Audit for a concrete brick facility in Mdoukha (2014, Prepared for SES, funded by Mr. Khodor Mohammad): the factory produces concrete bricks, and creep stone and interlock bricks and is located in Mdoukha, Bekaa; reviewed the audit report prior to submission to the Ministry of Environment ▪ Environmental Audit for a concrete brick facility in Racha (2014, Prepared for SES, funded by RFJ): assisted in the implementation of an audit at a concrete brick facility in Racha, North Lebanon; conducted an HSE audit at the industry including meetings and discussions with relevant employees, facility inspection and photographic documentation, and preparation and submission to the Ministry of Environment of a final audit report

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	▪ Environmental Audit for a butane gas storage facility in Bint Jbeil Lebanon (2014, Prepared for SES, funded by Noor Station): reviewed the audit report prior to submission to the Ministry of Environment *Initial Environmental Examination and other studies* ▪ Initial Environmental Examination for the construction and operation of the Dusk Lodge Hotel and Chalets Project in Ehden, Zgharta (Ongoing at SES, funded by Halim Frangie): prepared the IEE study. ▪ Initial Environmental Examination for the construction and operation of the eco-villages touristic development at Kawkaba, Bekaa (2014, Prepared for SES, funded by Caritas): reviewed the IEE report prior to submission to the Ministry of Environment ▪ Initial Environmental Examination for an ice cream production company at Zahleh Lebanon (2014, Prepared for SES, funded by Sea Sweet): reviewed the IEE report prior to submission to the Ministry of Environment ▪ Pilot procedure for co-firing with refuse derived fuel at a cement production company (2014, Prepared for SES, funded by Cimenterie Nationale): assisted in the preparation of a proposal for undertaking quality assurance / quality control procedures to ascertain the suitability of RDF production and use at CN all while managing potential risks on the environment and on the industrial process ▪ Environmental Assessment of cooling alternatives to be applied in the Kingdom of Saudi Arabia (2014, Prepared for SES, Funded by Booz): assisted in conducting an indicator-based environmental assessment for twelve different cooling technologies with the intent to identify the one which is most suitable to apply in the context of Saudi Arabia

Date from – to	September 2014 – Present
Location	Zouk Mosbeh
Company	Notre Dame University (NDU)
Position	Part time faculty member

Description	▪ Teaching of major classes in the environmental sciences program at the Faculty of Natural and Applied Sciences
	  ▪ ENS450: Environmental Impact Assessment
	  ▪ ENS 430: Solid Waste Management
	  ▪ GEO 311: Applied Hydrogeology

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Date from – to	2004-2014
Location	Beirut, Lebanon
Company	Miscellaneous
Position	Free-lance Environmental Consultant
Description	*HSE Auditing including experience in Jordan* ▪ Amman Development Corridor Project. (2006 to 2012; Project funded by the World Bank). ADCP is a construction project composed of a new 40 km road in Amman, Jordan. Participated in (1) the implementation of an ambient air quality monitoring survey on a quarterly basis for the duration of the project including pre-construction, construction and operation phases; (2) the implementation of Environmental and Health and Safety audits at the facilities operated by the project's contractors including workers' camps, crusher sites, asphalt plants, aggregate mixing plants and well sites; proposed recommendations intended to improve the HSE system at contractors' facilities. ▪ Environmental Audit of a Sugar Beet Factory (2005; Prepared for Envirotech Ltd, Funded by Sugar Beet Processing Company S.A.L.). Implemented with two other people an environmental audit of a Sugar Beet factory located in the industrial area of Majdel Anjar in the Caza of Zahle, Lebanon, pursuant to a request from the Ministry of Environment in January 2005. Following two comprehensive site inspections coupled to photographic documentation and interviews with workers, an audit report was prepared including an HSE management plan. ▪ Environmental Audit of a Secondary Lead Smelting Factory. (2004, Prepared for Envirotech Ltd, Funded by Hagopian Trading Company Ltd SARL). Implemented with two other people an environmental audit of a secondary lead smelting factory located in Dora industrial complex, Lebanon, pursuant to a request from the Ministry of Environment in June 2004. Following several site inspections coupled to stack emission measurements, photographic documentation and interviews with workers, an audit report was prepared including an HSE management plan. *Environmental Impact Assessment* ▪ Initial Environmental Examination for a Steel Product Manufacturing industry, Taanayel, Bekaa (2014, Prepared for SES, funded by Dalal Steel Industries): prepared the IEE study which involved baseline characterization, environmental and socio-economic impacts identification, as well as the elaboration of a HSE Management Plan

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Date from – to	2004-2014
Location	Beirut, Lebanon
Company	Miscellaneous
Position	Free-lance Environmental Consultant
	with particular emphasis on air and solid waste generation and management ▪ Initial Environmental Examination for an injection molding facility, Saida, Southern Lebanon (2013, Prepared for SES): prepared the IEE study which involved baseline characterization, environmental and socio-economic impacts identification, as well as the elaboration of a HSE Management Plan with particular emphasis on energy and water consumption and air and solid waste generation and management ▪ Initial Environmental Examination for an injection molding facility, Anfeh, Northern Lebanon (2013; Prepared for SES, funded by MegaPlast): prepared the IEE study which involved baseline characterization, environmental and socio-economic impacts identification, as well as the elaboration of a HSE Management Plan with particular emphasis on energy and water consumption and air and solid waste generation and management ▪ Strengthening Environmental Capacity in Iraq (2011; Funded by the World Bank, delivered to staff from Iraq's Ministry of Environment). Participated in the preparation and delivery of a training workshop regarding environmental impact assessment and environmental audits to senior staff from Iraq's Ministry of Environment. The training was conducted in Beirut, Lebanon, in October 2011. ▪ Social and Environmental Assessment for a polyethylene terephthalate (PET) preform production factory, Baghdad, Iraq. (2010; Submitted to the World Bank, prepared for Sebeel Al Safa Company for Petrochemical Industries and General Trading and Water Filling). Conducted a social and environmental assessment study for a PET preform production factory under establishment at the Jurf Al-Naddaf area South East of Baghdad following the MIGA's performance standards on social and environmental sustainability. The project consists of the installation of two injection molding machines, one thermoforming machine and other auxiliary equipment for the production of 78,000 PET bottle preforms per hour, and 6,000 PET glasses per hour filled with drinking water. Investigated baseline environmental and social conditions; assessed potential environmental and socio-economic impacts; compared potential process and site location alternatives; and proposed an HSE management plan for the factory. ▪ Environmental and Social Management Framework for Rural Energy and Electricity Distribution in Liberia. (2010; Submitted to the World

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Date from – to	2004-2014
Location	Beirut, Lebanon
Company	Miscellaneous
Position	Free-lance Environmental Consultant
	Bank, prepared for Earthtime Inc, Monrovia, Liberia). Participated in the preparation of environmental and social safeguards documentation capable to satisfactorily address in accordance with World Bank Safeguard Policies and Environmental, Health and Safety EHS Guidelines the potential environmental and social issues that may arise in the context of two proposed World Bank operations in the area of rural energy and electricity distribution. The two activities are (i) Catalyzing new and Renewable Energy in Rural Liberia; and (ii) the Monrovia Power Project. ▪ Al Furat Petroleum Company, EIA for the Tanak Field Area. (2004; Prepared for Envirotech Ltd, Funded by Al Furat Petroleum Company). Participated with two other people in the preparation of an EIA study for four oil fields (Tanak, Jido, Ishara and Maleh). Each field included 4 processing facilities, export and import pipeline network, 115 oil wells, oil pits and road networks. In addition, the Maleh Field included a Natural Occurring Radioactive Material (NORM) landfill while the Tanak Field had additional facilities including dumpsites, NORM yard, NORM decontamination Facility, base camps and offices. One of the fields was located near an agricultural and residential area. The EIA was developed following Shell's environmental policy and guidelines of environmental assessment and included a description of the study area and existing operations, an assessment of the environmental, social and economic impacts, and an HSE management and monitoring plan. *Others* ▪ Sustainability of operation and maintenance of the Tyre compost and recycling plant. (2005; Project funded by Envirotech Ltd). Developed with two other people a study intended to provide a marketing strategy for the recoverable materials to prevent their accumulation and dumping in Tyre landfill within the framework of the OMSAR Municipalities funding project for solid waste management. It describes the existing situation for compost and recyclables use in the region, examines potential markets for these materials, elucidates the requirements of the market in terms of quantity and quality, and estimates the potential revenues from the selling of all recoverable materials.

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Date from – to	2004-2014
Location	Beirut, Lebanon
Company	Miscellaneous
Position	Free-lance Environmental Consultant
	▪ Development of a National Biosafety Framework for Lebanon, funded by UNEP-GEF. (2005; Project funded by UNEP-GEF). Contributed to the drafting of a National Biosafety Framework for Lebanon under the UNEP-GEF funded project for assisting developing countries legally bound by the provisions of the Cartagena Protocol on Biosafety in drafting their frameworks. Participated to two workshops (Movenpick Hotel, December 17, 2005; Chamber of Agriculture, Industry and Commerce, April 1, 2005) aiming at information exchange and public participation in decision making processes.

Date from – to	2009-2014
Location	Beirut, Lebanon
Company	American University of Beirut
Position	PhD Researcher
Description	▪ Research ▪ Paper reviews ▪ Proposal writing

Date from – to	2007-2009
Location	Southampton, United Kingdom
Company	University of Southampton
Position	PhD Researcher
Description	▪ Research ▪ Paper reviews ▪ Proposal writing

Date from – to	2005-2007
Location	Beirut, Lebanon
Company	American University of Beirut
Position	Research Associate
Description	*Wastewater management* ▪ Effluent dispersion modeling for the proposed Jbeil and Batroun wastewater outfalls. (2006; Project funded by the Council of

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	Development and Reconstruction, Lebanon) Was involved in the assessment of the performance of two sea outfalls for the discharge of treated effluent from the proposed Jbeil and Batroun secondary wastewater treatment plants, including (1) definition of prevalent conditions in terms of effluent characteristics, hydrodynamic regimes in the study area, as well as seawater and sediment quality, (2) simulation of the dispersion profiles encountered for different outfall layouts including the proposed schemes, (3) determination of optimal outfall structure capable of achieving environmental and health standards. ▪ Zahleh leachate treatment plant, Lebanon. (2006; Project funded by USAID). Participated in the development of capacity building material for an awareness raising campaign on solid waste and leachate treatment opportunities for the Municipality of Zahleh, Lebanon. ▪ Bebnine project, Akkar, Lebanon. (2006; Project funded by IDRC). Participated in the development of a GIS database for Bebnine Village for water quality management for a better understanding of health implications. *Others* ▪ National Post-harvest Training Project, Expanding Economic Opportunities under Clustering for Economic Development and Revitalization of Industry Sectors: Post-harvest management, CEDARSplus Program. (2006-2007; Project funded by USAID through CHF International). Participated as research associate in the implementation of project activities including (1) the assessment of postharvest treatment baseline situation in the Lebanon, (2) the attendance of a training workshop on postharvest treatment procedures in Davis, California, United States (3) the attendance of a postharvest technology short course at UC Davis, California, United States, and (4) the implementation of a training on postharvest technology in the Chambers of Commerce, Industry, Agriculture and Trade of Lebanon. ▪ Environmental assessment for Raouche Rotana Suites Project, Beirut, Lebanon. (2006; Project funded by Société Generale Immobilière S.A.L.) The study involved baseline characterization, environmental and socio-economic impacts identification, as well as the elaboration of an Environmental Management Plan with particular emphasis on traffic, energy, water consumption and waste management.

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Date from – to	2003-2005
Location	Beirut, Lebanon
Company	American University of Beirut
Position	Research Assistant
Description	*Wastewater and water management including auditing of wastewater treatment facilities* ▪ MEDAWARE Project. Development of Tools and Guidelines for the Promotion of the Sustainable Urban Wastewater Treatment and Reuse in the Agricultural Production in the Mediterranean Countries. (2004-2005; Project funded by MEDAWATER, EU). Was involved in: (1) assessment of existing situation in Lebanon related to urban wastewater treatment and disposal practices (discharge, reuse), (2) examination of worldwide success stories in wastewater treatment and reuse particularly in the agricultural production (3) preparation of a training workshop (AUB, June 21 & 22, 2005) for exchange of information and promotion of appropriate systems among actors involved in the field. ▪ Uncertainty analysis applied to the evaluation of different wastewater treatment systems used in animal waste management strategies. (2004; Project funded by AUB). Was trained on the use of a prototype software designed to help compare various animal waste treatment systems on a site-specific basis. Conducted an extensive literature review for the study of the uncertainty of the values given to the model input parameters. ▪ Environmental Impact Assessment for the Khardale Dam and Reservoir Project (Proposed on the Litani River). (2004; Project funded by AUB) The project included the preparation of an EIA for the proposed Khardale Dam and Reservoir Project. ▪ Water and wastewater management plan for the Litani River Basin and the Karaoun Lake. (2004; Project funded by AUB) The project involved: (1) river water sampling at the hot spots of the basin (where there is a potential contamination from industrial and domestic wastewater) (2) identification of sources of pollution of Litani River and Karaoun Lake waters (3) proposition of a management plan that mitigates water pollution, restores the polluted Lake, and optimizes water usage in the basin.

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Membership in Professional Associations

- Member of the Transportation Research Board Committee on Environmental Analysis in Transportation (ADC10).
- Reviewer for the Transportation Research Board and the Journal of the Air and Waste Management Association.

Publications

- Abi-Esber, L. El-Fadel, M. et al. Modeling of processes governing PM2.5 exposure inside a commuting car. Transportation Research Part D (in preparation), 2017.
- Alameddine, I., Abi-Esber, L., Bou Zeid, E., Hatzopoulo, M., El-Fadel, M. Operational and environmental determinants of in-vehicle CO and PM2.5 exposure. Science of the Total Environment, 551-552, pp. 42-50, 2016.
- Abi-Esber, L., and El-Fadel, M. Indoor to outdoor air quality associations with self-pollution implications inside passenger car cabins. Atmospheric Environment 81, pp. 450-463, 2013.
- El-Fadel M., Abi-Esber, L., Salhab, S. Emission assessment at the Burj Hammoud inactive municipal landfill: Viability of landfill gas recovery under the clean development mechanism. Waste Management32 (11), pp. 2106-2114, 2012.
- Abi-Esber, L., and El-Fadel, M. Economic viability of LFG recovery under the CDM mechanism. WIT Transactions on Ecology and the Environment 163, pp. 83-92, 2012.
- El-Fadel M., Abi-Esber, L. Simulating industrial emissions using atmospheric dispersion modeling system: Model performance and source emission factors. Journal of the Air and Waste Management Association 62 (3), pp. 336-349, 2012.
- El-Fadel, M., Abi-Esber, L., Salem, N. Chemical oxygen demand fractionation and kinetic parameters for sequencing batch reactors treating paper mill wastewater. Environmental Engineering Science 29 (3), pp. 161-173, 2012.
- Abi-Esber, L., El-Fadel, M. Determinants of in-vehicle exposure to traffic-induced emissions.Transportation Research Record2270, pp. 152-161, 2012.
- El-Fadel M. and Abi-Esber L. In-vehicle exposure to carbon monoxide emissions from vehicular exhaust: A critical review, Critical Reviews in Environmental Science and Technology 39 (8), pp, 585-621, 2009.
- El-Fadel M., Abi-Esber L., Ayash T. Air pollution in highly industrialized areas: Regulatory compliance under uncertainty. Atmospheric Environment, 43 (32), pp. 5015-5026, 2009.
- Abi-Esber L. and El-Fadel M. In-vehicle CO ingression: Validation through field measurements and mass balance simulations, Science of the Total Environment 394(1), pp. 75-89, 2008.

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- Abi-Esber L., El-Fadel M., Nuwayhid I., and Saliba N. The effect of different ventilation modes on in-vehicle carbon monoxide exposure. Atmospheric Environment, 41(17): 3644-3657, 2007.
- Abi-Esber L., El-Fadel M., and Shehadeh A. Comparative assessment of grab and continuous sampling for in-vehicle monitoring of carbon monoxide, Atmospheric Environment, 41(28): 6087-6094, 2007.
- Abi-Esber L., and El-Fadel M. Carboxyhaemoglobin levels of in-vehicle occupants commuting in an urban commercial/residential area. Indoor and Built Environment, 16(2): 184-189, 2007.

Conference papers

- Abi-Esber, L., and El-Fadel, M. 2013. Influence of Ventilation Mode and Out-Vehicle Pollution on In-Vehicle PM2.5 Concentration. Presented at 92nd Annual Meeting of the Transportation Research Board, Washington, D.C., 2013.
- Abi-Esber, L., and El-Fadel, M. 2012. Economic viability of landfill gas recovery under the CDM mechanism. Presented at the Wessex Institute of Technology conference on Waste Management 2012, New Forest, England, 2012.

Trainings

- Application of the TEST (Transfer of Environmentally Sound Technologies) approach in environmental and energy auditing by UINDO - IRI (Beirut, 2016-2017)
- Green Building Basics and LEED Practice by the US Green Building Council (Beirut, November 12-14 2011).
  LEED 101: Green Building Basics and LEED
  LEED 201: Core concepts and strategies
  BD+C 251: Understanding the building design; Construction LEED rating system
- Postharvest Technology by the University of California Davis (Davis, USA, June 2006).
- Project planning and design by Hanns Seidel Stiftung and AFDC (Beirut, August 2004).

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Language Skills

Language	Reading	Speaking	Writing
English	1	1	1
French	1	1	1
Arabic	1	1	1

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CARY L EHRMAN

Senior Managing Consultant

Cary is a Senior Managing Consultant with over 30 years' experience in managing environmental and social impact assessment, permitting, sustainable development, site investigation, remediation and planning projects. She is the Regional Service Leader for Impact Assessment for the Americas, and works on ESIA projects globally. Throughout her career, she has served as Project Manager, Principal-in-Charge, and Program Manager on large, nationally significant projects across a range of environmental disciplines, market sectors and clients. Over the last 15 years, Cary has led ESIAs and managed the technical quality and performance of multi-disciplinary and multi-cultural teams with divergent technical skills, linking appropriate staff from both national and international locations to provide best for project solutions to client's unique challenges. Her particular expertise includes scoping environmental and social baseline data collection and impact assessment for projects in developing countries in challenging terrain, community consultation, the development of sustainability/resilience metrics and tools to bring transparency to alternatives analysis and decision-making, stakeholder engagement, and government liaison. She is passionate about solving complex issues requiring strategic thinking, technical challenges and integration of environmental and social assessment. She is a Certified Environmental Practitioner (CEnvP) and an International Association for Public Participation (IAP2) Certified Practitioner. She has extensive experience working with indigenous communities situated in remote settings, including Australia, Fiji, Papua New Guinea, and Brazil. Previously, her responsibilities included serving as the Australasian Regional Leader for the development and marketing of sustainable evaluation tools to bring transparency to alternatives analysis and decision-making in line with IFC Performance Standards.

CONTACT INFORMATION
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REPRESENTATIVE PROJECTS
ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

2017
Evaluation of Socio-Economic and Socio-Environmental Programs, Federal Public Ministry, Brazil
Socio-Economic and Socio-Environmental Technical Advisor

Reviews conducted by the Ramboll Task Force to evaluate the Environmental and Socioeconomic Programs proposed by the Renova Foundation for the recovery of damages caused by the failure of the Fundão Tailings Dam. The dam failure resulted in the release of a mass of approximately 48.3 million cubic meters of mud that was accumulated in the dam, causing a wave of devastation throughout the basin of the Rio Doce, reaching the Atlantic Ocean, a distance of 650 km. Damage was caused to people who live or depend on the affected territory in 41 affected municipalities and natural resources throughout the region, The Ramboll task force included environmental and social experts from the

Americas and Europe, together with Brazilian national staff. The work was undertaken as an aid to the analysis of the Federal Public Ministry of the State of Minas Gerais, regarding the actions and activities proposed by those responsible for the event. The assessment included the technical development and application of a Resilience Model used to evaluate the current and future status of work associated with the different dimensions of the Rio Doce River Basin recovery work (human/social capital, economic/financial, natural capital, physical/infrastructure, and governance), and to provide a clear understanding of progress towards achieving long-term, sustainable goals for recovery in the region. Given the identified gaps, Ramboll recommended programs to facilitate the Ministry's renegotiation of the nature, scope, and dimensions of the restoration requirements, monitoring, and management in accordance with IFC Performance Standards.

2013-2015
Environmental and Social Impact Assessment - Port of Port Moresby Relocation to Motukea Island, Independent Public Business Corporation, Papua New Guinea
Project Manager

Nationally significant ESIA and government approvals for the relocation of the Port of Port Moresby to Motukea Island, 12km from the existing port, to provide capacity up to tripling of size in next 10 years. The island is a 106ha development site with steel fabrication, dockyard and wharves including twin Panamax berths, each with a quay line of 212m and water depth of 13m at lowest tide. Classified by government as a project of national significance and requiring highest level of regulatory assessment. The project included marine land reclamation, shipping channel establishment, marine dredging works, and the construction of a new international berth, roads, causeway, drainage works, electrical power supply, and lighting and communication systems. The ESIA included:

- Environmental Inception Report, feasibility approvals, risk assessment and strategy.
- Negotiation with Papua New Guinea Ministry of Transport.
- Scoping and ESIA baseline investigations to assess existing conditions. Work included:
  - Marine flora/fauna assessment and marine sediment sampling.
  - Bathymetric study and shipping channel assessment.
  - Hydrodynamic and sediment transport modeling.
  - Mangrove and shoreline investigation.
  - Existing and future terminal operations assessment.
  - Assessment of subsistence reliance on marine and land resources.
  - Traffic studies.
  - Socioeconomic data collection and community consultation with affected villages.
- Impact assessment to define the nature and extent of potential physical, social and environmental impacts that may be associated with undertaking construction and operation of the proposed Port development at Motukea.
- Conservation and protection of the natural ecosystems and environmental value of the area by developing mitigation, management and monitoring measures to address the key risks identified in the impact assessment.
- Government Liaison and workshops.
- Stakeholder engagement design, meetings and development of support materials and posters.

2013-2014
Environmental and Cultural Heritage Investigations, Australian Commonwealth Government, Papua New Guinea
Project Manager

Environmental and cultural heritage baseline investigations to outline the potential significant environmental risks associated with the establishment and operation of the Manus Offshore Processing Centre on the PNG Navy Base at Lombrum Point on the remote, tropical Pacific island of Los Negros. MOPC was one of a number of offshore Australian immigration detention facilities operated by Transfield Services on behalf of the Australian Commonwealth Government. Works included detailed ecological

and aboriginal heritage survey, significance assessment, development of mitigation and management measures to mitigate loss in compliance with the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) ---- the Australian Government's national scheme of environment and heritage protection and biodiversity conservation--- and PNG legislation. Results of the investigations were used to undertake risk assessment, mitigation design, project permitting, demolition supervision of WWII era buildings, and training of site contractors.

2012-2015
Environmental and Social Impact Assessment - Project Fusion, Eyre Iron Pty Ltd, Australia
Project Manager

ESIA for a large, multi-pit iron ore (magnetite) mine about 20km northeast of the town of Tumby Bay, with onsite processing facilities and pipelines to port facilities, which was a joint venture partnership between Centrex Metals Ltd and Wuhan Iron & Steel (Group) Co, a Chinese government steelmaking enterprise. Significant project size, including pits, tailings facilities, waste dumps, processing plant, power, magnetite slurry pipeline, return water pipeline corridor to a proposed desalination plant and deep-water port on the Eyre Peninsula, and road corridors. Significant challenges within existing agricultural area and conservation values. Large multi-pit iron ore project with onsite processing facilities and pipelines to port facilities. Work included:

- Impact assessment technical re-scoping and data review.
- Peer review of environmental and social assessment.
- Government liaison. Social risk assessment and engagement design to redress existing challenges.

2012-2013
Environmental and Social Impact Assessment - Port Spencer, Centrex Metals Ltd, Australia
Project Manager

Port Spencer was a proposed bulk commodities port development project in South Australia, previously known as Sheep Hill, would have been located on lower Eyre Peninsula, on the western shore of Spencer Gulf. The project was conceived by Centrex Metals Ltd for the export of iron ore from prospective iron ore deposits at Wilgerup and in the hills of Koppio, and was to be the first direct shipping cape class size vessel port project in South Australia. The port was designed to be served by a 27km narrow gauge branch line from Ungarra on the Eyre Peninsula Railway. Lipson Cove lies immediately to the south with the proposed wharf structure 1.5km north of Lipson Island Conservation Park. A desalination plant capable of producing of 5-20GL of water per year would have been required to provide the water necessary to transport the ore in a slurry to the Port Spencer site. Once the ore was dewatered, it was to be loaded onto conveyors, along a 500m jetty and onto cape size bulk carrier vessels. An alternative was developed in November 2013 would see the ore trans-shipped from a shorter jetty in barges, each carrying 15,000 tonnes. If such a method were to be employed, 12 barge-loads (round trips) would be required to fill a single cape size vessel, with a capacity of 180,000 tonnes. Designated by government as having major economic significance, and classified as Major Project for highest level of State assessment. The port development required three stages of environmental approvals plus associated mine development approvals in order to proceed. The project included:

- State and Commonwealth Approvals; Project scoping and baseline scoping, Review, design and delivery of Public Environmental Report (ESIA) to state regulators; Federal EPBC approvals and impact assessment.
- Government liaison, community engagement design and implementation, including written publications preparation and program.
- Formal response to impact assessment comments documentation and presentation to both government levels.
- Federal response to identified risks to two threatened species known to visit the region --- the southern right whale and the fairy tern.

State and Commonwealth approval was granted in October 2013.

2010-2012
Environmental and Social Baseline Studies - Oriomo Industrial Development, Papua New Guinea Sustainable Development Programme, Papua New Guinea
Project Manager

Environmental and social baseline studies undertaken to assess primary risks associated with the potential development of an Industrial Park Complex in the Oriomo area and surrounding communities for the PNGSDP. PNGSDP commenced operations in Papua New Guinea to promote development that meets the needs of the present generation and paves the way for continued progress to benefit future generations. The project included the proposed Daru Island international deep-sea port facilities, including construction of a bridge from the Daru Port to the mainland. The proposed port would support construction of a proposed road from the mouth of the Oriomo River to a proposed 70-hectare industrial park, to be the point of export for Ok Tedi Mine with mine life extended to 2024, and be the port for the proposed Purari hydroelectric project in neighboring Gulf Province. The project included related infrastructure, including upgrade of the existing road from Oriomo to Wipim. The proposed road was designed to run as a spine, connecting Daru to the remote areas of the Highlands for the first time. The baseline studies included evaluation of existing physical, social and biological environment to collect data on land use, cultural heritage, population, health, education, geology, soils, water quality, flora / fauna, and village relocation. Significant development in remote, undeveloped part of Western Province in challenging environmental terrain. Significant socioeconomic data collection program involving travel to remote villages by boat and helicopter, and village stays.

2010-2012
Environmental and Social Impact Assessment, Waisoi Copper Mine, Newcrest Mining, Fiji
Technical Discipline Leader – Socioeconomic Studies

ESIA for the development of a major copper/gold mine prospect within remote Fiji highlands and considered a significant project by government. Technical direction of baseline data collection, impact assessment and development of ESIA document chapters for the following disciplines: Traffic and Transport, Visual Amenity, Socio-Economics, Stakeholder Consultation, Cultural Heritage, Human Health and Ecological Risk Assessment, Community Health, and Alternative Energy. High degree of technical challenges with existing environment and traditional villages within potentially directly and indirectly impacted areas. Project highlights include:

- Community engagement of over 1,500 people, socio-economic data collection of over 1,000 households, in over 20 communities.
- Many small subsistence traditional villages located in the study area all with strong cultural connections to the land and its history.
- Design and implementation of training program for local social team in survey and community engagement.
- Development of communication materials for community and stakeholders in two languages.
- Partnering with Fiji Museum and University of South Pacific for their local knowledge, and in turn, provided capacity building through training and discussion of our methodology and close collaboration.
- Use of predictive GIS model to enable identification of potential cultural resources sites, as well as known sites, and target field survey in these areas was developed by the team. This along with the techniques utilized in this project resulted in the identification and protection of numerous old village sites, war forts, temples and burial grounds.
- The most comprehensive cultural heritage assessment undertaken in the Pacific for this type of project and the largest in Fiji's history.

2005-2006
Technical and Economic Justification - Port Vera, Confidential Client, Port Yuzhny, Ukraine
Project Manager

Preparation of the Technical and Economic Justification (Russian ESIA documentation) for the expansion of a deep-water port within the Black Sea Region, Port Yuzhny located 35 km east of Odessa, Ukraine. The new port facilities were referred to as the "Port Vera Project". The project involved assessment of the technical feasibility study of building new offshore oil terminal complex, intermodal yard, support facilities such as storm water treatment, utilities, roadway and rail access, and upland earth placement/fill. The construction of the offshore oil complex was intended for:

- Reception of high-hardening oils and petroleum products from railway transport to reservoirs;
- Storage of oil and oil products in the tank farm.
- Pouring in tankers oil and oil products.

Given the high requirements for environmental protection, the requirements for the operation were of similar oil terminals in the EU countries. A technical and economic assessment of the oil terminal construction was developed in 2005. The Cabinet of Ministers of Ukraine and private investors repeatedly considered the site for the construction of a high-purity refinery, as well as for the construction of an LNG terminal. The development of the Port Vera Project was suspended due to the political and economic situation in Ukraine, as well as due to the fact that in 2008, The Government of Ukraine imposed a moratorium on changing the purpose of agricultural land.

2001-2005
Environmental Impact Statement - SCI-823 Portsmouth Bypass, Ohio Department of Transportation, United States
Deputy Program Manager
Environmental Impact Statement (EIS) and preliminary design for a 16-mile, limited-access four-lane, divided freeway through Scioto County, Ohio, as part of the Appalachian Development Highway System. The project included coordination and Environmental Scoping with state and federal regulatory agencies, preliminary design for several alternatives, the preparation of Draft and Final Environmental Impact Statements, and the completion of preliminary plans for the preferred alternative.

SITE INVESTIGATION & REMEDIATION

2006-2010
Dioxin Site Investigation & Remediation - Dandenong Treatment Plant, Melbourne Water Corporation, Australia
Project Manager

Investigation and remediation of widespread dioxin contamination in surface soils and sludges on the site, originating from trade waste discharges over several decades. Numerous phases of site investigation and analysis were conducted to identify the nature and extent of contamination. A cleanup strategy was formulated when an extensive review of available technologies for dioxin concluded that collection and on-site storage of the materials represented the only viable alternative for the nature and volumes of the materials involved. Sludges and contaminated soils were temporarily stored in one of the redundant lagoons while a permanent storage facility was constructed under the conditions of an EPAV Works Approval. Known as the CALM (Capped and Lined Mound), this state of the art clay and membrane composite lined storage cell contains in excess of 600,000 cubic meters of compacted soils and sludges. Completed in late 2010, the CALM will be utilized as public open space within the industrial development. This project gained national recognition by winning the Gold Award in the Environmental Category in Consult Australia's Award for Excellence in 2011.

2006-2008

Site Investigation & Remediation - Point Nepean Quarantine Station and Norris Barracks, Point Nepean Community Trust/Commonwealth Government of Australia, Australia
Project Manager

Investigation and remediation of the historic Point Nepean Quarantine Station and Norris Barracks under Section 53X of the Environment Protection Act, 1970. The site has a rich history and played an important role in shaping the early settlement, quarantine and defense of Victoria. Developed an investigation strategy that met sampling densities required for future educational and residential use, and broad-acre sampling for areas to be used for recreational and open space. Potential sources of contamination investigated included USTs, ASTs, explosive and chemicals storage areas, garages and hydrocarbon storage areas, former earth closets and waste areas. The scope of work included installation of 398 boreholes, a network of 12 groundwater wells, investigative protocols including Aboriginal monitors and recording of cultural artifacts. Areas of contamination were delineated and remediated to obtain a Statutory 53X Certificate of Audit for the site. Following remediation, the site was successfully transferred from the Commonwealth Government of Australia to Parks Victoria and has been opened to the public as a National Park.

2004

Site Investigation - Steelton Pond, Duluth, Missabe & Iron Range Railway, United States
Project Manager

Site investigation to address contamination found in Steelton Pond. The purpose of the SI was to determine the source of groundwater with elevated pH levels, confirm the direction of groundwater flow, and identify possible solutions for addressing the problem, determine if wetlands mitigation is necessary. Tasks included: installation of soil borings to collect groundwater samples for pH measurement, confirmation of the direction of groundwater flow, review of site conditions to determine surface water flow characteristics and area of impacted wetlands. The SI determined that surface water originating an upgradient cement plant property discharged through the storm sewer and had migrated downgradient as shallow, unconfined flow through the fill material in the filled ravine on the DM&IR property to the Steelton Pond. Used the findings of the SI to prepare a letter to the Minnesota Pollution Control Agency, and recommended remedial actions in connection with Brownfield redevelopment of the property by the City of Duluth.

1999-2000

Ohio VAP Brownfield Redevelopment - Smith Brothers Hardware Property, Capital Equities, United States
Project Manager

Brownfield redevelopment of the iconic Smith Brothers Hardware Property located in the historic Warehouse District in Columbus, Ohio under Ohio EPA's VAP Program. Work included Phase I and Phase II ESA including field investigations, an exposure pathway assessment, determination of applicable standards, and determination of groundwater use, quality, potential for commingling plumes, and ground water classification. Following the Phase II ESA, the remedial design (soil and groundwater controls) was developed and construction oversight of the hazardous materials abatement activities was performed. An Operations & Maintenance Plan to demonstrate that the remedy will continue to result in the property meeting applicable Ohio EPA. A No Further Action (NFA) Letter requested a Covenant Not to Sue based on the actions taken at the property. The Ohio EPA issued Findings and Orders for the Covenant Not to Sue for the property on August 18, 2000.

1991-1992

Site Investigation - Pontiac Storage Activity, U.S. Toxic and Hazardous Materials Agency, United States
Project Manager

Site Investigation at the Pontiac Storage Activity performed under USATHAMA in preparation for site closure and transfer/sale of the property under base realignment and closure (BRAC) activities. The SI

determined the types and chemical characteristics of any contamination; geologic and hydrologic conditions; environmental media affected by contamination; potential migration pathways; and potential receptors of contamination. The field program included soil gas survey, surface soil sampling, PCB wipe and chip sampling, soil borings, groundwater monitoring well installation, and asbestos and radon surveys. Responsible for all project related reporting, cost tracking, and development of remedial alternatives assessment documents.

1990-2000
Installation Restoration Program Task Order Contracts, Air Force Center of Environmental Excellence, United States
Project Manager
Two, consecutive 5-year RI/FS IDIQ contracts at WPAFB in Dayton, Ohio. Projects included the following:

- Performance of a $6M RI/FS performed under the CERCLA IRP and Administrative Orders of Consent for an Operable Unit that consisted of two landfills and an earthfill disposal zone. Remedial alternatives were evaluated utilizing a streamlined approach under the Superfund Accelerated Cleanup Model (SACUM).
- Performance of an RI/FS performed under the CERCLA IRP and USEPA Administrative Orders of Consent for an Operable Unit that consisted of a chemical disposal area, a UST farm, and a burial site.
- Provided construction services for the Air Force during construction and implementation of the remedial design at two landfills. Established an Independent Quality Assurance Team to implement the QA procedures detailed in the remedial design.
- Preparation of a remedial action plan, action memorandum, and landfill remedial design for two landfills.
- Preparation of proposed plans and Record of Decision for 33 No Further Action sites at WPAFB. The proposed plans summarized investigation results, site risks, evaluation of alternatives, and the preferred alternative in coordination with USEPA Region V.

1988-1991
Indefinite Delivery/Indefinite Quantity Contract - NASA, United States
Project Manager
3-year RI/FS IDIQ at two NASA facilities in Cleveland and Sandusky, Ohio:

- Corrective Actions RI/FS for leaking USTs at the NASA Plum Brook Station, Sandusky, Ohio. The investigation involved the study of the impacts of fourteen USTs at four locations at the facility, and was conducted under the jurisdiction of both the OEPA and BUSTR. The results of the investigation were used to conduct a risk assessment and develop risk-based remediation levels.
- Engineering evaluation of the NASA Glenn Research Center industrial wastewater sewer system. Directed the fieldwork necessary to determine the probable causes and contributing factors associated with NPDES violations at two outfalls located within the sewer system. Elements of the study included: determining wastewater disposal practices; visual observation of industrial and storm sewer flows; sampling and analysis of selected branches of the industrial and storm systems; evaluating wastewater management and handling procedures; performing an inflow and infiltration study; and the developing a prioritized program of construction and facility rehabilitation.
- Developed a UST compliance and management program to upgrade forty-two tanks at NASA Plum Brook Station, Sandusky, Ohio and Glenn Research Center, Cleveland, Ohio.

WASTE MANAGEMENT AND SUSTAINBILITY

2009
Triple Bottom Line Assessment - Works Approval for Landfill Expansion, Australian Paper, Australia
Project Manager
Triple Bottom Line Assessment to support the Works Approval Application for the proposed extension of a landfill. To demonstrate to EPA that the proposed option is preferred on a balance of environmental, social, and economic criteria, five feasible alternatives were developed, evaluated with regard to weighted criteria to assess performance with regard to sustainability, and the results evaluated to develop supporting justification of the preferred alternative.

2009
Waste Management Strategy 2020, Baw Baw Shire, Australia
Project Manager
Development of the Waste Management Plan 2020. The WMP2020 drew on industry best practice to provide strategic and operational recommendations for the provision of waste management programs and services. The W MP2020 provided strategies for the collection, transport and disposal of waste, management of transfer stations, recycling programs, community and education programs, disposal of C&D and C&I waste, 'Waste Wise' programs and industry best practice programs, advice to Council to achieve outcomes set out in the Victorian State Government's 'Toward Zero Waste Strategy' and the Gippsland Regional Waste Management Plan, took a holistic, whole of organization approach and assess recommendations using a triple bottom line (TBL) methodology and provided overarching vision, goals, objectives, indicators and targets for Council to implement an integrated approach that was cost effective and environmentally responsible.

2008
Integrated Waste Management Plan, City of Greater Bendigo, Australia
Project Manager

Inventory of regional commercial and industrial waste streams to review and assess the range of commercial opportunities for waste products as a resource. Following the development of a detailed profile of waste streams, business opportunities were identified and prioritized to facilitate expressions of interest by the waste to energy market to develop in principle agreements with the suppliers.

2007-2008
Towards Zero Waste Strategy, Sustainability Victoria, Australia
Project Director
Landfill audits to determine the composition of waste to landfill to gain a better understanding of the current quantities and types of materials being disposed of to landfill. Importantly, this project aimed to identify the types, quantities, and counts of priority materials disposed of to landfill. By comparing the data gained from this project with that of the previous landfill/transfer station audit conducted in 2005, Sustainability Victoria was able to ascertain what progress has been achieved towards landfill diversion targets specified in the Towards Zero Waste Strategy.

2007-2008
Sustainable Development Evaluation Tool - Point Nepean Quarantine Station, Point Nepean Community Trust/Commonwealth Government of Australia, Australia
Project Manager
Development of an options assessment tool to help manage the Point Nepean Quarantine Station's significant heritage and environmental values to optimize societal benefit when considering options for future use of the site. Developed a sustainability framework and analysis tool for the planning, redevelopment and operational phases involved in transferring the former Quarantine Station and Norris Barracks site from the Commonwealth to the Victorian State Government for incorporation into the Mornington Peninsula National Park.

EDUCATION

1986-1987, MS, Environmental Science & Management, The Ohio State University, OH, USA
1981-1985, BA, Geology, Marietta College, OH, USA

PUBLICATIONS

2015, Assessing Options for Tailings Management, Australian Institute for Mining and Metals Bulletin.

TECHNICAL PRESENTATIONS

- 2017, Development and Application of a Resilience Model for Socio-Ecological Restoration in the Mining Sector, 7th World Conference on Ecological Restoration, Brazil.
- 2018, Development and Application of a Resilience Model for the Restoration of the Rio Doce Basin, Brazil, IAIA18, South Africa.
- 2015, Environmental and Social Impact Assessment, Battelle Memorial Institute, USA.
- 2013, AUSIMM Uranium Conference, Assessing Options for Uranium Tailings Placement, Australia.
- 2011, Evaluating Options Sustainably, EcoForum, Australia.
- 2009, Carbon Pollution Reduction Scheme, National Greenhouse and Energy Reporting Methods 1 and 2, EcoForum, Australia.

OTHER ACTIVITIES

- 2012-2015, Sustainable Development Evaluation Tools Support and Development Centre Leader, Australasia Region.
- 2012-2014, Consult Australia Victorian Division Committee Member.

MEMBERSHIPS

Environmental Institute of Australia and New Zealand

International Association of Impact Assessment

International Association for Public Participation

JONAS FEJA

Senior Consultant

Jonas Feja is senior consultant with extensive experience in the permitting process of onshore wind turbines. His professional experience of more than 7 years comprises approval procedures and in particular noise, visual impact and shadow flicker assessments in accordance with administrative German law and international standards. Jonas could apply his management and coordination qualities in large number of projects including the first utility scale wind power project in Jordan. His second main expertise is the design and micrositing of wind farms he obtained in projects located in Germany, UK and Romania. Furthermore, Jonas has been involved and managed technical due diligence processes for wind energy projects of several hundred megawatt.

EDUCATION

2008-2009
Master of Land Economy
University of Aberdeen, Aberdeen, United Kingdom

2004-2008
Bachelor of Science (B.Sc.) in Earth and Atmospheric Sciences
Universität Innsbruck, Innsbruck, Austria

LANGUAGE SKILLS

German (mother tongue), English, Spanish

PROJECTS

2018
Fünfeichen
ABO Wind AG, Germany
Noise emission and shadow flicker analysis.

2018
Prötzel I
EnBW Windkraftprojekte GmbH, Germany
Noise emission and shadow flicker analysis.

2018
Menden
GELSENWASSER AG, Germany
Visual assessment.

CONTACT INFORMATION

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Germany

2018
ESIA Kospo update 5b
Korea Southern Power Co., LTD, Korea, Republic of
Noise emission analysis.

2017-2018
Billerbeck-Kentrup
SL Windenergie GmbH, Germany
Supplement of expert report.

2017-2018
Friesenhagen
ALTUS AG, Germany
Supplemental noise emission analysis.

2017-2018
Petershagen-Frille
Enercon GmbH, Germany
Supplemental noise emission analysis.

2018
Biegen Nachtrag LAI
ABO Wind AG, Germany
Supplemental noise emission analysis.

2018
Mülheim Gerichtsverhandlung
Energiepark Styrumer Ruhrbogen GmbH, Germany
Consulting-attending a trial.

2018
Neuengamme
Vierländer Windkraft Deiters, Pinau, Scheel KG, Germany
Supplemental noise emission analysis.

2018
Groß Ziescht WEA04
Enercon GmbH, Germany
Supplemental noise emission analysis.

2017-2018
Prötzel II
EnBW Windkraftprojekte GmbH, Germany
Noise emission and shadow flicker analysis.

2017-2018
Altengamme
NET Windenergie GmbH, Germany
Supplemental noise emission analysis.

2017-2018
Birkhorst
ABO Wind AG, Germany
Noise emission and shadow flicker analysis.

2017-2018
Vockenrod Nachtrag
VSB Neue Energien Deutschland GmbH, Germany
Supplemental noise emission analysis.

2017-2018
Everswinkel-Sassenberg
VenSol Neue Energien GmbH, Germany
Supplemental noise emission analysis.

2016-2017
Kospo ESIA
Korea Southern Power Co. Ltd. & DAELIM Energy, Jordan
Poject Manager
Environmental and Social Impact Assessment for an 50 MW wind energy project in Jordan.

CURRICULUM VITAE

Prof. Dr. Ghassan RAMADAN-JARADI

ID			
First name:	Ghassan		
Family name:	RAMADAN-JARADI		
Father's name:	Amin		
Nationality:	Lebanese		
Date of birth:	20 December 1948		
Place of birth:	Beirut /Lebanon		
		Sex:	Male
		Marital status:	Married (4 children)
		Wife's name:	Mona Fouad Karakira

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e-mail: grjaradi@hotmail.com

Certificates / Diplomas /Degrees/ Graduations

1- Baccalauréat (Third Secondary)	Lebanon	1969
2- Licence of Natural Sciences	Lebanese University /Lebanon	1973
3- Diplôme d'étude approfondie (D.E.A.)	AIX- MARSEILLE III/ France	1974
4- Doctorat of University in Ecology	AIX- MARSEILLE III/ France	1975
5- Dotorat d'Etat in Ornithology	AIX- MARSEILLE III/ France	1984

Specialization

Degrees	Standing level	Option / Subject
1. D.E.A.	Bien/ Good	Biologie appliquée
2-Doctorat of University	Très bien / Very Good	Biologie appliquée / Ecologie
3-Doctorat d'Etat Ornithology	Très Honorable	L'AVIFAUNE DES EMIRATS ARABES UNIS : ETUDE FAUNISTIQUE ET CARACTERISATION DES PEUPLEMENTS (Ornithology).

Basic Security in Field UN Certificate, Dec. 2008 & 2013.
Advanced Security in Field UN Certificate, Dec. 2008 and 2013.

Publications

RAMADAN- JARADI ,G. (1975) .- *Etude de la structure du peuplement d'oieaux nicheurs de la hêtraie de la Sainte- Baume (Var).*Thèse 3e cycle , Aix -Marseille.

RAMADAN-JARADI ,G . (1984) .-*l'avifaune des Emirats Arabes Unis, étude faunistique et caractérisation des peuplements.* Thèse d' Etat . Aix -Marseille.

RAMADAN-JARADI ,G.(1985) .-Les oiseaux non nicheurs observés en migration dans les Emirats Arabes Unis. *L'Oiseau et R.F.O.* ,55, no spécial , 52 pp .

RAMADAN -JARADI ,G.(1987) .- Analyse écologique de la répartition des oiseaux nicheurs des Emirats

Arabes Unis *.l'Oisau et R.F.O.* ,57, no 2 :113-140.
RAMADAN -JARADI ,G.(1988) .-Notes on some breeding birds of the United Arab Emirates. *Sandgrouse,*10 :81-84 .
RAMADAN -JARADI ,G.(1989).- The avifauna of palm groves and other irrigated areas of the United Arab Emirates an its relation with continental insularity .*Le Gerfaut* , 79 :81-90 .
RAMADAN -JARADI,G.(1991) .- Capitive breeding of the Kori Bustard (*Ardeotis kori*) in Al Ain Zoo.*D. ZOOL .Garten* (N F), 61: 283-288.
RAMADAN -JARADI,G.(1996a).- Etude de la diversite biologique du Liban :Les Oiseaux.*Projet GF/6105-92-72*. Publication No.4,1996,13-26.
RAMADAN -JARADI,G.(1996b).- Etude de la diversite biologique du Liban :Les Oiseaux.*Projet GF/6105-92-72*. Publication No.9,1996,93-102.
RAMADAN -JARADI,G. & DICKINSON,R.M.(1980).-*The Al Ain Zoo Guide Book*, Buch-und offsetdruck Dorrong, Graz,Austria, 208 pp.
RAMADAN -JARADI,G. & RAMADAN -JARADI ,M. (1989) .-Breeding the Houbara Bustard at the Al Ain Zoo and Aquarium ,Abu Dhabi, U.A.E.,*D .ZOOL Garten* (NF) ,59: 220-240.
RAMADAN -JARADI,G. & RAMADAN -JARADI,M.(*1997)*.-Notes on some breeding birds in Lebanon. *Sandgrouse* , 19 (2): 122-125.
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RAMADAN -JARADI ,G. &RAMADAN -JARADI ,M. (*1999)*.- An updated Checklist of the Birds of Lebanon. *Sandgrouse*, 21 (2): 132-170.
RAMADAN -JARADI ,G. (1999).- Key bird species of five protected areas in Lebanon. *National Council for Scientific Research publications.* Lebanon.
RAMADAN -JARADI ,G., SADEK, R. & ABU SAEED, M. (2000).- A Manual for Monitoring of biodiversity in Lebanon. *Ministry of Environment.* Lebanon.
RAMADAN -JARADI ,G. &RAMADAN -JARADI ,M. (2001).- The Avifauna of Palm Islands Reserve Lebanon 1893 to 2000. *Lebanese Science Journal*. Vol. 2, No.1, 2001:17- 35.
RAMADAN -JARADI ,G. &RAMADAN -JARADI ,M. (*in prep.)*.- *Birds of the United Arab Emirates.*
RAMADAN -JARADI, G., SADEK, R. & ABU SAEED, M. (2000).- A Manual for Monitoring of biodiversity in Palm Islands and in 4 other sites of Lebanon. *Ministry of Environment.* Lebanon.
BEALE, C.M. & RAMADAN-JARADI, G. (2001). Autumn routes of migrating raptors and other soaring birds in Lebanon. *Sandgrouse*, 23(2): 124-129.
RAMADAN -JARADI, G., BITAR, G., HALWANI, J., SABBAGH, H. (2001). Impact of management activities on birds, fishes, plants and water quality on Palm Islands Reserve., *UNESCO CAIRO OFFICE*, pp: 1- 69.
RAMADAN -JARADI ,G. &RAMADAN -JARADI ,M. (2002).- Population size of the Syrian Serin *Serinus syriacus* and other ornithological records from Lebanon. *Lebanese Science Journal*. Vol. 3, No.1, 2002:27-35.
RAMADAN -JARADI ,G. &RAMADAN -JARADI ,M. (*in press*).- Autumn routes of migrating raptors and other soaring birds in Southern Lebanon. *Alauda*:
RAMADAN-JARADI, G. (2003).- Management plan for the restoration, rehabilitation and conservation of urban birds in Beirut Central District. Solidere, Beirut, Lebanon.pp 130.
RAMADAN-JARADI, G., BARA, T., AL-MECIJA, M. & RAMADAN-JARADI, M.(2004).- Significant bird notes from Lebanon during 2002-03. *Sandgrouse*, 26 (1): 29-34.
RAMADAN-JARADI, G., WATERBURY, S. P. & RAMADAN-JARADI, M. (2005)- Ornithological observations from Lebanon during 2003-04. *Sandgrouse* 27(1): 69-73.
RAMADAN-JARADI, G. (2006) Status of Marine and Coastal bird species in Lebanon. Proceeding of the first symposium on the Mediterranean Action Plan for the conservation of marine and coastal birds. UNEP; MAP; RAC/SPA. Oct. 2006.
RAMADAN-JARADI, G. & BARA, T. AND RAMADAN-JARADI, M. (2008) Revised checklist of the birds of Lebanon 1999-2007. *Sandgrouse* 30 (1): 22-69.
RAMADAN-JARADI, G., BARA, T. (2008) First confirmed breeding record of Spur-winged Lapwing *Vanellus spinosus* for Lebanon. *Sandgrouse* 30 (2).
RAMADAN-JARADI Ghassan (2010). Rehabilitation of Economic Functions of War-damaged Palm Islands Nature Reserve (PINR) Lebanon. Obtained on 20/12/2010 the Prize of KSA for the best environmental management in Arab countries that was organized by the Arab League States.
RAMADAN-JARADI, G. (2011) Impact of Climate Variations on the birds of Lebanon and measures to assist birds adapting to Climate Change. *Lebanese Science Journal*. Vol. 12, No.2, 2011:25-32
Dtv-Atlas Okologie (2011). Dieter Heinrich, Manfred hergt. Deutscher Taschenbuch Verlag. Translated by Ghassan Ramadan-Jaradi for Librairie Orientale Lebanon in 2009/2010. 306pp (2011).
RAMADAN -JARADI ,G. &RAMADAN -JARADI ,M. (2012) Introduced, captive, caged and escaped exotic and native bird species in the littoral area of Lebanon. *Lebanese Science Journal*. Vol. 13, No.2, 20012: 27-

35.

RAMADAN-JARADI, G. & SERHAL, A. (*2014*) First confirmed breeding record of Northern Raven *Corvus corax* in Lebanon for over four decades and recent records in Lebanon of Black-winged Kite *Elanus caeruleus*, Pin-tailed Sandgrouse *Pterocles alchata* and Black-bellied Sandgrouse *P. orientalis. Sandgrouse* 36 (2).

RAMADAN -JARADI ,G. & RAMADAN -JARADI ,M. (201٥) Spring Flyways of Migrating Soaring Birds in Akar/North Lebanon. Lebanese Science Journal. Vol. 16, No.1, 20015.

RAMADAN-JARADI, G., SERHAL, A. & ITANI, F (2015) First two records of Eurasian Bullfinch *Pyrrhula pyrrhula* for Lebanon and first records of Marbled Duck *Marmaronetta angustirostris* and Little Bustard *Tetrax tetrax* for over 14 and 56 years respectively. Sandgrouse 37 (2).

RAMADAN-JARADI, G., SERHAL, A. & RAMADAN-JARADI, M (2016) First confirmed breeding of the European Serin *Serinus serinus* in Lebanon. A potential threat to Lebanese breeding Syrian Serins *Serinus syriacus*? *Sandgrouse* 38 (1).

RAMADAN-JARADI, G. AND FOUAD ITANI, F (2016) Six interesting bird records, including two new species for Lebanon: Common Rosefinch *Carpodacus erythrinus* and White crowned wheatear *Oenanthe leucopyga. Sandgrouse.*

FADEL DANI, BEJJANI RAMI, JARADI GHASSAN R. AND HANI NIZAR (2016) Screening of threatened economically important *Gundelia tournefortii* and *Scorzonera mollis* species in Shouf biosphere Reserve-Lebanon. IJPAES. Vol: 6 45-52.

RAMADAN-JARADI, G. FOUAD ITANI, F & ASSAD SERHAL (2017) Evidence of Eurasian Stone Curlew Burhinus oedicnemus breeding in Lebanon. Sandgrouse 39.

GHASSAN RAMADAN-JARADI, FOUAD ITANI & ASSAD SERHAL (2017) Interesting bird records for Lebanon including a Diederik Cuckoo *Chrysococcyx caprius* and the first records of Macqueen's Bustard *Chlamydotis macqueenii* and Blue-cheeked Bee-eater *Merops persicus* for over 58 and 70 years respectively. *Sandgrouse* 39 (2017)

RAMADAN-JARADI, GHASSAN (2017) Status and Distribution of Migrating and breeding birds in north Lebanon. *Lebanese Science Journal, Vol. 18, No. 2, 2017*

Complete list of reviewed articles, books (edited or authored), book chapters and articles in non-refereed proceedings (2001-2011).

BOOK CHAPTERS (AUTHORED BY DR. GHASSAN RAMADAN-JARADI)

RAMADAN –JARADI, G. (2009). Lebanon forests and biodiversity conservation assessment, **Chapter 2** (Biodiversity and Forest Resources): **3-9** (7pp). USAID/ECODIT, 2009.

RAMADAN –JARADI, G. (2011). State and Trends of the Lebanese Environment, 2010. **Chapter 5** (Biodiversity and Forests): **138-179** (41pp). MOE/UNDP/ECODIT, 2011.

RAMADAN –JARADI, G. (2011). Etat de l'Environnement et ses tendances au Liban, 2010. **Chapitre 5** (Biodiversite et Forets): **144-193** (50pp). MOE/UNDP/ECODIT, 2011.

الجرادي رمضان غسان (2011). لبنان في البيئة : والإتجاهات الواقع (2010)، الفصل 5 (التنوع والغابات البيولوجي): **123-159** (2011). صفحة 37, MOE/UNDP/ECODIT

ARTICLES IN NON-REFEREED PROCEEDINGS (FOR WHICH GHASSAN JARADI IS SIMULTANEOUSLY EDITOR AND RESEARCHER).

Tohmé, G.; Ramadan-Jaradi, G.; Abi Saeed, M.; and Hraoui-Bloquet (2005). Assessment and Monitoring of Biodiversity in Palm Islands Nature Reserve: MOE/UNDP/**Lebanese University**. 2004-2005. 118pp.

Tohmé, G.; Ramadan-Jaradi, G.; Abi Saeed, M.; and Hraoui-Bloquet (2005). Assessment and Monitoring of Biodiversity in Horsh Ehden Nature Reserve: MOE/UNDP/**Lebanese University**. 2004-2005. 163pp.

Tohmé, G.; Ramadan-Jaradi, G.; Abi Saeed, M.; and Hraoui-Bloquet (2005). Assessment and Monitoring of Biodiversity in Shouf Nature Reserve: MOE/UNDP/**Lebanese University**. 2004-2005. 197pp.

Tohmé, G.; Ramadan-Jaradi, G.; Abi Saeed, M.; Hraoui-Bloquet, S.; Dia, A.; Slim, K. (2005). Assessment and Monitoring of Biodiversity in Tyre Coast Nature Reserve: MOE/UNDP/**Lebanese University**. 2004-2005. 144pp.

Tohmé, G.; Ramadan-Jaradi, G.; Abi Saeed, M.; Hraoui-Bloquet, S.; Dia, A.; Slim, K. (2005).

Assessment and Monitoring of Biodiversity in Aammiq marshes: MOE/UNDP/**Lebanese University**. 2004-2005. 163pp.

Tohmé, G.; **Ramadan-Jaradi, G**.; Azzi, M.; Hraoui-Bloquet, S.; Dia, A. (2006). Assessment and Monitoring of Biodiversity in Naqoura and Damour Areas. RAC/SPA /MOE/**CAMP**. Thematic Activity. 2005-2006.

Ramadan-Jaradi, G.; Sema'an, M.; Sadeq, R.; Saoud, I; Farajallah, N. (2008). Biodiversity Assessment and Monitoring in Palm islands Nature Reserve. MOE/IUCN/ **American University of Beirut**. 116pp.

ARTICLES IN NON-REFEREED PROCEEDINGS (EDITED BY DR. TOHMÉ WHILST THE BIRD CHAPTER IS AUTHORED BY GHASSAN JARADI).

Tohmé, G & H.; **Ramadan-Jaradi, G**.; Geze, R.; Hraoui-Bloquet, S. (2011) Biodiversité de Jabal Moussa Réserve de Biosphère: Plantes, Oiseaux, Amphibiens, Reptiles et Geology. APJM, 2011. 58pp.

OTHER ARTICLES IN NON-REFEREED PROCEEDINGS.

Ramadan-Jaradi, G. (2004) Editor of the Proceedings for the Expert Group Meeting on "Rehabilitation of Degraded Ecosystems in Arab Countries: Policies and Techniques. Beirut/ Lebanon, 14-18 March 2004.

Ramadan-Jaradi, G. (2007) Effect of Oil on Palm Islands Nature Reserve and approaches to long term assessment. Cost of Environmental degradation. Case studies from Middle East and North Africa. Edited by Leila Croiteru and Maria Sarraf. The World Bank. 1711pp.

Ramadan-Jaradi, G. (2010) The Biosphere Reserves in Lebanon and the Madrid Action Plan. Proceedings of the 6th Arab MAB Meeting and Training Workshop on the Implementation of Madrid action Plan, Beirut 11-13 May, UNESCO, UCO & UBO: 2010

Ramadan-Jaradi, G. (2010) A creative approach to Environmental Education. Proceedings of the National UNESCO Commission in Syria and the Syrian Ministry of Education for the conducted Workshop on Environmental Education in Damascus/ Syria, 2-4 November 2010.

Ramadan-Jaradi, G. (2011) Best practices in tackling new and emerging challenges. ICSU-UNESCO Rio+20. Proceedings of the UCO for the Regional Science and Technology Workshop for the Arab States. Cairo, 12-14, Oct. 2011.

Masters and PhD theses examind or directed
Master professional on Impact of Insecticides on crops in conventional and organic farms. Mohamad Nahle. Lebanese University. 2010
Master Research on Climate Change Impact on the birds of Lebanon. Nadia Srour. Lebanese University. 2011
Master of Zoology, Night traping mammals. Lebanese University. Rebecca Baisari, Lebanese University. 2012
Master of Botany in Shouf Biosphere Reserve/ Lebanese University, Funded by UNESCO/ 2014
Master on Water Pollution at Jabal Moussa Biosphere Reserve, LAU, Funded by UNESCO 2014
Master of economic plants in Jabal Moussa Biosphere Reserve, Arab University, funded by UNESCO, 2014
Master of ornithology in Palm Islands Nature Reserve, Lebanese University, funded by UNESCO 2015
PhD in effective and strategic management of Biosphere Reserves in Arab Countries. Diane Matar, Environmental Sciences and Policy, Central European University, 1051 Budapest, Hungary 2012-2014. Defense 4/12/2015, Budapest.
Bird Reserarch Projects funded by LU or CNRSL

Ramadan-Jaradi, G (1995-2000) L'avifaune du Liban: Etude faunistique et caracterisation des peuplements et determination de l'origine des especes migratrices au moyen de baguage, CNRSL: 1995-2000.
Ramadan-Jaradi, G. (1997) An Updated Law for Hunting. Ministry of Environment: 53 pp.
Ramadan-Jaradi, G (1999) The avifauna of Assi area. Study Report. Municipality of Hermel, Northen Beqaa. 16 pp.
Ramadan-Jaradi, G (1999) Report on World Natural Heritage in Lebanon. MAB Periodical, 1999: 3.4, 153 – 160.
Ramadan-Jaradi, G (2000) In-Situ Conservation For Sustainable Development and Biodiversity-mainly bird-Protection" Paper presented at The "Arabian Ornithological Conservation Conference" in Bahrain, 21-25 October 2000.
Ramadan-Jaradi, G (2001-2004): L'avifaune du sud du Liban: Etude faunistique et caracterisation des peuplements et determination de l'origine des especes migratrices au moyen de baguage, CNRSL: 2001-2004
Ramadan-Jaradi, G (2002) Ornithological Report on Jabal Rihane, March-June 2002. CNRS. 23 pp.
Ramadan-Jaradi, G (2003-2005) Correlation between bird diversity and plant structure as a tool for the determination of degradation factors in some cedar forests in Lebanon. LU.
Ramadan-Jaradi, G (2005-2008) Study of the impact of spraying insecticides in Damour, Tyre and Beqaa plains on birds and the trophic chain, and development of an alternative strategy using birds in the biological fight.
Ramadan-Jaradi, G (2008-2010) Impact of climate change on the birds of Lebanon and measures to assist them adapting to it. CNRS. & *in press.*
Ramadan-Jaradi, G. (2011-2013). National Red List of the Birds of Lebanon.
Ramadan-Jaradi, G. (2013-2015). Tracing migratory bird flyways over the wind atlas map in Lebanon for avian conservation and protection from wind farms. CNRS

COUNTRY REPORTS AND PROJECTS

The following reports ® and projects (P) were prepared by G. RAMADAN JARADI:

1. (P) National Action Plan for Marine Turtles. *Ministry of Environment.* Lebanon. 1998.
2. ® Protected areas in Lebanon. UNESCO 1999.
3. (P) Management Plan of Palm Islands Nature reserve. Ministry of Environment, 1999.
4. (P) Conservation of Raptor flyways in the Beqaa Valley. BirdLife Intl. 1999.
5. (P) Conservation of Raptor flyways in the Beqaa Valley. BirdLife Intl. 1999.
6. (P) Conservation of Raptor flyways in the Beqaa Valley. BirdLife Intl. 1999.
7. ® Bird monitoring in Palm Islands Nature Reserve. UNESCO 2000.
8. (P) Multipurpose plants in Lebanon and their wise use to raise funds. UNESCO 2001.
9. (P) Multipurpose bird species in Al Shouf Reserve in fundraising strategies. Lebanese Univ. 2002.
10. (P) Management Plan for the restoration and rehabilitation of birds in Beirut Central District. Contract in 2004 with Solidere. This management plan contains a chapter on how to sustain bird conservation and management through funds generated by various appropriate events and festivals.
11. (P) Assessment & Monitoring of Biodiversity in Protected Areas LEB/95/G31, MOE/ UNDP/ LU, 2003-2004 (Task Manager).
12. (P) Thematic Activity: Marine Conservation Areas, 2003-2004, MOE/ CAMP/ AMWAJ NGO (Task Manager)
13. (P) Design, Testing and Evaluation of Best Practices for *in situ* Conservation of Economically Important Wild Species, including factsheets of key medicinal plants in Lebanon. UNEP/GEF Project EP/INT/204/GEF, MOE/ FAO/ LU, 2004/2005 (Task Manager). Regional project.
14. (P) Elaboration of the technical and legal documents necessary for the completion of the Nomination form of Jabal Rehan Biosphere Reserve. UNESCO Beirut Office, 2004 (Project Manager). Contract with UNESCO BEIRUT on 12/11/04. This project discusses fundraising kits and products with local communities in order to set a strategy for fundraising to benefit

development zone.
15. (P) Elaboration of biodiversity leaflets and signages for Aammiq Wetland and Tyre Reserve. Contract # 05/2 with UNDP MedWetCoast, Project # 00013377 on 20/07/05
16. (P) Elaboration of a Manual on birdwatching. MOE, MedWetCoast, Hans Zeidel. May, 2005. Lebanon. Contract with MedWetCoast # 05/3 on 17/05/05
17. ® Preparation of the Third National Report to the Convention of Biodiversity. Contract with UNDP-Lebanon # 01/05 0n 29/7/2005
18. (P) Management Plan for the restoration and rehabilitation of Swallows and Swifts in Tripoli. Contract on 28/7/05 with Safadi Institution.
19. (P) Baseline and incremental costs for the UNEP/GEF Project EP/INT/204/GEF, MOE/ FAO/ LU, 2006
20. (P) Development of the Bylaw of the Arab Network for the implementation of CBD and Biosafety (Arab League) on behalf of ACSAD (contract on 11/09/2006) as Regional Consultant. 2006.
21. (P) Amendment of the technical and legal documents necessary for the re-submission of the Nomination form of Jabal Rihan as Biosphere Reserve. MOU with Mr. Albertina Abella Association, BEIRUT, Oct. 2006.
22. (P) Management Plan for Jabal Rihan Biosphere Reserve-Lebanon. Developed on behalf of the Management Authority of Jabal Rihane BR. 2007. Accepted by UNESCO MAB Advisory Committee in June 2007. This project lists potential sources of incomes for local communities.
23. (P) Building common consensus among the local communities and stakeholders on the sustainable use of the Palm Islands Nature Reserve's resources, and updating the Management Plan of Palm Islands Nature Reserve with the financial support of the Embassy of Netherlands, 2007.
24. (P) Management Plan of the proposed Lezzab Biosphere Reserve in Syria. Under development in cooperation with the Ministry of Environment. 2007- early 2008. This project lists potential sources of incomes for local communities.
25. Preparation of the technical and legal documents necessary for the submission of the Nomination form of Jabal Moussa as Biosphere Reserve. Cntract with the Society for the protection of Jabal Moussa. 2006.
26. ® Preparation of the Fourth National Report to the Convention of Biodiversity. Contract with UNDP-Lebanon. Completed July 2009.
27. Providing input to "Lebanon Forest and Biodiversity Conservation Assessment" report in the form of concise write-ups related to hunting legislation, wetlands, and biosphere reserves in Lebanon. Contract with Ecodit October 2009.
28. Preparing the National State of Environment Report (SOER) about Biodiversity and Forests in Lebanon. Contract with Ecodit August 2010.
29. Promotion of nurseries with native forest, culinary, ornamental and medicinal plants, including the development of a brochure on medicinal plants in Lebanon. EPC-UNOPS Project 2011-2012. Task Manager.
30. (P) Strategic Management Plan of the Jabal Moussa Biosphere Reserve in Lebanon. Funded by UNESCO and MAVA 2011-2012. This project lists potential sources of incomes for local communities and marketing and business plans as well as Action Plan.
31. Prepared the files that contributed to declare Palm islands Reserve and Tyre Coast Reserve two SPMI by RAS/SPA in 2012.
32. (P) Preparation of the Aspiring Shouf-Jezzine Geopark nomination file for Shouf Reserve with financial support from UNESCO Cairo Office (UCO). September-December 2012. Marketing is one of the most important tools used to benefit the Geopark.
33. (P) Development of the Strategic Action Plan and Roadmap, including gap analysis for CNRSL as a potential Regional Center of Excellence. Contract with CNRSL. September-December 2012. In this document fundraising to maintain the sustainability of CNRSL is prevailing in some sections.
34. Preparation with 2 others (Hani Shaer and Lara Samaha) the National Strategy for Marine Protected Areas in Lebanon. IUCN-MOE, 2011-2012.

35. (P) Development of a project proposal on behalf of IUCN/ Regional ROWA Office, on Medicinal Plants Conservation, and adaptation to Climate Change. Submitted on 9 December, 2013 to BMU-ICI, Germany.
36. Establishment of Public Hunting areas in Lebanon. Consultancy Contract with SPNL, 2013-2014.
37. Identification of bottlenecks (protected areas) of soaring birds in Lebanon, UNDP-MOE, Lebanon, 2013-2014.
38. Management plan for Anjar Hima/ Contract with SPNL, 2014
39. Management plan for Room Responsible Hunting Areas/ Contract with SPNL, 2014
40. Ornithological Assessment of Potential Responsible Hunting Areas (Protected area). LEF-Lebanon, 2014-2015.
41. EIA for Anjar-Kfarzabad. LEF, 2014
42. Monitoring Anjar-Kfarzabad. LEF, 2015
43. EIA Roum-Aytouli. SPNL, 2015
44. State of Environment Report. Dubai. Chapter 5. UAE
31. KBAs identification in Lebanon/ Contract with SPNL, October 2016
32. Needs Assessment for the project Legal and Technical Support for Ecotourism in Palm Islands. MedPAN 2016.
33. Workplan and Gap analysis for monitoring 16 IBAs/KBAs in Lebanon, Onging with SPNL.
EIAs SEAs
1. Training the participants of the Institutional Strengthening of EIA in Metap Countries on EIA Reporting. METAP Workshop on Potential Contribution of Scientific NGOs to the Scientific aspects of Impact identification and Assessment. Phase II. Beirut, January 2001
2. Production of an EIA report for the establishment of a children zoo in downtown, Fiesta. 2003. Lebanon
3. Preparation of an EIA report on the impact of dams on birds in Nahr Bisri, with Mounir Abi Saeed, Ryad Sadeq and Michel Bariche. 2010
4. Preparation of an EIA report on the impact of dams on birds in Nahr Ibrahim, with Mounir Abi Saeed, Ryad Sadeq and Michel Bariche. 2010
5. Preparation of an ornithological EIA report in Roumieh Village, with Georges Tohme, for Khatib and Alami, 2012
6. Preparation of an ornithological EIA report in Jabal Akroum for Sustainable Akkar with Ecodit, (2013)
7. Preparing an ornithological SEA report on the impact of impoundments on birds. Ecodit, 2013-2014.
8. Preparing an EIA Report for Al-Sulai-Kharja in Ryadh/KSA 2015-2016.
9. Preparing an EIA for AlAbyad in KSA, 2017
10. Preparing EIA for Sustainable Akkar in 2015-2017.
11. Preparing assessment of potential IBAs in Oman, 2017-2018

TRANSLATION WORK INTO ARABIC
The following books were translated by G. RAMADAN JARADI:
1) *The Al Ain Zoo Guide Book*,Buch-und offsetdruck Dorrong,Graz,Austria,208 pp.
2) A Manual for Monitoring of biodiversity in Lebanon. *Ministry of Environment.* Lebanon. 80 pp. (1980).
3) Lebanon Strengthening of National Capacity and Grassroots In-situ Conservation for Sustainable Biodiversity Protection, Project Document, March 1997. 143 pp. MoE/IUCN (1998)
4) A Manual for Monitoring of biodiversity in Lebanon. *Ministry of Environment.* Lebanon. 80 pp. (2000)
5) Management Plan 2000-2005 of Palm Islands Nature Reserve, Protected Areas Project. IUCN, UNDP, GEF, Ministry of *Environment,* Lebanon. 129 pp. (2001).
6) Management Plan 2000-2005 of Horj Ehden Nature Reserve, Protected Areas Project. IUCN, UNDP, GEF, Ministry of *Environment,* Lebanon. 132 pp. (2001).

7) Management Plan 2000-2005 of Arz Al Chouf Nature Reserve, Protected Areas Project. IUCN, UNDP, GEF, Ministry of *Environment,* Lebanon. 141 pp. (2001).
8) Dtv-Atlas Okologie, Dieter Heinrich, Manfred hergt. Deutscher Taschenbuch Verlag. Translated for Librairie Orientale Lebanon in 2009/2010. 288pp (2010).

TRANSLATION WORK INTO ENGLISH

The following books were translated by G. RAMADAN JARADI:
1) Biodiversity of Palm Islands Nature Reserve. A Scientific Study. NCSR, IUCN and Ministry of Environment. 40 pp. (2000).
2) Biodiversity of Tyre Beach Nature Reserve. A Scientific Study. NCSR, IUCN and Ministry of Environment. 42 pp. (2001).
3) Biodiversity of Ammiq Swamp Nature Reserve. A Scientific Study. NCSR, IUCN and Ministry of Environment. 42 pp. (2001).

TRAINING SKILLS

The following training sessions were held by G. RAMADAN JARADI as Trainer:
1) Training and Refreshing training of Birdkeepers of Al Ain Zoo (UAE) on identification of species as a way to provide proper diet. One week/ year during 1976 -1986
2) Training the Rangers of the protected Sir Bani Yas Island, Abu Dhabi / U.A.E on birdwatcing. September,1986
3) Training the Rangers of Abu Al Abyad Island/ Wildlife Protected area Abu Dhabi / U.A.E on birdwatcing. October, 1986
4) Training the Rangers of the protected Rimah Forest, Abu Dhabi / U.A.E on birdwatcing. April,1987
5) Training the Rangers of the Ain Al Faydah/protected wetland, Abu Dhabi / U.A.E on birdwatcing. October,1987
6) Training on identification of Bustards chicks during the third International Symposium on Bustards, Austria, 1989.
7) Training school students in Beirut on birding within the framework of the Project “Preparation and management of environmental activities in schools, Environment and Development, GTZ, AUB” during October 1999.
8) Training school students in Hazmieh on birding within the framework of the Project “Preparation and management of environmental activities in schools, Environment and Development, GTZ, AUB” during October 1999.
9) Training school students in Deir El qamar on birding within the framework of the Project “Preparation and management of environmental activities in schools, Environment and Development, GTZ, AUB” during October 1999.
10) Training school students in Saida on birding within the framework of the Project “Preparation and management of environmental activities in schools, Environment and Development, GTZ, AUB” during November 1999.
11) Training school students in Qalamoun on birding within the framework of the Project “Preparation and management of environmental activities in schools, Environment and Development, GTZ, AUB” during November 1999.
12) Training school students in Beqaa on birding within the framework of the Project “Preparation and management of environmental activities in schools, Environment and Development, GTZ, AUB” during November 1999.
13) Training of management team of Palm Islands Nature Reserve on Bird monitoring within the framework of a project implemented by Greenline on behalf of the Ministry of Environment during December1999. A Manual for Monitoring of biodiversity (Birds) in Lebanon was also developed in 2000.
14) Training of management team of Horsh Ehden Nature Reserve on Bird monitoring within the framework of a project implemented by Greenline on behalf of the Ministry of Environment and IUCN during December 1999. A Manual for Monitoring of biodiversity (Birds) in Lebanon was also developed in 2000.
15) Training of management team of AL_Chouf Cedar Nature Reserve on Bird monitoring

within the framework of a project implemented by Greenline on behalf of the Ministry of Environment and IUCN during December 1999. A Manual for Monitoring of biodiversity (Birds) in Lebanon was also developed in 2000.
16) Training the participants of the Institutional Strengthening of EIA in Metap Countries on EIA Reporting. METAP Workshop on Potential Contribution of Scientific NGOs to the Scientific aspects of Impact identification and Assessment. Phase II. Beirut, January 2001
17) Training on identification of Raptors and waterbirds during the International Symposium on Raptors, Ankara, University of Vet, May, 2002
18) Training of participants from the American University Environmental Club on birdwatching during September 2003 and March 2004.
19) Training of groups from T.E.R.R.E NGO, EPC NGO and Lebanese University on birdwatching during 2003-2004.
20) Training and or providing advocacies to several individuals and VIPs from Lebanon and abroad on birdwatching and identification of birds during 2003-2004.
21) Eco-guide trainer on identification of birds and birdwatching and its use in ecotourism for income generation. MOE, MedWetCoast, Hans Zeidel, Aammiq: 27-29 May, 2005. Lebanon.
22) Training workshop for Head Teachers on an environmental kit developed on the initiative of MAB-UNESCO. Damascus, 2-4 Nov. 2010. UNESCO Contract No. 4500118561.
23) Spring Training 2-day workshop for Interior forces and Forest guards on identification of allowed for hunting game birds and strictly protected non game birds, with field application trip. Organized by UNDP & Ministry of Environment. Shouf Biosphere Reserve, on 1-2 June 2012.
24) Spring Training 2-day workshop for Interior forces and Forest guards on identification of allowed for hunting game birds and strictly protected non game birds, with field application trip. Organized by UNDP & Ministry of Environment. Western Beqaa (Aammiq), on 5-6 June 2012.
25) Spring Training 2-day workshop for Interior forces and Forest guards on identification of allowed for hunting game birds and strictly protected non game birds, with field application trip. Organized by UNDP & Ministry of Environment. Batroun, on 11-12 June 2012.
26) Spring Training 2-day workshop for Interior forces and Forest guards on identification of allowed for hunting game birds and strictly protected non game birds, with field application trip. Organized by UNDP & Ministry of Environment. Northern Beqaa (Zahleh), on 25-26 June 2012.
27) Autumn Training 2-day workshop for Interior forces and Forest guards on identification of allowed for hunting game birds and strictly protected non game birds, with field application trip. Organized by UNDP & Ministry of Environment. Northern Beqaa (Zahleh), on 27-28 Sep. 2012.
28) Autumn Training 2-day workshop for Interior forces and Forest guards on identification of allowed for hunting game birds and strictly protected non game birds, with field application trip. Organized by UNDP & Ministry of Environment. Batroun, on 1-2 Oct. 2012.
29) Autumn Training 2-day workshop for Interior forces and Forest guards on identification of allowed for hunting game birds and strictly protected non game birds, with field application trip. Organized by UNDP & Ministry of Environment. Shouf Biosphere Reserve, on 8-9 Oct. 2012.
30) Autumn Training 2-day workshop for Interior forces and Forest guards on identification of allowed for hunting game birds and strictly protected non game birds, with field application trip. Organized by UNDP & Ministry of Environment. Aley, on 11-12 Oct. 2012.
31) Training Middle Eastern NGOs members of IUCN on Fundraising (28-30 November 2013), Amman, Jordan.
32) Training of Internal Forces on Identification of game and threatened bird species, and on the Hunting Law enforcement. Organized by UNDP & Ministry of Environment 1-28 February 2014. Werwar.
Evaluation of the training program for interior forces (18 training sessions), 2012-2015.
Training Palm Islands Team on monitoring biodiversity. April, 2014
Gap analysis for the management of Palm Islands Nature Reserve, May 2014-June 2015.
Training of Anjar-Kfarzabad community on bird identification, May, 2015.
Training of Anjar community on bird identification and monitoring. April 2016
Training of ISF on ientification of bird species (March-June 2017). MOE/EU.

POST / TITLE / PROFICIENCY		

1	Assistant technician / Project of lebanese wildlife Studies / Lebanese University/ CNRS.	1973
2	Birds Curator at the Al Ain Zoo & Aquarium , Abu dhabi, U,A.E.	1976-1986
3	Assistant Director in charge at Al Ain Zoo & Aquarium , Abu Dhabi , U.A.E.	1986-1987
4	Head of research section at the Al Ain Zoo & Aquarium,Abu Dhabi, U.A.E.	1984-1991
5	Director in charge of the Al Ain Zoo & Aquarium , Abu Dhabi, U.A.E.	1987-1988
6	General Director of the Al Ain Zoo & Aquarium ,Abu Dhabi, U.A.E.	1988-1991
7	Technical manager of the protected Sir Bani Yas Island, Abu Dhabi, U.A.E.	1986-1991
8	Manager of Abu Al Abyad Island/ Wildlife Protected area Abu Dhabi / U.A.E.	1986-1991
9	Manager of Abu Al Abyad Island/ Wildlife Protected area Abu Dhabi/ U.A.E.	1986-1991
10	Technical manager of the protected Rimah forest, Abu Dhabi, U.A.E.	1987-1991
11	Technical manager of Ain Al Faydah/protected wetland, Abu Dhabi, U.A.E.	1987-1991
12	Manager of the Al Ain wildlife sanctuary,Abu Dhabi,U.A.E.	1987-1991
13	Member of Director's Board of the Natural History Museum/ U.A .E. Univ.	1976-1991
14	Consultant of the Scientific Research Group/ Natural Sciences / University of United Arab Emirates.	1987-1991
15	Member of director's board of Khaleefa's Avian Research Breeding Center/ Abu Dhabi	1989-1991
16	Head of the Commitee supervising the animal collections of the United Arab Emirates Prime Minister .	1989-1991
17	Member of the Council of Development and Planing/ Al Ain Municipality/ UAE.	1988-1991
18	Member of Developement and tourism Committee/ Al Ain Municipality/ UAE.	1990-1991
19	Member of the International Zoo – Director's Board / London .	1989-1991
20	Fellow Member of the Zoological Society of London /U.K.	1988-1999
21	Member of the Zoological Society of San Diego /U.S.A.	1988-1999
22	Member of the natural history group of Abu Dhabi /U.A.E.	1979-up to date
23	Member of the International Primate Protection League (IPPL) U.S.A.	1989-up to date
24	Maitre Assisstant, Lebanese Univ. Nat. Sc. /Lebanon	1995-up to 2005
25	Secretary General of the National MAB Committee/ Lebanon	1996-up to date
26	Researcher at NCSR /Lebanon	1995-up to date
27	Co – auther to Lebanese birds at OSME	1996-up to date
28	Coordinator of Birdlife International	1997-up to date
29	Member of Environment Protection Committee (EPC) that is a member of IUCN (World Conservation Union-Switzerland)	1997-up to 2015
30	Manager consultant of Palm Islands Reserve. Protected Areas Project/ Lb	1997-up to 2016
31	Member of Ramsar Wetland Expert Database	1997-up to date
32	Member of Lebanese Environmental Forum	1998-up to date
33	Member of Environment Protection Committee, Tripoli	1997-up to 2015
34	Member of Executive Committee at EPC, Tripoli (NGO)	2000-up to date
35	Member of executive Committee at SPNL, Beirut (BirdLife Partner)	1997-up to 2002
36	Member of Executive Committee at Amwaj Al Bi'a, Tyre (NGO)	2001-up to date
37	Member of Lebanon Biodiversity National Steering Committee	1998-up to1999
38	Expert of Lebanon at Barcelona Convention	1998-up to date
39	Chairman of BirdLife International Regional Council/ Middle East	1999-up to 1999
40	Expert of Lebanon at MEDTURTLE GROUP, Greece	1999-up to 2000
41	Expert of Lebanon at Biodiversity Convention	1998-up to date
42	Member of Inter-government Committee for Biosafety (CBD)	2000-up to date
43	National Focal Point of ICCP (Biosafety)	2000-up to date
44	Member of the Arab MAB Network Bureau/ UNESCO	2001-up to date
45	Vice President of the Ornithological Society for the Middle East. London	2002-up to 2013
46	Examiner expert at the National Service Council.	2002-up to date
47	President of Palm Islands Nature Reserve's Committee (GAC)	2002-up to date
48	Task Manager, Editor & Translator of the "Biodiversity Assessment & Monitoring in the Protected Areas, LEB/95/G31	2003-up to 2005

49	Task Manager, Editor of the Economic Species Project/ FAO/MOE/LU	2004-up to 2006
50	Chair of ArabMab Network/ UNESCO from 18/3/2004	2004- 2007
51	Member of ArabMAB Bureau	2001-up to date
52	Technical Focal Point for AEWA International Convention	2004-up to 2012
53	Manager of the project "Elaboration of the technical and legal documents necessary for the completion of the Nomination form of Jabal Rehan". UNESCO Beirut Office, 2004	2004-up to 2005
54	National Focal Point for the Biosafety Clearing-House: Aug 2005	2005-up to 2008
55	National consultant for the UNEP/GEF Project EP/INT/204/GEF, MOE/ FAO/ LU, 2006	2006-up to 2008
56	Regional Coordinator for AEWA International Convention	2006-up to 2013
57	Member of the International Advisory Committee for Biosphere Reserves/ Unesco.	2006-up to 2013
58	Re-selected Chair of Palm Islands Nature Reserve Committee 7/6/06	2006-up to date
59	Full Professor/ Lebanese University	2006-up to date
60	SBSTTA-CBD Focal Point	2006-up to date
61	Representative of south western Asia at the Technical Committee of AEWA International Agreement	2006-up to date
62	Executive Director of the National Bird Records Committee at the National Council for Scientific Research.	2007-up to date
63	Member of the "Friends of the American University Campus in Beirut"	2007-up to 2011
64	Vice-President, ICC-MAB-UNESCO-BUREAU	2008-up to 2010
65	Member of the International Advisory Committee for Biosphere Reserves/ Unesco.	2011-up to 2014
66	Coordinator of the IUCN-National Committee in Lebanon	July-Dec - 2013
67	Project Manager for updating NBSAP and 5 NR of Lebanon, Feb-May 2013. MOE, UNEP.	Feb-May 2013
68	Member of NBSAP Forum	2013-2015
69	Member of Higher Hunting Council, Ministry of Environment, 2014.	2014-2017
70	National Consultant to UNESCO Beirut Office for supervising research in 7 Protected Areas conducted by Msc students in 7 universities.	2014-2015.
71	Representative of Lebanese University in the UNOPS Committee for small grants GEF	2016- ongoing
72	President of Palm Islands Nature Reserve, Ministerial Decision, MOE	2017-2020

VARIOUS
Prepared in 2000 the Ramsar file of Palm Islands Nature Reserve to Ramsar Secretariat. This led to declare Palm Islands a Ramsar Site in 2001.
Prepared in 2011 the file of Palm Islands Nature Reserve and Tyre Coast Nature reserve to RAC/SPA (Barcelona Convention). This led to declare both sites Specially Protected Areas of Mediterranean Importance in 2012.

LANGUAGES
ENGLISH , FRENCH AND ARABIC= VG
GERMAN = medium, URDU= less than medium.

International Symposiums/ Conferences/ Workshops/ Meetings attended (L=Lecturer)			
1	La Conférence Internationale Ornithologique des Francophones	Paris/ France	1974
2. L	The First International Symposium on Falconry	Abu Dahbi/ U.A.E	1977
3. L	The First International Symposium on Bustards	Jaipur/ India	1979
4. L	The World's Conference for the Protection of Raptors	Thessaloniki/	1982

		Greece	
5	La Conférence International Ornithologique des Francophones	Paris / France	1985
6	The Second International Symposium on Bustards	Dubai/ U.A.E.	1986
7. L	The third International Symposium on Bustards	Vienna / Austria	1989
8. L	The regional Workshop on ArabMAB Network of Biosphere Reserves	Damascus / Syria	1996
9	The international Rare Birds Club meeting. BirdLife Internation	Amman/Jordan	1997
10. L	Workshop on Ecotechnie and Development of Environmental Education	Aswan/ Egypt.	1997
11. L	Meeting of Experts for the evaluation of MAP for Marine Turtles. RAC/SPA-UNEP:27-29 October	Arta/ Greece	1998
12. L	Meeting of Experts for the evaluation of MAP for Marine Mammals. RAC/SPA-UNEP:29-31 October	Arta/ Greece	1998
13. L	Middle Eastern Regional Workshop on IBAs/BirdLife International: 18-20 April	Amman/Jordan	1999
14. L	Meeting of Experts on World Heritage Convention:29 May-2 Jun	Cairo/ Egypt	1999
15. L	Informal Consultations of experts on Biosafety Protocol:14-19 Sep	Austria/ Vienna	1999
16. L	Global Meeting of BirdLife Partners,: 9-13 Oct.	KL/ Malaysia	1999
17. L	Global Conference of BirdLife International, Malaysia: 14-17 Oct	Kuala Lampur	1999
18	Biosafety ExCop1 Meeting,: 20-28 Jan.(with credential letter)	Montreal/ Canada	2000
19	SBSTTA5 Meeting: 31 Jan. – 4 Feb.	Montreal/Canada	2000
20. L	Regional Workshop for Capacity Building, WNH, 23-27 Sept. Case Study of Palm Islands Nature Reserve. Protection, Management and Biodiversity Conservation.	Muscat, Oman	2000
21. L	The Arabian Ornithological and Conservation conference, 21-25 Oct. In Situ Conservation for Sustainable Development and Biodiversity Protection. Case Study of Palm Islands Nature Reserve, Lebanon.	Manama/ Bahrain	2000
22	The first meeting of Intergovernmental Committee for the Protocol of Biosafety: 11-15 Dec.	Montpellier/ France	2000
23. L	Regional meeting of BirdLife International, Hilton: 13-15 Jan.	Manama/ Bahrain	2001
24. L	Arab States Outreach meeting on Wetlands, Hilton, 16-17 Jan.	Manama/ Bahrain	2001
25	SBSTTA6 to the Convention of Biodiversity, 12-16 Mar	Montreal/ Canada	2001
26. L	Regional Meeting of Experts on the Role of the Multipurpose Species in the Development of Communities in Arabic Countries and the Meeting of the Bureau & the Coordination Council of ArabMab Network, Fardous Hotel, 10-14 September	Damascus/ Syria	2001
27	Asia-Pacific Regional meeting on Biosafety (UNEP-GEF-CBD-IUCN), Xiyan Hotel, 4-8 March 2002.	Beijing/ China	2002
28. L	BirdLife International Regional Meeting (WCA), Safir Hotel, 19-24 March	Kuwait/ Kuwait	2002
29. L	UNESCO MAB Aleppo Meeting	Aleppo/ Syria	2002
30. L	II International Symposium on Raptors, Ankara, University of Vet.: 16-22 May	Ankara/ Turkey	2002
31	Middle East Sub-regional RAMSAR Meeting. “Le Bristol” Hotel, 7-9 October	Beirut/ Lebanon	2002
32	SBSTTA8 to the convention of Biodiversity, 9-15 March	Montreal/ Canada	2003
33	BIOSAFETY MYPOW Meeting, CBD, 17-22 March	Montreal/ Canada	2003
34	Intenational workshop on Forest Protected Areas, 6-8 Nov.	Montreal/ Canada	2003
35	SBSTTA9 to the convention of Biodiversity, 10-14 Nov.	Montreal/ Canada	2003
36	Expert Meeting on Rehabilitation of degraded Ecosystems in Arab Countries: Policies & Techniques, Beirut-Lebanon,14-18 March 04	Beirut/ Lebanon	2004
37	2nd Steering Committee Meeting, Design, Testing & Evaluation of best practices for in-situ conservation of Economically Imoportant Wild Plant Species, UNEP/GEF Project EP/ INT/ 204/ GEF. Roma, Italy, 27-30 April 2004.	ROME/ ITALY	2004
38	3rd Steering Committee Meeting, Design, Testing & Evaluation of	ROME/ ITALY	2004

	best practices for in-situ conservation of Economically Imoportant Wild Plant Species, UNEP/GEF Project EP/ INT/ 204/ GEF. Roma, Italy, 7-10 September 2004.		
39	Second International Workshop on Ecohydrology and ArabMAB Bureau Meeting. Tower Plaza, 11-13 October 2004, with submission, by Dr. Jaradi in his capacity as Chair of ArabMAB Network, of the first project on the Establishment of the ArabMAB Fund.	Beirut/ Lebanon	2004
40	18th Session of the International Coordinating Council Meeting of MAB. Unesco HQ, Paris, 25-29 October 2004.	Paris/ France	2004
41	First Training Workshop on Database Arab Biodiversity in Foreign Museums. Cairo. UNESCO Commision. 10-12 Oct. 2005	Cairo/ Egypt	2005
42	Workshop of Ecotourism in Arab Countries. UNESCO Cairo Office, Sharm El Sheikh, 13-16 November 2005	Sharm El Sheikh Egypt	2005
43	First Symposium on the Mediterranean Action Plan for the conservation of marine and coastal birds (17 – 19 November 2005; Vilanova i la Geltru, Barcelona)	Barcelona/ Spain	2005
44	Final Steering Committee meeting for the UNEP/GEF Project EP/INT/204/GEF, MOE/ FAO/ LU, FAO, ROME, 2006	Rome/ Italy	2006
45	Workshop on efforts of Arab countries to implement articles of CBD and Biosafety Protocol, Damascus, ACSAD, 12-14 June 06	Damascus/ Syria	2006
46	Meeting of the Advisory Committee for Biosphere Reserves/MAB/ UNESCO, 5-7 July 2006, Unesco Headquarter, Paris	Paris/ France	2006
47	7th Meeting of the Technical Committee of AEWA Intl. Agreement, 29 Oct-1 Nov. 2006, at WAZA Bern-Switzerland	Bern/ Switzerland	2006
48	Ecohydrology experts group meeting, 4-5 June 2007, Sharm El Sheikh	Sharm El Sheikh Egypt	2007
49	ArabMab Meeting, 6-8 June 2007, Sharm El Sheikh. Funding strategy and proposal writing on Drylands.	Sharm El Sheikh Egypt	2007
50	"July 2006 Lebanon Oil Spill: Long-Term Impact Assessment for Lebanon and the Eastern Mediterranean Region, Cyprus, Larnaca, Palm Beach Hotel Feb. 12 – 13, 2007.	Larnaca/ Cyprus	2007
51	Meeting of the Advisory Committee for Biosphere Reserves/MAB/ UNESCO, and discussion of Debts for nature Swaps, 11-13 June 2007, Unesco Headquarter, Paris	Paris/ France	2007
52	Meeting to identify and elaborate an option for international cooperation on African-Eurasian migratory raptors under the Convention on Migratory Species. Loch Lomond, Scotland, United Kingdom, 22-25 October 2007	Glasgow/ UK	2007
53	ICC-MAB UNESCO 20th Meeting and 3rd World Symposium of UNESCO on Biosphere Reserves, Madrid, 4-9 February 2008	Madrid/ Spain	2008
54	Training Meeting on Oil cleanup processes after the PRESTIGE disaster in Galicia, TRAGSA, 9-15 March 2008	Galicia/ Spain	2008
55	ICC-MAB UNSECO Bureau Meeting, Paris, 21-22 April 2008	Paris/ France	2008
56	Meeting of the Advisory Committee for Biosphere Reserves/MAB/ UNESCO, February 2009, Unesco Headquarter, Paris	Paris/ France	2009
57	9th Meeting of the AEWA Technical Committee in Zagreb, Croatia from 20 - 23 April 2009	Zagreb, Croatia	2009
58	Migratory Soaring Birds. Inception Workshop, 28-30 April, 2009	Amman/Jordan	2009
59	ICC-MAB UNSECO Bureau Meeting, Paris, Jan 2010	Paris/ France	2010
60	The sixteenth meeting of the Advisory Committee for Biosphere Reserves from 27 through 29 January 2010 in Paris/France. These dates coincide with the Scientific Conference on Biodiversity which UNESCO has organized in the context of the International Year of Biodiversity (2010).	Paris/France	2010
61 L	The 6th Arab MAB Meeting and Training Workshop on the Implementation of Madrid action Plan, Beirut 11-13 May, 2010	Beirut/ Lebanon	2010
62 L	Training workshop on an environmental kit developed on the	Damascus/ Syria	2010

	initiative of MAB-UNESCO. Damascus, 2-4 Nov. 2010		
63	Experience sharing workshop of MEDPAN. organized in partnership with the APAL (Tunisian Coastal Protection and Planning Agency) and with the support of the RAC/SPA (Regional Activity Center for Specially Protected Areas). Korba. Tunisia. 12-14 December 2010.	Korba/ Tunisia	2010
64	General Assembly of the MedPAN network. 3rd General Assembly of the MedPAN organization on 15 December 2010 following the MedPAN workshop.	Korba/ Tunisia	2010
65	Meeting of the experts on MAB Biosphere Reserves and Earth Resources. 14 Feb. 2011	Paris- France	2011
66	The seventeenth meeting of the Advisory Committee for Biosphere Reserves February 2011 in Paris/France.	Paris/France	2011
67	Meeting of Experts of Biosphere Reserve for setting the criteria for Research MAB Sites. 21-22 Feb. 2011	Paris- France	2011
68	AEWA TC10 Meeting. Kenya, Naivasha. 12-16 Sep. 2011	Naivasha- Kenya	2011
69L	Regional Science and Technology Workshops organized by ICSU & UNESCO Regional Offices. Best practises in tackling new and emerging challenges. Cairo 11-14 Oct. 2011	Cairo/ Egypt	2011
70	Seventh meeting of the AD HOC Open-Ended Inter-Sessional working group on Article 8(j) and related provisions on biological diversity. 31/10/2011-4/11/2011.	Montreal-Canada	2011
71	Fifteenth meeting of the Subsidiary Body on Scientific, Technical and Technological Advice (the Subsidiary Body), 6/11/2011-11/11/2011.	Montreal-Canada	2011
72	The eighteenth meeting of the Advisory Committee for Biosphere Reserves February 2012 in Paris/France.	Paris/France	2012
73	2012 Forum of Marine Protected Areas (MPAs) in the Mediterranean and the MedPAN network being held from November 24th to 28th, 2012 in Antalya, Turkey.	Antalya/Turkey	2012
74	General Assembly of the MedPAN network. 5th General Assembly of the MedPAN organization on 29 Nov. 2012 following the 2012 MedPAN Forum.	Antalya/Turkey	2012
75	The Fundraising Training Workshop of IUCN for the Middle Eastern NGOs that are members of IUCN in Lebanon, Syria, Jordan and Palestine Authority.	Amman/Jordan	2013
76	International Workshop bringing together scientists and MPA practitioners. MEDPAN & WWF. 5 & 6 March 2013	Siracusa-Italy	2013
77	The nineteenth meeting of the Advisory Committee for Biosphere Reserves 11-13 March 2013 in Paris/France.	Paris/France	2013
78	Green Economy Workshop and Arab Coordinating Council meeting for Man and Biosphere Reserves. Dana, Moujeb-Jordan. 12-13 April 2013.	Dana, Moujeb	2013
79	INCAM Final Regional Conference. Endorsing ICZM & environmental objectives in the Mediterranean: Lessons learned from the FP7 INCAM Project. IZMIR/TURKEY, 15-16 May 2013	IZMIR/ Turkey	2013
80	25th Session of ICC MAB-UNESCO meeting at UNESCO HQ. 27-30 May 2013	Paris/ France	2013
81	First National Training workshop on upating NBSAP and 5NR to CBD, Muscat, MOECA, 3-5 September 2013	Muscat/Oman	2013
82	Second National Training workshop on upating NBSAP and 5NR to CBD, Muscat, MOECA, 1-3 December, 2013	Muscat/Oman	2013

83	The MedPan Review Marine Protected Areas 2013-2017 Strategy and IMPAC3 International Marine Protecte Areas Conference III, Marseille. October 22-27 October 2013.	Marseille/France	2013
84	Regional Conference on 5th NR preparation for MENA. Qatar, 14-17 December 2013	Doha/Qatar	2013
	ArabMAB Network meeting on Ecotourism in Arab Biosphere Reserves. Aghadir – Morocco, May 3-5, 2014.	Aghadir/Morocco	2014
	Training on Buisiness planning for Marine Protected Areas. MedPan, Corsica.	Corsica/France	2015
	Mediterranean Workshop on Conservation of Seabirds. BirdLife-Malta, Gozo Island. Malta. 23-25 November 2015.	Gozo/Malta	2015
	International Workshop on Conservation of Seabirds. BirdLife-International, Gozo Island. Malta. 26-28 November 2015.	Gozo/Malta	2015
	ArabMAB Network meeting on the Effective Management of Biosphere Reserves in Arab Countries. Algeria, 1-3 December 2015.	Algier/Algeria	2015

Important Local Symposium/ Conferences/ Workshops attended (L=Lecturer)			
1	Researches in Lebanon: Present and Horizons. Ministry of Higher Education: 27 May	Louisa University	1994
2	Medicinal Plants and Phytotherapy. CNRS/ Lebanese University/ Faculty of Pharmacy: 17 Nov.	Sin El Fil	1995
3. L	Biodiversity Project in Lebanon Ministry of Agriculture/ UNDP Bustan Hotel: 5,6,7 Dec.	Brummana	1995
4. L	Third Seminar on Scientific Researches Ministry of Higher Education/ NCSR Westhall/ AUB/: 4 Jul.	Beirut	1996
5. L	Biodiversity Project in Lebanon Ministry of Agriculture/ UNDP Bristol Hotel: 31 Jul.	Beirut	1996
6. L	The Environmental Crisis in Lebanon: Challenges and Alternatives. Lebanese Center for Policy Studies/ Commodore: 17/18 Jan.	Beirut	1997
7. L	Fourth Seminar on Scientific Researches Ministry of Higher Education/ NCSR Westhall/ AUB/: 4 Jul.	Beirut	1997
8	The first Training Workshop on Protected Areas Management. Ministry of Environment/ UNDP/ IUCN: 23-30 Oct.	Baakline/ Shouf	1997
9	The role of the university in diversity of community: case of Lebanon, Central Administration/ Lebanese university: 4,5,6 Feb.	Beirut	1998
10	First National Workshop on Biodiversity, Ministry of Environment/ UNDP Mariott Hotel: 19 Feb.	Beirut	1998
11. L	North Lebanon Workshop on Biodiversity. Ministry of Environment/ UNDP Balamand University: 19 Jun.	Balamand	1998
12. L	Bekaa Lebanon Workshop on Biodiversity. Ministry of Environment/ UNDP Chtaura Park Hotel: 8 Jul.	Chtaura	1998
13. L	South Lebanon Workshop on Biodiversity. Ministry of Environment/ UNDP, Chamber of Industry Saida: 31 Jul.	Saida	1998
14. L	Jabal Loubnan Workshop on Biodiversity. Ministry of Environment/ UNDP, Beit El Dine, Mir Amine Palace: 20 Aug.	Beit El Dine	1998
15	1er Colloque Franco-Libanais sur L'EAU ET LA SANTĒ. CNRS/SFM-Bir Hassan 15 Oct.	Beirut	1998
16	Workshop on the preparation of Environmental Activator for Young People. Ministry of Environment Antelias 23-24 Oct.	Antelias	1998
17	Second National Workshop on Biodiversity, Ministry of Environment/ UNDP Mariott Hotel, Beirut: 17 Nov.	Beirut	1998
18. L	Active Environmentalist Program, Fredrich Ebert, Qalamoun: 23 Apr.	Qalamoun	1999

19. L	Landscape Ecology: Principles and applications to the Mediterranean Region, MAICH/ Lebanese University: 28 Sep.	Ain Saada	1999
20	13th Scientific Meeting, Beirut: Cultural Capital of Arabic Countries, CNRS, LAU, Beirut: 2-4 Oct.	Beirut	1999
21. L	Role of Protected Areas in developping local communities, MOE, Palmere Hotel: 6 Oct.	Baalabek	1999
22. L	Preparation and management of environmental activities in schools, Environment and Development, GTZ, AUB: 22 Oct.	Beirut	1999
23. L	Preparation and management of environmental activities in schools, Environment and Development, GTZ: 29 Oct. 1999.	Hazmieh	1999
24. L	Preparation and management of environmental activities in schools, Environment and Development, GTZ: 5 Nov.	Deir El Qamar	1999
25. L	Preparation and management of environmental activities in schools, Environment and Development, GTZ: 12 Nov.	Saida	1999
26. L	Preparation and management of environmental activities in schools, Environment and Development, GTZ: 19 Nov.	Qalamoun	1999
27. L	Preparation and management of environmental activities in schools, Environment and Development, GTZ: 26 Nov.	Beqaa	1999
28. L	Fauna Monitoring Training Workshop, Greenline, EPC: 2 Dec.	Tripoli	1999
29. L	Fauna Monitoring Training Workshop, Greenline, Chouf Reserve: 4 Dec.	Chouf	1999
30. L	Fauna Monitoring Training Workshop, Greenline, Horj Ehden: 9 Dec.	Ehden	1999
31	First Workshop on Monitoring and Reporting. UN Bldg. Beirut: 6 Jan.	Beirut	2000
32	Second Workshop on Monitoring and Reporting. UN Bldg. Beirut: 13 Jan.	Beirut	2000
33. L	Workshop “Problems of the Environment”, MOE, Byblos sur mer: 19 Feb.	Byblos	2000
34	First Workshop on preparation of projects and Reporting: Microsoft Projects, UN Bldg. Beirut: 14 Mar.	Beirut	2000
35	Second Workshop on preparation of projects and Reporting: Microsoft Projects, UN Bldg. Beirut: 21 Mar.	Beirut	2000
36. L	The national symposium on Environment, tourism and 2YK, Centre de Presse Media. Ecotourism and Protected Areas, Century Park Hotel, Kaslik, 6 April.	Kaslik	2000
37	Conference finale : Observatoire de l’Environnement et du Developpement, Communaute Urbaine Al Fayhaa, Tripoli, Foire Internationale Rachid Karame, 8 April.	Tripoli	2000
38	Protected Areas Visitor Management Workshop,:18-22 April, Hotel La Mairie.	Ehden	2000
39. L	Sustainable Development, case study of Palm Islands Nature Reserve: 8 July. Hotel Byblos sur mer.	Byblos	2000
40. L	Restoration of marine protected areas, case study of Palm Islands Nature Reserve: 29 Oct.	Broummana	2000
41. L	Economic assessment of resources in marine protected areas, case study of Palm Islands Nature Reserve, Ehden: 4 Nov.	Ehden	2000
42. L	Workshop on Collaborative management of Protected areas, including Palm Islands Nature Reserve. Byblos: 14-17 Nov.	Byblos	2000
43. L	14th Science Meeting 2000. NCSR (Lebanese Council for Scientific Research) & LAAS (Lebanese Association for the Advancement of Science), AUB, Beirut, 23-25 Nov.	Beirut	2000
44. L	Workshop on Ecotourism in Protected Areas. Quality inn Tripoli: Dec.	Tripoli	2000
45. L	Institutional Strengthening of EIA in Metap Countries. METAP Workshop on Potential Contribution of Scientific NGOs to the Scientific aspects of Impact identification and Assessment. Phase II. Holiday Inn, Martinez, 24/1/2001.	Beirut	2001

46. L	Workshop on Ways of Cooperation between Ministry of Environment and NGOs., Rotana Hotel, Jefinor; 30/1/2001.	Beirut	2001
47. L	Eco-tourism Development in the Arab Middle Eastern Region, AFDC(Lebanon), RSCN(Jordan) and Heinz Seidel, AFDC, 25-28 Feb. Case Study from Palm Islands.	Ramlieh	2001
48. L	Workshop on hunting, AFDC, LEF, MOE, MOA and Heinz Seidel, AFDC, 1 March.	Ramlieh	2001
49. L	Workshop on hunting, AFDC, LEF, MOE, MOA and Heinz Seidel, AFDC, 24-25 March.	Ramlieh	2001
50. L	Seminar on Environment in Lebanon, UNDP, PARLIAMENT, Parliament, Beirut; Protected Areas and their needs for improvement. 7 June.	Beirut	2001
51. L	Workshop on the promotion of the environmental law implementation, The Law of hunting in Lebanon, Theory and application. Ministry of Environment, Ministry of Justice and Hans Seidel. Royal Park Hotel. 20/10/2001.	Ain Saada	2001
52	GEF Country Dialogue Workshop, Martinez Holiday Inn, 10-11/1/2002.	Beirut	2002
53. L	The birds of Lebanon, present status, conservation issues and comments on the new proposed hunting law in Lebanon. By G. Ramadan Jaradi, AUB, College Hall, B1, 15/1/2002.	Beirut	2002
54	Sustainable Development after Rio in Lebanon, Ministry of Environment, Ministry of Forein affaires, ESCWA, 17/1/2002.	Beirut	2002
55	Ecotourism National Action Plan Setting. Ministry of Environment, Ministry of Tourism, ESCWA, 23-24/1/2002.	Beirut	2002
56	National Workshop on Sustainable Development in preparation for the Second Earth Summit. NGOS and UNDP. ESCWA, 6 August.	Beirut	2002
57. L	Workshop on improving the mecanism of law enforcement, Ehden Country Club, 20-22 Sep. Lecture on Hunting, 20.9.02.	Ehden	2002
58. L	Natural and Cultural Heritage Interpretation and Evaluation Training Workshop. Al Shouf Cedars, Victoria, 25-27 Sep. Lecture on Birdwatching as a tool for interpretation and monitoring.	Barouk	2002
59. L	Ways of Cooperation between the Ministry of Environment and public administrations. 11-13 Jul. 03, W. Beqaa. Masharif Saghbine Hotel. L: Role of protected areas in developing local communities.	Saghbine	2003
60. L	Towards the application of Project-Law of Hunting in Lebanon. AFDC/ Parliament Environment Committee/ Hans Seidel. Parliament, Beirut: 24/11/03	Beirut	2003
61	Regional Technical Seminar “National Strategies and Policies for Wetlands” Beirut, 16-18 Feb. 2004	Beirut	2004
62	National Workshop on Economically Important Wild Plant Species (EIWPS), (MOE-LU-FAO), NCSR, 27-29 July 2004.	Beirut	2004
63. L	Workshop on Avian Influenza Preparedness In the Middle East, April 18-21, 2006	Beirut	2006
64	Workshop on SISPAM, NAPPA Draft Discussion, Ecodit-MOE, 20 April 06, Engineer’s Order, Bir Hassan, Beirut.	Beirut	2006
65. L	Training workshop for Veterinarians on Prevention and Early Detection of Highly Pathogenic Avian Influenza. Agriculture Research and Education Center-AUB Bekaa. 2 May 06	Beqaa	2006
66.L	Impact of Oil Spill on Palm Islands Nature Reserve. Case Study. Workshop on Peace for Protected Areas; MOE, Deir El Ahmar, 10/3/2007	Deir El Ahmar	2007
67.L	The 6th Arab MAB Meeting and Training Workshop on the Implementation of Madrid action Plan, Beirut 11-13 May, 2010	Beirut	2010
68. L	Regional workshop for Middle East and North Africa on Updating National Biodiversity Strategy and Action Plans. Beirut. Lebanon. 2-7	Beirut	2011

	May 2011.		
69. L	"Effective Management of Biosphere Reserves in the Arab Region" Workshop at Shouf Biosphere Reserve/ Maaser Park House/ Lebanon. May 16-21, 2011	Maaser Shouf	2011
70	Migratory Soaring Birds Project. Regional workshop on mainstreaming the conservation of MSBs into hunting sector along the Rift Valley/ Red Sea Flyway. Beirut, Commodore, 1-19/10/2011	Beirut	2011
71	Media and Random Hunting Workshop. Migratory Soaring Birds Project. Regional Beirut, Holiday Inn Dunes-Verdun, 25/11/2011	Beirut	2011
72L	Training Workshop on identification of game birds and globally threatened soaring birds for ISF & Forest guards. MoE-UNDP. Part1. June	Maasser El Shouf	2012
73L	Training Workshop on identification of game birds and globally threatened soaring birds for ISF & Forest guards. MoE-UNDP. Part1. June	Aammiq	2012
74L	Training Workshop on identification of game birds and globally threatened soaring birds for ISF & Forest guards. MoE-UNDP. Part1. June	Batroun	2012
75L	Training Workshop on identification of game birds and globally threatened soaring birds for ISF & Forest guards. MoE-UNDP. Part2. June	Zahleh	2012
76L	Training Workshop on identification of game birds and globally threatened soaring birds for ISF & Forest guards. MoE-UNDP. Part2. September	Batroun	2012
77L	Training Workshop on identification of game birds and globally threatened soaring birds for ISF & Forest guards. MoE-UNDP. Part2. October	Zahleh	2012
78L	Training Workshop on identification of game birds and globally threatened soaring birds for ISF & Forest guards. MoE-UNDP. Part2. October	Shouf	2012
79L	Training Workshop on identification of game birds and globally threatened soaring birds for ISF & Forest guards. MoE-UNDP. Part2. October	Aley	2012
80L	Bridging with Civil Society for a better Environment. Notre Dame University-Louaize (NDU), Biodiversity of PINR. Monday 14, January, 2013	Louaize	2013
81	Wind power and migratory birds Workshop. April 8th, 2013, SPNL at Holiday Inn Dunes, Beirut.	Beirut	2013
	Workshop on Monitoring at Anjar-Kfarzabad-Lebanon		
	Workshop on 5th NR to CBD-Lebanon		
	Workshop on 5th NR to CBD-Lebanon		
	Workshop NBSAP-Lebanon		
	Workshop NBSAP-Lebanon		
	Stopped recording local workshops since 2013		2013

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IMAD A. HAMZÉ

Senior economic development specialist with ample experience in Social Corporate Responsibly of Oil and Gas companies, MSME development, value chain analysis, rural banking, MSMEs finance, livelihood, job creation, and strategic planning in the Middle East, North Africa and South Asia. More than 20 years of international development and access to finance experience in Lebanon, the West Bank and Gaza, Jordan, Morocco, Yemen, Canada, Tunisia, and the Maldives. Skilled in the application of participatory methodologies to for designing, implementation, monitoring and evaluation of technical assistance projects with multilateral development organizations, and bid business corporations including OMV, USAID, the World Bank, International Finance Corporation, Asian Development Bank (ADB), the Economic and Social Commission for Western Asia, and UNICEF. Head of the Economic Development Unit of the OMV Skills to Succeed project in South Tunisia, Team Leader in Maldives for the ADB Private Sector Development Project. Experience in outreach to municipalities, rural communities, and local NGOs. Experience in linking local economic systems to international markets. Fluent in the evaluation of MSMEs, NGOs, finance organizations and their projects from a governance, strategic, procedural and policies points of view. Experience in the fields of strengthening rural communities and in designing sustainable solutions in the private, public, and NGO sector. Institutional strengthening, capacity building in developing countries, countries in transition, and in challenging security situations. Author/co-author of numerous case studies, papers, and presentations on rural banking, access to finance, and SME support programs. Holds Lebanese and Canadian citizenships. Fluent in English, Arabic, French, and Spanish.

EDUCATION

Masters of Science in Agricultural Economics and Development, McGill University, Canada, 1998. Emphasis in International Agricultural Trade and Policy.

Masters of Science of Agricultural Economics, American University of Beirut, Lebanon, 1991. Emphasis on Extension and Agricultural Development.

Post-Graduate Specialist Diploma in Rural Planning in Relation to the Environment, International Center for Advanced Agricultural Studies in the Mediterranean**,** Spain, 1987.

Bachelor in Science of Agriculture, American University of Beirut, Lebanon, 1986.

PROFESSIONAL HISTORY

09/2017 – up to date **Secours Islamique France. Food Security and Agricultural Livelihood Expert.** Project Design, recruitment of specialized team, linkages to local NGOs and municipalities, strategic planning, and direction. Engaging youth in local economic development activities to help in their resilience efforts. Vocational Training, life skills, access to grants and loans, tutoring, etc. Started developing several valuation chains in partnership with local environmental organizations to help develop livelihoods and at the same time preserve the natural resources. Put the project frame work, forms, project investment profile standards. Started several high impact micro-projects for farmers that reached 250 farmers in the first quarter of the project cycle.

06/2017 – up to date **Ibdaa Microfinance. Economic Development Expert.** Creating a business advisory services unit at IBDAA. Setting he manual of operations of the new department and helping in expanding the business of IBDAA besides the lending services they do.

03/2017 – 05/2017 **STTE, Economic Development and Livelihood expert with Palladium group.** Support in the research, meetings and writing of two proposals; one for a coming USAID local economic development project LED, and one for DFID to support Syrian refugees and host community job creation.

05/2016 – 03/2017 **Livelihood and Humanitarian support expert for refugees from Syria in Lebanon.** Solidar Suisse, Pursue, and Oxfam GB. Plan new interventions that are innovative in helping refugees and the host communities get a better income, and get engaged in the life of the community, public and business. Participate in all livelihood and relevant Lebanon refugees support working groups and coordination forums. Research issues and design solutions to help support refugees in the most appropriate ways possible Put strategies to help find jobs and support businesses that can recruit Syrian refugees and Palestinian refugees from Syrian and their host communities.

02/2013 – 3/2016 **Hilfswerk Austria International, Tunisia (OMV oil company CSR).** International Economic Development Expert. Was able to help the OIL and Gas Company OMV in creating an enabling environment in the governorate of Tataouine so the company can install its gas pipes from the desert towards the coastal refineries. I was able to engage the activists and rioters from the NGOs and active groups in the economic

development process of the Tataouine governorate. I helped in Job creation and development, grants management, finance to the main value chains in Agro-industry, arts and crafts, tourism, and other sub-sectors linked to the value chains of the mentioned sectors. Sectors working on are: Olive oil value chain, milk from goats, cows and camels value chain (market, cheese making, milk transport, storage, handling, quality, hygiene, health of animal etc), therapeutic herbs, forage production, composting, eco-tourism, arts and crafts, vocational training plus training on starting anew business and business planning. Work starts from planning up to access to finance and coaching. ***I won the OMV outstanding achievement award for economic development.***

06/2012- 01/2013 **Society for Development Studies. Lebanon.** Business Development Director, research, project design, fund raising, and recruiting.
Recently design the SMILEY Project that stands for Social Media Initiative for Lasting Empowerment of Youth. (1 million dollar project to help support youth in creating the needed change in the society to help them have a better life; that is better education, freedom, health etc I have also supported in proposal writing in cooperation of the Lebanese Association for Democratic Elections.

11/2010 – 05/2012 **Team Leader. Asian Development Bank, Maldives.** Partnership with the Bank of Maldives on micro lending where I served as head of the credit committee. Private Sector Development Program. Agriculture, Fisheries, fine arts. MSME support through Business Development Services, access to finance, access to markets, and access to grants. Was able to introduce new business models on the ground such as mud crabs, goat farming, fish processing, vegetables production in hydroponics and microfinance, training to 10,000 people, start 300 new SMEs. The project followed the value chain approach and I have developed several value chains in fishing, arts and crafts and in poultry. I published a study: The value chain of arts and crafts in Maldives; the case of Mat Weaving (Ministry of Economic development, January 2012).

2007 up to date **Chairman** of the board of the National Initiative for Advanced Agro-Industry in the *Jurd* (Semi Arid) regions (NIAAJ S.A.L.); a private company that works in agro industry, organic cheese making and eco-tourism. The company helped in developing the goat organic milk industry in Lebanon. It is the first farm to get organic certification for its goats, and milk from goats. I personally helped goat farmers groups, start a milk collection system, worked with reliable milk transporters, payments linked to milk testing and quality, plus supporting other rings in the value chain, specially the marketing aspect.

01/08/2010 – 10/2010 **ISAMI Project.** Prepare all legal, regulatory, organizational, and programmatic documents procedures and manuals for the launch of the "Islamic Sustainable and Accessible Microfinance Institution" ISAMI.

Board Member and fund raiser for the Lazzab eco-lodge. (www.lazzab.net). A breath taking relaxing lodge at 2000 meters above sea level between biblical Juniper trees at the cliffs of the mount of 40 in

North Beqaa above Hermel. Helped raise funds to build traditional guest rooms, train local guides on new hiking trails, nomadic tourism and hospitality. (UNOPS, NIAAJ S.A.L.).

25/06/2010 – 13/07/2010 Business Development, Proposal Writer/Program Design.
Yemen. Promoting Youth Civic and Economic Engagement in Yemen.
Save the Children. An USAID RFA.

05/2008– 03/2010 **Chief of Party and Country Director** Empowering Municipalities through Local Economic Development (Baladiyyat). Relief International. A USAID project to help engage municipalities in job creation through private public partnerships and through the value chain development of the following sub-sectors: Water and irrigation (rain harvesting in artificial pools, property right, water rights, water distribution), cows milk sector, mushroom production and marketing, green houses for vegetable production, packing house, quality seal for start food items, olive oil from pre-harvest, post harvest etc to the upgrade of Oil mills and HACCP training, Laying hens farming.
Worked with 130 municipalities in several regions of Lebanon. Project was able to create a new microfinance institution that served 100s of economically challenged individuals to start a new business or to expand and develop their existing business.. A small grants component has also helped create more than 200 new ventures that created jobs for more than 1000 people in rural areas. All projects are linked to the market. Moreover, I was able to engage commercial banks in lending the SMEs in rural areas and was able to involve a loan guarantee company in the scheme. I amslo managed and directed 4 more projects as country Director as follows:
CISCO ICT lending. Provided the market research, proposal design and contracted implanting partners in Lebanon. $2 million.
UNICEF. Wash and empowering teachers through technical know how on hygiene kits teaching and distribution plus school rehabilitation.
SKOLL Foundation. Project design in cooperation with 3 youth groups, youth centres setting, equipment and work plans.
Jameel Rida Said Foundation. Managed a University Student scholarship fund.

09/2008-11/2008 **Consultant for the Economic and Social Commission for Western Asia (ESCWA).** Prepare a Manual of Operations for the Business Development Centers that support M/SME start ups in Iraq.

10/2005- 02/2008 **Deputy Chief of Party, Senior Access to Finance Specialist, Deputy Country Representative,** Action for Sustainable Agro-Industry in Lebanon (ASAIL), ACDI/VOCA. A USAID project implemented under the Expanding Economic Opportunities (EEO) initiative.
Responsibilities Included:

- *Program design and Operational Oversight*: Worked on design on ASAIL project, the largest of the EEO implementing programs. Management (administration, financial, technical), donor and host

government liaison and reporting. Supervised 40 people employees, including component managers, field staff, M&E team, BDS team, Marketing team, Small ruminant animals component teams, Niche Lebanese food component team, pilot plants managers and staff, banks loan officers, and other support staff. I was able to develop the following sectors: Pomegranate Syrup, molasses, honey, other distillates, fruits and vegetables (dryers for tomatoes, apples, peaches, apricots, Jews mellow. Developed the baking sector (shelf life extension, packaging, recipes etc), and cheese sector plus). I designed three main food processing and testing plants for fruits and vegetables, distillates and essential oils and for baking. The pilot plants had food tasting panels, chemical and biological lab for testing sugar content, contamination, water retract-meters etc.). The labs also had packaging facility from canning, vacuum packing, modified atmosphere injections, shock freeze etc.

- *USAID project coordination:* Coordinated outreach to communities and 150 SMEs. Coordinated and integrated development activities to improve the agro-industry in Lebanon. Set up successful linkages of food processed products with international markets that resulted in an increase in exports worth millions of dollars. Studied the value chains of food processing and as a result established product development plants with biochemical labs to improve the quality and packaging of food processed goods to meet the needs of export markets. Formed the nucleus of a federation of microfinance and set the bylaws, which resulted in the distribution of more than $3 million of loans to farmers and sheep herders across Lebanon.
- *Sustainable local partnerships:* Supported community-based development by linking the public and private sectors, NGOs, farmers, and community-based organizations, municipalities, and associations.

11/94-10/04 **President/Business Development Director,** Society for Development Studies, Beirut, Lebanon. Technical NGO on development issues in Lebanon. Responsibilities Included:

- *Micro and SME development*: Evaluation, diagnosis, action plans, good governance, marketing, and technical assistance to upgrade products and service standards. Worked with enterprises dealing with cottage industries, rural tourism, and artisan revival, in addition to projects in cultural heritage preservation. Planned and implemented the first bird sanctuary in Lebanon.
- *Research:* Researched development topics pertinent to Lebanon, including milk production in Lebanon and its market and potential and the introduction of a new grape variety to Lebanon.
- *Awareness Raising:* Developed awareness workshops on environmental issues in Canada and the Middle East. Organized several fundraising events for development issues.

09/03-08/05 **Chief of Party,** Action for Strengthening Microfinance Associations (ASMA) project, Development Alternatives Inc. (DAI), Morocco. Managed the $2 million project and helped Microfinance associations

and banks establish new MIS and promote good governance. Responsibilities Included:

- *Project Coordination and Management:* Coordinated with MFIs, worked with them to raise funds, and successfully linked them with commercial banks to help them reach small enterprises. Added new products and services to benefit micro-enterprises and SMEs. Developed a program that provided more than 100 micro-enterprises with business development services and daily tutoring on quality and marketing to help them expand and grow to a viable level.

01/02 – 08/03 **Deputy Chief of Party/access to finance expert Jordan.** Working with Jordanian central Bank and MFIs to help duplicate their experience in the west Bank and Gaza. This is part of the AMIR project f USAID and West Bank and Gaza plus Jordan worked together on this initiative that supported the private sector in both countries.

01/01-08/03 **Senior Microfinance Specialist/Deputy Chief of Party,** Initiative for Sustainable and Accessible Microfinance Industry, Chemonics International, Inc. West Bank & Gaza Strip. Lead Regional Microfinance Specialist for the Palestinian Private Sector. Responsibilities Include:

- *Project Management and Team Leadership*: Provided direct technical and management oversight to the USAID-financed, $8 million microfinance industry building by supporting microfinance providers, both banks and NGOs. Led a team of domestic consultants to produce country studies, facilitate country workshops, and organize conferences on microfinance commercialization.
- *New Business Development*: Participated in new business development, including: identifying and tracking country projects, marketing and development; writing both technical and non-technical portions of proposals; recruiting or supervising recruitment of proposal personnel, and negotiating salary.
- *Training and Research*: Developed knowledge products and provided training related to rural and microfinance to staff at Chemonics and other microfinance development organizations. Presented public awareness campaigns, set training courses, provided oversight to studies and research, and initiated the founding of a Palestinian Small and Micro Finance Network.

5/00-12/00 **Resident Advisor**, DAI./IFC/World Bank. Microfinance project in the West Bank and Gaza. Responsibilities Included:

Team Leader: Team Leader and resident advisor to the Commercial Bank of Palestine. Restructured their micro-finance department and developed a strategic plan of action. Developed a comprehensive marketing strategy that included a public awareness campaign, done in cooperation with village councils.

2/00-4/00 **Deputy Chief of Party,** Chemonics International/USAID, West Bank and Gaza . Access to Finance to SMEs. Advisor to the Arab Bank and the Bank of Jordan. Responsibilities included: program design, planning, recruiting, evaluation, oversight, and training.

11/99-11/99 **Chief Consultant,** Quakers Peace and Service. Vocational Training Program. for Palestinian Refugee Camps, Lebanon. Responsibilities included: needs assessment, evaluation, and the development of a new strategic plan of action for SMEs development.

09/99-10/99 **Main Trainer and Coordinator**. Strategic Planning and Best Lending Practices. Workshop for Palestinian Refugee Camps' Microfinance Leaders, UNICEF, Lebanon.

05/99-10/99 **Consultant,** United Nations Economic and Social Commission for Western Asia. Assignments Included:

- Micro-finance and its impact on poverty in Lebanon
- Review and evaluation of the "Women's Micro-Industry Credit Program Unit" in Yemen
- Training of development agents in Community Development and proposal for fund raising

01/99-2/00 **Instructor**, Agricultural Economics and Development Department of the Schools of Agriculture and Food Science, American University of Beirut, Lebanon. Taught 2 courses in: Rural Social Systems and Agricultural Extension & Community Development. Courses included starting an NGO with the students and working in the field with fishermen communities, agricultural cooperatives, and with local village councils.

Instructor, Agricultural Research and Education Center (AREC), American University of Beirut (AUB), Lebanon. Responsibilities Included:
Development of Education Project: Strategized planning for developing 4 clusters of villages in the Beqa'a valley in Lebanon. Started a pilot educational project named "Learning by Doing" where students worked with local community committees of various villages in the Beqa'a Valley to assess their needs and come up with a plan of action and a fund raising proposal for improving life in these villages. The course exposed students to the real world of development, rural politics, organizational behavior, conflict resolution, and rural sociology.

02/99-03/99 **Access to Credit Specialist**, Consultant, The European Commission. Participated in a market study on the SME finance programs in Lebanon.

08/98-11/98 **SME Finance Training Specialist**, International Finance Corporation (IFC)/ World Bank/ DAI, Palestine. Coordinated a Micro-enterprise project in Palestine, coordinated training, and provided support to the Commercial Bank of Palestine in the area of Micro-lending.

01/96-08/98 **Economic Development Coordinator,** Canadian Arab Federation. Quebec, Canada. Coordinated several conferences and workshops, such as: "the new economic, political, and social reality of Canada."

06/93-02/94 **Senior Project Officer**, Centre d'étude arab pour le developpement (CEAD). Responsibilities Included:

- *Organization of conferences and development projects*: Researched, coordinated, planned, and followed up on several conferences and development projects, such as: "Economic Development and Investment in the Middle East."
- *Research*: Researched methods and resources on soil conservation, institution building, and Islamic Lending for Small Scale Enterprises.

06/89-02/93 **Senior Loan Officer /Acting manager (M/SME Department)**
Save the Children, Lebanon. Responsibilities Included:

- *Program Management and Loan Provision*: Managed an $8 million portfolio for the development of SMEs (agricultural, industrial, commercial) in Lebanon. Conducted feasibility studies of proposed and potential projects to be financed. Provided loans and technical assistance to target groups. Introduced "Islamic lending" to certain villages in Lebanon. Planned several cottage industry projects. Studied the credibility, character, cash flow, and collateral of prospective borrowers prior to loan approval. Assessed potential projects, and followed-up on project implementation during which technical assistance was provided when needed. Monitored the economic, social, and environmental sustainability of the projects. Supported the "credit section" of the International Fund for Agricultural development (IFAD) of the UN in their mission to Lebanon in 1992.

SELECTED PUBLICATIONS & PAPERS

Value Chain Analysis of arts and craft sector in Maldives- the case of Mats Weaving. Ministry of Economic Development web site (www.BDSC.com.mv), December 2011.

"Role of Microcredit in Poverty Alleviation: microcredit sector profile in Lebanon". Eradication Poverty Studies Series No. 12. United Nations Economic & Social Commission for Western Asia (UN-ESCWA). Beirut & New York. May 2000.

"Potential Agricultural Trade Following Peace in the Middle East: The Case of Syria and Israel". Masters of sciences thesis. McGill School of graduate studies, 1999.

"Agricultural Policies of Israel in the Occupied Territories". McGill University. May 1995.

"Land Titling and Credit Efficiency in the Developing Countries: The Case of Africa". Paper presented at McGill University. 1995.

"The Environmental Problems in Lebanon". Al Mustakbal Newspaper. Montreal, Canada. June 1994.

"Underdevelopment and Drugs: the Socio-economic impact of opium and hash cultivation in Lebanon. American University of Beirut. 1992.

"Agricultural Credit in Lebanon: Reality and Prospects". Central Bank of Lebanon. 1992.

“Food Security in the Kingdom of Saudi Arabia”. Paper Presented at AUB, 1991.

“The Other Face of Food Aid:. Scientific Horizons. Cyprus, 1987.

References

Upon request

Sara Hteit

Position Title and No.	Environmental Consultant
Name of Expert:	Sara Hteit
Date of Birth:	29th of August 1990
Country of Citizenship/Residence	Lebanese

Education:

Institution American University of Beirut, Lebanon
Date (year) to (year) 2015 to 2018
Degree or Diploma MS in Environmental Technology

Institution American University of Beirut, Lebanon
Date (year) to (year) 2008 to 2011
Degree or Diploma BS in Environmental Health and Minor in Public Health

Institution National Protestant College, Lebanon
Date (year) to (year) 1996 to 2008
Degree or Diploma Lebanese Baccalaureate in Life Science

Employment Record:

Date from – to	January 2014 – Present
Location	Beirut, Lebanon
Company	Sustainable Environmental Solutions - SES
Position	Environmental Consultant
Description	*HSE Auditing* ▪ Environmental Audit for a meat processing industry and slaughterhouse in Chweifat- Aley (-2017, Under preparation for SES, funded by Harkous Chicken Group S.A.R.L.): the industry is for the production of several meat processed products and slaughtering of chicken; conducted an HSE audit at the site including meetings and discussions with relevant employees, facility inspection, noise and wastewater sampling; ▪ Environmental Audit for Rotoflexopress company in Choueir- Mount Lebanon (2017, prepared for SES, funded by Rotoflexopress S.A.R.L.):

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	the industry is located in Choueir, Mount Lebanon and it is for the production and printing of different types of packages, labels and bags; assisted in conducting an HSE audit at the site including meetings and discussions with relevant employees, facility inspection, noise and testing of emissions from generator stacks; The project also included the development of an EMP and a timeframe for its implementation. ▪ Environmental Audit for a Chemical Manufacturing Facility in Taanayel- Bekaa (2016-2017, Under preparation for SES, funded by Ecotreat S.A.R.L.): the industry is located in Taanayel, Bekaa and it is for the production of different chemicals and assembly of water treatment systems; conducted an HSE audit at the site including meetings and discussions with relevant employees, facility inspection, noise and wastewater sampling; ▪ Environmental Audit for a Milk filtration industry in Jdita- Bekaa (2016-2017, Under preparation for SES, funded by Lebanon Fruit Juice Co. S.A.L.): the industry is located in Jdita, Bekaa and it is for the filtration of milk; conducted an HSE audit at the site including meetings and discussions with relevant employees, facility inspection, noise and wastewater sampling and testing of emissions from generator stacks; ▪ Environmental Audit for a Mayonnaise manufacturing industry in Mandara- Bekaa (2015, prepared for SES, funded by A-Z Manufacturing and Trading S.A.R.L.): the industry is located in Mandara, Bekaa and it is for the production of mayonnaise; conducted an HSE audit at the site including meetings and discussions with relevant employees, facility inspection, noise and wastewater sampling and testing of emissions from generator stacks; ▪ Environmental Audit for the construction premises of a floating barge in El Mina- Tripoli (2015, prepared for SES, funded by Beirut International Marine Industry and Commerce S.A.R.L.): the construction premises is located in El Mina, Tripoli and it is for the construction of the first floating barge in the world; conducted an HSE audit at the site including meetings and discussions with relevant employees, facility inspection, photographic documentation noise and testing of emissions from generator stacks; ▪ Environmental Audit for a steel product manufacturing industry (2014-2015, prepared for SES, funded by Profile Tic): the factory produces metallic products and is located in Taanayel, Bekaa; assisted

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	in conducting an HSE audit at the industry including meetings and discussions with relevant employees, facility inspection, photographic documentation, air, noise, water (domestic and drinking) and wastewater sampling, testing of emissions from generator stacks; ▪ Environmental Audit for a steel product manufacturing industry (2014, prepared for SES, funded by Dalal Steel Industries): the factory produces hangars, cranes, prefabricated houses, and other metallic products and is located in Taanayel, Bekaa; assisted in conducting an HSE audit at the industry including meetings and discussions with relevant employees, facility inspection, photographic documentation, air, noise, water (domestic and drinking) and wastewater sampling, testing of emissions from generator stacks; ▪ Environmental Audit for a cosmetics manufacturing facility (2014, prepared for SES, funded by ARD Cosmetics): the factory produces creams and lotions and is located in Tripoli, North Lebanon; conducted an HSE audit at the industry including meeting and discussion with the project owner, facility inspection, and photographic documentation and prepared the audit report; ▪ Environmental Audit for a concrete brick facility in Mdoukha (2014, Prepared for SES, funded by Mr. Khodor Mohammad): the factory produces concrete bricks, and creep stone and interlock bricks and is located in Mdoukha, Bekaa; reviewed the audit report prior to submission to the Ministry of Environment; ▪ Environmental Audit for a concrete brick facility in Racha (2014, Prepared for SES, funded by RFJ): prepared the audit report for a concrete brick facility in Racha, North Lebanon; ▪ Environmental Audit for a butane gas storage facility in Bint Jbeil Lebanon (2014, Prepared for SES, funded by Noor Station): assisted in conducting an HSE audit at the industry including meetings with the project owner and manager, facility inspection, and photographic documentation; *Environmental Impact Assessment* ▪ Environmental Impact Assessment for the installation and operation of several PV farms in Lebanon (2017, Under preparation for SES): preparing the EIA study which involved baseline characterization, environmental and socio-economic impacts identification, analysis of

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	alternatives as well as the elaboration of a HSE Management Plan with particular emphasis on air, wastewater and solid waste generation and management; ▪ Environmental Impact Assessment for the installation and operation of a wastewater treatment plant in Majdel Tarchich, Metn (2017, Under preparation for SES, funded by Municipality of Majdel Tarchich): preparing the EIA study which involved baseline characterization, environmental and socio-economic impacts identification, analysis of alternatives as well as the elaboration of a HSE Management Plan with particular emphasis on air, wastewater and solid waste generation and management; ▪ Environmental Impact Assessment for the construction and operation of Eden Bay Studio, Mousaytbeh (2017, Under preparation for SES, funded by Eden Bay Resort sal): preparing the EIA study which involved baseline characterization, environmental and socio-economic impacts identification, analysis of alternatives as well as the elaboration of a HSE Management Plan with particular emphasis on air, wastewater and solid waste generation and management; ▪ Environmental Impact Assessment for the installation and operation of an Infectious Healthcare waste treatment center in Bshamoun Specialty Hospital (2017, Under Preparation for SES, funded by Khayyat Med sarl): preparing the EIA study which involved baseline characterization, environmental and socio-economic impacts identification, analysis of alternatives as well as the elaboration of a HSE Management Plan with particular emphasis on air, wastewater and solid waste generation and management; ▪ Environmental Impact Assessment for the construction and operation of a beach resort in Kleileh, Tyre (2016-2017, Prepared for SES, funded by Mr. Mohmad Khodor Taleb): preparing the EIA study which involved baseline characterization, environmental and socio-economic impacts identification, analysis of alternatives as well as the elaboration of a HSE Management Plan with particular emphasis on air, wastewater and solid waste generation and management; ▪ Environmental Impact Assessment for the construction and operation of a new meat processing industry in Dibbiyeh, Chouf (2016-2017, Prepared for SES, funded by Al Taghziah): preparing the EIA study which involved baseline characterization, environmental and socio-

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	economic impacts identification, analysis of alternatives as well as the elaboration of a HSE Management Plan with particular emphasis on air, wastewater and solid waste generation and management; ▪ Environmental Impact Assessment for the construction and operation of a new WWTP at SHD in Selaata, Lebanon (2015-2016, Prepared for SES, funded by SHD): assisted in preparing the EIA study which involved baseline characterization, environmental and socio-economic impacts identification, analysis of alternatives as well as the elaboration of a HSE Management Plan with particular emphasis on air, wastewater and solid waste generation and management; ▪ Scoping report for Environmental Impact Assessment for the construction and operation of a solid waste management center at Jesuit Fathers domain in Taanayel,- Bekaa (2015-2016, prepared for SES, funded by arcenciel): prepared the scoping report for the EIA study which involved baseline characterization, environmental and socio-economic impacts identification; *Initial Environmental Examination* ▪ Initial and Environmental Examination for the construction and operation of Elderly House at Chartoun- Aley (2017, under preparation for SES, funded by Ictos): prepared the IEE study which involved baseline characterization, environmental and socio-economic impacts identification, as well as the elaboration of a HSE Management Plan with particular emphasis on air and solid waste generation and management; ▪ Initial and Environmental Examination for the construction and operation of gas filling station at Bshamoun- Aley (2017, prepared for SES, funded by Mr. Zouheir Bahlawan): prepared the IEE study which involved baseline characterization, environmental and socio-economic impacts identification, as well as the elaboration of a HSE Management Plan with particular emphasis on air and solid waste generation and management; ▪ Initial and Environmental Examination for the construction and operation of cattle farm at Zahle- Bekaa (2017, Prepared for SES, funded by Taanayel Farms): preparing the IEE study which involved baseline characterization, environmental and socio-economic impacts identification, as well as the elaboration of a HSE Management Plan

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	with particular emphasis on air and solid waste generation and management; ▪ Initial and Environmental Examination for the construction and operation of Cosmetic Soap, Detergents, Cleansing and Polishing Powder Factory in Haouch El Oumaraa (2016-2017, prepared for SES, funded by Abou Obeid Trading): managed and reviewed the IEE study which involved baseline characterization, environmental and socio-economic impacts identification, as well as the elaboration of a HSE Management Plan with particular emphasis on air and solid waste generation and management; ▪ Initial and Environmental Examination for the construction and operation of gas filling station at Marouaniyeh- Saida (2016, prepared for SES, funded by Mr. Hussein Amin Ghaddar): prepared the IEE study which involved baseline characterization, environmental and socio-economic impacts identification, as well as the elaboration of a HSE Management Plan with particular emphasis on air and solid waste generation and management; ▪ Initial and Environmental Examination for the construction and operation of cattle farm at Saraain Et Tahta- Bekaa (2016, Prepared for SES, funded by Dr. Alaa Jalous): preparing the IEE study which involved baseline characterization, environmental and socio-economic impacts identification, as well as the elaboration of a HSE Management Plan with particular emphasis on air and solid waste generation and management; ▪ Initial and Environmental Examination for the construction and operation of cattle farm at Ain Aata- Rachaya (2016, prepared for SES, funded by Hay Day): prepared the IEE study which involved baseline characterization, environmental and socio-economic impacts identification, as well as the elaboration of a HSE Management Plan with particular emphasis on air and solid waste generation and management; ▪ Initial and Environmental Examination for the construction and operation of gas filling station at Froun- Bint Jbeil (2016, prepared for SES, funded by Ms. Randa Ahmad Haidar): prepared the IEE study which involved baseline characterization, environmental and socio-economic impacts identification, as well as the elaboration of a HSE

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	Management Plan with particular emphasis on air and solid waste generation and management; ▪ Initial and Environmental Examination for the construction and operation of gas filling station at Kharnoubeh- Akkar (2015, Prepared for SES, funded by Eng. Mohamad Affan): prepared the IEE study which involved baseline characterization, environmental and socio-economic impacts identification, as well as the elaboration of a HSE Management Plan with particular emphasis on air and solid waste generation and management; ▪ Initial and Environmental Examination for the construction and operation of HYPCO gas filling station at Jiyeh- Mount Lebanon (2015, Prepared for SES, funded by HYPCO sal): prepared the IEE study which involved baseline characterization, environmental and socio-economic impacts identification, as well as the elaboration of a HSE Management Plan with particular emphasis on air and solid waste generation and management; ▪ Initial and Environmental Examination for Sour Wastewater Collection System Extension in Caza of Tyre- South Lebanon (2015, Prepared for SES, funded by Hydra Engineering Group SAL): prepared the IEE study which involved baseline characterization of the 15 towns, environmental and socio-economic impacts identification, as well as the elaboration of a HSE Management Plan with particular emphasis on air, wastewater and solid waste generation and management; ▪ Initial and Environmental Examination for the construction and operation of a new gas filling station at Btouratij- North Lebanon (2015, Prepared for SES, funded by Mr. Alfred El Chami): prepared the IEE study which involved baseline characterization, environmental and socio-economic impacts identification, as well as the elaboration of a HSE Management Plan with particular emphasis on air and solid waste generation and management; ▪ Initial and Environmental Examination for the operation of a new chemical manufacturing facility in Ghazieh- South Lebanon (2015, Prepared for SES, funded by Tamar Lebanon): prepared the IEE study which involved baseline characterization, environmental and socio-economic impacts identification, as well as the elaboration of a HSE Management Plan with particular emphasis on air, wastewater and solid waste generation and management;

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	▪ Initial and Environmental Examination for the construction and operation of a new filling gas station at Hraiche- North Lebanon (2014, Prepared for SES, funded by Charles Semaha): prepared the IEE study which involved baseline characterization, environmental and socio-economic impacts identification, as well as the elaboration of a HSE Management Plan with particular emphasis on air and solid waste generation and management; ▪ Initial Environmental Examination for the construction and operation of the eco-villages touristic development at Kawkaba, Bekaa (2014, Prepared for SES, funded by Caritas): reviewed the IEE report prior to submission to the Ministry of Environment; ▪ Initial and Environmental Examination for the construction and operation of a new filling gas station at Taire- Bint Jbeil (2014, Prepared for SES, funded by Abd El-Rida Shaitou): prepared the IEE study which involved baseline characterization, environmental and socio-economic impacts identification, as well as the elaboration of a HSE Management Plan with particular emphasis on air and solid waste generation and management; ▪ Initial Environmental Examination for a Steel Product Manufacturing industry, Taanayel, Bekaa (2014, Prepared for SES, funded by Dalal Steel Industries): assisted in the preparation of the IEE study which involved baseline characterization, environmental and socio-economic impacts identification, as well as the elaboration of a HSE Management Plan with particular emphasis on air and solid waste generation and management; ▪ Initial Environmental Examination for a New Steel factory, Taanayel, Bekaa (2014, Prepared for SES, funded by Hochaymeh Steel Factory): reviewed the IEE study prior to submission to the Ministry of Environment; *Solid waste Management Studies* ▪ Solid Waste Awareness Campaign in Union of Jezzine Municipalities (2014-2016, for SES, Funded by European Inion Delegation to Lebanon): assisted in the implementation of the project in the Union of Jezzine Municipalities and coordinated with the different municipalities (45 municipalities) to implementing the sorting at

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	source campaign. Prepared the different narrative reports for the European Union delegation to Lebanon. ▪ Assessment of Solid waste management system (2014, prepared for SES, funded by UNICEF): the study includes 24 municipalities in Akkar and Bekaa; assisted in conducting field visits for the municipalities, including meetings and discussions with the municipality members, preparing assessment reports, and bills of quantities. *Environmental studies* ▪ Environmental Compliance Guidelines for the meat processing industry, cattle farms, dairy industries and slaughterhouses (2015-2016, prepared for the Lebanese Ministry of Environment, funded by World Bank): assisted in the development of the environmental compliance guidelines for the four sectors. ▪ Environmental Examination for the installation of water network in Taalabaya- Bekaa (2015, Prepared for SES, funded by W.E.T. SAL): prepared the IEE study which involved baseline characterization, environmental and socio-economic impacts identification, as well as the elaboration of a HSE Management Plan with particular emphasis on air, wastewater and solid waste generation and management; ▪ Pilot procedure for co-firing with refuse derived fuel at a cement production company (2014, Prepared for SES, funded by Cimenterie Nationale): assisted in the preparation of a proposal for undertaking quality assurance / quality control procedures to ascertain the suitability of RDF production and use at CN all while managing potential risks on the environment and on the industrial process. ▪ Environmental Assessment of cooling alternatives to be applied in the Kingdom of Saudi Arabia (2014, Prepared for SES, Funded by Booz): assisted in conducting an indicator-based environmental assessment for twelve different cooling technologies with the intent to identify the one which is most suitable to apply in the context of Saudi Arabia;

Date from – to	February 2012 – December 2013
Location	Doueir, Nabatieh- Lebanon
Company	Municipality of Doueir
Position	Technical Coordinator

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Description	▪ Solid Waste Awareness Campaign in Doueir (2012-2013, for Municipality of Doueir, Funded by European Inion Delegation to Lebanon): assisted in the implementation of the project in Doueir, coordinated with the citizens (especially women) and schools to raise awareness on solid waste management in the village, responsible for the following: ▪ Preparation of narrative and financial reports for the European Union delegation to Lebanon, ▪ Preparation of an environmental guide which tackled different subjects on solid waste management especially composting in households. ▪ Development of a survey to determine the population's knowledge and attitude towards solid waste management and the environmental problems that they are facing. 120 household were chosen randomly in order to fill the questionnaire; ▪ Organization of different workshops and a conference in the village on solid waste management; and ▪ Purchase of solid waste managemnet machinery and equipmnet (street sweeper, bobcat, pickup, street bins and sorting bins)

Date from – to	2011-2011
Location	Beirut, Lebanon
Company	American University of Beirut (AUB)
Position	Surveyor
Description	▪ Assessment of the Physical Environment of the Schools in the Palestinian camps (2011, For the Faculty of Health Sciences in AUB): filled surveys on the physical environment of different schools that are built by UNRWA in the Palestinian refugee s Camps all around Lebanon.

Date from – to	2010-2011
Location	Beirut, Lebanon
Company	American University of Beirut (AUB)

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Position	Research Assistant
Description	▪ Assessment of the Water Quality of the Litani River (2011, For the Department of Environmental Health in AUB): examined the quality of water samples from different locations of the river.

Publications

- Hteit, S. at al. 2017. Initial Environmental Examination for the Construction and Operation of gas filling station, Bashamoun, Aley. Prepared by Sustainable Environmental Solutions (SES).
- Hteit, S. at al. 2016-2017. Environmental Impact Assessment for the construction and operation of a new meat processing industry in Dibbiyeh, Chouf. Prepared by Sustainable Environmental Solutions (SES).
- Hteit, S. at al. 2016. Environmental Impact Assessment for the Construction and Operation of Resort in EL-Kleileh-Tyre. Prepared by Sustainable Environmental Solutions (SES).
- Hteit, S. at al. 2016. Initial Environmental Examination for the Construction and Operation of gas filling station, Marouaniyeh, Saida. Prepared by Sustainable Environmental Solutions (SES).
- Hteit, S. at al. 2016. Initial Environmental Examination for the Construction and Operation of Cattle Farm, Saraain Et Tahta, Baalbek. Prepared by Sustainable Environmental Solutions (SES).
- Hteit, S. at al. 2016. Initial Environmental Examination for the Construction and Operation of gas filling station, Froun, Bint Jbeil. Prepared by Sustainable Environmental Solutions (SES).
- Hteit, S. at al. 2016. Initial Environmental Examination for the Construction and Operation of HAYDAY: Cattle Farm, Ain Aata, Rachaya. Prepared by Sustainable Environmental Solutions (SES).
- Hteit, S. at al. 2015. Initial and Environmental Examination for the installation of water network in Taalabaya- Bekaa. Prepared by Sustainable Environmental Solutions (SES).
- Hteit, S. at al. 2015. Initial Environmental Examination for the Construction and Operation of gas filling station, Kharnoubeh, Akkar. Prepared by Sustainable Environmental Solutions (SES).
- Hteit, S. at al. 2015. Environmental Audit for A-Z Manufacturing & Trading SARL: Facility for the production of Mayonnaise in Mandara- Bekaa. Prepared by Sustainable Environmental Solutions (SES).
- Hteit, S. at al. 2015. Environmental Audit for Construction Premises of a Floating Barge in ElMina, Tripoli. Prepared by Sustainable Environmental Solutions (SES).

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- Hteit, S. at al. 2015. Initial Environmental Examination for the Construction and Operation of HYPCO gas filling station, Jiyeh, Mount Lebanon. Prepared by Sustainable Environmental Solutions (SES).
- Hteit, S. at al. 2015. Initial Environmental Examination for Sour Wastewater Collection System Extension in Tyre- South Lebanon. Prepared by Sustainable Environmental Solutions (SES).
- Hteit, S. at al. 2015. Initial Environmental Examination for the Construction and Operation of new gas filling station, Btouratij, North Lebanon. Prepared by Sustainable Environmental Solutions (SES).
- Hteit, S. at al. 2015. Initial Environmental Examination for the Operation of a new chemical manufacturing facility, Ghazieh, South Lebanon. Prepared by Sustainable Environmental Solutions (SES).
- Hteit, S. at al. 2015. Environmental Audit for Profile Tic Steel Industry in Taanayel. Prepared by Sustainable Environmental Solutions (SES).
- Hteit, S. at al. 2014. Initial Environmental Examination for the Construction and Operation of a new filling gas station, Hraiche, North Lebanon. Prepared by Sustainable Environmental Solutions (SES).
- Hteit, S. at al. 2014. Environmental Audit for Dalal Steel Industry in Taanayel. Prepared by Sustainable Environmental Solutions (SES).
- Hteit, S. at al. 2014. Environmental Audit for a Cosmetics Manufacturing Industry in Tripoli. Prepared by Sustainable Environmental Solutions (SES).
- Hteit, S. at al. 2014. Initial Environmental Examination for the Construction and Operation of a new filling gas station, Taire, Bint Jbeil. Prepared by Sustainable Environmental Solutions (SES).
- Hteit, S. at al. 2014. Environmental Audit for a concrete brick facility in Mdoukha, Rachaya. Prepared by Sustainable Environmental Solutions (SES).
- Hteit, S. at al. 2014. Environmental Audit for a concrete brick facility in Racha, Batroun. Prepared by Sustainable Environmental Solutions (SES).
- Hteit, S. and Hotait, H. 2013. Environmental Management of Solid Waste and the Production of Compost from Organic Waste. Prepared by Green Doueir Project.

Trainings

ISO 22000:2005 Essentials organized by SMG s.a.r.l. -Sustainable Management Group (SMG, Beirut, July 2013).

Level 3 HACCP in Manufacturing organized by Boecker (Boecker, Beirut, June 2013).

Language Skills

Language	Reading	Speaking	Writing
Arabic	1	1	1

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English	1	1	1
French	5	5	5

Expert's contact information:

E-mail:shteit@ses-lb.com; Phone: 00961-70-781997

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Leïla Morcos

Position Title and No.	Junior Environmental Consultant
Name of Expert:	Leïla Morcos
Date of Birth:	20th of January 1994
Country of Citizenship/Residence	Lebanese

Education:

Institution Lebanese University, Faculty of Sciences – section II, Lebanon
Date (year) to (year) 2014 to 2016
Degree or Diploma MS in Expertise and treatment in Environment

Institution Lebanese University, Faculty of Sciences – section II, Lebanon
Date (year) to (year) 2011 to 2014
Degree or Diploma BS in General Chemistry

Institution Official College of Antelias, Lebanon
Date (year) to (year) 2008 to 2011
Degree or Diploma Lebanese Baccalaureate in Life Science

Employment Record:

Date from – to	August 2016 – Present
Location	Beirut, Lebanon
Company	Sustainable Environmental Solutions – SES
Position	Junior Environmental Consultant
Description	*HSE Auditing* ▪ Environmental Audit of Organic, a fertilizer blending facility at Haouch El Oumaraa – Bekaa (prepared for SES, funded by Organic) Implemented an HSE audit at Organic consistent with the 2016 guidelines of the Ministry of Environment regarding environmental audit reports (Decision 189/1 of 2016). The facility mixes existing fertilizers into specific custom-made blend.

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	▪ Environmental Audit of C-delights Company for the production premium cuts and catering, Chekka – North Lebanon (prepared for SES, funded by C-delights) Implemented an HSE audit at C-delights consistent with the 2016 guidelines of the Ministry of Environment regarding environmental audit reports (Decision 189/1 of 2016). The facility produces a range of pastries, cold cuts and ready to serve meals for takeaway and big dinners and events. *Environmental Impact Assessment* ▪ Environmental Impact Assessment for solid waste management facility in Kfardebian, Mount Lebanon (On-going, prepared for SES, funded by Bureau d'Etudes Alain Joseph et Associes) SES was rewarded by Bureau d'Etudes Alain Joseph et Associes the development of an EIA study for the construction and operation of a new solid waste management facility in Kfardebian, Mount Lebanon. The facility can treat up to 200 tons/day of domestic solid waste and will serve several municipalities of the Metn and Keserwan Cazas. The process inside the facility is based on manual and mechanical sorting followed by additive assisted and mechanical aerobic digestion using latest advanced technologies. The project also includes a space for hydroponic agriculture, an eco-friendly restaurant and a yard for cultural events which will host concerts and farmers' markets. ▪ Environmental Impact Assessment for the proposed Jounieh Touristic Cruise Port (On-going, prepared for SES, funded by the Ministry of Public Works and Transport) Implementing in partnership with Seatec an EIA study for the touristic port of Jounieh. The project is divided into two parts: the cruise port (where up to 5000 passenger cruise ships will berth) and the marina (where up to 400 smaller boats and yachts will berth), in addition to 4 parking lots, the harbor Master and the terminal building. ▪ Environmental Impact Assessment for the proposed asphalt and ready mix concrete plant for Geitani Ekhwan, Mejdlaya, Zgharta (On-going, prepared for SES, funded by Geitani Ekhwan) Developing an EIA study for a proposed asphalt and ready mixed concrete production facility with respective capacities of 140 tons/hour and 2 m3/hour, including the design of the most appropriate air pollution control system.

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	Initial Environmental Examination ▪ Initial Environmental Examination for the construction and operation of Cosmetic Soap, Detergents, Cleansing and Polishing Powder Factory in Haouch El Oumaraa (2016-2017, prepared for SES, funded by Abou Obeid Trading): managed and reviewed the IEE study which involved baseline characterization, environmental and socio-economic impacts identification, as well as the elaboration of a HSE Management Plan with particular emphasis on air and solid waste generation and management; ▪ Initial Environmental Examination for the construction and operation of a refrigerator truck assembly factory at Al Hadath- Beirut (2016, prepared for SES, funded by Farjallah trading company): prepared the IEE study which involved baseline characterization, environmental and socio-economic impacts identification, as well as the elaboration of a HSE Management Plan with particular emphasis on air and solid waste generation and management.

Date from – to	February 2016 – August 2016
Location	Beirut, Lebanon
Company	Sustainable Environmental Solutions – SES
Position	Freelance Junior Environmental Consultant
Description	*Initial Environmental Examination* ▪ Initial Environmental Examination for the construction and operation of a Touristic residential project in Ehmej (2016, prepared for SES, funded by Jean El Khoury development): managed and reviewed the IEE study which involved baseline characterization, environmental and socio-economic impacts identification, as well as the elaboration of a HSE Management Plan with particular emphasis on air and solid waste generation and management; *Environmental Audit*

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	▪ Environmental Audit for a Infectious Health Care Waste facility in Jisr El Wati- Mount Lebanon (2016, prepared for SES, funded by Arc en ciel): the industry is located in Mandara, Bekaa and it is for the treatment of infectious health care waste; conducted an HSE audit at the site including meetings and discussions with relevant employees, facility inspection, noise and wastewater sampling and testing of emissions from generator stacks; ▪ Environmental Audit for a frozen pre-fried potato manufacturing industry in Ansariyeh- Saida (2016, prepared for SES, funded by Tayyebat): the industry is located in Ansariyeh, Saida and it is for the production of frozen pre-fried potato; conducted an HSE audit at the site including meetings and discussions with relevant employees, facility inspection, noise and wastewater sampling and testing of emissions from generator stacks;

Date from – to	July 2015 – August 2015
Location	Kaslik, Lebanon
Company	V4Advisors
Position	Intern
Description	▪ Checking existing platforms ▪ Suggesting optimization steps to improve online platform ▪ Procuring information about standards and references

Date from – to	July 2013 – August 2013
Location	Antelias, Mount Lebanon - Lebanon
Company	Pointure
Position	Saleswoman
Description	▪ Organization of the items to be sold ▪ Customers/management contact ▪ Phone orders

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Date from – to	August 2011- October 2011
Location	Mazraat Yachouh, Mount Lebanon Lebanon
Company	Mallah Bookstore
Position	Saleswoman
Description	▪ Management of the office and school books ▪ Customer services

Date from – to	July 2011
Location	Mtayleb, Mount Lebanon Lebanon
Company	Sketch
Position	Saleswoman
Description	▪ Organization of the items to be sold ▪ Customers/management contact

Publications

- Morcos, L. at al. 2016. Initial Environmental Examination for the Construction and Operation of the "Iceberg" refrigerated truck bodies' assembly factory in Hadath-Beirut. Prepared by Sustainable Environmental Solutions (SES).
- Morcos, L. at al. 2016. Initial Environmental Examination for the Construction and Operation of the "Abou Obeid Trading" liquid soap and detergents facility in Haouch El Oumaraa-Zahle. Prepared by Sustainable Environmental Solutions (SES).

Language Skills

Language	Reading	Speaking	Writing
Arabic	1	1	1
English	1	1	1
French	1	1	1

Expert's contact information:

E-mail:lmorcos@ses-lb.com; Phone: 00961-76-830360

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Summary in English of the letter of response of Ministry of Environment on scoping report:

The scoping report is approved with a note on the necessity of addressing the comments of the reviewing committee outlined in table below and ensuring compliance with the following:

- Form attached with the scoping letter
- Lebanon's strategic environmental assessment study for the renewable energy sector.
- Letter of Ministry of Environment to Minister of Energy and Water no. 14175/B 2017 dated 19/12/2017
- Guideline report for environmental impact assessment for wind farm developments prepared by CEDRO

Required information	Required clarification	Reason
Background information	Include in ESIA relevant documents required in Decision 9/1 of 2014 and rental agreement for project area	The documents were not included in scoping report
Policy legal and institutional framework	Double check the date of Decree no 810 (amendment of Decree 3750 dated 22/6/2016)	There is a mistake in the date of the Decree
Environmental management plan	Include in ESIA emergency plans for the management of earthquakes, fires, storms and lightnings	Not included

Matters that have been scoped out during the scoping phase:

A preliminary assessment of expected environmental impacts was performed as part of the scoping report development and the following impacts were scoped out with the understanding that they are expected to have negligible significance:

- Noise and vibration impacts during construction and decommissioning phases
- Impact of solid waste and loss of vegetative cover during construction phase
- Visual impact from storage of aggregate materials, construction equipment, excavation waste during construction phase
- Visual impact from onsite temporary storage of solid waste during decommissioning phase
- Pressure on existing solid waste management infrastructure in the study area during construction and operation phases

الجمهورية اللبنانية
وزارة البيئة

الوزير

رقم التسجيل: ١٩٧/ب/٢٠١٨ **بيروت، في** ٢١/١/٢٠١٩

جانب شركة Sustainable Akkar SAL
Helo vision bldg.، ط٤، سن الفيل
هاتف: ٠١/٣٧٤٢٨٧

الموضوع: موقف وزارة البيئة من دراسة تقييم الأثر البيئي العائد لمشروع إنشاء مزرعة رياح في منطقة جبل أكروم العقارية – محافظة عكار.

المرجع:
- القانون رقم ٤٤٤ تاريخ ٢٠٠٢/٧/٢٩ (حماية البيئة)
- القانون رقم ٦٩٠ تاريخ ٢٠٠٥/٨/٢٦ (تحديد مهام وزارة البيئة وتنظيمها)
- المرسوم رقم ٢٢٧٥ تاريخ ٢٠٠٩/٦/١٥ (تنظيم الوحدات التابعة لوزارة البيئة وتحديد مهامها وملاكها وشروط التعيين الخاصة في بعض وظائفها)
- المرسوم رقم ٨٦٣٣ تاريخ ٢٠١٢/٨/٧ (أصول تقييم الأثر البيئي)
- قرار وزير البيئة رقم ١/٢٦١ تاريخ ٢٠١٥/٦/١٢ (آلية مراجعة تقارير تحديد نطاق تقييم الأثر البيئي وتقارير تقييم الأثر البيئي)
- قرار وزير البيئة رقم ١/١١١٤ تاريخ ٢٠١٨/١٢/١١ تأليف لجنة تقنية لمراجعة دراسة تقييم الأثر البيئي العائد لمشروع إنشاء مزرعة رياح في منطقة جبل أكروم العقارية – محافظة عكار
- دراسة تقييم الأثر البيئي العائد لمشروع إنشاء مزرعة رياح في منطقة جبل أكروم العقارية – محافظة عكار، المسجل في وزارة البيئة تحت الرقم ١٩٧/ب/٢٠١٨، تاريخ ٢٠١٨/١١/٢٦.

تحية طيبة،

بالإشارة الى الموضوع والمرجع المبيّنين أعلاه،

واستناداً إلى تقرير اللجنة التقنية المكلّفة بموجب قرار الوزير المبيّن أعلاه (مرفق ربطاً)؛

تفيد وزارة البيئة بضرورة تعديل التقرير المذكور وفق الملاحظات المبيّنة في تقرير اللجنة التقنية المرفق والإعادة إلى الوزارة للمراجعة حسب الأصول كما وضرورة الالتزام بدراسة التقييم البيئي الاستراتيجي المعدة من قبل وزارة البيئة الموجودة على الرابط التالي:

http://climatechange.moe.gov.lb/viewfile.aspx?id=249

وتفضلوا بقبول فائق الاحترام.

طارق الخطيب
وزير البيئة

مرفق ربطاً: تقرير اللجنة التقنية رقم ١٩٧/ب/٢٠١٨ تاريخ ٢٠١٩/١/٢٥
نسخة تبلغ الى:
- وزارة الداخلية والبلديات – المديرية الإدارية المشتركة
- محافظة عكار
- بلدية أكروم (فاكس: ٠٦/٨٥٠١٣٦)
- بلدية كفرتون (هاتف: ٠٣/٨٧٥٥٠٦)
- بلدية عندقت (فاكس: ٠٦/٨٨٠٣١٠)
- بلدية القبيات (فاكس: ٠٦/٣٥٢٠٠٥)
- المركز اللبناني لحفظ الطاقة LCEC
- الشركة الاستشارية ECODIT
- وزارة البيئة - مصلحة تكنولوجيا البيئة - مصلحة البيئة السكنية - مصلحة الدوائر الاقليمية والضابطة البيئية / الدائرة الاقليمية في لبنان الشمالي - أعضاء اللجنة التقنية

رقم التسجيل: ١٩٧/ب/٢٠١٨ بيروت، في ٢٠١٩/١/٢٥

تقرير فني

الموضوع: مراجعة دراسة تقييم الأثر البيئي العائد لمشروع إنشاء مزرعة رياح في منطقة جبل أكروم العقارية – محافظة عكار.

المرجع:	- القانون رقم ٤٤٤ تاريخ ٢٠٠٢/٧/٢٩ (حماية البيئة) - القانون رقم ٦٩٠ تاريخ ٢٠٠٥/٨/٢٦ (تحديد مهام وزارة البيئة وتنظيمها) - المرسوم رقم ٢٢٧٥ تاريخ ٢٠٠٩/٦/١٥ (تنظيم الوحدات التابعة لوزارة البيئة وتحديد مهامها وملاكها وشروط التعيين الخاصة في بعض وظائفها) - المرسوم رقم ٨٦٣٣ تاريخ ٢٠١٢/٨/٧ (أصول تقييم الأثر البيئي) - قرار وزير البيئة رقم ١/٢٦١ تاريخ ٢٠١٥/٦/١٢ (آلية مراجعة تقارير تحديد نطاق تقييم الأثر البيئي وتقارير تقييم الأثر البيئي) - قرار وزير البيئة رقم ١/١١١٤ تاريخ ٢٠١٨/١٢/١١ تأليف لجنة تقنية لمراجعة دراسة تقييم الأثر البيئي العائد لمشروع إنشاء مزرعة رياح في منطقة جبل أكروم العقارية – محافظة عكار - دراسة تقييم الأثر البيئي العائد لمشروع إنشاء مزرعة رياح في منطقة جبل أكروم العقارية – محافظة عكار، المسجل في وزارة البيئة تحت الرقم ١٩٧/ب/٢٠١٨، تاريخ ٢٠١٨/١١/٢٦.

بالإشارة الى الموضوع والمراجع المبينين أعلاه،

تفيد اللجنة بالملاحظات الآتية:

المعلومات المطلوبة في تقرير تحديد نطاق تقييم الأثر البيئي	المطلوب توضيحه	المبرّر
مقدمة	----	----
معلومات مرجعية	- ارفاق كافة المعلومات المرجعية المذكورة بقرار وزير البيئة رقم ١/٩ تاريخ ٢٠١٤/٦/٢٦ - تأمين التالي: ▪ موافقة المديرية العامة للطيران المدني ▪ نسخة عن موافقة التنظيم المدني ▪ موافقة كافة الجهات المعنية بشق الطرقات وتوسيعها بحسب الأصوال ▪ كافة الافادات العقارية/علم وخبر مصدقة بحسب الأصول لكافة الأراضي الواقعة ضمن المشروع مع موافقة البلديات المعنية ▪ لائحة بكافة الأراضي المستأجرة مع نموذج عن عقد الإيجار	- لم يتم ذكر ذلك - لم يتم ذكر ذلك
الاهداف	----	----
متطلبات تقييم الاثر البيئي	----	----
منطقة الدراسة	----	----
نطاق العمل	----	----
التقرير		
– إطار السياسات والاطر القانونية	- إضافة والالتزام بالقانون رقم ٧٨ تاريخ ٢٠١٨/٤/١٩ - إضافة والالتزام بالمرسوم رقم ٣٣٢٠ تاريخ ٢٠١٨/٦/٢٩ المتعلق بابرام الانضمام الى معاهدة	- تم ذكر الالتزام بمسودة قانون نوعية الهواء مع الإشارة الى أن القانون قد صدر - لم يتم ذكر ذلك

	المحافظة على الانواع المهاجرة من الحيوانات الفطرية (CMS) الموقعة في بون عام ١٩٧٩	
- المساعدة في التنسيق بين الإدارات الرسمية ومشاركة العامة	----	----
- وصف المشروع المقترح	- خريطة المشروع التي تبين مواقع كافة أقسام المشروع (مراوح، محطة التحويل، مبنى التشغيل والمراقبة...) وارفاقها بـ KMZ file - تحديد أنواع وأعداد ومواقع المراوح النهائية - تحديد مواقع الجسور التي سيتم تفكيكها وما إذا كان قد تم التنسيق مع المشاريع الأخرى بغية تفادي تفكيك الجسور عدة مرات - تحديد ما إذا كان سيتم فصل الأشرطة الكهربائية التابعة للمولدات الكهربائية على الطريق الذي سيتم استخدامه لنقل المراوح - تحديد سبب عدم اعتماد تقنية تذويب الجليد (De-Icing) خاصة وأن المشروع يقع في منطقة معرضة تساقط الثلوج وخطر الجليد	- لم يتم ذكر ذلك - لم يتم ذكر ذلك - لم يتم ذكر ذلك - لم يتم ذكر ذلك - لم يتم ذكر ذلك
- وصف البيئة المحيطة بالمشروع	- تزويد وزارة البيئة بالدراسة المتعلقة بمواقع كهوف الخفافيش وحركتها كاملة - تزويد وزارة البيئة بالدراسة المتعلقة بالزواحف والثديات كاملة - تحديد أعداد وأنواع وأماكن الأشجار التي سيتم قطعها وخطة التعويض البيئية وإرفاق موافقة وزارة الزراعة على قطع الأشجار	- ذكر في الصفحة ٥-٧٠ و ٨-٣ بأن دراسة الخفافيش تمت في فصل الشتاء فقط وبأنه سيتم استكمالها - ذكر في الصفحة ٨-٣ وبأنه سيتم استكمال دراسة الزواحف والثديات - الالتزام بالقوانين التي تمنع قطع أنواع مخصصة من الأشجار (قانون حماية الغابات اللبناني لعام ١٩٤٩ وقانون رقم ٨٥/ ١٩٩١المحافظة على الثروة الحرجية والأحراج)
- الأثار البيئية المحتملة للمشروع	- تحليل خطر تصادم الطيور بالمراوح (Collision Risk Analysis) - دراسة تأثير المشروع على المواقع المحمية المجاورة (محمية كرم شباط، محمية القموعية، غابة عندقت، ...) علماً أن واحدة من المراوح المقترحة تقع ضمن نطاق غابة عندقت المقترح إعلانها كمحمية طبيعية وأكثرية المواقع الأخرى على حدودها	- لم يتم ذكر ذلك - لم يتم ذكر ذلك

الجمهورية اللبنانية
وزارة البيئة

	- دراسة تأثير المشروع على مسار الطيور المهاجرة - التشدد على ضرورة توقيف المراوح عند تخطي وفيات الطيور المعدل المقبول به من وزارة البيئة (Bird Mortality Rate) - دراسة الاثر البيئي المتراكم الناتج عن المشاريع الثلاثة مجتمعة المذكورة في قرار مجلس الوزراء رقم ٤٣ تاريخ ٢٠١٧/١١/٢	- لم يتم ذكر ذلك - إن تخطي هذا المعدل قد تلزم أصحاب المشروع بتعويضات بحسب المادة ٥١ من قانون البيئة رقم ٢٠٠٢/٤٤٤ - لم يتم ذكر ذلك
- تحليل البدائل للمشروع	---	----
- خطة الإدارة البيئية	- تضمين الدراسة خطة تعويضات (Offsetting Plan) للضرر الذي سيلحق بالبيئة المحيطة بالمشروع - تعديل خطة الإدارة البيئية بما يتناسب مع ما ذكر أعلاه - دارسة آثار تفكيك المشروع (decommissioning) - تزويد وزارة البيئة بتقارير الخبراء النصف سنوية المتعلقة بالخفافيش والطيور والاجراءات التخفيفية التي تم اعتمادها - تزويد وزارة البيئة بالتقارير السنوية التي تبين على سبيل المثال وليس الحصر التالي: ▪ Electricity Production vs EDL Electricity Distribution ▪ Record of Electricity Counter ▪ Capacity factor ▪ Efficiency capacity factor ▪ Diesel consumption on site	- لم يتم ذكر ذلك - لم يتم ذكر ذلك - لم يتم ذكر ذلك - لم يتم ذكر ذلك

بناء على ما تقدم، تقترح اللجنة التقنية استكمال النقاط الواردة أعلاه من خلال تعديل التقرير المذكور والإعادة إلى الوزارة حسب الاصول **كما وتؤكد على ضرورة الالتزام:**

١- الاستمارة المرفقة بالتقرير (ملحق رقم ١)

٢- بدراسة التقييم البيئي الاستراتيجي المعدة من قبل وزارة البيئة الموجودة على الرابط التالي:
http://climatechange.moe.gov.lb/viewfile.aspx?id=249

٣- كتاب وزارة البيئة إلى معالي وزير الطاقة والمياه رقم ١٤١٧٥/ب٢٠١٧ تاريخ ٢٠١٧/١٢/١٩

٤- دراسة الأثر البيئي التوجيهية المعدة من قبل CEDRO الموجودة على الرابط التالي:
https://tinyurl.com/yb5vcwry

أعضاء اللجنة:

الإسم	المنصب	الوحدة	الإمضاء
م. نتالي كرم	رئيسا	مصلحة تكنولوجيا البيئة	
م. جميلة الهادي	عضوا مقررا	مصلحة البيئة السكنية	
أ.تجاف جرجس	عضوا	مصلحة الموارد الطبيعية	

الجمهورية اللبنانية
وزارة البيئة

WIND ENERGY DEVELOPMENTS
(ملحق رقم ١)

Recommendation / Mitigation Measure	Yes/No	Comments
Wind farms are located outside Nature Reserves and their 500 m buffer zones		
Wind farms are located outside Important Birds Areas		
Wind farms are located in areas with a low incidence of fog and mist		
Wind farms are installed at a minimum distance from residential areas/sensitive receptors (e.g. 500- 700 m depending on the size of the turbines)		
Wind farms are at a minimum distance of 200 m from roads		
Analysis of alternatives considers different sites within the intended development area and demonstrates that selected site has least impacts on avifauna		
When Wind Farms Are Located in Agricultural Areas:		
Justifications for the installation of wind farms in agricultural areas and promotion of social cohesion and integration are provided		
Wind farms are located in agricultural areas where developers pay rent in exchange for the used amount of surface areas to the land owners		
Wind farms are installed in areas that have been earmarked for potential wind farm development - *when applicable*		
Ornithological study over at least one year is provided		
Evaluation of avian and bat use (including the locations of active nest sites, colonies, roosts, and migration corridors) of the project area is provided		
Means to be utilized for the detection, assessment and monitoring of the effects of wind farms on birds are provided		
Means to avoid impacts on birds when detected and during migratory seasons (spring and fall seasons) are provided		
Consideration of various configurations for the siting of the turbines and demonstrating that the selected configuration has the least impact on avifauna		
Acoustic study with noise modeling is provided		

Software configuration alleviating flickering problems is provided		

Statistical approach taking into account the sunlight fraction, local features of wind and of the wind farm to quantitatively assess the probability of a perception of the flickering effect and possible disturbance to local residents are provided		
Visual modelling showing how the project is integrated into the surrounding landscape is provided		
Proof that power cables or lines will bè installed underground is provided		
Proof that flashing lights on the turbines is synchronized to flash at the same time is provided		
Management plan for all waste streams is provided		
Employee training plan is provided		
Public engagement plan is provided with evidence of early consultation with affected communities and their participation in the design process throughout the EIA study		
Socio-economic study demonstrating how existing land-uses can be integrated within the project and possible co-use of the land		
Proof that the cost of assessment of land devaluation as a result of the proposed wind energy project are covered by the developer is provided		
Proof that land expropriation and compensation will be conducted in accordance with relevant legislations (Expropriation Law No. 58/1991 and its amendment No. 8/2006) is provided		

APPENDIX G
STAKEHOLDER ANALYSIS MATRIX

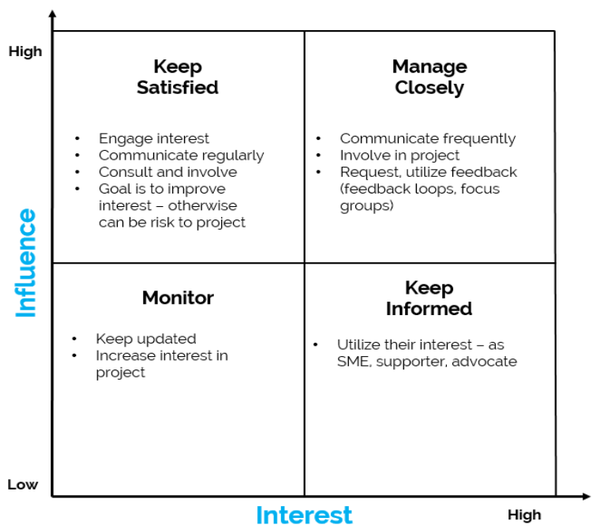
Preliminary Stakeholders Analysis - SA,LWP and HA.
8-Aug-19
Source of information1:The external relations manager for SA and LwP: Sarkis Farah
Source of information 2: The project coordinator for HA: Wassim Nehme

Stakeholder Engagement Assessment Matrix (C= current; D= Desired)

Stakeholder #	Location	Project Component	Community	Power / influence	Interest in the project	Unaware	Resistant	Neutral	Supportive	Leading	Current Engagement Strategy	Planned Engagement Strategy	Contract Status	Type of Response
Stakeholder 1	Rweimeh	SA and LWP Main Substation	Rweimeh - Jaafar Family	High	High					CD	Land leasing	Land Purchase	Almost signed	Manage closely, actively involve
Stakeholder 2	Rweimeh	SA and LWP Main Substation	Rweimeh -family Melhlem	Low	Low			CD			None	Information	NA	Monitor for changes
Stakeholder 3	Rweimeh	SA and LWP Main Substation	Few Syrian refugees	Low	Low	C		D			None	Information	NA	Monitor for changes
Stakeholder 4	Karm chbat	LWP wind turbine location & LWP substation	Jaafar family	High	High					CD	Land leasing	Land leasing	Signed	Manage closely, actively involve
Stakeholder 5	Fnaidek	LWP Wind turbines location	Fnaidek municipality	High	High					CD	Land leasing	Land leasing	Signed	Manage closely, actively involve
Stakeholder 6	Fnaidek	LWP Wind turbines location	Fnaideq General population	Medium	Medium			C	D		Public meetings on social and environmental impact, highlighting job opportunities and CSR projects	Need assessments for CSR projects. Additional meetings to manage expectations	NA	Identify concerns and keep informed
Stakeholder 7	Fnaidek	LWP Wind turbines location	Gypsies	Low	Low	C		D			None	Information	NA	Monitor for changes
Stakeholder 8	Fnaidek	LWP Wind turbines location	Syrian and Palestinian refugees	Low	Low	C		D			None	Information	NA	Monitor for changes
Stakeholder 9	Aandqet	SA Wind turbines	Aandqet municipality - Head of the Municipality and Municipality Council	High	High					CD	Land leasing	Land leasing	Signed	Manage closely, actively involve
Stakeholder 10	Aandqet	SA Wind turbines	Aandqet local NGOs/ CSOs - Head of the Municipality and Municipality Council	Medium	Medium			C	D		Public meeting on social and environmental impact, highlighting job opportunities and CSR projects	Need assessments for CSR projects. Additional meetings to manage expectations	NA	Identify concerns and keep informed
Stakeholder 11	Aandqet	SA Wind turbines	Aandqet General population	Medium	Medium			C	D		Public meeting on social and environmental impact, highlighting compliance with environmental standards and lease agreement (7000$/megawatt/ year)	Need assessments for CSR projects. Additional meetings to manage expectations	NA	Identify concerns and keep informed
Stakeholder 12	Jabal Akroum-Sahle	SA Wind turbines	Kanaan Family	High	High					CD	Land leasing	Land leasing	Signed	Manage closely, actively involve
Stakeholder 13	Jabal Akroum-Kfartoun	SA Wind turbines	Adraa Family (part1)	High	High					CD	Land leasing	Land leasing	Signed	Manage closely, actively involve

Stakeholder #	Location	Project Component	Community	Power / influence	Interest in the project	Unaware	Resistant	Neutral	Supportive	Leading	Current Engagement Strategy	Planned Engagement Strategy	Contract Status	Type of Response
Stakeholder 14	Jabal Akroum-Kfartoun	SA Wind turbines	Adraa Family (part 2)	Medium	Low		C	D			None	TBD	NA	Understand and satisfy their needs
Stakeholder 15	Jabal Akroum-Kfartoun	SA Wind turbines	Bou Amchi family	High	High					CD	Land leasing	Land leasing	Ongoing negotiations (want to be paid before operation)	Manage closely, actively involve
Stakeholder 16	Jabal Akroum-Kfartoun	SA Wind turbines	Jabal Akroum-Kfartoun - Member of municipal council of Kfartoum	High	Low		C		D		Door to door visit; was invited to the a wind power farm in Turkey. Request to create a committee to discuss environmental and social impacts.	Creation of a committee to discuss environmental and social impacts. Percentage of the income?	NA	Understand and satisfy their needs
Stakeholder 17	Jabal Akroum-Sehleh	SA Wind turbines	Jabal Akroum-Kfartoun - Mukhtar of Sahle	High	Low		C		D		Door to door visit. Request to create a committee to discuss environmental and social impacts.	Mapping to clarify distances. Percentage of the income?	NA	Understand and satisfy their needs
Stakeholder 18	Jabal Akroum - Sehleh	SA Wind turbines	Jabal Akroum-Kfartoun-Mayor of Sahle	High	Low		C		D		Door to door visit. Request to create a committee to discuss environmental and social impacts.	Peer to peer visits. Clarify the E&S standards of the project to the municipality. Start negociating our "right of way"	NA	Understand and satisfy their needs
Stakeholder 19	Jabal Akroum-Kfartoun	SA Wind turbines	Jabal Akroum-Kfartoun - neighbor	High	Low		C		D		Door to door visit	Percentage of the income?	NA	Understand and satisfy their needs
Stakeholder 20	Jabal Akroum-el Kounieh	SA Wind turbines	Jabal Akroum-Kfartoun ex-mayor of Kfartoum	High	Low		C		D		Door to door visit	Percentage of the income?	NA	Understand and satisfy their needs
Stakeholder 21	Jabal Akroum-Kfartoun	SA Wind turbines	Jabal Akroum-Kfartoun - the new mayor of Kfartoum	High	Low				C	D	Door to door visit	Percentage of the income?	NA	Understand and satisfy their needs
Stakeholder 22	Jabal Akroum	SA Wind turbines	Jabal Akroum-Kfartoun (Former Head of Union Jabal Akroum)	Medium	Medium			C		D	Request to create a committee to discuss environmental and social impacts	Creation of a committee to discuss environmental and social impacts.	NA	Identify concerns and keep informed
Stakeholder 23	Jabal Akroum	SA Wind turbines	Current Head of Union Jabal Akroum	TBC	TBC			C		D	NA	Felicitation Visit		TBC

Stakeholder #	Location	Project Component	Community	Power / influence	Interest in the project	Unaware	Resistant	Neutral	Supportive	Leading	Current Engagement Strategy	Planned Engagement Strategy	Contract Status	Type of Response
Stakeholder 24	Jabal Akroum	SA Wind turbines	Jabal Akroum- General population	Low	Medium			C	D		Public meeting on social and environmental impact, highlighting job opportunities and CSR projects	Additional meetings & Need assessments for CSR projects, while managing expectations	NA	Identify concerns and keep informed
Stakeholder 25	Jabal Akroum	SA Wind turbines	Jabal Akroum- Refugees	Low	Low			C	D		None	Information	NA	Monitor for changes
Stakeholder 26	Machta Hassan	HA, SA and LWP turbines transportation	Machta Hassan Municipality	High	Low		C		D		Meetings	Engaging Political leaders	Ongoing negotiations	Understand and satisfy their needs
Stakeholder 27	Machta Hassan	HA, SA and LWP turbines transportation	Refugees	Low	Low	C		D			None	Information	NA	Monitor for changes
Stakeholder 28	Jabal Akroum	SA turbines	Salah Family	Low	High				CD		Land leasing	Land leasing	Signed	Identify concerns and keep informed



APPENDIX H
PUBLIC DISCLOSURE MEETING INFORMATION

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RAMBOLL

LEBANON WIND POWER
Coming from the north to the south

٢٠١٨/٤/٣٠

الموضوع: طلب وضع اعلان لمشروع إنشاء مزرعة رياح بطاقة ٦٠ ميجاوات في محافظة عكار
المرجع: مرسوم ٨٦٣٣ الصادر عن وزارة البيئة في عام ٢٠١٢ المتعلق بأصول تقييم الأثر البيئي

جانب رئيس بلدية فيسان المحترم،

لقد كُلفت شركة الحلول البيئية الدائمة SES - بالتعاون مع شركة رامبول Ramboll بالقيام بدراسة تقييم الاثر البيئي لمشروع (Lebanon Wind Power) الذي يهدف الى إنشاء مزرعة رياح بطاقة ٦٠ ميجاوات في المنطقة المبينة في الصورة أدناه من محافظة عكار والمطلة على بلدة فيسان.

وبما أن المادة السابعة من المرسوم ٨٦٣٣ تنص على ضرورة قيام البلدية بالاعلان عن المشروع القائم في جوار البلدة وذلك ضمن عملية دراسة تقييم الاثر البيئي، نرجو من سعادتكم وضع الاعلان المرفق ربطاً لغاية ١٥ يوماً على لوحة الاعلانات العمومية الخاصة بالبلدية.

ولكم جزيل الشكر،
د ناجي شامية
مدير شركة الحلول البيئية الدائمة

SES Sustainable Environmental Solutions

رئيس بلدية جوار الحشيش
ياسين علي جعفر

SES Sustainable Environmental Solutions

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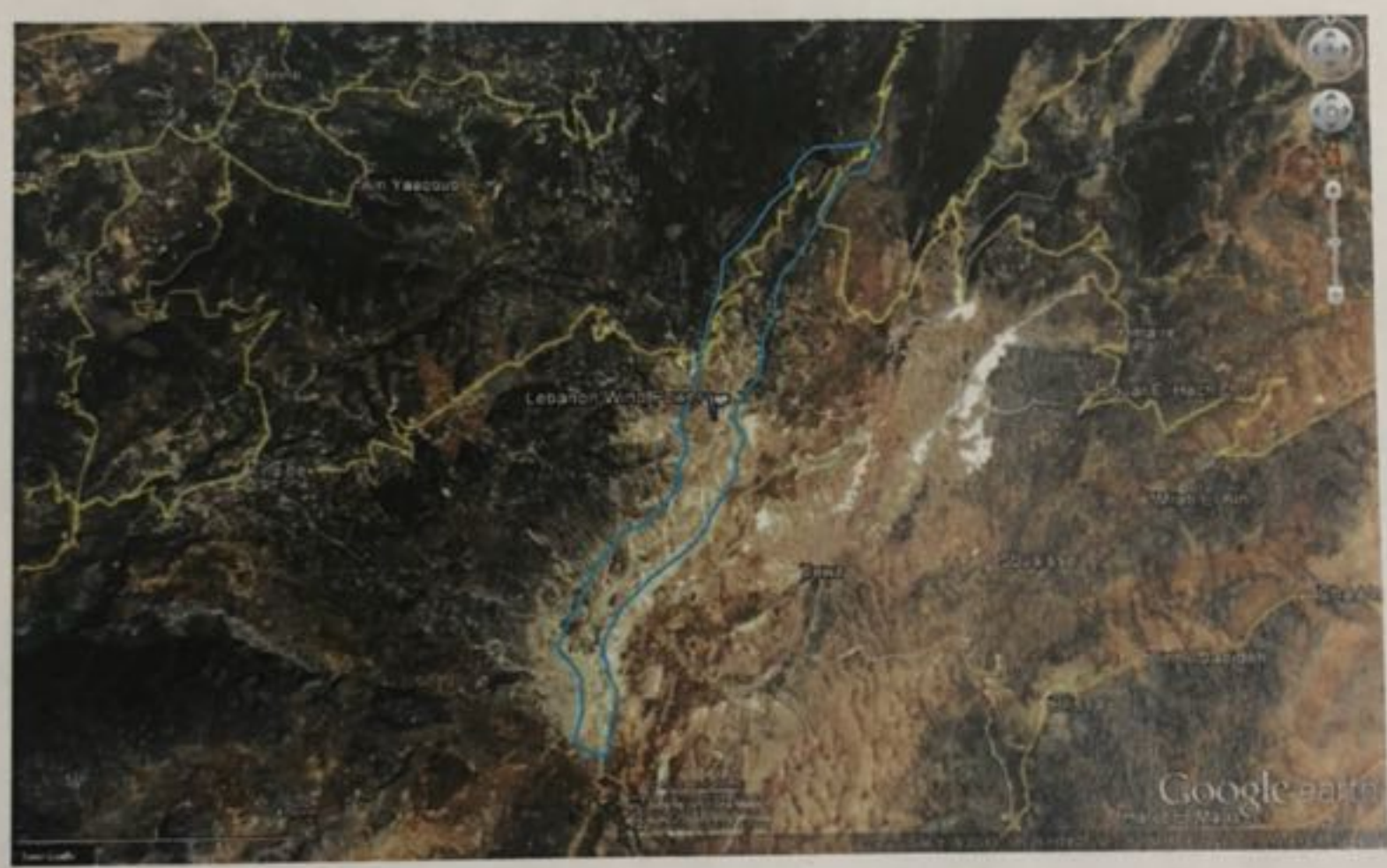
LEBANON WIND POWER
Coming from the north to the south

٢٠١٨/٤/٣٠

الموضوع: طلب وضع اعلان لمشروع إنشاء مزرعة رياح بطاقة ٦٠ ميجاوات في محافظة عكار
المرجع: مرسوم ٨٦٣٣ الصادر عن وزارة البيئة في عام ٢٠١٢ المتعلق بأصول تقييم الأثر البيئي

جانب رئيس بلدية الفنيدق المحترم،

لقد كُلّفت شركة الحلول البيئية الدائمة SES - بالتعاون مع شركة رامبول Ramboll بالقيام بدراسة تقييم الاثر البيئي لمشروع (Lebanon Wind Power) الذي يهدف الى إنشاء مزرعة رياح بطاقة ٦٠ ميجاوات في المنطقة المبينة في الصورة أدناه من محافظة عكار [redacted] لبلدة الفنيدق.



وبما أن المادة السابعة من المرسوم ٨٦٣٣ تنصّ على ضرورة قيام البلدية بالاعلان عن المشروع القائم في [redacted] البلدة وذلك ضمن عملية دراسة تقييم الاثر البيئي، نرجو من سعادتكم وضع الاعلان المرفق ربطاً لغاية ١٥ يوماً على لوحة الاعلانات العمومية الخاصة بالبلدية.

ولكم جزيل الشكر،
د ناجي شامية
مدير شركة الحلول البيئية الدائمة

SES Sustainable Environmental Solutions

استلمت
رئيس بلدية فنيدق
أحمد عبدو البعريني

الجمهورية اللبنانية
بلدية فنيدق
وزارة الداخلية والبلديات

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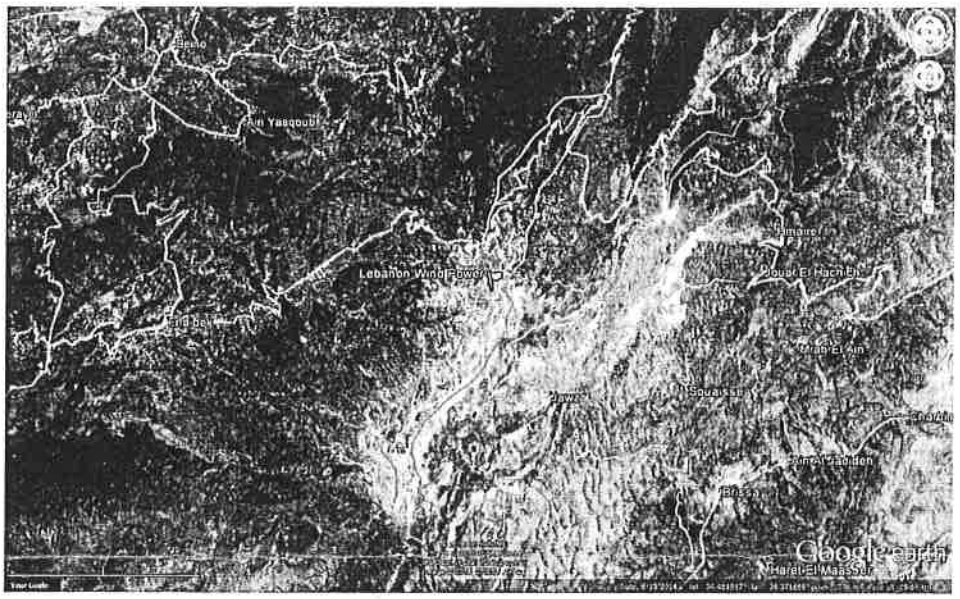
LEBANON WIND POWER
Coming from the north to the south

٢٠١٨/٤/٣٠

الموضوع: طلب وضع اعلان لمشروع إنشاء مزرعة رياح بطاقة ٦٠ ميجاوات في محافظة عكار
المرجع: مرسوم ٨٦٣٣ الصادر عن وزارة البيئة في عام ٢٠١٢ المتعلق بأصول تقييم الأثر البيئي

جانب رئيس بلدية القبيات المحترم،

لقد كُلّفت شركة الحلول البيئية الدائمة SES - بالتعاون مع شركة رامبول Ramboll بالقيام بدراسة تقييم الاثر البيئي لمشروع (Lebanon Wind Power) الذي يهدف الى إنشاء مزرعة رياح بطاقة ٦٠ ميجاوات في المنطقة المبينة في الصورة أدناه من محافظة عكار والمجاورة لبلدة القبيات.



وبما أن المادة السابعة من المرسوم ٨٦٣٣ تنصّ على ضرورة قيام البلدية بالاعلان عن المشروع القائم في جوار البلدة وذلك ضمن عملية دراسة تقييم الاثر البيئي، نرجو من سعادتكم وضع الاعلان المرفق ربطاً لغاية ١٥ يوماً على لوحة الاعلانات العمومية الخاصة بالبلدية.

ولكم جزيل الشكر،
د ناجي شامية
مدير شركة الحلول البيئية الدائمة

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وزارة الداخلية والبلديات
بلدية القبيات
رقم التسجيل : ٢٤٩
رقم الورود : ٢٠١٨/٤/٣٠

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LEBANON WIND POWER
Coming from the north to the south

بيروت في ٢٠١٨/٥/٨

وزارة البيئة
٨ أيار ٢٠١٨

وزارة البيئة
مبنى العازارية، الطابق السابع
بيروت، لبنان

الموضوع: دعوة لحضور جلسة عامة لتحديد نطاق الأثر البيئي العائد لمشروع إنشاء مزرعة رياح بطاقة ٦٠ ميجاوات في منطقة جرود عكار.

تحية طيبّة وبعد،

تفيدكم شركة الحلول البيئية الدائمة، المصنّفة من قبل مجلس الإنماء والإعمار لإعداد دراسات بيئية وفقًا لقرار وزير البيئة رقم ٧/١ الصادر في العام ٢٠٠٣، أنها بصدد إعداد دراسة تقييم أثر بيئي لمشروع (Lebanon Wind Power) الذي يهدف الى إنشاء وتشغيل مزرعة رياح بطاقة ٦٠ ميجاوات في منطقة جرود عكار.
وفي هذا السياق وتطبيقاً للمرسوم ٢٠١٢/٨٦٣٣، ندعوكم للمشاركة في جلسة عامة لتحديد نطاق الدراسة وعرض المشروع ومناقشة أهم المسائل البيئية المرتبطة بالمشروع وذلك

يوم الثلاثاء الواقع في ١٥ أيار ٢٠١٨ في تمام الساعة العاشرة والنصف صباحاً في مطعم بيدروز (Pedro's) في ساحة القبيات.

تتلخّص أهداف الجلسة بما يلي:

١- فهم نطاق المشروع (وبالأخص متطلّبات المشروع وكيفية إدارته)
٢- تحديد المسائل البيئية الأساسية المرتبطة بالمشروع
٣- نقاش

لمزيد من المعلومات، الرجاء الإتصال بنا على الرقم ٠١٣٧١٢٨٤.

نشكر لكم حسن تعاونكم.

د. ناجي شامية
المدير العام

SES Sustainable Environmental Solutions

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LEBANON WIND POWER
Coming from the north to the south

بيروت في ٢٠١٨/٥/٨

وزارة الطاقة والمياه
بيروت – كورنيش النهر

الموضوع: دعوة لحضور جلسة عامة لتحديد نطاق الأثر البيئي العائد لمشروع إنشاء مزرعة رياح بطاقة ٦٠ ميجاوات في منطقة جرود عكار.

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تفيدكم شركة الحلول البيئية الدائمة، المصنّفة من قبل مجلس الإنماء والإعمار لإعداد دراسات بيئية وفقًا لقرار وزير البيئة رقم ٧/١ الصادر في العام ٢٠٠٣، أنها بصدد إعداد دراسة تقييم أثر بيئي لمشروع (Lebanon Wind Power) الذي يهدف الى إنشاء وتشغيل مزرعة رياح بطاقة ٦٠ ميجاوات في منطقة جرود عكار.
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يوم الثلاثاء الواقع في ١٥ أيار ٢٠١٨ في تمام الساعة العاشرة والنصف صباحاً في مطعم بيدروز (Pedro's) في ساحة القبيات.

تتلخّص أهداف الجلسة بما يلي:

١- فهم نطاق المشروع (وبالأخص متطلّبات المشروع وكيفية إدارته)
٢- تحديد المسائل البيئية الأساسية المرتبطة بالمشروع
٣- نقاش

لمزيد من المعلومات، الرجاء الإتصال بنا على الرقم ٠١٣٧١٢٨٤.

نشكر لكم حسن تعاونكم.

د. ناجي شامية
المدير العام

الجمهورية اللبنانية

وزارة الداخلية والبلديات

إيصال بإستلام المعاملة

المستدعي/المصدر : شركة الحلول البيئية الدائمة ش م ل

العنوان : بيروت **رقم الهاتف:** ٠٣/٣٨٢٠٦٧

نوع المعاملة : دعوة لحضور جلسة

رقم المصدر : **تاريخ المصدر:** ٢٠١٨/٠٥/٠٨

موضوع المعاملة : دعوة لحضور جلسة عامة لتحديد نطاق الاثر البيئي العائد لمشروع انشاء مزرعة رياح بطاقة ٦٠ ميغاوات في منطقة جرود عكار بتاريخ ١٥-٥-٢٠١٨ في مطعم بيدروز- القبيات

سجل الطلب بتاريخ ٢٠١٨/٠٥/٠٨ **تحت رقم** ١١٠٠٩/ودب٢٠١٨

ملاحظات :

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LEBANON WIND POWER
Coming from the north to the south

بيروت في ٢٠١٨/٥/٨

وزارة الداخلية والبلديات
الحمراء – الصنائع
بيروت، لبنان

الموضوع: دعوة لحضور جلسة عامة لتحديد نطاق الأثر البيئي العائد لمشروع إنشاء مزرعة رياح بطاقة ٦٠ ميجاوات في منطقة جرود عكار.

تحية طيبة وبعد،

تفيدكم شركة الحلول البيئية الدائمة، المصنّفة من قبل مجلس الإنماء والإعمار لإعداد دراسات بيئية وفقًا لقرار وزير البيئة رقم ٧/١ الصادر في العام ٢٠٠٣، أنها بصدد إعداد دراسة تقييم أثر بيئي لمشروع (Lebanon Wind Power) الذي يهدف الى إنشاء وتشغيل مزرعة رياح بطاقة ٦٠ ميجاوات في منطقة جرود عكار.
وفي هذا السياق وتطبيقاً للمرسوم ٢٠١٢/٨٦٣٣، ندعوكم للمشاركة في جلسة عامة لتحديد نطاق الدراسة وعرض المشروع ومناقشة أهم المسائل البيئية المرتبطة بالمشروع وذلك

يوم الثلاثاء الواقع في ١٥ أيار ٢٠١٨ في تمام الساعة العاشرة والنصف صباحاً في مطعم بيدروز (Pedro's) في ساحة القبيات.

تتلخّص أهداف الجلسة بما يلي:

١- فهم نطاق المشروع (وبالأخص متطلّبات المشروع وكيفية إدارته)
٢- تحديد المسائل البيئية الأساسية المرتبطة بالمشروع
٣- نقاش

لمزيد من المعلومات، الرجاء الإتصال بنا على الرقم ٠١٣٧١٢٨٤.

نشكر لكم حسن تعاونكم.

د. ناجي شامية
المدير العام

LEBANON WIND POWER
Coming from the north to the south

RAMBOLL

SES Sustainable Environmental Solutions

تقييم الأثر البيئي العائد لمشروع إنشاء مزرعة رياح في عكار Lebanon Wind Power

الزمان: الثلاثاء ١٥ أيار ٢٠١٨

المكان: مقهى بيدروز في القبيات

Attendance Sheet - لائحة الحضور

التوقيع Signature	Email البريد الاكتروني	Tel تلفون	Profession المهنة	Name الإسم
	[redacted]		Project coordinator	Jules Assi
			رئيس بلدية قنيورج	احمد عبده البعريني
			موظف بلدية	عصمت مراد
			Mech. eng. SES	Bashir Marj
			Assistant proj coordinator	Joe Abi Mansoor
			صاحبة المقهى Pedros	حنان الإزي
			Env specialist SES	ليال أبي اسبر
			Civil eng. MOIM Tech dept	سعيد هاشم

LEBANON WIND POWER
Coming from the north to the south

RAMBOLL

SES Sustainable Environmental Solutions

التوقيع Signature	Email البريد الاكتروني	Tel تلفون	Profession المهنة	Name الإسم
	[redacted]		Environmental consultant SES	ليلى موتى
			Environmental Engineer	Nathalie Karam
			Environmental Specialist	Jeff gergs.
			Retired Captain.	Samir Boutros.
				Jean Zaccour

Consultancy Services

مشروع إنشاء مزرعة رياح في عكار
Lebanon Wind Power

دراسة تقييم الأثر البيئي

١٥ أيار ٢٠١٨

SES Sustainable Environmental Solutions

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LEBANON WIND POWER

البرنامج

- وصف المشروع
- دراسة تقييم الأثر البيئي
- مخطط الآثار المحتملة وتدابير التخفيف المقترحة
- المناقشة العامة: توصيات وملاحظات

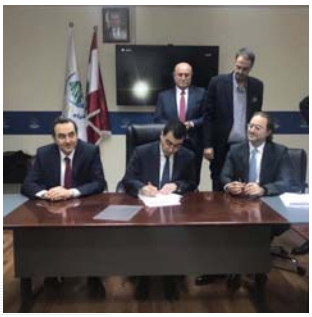
مقدمة

- صاحب المشروع: شركة Lebanon Wind Power.
- الإستشاري البيئي SES بالتعاون مع شركة Ramboll.
  - التشريعات المحلية
  - معايير أداء مؤسسة التمويل الدولية (IFC) بشأن الإستدامة البيئية والإجتماعية (٢٠١٢)، وبشأن البيئة والصحة والسلامة (٢٠٠٧)، طاقة الرياح (٢٠٠٧)، الطرقات (٢٠٠٧)
  - المبادئ التوجيهية لتقييم الأثر البيئي لمزارع الطاقة من قبل برنامج الأمم المتحدة الإنمائي / دعم تحسين كفاءة إستهلاك الطاقة المتجددة في لبنان، سيدرو (CEDRO، ٢٠١٢)
  - أفضل الممارسات الدولية

معلومات مرجعية

- أبرزت دراسة لوزارة الطاقة والمياه بالتعاون مع المركز اللبناني لحفظ الطاقة أن العجز في القدرة عل تأمين الطاقة الكهربائية قد بلغ ٣٤٧٨ جيغواط-ساعة في العام ٢٠٠٩
- عام ٢٠٠٩، التزم لبنان على أعقاب الجلسة الخامسة عشرة للبلدان المشاركة بإتفاقية الامم المتحدة الإطارية لتغير المناخ بتأمين ١٢% من الحاجة إلى الطاقة عام ٢٠٢٠ من المصادر المتجددة
- إن المشروع المقترح **يساعد** لبلوغ هذه الغاية

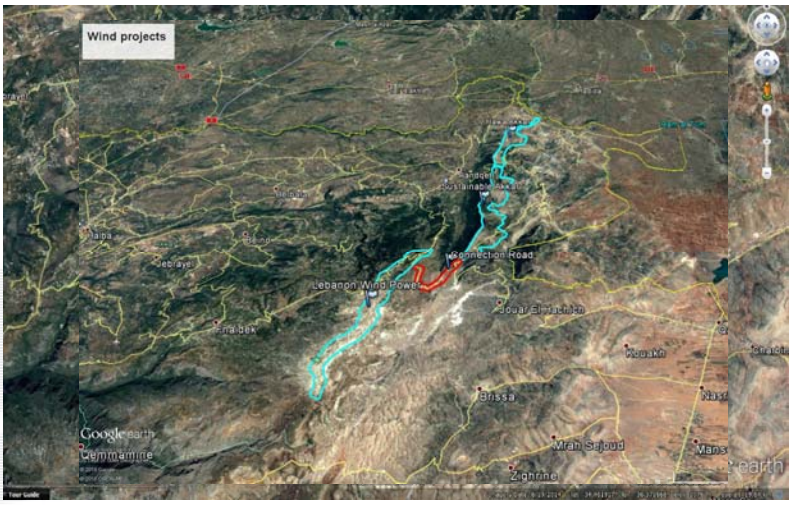
معلومات مرجعية



- قرار مجلس الوزراء الرقم ٤٣ تاريخ ٢/١١/٢٠١٧ الذي وافق بموجبه على منح ثلاثة تراخيص لانتاج الطاقة من الرياح بقدرة ٢٠٠ ميغاواط
- تم توقيع في شباط ٢٠١٨ عقد شراء طاقة مع ممثلي الشركات الثلاث المؤهلة وهي **Lebanon Wind Power SAL**، Hawa Akkar SAL و Sustainable Akkar

وصف المشروع

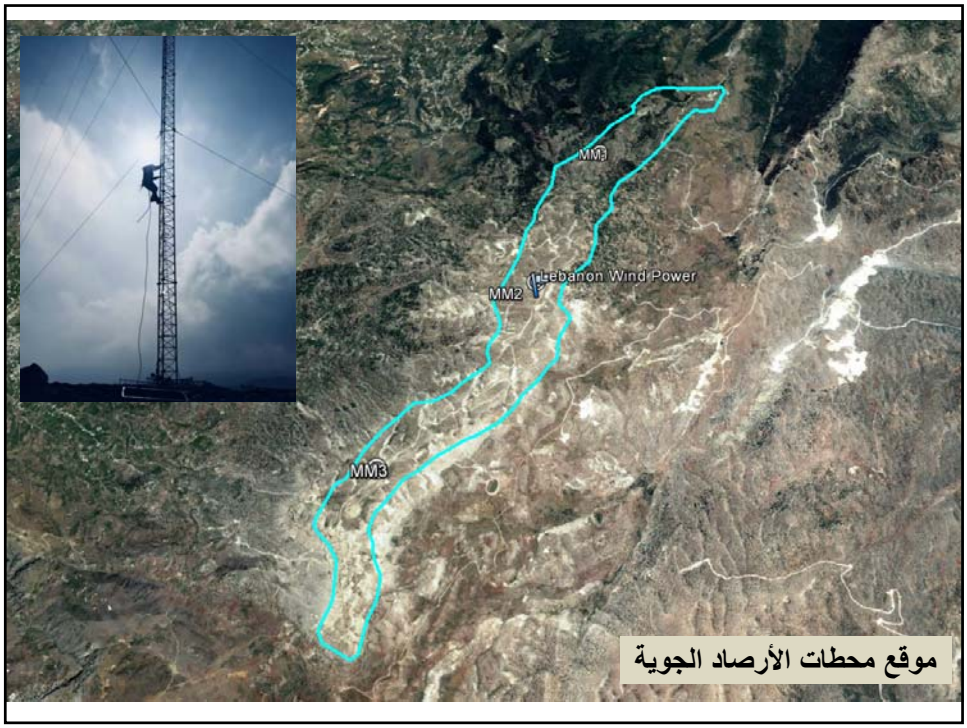
- موقع المشروع: جرود عكار.



وصف المشروع

- ٢٢ موقع محتمل للمراوح الهوائية ذات قدرة إنتاجية تتراوح بين من ٣,٨ إلى ٤,٢ ميجاوات (٣٠٠٠-٣٥٠٠ متر مربع)
- توصيل ٦٠ ميجاواط بالشبكة العامة
- محطة فرعية واحدة (١٠٠٠٠ متر مربع)
- خطوط النقل (٧ كم)
- ٣ محطات أرصاد جوية (مثبتة حالياً)
- توسيع بعض الطرقات

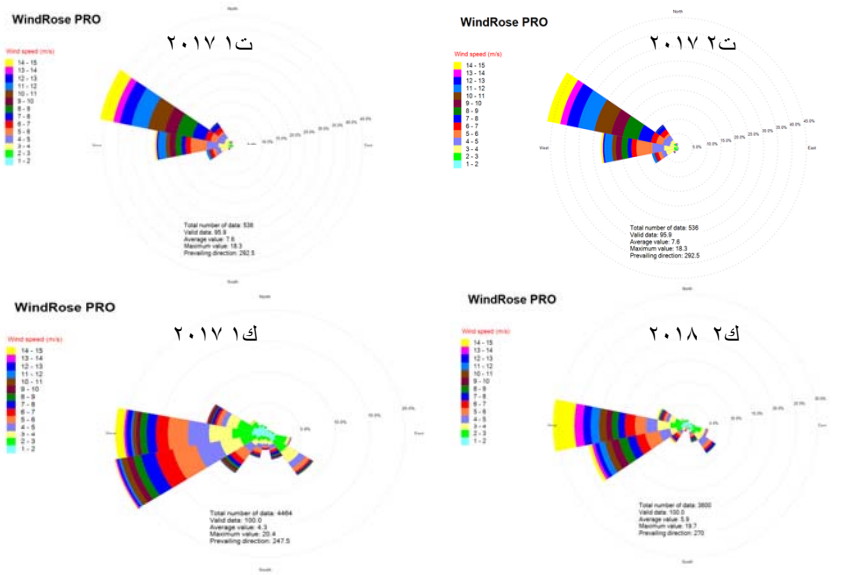
- **الإعتبارات لإختيار الموقع:**
  - **محاكاة إنتاجية المراوح في المواقع المحتملة**
  - **كثافة الغطاء النباتي**
  - **طوبوغرافية الارض**



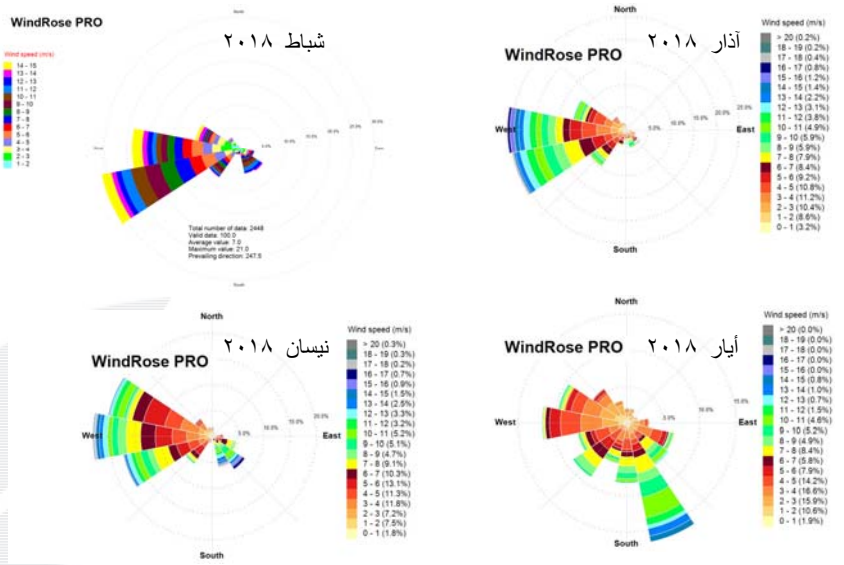
وصف المشروع

- **البرنامج**
  - حزيران ٢٠١٨- نهاية التشاورات حول الاراضي
  - حزيران ٢٠١٨- اختيار الشركة المنتجة للتوربينات
  - كانون الثاني ٢٠١٩- تحضير الموقع والطرقات
  - كانون الثاني ٢٠٢٠- التجهيز
  - حزيران ٢٠٢٠- بدء التشغيل

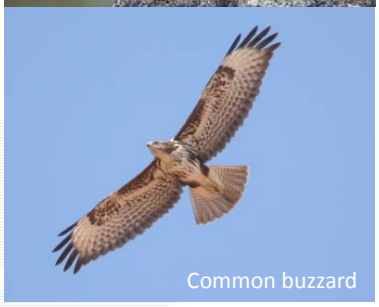
البيئة المحيطة - الهواء



البيئة المحيطة - الهواء



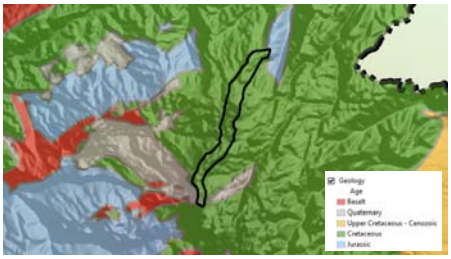
البيئة المحيطة - الفونا



- دراسة للطيور على مدار السنة
- الزيارات الميدانية تزداد كثافتها اثناء فترة هجرة الطيور
- أنواع التقييم:
  - الطيور الدائمة، والموسمية (الصيفية والشتوية)، والمهاجرة (الخريف ، الربيع)، وطيور جارحة ليلية
  - الطيور الشائعة، والنادرة، والمهددة بالانقراض
  - عدد ، موقع، خط العبور أوالهجرة
  - علو التحليق
  - مواقع التزاوج والتعشيش
- الإدارة البيئية بما في ذلك متطلبات المراقبة

البيئة المحيطة - الفلورا

البيئة المحيطة - الجيولوجيا



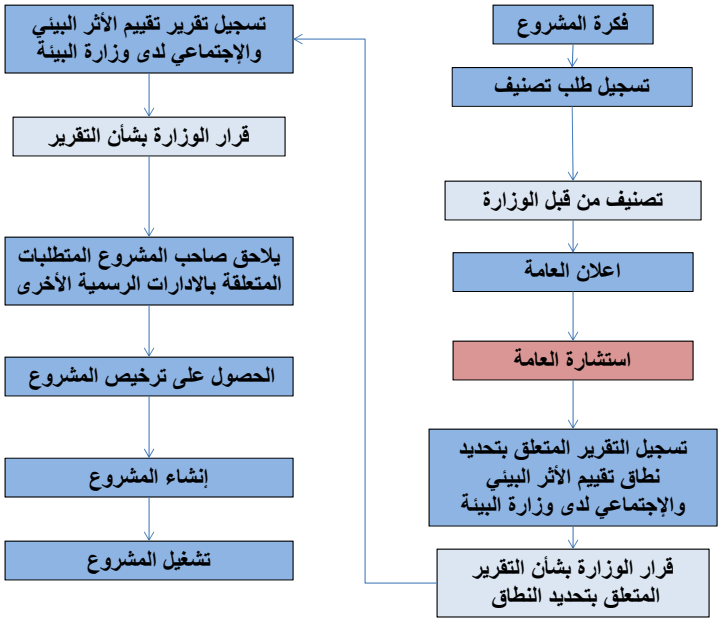
- التشكيل الجيولوجي في المنطقة يعود إلى العصر الكريتاسي.
- تطغى على الموقع الأحجار الرملية والكلسية.
- دراسة جيولوجية / زلزالية

البيئة المحيطة – المرافق الحساسة

- الإستحصال على خرائط ١/٢٠٠٠٠ من الجيش اللبناني للمنطقة الممتدة على مسافة ١٥ كم من المشروع:
  - المناطق السكنية
  - الأبنية
  - الغابات
  - المعالم السياحية
  - المراكز الدينية
  - المدارس، المستشفيات
  - الخ

دراسة تقييم الأثر البيئي

- **دراسة تقييم الأثر البيئي:**
  - استعراض القوانين والمعايير البيئية المطبقة على المشروع
  - تقييم لمنطقة الدراسة واصفا الظروف الفيزيائية والبيولوجية والاجتماعية والاقتصادية
  - مشاركة المجتمع المحلي
  - تحديد و تقييم الآثار البيئية والاجتماعية
  - تحليل البدائل
  - وضع خطة الإدارة البيئية والتدابير التخفيفية
    - تدابير التخفيف لمراحل الإنشاء والتنفيذ
    - برنامج رصد و مراقبة



لوزارة البيئة ٨٦٣٣ بحسب المرسوم

الآثار البيئية والإجتماعية-الإقتصادية المحتملة

- مستوى الضجيج
- التنوع البيولوجي
- تحليل وميض الظل
- الأثر البصري

- التأثير على صحة وسلامة العامة والعمّال
- التأثير الاقتصادي الاجتماعي
- حركة النقل
- نوعية الهواء
- إنتاج النفايات الصلبة

الآثار على مستوى الضجيج

- **مصادر الضجيج:**
  - الضجيج من تحضير الأراضي، كالحفر ومعدات الإنشاء
  - الضجيج الميكانيكي والهوائي من المراوح أثناء التشغيل
  - سوف يتم دراسة المرافق الحساسة ضمن مسافة ٢ كم (١٠٥ دسيبل حد أقصى، يصبح ٥٥ دسيبل على بعد ١٠٠م)

- **بعض التدابير التخفيفية المقترحة:**
  - استخدام كاتم صوت على الآلات خلال الإنشاء
  - تعديل تصميم المراوح لعزل الضجيج
  - رصد مستوى الضجيج خلال التشغيل بشكل دوري

تحليل مستوى الضجيج

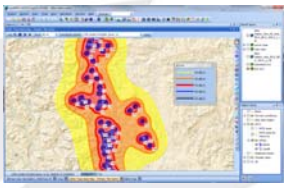
Input

- المرافق الحساسة
- مستويات الضوضاء من مراوح الهواء المستعملة
- محاكاة الأثر المتراكم للمزارع الثلاث المقترحة

WindPRO 3.0

Output

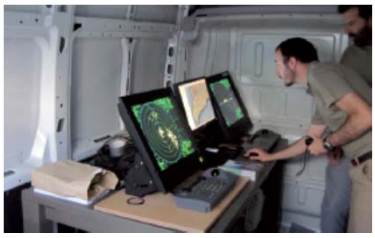
- وضع التجاوزات المحتملة خاصة في المناطق والمرافق الحساسة بواسطة وحدة DECIBEL

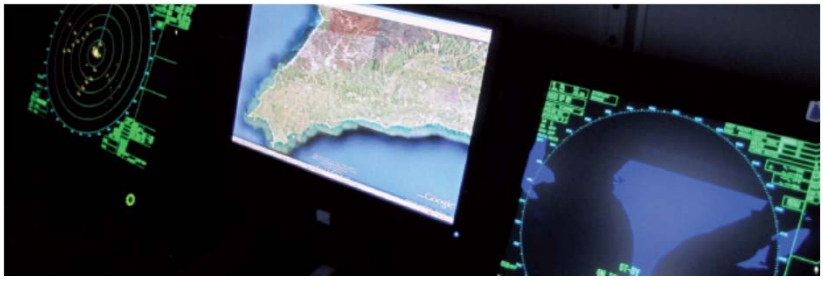


خريطة الضوضاء حسب مستويات dB المطلوبة

الآثار على التنوع البيولوجي

- **مصادر الآثار على التنوع البيولوجي:**
  - فقدان بعض النباتات في الموقع أثناء الحفر وتحضير الأراضي
  - إحتمال فقدان مواطن التعشيش للطيور الدائمة
  - تغيير المسار الطبيعي للطيور
  - ارتطام الطيور (اهمية الأثر متعلقة بأهمية الطيور، وبعلو ومسار تحليقها، وإحتمال الضباب)
- **بعض التدابير التخفيفية المقترحة:**
  - مواطن تعشيشية محاذية
  - تفادي المناطق ذات الغطاء النباتي الكثيف
  - المسافة بين المراوح أكثر من ٢٠٠ متر
  - وقف المراوح خلال مواسم الهجرة وخلال ساعات الهواء الخفيفة
  - وضع ردار لرصد الوجود الكثيف للطيور ودراسة مسارها
  - توزيع مراوح الهواء على خط موازي لمسار الهجرة للطيور





تحليل وميض الظل

- **الآثار المحتملة:**
  - يحدث وميض الظل عندما تعبر أشعة الشمس خلف التوربينات وتلقي بالظل على مسافة من المشروع
  - سوف يتم دراسة المرافق الحساسة ضمن مسافة ٢ كم (لا أهمية للأثر على مسافة أبعد من عشر مرات طول الشفرة)

- **بعض التدابير التخفيفية المقترحة:**
  - دراسة الموقع
  - وقف التوربينات عند تعدي الحدود المسموحة

تحليل وميض الظل

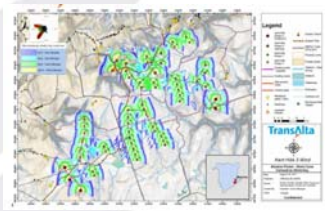
Input

- المرافق الحساسة
- نموذج الارتفاع الرقمي لاستبعاد مناطق الظل الطبيعية
- معلومات تقنية:
  - إتجاه الشرفات
  - البعد عن التوربينات
  - إرتفاع التوربين وقطر الشفرات
  - سرعة دوران الشفرة
  - الوقت من اليوم والوقت من السنة
- محاكاة الأثر المتراكم للمزارع الثلاث المقترحة

WindPRO 3.0

Output

- تحديد أوقات ومدة حدوث وميض الظل في المناطق الحساسة
- لا ينبغي أن يكون التعرض على المرافق الحساسة أطول من ٣٠ دقيقة في اليوم و ٣٠ ساعة في السنة



تحليل التأثير البصري

- **الآثار على المناظر الطبيعية:**
  - إزالة الغطاء النباتي خلال الإنشاء
  - سوف يتم دراسة التأثير البصري للمشروع ضمن مسافة ١٥ كم من المشروع

- **بعض التدابير التخفيفية المقترحة:**
  - التسلسل السليم لعملية الإنشاء وإعادة الغطاء النباتي
  - استعمال تصميم موحد للتوربينات
  - إضاءة التوربينات حسب المعايير المحلية/الدولية
  - تخفيض قدر المستطاع عدد الطرقات والبنى/المنشآت الظاهرة

تحليل التأثير البصري

Input

- خريطة لمناطق السكن والمرافق الحساسة (المواقع التاريخية / الثقافية، المحميات البيئية)
- متوسط إرتفاع الحواجز
- صور فوتوغراقية لموقع المشروع من عدد من المرافق الحساسة

WindPRO 3.0

Output

- التأثير البصري على المرافق الحساسة التي تم إختيارها
- عرض النتائج على خرائط (DIN A3)
- خلق تصورات لمزارع الهواء بواسطة وحدة PHOTOMONTAGE

الآثار على صحة وسلامة العامة والعمّال

- **الآثار على صحة وسلامة العامة والعمّال:**
  - الحوادث المحتملة أثناء الإنشاء
  - الآثار المحتملة أثناء التشغيل:
    - حركة الطيران (إذن اولي مبدئي)
    - القاء شفرة أو ثلج (على بعد ١,٥ مرات طول الشفرة)
    - لا أثر بيولوجي نتيجة الحقل الإلكترومغناطيسي بحسب منظمة الصحة العالمية
    - إحتمال تأثير على أنظمة الإرسال

- **بعض التدابير التخفيفية المقترحة:**
  - اعتماد تدابير السلامة المهنية أثناء الإنشاء وتدريب العمال لفهم المخاطر وسبل الوقاية
  - تأمين المسافة المطلوبة بين المروحة وأقرب منشأة أونظام إرسال
  - الإستحصال على موافقة المديرية العامة للطيران المدني
  - إضاءة التوربينات حسب المعايير المحلية / الدولية
  - تزويد التوربينات بالقدرة على تذويب الثلج (de-icing mechanism)

الآثار الإقتصادية والإجتماعية

- **مصادر التأثيرات على العوامل الاجتماعية والاقتصادية:**
  - لا يوجد إستعمالات أخرى للأراضي، مثلاً زراعة أو صناعة
  - توظيف العمال خلال مرحلة الإنشاء والتشغيل
  - المردود لمالكي الأراضي من عقود الإيجار الطويلة الامد
  - المردود للبلديات الممكن استثماره في مشاريع تنموية
  - تحسين في جودة الحياة نتيجة توفر الكهرباء من مصدر نظيف

الآثار على حركة النقل

- **مصادر الزحمة:**
  - إحتمال زحمة في السير نتيجة نقل التوربينات من الميناء الى منطقة المشروع خلال الإنشاء
  - تحسن في الطرقات المحلية نتيجة توسيعها

- **بعض التدابير التخفيفية المقترحة:**
  - تفادي ساعات الذروة المرورية في عملية النقل

الآثار على نوعية الهواء

- **مصادر تلوث الهواء:**
  - الغبار والإنبعاثات الناتجة عن أعمال الإنشاء
  - إنخفاض في الإنبعاثات من المولدات الخاصة نتيجة الزيادة في تأمين الكهرباء

- **بعض التدابير التخفيفية المقترحة:**
  - توفير غطاء على مواد البناء ونفايات الحفر أثناء نقلها أو تخزينها
  - تطبيق الحد الأدنى من سرعة حركة المرور
  - صيانة الآلات والمركبات المستعملة خلال مرحلة الإنشاء
  - السيطرة على التلوث من خلال إستعمال وصيانة فلاتر الهواء على الآلات والمركبات والمداخن
  - رش المياه وتعبيد الطرقات

إنتاج النفايات الصلبة

- **مصادر النفايات الصلبة:**
  - المواد المستخرجة خلال تجهيز الموقع خلال الإنشاء
  - النفايات المنزلية خلال الإنشاء والتشغيل

- **بعض التدابير التخفيفية المقترحة:**
  - حظر حرق النفايات
  - إعادة استخدام المواد المستخرجة كالردم خلال إنشاء المشروع

برنامج الرصد وتعزيز القدرة المؤسساتية

- سوف يتم وضع برنامج لمراقبة الإنبعاثات والآثار المحتملة
- توكيل موظَف للإشراف على تطبيق خطة الإدارة البيئية وبرنامج الرصد بالتعاون مع الإستشاريين المتخصصين، بما في ذلك التدريبات الدورية، وحفظ التقارير المتعلقة بالخطة البيئية، والحوادث التي تطرأ في الموقع.

نقاش

APPENDIX I
EMISSIONS AND EMISSIONS FACTORS

EMISSIONS AND AIR QUALITY ASSESSMENT REPORT
FOR THE WIND FARMS OF SUSTAINABLE AKKAR AND LEBANON WIND POWER
IN AKKAR

Final report

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March 8, 2019

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Executive summary

In February 2018, Lebanon signed its power purchase agreement (PPA) for wind energy with three separate consortiums that will build and operate wind farms in Akkar. Sustainable Akkar (SA) and Lebanon Wind Power (LWP) are two of the three private investors, selected to build Wind Farms Power Plant (WFPP) in Akkar, North of Lebanon.

The assessment of emissions and the air quality resulting from the construction, operation and decommissioning of the Wind farms was conducted.

Allowed increment in air quality based on the background values showed a comfortable margin for the project. The emissions calculation for the construction, operation, and decommissioning showed that unlike CO, NOx, and SO_2, PM resulting from fugitive emissions might constitute a concern. When carefully looking at the location of the receptors, the impact that the PM emissions would have is low since all receptors are located >350m from the construction sites and only one receptor is located at 40m from the construction road. The cumulative impact shows an increase of around 20% for NOx, 2% for CO and less than 1% for SO_2 is expected as an increment on the emissions background. PM emissions are very high compared to the background emissions. Mitigation measures are to be taken and can easily reduce fugitive emissions by 75%, lowering further the impact.

The GHG emissions showed that the main GHG from this project is CO_2 with the construction phase being again the highest emitter.

1. Introduction

Lebanon has embarked on the path of sustainable energy since the commitment launched in Copenhagen in 2009 by the Lebanese Government to develop renewable energy. That commitment is defined in the 2010 Ministry of Energy and Water (MoEW) Policy Paper for the Electricity Sector. The National Energy Efficiency Action Plan for Lebanon (NEEAP 2011-2015) clarified quantitatively rather than qualitatively-all the individual targets for the different renewable energy technologies needed to reach the 12% target first set in 2009.

In February 2018, Lebanon signed its power purchase agreement (PPA) for wind energy with three separate consortiums that will build and operate wind farms in Akkar. This PPA with the private sector in electricity generation as part of efforts to close an estimated 1 GW gap between current electrical supply and demand in the country. Combined the wind farms will have a total generation capacity of 180-200 MW.

Sustainable Akkar (SA) and Lebanon Wind Power (LWP) are two of the three private investors, selected to build Wind Farms Power Plant (WFPP) in Akkar, North of Lebanon. As part of the ESIA, SA has engaged the services of Charbel Afif to assess the air quality and emissions resulting from the construction, operation and decommissioning of the Wind farms.

This standalone study comes also in support to the Environmental and Social Impact Assessment study being prepared by Ramboll.

2. Assessment methodology

SA and LWP will be operating the two wind farms. The IFC guidelines will be applied to the project. The construction, operation, and decommissioning of the two wind farms will emit pollutants into the atmosphere from different sources. The assessment will consist on estimating the monthly emissions for the air quality pollutants and the GHG emissions for the three phases of the project. The results will be discussed for each wind farm and assessed regarding air quality. Mitigation measures will be presented as appropriate.

3. Location Map

The Wind Farms are located in Akkar area North of Lebanon, around 1-2 km from the Syrian borders. Several villages are located within the first few kilometers, i.e. AkroumChadra, Kobayat, Aandqet, etc. (***Figure 1***).

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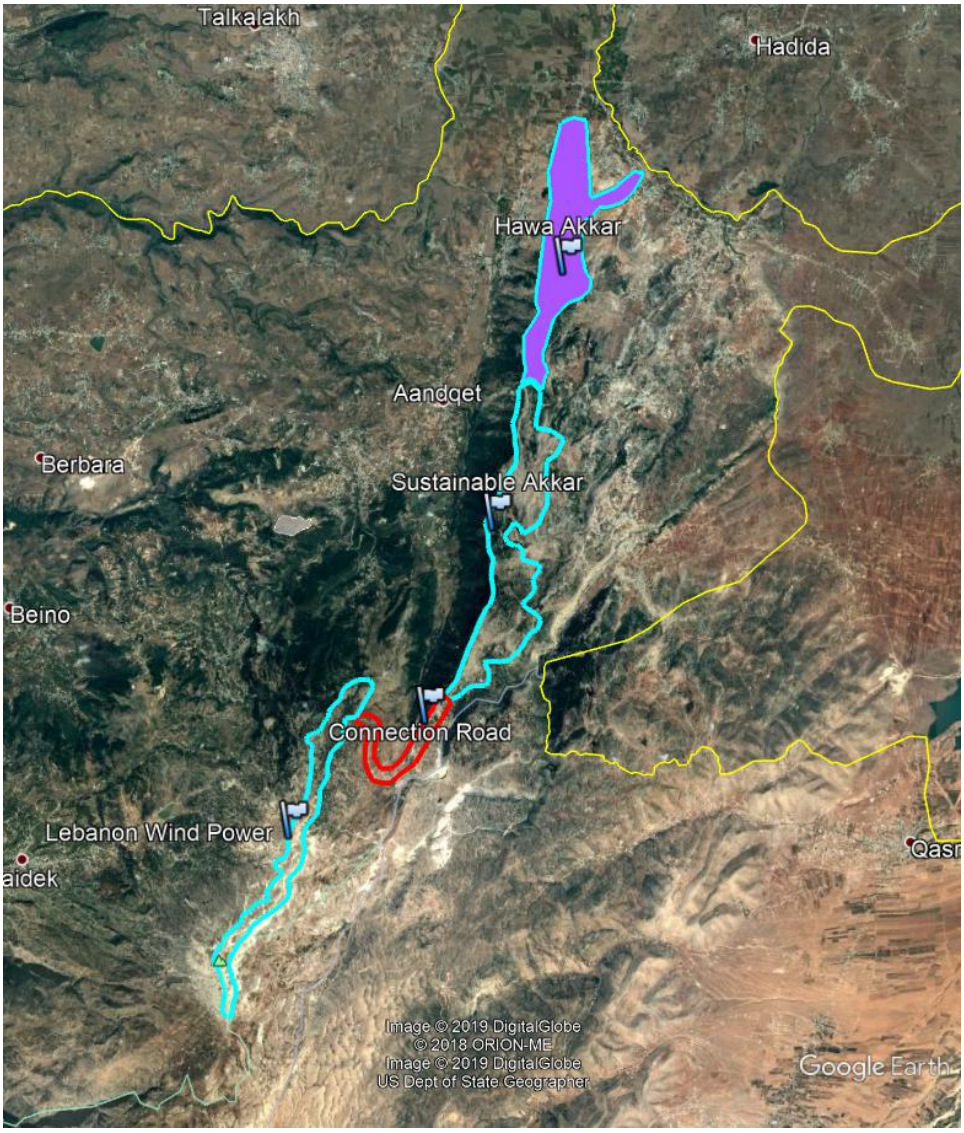

Figure 1. *Map of the 3 wind farms in Akkar and the surrounding villages (Google Earth ®, 2019)*

4. Background concentrations

Till 2013, there has not been a centralized data collection process, through a formal air quality monitoring network; measurements of criteria pollutants in Lebanon have been relying on individual initiatives and remain scattered in time and space. Few studies have been conducted and focused mainly on Beirut. Nonetheless, in 2013 MoE launched real time air quality monitoring in five sites using online analyzers connected to a supervisory control and data acquisition system located at MOE. The current network includes around 16 urban background stations. In order to get background concentrations, the AQMN needs to operate at least one full year with high data completeness and validity. In all cases, an AQMN is not installed in the project area by MoE. On the other hand, MoE coordinated with the Italian National Agency for New Technologies, Energy and Sustainable Economic Development (ENEA, Italy) and Saint Joseph University (SJU, Lebanon) an ensemble air quality modeling exercise to determine yearly background concentrations of some of the pollutants to enable consultants to account for background concentrations in Environmental Impact Assessments (MoE, 2015). The modelling exercise had only one common part which is the highly resolved emission inventory prepared by Waked and his coworkers (Waked et al., 2012, Waked

and Afif, 2012). ***Figure 2*** shows the different cells where yearly background concentrations where determined.

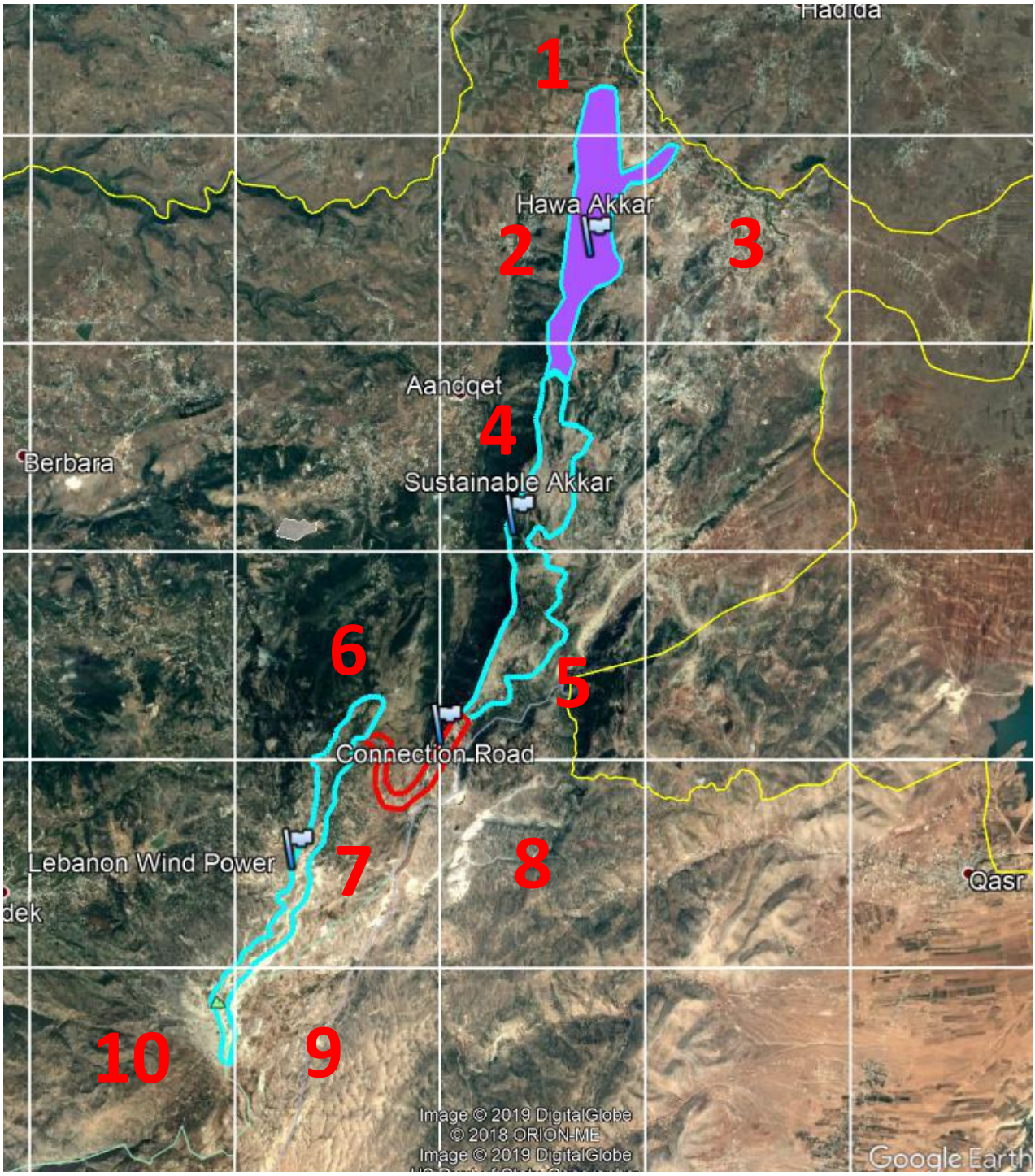

Figure 2. *Cells considered to calculate the background concentration for the different pollutants for the BAE study*

Annual background average concentrations in µg.m^{-3} as provided by the Lebanese Ministry of Environment are presented in Table 1. Values show generally low concentrations of primary pollutants, well below values encountered in Tripoli for example (Annual averages of PM10 above 80 µg.m^{-3} based on "Lebanon's National Strategy for Air Quality Management for 2030" (2017)).

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Table 1. Annual background values for the different pollutants (µg.m^{-3}) as provided by the Lebanese MoE

Cell ID	NO_2	O_3	PM10	PM2.5	SO_2	CO
1	9.169	83.319	17.740	15.420	10.070	201.113
2	11.879	81.668	17.613	15.469	10.554	206.054
3	10.483	81.116	17.116	15.061	9.950	199.545
4	11.097	82.540	16.436	14.555	9.555	201.673
5	9.995	82.868	15.382	13.658	8.592	195.067
6	12.006	81.465	16.219	14.296	9.761	203.033
7	6.460	85.945	14.304	12.484	6.356	185.880
8	7.000	85.618	14.078	12.452	6.512	184.593
9	4.694	87.115	13.383	11.665	4.988	175.124
10	7.071	85.847	14.283	12.369	6.463	183.716

5. Pollutants and air quality guidelines

The impact of air pollution on human health has long been recognized. The World Health Organization (WHO) developed a set of guidelines for air quality that could serve as an international benchmark and offers guidance in reducing the health impacts of air pollution (WHO, 2006). They are set based on a review of the accumulated scientific evidence. The guidelines help nations worldwide in setting their own guidelines and implementing them according to their socio-economic situation. ***Table 2*** presents the WHO air quality guidelines for some pollutants (WHO, 2006). The International Finance Corporation/World Bank Group (IFC/WB) adopts the WHO air quality guidelines in the absence of national air quality regulations.

Table 2. *WHO air quality guidelines (WHO, 2006)*

Pollutant	Maximum concentration	Averaging period
Sulfur dioxide (SO_2)	500 µg.m^{-3}	10 minutes
	20 µg.m^{-3}	24 hours
Nitrogen dioxide (NO_2)	200 µg.m^{-3}	1 hour
	40 µg.m^{-3}	1 year
Ozone (O_3)	100 µg.m^{-3}	8 hours
Carbon monoxide (CO)	100,000 µg.m^{-3}	15 minutes
	60,000 µg.m^{-3}	30 minutes
	30000 µg.m^{-3}	1 hour
	10,000 µg.m^{-3}	8 hours
Total suspended particles (TSP)	*Not available*	
Particulate matter smaller than 10 µm (PM_{10})	50 µg.m^{-3}	24 hours
	20 µg.m^{-3}	1 year
Particulate matter smaller than 2.5 µm ($PM_{2.5}$)	25 µg.m^{-3}	24 hours
	10 µg.m^{-3}	1 year
Lead	0.5 µg.m^{-3}	1 year
Benzene	no safe level of exposure can be recommended	excess lifetime risk of leukemia at a concentration of 1 µg.m^{-3} is 6×10^{-6}

The Lebanese Ministry of Environment has issued in 1996 Decision 52 over 1 proposing national air quality guidelines. Annex 14 of the Decision provides ambient air standards (averaging periods and values) as per ***Table 3*** below, presenting standards for sulfur dioxide, nitrogen dioxide, ozone, carbon monoxide, total suspended particles, particulate matter smaller than 10 µm, Lead, and Benzene. Based on the IFC/WB EHS guidelines, since Lebanese regulations exist, they shall apply to this project.

Table 3. *Air quality guidelines according to Lebanese decision 52/1*

Pollutant	Maximum concentration	Averaging period
Sulfur dioxide (SO_2)	350 µg.m^{-3}	1 hour
	120 µg.m^{-3}	24 hours
	80 µg.m^{-3}	1 year
Nitrogen dioxide (NO_2)	200 µg.m^{-3}	1 hour
	150 µg.m^{-3}	24 hours
	100 µg.m^{-3}	1 year
Ozone (O_3)	150 µg.m^{-3}	1 hour
	100 µg.m^{-3}	8 hours
Carbon monoxide (CO)	30,000 µg.m^{-3}	1 hour
	10,000 µg.m^{-3}	8 hours
Total suspended particles (TSP)	120 µg.m^{-3}	24 hours
Particulate matter smaller than 10 µm (PM_{10})	80 µg.m^{-3}	24 hours
Lead	1 µg.m^{-3}	1 year
Benzene	5 ppb	1 year

Moreover, the IFC/WB indicates that emissions resulting from a project shall not contribute to more than 25% of the applicable air quality standards to allow additional, future sustainable development in the same airshed. Consequently, based on the IFC guidelines which indicates the use of the national air quality standards, the project shall not result in more than the values presented in **Table 4**.

Table 4. Maximum allowed concentrations increment resulting from the project

Pollutant	Maximum allowed concentration	Averaging period
Sulfur dioxide (SO_2)	87.5 µg.m^{-3}	1 hour
	30 µg.m^{-3}	24 hours
	20 µg.m^{-3}	1 year
Nitrogen dioxide (NO_2)	50 µg.m^{-3}	1 hour
	37.5 µg.m^{-3}	24 hours
	25 µg.m^{-3}	1 year
Carbon monoxide (CO)	7500 µg.m^{-3}	1 hour
	2500 µg.m^{-3}	8 hours
Total suspended particles (TSP)	30 µg.m^{-3}	24 hours
Particulate matter smaller than 10 µm (PM_{10})	20 µg.m^{-3}	24 hours

6. Sensitive Receptors

Many villages and houses exist near the sites but are all more than 350 m from the wind turbines locations for SA and LWP (Figure 3), and generally more than 50 m from the road except for one in LWP which is located at around 40m from the road (Figure 4).

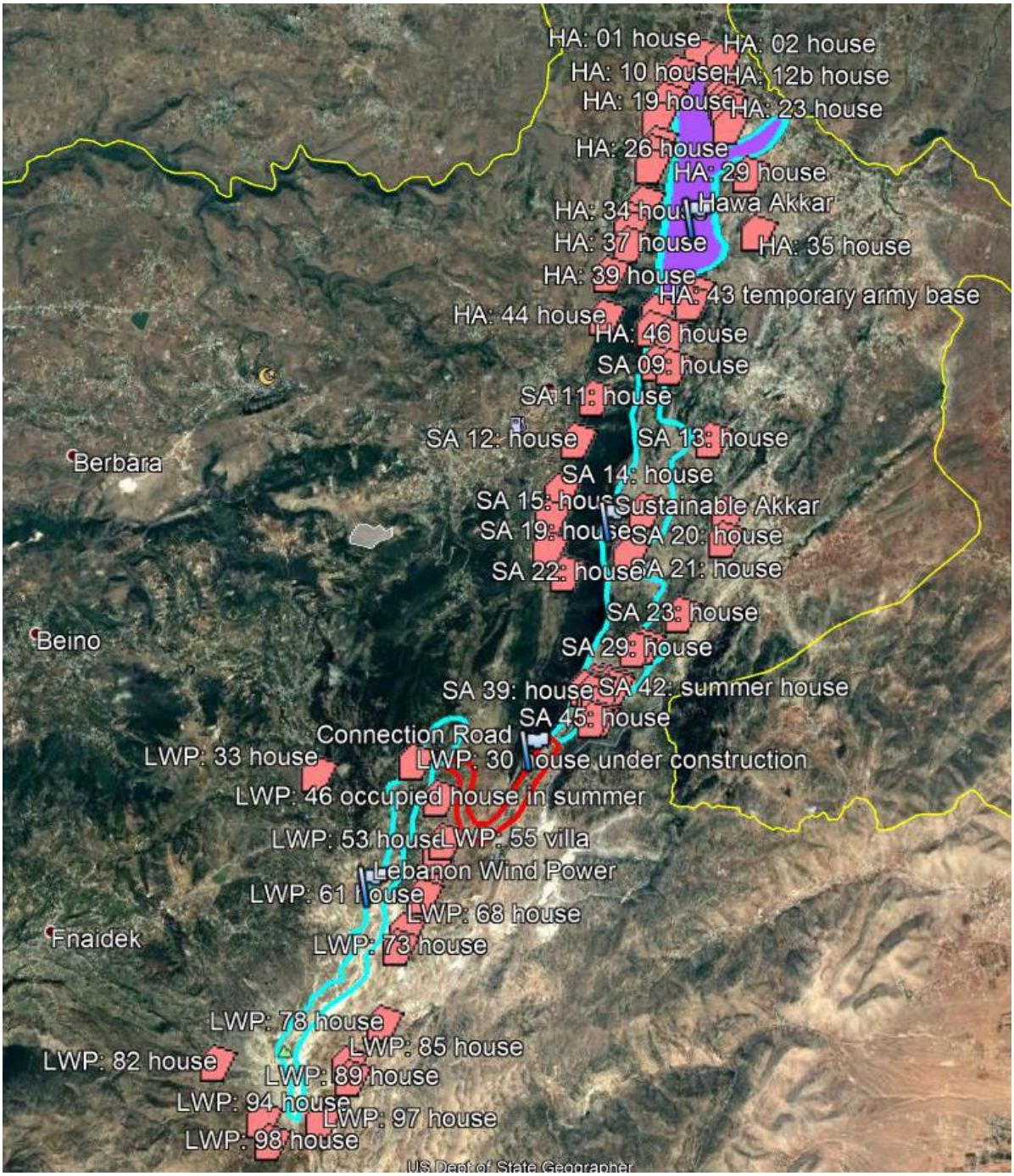

Figure 3. Location of the sensitive receptors within the project area.

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Figure 4. Location of a house under construction in LWP around 40 m away from the road

7. Emissions estimation

The assessment considers the emissions calculation for the construction phase, the operation phase (including maintenance), and the decommissioning phase of the project.

The sources considered for the three phases are combustion of fuel and fugitive emissions. The combustion sources encompass vehicle tailpipe and stacks, while the fugitive emissions consider mainly the dust entrainment generated by vehicles while running, and emissions from loading/unloading of material, bulldozing, etc. Emission factors were acquired from the EMEP/EEA guidebook (2016) for on-road and off-road vehicles, while the fuel consumption was provided by actual contractors (MAN and DAKO). The sulphur content used is the upper limit of the Lebanese regulations: 10 ppm maximum for automotive fuel while it is of 350 ppm for diesel used for boilers and reciprocating engines. The activity data assumed was acquired from Sustainable Akkar based on the project details and planning.

The emission sources are presented in Table 5while the details are presented in Appendix A for the activity data for all phases and in Appendix B for the emission factors and fuel consumption used.

Table 5. Emission sources considered and some of their characteristics

Emission source	Emission type	Fuel type
Main crane	Exhaust	Diesel
Auxiliary crane	Exhaust	Diesel

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LDV for personnel movement on site and out of site	Exhaust	Gasoline
Tractor FH440	Exhaust	Diesel
Bus	Exhaust	Gasoline
Trucks 20m3	Exhaust	Diesel
Jackhammer	Exhaust	Diesel
Caterpillar D9	Exhaust	Diesel
Excavator	Exhaust	Diesel
Concrete Mixer Truck	Exhaust	Diesel
Concrete Pump	Exhaust	Diesel
Skidoo	Exhaust	Gasoline
Bulldozing Moisture 1%, silt 5%	Fugitive	-
Loading/Unloading	Fugitive	-
Dust entrainment from paved roads - Truck 40t on average, silt 5g/m^2	Fugitive	-
Dust entrainment from paved roads - LDV 1.8 t, silt 5g/m^2	Fugitive	-
Dust entrainment from paved roads - Bus 5t, silt 5g/m^2	Fugitive	-
Dust entrainment from unpaved roads - Trucks 40t on average	Fugitive	-
Dust entrainment from unpaved roads - LDV 1.8t	Fugitive	-
Dust entrainment from unpaved roads - Bus 5t	Fugitive	-

8. Results

This section presents the emissions estimation of the three wind farms with a focus on LWP and SA. Then a cumulative assessment of the three is conducted.

8.1. Lebanon Wind Power

LWP Wind Farm encompasses 16 wind turbines and is located at a higher altitude than SA and HA. During November to April, the site is mainly covered with snow which makes the construction stop during these months. During the operation phase, the site is only accessible with the skidoos. Results of the emissions estimation are presented in Table 6. The construction phase exhibits generally the highest emissions of the pollutants. The highest emissions are those of the PM and originate mainly from fugitive emissions (>99%).

Table 6. Emissions from the different phases of LWP

Emissions in kg	NOx	PM10	PM2.5	SO_2	CO
Construction	12651.2	583330.8	117504.3	86.3	3288.6
Operation (1yr)	232.1	11762.4	1821.5	19.1	4456.6
Decommissioning	1307.8	21771.9	4225.4	1.0	471.0

Figure 5 shows the monthly variation of the NOx emissions from the construction and operation phases. NOx comes from the combustion of fuel (transport but also reciprocating engines and boilers). The increase around mid-2020 is due to the platforms construction and turbines erection.

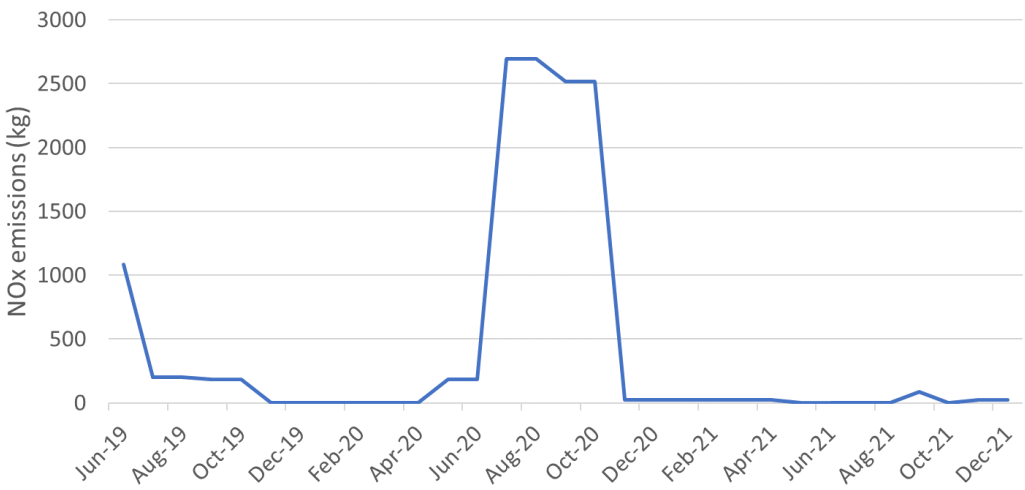

Figure 5. NOx emissions during construction and operation of LWP

8.2. Sustainable Akkar

SA Wind Farm encompasses 21 wind turbines and is the largest wind farm among the three, namely LWP, HA, and SA. The site is not expected to close during winter. Results of the emissions estimation are presented in Table 7. Like for LWP, the construction phase exhibits generally the highest emissions of the pollutants. The highest emissions are those of the PM and originate mainly from fugitive emissions (>99%).

Table 7. Emissions from the different phases of SA

Emissions in kg	NOx	PM10	PM2.5	SO_2	CO
Construction	18669.7	833429.9	167621.2	137.1	4845.2
Operation (1yr)	223.4	45182.4	6702.0	19.4	256.5
Decommissioning	1745.6	27705.1	5415.3	1.2	615.6

Figure 6 shows the monthly variation of the NOx emissions from the construction and operation phases. Like for LWP, the increase around mid-2020 is due to the platforms construction and turbines erection. Moreover, one can notice that during winter, works will still be running unlike LWP.

Figure 6. NOx emissions during construction and operation of SA

8.3. Hawa Akkar

HA comprises 16 WT and is located at an altitude lower than LWP. Due to lack of data on HA, LWP activity data was used except that during winter HA site is still accessible like SA. Results of the emissions estimation are presented in Table 8. Like for LWP and SA, the construction phase exhibits generally the highest emissions of the pollutants. The highest emissions are those of the PM and originate mainly from fugitive emissions (>99%). The emissions during construction are slightly higher than those of LWP since the since is not closed during winter and the contractor and owner personnel are always present on site. SO_2 emissions originate from fuel combustion and are relatively low since sulphur content in automotive fuel is 10 ppm in Lebanon.

Table 8. Emissions from the different phases of HA

Emissions in kg	NOx	PM10	PM2.5	SO_2	CO
Construction	13783.7	590858.1	118689.7	125.2	3498.6
Operation (1yr)	215.8	24138.5	3614.5	19.2	191.9
Decommissioning	1307.8	21771.9	4225.4	1.0	471.0

Figure 7 shows the monthly variation of the NOx emissions from the construction and operation phases. Like for LWP, the increase around mid-2020 is due to the platforms construction and turbines erection. Moreover, one can notice that during winter, works will still be running unlike LWP.

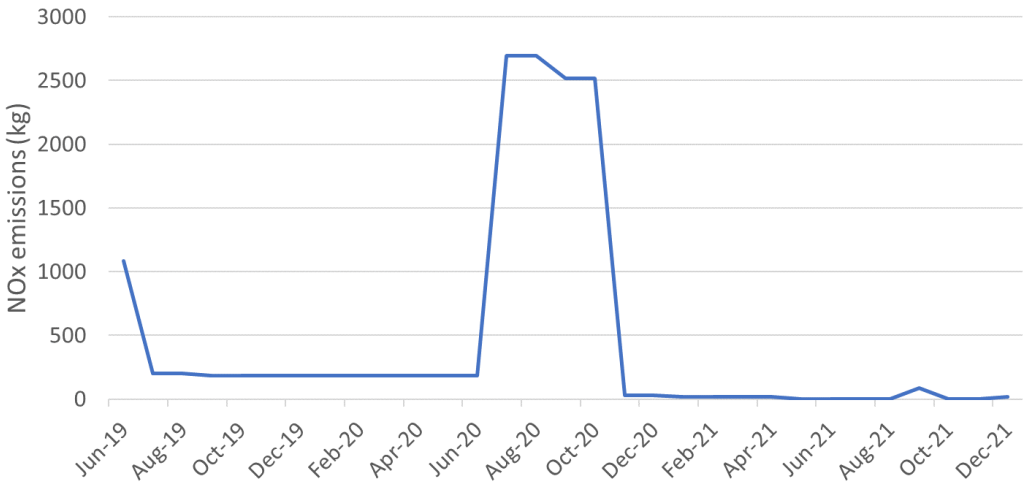

Figure 7. NOx emissions during construction and operation of HA

8.4. Impact of PM

The fugitive emissions constitute one of the main concerns in construction and demolition activities (IAQM, 2014). The earthworks have large impacts on a human receptor in LWP and SA since large quantities of material is excavated and moved. On the other hand, the construction has limited impact since a substation is built in each site along with the erection of the turbines. As for the trackout, it has a medium impact since the vehicles speed is generally low especially the Heavy-Duty Vehicles with around 15-16 km/hr and with less than 50 HDV passing on the roads per day. The sensitivity of the area is low but the workers are mainly impacted resulting in a medium impact.

On the other hand, according to IAQM "Guidance on the assessment of dust from demolition and construction" (2014), particles originating from a construction site have low impact if a "human receptor" is located beyond 350 m. This is the case for most of the receptors in this project, mainly in SA but not in LWP where a sensitive receptor is located 40 m from the road used by the construction vehicles. Therefore, the above-mentioned impact applies before the implementation of any mitigation measures even though it is of short duration and reversible.

8.5. Cumulative impact

The total emissions originating from the three wind farms are presented in Table 9.The construction phase will emit the most but is also of short period when compared to the project lifetime. When compared to the emissions of Waked et al. (2012) for Akkar area (emissions of cells 1 and 2 for HA, 4 and 5 for SA, and 6, 7, and 10 for LWP since their emissions will be local), the increment of the emissions of NOx is less than 20%, the one for CO is less than 2% and less than 1% for SO_2. On the other hand, the PM emissions are more than an order of magnitude higher than those calculated by Waked et al. (2012). That means that the CO, NOx, and SO_2 incremental emissions are not expected to breach the air quality standards in any of the phases. On the other hand, PM which originates mainly from fugitive emissions shall be mitigated especially during construction even though receptors are generally beyond 350m from the construction site.

Table 9. Cumulative emissions resulting from the three wind farms in Akkar for the different phases

Emissions in kg	NOx	PM10	PM2.5	SO_2	CO
Construction	45104.6	2007618.8	403815.1	348.6	11632.4
Operation (1yr)	671.2	81083.3	12138.0	57.7	4905.0
Decommissioning	4361.3	71249.0	13866.0	3.1	1557.7

In addition to that, the operation of the wind farms emits less than the power barge at Zouk (198 MW) running on Heavy Fuel Oil since the latter emits a lot more for all pollutants with no exception, even PM without abatement (Table 10).

Table 10. Emissions of the Zouk Power Barge for the year 2016

Zouk Power Barge	NOx	PM10	PM2.5	SO_2	CO
Year 2016 (kg/yr)	20478010.5	137709.2	133405.8	6262367	318905.7

9. Mitigation measures

The main concern in the mitigation measures to implement is due to PM emissions and specifically fugitive PM.

IAQM (2014) and Mojave Desert (2013) suggest effective measures:

- use of wind screens or enclosures around dusty activities or the site boundary. Mojave Dessert Air Quality Management District assumes that complete coverage by wind screens (on the windward side) will provide a control efficiency of 75 percent.
- Water spray is also used to reduce fugitive dust as it increases the moisture content of the material. Therefore, and according to Mojave Desert too, Water spray (Application point) will ensure a control efficiency of 75%. This is very useful for exaction for example.

- For unpaved roads, water flushing is the essential with 0.48 gallons per square yard twice per day to maintain a control efficiency above 50%.
- For paved roads, water flushing with 0.48 gallons per square yard followed by sweeping is very effective and can reach 96%. If conducted directly before the passage of the turbines convoy or the morning and evening passages of the project vehicles to and from the site, a consequent decrease will occur.
- A combination of the different above-mentioned measures will give a higher control efficiency that when applied individually.

Practically, fugitive PM can be easily decreased by 75% lowering the impact further.

10. Green House Gases emissions

GHG emissions are estimated using the IPCC Tier 1 methodology (IPCC, 1997, 2000) using the quantity of fuel burnt by source category for CO_2, CH_4, N_2O. Fuel consumption was estimated based on activity data in Appendix A and Appendix B for the three phases of the project and the different wind farms.

The emission factors for each category are presented in Table 11.

Table 11. GHG emission factors

Source	Unit	CO_2	CH_4	N_2O
Transport – diesel	g/L	2652.42	0.1498	0.06656
Transport – Gasoline	g/L	2287.15	0.6675	0.01997
Energy - diesel	g/L	2645.60	0.1082	0.02155

To calculate the CO_2eq. emissions, a Global Warning Potential (GWP) of 1 was used for CO_2, 21 for CH_4 and 310 for N_2O.

Table 12 presents the quantities emitted with the CO_2 being the main pollutant emitted and SA the highest emitter.

Table 12. GHG emissions for the different phases of the wind farms life

Wind farm	Phase	CO_2 em. (kg)	CH_4 em. (kg)	N_2O em. (kg)	CO_2eq. em. (kg)
HA	Construction	2030449.5	127.1	39.8	2045451.0
	Operation (1yr)	162145.3	23.8	1.5	163111.7
	Decommissioning	151051.4	14.1	3.4	152402.5
SA	Construction	2632223.2	161.1	54.9	2652619.6
	Operation (1yr)	199744.9	34.8	1.8	201043.5
	Decommissioning	193826.4	16.5	4.5	195561.0
LWP	Construction	1763656.7	106.6	37.6	1777547.2
	Operation (1yr)	168357.1	25.6	1.6	169378.4
	Decommissioning	151051.4	14.1	3.4	152402.5

11. Conclusion

Sustainable Akkar (SA) and Lebanon Wind Power (LWP) are two of the three private investors, selected to build Wind Farms Power Plant (WFPP) in Akkar, North of Lebanon. The assessment of emissions and the air quality resulting from the construction, operation and decommissioning of the Wind farms was conducted.

Allowed increment in air quality based on the background values showed a comfortable margin for the project. The emissions calculation for the construction, operation, and decommissioning showed that unlike CO, NOx, and SO2, PM resulting from fugitive emissions might constitute a concern. When carefully looking at the location of the receptors, the impact that the PM emissions would have is low since all receptors are located >350m from the construction sites and only one receptor is located at 40m from the construction road. The cumulative impact shows an increase of around 20% for NOx, 2% for CO and less than 1% for SO_2 is expected as an increment on the emissions background. PM emissions are very high compared to the background emissions. Mitigation measures are to be taken and can easily reduce fugitive emissions by 75%, lowering further the impact.

The GHG emissions showed that the main GHG from this project is CO_2 with the construction phase being again the highest emitter.

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APPENDIX A: Assumptions for emissions calculations

Appendix A: Assumptions for emissions calculations

Construction

Source	Lebanon Wind Power	Sustainable Akkar	Hawa Akkar
Contractor and owner cars to supervise work	Exhaust. LDV. From May to October. Contractor 7 cars, 3 cars for owner, contractor 50 km/d, owner 65 km/day, 6d/w, 26 d/m, totals 14170 km/m	Exhaust. LDV. From June 2019 to December 2020 Contractor 7 cars, 3 cars for owner, contractor 50 km/d, owner 65 km/day, 6d/w, 26 d/m, totals 14170 km/m	Exhaust. LDV. From June 2019 to December 2020 Contractor 7 cars, 3 cars for owner, contractor 50 km/d, owner 65 km/day, 6d/w, 26 d/m, totals 14170 km/m
Contractor and owner cars to supervise work	Fugitive paved road. LDV. From May to October. Contractor 7 cars, 3 cars for owner, contractor 40 km/d, owner 40 km/day, 6d/w, 26d/m, totals 10400 km/m	Fugitive paved road. LDV. From June 2019 to December 2020 Contractor 7 cars, 3 cars for owner, contractor 40 km/d, owner 40 km/day, 6d/w, 26d/m, totals 10400 km/m	Fugitive paved road. LDV. From June 2019 to December 2020 Contractor 7 cars, 3 cars for owner, contractor 40 km/d, owner 40 km/day, 6d/w, 26d/m, totals 10400 km/m
Contractor and owner cars to supervise work	Fugitive unpaved road. LDV. From May to October. Contractor 7 cars, 3 cars for owner, contractor 10 km/d, owner 25 km/day, 6d/w, 26d/m, totals 3770 km/m	Fugitive unpaved road. LDV. From June 2019 to December 2020 Contractor 7 cars, 3 cars for owner, contractor 10 km/d, owner 25 km/day, 6d/w, 26d/m, totals 3770 km/m	Fugitive unpaved road. LDV. From June 2019 to December 2020 Contractor 7 cars, 3 cars for owner, contractor 10 km/d, owner 25 km/day, 6d/w, 26d/m, totals 3770 km/m
Bus for labors	Exhaust. Bus. From May to October. 50 km/d, 6d/w, 26d/m, totals 1300 km/m	Exhaust. Bus. From June 2019 to December 2020 50 km/d, 6d/w, 26d/m, totals 1300 km/m	Exhaust. Bus. From June 2019 to December 2020 50 km/d, 6d/w, 26d/m, totals 1300 km/m
Bus for labors	Fugitive paved road. Bus. From May to October. 40 km/d, 6d/w, 26d/m, totals 1040 km/m	Fugitive paved road. Bus. From June 2019 to December 2020 40 km/d, 6d/w, 26d/m, totals 1040 km/m	Fugitive paved road. Bus. From June 2019 to December 2020 40 km/d, 6d/w, 26d/m, totals 1040 km/m
Bus for labors	Fugitive unpaved road. Bus. From May to October. 10 km/d, 6d/w, 26d/m, totals 260 km/m	Fugitive unpaved road. Bus. From June 2019 to December 2020 10 km/d, 6d/w, 26d/m, totals 260 km/m	Fugitive unpaved road. Bus. From June 2019 to December 2020 10 km/d, 6d/w, 26d/m, totals 260 km/m
Road Opening	Exhaust.	Exhaust.	Exhaust.

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	Caterpillar D9. June 2019. 11 km, 1 km in 2 days, 10h of operation per day, totals 220 hours	Caterpillar D9. June 2019. 26 km, 1 km in 2 days, 10h of operation per day, totals 520 hours	Caterpillar D9. June 2019. 11 km, 1 km in 2 days, 10h of operation per day, totals 220 hours
Road Opening	Fugitive from bulldozing and grading. 11 km	Fugitive from bulldozing and grading. 26 km	Fugitive from bulldozing and grading. 11 km
Construction camp	Exhaust. Concrete mixer truck. June 2019. 16 km, 1 truck, 1d	Exhaust. Concrete mixer truck. June 2019. 16 km, 1 truck, 1d	Exhaust. Concrete mixer truck. June 2019. 16 km, 1 truck, 1d
Construction camp	Fugitive paved road. Concrete mixer truck. June 2019. 8 km, 1d	Fugitive paved road. Concrete mixer truck. June 2019. 8 km, 1d	Fugitive paved road. Concrete mixer truck. June 2019. 8 km, 1d
Construction camp	Fugitive unpaved road. Concrete mixer truck. June 2019. 8 km, 1d	Fugitive unpaved road. Concrete mixer truck. June 2019. 8 km, 1d	Fugitive unpaved road. Concrete mixer truck. June 2019. 8 km, 1d
Construction camp	Exhaust. Auxiliary crane. June 2019. 10 hours of operation, 1 d	Exhaust. Auxiliary crane. June 2019. 10 hours of operation, 1 d	Exhaust. Auxiliary crane. June 2019. 10 hours of operation, 1 d
Construction camp	Exhaust. Trailors. June 2019. 145 km each, 7 trucks, 1d, totals 1015 km	Exhaust. Trailors. June 2019. 160 km each, 7 trucks, 1d, totals 1120 km	Exhaust. Trailors. June 2019. 145 km each, 7 trucks, 1d, totals 1015 km
Construction camp	Fugitive unpaved road. Trailors. June 2019. 11km each, 7 trucks, 1d, totals 77 km	Fugitive unpaved road. Trailors. June 2019. 26km each, 7 trucks, 1d, totals 182 km	Fugitive unpaved road. Trailors. June 2019. 11km each, 7 trucks, 1d, totals 77 km
Construction camp	Fugitive paved road. Concrete mixer truck. June 2019. 134 km each, 7 trucks, 1 d, totals 938 km	Fugitive paved road. Concrete mixer truck. June 2019. 134 km each, 7 trucks, 1 d, totals 938 km	Fugitive paved road. Concrete mixer truck. June 2019. 134 km each, 7 trucks, 1 d, totals 938 km
Construction camp	Exhaust. Generator. From May till October. 24h/d, 7d/w, totals 720 h/m	Exhaust. Generator. From June 2019 to August 2020 24h/d, 7d/w, totals 720 h/m	Exhaust. Generator. From June 2019 to August 2020 24h/d, 7d/w, totals 720 h/m
Construction camp	Exhaust. Concrete pump. June 2019. 1d, 5 h	Exhaust. Concrete pump. June 2019. 1d, 5 h	Exhaust. Concrete pump. June 2019. 1d, 5 h
Construction camp	Fugitive paved road. Concrete pump. June 2019.	Fugitive paved road. Concrete pump. June 2019.	Fugitive paved road. Concrete pump. June 2019.

	16 km, totals 1hr	16 km, totals 1hr	16 km, totals 1hr
Construction camp	Fugitive unpaved road. Concrete pump. June 2019. 16km, totals 1hr	Fugitive unpaved road. Concrete pump. June 2019. 16km, totals 1hr	Fugitive unpaved road. Concrete pump. June 2019. 16km, totals 1hr
Substation	Exhaust. Jackhammer. June 2019. 1 jackhammer, 150 hours, 10h/d, 20000 m3	Exhaust. Jackhammer. June 2019. 2 jackhammers, 520 hours, 10h/d each, 70000 m3	Exhaust. Jackhammer. June 2019. 1 jackhammer, 150 hours, 10h/d, 20000 m3
Substation	Exhaust. Excavator. June 2019. 1 excavator, 150 hours, 10h/d, 20000m3	Exhaust. Excavator. June 2019. 2 excavators, 520 hours, 10h/d, 70000m3	Exhaust. Excavator. June 2019. 1 excavator, 150 hours, 10h/d, 20000m3
Substation	Fugitive loading/unloading. Excavator/truck. June 2019. 20000 m3, 1.4 tons/m3, totals 28000 tonnes	Fugitive loading/unloading. Excavator/truck. June 2019. 70000 m3, 1.4 tons/m3, totals 98000 tonnes	Fugitive loading/unloading. Excavator/truck. June 2019. 20000 m3, 1.4 tons/m3, totals 28000 tonnes
Substation	Exhaust. Truck. June 2019. 20000m3, 20m3 per truck, 1000 trucks, 50 km, totals 50000 km	Exhaust. Truck. June 2019. 70000m3, 20m3 per truck, 3500 trucks, 50 km, totals 175000 km	Exhaust. Truck. June 2019. 20000m3, 20m3 per truck, 1000 trucks, 50 km, totals 50000 km
Substation	Fugitive unpaved road. Truck. June 2019. 1000 trucks, 16 km unpaved per truck, totals 16000 km	Fugitive unpaved road. Truck. June 2019. 3500 trucks, 16 km unpaved per truck, totals 56000 km	Fugitive unpaved road. Truck. June 2019. 1000 trucks, 16 km unpaved per truck, totals 16000 km
Substation	Fugitive paved road. Truck. June 2019. 1000 trucks, 34 km paved per truck, totals 34000 km	Fugitive paved road. Truck. June 2019. 3500 trucks, 34 km paved per truck, totals 119000 km	Fugitive paved road. Truck. June 2019. 1000 trucks, 34 km paved per truck, totals 34000 km
Substation	Exhaust. Concrete mixer truck. July-August 2019. 100 trucks, 32 km, totals 3200 km	Exhaust. Concrete mixer truck. July-August 2019. 100 trucks, 32 km, totals 3200 km	Exhaust. Concrete mixer truck. July-August 2019. 100 trucks, 32 km, totals 3200 km
Substation	Fugitive unpaved road. Concrete mixer truck. July-August 2019. 100 trucks, 16km unpaved, totals 1600 km	Fugitive unpaved road. Concrete mixer truck. July-August 2019. 100 trucks, 16km unpaved, totals 1600 km	Fugitive unpaved road. Concrete mixer truck. July-August 2019. 100 trucks, 16km unpaved, totals 1600 km
Substation	Fugitive paved road. Concrete mixer truck. July-August 2019.	Fugitive paved road. Concrete mixer truck. July-August 2019.	Fugitive paved road. Concrete mixer truck. July-August 2019.

	100 trucks, 16km paved, totals 1600 km	100 trucks, 16km paved, totals 1600 km	100 trucks, 16km paved, totals 1600 km
Substation	Exhaust. Steel truck. July-August 2019. 5 trucks, 145 km, totals 725 km total	Exhaust. Steel truck. July-August 2019. 5 trucks, 145 km, totals 725 km total	Exhaust. Steel truck. July-August 2019. 5 trucks, 145 km, totals 725 km total
Substation	Fugitive unpaved road. Steel truck. July-August 2019. 5 trucks, 11 km unpaved, totals 55km	Fugitive unpaved road. Steel truck. July-August 2019. 5 trucks, 11 km unpaved, totals 55km	Fugitive unpaved road. Steel truck. July-August 2019. 5 trucks, 11 km unpaved, totals 55km
Substation	Fugitive paved road. Steel truck. July-August 2019. 5 trucks, 134 km paved, totals 670km	Fugitive paved road. Steel truck. July-August 2019. 5 trucks, 134 km paved, totals 670km	Fugitive paved road. Steel truck. July-August 2019. 5 trucks, 134 km paved, totals 670km
Substation	Exhaust. Concrete pump. July-August 2019. 6 d, 6h/d, + 6 hours of transport, totals 42 hours total	Exhaust. Concrete pump. July-August 2019. 6 d, 6h/d, + 6 hours of transport, totals 42 hours total	Exhaust. Concrete pump. July-August 2019. 6 d, 6h/d, + 6 hours of transport, totals 42 hours total
Substation	Fugitive unpaved road. Concrete pump. July-August 2019. 16km, 6d, 96 km, speed 16km/h, totals 12h	Fugitive unpaved road. Concrete pump. July-August 2019. 16km, 6d, 96 km, speed 16km/h, totals 12h	Fugitive unpaved road. Concrete pump. July-August 2019. 16km, 6d, 96 km, speed 16km/h, totals 12h
Substation	Fugitive paved road. Concrete pump. July-August 2019. 16km, 6d, 96 km, speed 16km/h, totals 12h	Fugitive paved road. Concrete pump. July-August 2019. 16km, 6d, 96 km, speed 16km/h, totals 12h	Fugitive paved road. Concrete pump. July-August 2019. 16km, 6d, 96 km, speed 16km/h, totals 12h
Substation	Exhaust. Construction material truck. July-August 2019. 5 trucks, 32 km, totals 160 km	Exhaust. Construction material truck. July-August 2019. 5 trucks, 32 km, totals 160 km	Exhaust. Construction material truck. July-August 2019. 5 trucks, 32 km, totals 160 km
Substation	Fugitive unpaved road. Construction material truck. July-August 2019. 5 trucks, 16 km, totals 80km	Fugitive unpaved road. Construction material truck. July-August 2019. 5 trucks, 16 km, totals 80km	Fugitive unpaved road. Construction material truck. July-August 2019. 5 trucks, 16 km, totals 80km
Substation	Fugitive paved road. Construction material truck. July-August 2019. 5 trucks, 16 km, totals 80km	Fugitive paved road. Construction material truck. July-August 2019. 5 trucks, 16 km, totals 80km	Fugitive paved road. Construction material truck. July-August 2019. 5 trucks, 16 km, totals 80km
Platform	Exhaust. Jackhammer.	Exhaust. Jackhammer.	Exhaust. Jackhammer.

	July-October 2020. 3 jackhammers, 400000 m3 of excavation, 1.4 tons/m3, 10h/d, 6d/platform, totals 2880 hours for the 16 platforms	July-October 2020. 3 jackhammers, 525000 m3 of excavation, 1.4 tons/m3, 10h/d, 6d/platform, totals 3780 hours for the 21 platforms	July-October 2020. 3 jackhammers, 400000 m3 of excavation, 1.4 tons/m3, 10h/d, 6d/platform, totals 2880 hours for the 16 platforms
Platform	Exhaust. Excavator. July-October 2020. 1 excavator, 10h/d, 6d/platform, totals 960 hours operation	Exhaust. Excavator. July-October 2020. 1 excavator, 10h/d, 6d/platform, totals 1260 hours operation	Exhaust. Excavator. July-October 2020. 1 excavator, 10h/d, 6d/platform, totals 960 hours operation
Platform	Fugitive loading/unloading. Excavator/truck. July-October 2020. 400000 m3, 1.4 t/m3, in totals 560000 tons	Fugitive loading/unloading. Excavator/truck. July-October 2020. 525000 m3, 1.4 t/m3, in totals 735000 tons	Fugitive loading/unloading. Excavator/truck. July-October 2020. 400000 m3, 1.4 t/m3, in totals 560000 tons
Platform	Exhaust. Truck. July-October 2020. 400000 m^3, 20 m^3/ truck, 20000 trucks, 50km, totals 1000000 km	Exhaust. Truck. July-October 2020. 525000 m^3, 20 m^3/ truck, 26250 trucks, 50km, totals 1312500 km	Exhaust. Truck. July-October 2020. 400000 m^3, 20 m^3/ truck, 20000 trucks, 50km, totals 1000000 km
Platform	Fugitive unpaved road. Truck. July-October 2020. 400000 m3, 20 m3 per truck, 20000 trucks in total, 16km unpaved, totals 320000 km	Fugitive unpaved road. Truck. July-October 2020. 525000 m3, 20 m3 per truck, 262500 trucks in total, 16km unpaved, totals 420000 km	Fugitive unpaved road. Truck. July-October 2020. 400000 m3, 20 m3 per truck, 20000 trucks in total, 16km unpaved, totals 320000 km
Platform	Fugitive paved road. Truck. July-October 2020. 400000 m3, 20 m3 per truck, 20000 trucks, 34km paved, totals 680000 km	Fugitive paved road. Truck. July-October 2020. 000 m3, 20 m3 per truck, 20000 trucks, 34km paved, totals 892500 km	Fugitive paved road. Truck. July-October 2020. 400000 m3, 20 m3 per truck, 20000 trucks, 34km paved, totals 680000 km
Platform	Exhaust. Steel truck. July-October 2020. 43 trucks, 145 km, totals 6235 km	Exhaust. Steel truck. July-October 2020. 57 trucks, 160 km, totals 9120 km	Exhaust. Steel truck. July-October 2020. 43 trucks, 145 km, totals 6235 km
Platform	Fugitive unpaved road. Steel truck. July-October 2020. 40 trucks, 11 km, totals 440km	Fugitive unpaved road. Steel truck. July-October 2020. 57 trucks, 26 km, totals 1482km	Fugitive unpaved road. Steel truck. July-October 2020. 40 trucks, 11 km, totals 440km
Platform	Fugitive paved road. Steel truck. July-October 2020.	Fugitive paved road. Steel truck. July-October 2020.	Fugitive paved road. Steel truck. July-October 2020.

	40 trucks, 134 km, totals 5360km	57 trucks, 134 km, totals 7638km	40 trucks, 134 km, totals 5360km
Platform	Exhaust. Concrete mixer truck. July-October 2020. 1200 trucks, 32 km, totals 38400 km	Exhaust. Concrete mixer truck. July-October 2020. 1800 trucks, 32 km, totals 57600 km	Exhaust. Concrete mixer truck. July-October 2020. 1200 trucks, 32 km, totals 38400 km
Platform	Fugitive unpaved road. Concrete mixer truck. July-October 2020. 1200 trucks, 16km, totals 19200 km	Fugitive unpaved road. Concrete mixer truck. July-October 2020. 1800 trucks, 16km, totals 28800 km	Fugitive unpaved road. Concrete mixer truck. July-October 2020. 1200 trucks, 16km, totals 19200 km
Platform	Fugitive paved road. Concrete mixer truck. July-October 2020. 1200 trucks, 16km, totals 19200 km	Fugitive paved road. Concrete mixer truck. July-October 2020. 1800 trucks, 16km, totals 28800 km	Fugitive paved road. Concrete mixer truck. July-October 2020. 1200 trucks, 16km, totals 19200 km
Platform	Exhaust. Concrete pump. July-October 2020. 16d, 12h/d, transport to each platform 2 h, totals 224 h of operation	Exhaust. Concrete pump. July-October 2020. 21d, 12h/d, transport to each platform 2 h, totals 294 h of operation	Exhaust. Concrete pump. July-October 2020. 16d, 12h/d, transport to each platform 2 h, totals 224 h of operation
Platform	Fugitive unpaved road. Concrete pump. July-October 2020. 16km, 16d, totals 256 km	Fugitive unpaved road. Concrete pump. July-October 2020. 16km, 21d, totals 336 km	Fugitive unpaved road. Concrete pump. July-October 2020. 16km, 16d, totals 256 km
Platform	Fugitive paved road. Concrete pump. July-October 2020. 16km, 16d, totals 256 km	Fugitive paved road. Concrete pump. July-October 2020. 16km, 21d, totals 336 km	Fugitive paved road. Concrete pump. July-October 2020. 16km, 16d, totals 256 km
Transport of turbines	Exhaust. Tractor FH440. July-October 2020. 11 vehicles each time, 145 km, 16 WT, totals 25520 km	Exhaust. Tractor FH440. July-October 2020. 11 vehicles each time, 160 km, 21 WT, totals 36960 km	Exhaust. Tractor FH440. July-October 2020. 11 vehicles each time, 145 km, 16 WT, totals 25520 km
Transport of turbines	Fugitive unpaved road. Tractor FH440. July-October 2020. 11 vehicles each time, 11 km, 16 WT, totals 1936 km	Fugitive unpaved road. Tractor FH440. July-October 2020. 11 vehicles each time, 26 km, 21 WT, totals 6006 km	Fugitive unpaved road. Tractor FH440. July-October 2020. 11 vehicles each time, 11 km, 16 WT, totals 1936 km
Transport of turbines	Fugitive paved road. Tractor FH440. July-October 2020. 11 vehicles each time, 134 km, 16 WT, totals 23584 km	Fugitive paved road. Tractor FH440. July-October 2020. 11 vehicles each time, 134 km, 21 WT, totals 30954 km	Fugitive paved road. Tractor FH440. July-October 2020. 11 vehicles each time, 134 km, 16 WT, totals 23584 km
Erection of turbines	Exhaust. Main crane.	Exhaust. Main crane.	Exhaust. Main crane.

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	July-October 2020. 3d/platform, 10h/d, 16 platforms, totals 480 hours	July-October 2020. 3d/platform, 10h/d, 21 platforms, totals 630 hours	July-October 2020. 3d/platform, 10h/d, 16 platforms, totals 480 hours
Erection of turbines	Exhaust. Auxiliary crane. July-October 2020. 5d/platform, 10h/d, 16 platforms, totals 800 hours	Exhaust. Auxiliary crane. July-October 2020. 5d/platform, 10h/d, 21 platforms, totals 1050 hours	Exhaust. Auxiliary crane. July-October 2020. 5d/platform, 10h/d, 16 platforms, totals 800 hours

Operation

Source	Lebanon Wind Power	Sustainable Akkar	Hawa Akkar
Operation	Exhaust. LDV. Beginning August 2020 (except Nov-April due to snow). 1 LDV 60 km/d, 22d/m, 1 LDV 55km/d, 22d/m, 6 LDV, 50 km/d, 30d/m, totals 11530 km/m	Exhaust. LDV. Beginning August 2020 1 LDV 70 km/d, 22d/m, 1 LDV 65km/d, 22d/m, 6 LDV, 60 km/d, 30d/m, totals 13770 km/m	Exhaust. LDV. Beginning August 2020 1 LDV 60 km/d, 22d/m, 1 LDV 55km/d, 22d/m, 6 LDV, 50 km/d, 30d/m, totals 11530 km/m
Operation	Fugitive unpaved road. LDV. Beginning August 2020 (except Nov-April due to snow). 1 LDV 20 km/d, 22d/m, 1 LDV 15km/d, 22d/m, 6 LDV, 20 km/d, 30d/m, 4370 km/m	Fugitive unpaved road. LDV. Beginning August 2020 1 LDV 30 km/d, 22d/m, 1 LDV 25km/d, 22d/m, 6 LDV, 20 km/d, 30d/m, 4810 km/m	Fugitive unpaved road. LDV. Beginning August 2020 1 LDV 20 km/d, 22d/m, 1 LDV 15km/d, 22d/m, 6 LDV, 20 km/d, 30d/m, 4370 km/m
Operation	Fugitive paved road. LDV. Beginning August 2020 (except Nov-April due to snow). 1 LDV 40 km/d, 22d/m, 1 LDV 40km/d, 22d/m, 6 LDV, 40 km/d, 30d/m, totals 8960 km/m	Fugitive paved road. LDV. Beginning August 2020 1 LDV 40 km/d, 22d/m, 1 LDV 40km/d, 22d/m, 6 LDV, 40 km/d, 30d/m, totals 8960 km/m	Fugitive paved road. LDV. Beginning August 2020 1 LDV 40 km/d, 22d/m, 1 LDV 40km/d, 22d/m, 6 LDV, 40 km/d, 30d/m, totals 8960 km/m
Operation	Exhaust. LDV. Every Nov-April beginning Nov 2020 due to snow. 2 LDV 40km/d, 22d/m, 6 LDV, 40 km/30d/m, totals 8960	-	-
Operation	Fugitive unpaved road. LDV.	-	-

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	Every Nov-April beginning Nov 2020 due to snow. 0 km		
Operation	Fugitive paved road. LDV. Every Nov-April beginning Nov 2020 due to snow. 2 LDV 40km/d, 22d/m, 6 LDV, 40 km/30d/m, totals 8960 km/m	-	-
Operation	Exhaust. Skidoo. Every Nov-April beginning Nov 2020 due to snow. 11km/d, 2 skidoos for management team, 14L/100km gasoline, 22d/m, totals 484 km/m	-	-
Operation	Exhaust. LDV for security. Beginning August 2020 (except Nov-April due to snow). 2 veh., 128km/d, 30d/m, totals 7680km/m	Exhaust. LDV for security. Beginning August 2020 2 veh., 250km/d, 30d/m, totals 15000 km/m	Exhaust. LDV for security. Beginning August 2020 2 veh., 128km/d, 30d/m, totals 7680km/m
Operation	Fugitive unpaved road. LDV for security. Beginning August 2020 (except Nov-April due to snow). 2 veh., 88km/d, 30d/m, totals 5280 km/m	Fugitive unpaved road. LDV for security. Beginning August 2020 2 veh., 210km/d, 30d/m, totals 12600 km/m	Fugitive unpaved road. LDV for security. Beginning August 2020 2 veh., 88km/d, 30d/m, totals 5280 km/m
Operation	Fugitive paved road. LDV for security. Beginning August 2020 (except Nov-April due to snow). 2 veh., 40km/d, 30d/m, totals 2400 km/m	Fugitive paved road. LDV for security. Beginning August 2020 2 veh., 40km/d, 30d/m, totals 2400 km/m	Fugitive paved road. LDV for security. Beginning August 2020 2 veh., 40km/d, 30d/m, totals 2400 km/m
Operation	Exhaust. LDV. Every Nov-April beginning Nov 2020 due to snow. 2 veh., 40km/d, 30d/m, totals 2400km	-	-
Operation	Fugitive unpaved road. LDV for security. Every Nov-April beginning Nov 2020 due to snow. 0 km	-	-
Operation	Fugitive paved road. LDV for security.	-	-

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	Every Nov-April beginning Nov 2020 due to snow. 2 veh., 40km/d, 30 d/m, totals 2400 km		
Operation	Exhaust. Skidoo for security. Every Nov-April beginning Nov 2020 due to snow. 88km/d each, 4 skidoos, totals, 10560 km/m	-	-
Operation	Exhaust. Boiler 75 KW. Every Nov-April beginning Nov 2020. 24h/d, 30d/m, totals 720 h/m	Exhaust. Boiler 75 KW. Every Nov-April beginning Nov 2020. 24h/d, 30d/m, totals 720 h/m	Exhaust. Boiler 75 KW. Every Nov-April beginning Nov 2020. 24h/d, 30d/m, totals 720 h/m
Maintenance	Exhaust. LDV. Beginning June 2021. 1 LDV 90 km/d, 100d/yr, average 750 km/m	Exhaust. LDV. Beginning June 2021. 1 LDV 105 km/d, 100d/yr, average 875 km/m	Exhaust. LDV. Beginning June 2021. 1 LDV 90 km/d, 100d/yr, average 750 km/m
Maintenance	Fugitive unpaved road. LDV. Beginning June 2021. 1 LDV 50 km/d, 100d/yr, average 417km/m	Fugitive unpaved road. LDV. Beginning June 2021. 1 LDV 65 km/d, 100d/yr, average 542km/m	Fugitive unpaved road. LDV. Beginning June 2021. 1 LDV 50 km/d, 100d/yr, average 417km/m
Maintenance	Fugitive paved road. LDV. Beginning June 2021. 1 LDV 40 km/d, 100d/yr, average 333km/m	Fugitive paved road. LDV. Beginning June 2021. 1 LDV 40 km/d, 100d/yr, average 333km/m	Fugitive paved road. LDV. Beginning June 2021. 1 LDV 40 km/d, 100d/yr, average 333km/m
Maintenance	Exhaust. Main crane. Beginning June 2021, once per year. 2d/yr, 10h/d, totals 20 hours	Exhaust. Main crane. Beginning June 2021, once per year. 2d/yr, 10h/d, totals 20 hours	Exhaust. Main crane. Beginning June 2021, once per year. 2d/yr, 10h/d, totals 20 hours
Maintenance	Exhaust. Auxiliary crane. Beginning June 2021, once per year. 4d, 10h/d, totals 40 hours	Exhaust. Auxiliary crane. Beginning June 2021, once per year. 4d, 10h/d, totals 40 hours	Exhaust. Auxiliary crane. Beginning June 2021, once per year. 4d, 10h/d, totals 40 hours
Maintenance	Exhaust. Tractor FH440. Beginning June 2021, once per year. 3 vehicles once per year, 145 km, 1 WT/yr, totals 435 km	Exhaust. Tractor FH440. Beginning June 2021, once per year. 3 vehicles once per year, 160 km, 1 WT/yr, totals 480 km	Exhaust. Tractor FH440. Beginning June 2021, once per year. 3 vehicles once per year, 145 km, 1 WT/yr, totals 435 km
Maintenance	Fugitive unpaved road. Tractor FH440. Beginning June 2021, once per year.	Fugitive unpaved road. Tractor FH440. Beginning June 2021, once per year.	Fugitive unpaved road. Tractor FH440. Beginning June 2021, once per year.

	3 vehicles once per year, 11 km, totals 33 km	3 vehicles once per year, 26 km, totals 78 km	3 vehicles once per year, 11 km, totals 33 km
Maintenance	Fugitive paved road. Tractor FH440. Beginning June 2021, once per year. 3 vehicles once per year, 134 km, totals 402 km	Fugitive paved road. Tractor FH440. Beginning June 2021, once per year. 3 vehicles once per year, 134 km, totals 402 km	Fugitive paved road. Tractor FH440. Beginning June 2021, once per year. 3 vehicles once per year, 134 km, totals 402 km

Dismantling

Source	Lebanon Wind Power	Sustainable Akkar	Hawa Akkar
Dismantling	Exhaust. Main crane. 1.5d/platform, 10h/d, 16 platforms, totals 240 hours	Exhaust. Main crane. 1.5d/platform, 10h/d, 21 platforms, totals 315 hours	Exhaust. Main crane. 1.5d/platform, 10h/d, 16 platforms, totals 240 hours
Dismantling	Exhaust. Auxiliary crane. 4d/platform, 10h/d, 16 platforms, totals 640 hours	Exhaust. Auxiliary crane. 4d/platform, 10h/d, 21 platforms, totals 840 hours	Exhaust. Auxiliary crane. 4d/platform, 10h/d, 16 platforms, totals 640 hours
Dismantling	Exhaust. Tractor FH440. 11 vehicles each time, 145 km, 16 WT, totals 25520 km	Exhaust. Tractor FH440. 11 vehicles each time, 160 km, 21 WT, totals 36960 km	Exhaust. Tractor FH440. 11 vehicles each time, 145 km, 16 WT, totals 25520 km
Dismantling	Fugitive unpaved road. Tractor FH440. 11 vehicles each time, 11 km, 16 WT, totals 1936 km	Fugitive unpaved road. Tractor FH440. 11 vehicles each time, 26 km, 21 WT, totals 6006 km	Fugitive unpaved road. Tractor FH440. 11 vehicles each time, 11 km, 16 WT, totals 1936 km
Dismantling	Fugitive paved road. Tractor FH440. 11 vehicles each time, 134 km, paved roads, 16 WT, totals 23584 km	Fugitive paved road. Tractor FH440. 11 vehicles each time, 134 km, paved roads, 21 WT, totals 30954 km	Fugitive paved road. Tractor FH440. 11 vehicles each time, 134 km, paved roads, 16 WT, totals 23584 km
Dismantling	Exhaust. LDV. 8 LDV, 120 km/d each, 80d, totals 76800 km	Exhaust. LDV. 8 LDV, 120 km/d each, 80d, totals 76800 km	Exhaust. LDV. 8 LDV, 120 km/d each, 80d, totals 76800 km
Dismantling	Fugitive unpaved road. LDV. 8 LDV, 80 km/d each, 80d, totals 51200 km	Fugitive unpaved road. LDV. 8 LDV, 80 km/d each, 80d, totals 51200 km	Fugitive unpaved road. LDV. 8 LDV, 80 km/d each, 80d, totals 51200 km
Dismantling	Fugitive paved road. LDV. 8 LDV, 40 km/d each, 80d, totals 25600 km	Fugitive paved road. LDV. 8 LDV, 40 km/d each, 80d, totals 25600 km	Fugitive paved road. LDV. 8 LDV, 40 km/d each, 80d, totals 25600 km

APPENDIX B: Emission factors used

Appendix B: Emission factors used

Emission factors used

Emission source	Fuel type	EF unit	EF CO	EF Nox	EF PM	EF PM10	EFPM2.5	EF SO2	Fuel Cons.	Fuel Cons. unit	Reference
Main crane	Diesel	g/hr	914.32	2769.02	178.55	178.55	178.55	1.70	102	l/hr	EMEP/EEA (2016) and Contractor
Aux crane	Diesel	g/hr	224.09	678.68	43.76	43.76	43.76	0.42	25	l/hr	EMEP/EEA (2016) and Contractor
LDV for personnel movement on site and out of site	Gasoline	g/km	0.53	0.06	0.0014	0.0014	0.0014	0.0020	0.135	l/km	EMEP/EEA (2016)
Tractor FH440	Diesel	g/km	2.64	8.01	0.52	0.52	0.52	0.0050	0.295	l/km	EMEP/EEA (2016) and Contractor
Bus	Gasoline	g/km	0.22	5.42	0.0462	0.0462	0.0462	0.0020	0.135	l/km	EMEP/EEA (2016)
Trucks 20m3	Diesel	g/km	1.49	6.27	0.13	0.13	0.13	0.0233	0.333	l/km	EMEP/EEA (2016)
Jackhammer	Diesel	g/hr	116.53	352.91	22.76	22.76	22.76	0.2163	13	l/hr	EMEP/EEA (2016)
Caterpillar D9	Diesel	g/hr	690.22	2090.34	134.79	134.79	134.79	1.2818	77	l/hr	EMEP/EEA (2016) and Contractor
Excavator	Diesel	g/hr	116.53	352.92	22.76	22.76	22.76	0.2163	13	l/hr	EMEP/EEA (2016) and Contractor
Concrete Mixer Truck	Diesel	g/km	1.49	6.27	0.13	0.13	0.13	0.0233	0.333	l/km	EMEP/EEA (2016)
Concrete Pump	Diesel	g/hr	71.71	217.18	14.00	14.00	14.00	0.1331	8	l/hr	EMEP/EEA (2016) and Contractor
Skidoo	Gasoline	g/km	64.74	0.29	0.39	0.39	0.39	2.09E-07	0.14	l/km	EMEP/EEA (2016)
Bulldozing Moisture 1%, silt 5%	-	g/hr	0	0	10342	5032.83	1535.67	0	-		Mojave desert (2013), based on USEPA AP42
Loading/Unloading	-	g/tonne	0	0	14.50	7.00	2.00	0	-		Mojave desert (2013), based on USEPA AP42

Dust entrainment from paved roads - Truck 40t on average, silt 5g/m2	-	g/km	0	0	2038.36	396.97	98.54	0	-		Mojave desert (2013), based on USEPA AP42
Dust entrainment from paved roads - LDV 1.8 t, silt 5g/m2	-	g/km	0	0	19.71	3.80	0.96	0	-		Mojave desert (2013), based on USEPA AP42
Dust entrainment from paved roads - Bus 5 t, silt 5g/m2	-	g/km	0	0	90.09	17.60	4.50	0	-		Mojave desert (2013), based on USEPA AP42
Dust entrainment from unpaved roads - Trucks 40t on average	-	g/km	0	0	3102.58	732.01	106.99	0	-		Mojave desert (2013), based on USEPA AP42
Dust entrainment from unpaved roads - LDV 1.8t	-	g/km	0	0	658.81	211.16	30.97	0	-		Mojave desert (2013), based on USEPA AP42
Dust entrainment from unpaved roads - Bus 5 t	-	g/km	0	0	1098.01	318.14	47.86	0	-		Mojave desert (2013), based on USEPA AP42

Sulfur content in automotive fuel in Lebanon: 10 ppm max.

Sulfur content in diesel for boilers and reciprocating engines: 350 ppm ma

CA

APPENDIX J
TERIFROM GROUND STUDY

ÖZ - DE - HA

GROUND STUDY REPORT

JUNE 2018

LEBANON WIND POWER
60MW Wind Energy Project

AKKAR REGION – SOUTHERN RIDGE
LEBANON

tefirom

This report has been prepared for Tefirom under the Engineering Works Agreement for the LWP wind farm.

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1. REPORT PURPOSE AND COVERAGE

This report is the "Geophysical Ground Survey Report" of the wind power plant that will be built by LWP Company.

The report has been prepared in order to determine the engineering parameters of the wind power plant foundations, platforms and roads to be constructed. In this context, a total of 506 Multichannel Analysis Surface Waves (MASW) measurements were taken in the field. In the report, 2D-3D models and evaluations are presented.

The project site location map and satellite images are shown in Figure 1.

Figure 1 Project site satellite image (Highurce: Google Earth)

2. GEOLOGY

2.1 THE GEOLOGY OF LEBANON

2.1.1 THE MAIN FEATURES OF LEBANON

Figure 2 gives a basic geological map of Lebanon. Figure 3 shows the main structural features and Figure 4 gives a sketch cross section across the region.

2.1.1.1 THE LANDSCAPE

The three main divisions of Lebanon are; A Western Mountain rising to 3083 meters is known as Lebanon, a Bekaa Valley and an East Jebel Lubnan al Sharqi or Anti-Lebanon with Mount Hermon of 2814 m. It is worth remembering that the Bekaa is almost everywhere above 850m in altitude and that this is as high as some of the highest mountains of many countries. One other feature should mentioned at this point because it is frequently overlooked. This is that the continental shelf of Lebanon is very narrow indeed (it has a maximum width of ten kilometres, see Fig 4) and drops down abruptly to water depths of 1500m. We know very little about what lies off the coast of Lebanon and the area has not been mapped in. Beyond this shelf break, which is cut by deep canyons, lies what must be ancient ocean crust.

The rivers of Lebanon can be divided into two groups. The first group is made up of the east-west rivers, mostly cut into steep gorges, which drain Mount Lebanon. The second group is that of the two large rivers of the Bekaa; the Litani, which flows south and eventually cuts through to the Mediterranean and the Nahr al Assi which flows northwards into Syria.

2.1.1.2 FOLDS

There is a hierarchy of folds in Lebanon. The major geological structures of the area, Mount Lebanon, the Bekaa 3 and the Anti-Lebanon (see Figs. 2 and 3) are basically two very large NNE-SSW trending anticlines separated by a large syncline. They have however been broken up and disrupted later by a series of major and minor faults. These form what we can call the first order structures or megastructures.

Smaller folds occur locally but, in general, the brittle limestone rocks of the region have deformed more by faulting than folding. Perhaps the most spectacular folds are the overturned beds at Nabi Ayoub along the southwestern part of the Baruk-Niha ridge. Immediately east of the Yammouneh Fault a number of small NE-SW trending anticlines occur. Other good folds occur in the Tripoli area (i.e. at Jebel Terbol).

A major fold that is widely seen is the NNE-SSW trending Western Lebanon Flexure which runs from the western edge of the Chouf up to the latitude of Tripoli inland of the coast. This feature is technically a monocline and in places gives steep and even vertical dipping rocks.

2.1.1.3 FAULTS

Lebanon is cut by faults of every scale. Figure 3 merely shows some of the main ones. The longest fault in Lebanon is the Yammouneh Fault that runs along the western margin of the Bekaa and links the major fault of the Jordan Valley to the Ghab Valley Fault of Northern Syria. This is a lateral, or strike slip fault and is the Lebanese segment of the Dead Sea Transform Fault (see Section 2.1.5). It originated around 12 to 10 million years ago as the boundary between the Arabia Plate and the Levantine part of the African Plate and has ben

moving since. The result of this is that the Bekaa has moved some 50 km northwards with respect to Mount Lebanon. The evidence suggests that the Yammouneh Fault has not moved for many thousands of years; and whether it is dead or dormant is not clear. We would dearly love to know will move again. Like many large faults the Yammouneh Fault is not actually very impressive on the ground and is often only marked by a wide breccia zone.

The Roum Fault, which runs from near Marjayoun towards Beirut is probably where most of the plate tectonic motion is going on now and may be the present plate boundary between the Arabian and the African Plate. One model is that the plate motion has fairly recently (in geological terms) switched from the Yammouneh to the Roum Fault. The last recent earthquakes in Lebanon have been along this fault including the Chhim earthquake of 1956 that caused many deaths and much damage. One slightly worrying point is that the Roum Fault seems to be on line for Beirut. If it does have an active fault segment near (or even under) the capital then that must raise the earthquake risk. Earthquakes are discussed below in Section 2.1.7.

There are other major faults particularly in the Anti-Lebanon. The main highway to Damascus shows a good deal of faulting in the road cuts as it passes through this area. The Serghaya Fault in particular is apparently another major strike slip fault.

There many other faults in Lebanon with displacements ranging from a few centimetres to several kilometres. Working out which are major faults, and which are minor, is not easy.

2.1.1.4 IGNEOUS FEATURES

There is no current volcanic activity within Lebanon. However within the last ten million years there was large-scale basaltic volcanism both in the extreme north of Lebanon with the Homs Basalts, which extend into the Akkar and in the extreme southeast where the Golan and Jebel Druze volcanics occur round Mount Hermon. The Golan volcanism in particular seems to have died out very recently, probably within the last 10,000 years. The very much older Jurassic and Cretaceous volcanics are discussed in connection with the geological history in Section 2.2.

Older and subtler volcanic features can be seen exist in a number of Late Jurassic volcanic vents. There is a good one at Aintoura on the Dour Choueir-Zahle road. But even here you need a lot of imagination to see it as smoking volcano emitting lava.

2.1.2 ROCK TYPES IN LEBANON

Almost all the rocks in Lebanon are sedimentary rocks and most of these are pale limestones. These and/or the snow cover may be the origin of the name as L-B-N is 'white' in the Semitic languages. Despite the vast thicknesses of limestone I have to say that the variation in limestone types is rather limited; much of it is so fine grained that it needs a microscope to show any interesting features. The most varied sequence of sediments is that which extends from Late Jurassic to the Medium Cretaceous (see Fig. 6) and shows a considerable variety of limestones, sandstones, clays and volcanic ashes. The ashes tend to weather to a bright red or purple colour and to give fertile grounds.

The only igneous rocks are basaltic flows and intrusions of a variety of ages. The only metamorphic rocks are confined to narrow bands around the edges of the intrusions.

2.1.3. FOSSILS OF LEBANON

Given that Lebanon is largely Jurassic and Cretaceous limestones and rocks of this period are generally very fossiliferous the sequence here is frankly disappointing. In the Jurassic there are, especially towards the top, beds with corals and sponges (often turned into brown weathering silica), enormous echinoid spines and the odd bivalve. The Lower Cretaceous sandstones have plant debris and occasional amber lumps. These are rather dull and cracked and certainly not of jewellery quality. These contain good insects but the reports of preserved DNA in them (and in any other rocks) have now been more or less discounted; Jurassic Park is pure fiction. The rest of the Cretaceous has a number of bivalves and gastropods in it, particularly at specific levels. There are some ammonites in the higher beds. The redeeming feature of the Lebanese fossil record is, of course, the famous Late Cretaceous 'Fish Beds'. These are world class features and probably rank in the top twenty or thirty localities in the world. They are also very important historically; some of the earliest reports of fossils refer to 'fish in the rocks of the mountains of Lebanon'. The four outcrops known present a remarkable picture of life in the sea a hundred million years ago complete with worms, squids, the occasional octopus, prawns and of course fish. Although we might expect to have dinosaur fragments in our thick Jurassic and Cretaceous rocks and as far as I know no dinosaurs have been found in Lebanon, probably because the rocks were mainly marine during these times.

The Cenozoic rocks have some fossils. The Eocene limestones is often rich in the giant coin shaped foraminifera Nummulites. There are some vertebrate bones in the Late Cenozoic gravels. Highme of the cave systems have good mammal fossils, including those of the bear. One feels that there should be fossils of Neanderthal man but I think there are no reports from Lebanon

A useful little guide book to local fossils is 'Les Fossiles du Liban: Guide Practique' by Arslan, S.; Gèze, R. and Abdul-Nour, H. published in 1995.

2.1.4. MINERALS OF LEBANON

There are few 'exciting' minerals in Lebanon. Good crystals of calcite are common and sometimes calcite or quartz filled geodes occur in rocks. Metallic minerals appear to be confined to the iron ores of haematite and limonite.

2.1.5 LEBANON IN ITS REGIONAL PLATE TECTONIC SETTING

I find it useful to explain what is happening in the modern Medium East in plate tectonic terms. Firstly, it helps them understand Lebanon Secondly the Medium East area provides excellent examples of plate tectonic processes.

Figure 5 shows the region diagrammatically. The overall theme for the last sixty million years has been that the great oceanic seaway, the Tethys, which once lay to the north of the Arabia, has almost been entirely consumed as Africa and Arabia have collided with Eurasia.

The first main collision between what we can call the Africa-Arabia Plate and Eurasia took place around 40 million years ago. As it continued it gave rise to the Taurus and Zagros Mountain Ranges. For reasons not yet fully explained, but possibly due to the nature of the collision the Arabia part of the African Plate kept on moving north and rifted away from the larger African body. The spreading ocean that resulted is the Red Sea and Gulf of Aden. The

movement of this new plate past the Levantine protrusion of the African Plate has given rise to the Dead Sea Transform Fault zone.

In summary we have

A. A divergent or spreading boundary is well shown by the Red Sea which now forms what can be called an embryonic ocean.
B. The continent-continent type of destructive or convergent boundary is well seen in the Taurus and Zagros ranges which represents where the old Tethys ocean has been completely destroyed. An ocean-continent collision can be seen along the northern part of the Gulf of Oman along the edge of the Makran and along the arc which extends from Cyprus to the northeast. In both cases fragments of the Tethys are still being consumed.
C. The Dead Sea Fault System forms an excellent transform margin between the Arabian Plate and the Levantine part of the African Plate. Both are moving northwards but the Arabian plate is moving faster.

The Medium East has therefore all three types of plate boundary and if textbooks were written here rather than in the States we would doubtless be in it as a wonderful example.

2.1.6. RESOURCES OF LEBANON

Lebanon has only limited geological resources. Iron oxides occur locally in the mountains and were some of the first iron ores to be exploited; by the 7th century BC Lebanese iron was being exported to Babylon. Unfortunately iron smelting requires high temperatures and as wood was the only fuel this was a major factor in the catastrophic deforestation. The limestone has also been used as a building stone and for fertiliser and cement. The last two processes also use wood and have contributed to the deforestation.

There is no oil known and the general opinion is rather negative about prospects. The main problem seems to be that the heavy faulting has fractured any possible oil reservoirs and allowed water to get in. However drilling programs have been minimal and oil may exist at depth. The narrow continental shelf means that any offshore oil fields, even if they exist are not likely to be extensive. Highme bitumen has been recorded along the southern flanks of the Bekaa but this may only be a leakage of immature oil and may be no indicator of major oil fields at depth.

The chief natural resource is water. The mountains give a high rainfall (widely over a meter a year in Mount Lebanon), and the porous fractured limestone makes an excellent aquifer which are refilled over spring and early summer by the slow melting of snow. The resulting abundant springs and rivers, unique to the Arab world, gave the country its once abundant forests and legendary fertility. However due to the steep slopes and the stony, shallow grounds this fertility has proved hard to harness for agriculture and the removal of the forests has tended to produce only short lived farming land.

Stone for building and cement can also be accounted a resource and the frequently enormous, visually and environmentally appalling quarries bear witness to this. I am not against all quarries but there are ways of designing and planning them so that they have minimal impact on the environment. This is - to say the least -not the practice here.

2.1.7 GEOLOGIC HAZARDS OF LEBANON

A main concern in Lebanon is that of earthquakes as the area is in an active region. Beirut has been destroyed many times by earthquakes and tsunami ('tidal waves') most notably in 551 AD. Lesser quakes have occurred since. Unfortunately prediction of such events is still in its infancy and we have no way of knowing when the next major quake may occur. Even small earthquakes may trigger landslides.

A subtler hazard is that of ground erosion. The steep slopes of Lebanon and the high rainfall means that the grounds, in many cases the product of thousands of years of formation, are easily eroded. Deforestation and the reckless building of the last ten years, has made this problem even worse. These grounds are not now being replaced. Related to this are widespread landslides on various scales due to the steep slopes and wet winters. The loss of trees, and extensive urbanisation has again only made this worse.

A final geological concern is of the pollution and contamination of the underground water supplies due to poor waste disposal practices. The complex network of underground fissures that makes up the main aquifers means that pollutants can circulate rapidly and unpredictably. The chief dangers here come from the 'ordinary' unspectacular pollution of aquifers by sewage and agricultural chemicals. The widespread use of large quantities of pesticides are a major concern. The seems little doubt that the uncontrolled shooting of the birds has caused such an explosion in insect numbers that people are forced to use pesticides. A far better practice would be to leave the birds to naturally control the insects and so keep pesticides out of our drinking water.

2.1.8 THE IMPORTANCE OF GEOLOGY IN LEBANON

It can be said that it is the geology that has largely controlled the history of Lebanon.

It has given Lebanon its high mountains and inaccessible valleys. Positively, this makes the area an excellent refuge for minorities. Negatively, this leads to isolationism, a clan system and makes a centralised state difficult.

It has given the country good ports. This is in marked contrast to the coast of Palestine. The Lebanon region is also protected by Cyprus from worst winter storm waves.

It has given the region its fertility with the high rainfall and excellent springs. However this is localised, demands hard work to farm due to the steep slopes and is easily destroyed. As a result wealth based on agriculture has not proved easy and many Lebanese have traditionally migrated or gone into commerce. This has been encouraged by the lack of mineral wealth.

2.2 AN OUTLINE OF THE GEOLOGICAL HISTORY OF LEBANON

2.2.1 INTRODUCTION

This is a summary of the geological history of Lebanon modified extensively from a longer (and more technical) guide. The most recent summary for Lebanon is the stratigraphic table (Figure 6).

Rather than go through the sequence unit by unit presented the geological history of Lebanon here in terms of five broad summary episodes each distinguished by varying plate tectonic

and depositional style. Each episode more or less corresponds to a 50 million year interval starting from around 250 ma (million years ago).

The oldest rocks seen at the surface in Lebanon are Early Jurassic, perhaps 200 million years old. This is a very recent age when set against the 4.6 billion year age of the earth. The handful of wells drilled for oil prior to 1975 never penetrated any older rocks. This level of ignorance about the subsurface, coupled with the only rudimentary geophysical data, means that Lebanon is very poorly studied indeed. There are few, if any, other countries in the world whose geological history goes no further back than the surface rocks and there are certainly very few whose pre-Jurassic history is so sketchy.

On the basis of the adjacent countries we can speculate at what must have happened in Lebanon before the Triassic. There was probably a major mountain building episode around 800-600 million years ago, deposition of an interrupted sequence of sandstone and clays during the Early Paleozoic, some sort of uplift during the Devonian and Carboniferous and a flooding by shallow limestone seas during the Permian. In terms of plate tectonics the Lebanon area was part of the supercontinent Gondwana during Paleozoic to Triassic time.

2.2.2 EPISODE 1: 250-200 MA (END PERMIAN TO LATE TRIASSIC) THE FIRST RIFTING

Although there are no rocks of this time period known in Lebanon we can make a fairly good guess as to what events took place in this area from data from surrounding countries.

After the relatively high sealevels in the Permian the seas began to fall during the Triassic so that by the end of the Triassic evaporites and shallow water limestones were probably being deposited.

During the Late Permian to Triassic the supercontinent Gondwana began to break up with the formation of a series of rifts and opening oceanic seaways. This trend towards breakup was to continue until the middle of the Cretaceous. During the Triassic the Tethyan Ocean progressively opened westwards round the northeastern to northwestern margins of what is now Arabia. It is probable that by the Late Triassic sea floor spreading had opened a narrow NE-SW aligned ocean whose eastern margin lay just to the west of the present day continental slope, some 10-20 km west of the modern shoreline (Fig 7a).

2.2.3 EPISODE 2: 200-150 MA (EARLY - LATE JURASSIC) STABILITY AND WARM CLEAR SEAS

The oldest rocks seen in Lebanon are Lower Jurassic in age. The main part of the Jurassic sequence in Lebanon is extremely thick (possibly greater than two km) but poorly known largely due to the cliff forming and monotonous character. This massive Jurassic sequence (the Kesrouane Formation) occurs essentially in three main areas. These are a) Mount Lebanon north of the Damascus Road (the Metn and Kesrouane), b) the Chouf and Jebel Barouk and c) the central and southern Anti-Lebanon.

For most of the Jurassic time (210-144 million years ago) the Lebanon region appears to have been a stable area upon which marine limestones were deposited. Over this area sea levels gradually rose during the Early and Medium Jurassic so that shoreline and tidal flat

limestones and evaporites were gradually replaced by shallow marine limestone muds and sands with local patches of corals and sponge reefs.

Whether any seafloor spreading occurred offshore Lebanon at this time is unclear, but until the Late Jurassic the region appears to have been tectonically quiet.

2.2.4 EPISODE 3: 150-100 MA (END JURASSIC - MID CRETACEOUS) UPLIFT, VOLCANOES AND DELTAS

At the start of the Late Jurassic further tectonism began to occur in the region. This probably mainly involved the break up of the area into a distinct series of blocks, some of which rose above the sea and became covered by grounds. There was the widespread eruption of basalt lava and ashes from a number of vents. It is probable that this tectonism is related to a renewed phase of breakup of Gondwana; similar Late Jurassic rifting is known across Africa and into southern Arabia. This volcanic and tectonic phase was relatively temporary and there was renewed flooding of the Lebanon area during the last part of the Jurassic to give further limestone deposition. However sometime, either at the very end of the Jurassic or during earliest Cretaceous time, the area underwent more block faulting giving emergence and erosion that possibly lasted for 10 or so million years. The result of this is that the sandy Lower Cretaceous sandstones of the Chouf Formation rest unconformably upon the Jurassic limestones. Associated with this pre-Chouf Sandstone uplift was another phase of basaltic volcanism which continued in places into the middle part of the Cretaceous. In addition to this it seems tectonism it seems as if seafloor spreading continued in the offshore area until mid Cretaceous time.

During the Early Cretaceous Lebanon was covered by a series of swamps, rivers and deltas which has given a widespread sequence of sands and shales up to 500m thick. These Early Cretaceous strata are widely worked for building sand. They also contain good fossil amber with well preserved insects.

During the later part of the Early Cretaceous sea levels began to rise and marine incursions became increasingly prominent. The supply of sands into the Lebanon area began to wane switching off almost totally during the middle Cretaceous when a sea level rise brought in a widespread pure limestone deposition, locally with reefs, across the area. After a brief return to sandstone and clay deposition sea levels rose further to give a return to widespread limestones.

2.2.5 EPISODE 4: 100-50 MA (LATE CRETACEOUS - EARLY EOCENE) HIGH SEALEVELS AND GENTLE FOLDING

After the seafloor spreading which marked the first three episodes the Late Cretaceous saw a major switch in the tectonic pattern as Eurasia and the Africa-Arabia Plate began to come closer together causing the start of the closure of the Tethyan Ocean. Although any collision zone was well offshore and far to the north and northwest of the Lebanon area the first compressional effects seem to have been felt across the area during the Late Cretaceous. This gave rise to the first gentle uplifting of the Mount Lebanon and Anti-Lebanon area so that the main features of Lebanon started to form at this time.

A more obvious feature was that of the very high sea levels which dominated most of Late Cretaceous and Early Tertiary time. These contributed to thick sequences of pale fine

limestones and chalks. It is during this time the 'fish beds' formed in local areas of oxygen shortage close to the edge of the carbonate platform. The fine grained limestones seem to cross the Cretaceous-Tertiary boundary with no major change. Whatever did kill off the dinosaurs and ammonites left no obvious signs of its action here.

2.2.6 EPISODE 5: 50-0 MA (MID EOCENE TO THE RECENT) TECTONIC UPLIFT AND CLIMATIC COOLING

The last fifty million years has seen an enormous change in the area from the Mid Eocene time when the area was covered by shallow seas in which limestones were being deposited to its present state of being an emergent and eroding land mass.

At the start of this episode the Africa-Arabian Plate was just beginning to collide with Eurasia and there was still a substantial Tethyan Ocean present (Fig 6b). As the plates collided the geology changed. Substantial uplift occurred in the Late Eocene and Oligocene giving a major emergence and the marking out of the threefold NNE-SSW trending pattern of modern Lebanon. During this time the sea was progressively pushed out of the Bekaa depression and restricted to shallow marine incursions along the line of the present day coast. The erosion of some of the main river valleys of Mount Lebanon may have started at this time.

Perhaps ten million years ago the area began to be dissected by the first motions along the faults of the Dead Sea Transform Fault System. These caused new tilting and uplift and caused major disruption of drainage patterns. At the end of the Miocene the Mediterranean dried up and during this time the river valleys may have cut down across the continental shelf.

There has been continued uplift and local tilting over the last five million years and some major disruption of river courses as various blocks slide against one another due to the strike slip faulting. Uplift and local tilting is evidently continuing; evidences for this are the numerous raised beach levels and the continuing seismicity. A classic case of this is the Litani River which, at one point, probably originally flowed due south into the Hula and Jordan valley areas but which had its path blocked by uplift and basaltic volcanism, redirecting it eastwards to the Mediterranean.

Superimposed on the effects of these tectonic events have been the major climatic and sea level changes of the last part of the Cenozoic. The lowering of temperatures over the last two million years gave rise to frequently wetter and colder conditions during the Pleistocene . Highme of the best evidence for this can be seen in the way that the southern part of the Bekaa (from Rayak southwards) appears to have been sporadically covered by a large lake with a well marked shoreline at around 970m. The last remains of this lake system can be seen in the Aammiq Wetlands area. The extent to which glaciers were present on the tops of the highest peaks during the Pleistocene glacial periods is uncertain. The evidence suggests that limited glacier systems existed at altitudes above 2500m at the coldest times giving glacial moraines at such places as the Cedars at Bcharré.

From 10,000 years ago the area warmed up and reforestation occurred. Human activity however started to negatively affect the environment on a large scale from around 4000 BC onwards; a process that has increased alarmingly in the 20th Century.

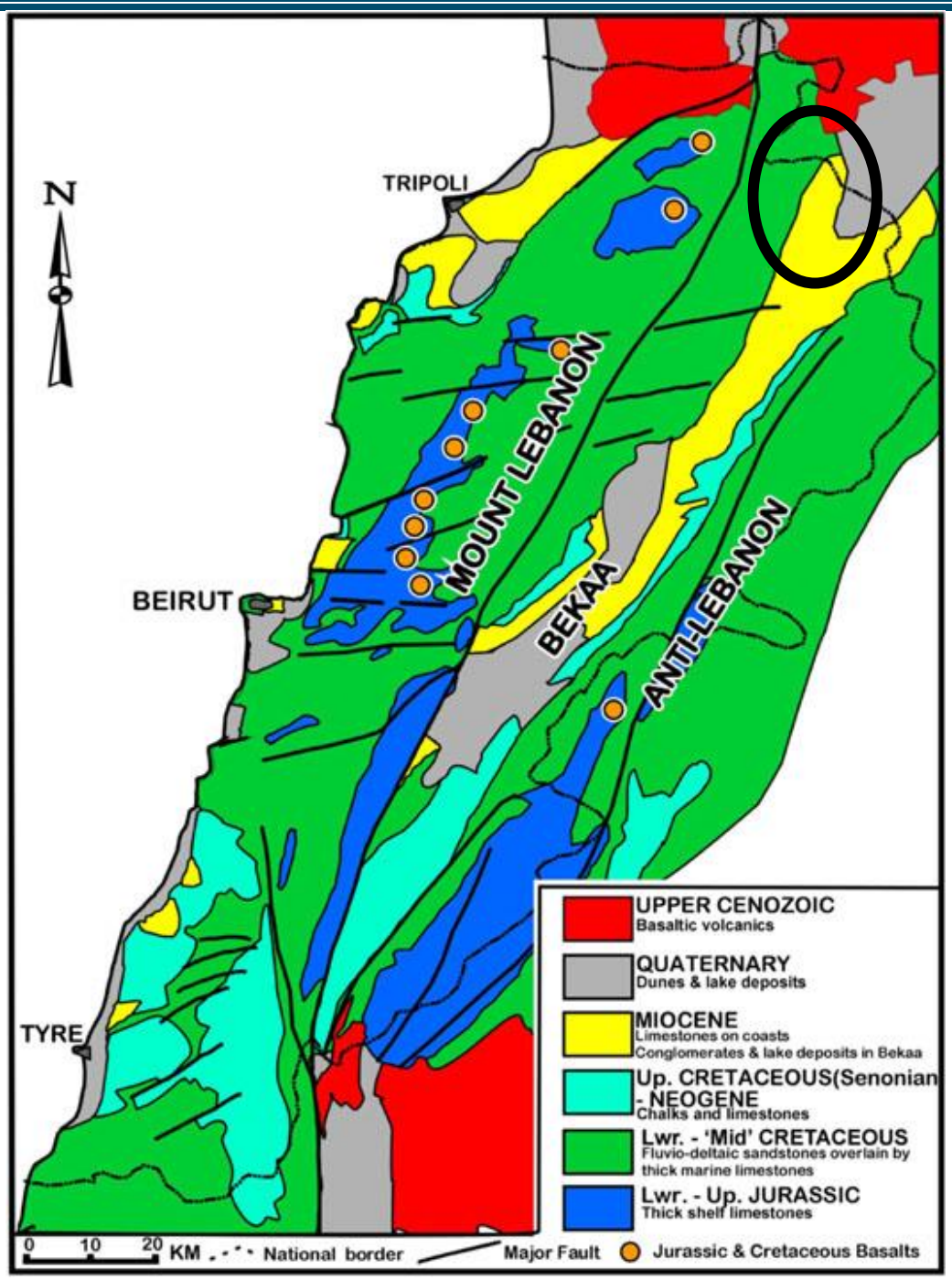


Figure 1 Geology Map of Lebanon

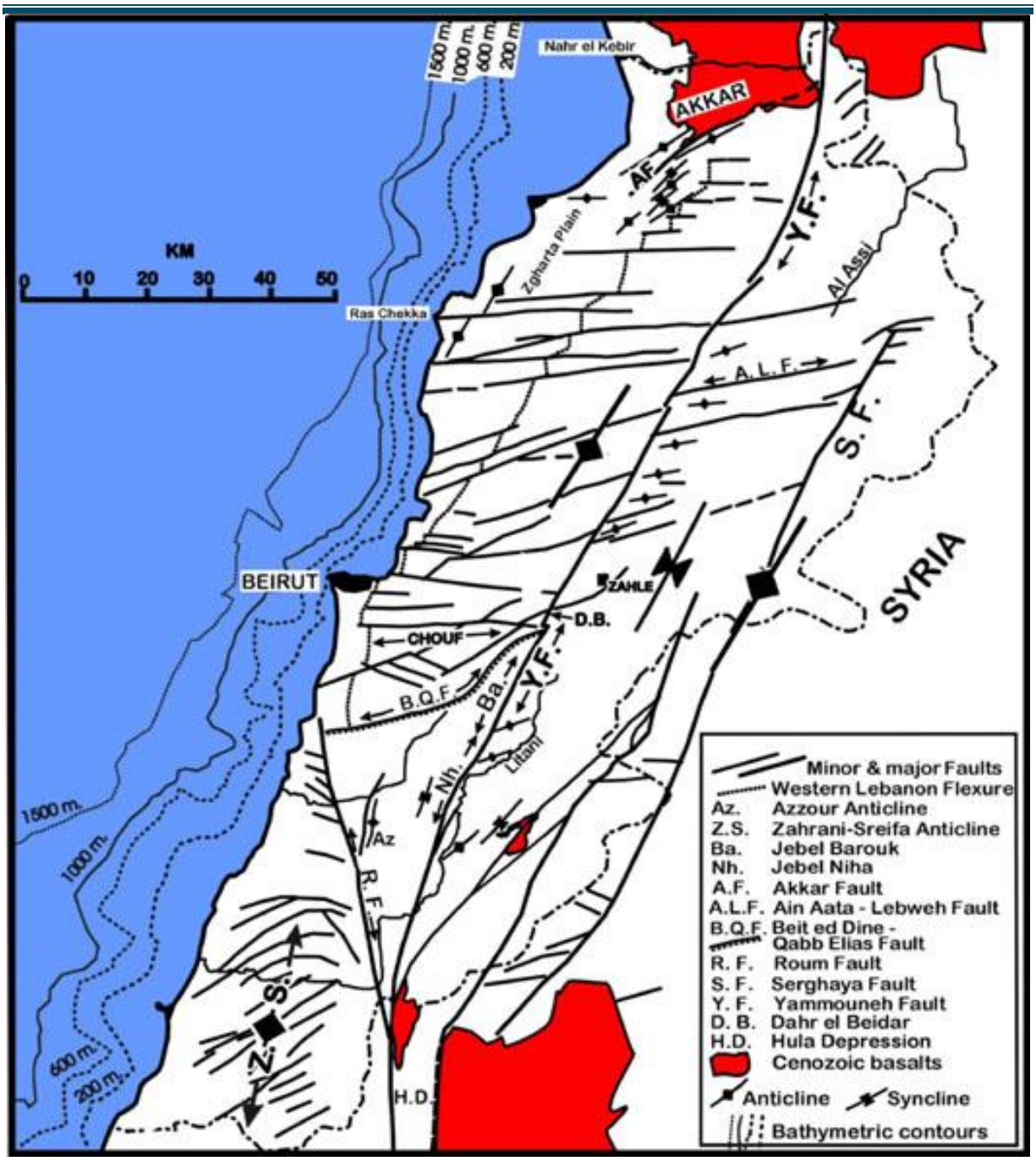


Figure 2 Simplified structural map of Lebanon

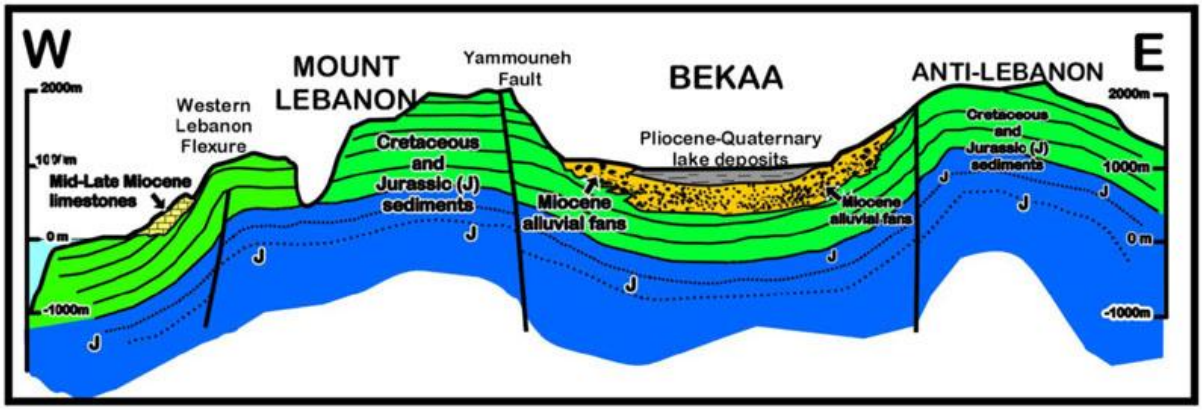


Figure 3 Schematic east-west cross section across Northern Lebanon

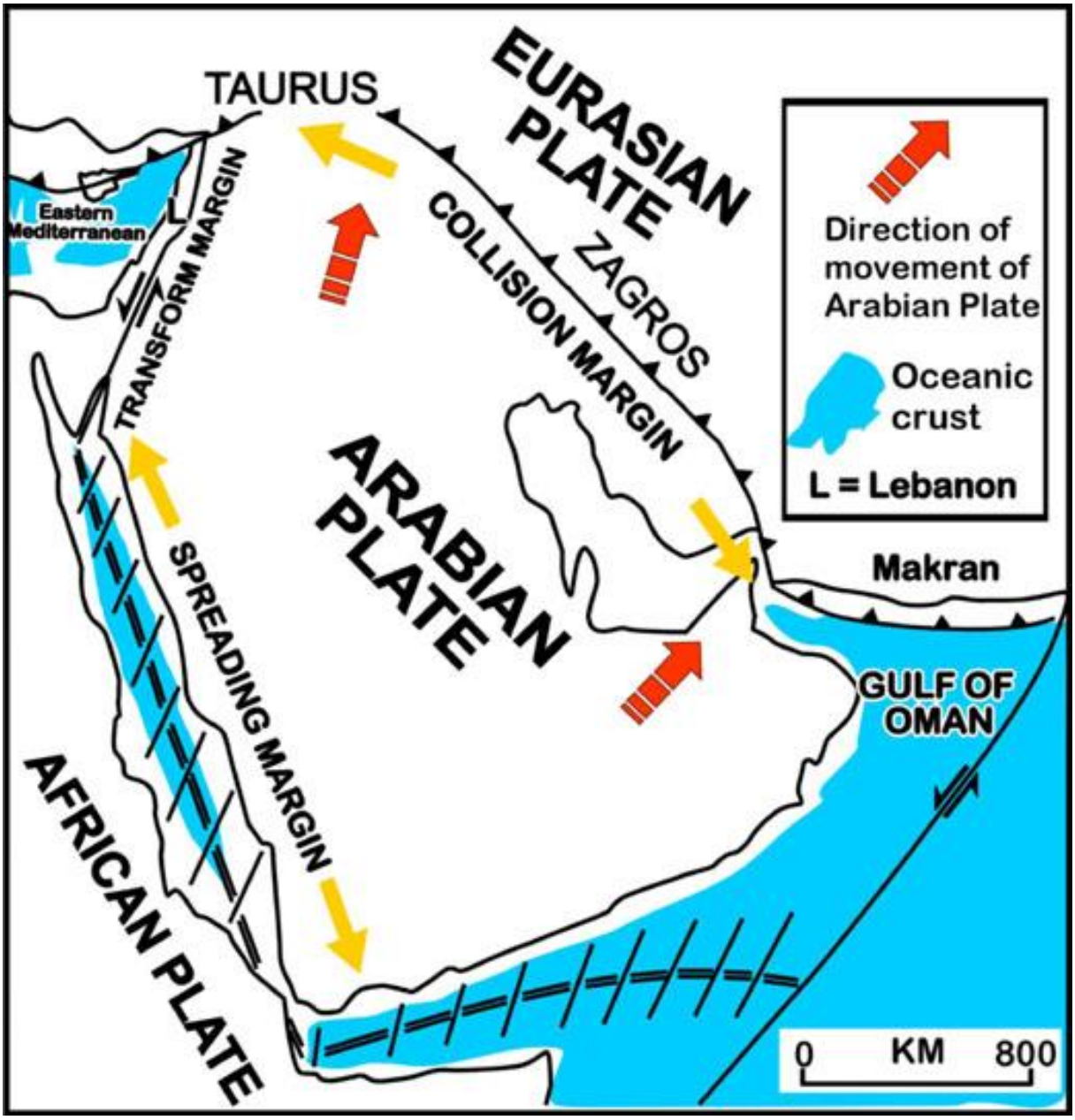


Figure 4 Modern day regional tectonic map

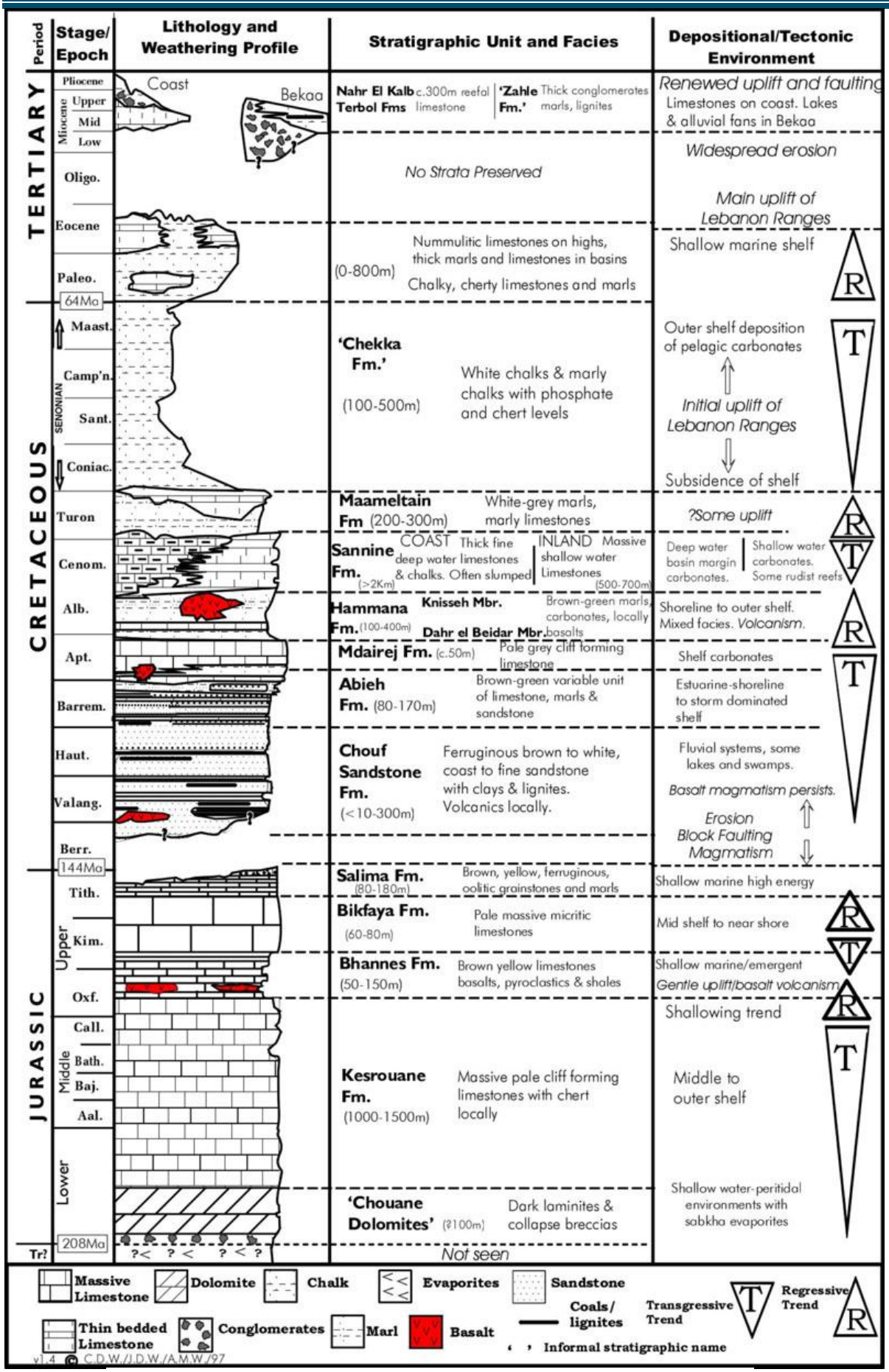


Figure 5 Summary stratigraphic table

Figure 6a: Schematic models for the plate tectonic evolution of the Lebanon region in Early Jurassic (200 millions years ago)

Figure 7b: Schematic models for the plate tectonic evolution of the Lebanon region in Early Tertiary time (50 million years ago)

3. FIELD AND OFFICE OPERATION METHODS

Seismic study (fracture (P wav) - active source surface wave) has been performed along 1 profile to determine the seismic velocities (P and S), thicknesses and dynamic engineering parameters of the basement-forming units in the study area.

In the studies DOREMI brand SEISMIC-DRM12 model recorder 4.5 hertz vertical geophones and cables was used. And 8 kg sledgehammer was used as seismic source.

In the seismic studies, 2 m. geophone range was selected and a shot was made for the 12 channel recording was taken.

Offset distance 4 m. total length of single profile (including offset) 26 m. d. The number of sampling records is 256 in milliseconds, and the recording length is 1024 ms.

Signals and land records belonging to all geophysical works, evaluation results are presented in Attechments.

General Information about Active Resource Masw Survey

Surface waves have been characterized as noise in other seismic methods until recently and have been removed. Later, thanks to the developing technology and software, the information carried by surface waves began to be examined. The indication of the strength of the ground has been an effective way to calculate shear waves and has played an important role in various investigations. The Vs30 value can be calculated with MASW (Multichannel Analysis Surface Waves) technique from the surface wave analysis methods. Vs30, UBC and Eurocode-8 are the main parameters used in international standards. In surface wave analysis methods, the shear wave of underground layer constructions exploits the dispersive property of the Rayleigh wave for the purpose of calculating the variation of Velocity (Vs). Surface wave methods can be grouped into two main groups, active-source and passive-source methods. Passive methods have deeper population power. Particularly, it can be used effectively in areas where the depth of the bedrock should be reached. In addition to the advantages of easy-to-apply method at first glance, there are disadvantages of geometry-related problems during data processing and the fact that there is a margin of error in finding layers near the surface. In addition to this, the MASW method has more limited population depth and more effective results are obtained by using efficient resources. In particular, Vs30 has effective usage because it gives 30 healthy and very healthy results in detection of thin lines. The greatest advantage over other methods is that the source is controlled. S wave velocity structure can be determined by using active and passive source surface wave methods.

There are two steps to this. The first is to determine the dispersion curve for the area studied. The purpose of all surface wave methods is to obtain the dispersion curve of the studied area. The derivation of the dispersion curve is different for all methods. The second step is reverse-solution. During this process, the layer parameters of 1B medium are obtained by using the dispersion curve.

Determining S-wave velocities from geophysical studies carried out in the scope of the Ground Survey Report and for the purpose of in order to reveal the dynamic - elastic properties of the place which can not be calculated by geotechnical studies the density (r),

maximum shear modulus (Gmax), young modulus (Ed), poisson's ratio (n), bulk modulus (K), seismic velocity ratio (Vp / Vs) and Vs30 (m / sec) were calculated for each determined layer. (Ercan,2001).

DOREMI brand SEISMIC-DRM12 model recorder was used in the process of taking the records in field works.

Technical specifications of DOREMI brand SISMIK-DRM12 Tool

Multy Channel Analysis of SurfaceWaves (MASW) technique was used for S-type seismic velocity analysis. Geophones with a natural frequency of 4.5 Hz were used during the data acquisition phase. The method is based on the principle that Rayleigh type surface waves present in P-type field recording are separated into plane-wave components. The dispersion curve is determined from the phase Velocity - frequency spectrum obtained after the analysis and an S - type velocity - depth model is constructed iteratively following an initial model.

A 12-channel DOREMI engineering seismograph recorder was used for the Masw studies. It consists of a tablet PC for system records, a sensor for detecting seismic tracks, a trigger, a sledgehammer, 12 vertical geophones (4.5 Hz geophone) and special connection units.

Figure 6 Image of the seismic device

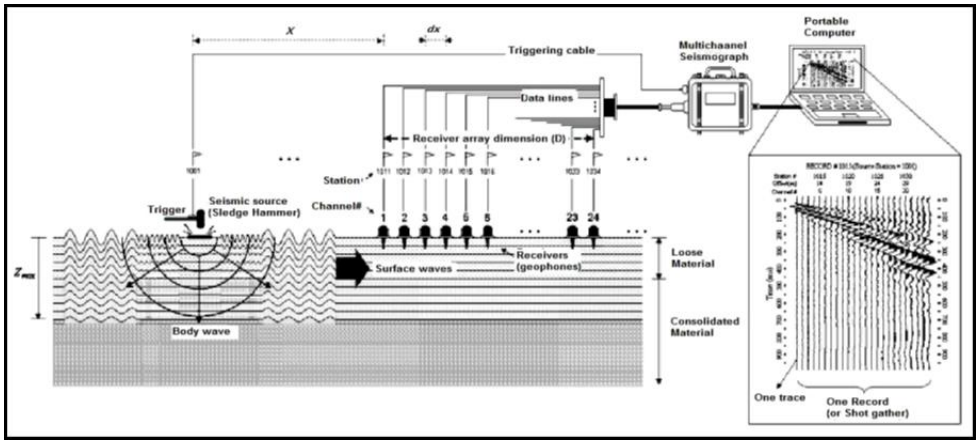


Figure 7 Schematic representation of the field application of the Fracture - Masw method.

Seismic Refraction and Interpretation of Masw

There are different methods to investigate various parts of the globe. However, they are very expensive and provide local information. Geophysical methods determine changes in a wide area of the earth very quickly. Geophysical searches do remove the need for drilling. However, it helps to reduce the time and economic factors to the minimum by better directing the search / research program.

When a basic drilling well is opened, many static features of the opening are determined. But the characteristics of a movement can not be determined. Since the earthquake is a dynamic phenomenon, it must be known depending on the motion of the ground.

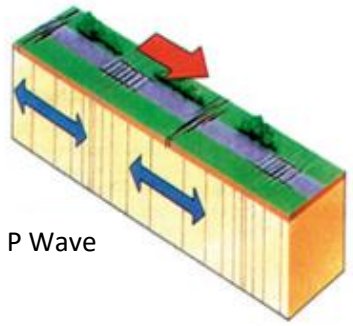
In the interpretation phase;

In order to obtain the values of the P and S waves which vary greatly from the digital recordings obtained as a result of field studies; a special software program is used to transform the Rayleigh wave spectrum to the S wave and the P wave spectra with fourier analysis in the firecance environment to obtain the P and S velocity values of the working ground.

The environment modeling is performed. The number of layers, layer thicknesses and slopes and positions of layers in the modeling resultant environment are determined. Seismic recorded seismic fault data was evaluated with SurfSeis1.5 software. At the end of the evaluation, layer thicknesses, underground speed structure and topography were revealed. Depending on the P and surface wave velocities, the ground dynamic elastic parameters and the Vs velocities, Vibration Periods, ground amplitudes were calculated. Waveforms of seismic studies, road-time plots and sections are given in Appendix.

4 ENGINEERING PARAMETERS

4.1. Seismic P wave velocity(*Compressional Wave Velocity* (Vp))

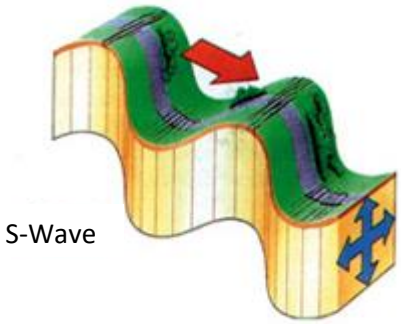


- Seismograph is the first earthquake wave that reaches first.
- The speed varies between 1.5 km / h and 8 km / h depending on the structure of the shell.
- Destructive effects are low.
- They spread in every environment (solid-liquid-gas).
- Longitudinal wave.

Today, it is impmıddlent for the project to determine the removability and removability of the grounds and rocks in projects that require medium and large-scale excavation and removal works such as road, railway, water structures, mining, tunnel construction, subway, sewerage. Excavation: simple removal of floors from the ground. Detachability: can be defined as the process of removing rocks, whether by means of vehicles or by compressor or dynamite fragmentation Pre-determination of the removability / excavability conditions of rocks and grounds with the aid of geophysical-geotechnical data; machine park selection and calculation of unit excavation costs. Depending on the properties of rock or floor material and rock mass; direct excavation, drilling-blasting or pre-loosening mechanical excavation with mechanical excavation tools constitute the main excavation methods. (Göktan and Iphar, 2013).

“The concept of "removability" is related to the degree of ease / difficulty encountered in the process of loosening a consumable material by the remover-dozer in the appropriate part sizes. (Eskikaya and Göktan, 1988).

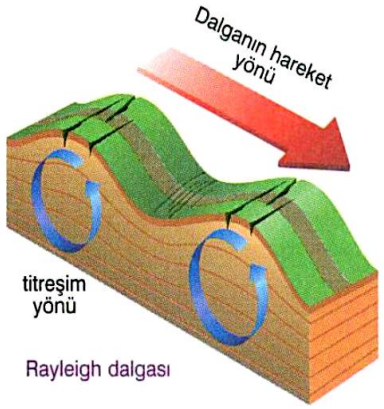
4.2. Seismic S wave velocity (*Transverse wave Velocity* (Vs))



- Seismography is the second wave of seismic waves.
- -The speed varies between 60% and 70% of the P-wave velocity.
- Demolition effects are high.
- They only spread in solid medium.
- -They are waves. (Shear Wave)

During the propagation of the slip waves, deformations occur on the rocks. The reason for this is that in the wave propagation, the direction of the vibration of the particles is perpendicular to the direction of the wave propagation. Naturally, shear wave velocities come into play if the material is resistant to distortion or distortion. Normally, the P wave and the S wave increase together and tend to decrease together, but when the P wave in the water takes a value of about 1500 m / s, the S speed is 0. This is because the P wave velocity is high because the water is not compressible, and the reason why the S velocity is 0 in water is that water does not have a resistance against twisting and shape change and it can be cut.

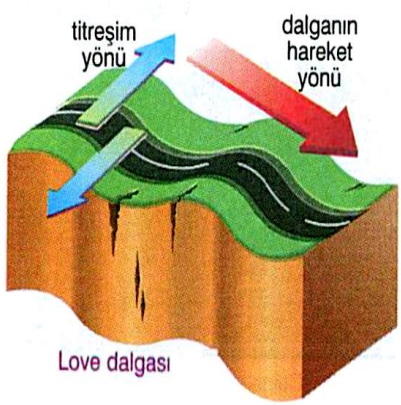
4.3. Surface Waves



The closest point to the image is the wave surface waves that spread from the area called the epicentre.
Surface Waves Properties;
- Earthquakes are the slowest waves in waves.
- Surface waves propagate along the earth's surface.
- P and S are recorded after the waves.
- The effect is great because the ground moves during the formation of surface waves.

Surface waves there are two types of waves, Rayleigh Waves and Lowe Waves.

Properties of Rayleigh Waves;



It is called the wave of Rayleigh wave that acts on the earth as the water ripples on the ocean. Most of the vibrations felt during an earthquake are caused by this Rayleigh wave, which carries much more energy than other waves.

Features of Lowe Waves;
The surface waves that move the floor in the horizontal plane are called Lowe waves. It is the fastest surface wave. Moving the ground in a horizontal plane causes splits on the earth.

The Vs30 value can be calculated with MASW (Multichannel Analysis Surface Waves) technique from the surface wave analysis methods. Vs30, UBC and Eurocode-8 are the main parameters used in international standards.

In the surface wave analysis methods, the shear wave of underground-stratified structures utilizes the dispersive property of the Rayleigh wave for the purpose of calculating the Waveness (Vs) variation.

Surface wave methods can be grouped into two main groups, active-source and passive-source methods. Passive methods have deeper population power. Particularly, it can be used effectively in areas where the depth of the bedrock should be reached. In addition to the advantages of easy-to-apply method at first glance, disadvantages are the disadvantages of geometry-induced problems during data handling and the fact that there is a margin of error in the detection of near-surface layers.

In addition to this, the MASW method has more limited penetration depth and more effective results are obtained by using the effective source. In particular, Vs30 has an effective use because it provides the first 30 metronomes in the study and gives very healthy results in the detection of thin layers. The greatest advantage over other methods is that the source is controlled. S wave velocity structure can be determined by using active and passive source surface wave methods

According to the NEHRS Provisions and the Uniform Building Code (UBC), the Ground Classification (Ground Classification according to Eurocode 8 to Vs30)

GROUND GROUPS	DEFINITION	FEATURES (m/sec)
A	Rock Or Other Similar Formations	Vs30>800
B	High hard sand pebbles very hard clay	360<Vs30<800
C	Tight to medium tight sand, gravel or hard clay	180<Vs30<360
D	Cohesionless ground from loose to medium tight	180>Vs30

The interpretations made for the Turbines shall be made by evaluating the following data according to these tables.

4.4. Shear Modulus-G (kg/cm²)

It shows resistance to shear stresses, that is, resistance against horizontal forces. This parameter is zero because the liquids are not resistant to shear. The higher the shear modulus, the greater the resistance to shear stresses of the formation, that is, the horizontal forces (horizontal earthquake load).

The Shear Modulus according to seismic data is calculated as 2.

1) $\mu = \rho * V_s^2$ calculated from the formula. From here $\rho = \gamma_n / g$ calculated from the formula.

ρ=density,
γn= Natural (total) unit volume weight
g= acceleration of gravity (9.8m/sn^2).

2) specific gravity $d=0.31*V_p^{0.25}$ from here $G=(d*V_s^2)/100$ (kg/cm^2)

According to the above model, Shear Modulus is calculated as follows.

4.5. Elasticity Modulus-E (kg/cm²)

The ratio of the elongation to the unit length applied to the unit cross-sectional area is called Elastic Modulus. In a certain direction, the stresses are defined as the ratio to the deformations.

$E=2\mu(1+\sigma)$ kg/cm^2 $\qquad$ $E=G*(3*V_p^2-4*V_s^2)/(V_p^2-V_s^2)$

4.6. Poisson's Ratio - (б)

It is defined as the ratio of unit variation of the formation to the longitudinal unit change. This ratio varies from 0 to 0.25 in non-porous media, from 0.25 to 0.35 in moderate porous media, and from 0.35 to 0.50 in porous media. The Poisson's ratio expresses the porosity of units in other words. Unitless.

$б=(V_p^2-2*V_s^2)/(2*V_p^2-2*V_s^2)$

4.7. Density - ρ (gr/ cm³)

The density given by Telford (1976) as the empirical value according to the longitudinal wave velocity is calculated from the following formula.

$\rho = d = 0.31*V_p^{0.25}$(gr/cm^3)

4.8. Modulus of Subgrade Reaction – D Y K (ton/m^3)

The bearing coefficient is resistance to unit displacement of the unit area of the floor under load. The bearing coefficient (kV) is calculated from the nearest approximation of the pressure-settlement curve using the largest possible plate diameters from the near-elastic properties of the floor.

4.9. Bearing Capacity qu (kg/cm^2) / Allowable Bearing Capacity qa (kg/cm^2)

It is called the foundation which provides direct contact with the ground and transfers the loads from the building to the ground. The settlement values for a healthy base must remain within the secure boundary and provide adequate resistance to slip. For this reason, the basic design is dimensioned according to the sensitivity of the structure on it and the properties of the ground. Carrying capacity conditions are met if these criteria are adhered to. High Carrying capacity is the greatest burden that the ground can carry without sitting and immigrating. Safe Carrying capacity is obtained by dividing the Carrying capacity by a Secure factor without a unit.

4.10. Vibration Period - T0 (sec) / Ground Amplification (Ak)

Period is natural or artificial factors, period is between 0,05-2 seconds earth vibrations. (Ercan, 2001) In a certain number of occurrences of a certain period is the maximum number of repetitions. The period with the maximum repetition is defined as the dominant period. (Kanai, 1984).

T_0=4h/Vs (sec) ve T_a=T_0/1,5 ve T_b=T_0*1,5

The dominant vibration of earthquake motion on soft ground has a greater displacement amplitude, in other words more oscillation. On the hard ground this is the opposite.

If the vibrational frequency of the structure on the ground coincides with the floor vibration frequency, the energy that is emitted by triggering each other is reflected twice as much as the structure. To avoid this situation, these frequencies must be different from each other. The When an earthquake strikes, different seismic waves begin to spread at different speeds in the earth from the source. These waves produce vibrations for a few seconds to a minute when they reach the ground surface. The duration and intensity of the vibration in a particular place; the earthquake size, the distance from the source, the physical characteristics of the environment where the waves travel, and the ground properties of the site in depends. Seismic waves travel a considerable part of their travel from the source to the earth in the hard bedrock, which forms the earth's crust. The last stage of their travel takes place in loosely adhered ground layers, whose characteristics are quite different from that of the main rock, and the physical properties of these ground layers largely determine the character of the vibration observed on earth. The ground strata are almost like a filter for seismic waves. The changes that seismic waves have in the ground layers are called ground effect. Since this change is generally observed as an increase in amplitudes, the ground effect is also referred to as a ground growth (Ak)

5. EVALUATION AND INTERPRETATION

5. 1. WTG01

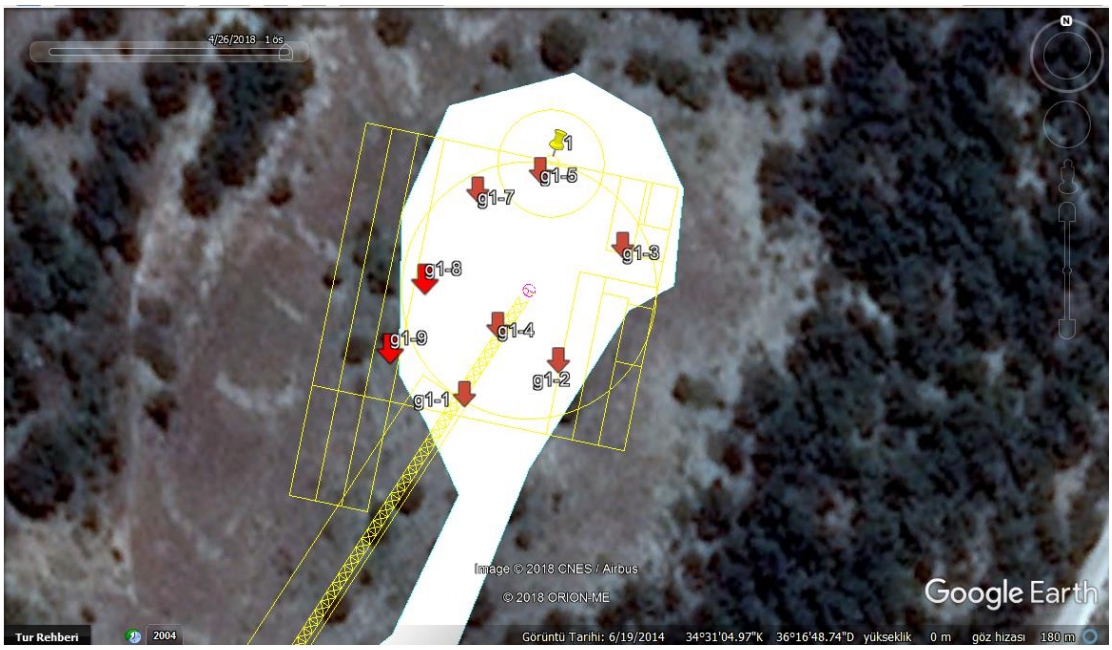
There are 9 measurements were taken on the WTG. Three layers were seen in this scale. Layer 1 was found to be between 0,00m and 4,21m depth, Layer 2 average between 4,21m and 17,14m depth, and Layer 3 at an average depth of 17,14m. The parameters of these layers are given in the table below.

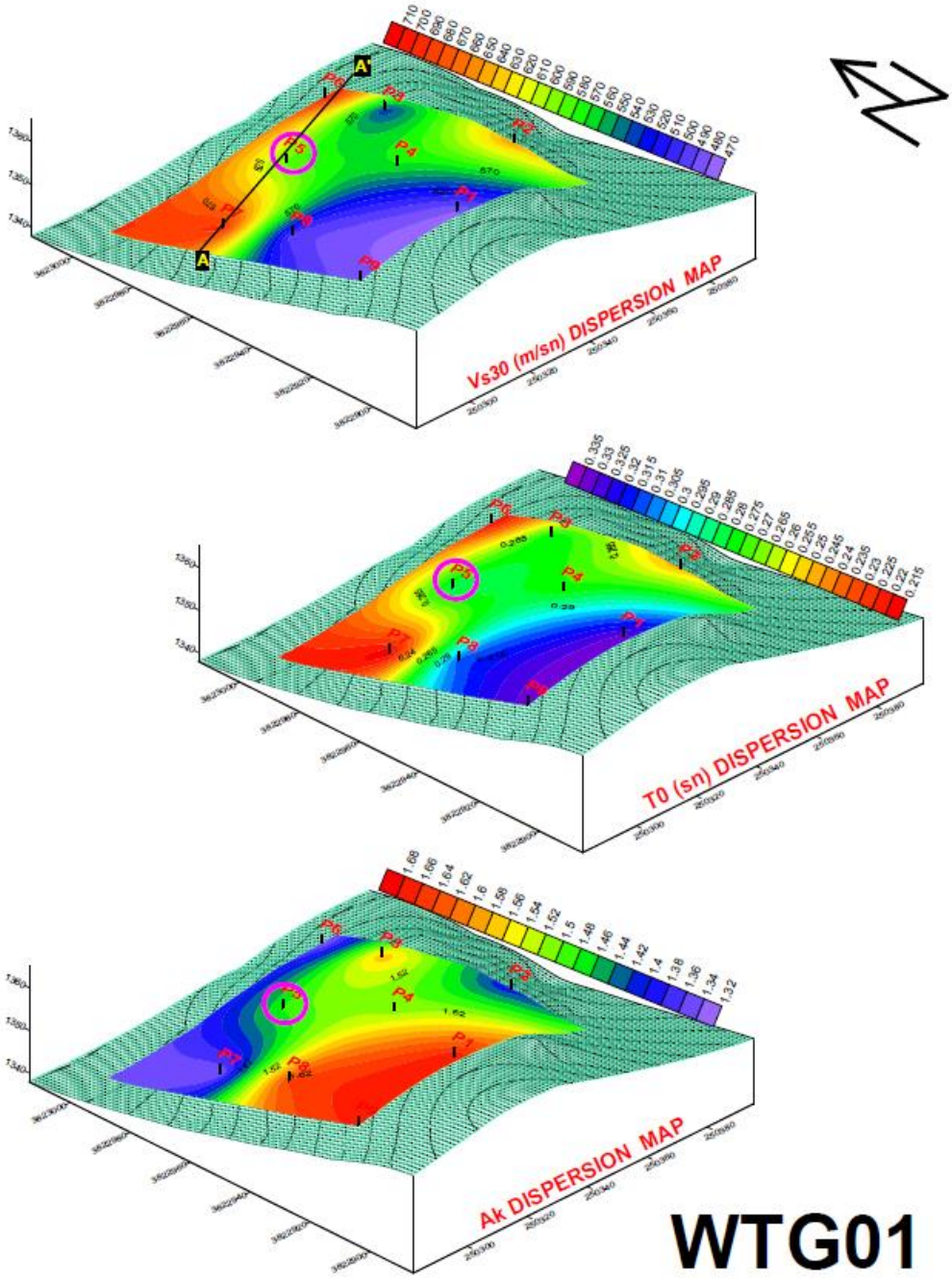
LAYERS	Vp_ Velocity	STRIPPABILITY
1. LAYER	788	Simple strippability
2.LAYER	1153	Simple strippability
3.LAYER	2421	Explosive
LAYERS	**Vs_ Velocity**	**GROUND GROUP**
1. LAYER	319	C
2.LAYER	558	B
3.LAYER	1081	A
LAYERS	**G (kg/cm2)**	**ENDURANCE**
1. LAYER	2016	Medium
2.LAYER	6239	Sturdy
3.LAYER	26377	High sturdy
LAYERS	**E (kg/cm2)**	**ENDURANCE**
1. LAYER	5549	Medium
2.LAYER	16587	Sturdy
3.LAYER	72360	High sturdy

LAYERS	(σ)	POROSITY
1. LAYER	0,38	High Porosity
2.LAYER	0,34	Medium Porosity
3.LAYER	0,37	High Porosity
LAYERS	**ρ (gr/cm3)**	**DEFINITION**
1. LAYER	1,62	Medium
2.LAYER	1,80	Medium
3.LAYER	2,17	High
LAYERS	**D Y K (ton/m^3)**	
1. LAYER	2369	
2.LAYER	4208	
3.LAYER	9264	
LAYERS	**Ground Carrying Capacity (qu,kg/cm2)**	**Secure Carrying Capacity (qa,kg/cm2)**
1. LAYER	5,92	1,97
2.LAYER	10,52	3,51
3.LAYER	23,16	7,72

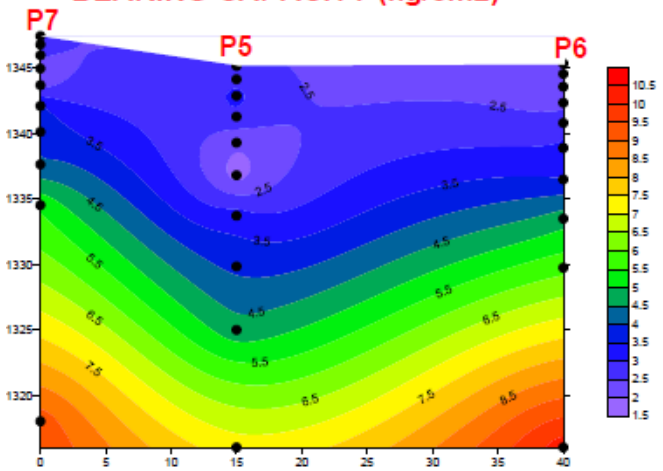
To (sec)	Ta (sec)	Tb (sec)	Vs30 (m/sec)	Ak (Amplification)
0,28	0,18	0,42	577	1,51

It is recommended to excavate the first 3.50 meters from the ground level in the profiles 1-2-3 and 8 at the measurements taken in the field. Profile points should be viewed in engineering parameters section for detailed values considering the following application.

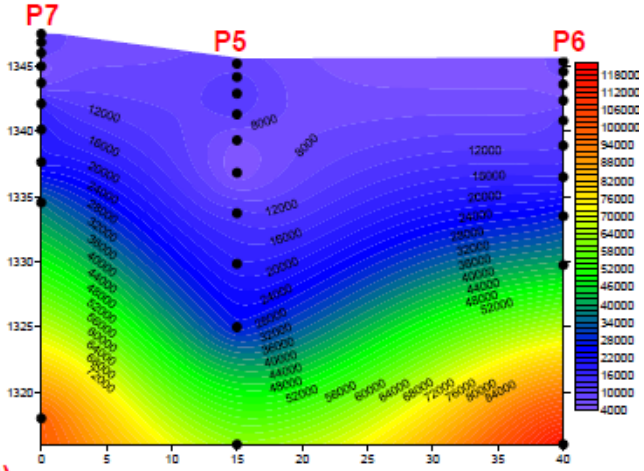



Vs30 (m/sn) DISPERSION MAP
T0 (sn) DISPERSION MAP
Ak DISPERSION MAP
WTG01

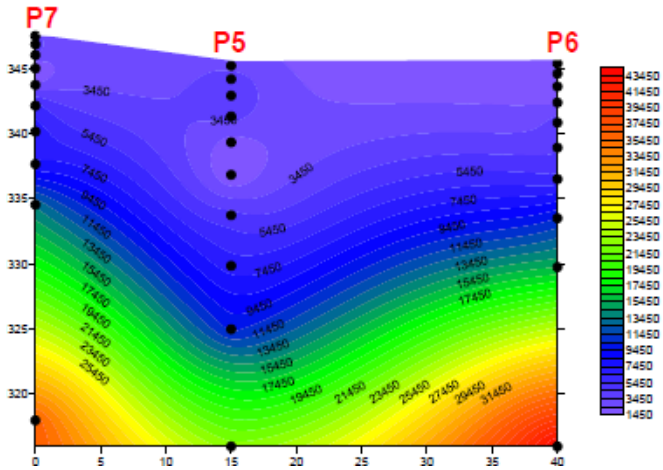
BEARING CAPACITY (kg/cm2)



YOUNG MODULE DISPERSIONE (kg/cm2)



SLIDE MODULE DISPERSIONE (kg/cm2)



5.1.1. WTG01 Seismic P wave velocity (Compressional Wave Velocity (Vp))

Vp VELOCITY				
PROFILES	LAYERS	DEPTH	Vp_ Velocity	STRIPPABILITY
1_PROFILE	1. LAYER	-2,94	536	Simple Strippability
	2.LAYER	-19,89	933	Simple Strippability
	3.LAYER		2063	High Difficult Strippability
2_PROFILE	1. LAYER	-2,98	488	Simple Strippability
	2. LAYER	-20,17	1240	Medium Strippability
	3. LAYER		3112	Explosive
3_PROFILE	1. LAYER	-3,05	506	Simple Strippability
	2. LAYER	-13,66	1078	Simple Strippability
	3. LAYER		2399	Explosive
4_PROFILE	1. LAYER	-5,11	1036	Simple Strippability
	2. LAYER	-16,06	1148	Simple Strippability
	3. LAYER		2164	Explosive
5_PROFILE	1. LAYER	-4,69	1046	Simple Strippability
	2. LAYER	-21,01	1155	Simple Strippability
	3. LAYER		2305	Explosive
6_PROFILE	1. LAYER	-3,63	1056	Simple Strippability
	2. LAYER	-16,25	1361	Medium Strippability
	3. LAYER		2831	Explosive
7_PROFILE	1. LAYER	-4,28	1078	Simple Strippability
	2.LAYER	-13,46	1410	Medium Strippability
	3.LAYER		2744	Explosive
8_PROFILE	1. LAYER	-3,73	497	Simple Strippability
	2. LAYER	-16,69	981	Simple Strippability
	3. LAYER		2198	Explosive
9_PROFILE	1. LAYER	-7,47	847	Simple Strippability
	2. LAYER	-17,11	1070	Simple Strippability
	3. LAYER		1975	High Difficult Strippability

P Wave Velocity (m/sec)	Strippability
Vp<458	High Simple Strippability
458<Vp<1220	Simple Strippability
1220<Vp<11525	Medium Strippability
1525<Vp<11830	Difficult Strippability
1830<Vp<12135	High Difficult Strippability
Vp>2135	Explosive Strippability

||AVERAGE||			
LAYERS	DEPTH	Vp_ Velocity	STRIPPABILITY
1. LAYER	-4,21	788	Simple Strippability
2.LAYER	-17,14	1153	Simple Strippability
3.LAYER	∞	2421	Explosive

P wave velocities of the grounds in the study area and strippability

The above table shows the change table and strippability properties of Vp velocity depth values in the direction of the seismic data obtained from the field studies.

5.1.2. WTG01 Seismic S wave velocity (*Transverse Wave Velocity* (Vs))

Vs VELOCITY				
PROFILES	LAYERS	DEPTH	Vs_ Velocity	GROUND GROUP
1_PROFILE	1. LAYER	-2,94	214	C
	2.LAYER	-19,89	443	B
	3.LAYER		975	A
2_PROFILE	1. LAYER	-2,98	247	C
	2. LAYER	-20,17	653	B
	3. LAYER		1298	A
3_PROFILE	1. LAYER	-3,05	219	C
	2. LAYER	-13,66	571	B
	3. LAYER		1010	A
4_PROFILE	1. LAYER	-5,11	437	B
	2. LAYER	-16,06	493	B
	3. LAYER		982	A
5_PROFILE	1. LAYER	-4,69	467	B
	2. LAYER	-21,01	500	B
	3. LAYER		1031	A
6_PROFILE	1. LAYER	-3,63	358	C
	2. LAYER	-16,25	627	B
	3. LAYER		1394	A
7_PROFILE	1. LAYER	-4,28	405	B
	2.LAYER	-13,46	658	B
	3.LAYER		1268	A
8_PROFILE	1. LAYER	-3,73	239	C
	2. LAYER	-16,69	528	B
	3. LAYER		966	A
9_PROFILE	1. LAYER	-7,47	282	C
	2. LAYER	-17,11	546	B
	3. LAYER		804	A

S Wave Velocity (m/sec)	Ground group
Vs<200	D
200<Vs<400	C
400<Vs<700	B
700<Vs	A

Ground groups according to slip wave velocity(Abyyhy, 1998)

||AVERAGE||			
LAYERS	DEPTH	Vs_ Velocity	GROUND GROUP
1. LAYER	-4,21	319	C
2.LAYER	-17,14	558	B
3.LAYER	∞	1081	A

S wave velocities of the grounds in the study area and ground group

Ground Group	Ground group and top ground layer thickness(h_1)
Z1	(A) Ground group h1< 15 m (B) Ground group
Z2	h_1> 15 m (B) Ground group h_1< 15 m (C) Ground group
Z3	15 m < h_1< 50 m (C) Ground group h_1< 10 m (D) Ground group
Z4	h_1> 50 m (C) Ground group h_1> 10 m (D) Ground group

Ground Group Class

The above table shows that Vs velocity values in the direction of the seismic data obtained in the field studies are the absolute change tables and that the layers are included in the ground groups.

5.1.3. WTG01 Vs30

PROFILES	Vs30 (m/sec)
1.PROFILE	480
2.PROFILE	652
3.PROFILE	532
4.PROFILE	569
5.PROFILE	588
6.PROFILE	702
7.PROFILE	693
8.PROFILE	495
9.PROFILE	485

Vs30 values in the direction of the seismic data obtained from the field studies are given in the table above.

5.1.4. WTG01 Shear Modulus-G (kg/cm²)

SHEAR MODULUS				
PROFILES	LAYERS	DEPTH	G(kg/cm^2)	ENDURANCE
1_PROFILE	1. LAYER	-2,94	702	Weak
	2.LAYER	-19,89	3752	Sturdy
	3.LAYER		19863	Rock Highlid
2_PROFILE	1. LAYER	-2,98	893	Weak
	2. LAYER	-20,17	9045	Sturdy
	3. LAYER		39017	Rock Highlid
3_PROFILE	1. LAYER	-3,05	834	Weak
	2. LAYER	-13,66	6239	Sturdy
	3. LAYER		22123	Rock Highlid
4_PROFILE	1. LAYER	-5,11	3375	Sturdy
	2. LAYER	-16,06	4814	Sturdy
	3. LAYER		20385	Rock Highlid
5_PROFILE	1. LAYER	-4,69	3859	Sturdy
	2. LAYER	-21,01	5096	Sturdy
	3. LAYER		22848	Rock Highlid
6_PROFILE	1. LAYER	-3,63	2279	Medium
	2. LAYER	-16,25	8004	Sturdy
	3. LAYER		43921	Rock Highlid
7_PROFILE	1. LAYER	-4,28	2995	Medium
	2.LAYER	-13,46	8453	Sturdy
	3.LAYER		36049	Rock Highlid
8_PROFILE	1. LAYER	-3,73	923	Weak
	2. LAYER	-16,69	5406	Sturdy
	3. LAYER		19819	Rock Highlid
9_PROFILE	1. LAYER	-7,47	2284	Medium
	2. LAYER	-17,11	5345	Sturdy
	3. LAYER		13368	Rock Highlid

Shear Modulus (kg/cm^2)	Dayanım
G<400	High Weak
400<G<1500	Weak
1500<G<3000	Medium
3000<G<10000	Sturdy
10000<G	Rock Highlid

The endurance of ground or rocks according to Slip Module values(Keçeli, 1990)

$G = (d*Vs^2)/100$

‖AVERAGE‖			
LAYERS	DEPTH	G (kg/cm^2)	ENDURANCE
1. LAYER	-4,21	2016	Medium
2.LAYER	-17,14	6239	Sturdy
3.LAYER	∞	26377	Rock Highlid

Shear modules and endurance of the grounds in the study area

Calculation of shear Modulus values in the direction of the seismic data obtained in the field studies and the table of variation are given in the table above.

5.1.5. WTG01 Elasticity Modulus-E (kg/cm²)

ELASTIC MODULUS				
PROFILES	LAYERS	DEPTH	E(kg/cm^2)	ENDURANCE
1_PROFILE	1. LAYER	-2,94	1954	Weak
	2.LAYER	-19,89	10075	Sturdy
	3.LAYER		53875	Rock Highlid
2_PROFILE	1. LAYER	-2,98	2355	Weak
	2. LAYER	-20,17	23562	Sturdy
	3. LAYER		108833	Rock Highlid
3_PROFILE	1. LAYER	-3,05	2202	Weak
	2. LAYER	-13,66	16286	Sturdy
	3. LAYER		61605	Rock Highlid
4_PROFILE	1. LAYER	-5,11	9366	Medium
	2. LAYER	-16,06	13011	Sturdy
	3. LAYER		55869	Rock Highlid
5_PROFILE	1. LAYER	-4,69	10592	Sturdy
	2. LAYER	-21,01	13669	Sturdy
	3. LAYER		62825	Rock Highlid
6_PROFILE	1. LAYER	-3,63	6531	Medium
	2. LAYER	-16,25	21661	Sturdy
	3. LAYER		117714	Rock Highlid
7_PROFILE	1. LAYER	-4,28	8416	Medium
	2.LAYER	-13,46	22959	Sturdy
	3.LAYER		98367	Rock Highlid
8_PROFILE	1. LAYER	-3,73	2368	Weak
	2. LAYER	-16,69	13901	Sturdy
	3. LAYER		54709	Rock Highlid
9_PROFILE	1. LAYER	-7,47	6160	Medium
	2. LAYER	-17,11	14161	Sturdy
	3. LAYER		37447	Rock Highlid

Elastic Modulus (kg/cm^2)	Dayanım
E<1000	High Weak
1000<E<5000	Weak
5000<E<10000	Medium
10000<E<30000	Sturdy
30000<E	Rock Highlid

The endurance of ground or rocks according to Slip Module values(Keçeli, 1990)

$E=G*(3*V_p^2-4*V_s^2)/(V_p^2-V_s^2)$

‖AVERAGE‖			
LAYERS	DEPTH	E (kg/cm^2)	ENDURANCE
1. LAYER	-4,21	5549	Medium
2.LAYER	-17,14	16587	Sturdy
3.LAYER	∞	72360	Rock Highlid

Elasticity modules and endurance of the grounds in the study area

Calculation of the modulus of elasticity in the direction of the seismic data obtained in the field studies and the change table are given in the above table.

5.1.6. WTG01 Poisson's Ratio - (б)

POISSON'S RATIO				
PROFILES	LAYERS	DEPTH	(σ)	POROSITY
1_PROFILE	1. LAYER	-2,94	0,40	High Porous
	2.LAYER	-19,89	0,35	High Porous
	3.LAYER		0,36	High Porous
2_PROFILE	1. LAYER	-2,98	0,32	Medium Porous
	2. LAYER	-20,17	0,31	Medium Porous
	3. LAYER		0,39	High Porous
3_PROFILE	1. LAYER	-3,05	0,35	High Porous
	2. LAYER	-13,66	0,30	Medium Porous
	3. LAYER		0,39	High Porous
4_PROFILE	1. LAYER	-5,11	0,39	High Porous
	2. LAYER	-16,06	0,38	High Porous
	3. LAYER		0,37	High Porous
5_PROFILE	1. LAYER	-4,69	0,37	High Porous
	2. LAYER	-21,01	0,38	High Porous
	3. LAYER		0,37	High Porous
6_PROFILE	1. LAYER	-3,63	0,43	High Porous
	2. LAYER	-16,25	0,37	High Porous
	3. LAYER		0,34	Medium Porous
7_PROFILE	1. LAYER	-4,28	0,41	High Porous
	2.LAYER	-13,46	0,36	High Porous
	3.LAYER		0,36	High Porous
8_PROFILE	1. LAYER	-3,73	0,32	Medium Porous
	2. LAYER	-16,69	0,30	Medium Porous
	3. LAYER		0,38	High Porous
9_PROFILE	1. LAYER	-7,47	0,38	High Porous
	2. LAYER	-17,11	0,32	Medium Porous
	3. LAYER		0,40	High Porous

Poisson's Ratio;(σ)	Porosity
0,00≤σ≤0,25	Nonporous
0,26≤σ≤0,35	Medium Porous
0,36≤σ≤0,50	High Porous

Poisson ratio classification

$\sigma=(Vp^2-2*Vs^2)/(2*Vp^2-2*Vs^2)$

‖AVERAGE‖			
LAYERS	DEPTH	(σ)	POROSITY
1. LAYER	-4,21	0,38	High Porous
2.LAYER	-17,14	0,34	Medium Porous
3.LAYER	∞	0,37	High Porous

Poisson's ratio values of the units in the study area, porosity

Calculation of poisson's ratio values in the direction of the seismic data obtained in the field studies and the change table are given in the above table.

5.1.7. WTG01 Density - ρ (gr/ cm^3)

DENSITY				
PROFILES	LAYERS	DEPTH	ρ (gr/cm^3)	DEFINITION
1_PROFILE	1. LAYER	-2,94	1,49	Medium
	2.LAYER	-19,89	1,70	Medium
	3.LAYER		2,09	High
2_PROFILE	1. LAYER	-2,98	1,46	Medium
	2. LAYER	-20,17	1,82	Medium
	3. LAYER		2,32	High
3_PROFILE	1. LAYER	-3,05	1,46	Medium
	2. LAYER	-13,66	1,76	Medium
	3. LAYER		2,17	High
4_PROFILE	1. LAYER	-5,11	1,76	Medium
	2. LAYER	-16,06	1,80	Medium
	3. LAYER		2,11	High
5_PROFILE	1. LAYER	-4,69	1,76	Medium
	2. LAYER	-21,01	1,80	Medium
	3. LAYER		2,15	High
6_PROFILE	1. LAYER	-3,63	1,77	Medium
	2. LAYER	-16,25	1,88	Medium
	3. LAYER		2,26	High
7_PROFILE	1. LAYER	-4,28	1,78	Medium
	2.LAYER	-13,46	1,90	Medium
	3.LAYER		2,24	High
8_PROFILE	1. LAYER	-3,73	1,46	Medium
	2. LAYER	-16,69	1,72	Medium
	3. LAYER		2,12	High
9_PROFILE	1. LAYER	-7,47	1,67	Medium
	2. LAYER	-17,11	1,77	Medium
	3. LAYER		2,07	High

Density: ρ (gr/cm³)	Tanımlama
ρ<1,20	High low
1,20<ρ<1,40	Low
1,40<ρ<1,90	Medium
1,90<ρ<2,20	High
2,20<ρ	Too High

Density Classification of Ground Units: (Keçeli, 1990)

*ρ =d=0.31*Vp0.25*

‖AVERAGE‖			
LAYERS	DEPTH	ρ (gr/cm³)	DEFINITION
1. LAYER	-4,21	1,62	Medium
2.LAYER	-17,14	1,80	Medium
3.LAYER	∞	2,17	High

Density values and description of the units in the study area

Calculation of the density values of the geological units in the direction of the seismic data obtained in the field studies and the table of variation are given in the above table.

5.1.8. WTG01 Modulus of Subgrade Reaction – D Y K (ton/m³)

Modulus of Subgrade Reaction			
PROFILES	LAYERS	DEPTH	D Y K (ton/m³)
1_PROFILE	1. LAYER	-2,94	1497
	2.LAYER	-19,89	3260
	3.LAYER		8025
2_PROFILE	1. LAYER	-2,98	1717
	2. LAYER	-20,17	5005
	3. LAYER		11798
3_PROFILE	1. LAYER	-3,05	1532
	2. LAYER	-13,66	4273
	3. LAYER		8589
4_PROFILE	1. LAYER	-5,11	3228
	2. LAYER	-16,06	3698
	3. LAYER		8163
5_PROFILE	1. LAYER	-4,69	3456
	2. LAYER	-21,01	3763
	3. LAYER		8693
6_PROFILE	1. LAYER	-3,63	2651
	2. LAYER	-16,25	4830
	3. LAYER		12346
7_PROFILE	1. LAYER	-4,28	3010
	2.LAYER	-13,46	5079
	3.LAYER		11139
8_PROFILE	1. LAYER	-3,73	1659
	2. LAYER	-16,69	3913
	3. LAYER		8060
9_PROFILE	1. LAYER	-7,47	2576
	2. LAYER	-17,11	4053
	3. LAYER		6562

‖AVERAGE‖		
LAYERS	DEPTH	D Y K (ton/m³)
1. LAYER	-4,21	2369
2.LAYER	-17,14	4208
3.LAYER	∞	9264

kv= 40*(Gs)*qu ton/m³ *(Bowles 1984)*

The above table shows the Modulus of Subgrade Reaction obtained for each layer in the direction of the data obtained after the seismic measurements made in the study area.

5.1.9. WTG01 Bearing Capacity qu (kg/cm2) /Allowable Bearing Capacity qa (kg/cm2)

PROFILES	LAYERS	DEPTH	BEARING CAPACITY (qu,kg/cm^2)	ALLOWABLE BEARING CAPACITY (qa,kg/cm^2)
1_PROFILE	1. LAYER	-2,94	3,74	1,25
	2.LAYER	-19,89	8,15	2,72
	3.LAYER	-30,11	20,06	6,69
2_PROFILE	1. LAYER	-2,98	4,29	1,43
	2. LAYER	-20,17	12,51	4,17
	3. LAYER	-29,83	29,50	9,83
3_PROFILE	1. LAYER	-3,05	3,83	1,28
	2. LAYER	-13,66	10,68	3,56
	3. LAYER	-36,34	21,47	7,16
4_PROFILE	1. LAYER	-5,11	8,07	2,69
	2. LAYER	-16,06	9,24	3,08
	3. LAYER	-33,94	20,41	6,80
5_PROFILE	1. LAYER	-4,69	8,64	2,88
	2. LAYER	-21,01	9,41	3,14
	3. LAYER	-28,99	21,73	7,24
6_PROFILE	1. LAYER	-3,63	6,63	2,21
	2. LAYER	-16,25	12,08	4,03
	3. LAYER	-33,75	30,87	10,29
7_PROFILE	1. LAYER	-4,28	7,52	2,51
	2.LAYER	-13,46	12,70	4,23
	3.LAYER	-36,54	27,85	9,28
8_PROFILE	1. LAYER	-3,73	4,15	1,38
	2. LAYER	-16,69	9,78	3,26
	3. LAYER	-33,31	20,15	6,72
9_PROFILE	1. LAYER	-7,47	6,44	2,15
	2. LAYER	-17,11	10,13	3,38
	3. LAYER	-32,89	16,41	5,47

||AVERAGE||		
LAYERS	DEPTH	Bearing Capacity (qu,kg/cm^2)
1. LAYER	-4,21	5,92
2.LAYER	-17,14	10,52
3.LAYER	∞	23,16
qu=(0,024*Vs*(J.B.K+0,002*Vp)*0,71)/G.K		

||AVERAGE||		
LAYERS	DEPTH	Allowable Bearing Capacity (qa,kg/cm^2)
1. LAYER	-4,21	1,97
2.LAYER	-17,14	3,51
3.LAYER	∞	7,72
qa=qu/G.K G.K=3 empirical value		

5.1.10. WTG01 Vibration Period - T_0 (sec) / Ground Amplification (Ak)

PROFILES	To (sec)	Ta (sec)	Tb (sec)	Ak (Amplification)
1.PROFILE	0,33	0,22	0,50	1,67
2.PROFILE	0,25	0,16	0,37	1,39
3.PROFILE	0,28	0,19	0,42	1,57
4.PROFILE	0,28	0,18	0,41	1,51
5.PROFILE	0,29	0,19	0,43	1,48
6.PROFILE	0,22	0,15	0,33	1,33
7.PROFILE	0,22	0,14	0,32	1,34
8.PROFILE	0,31	0,21	0,47	1,64
9.PROFILE	0,33	0,22	0,50	1,66

AVERAGE			
To (sec)	Ta (sec)	Tb (sec)	Ak (Amplification)
0,28	0,18	0,42	1,51

$To = \sum 4H\ Vs\ n\ \iota$=1 (sec)……. (Zeevaert,1967)

Ak=68*$Vs_{30}^{-0,6}$…… (Midorikawa, 1987)

The Vibration Period and Ground Amplification calculated in the direction of the parameters obtained during the seismic studies made during the field survey are presented in the table above.

5. 2. WTG02

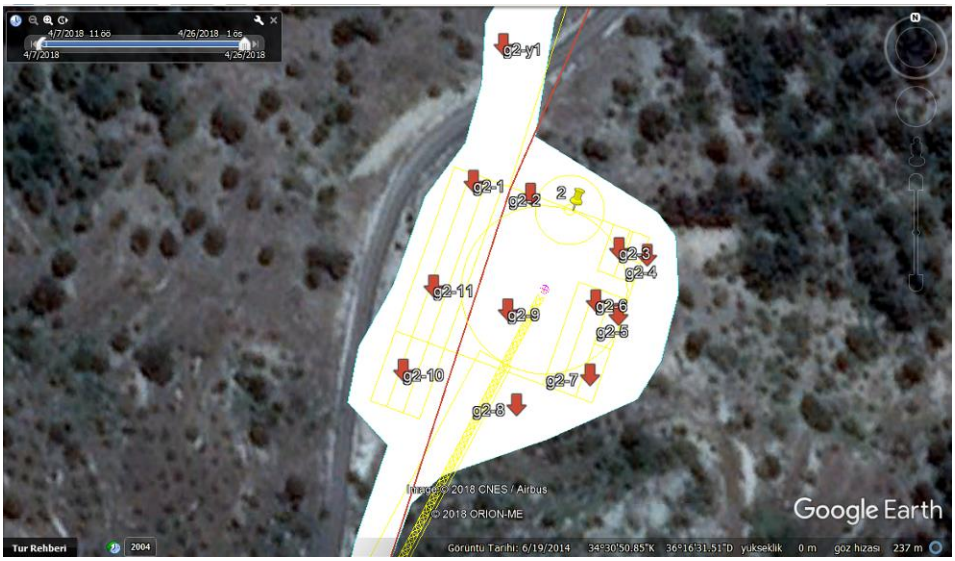
There are 11 measurements taken on the WTG. Three layers were seen in this scale. Layer 1 was found between 0.00 m and 4,24 m depth, Layer 2 was found between 4,24 m and 16,41 m depth and Layer 3 was found from average depth of 16,41 m. The parameters of these layers are given in the table below.

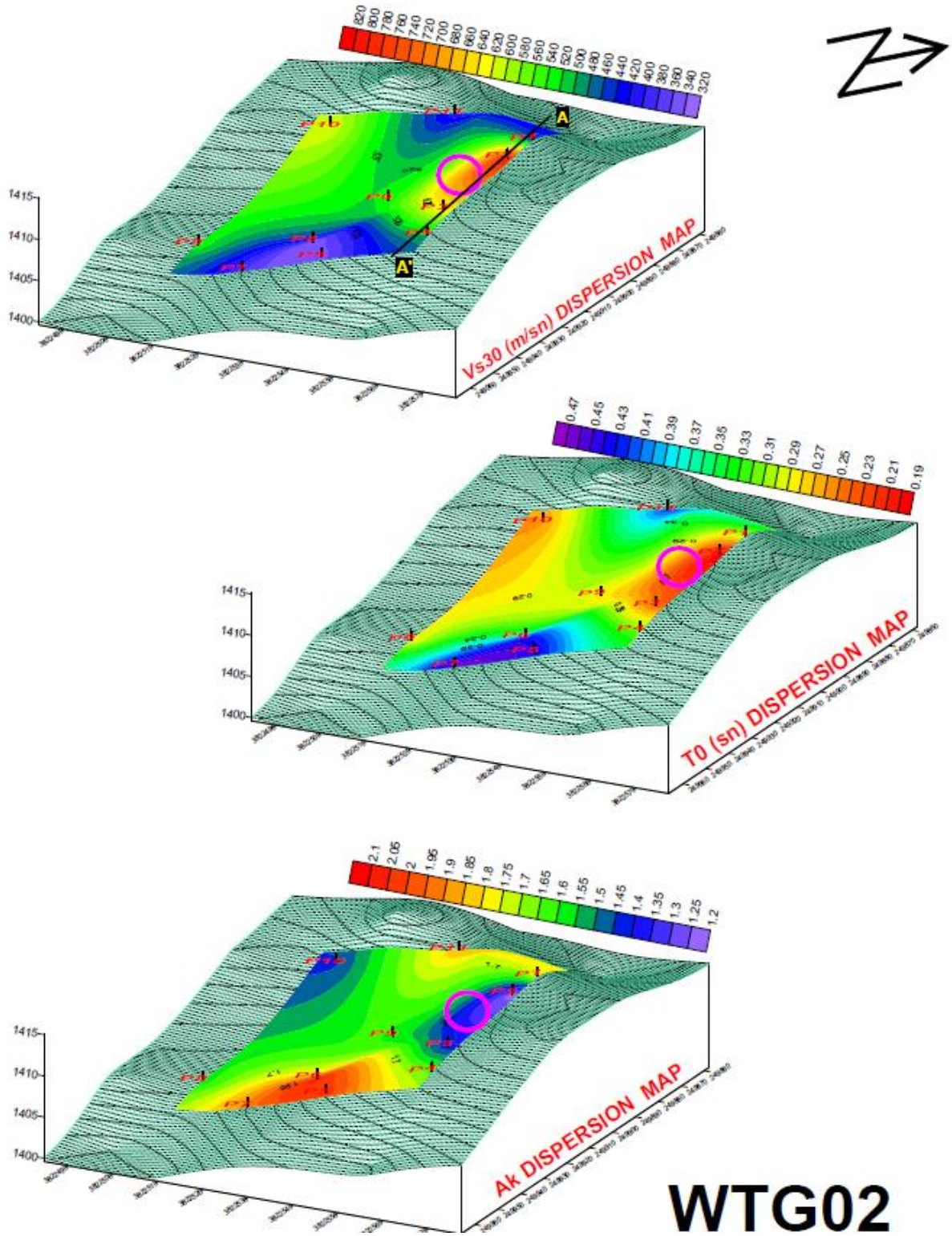
LAYERS	Vp_ Velocity	STRIPPABILITY
1. LAYER	691	Simple strippability
2.LAYER	1030	Simple strippability
3.LAYER	2138	Explosive
LAYERS	**Vs_ Velocity**	**GROUND GROUP**
1. LAYER	276	C
2.LAYER	510	B
3.LAYER	934	A
LAYERS	**G (kg/cm2)**	**ENDURANCE**
1. LAYER	1391	Weak
2.LAYER	5316	Sturdy
3.LAYER	20768	High sturdy
LAYERS	**E (kg/cm2)**	**ENDURANCE**
1. LAYER	3792	Weak
2.LAYER	14064	Sturdy
3.LAYER	57194	High sturdy

LAYERS	(σ)	POROSITY
1. LAYER	0,39	High Porosity
2.LAYER	0,33	Medium Porosity
3.LAYER	0,38	High Porosity
LAYERS	**ρ (gr/cm3)**	**DEFINITION**
1. LAYER	1,58	Medium
2.LAYER	1,74	Medium
3.LAYER	2,09	High
LAYERS	**D Y K (ton/m^3)**	
1. LAYER	1998	
2.LAYER	3808	
3.LAYER	7883	
LAYERS	**Ground Carrying Capacity (qu,kg/cm2)**	**Secure Carrying Capacity (qa,kg/cm2)**
1. LAYER	5,00	1,67
2.LAYER	9,52	3,17
3.LAYER	19,71	6,57

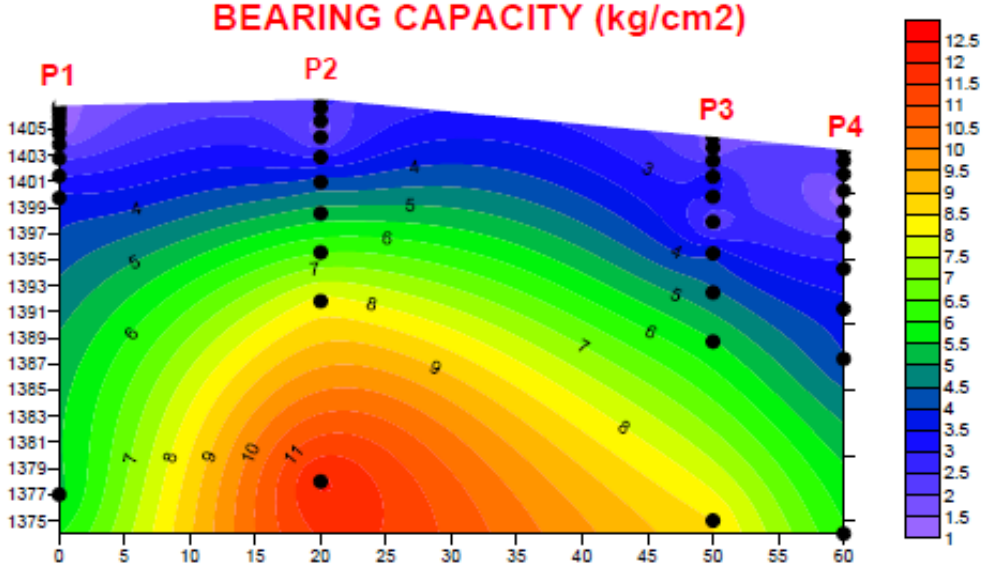
To (sec)	Ta (sec)	Tb (sec)	Vs30 (m/sec)	Ak (Amplification)
0,33	0,22	0,50	505	1,68

It is recommended to excavate the first 4.50 meteric tons from the ground level on the 5th profile. Profile points should be viewed in engineering parameters section for detailed values considering the following application.

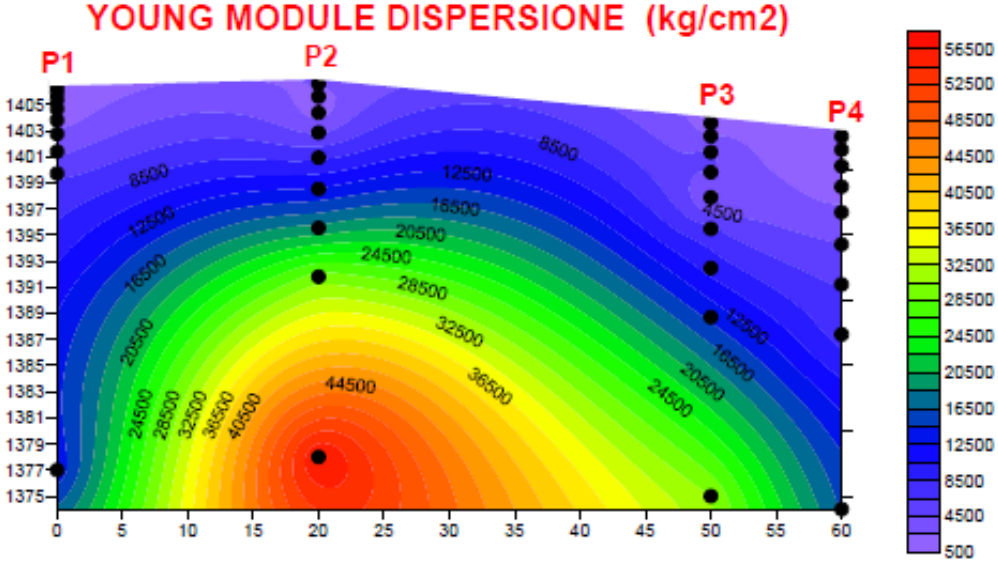



Vs30 (m/sn) DISPERSION MAP
T0 (sn) DISPERSION MAP
Ak DISPERSION MAP
A
A'
1415
1410
1405
1400
WTG02

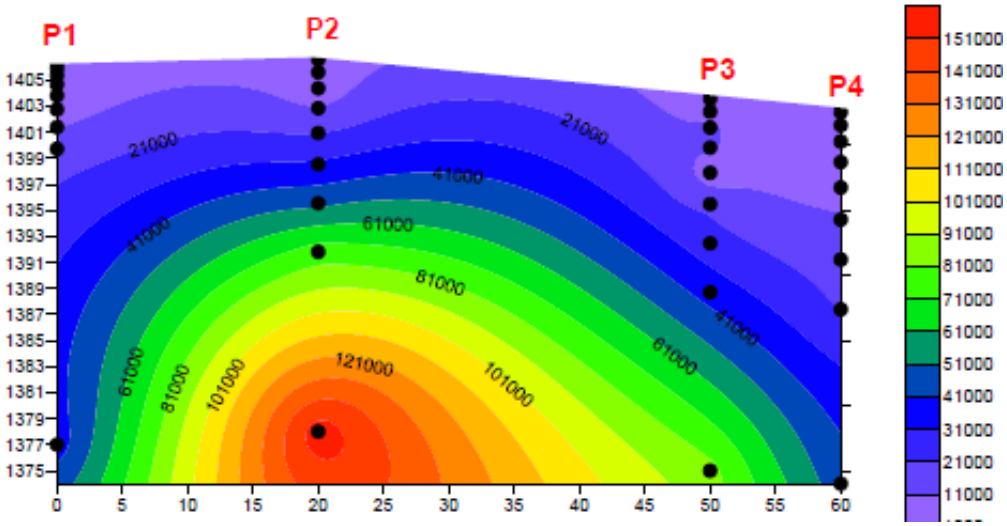
BEARING CAPACITY (kg/cm2)



YOUNG MODULE DISPERSIONE (kg/cm2)



SLIDE MODULE DISPERSIONE (kg/cm2)



5.2.1. WTG02 Seismic P wave velocity (*Compressional Wave Velocity* (Vp))

Vp VELOCITY				
PROFILES	LAYERS	DEPTH	Vp_ Velocity	STRIPPABILITY
1_PROFILE	1. LAYER	-2,32	564	Simple Strippability
	2.LAYER	-7,28	872	Simple Strippability
	3.LAYER		1828	High Difficult Strippability
2_PROFILE	1. LAYER	-3,62	822	Simple Strippability
	2. LAYER	-16,19	1535	High Difficult Strippability
	3. LAYER		3507	Explosive
3_PROFILE	1. LAYER	-2,41	934	Simple Strippability
	2. LAYER	-16,29	1248	Medium Strippability
	3. LAYER		2644	Explosive
4_PROFILE	1. LAYER	-3,71	779	Simple Strippability
	2. LAYER	-16,61	1030	Simple Strippability
	3. LAYER		2140	Explosive
5_PROFILE	1. LAYER	-4,22	415	High Simple Strippability
	2. LAYER	-18,89	675	Simple Strippability
	3. LAYER		1524	Medium Strippability
6_PROFILE	1. LAYER	-4,47	617	Simple Strippability
	2. LAYER	-10,25	762	Simple Strippability
	3. LAYER		1372	Medium Strippability
7_PROFILE	1. LAYER	-6,75	641	Simple Strippability
	2.LAYER	-21,22	835	Simple Strippability
	3.LAYER		1548	High Difficult Strippability
8_PROFILE	1. LAYER	-4,62	757	Simple Strippability
	2. LAYER	-14,53	1157	Simple Strippability
	3. LAYER		2153	Explosive
9_PROFILE	1. LAYER	-4,13	781	Simple Strippability
	2. LAYER	-12,99	1080	Simple Strippability
	3. LAYER		2254	Explosive
10_PROFILE	1. LAYER	-4,56	772	Simple Strippability
	2. LAYER	-20,39	1273	Medium Strippability
	3. LAYER		2714	Explosive
11_PROFILE	1. LAYER	-5,79	517	Simple Strippability
	2. LAYER	-25,92	861	Simple Strippability
	3. LAYER		1830	High Difficult Strippability

P Wave Velocity (m/sec)	Strippability
Vp<458	High Simple Strippability
458<Vp<1220	Simple Strippability
1220<Vp<11525	Medium Strippability
1525<Vp<11830	Difficult Strippability
1830<Vp<12135	High Difficult Strippability
Vp>2135	Explosive Strippability

Strippability of floors with P wave velocity (Church, 1981)

‖AVERAGE‖			
LAYERS	DEPTH	Vp_ Velocity	STRIPPABILITY
1. LAYER	-4,24	691	Simple Strippability
2.LAYER	-16,41	1030	Simple Strippability
3.LAYER	∞	2138	Explosive

P wave velocities of the grounds in the study area and strippability

The above table shows the change table and strippability properties of Vp velocity depth values in the direction of the seismic data obtained from the field studies.

5.2.2. WTG02 Seismic S wave velocity (*Transverse Wave Velocity* (Vs))

Vs VELOCITY				
PROFILES	LAYERS	DEPTH	Vs_ Velocity	GROUND GROUPS
1_PROFILE	1. LAYER	-2,32	220	C
	2.LAYER	-7,28	456	B
	3.LAYER		798	A
2_PROFILE	1. LAYER	-3,62	369	C
	2. LAYER	-16,19	826	A
	3. LAYER		1544	A
3_PROFILE	1. LAYER	-2,41	316	C
	2. LAYER	-16,29	590	B
	3. LAYER		1172	A
4_PROFILE	1. LAYER	-3,71	329	C
	2. LAYER	-16,61	485	B
	3. LAYER		877	A
5_PROFILE	1. LAYER	-4,22	172	D
	2. LAYER	-18,89	353	C
	3. LAYER		788	A
6_PROFILE	1. LAYER	-4,47	205	C
	2. LAYER	-10,25	390	C
	3. LAYER		541	B
7_PROFILE	1. LAYER	-6,75	260	C
	2.LAYER	-21,22	393	C
	3.LAYER		563	B
8_PROFILE	1. LAYER	-4,62	330	C
	2. LAYER	-14,53	515	B
	3. LAYER		953	A
9_PROFILE	1. LAYER	-4,13	284	C
	2. LAYER	-12,99	540	B
	3. LAYER		947	A
10_PROFILE	1. LAYER	-4,56	324	C
	2. LAYER	-20,39	622	B
	3. LAYER		1271	A
11_PROFILE	1. LAYER	-5,79	226	C
	2. LAYER	-25,92	436	B
	3. LAYER		821	A

S Wave Velocity (m/sec)	Ground group
Vs<200	D
200<Vs<400	C
400<Vs<700	B
700<Vs	A

Ground groups according to slip wave velocity(Abyyhy, 1998)

||AVERAGE||			
LAYERS	DEPTH	Vs_ Velocity	GROUND GROUPS
1. LAYER	-4,24	276	C
2.LAYER	-16,41	510	B
3.LAYER	∞	934	A

S wave velocities of the grounds in the study area and ground group

Ground Group	Ground group and top ground layer thickness(h_1)
Z1	(A) Ground group h1< 15 m (B) Ground group
Z2	h_1> 15 m (B) Ground group h_1< 15 m (C) Ground group
Z3	15 m < h_1< 50 m (C) Ground group h_1< 10 m (D) Ground group
Z4	h_1> 50 m (C) Ground group h_1> 10 m (D) Ground group

Ground Group Class

The above table shows that Vs velocity values in the direction of the seismic data obtained in the field studies are the absolute change tables and that the layers are included in the ground groups.

5.2.3. WTG02 Vs30

PROFILES	Vs30 (m/sec)
1.PROFILE	451
2.PROFILE	807
3.PROFILE	641
4.PROFILE	500
5.PROFILE	349
6.PROFILE	336
7.PROFILE	381
8.PROFILE	536
9.PROFILE	529
10.PROFILE	618
11.PROFILE	407

Vs30 values in the direction of the seismic data obtained from the field studies are given in the table above.

5.2.4. WTG02 Shear Modulus-G (kg/cm²)

SHEAR MODULUS				
PROFILES	LAYERS	DEPTH	G(kg/cm^2)	ENDURANCE
1_PROFILE	1. LAYER	-2,32	753	Weak
	2.LAYER	-7,28	3690	Sturdy
	3.LAYER		12912	Rock Highlid
2_PROFILE	1. LAYER	-3,62	2332	Medium
	2. LAYER	-16,19	14728	Rock Highlid
	3. LAYER		56906	Rock Highlid
3_PROFILE	1. LAYER	-2,41	1785	Medium
	2. LAYER	-16,29	7039	Sturdy
	3. LAYER		30527	Rock Highlid
4_PROFILE	1. LAYER	-3,71	1935	Medium
	2. LAYER	-16,61	4514	Sturdy
	3. LAYER		16217	Rock Highlid
5_PROFILE	1. LAYER	-4,22	458	Weak
	2. LAYER	-18,89	2155	Medium
	3. LAYER		12021	Rock Highlid
6_PROFILE	1. LAYER	-4,47	1035	Weak
	2. LAYER	-10,25	2513	Medium
	3. LAYER		5513	Sturdy
7_PROFILE	1. LAYER	-6,75	1097	Weak
	2.LAYER	-21,22	2595	Medium
	3.LAYER		6173	Sturdy
8_PROFILE	1. LAYER	-4,62	1886	Medium
	2. LAYER	-14,53	4876	Sturdy
	3. LAYER		19182	Rock Highlid
9_PROFILE	1. LAYER	-4,13	1344	Weak
	2. LAYER	-12,99	5435	Sturdy
	3. LAYER		19164	Rock Highlid
10_PROFILE	1. LAYER	-4,56	1863	Medium
	2. LAYER	-20,39	7461	Sturdy
	3. LAYER		36152	Rock Highlid
11_PROFILE	1. LAYER	-5,79	818	Weak
	2. LAYER	-25,92	3472	Sturdy
	3. LAYER		13678	Rock Highlid

Shear Modulus (kg/cm²)	Dayanım
G<400	High Weak
400<G<1500	Weak
1500<G<3000	Medium
3000<G<10000	Sturdy
10000<G	Rock Highlid

The endurance of ground or rocks according to Slip Module values(Keçeli, 1990)

$G = (d*Vs^2)/100$

‖AVERAGE‖			
LAYERS	DEPTH	G (kg/cm²)	ENDURANCE
1. LAYER	-4,24	1391	Weak
2.LAYER	-16,41	5316	Sturdy
3.LAYER	∞	20768	Rock Highlid

Shear modules and endurance of the grounds in the study area

Calculation of shear Modulus values in the direction of the seismic data obtained in the field studies and the table of variation are given in the table above.

5.2.5. WTG02 Elasticity Modulus-E (kg/cm²)

ELASTIC MODULUS				
PROFILES	LAYERS	DEPTH	E(kg/cm²)	ENDURANCE
1_PROFILE	1. LAYER	-2,32	2099	Weak
	2.LAYER	-7,28	9678	Medium
	3.LAYER		35696	Rock Highlid
2_PROFILE	1. LAYER	-3,62	6220	Medium
	2. LAYER	-16,19	37931	Rock Highlid
	3. LAYER		157024	Rock Highlid
3_PROFILE	1. LAYER	-2,41	5065	Medium
	2. LAYER	-16,29	18723	Sturdy
	3. LAYER		84117	Rock Highlid
4_PROFILE	1. LAYER	-3,71	5195	Medium
	2. LAYER	-16,61	12018	Sturdy
	3. LAYER		45378	Rock Highlid
5_PROFILE	1. LAYER	-4,22	1218	Weak
	2. LAYER	-18,89	5625	Medium
	3. LAYER		31679	Rock Highlid
6_PROFILE	1. LAYER	-4,47	2827	Weak
	2. LAYER	-10,25	6651	Medium
	3. LAYER		15525	Sturdy
7_PROFILE	1. LAYER	-6,75	3016	Weak
	2.LAYER	-21,22	6993	Medium
	3.LAYER		17578	Sturdy
8_PROFILE	1. LAYER	-4,62	5098	Medium
	2. LAYER	-14,53	13358	Sturdy
	3. LAYER		52871	Rock Highlid
9_PROFILE	1. LAYER	-4,13	3810	Weak
	2. LAYER	-12,99	14500	Sturdy
	3. LAYER		53382	Rock Highlid
10_PROFILE	1. LAYER	-4,56	4989	Weak
	2. LAYER	-20,39	20062	Sturdy
	3. LAYER		98297	Rock Highlid
11_PROFILE	1. LAYER	-5,79	2174	Weak
	2. LAYER	-25,92	9164	Medium
	3. LAYER		37583	Rock Highlid

Elastic Modulus (kg/cm^2)	Dayanım
E<1000	High Weak
1000<E<5000	Weak
5000<E<10000	Medium
10000<E<30000	Sturdy
30000<E	Rock Highlid

The endurance of ground or rocks according to Slip Module values(Keçeli, 1990)

$E=G*(3*V_p^2-4*V_s^2)/(V_p^2-V_s^2)$

‖AVERAGE‖			
LAYERS	DEPTH	E (kg/cm^2)	ENDURANCE
1. LAYER	-4,24	3792	Weak
2.LAYER	-16,41	14064	Sturdy
3.LAYER	∞	57194	Rock Highlid

Elasticity modules and endurance of the grounds in the study area

Calculation of the modulus of elasticity in the direction of the seismic data obtained in the field studies and the change table are given in the above table

5.2.6. WTG02 Poisson's Ratio - (б)

POISSON'S RATIO				
PROFILES	LAYERS	DEPTH	(σ)	POROSITY
1_PROFILE	1. LAYER	-2,32	0,40	High Porous
	2.LAYER	-7,28	0,31	Medium Porous
	3.LAYER		0,38	High Porous
2_PROFILE	1. LAYER	-3,62	0,36	High Porous
	2. LAYER	-16,19	0,30	Medium Porous
	3. LAYER		0,38	High Porous
3_PROFILE	1. LAYER	-2,41	0,43	High Porous
	2. LAYER	-16,29	0,35	Medium Porous
	3. LAYER		0,38	High Porous
4_PROFILE	1. LAYER	-3,71	0,37	High Porous
	2. LAYER	-16,61	0,35	Medium Porous
	3. LAYER		0,40	High Porous
5_PROFILE	1. LAYER	-4,22	0,37	High Porous
	2. LAYER	-18,89	0,31	Medium Porous
	3. LAYER		0,32	Medium Porous
6_PROFILE	1. LAYER	-4,47	0,39	High Porous
	2. LAYER	-10,25	0,32	Medium Porous
	3. LAYER		0,41	High Porous
7_PROFILE	1. LAYER	-6,75	0,39	High Porous
	2.LAYER	-21,22	0,35	Medium Porous
	3.LAYER		0,42	High Porous
8_PROFILE	1. LAYER	-4,62	0,38	High Porous
	2. LAYER	-14,53	0,37	High Porous
	3. LAYER		0,38	High Porous
9_PROFILE	1. LAYER	-4,13	0,42	High Porous
	2. LAYER	-12,99	0,33	Medium Porous
	3. LAYER		0,39	High Porous
10_PROFILE	1. LAYER	-4,56	0,37	High Porous
	2. LAYER	-20,39	0,34	Medium Porous
	3. LAYER		0,36	High Porous
11_PROFILE	1. LAYER	-5,79	0,36	High Porous
	2. LAYER	-25,92	0,33	Medium Porous
	3. LAYER		0,37	High Porous

Poisson's Ratio;(σ)	Porosity
0,00≤σ≤0,25	Nonporous
0,26≤σ≤0,35	Medium Porous
0,36≤σ≤0,50	High Porous

Poisson ratio classification

$\sigma=(Vp^2-2*Vs^2)/(2*Vp^2-2*Vs^2)$

‖AVERAGE‖			
LAYERS	DEPTH	(σ)	POROSITY
1. LAYER	-4,24	0,39	High Porous
2.LAYER	-16,41	0,33	Medium Porous
3.LAYER	∞	0,38	High Porous

Poisson's ratio values of the units in the study area, porosity

Calculation of poisson's ratio values in the direction of the seismic data obtained in the field studies and the change table are given in the above table.

5.2.7. WTG02 Density - ρ (gr/ cm^3)

DENSITY				
PROFILES	LAYERS	DEPTH	ρ (gr/cm^3)	DEFINITION
1_PROFILE	1. LAYER	-2,32	1,51	Medium
	2.LAYER	-7,28	1,68	Medium
	3.LAYER		2,03	High
2_PROFILE	1. LAYER	-3,62	1,66	Medium
	2. LAYER	-16,19	1,93	High
	3. LAYER		2,39	High
3_PROFILE	1. LAYER	-2,41	1,71	Medium
	2. LAYER	-16,29	1,84	Medium
	3. LAYER		2,22	High
4_PROFILE	1. LAYER	-3,71	1,64	Medium
	2. LAYER	-16,61	1,75	Medium
	3. LAYER		2,11	High
5_PROFILE	1. LAYER	-4,22	1,40	Low
	2. LAYER	-18,89	1,57	Medium
	3. LAYER		1,94	High
6_PROFILE	1. LAYER	-4,47	1,54	Medium
	2. LAYER	-10,25	1,63	Medium
	3. LAYER		1,89	Medium
7_PROFILE	1. LAYER	-6,75	1,56	Medium
	2.LAYER	-21,22	1,66	Medium
	3.LAYER		1,94	High
8_PROFILE	1. LAYER	-4,62	1,62	Medium
	2. LAYER	-14,53	1,81	Medium
	3. LAYER		2,11	High
9_PROFILE	1. LAYER	-4,13	1,64	Medium
	2. LAYER	-12,99	1,77	Medium
	3. LAYER		2,14	High
10_PROFILE	1. LAYER	-4,56	1,63	Medium
	2. LAYER	-20,39	1,84	Medium
	3. LAYER		2,24	High
11_PROFILE	1. LAYER	-5,79	1,48	Medium
	2. LAYER	-25,92	1,67	Medium
	3. LAYER		2,03	High

Density: ρ (gr/cm³)	Tanımlama
ρ<1,20	High low
1,20<ρ<1,40	Low
1,40<ρ<1,90	Medium
1,90<ρ<2,20	High
2,20<ρ	Too High

Density Classification of Ground Units: (Keçeli, 1990)

*ρ =d=0.31*Vp0.25*

||AVERAGE||			
LAYERS	DEPTH	ρ (gr/cm³)	DEFINITION
1. LAYER	-4,24	1,58	Medium
2.LAYER	-16,41	1,74	Medium
3.LAYER	∞	2,09	High

Density values and description of the units in the study area

Calculation of the density values of the geological units in the direction of the seismic data obtained in the field studies and the table of variation are given in the above table.

5.2.8. WTG02 Modulus of Subgrade Reaction – D Y K (ton/m³)

Modulus of Subgrade Reaction			
PROFILES	LAYERS	DEPTH	D Y K (ton/m³)
1_PROFILE	1. LAYER	-2,32	1543
	2.LAYER	-7,28	3321
	3.LAYER		6416
2_PROFILE	1. LAYER	-3,62	2659
	2. LAYER	-16,19	6514
	3. LAYER		14536
3_PROFILE	1. LAYER	-2,41	2306
	2. LAYER	-16,29	4486
	3. LAYER		10202
4_PROFILE	1. LAYER	-3,71	2363
	2. LAYER	-16,61	3601
	3. LAYER		7274
5_PROFILE	1. LAYER	-4,22	1185
	2. LAYER	-18,89	2517
	3. LAYER		6137
6_PROFILE	1. LAYER	-4,47	1782
	2. LAYER	-10,25	2795
	3. LAYER		4144
7_PROFILE	1. LAYER	-6,75	1838
	2.LAYER	-21,22	2843
	3.LAYER		4400
8_PROFILE	1. LAYER	-4,62	2367
	2. LAYER	-14,53	3865
	3. LAYER		7915
9_PROFILE	1. LAYER	-4,13	2041
	2. LAYER	-12,99	4029
	3. LAYER		7944
10_PROFILE	1. LAYER	-4,56	2326
	2. LAYER	-20,39	4742
	3. LAYER		11139
11_PROFILE	1. LAYER	-5,79	1572
	2. LAYER	-25,92	3178
	3. LAYER		6604

||AVERAGE||		
LAYERS	DEPTH	D Y K (ton/m^3)
1. LAYER	-4,24	1998
2.LAYER	-16,41	3808
3.LAYER	∞	7883
kv= 40*(Gs)*qu ton/m^3 *(Bowles 1984)*		

The above table shows the Modulus of Subgrade Reaction obtained for each layer in the direction of the data obtained after the seismic measurements made in the study area.

5.2.9. WTG02 Bearing Capacity qu (kg/cm2) / Allowable Bearing Capacity qa (kg/cm2)

PROFILES	LAYERS	DEPTH	BEARING CAPACITY (qu,kg/cm^2)	ALLOWABLE BEARING CAPACITY (qa,kg/cm^2)
1_PROFILE	1. LAYER	-2,32	3,86	1,29
	2.LAYER	-7,28	8,30	2,77
	3.LAYER	-42,72	16,04	5,35
2_PROFILE	1. LAYER	-3,62	6,65	2,22
	2. LAYER	-16,19	16,28	5,43
	3. LAYER	-33,81	36,34	12,11
3_PROFILE	1. LAYER	-2,41	5,76	1,92
	2. LAYER	-16,29	11,22	3,74
	3. LAYER	-33,71	25,51	8,50
4_PROFILE	1. LAYER	-3,71	5,91	1,97
	2. LAYER	-16,61	9,00	3,00
	3. LAYER	-33,39	18,18	6,06
5_PROFILE	1. LAYER	-4,22	2,96	0,99
	2. LAYER	-18,89	6,29	2,10
	3. LAYER	-31,11	15,34	5,11
6_PROFILE	1. LAYER	-4,47	4,45	1,48
	2. LAYER	-10,25	6,99	2,33
	3. LAYER	-39,75	10,36	3,45
7_PROFILE	1. LAYER	-6,75	4,60	1,53
	2.LAYER	-21,22	7,11	2,37
	3.LAYER	-28,78	11,00	3,67
8_PROFILE	1. LAYER	-4,62	5,92	1,97
	2. LAYER	-14,53	9,66	3,22
	3. LAYER	-35,47	19,79	6,60
9_PROFILE	1. LAYER	-4,13	5,10	1,70
	2. LAYER	-12,99	10,07	3,36
	3. LAYER	-37,01	19,86	6,62
10_PROFILE	1. LAYER	-4,56	5,81	1,94
	2. LAYER	-20,39	11,85	3,95
	3. LAYER	-29,61	27,85	9,28
11_PROFILE	1. LAYER	-5,79	3,93	1,31
	2. LAYER	-25,92	7,94	2,65
	3. LAYER	-24,08	16,51	5,50

LAYERS	||AVERAGE|| DEPTH	Bearing Capacity (qu,kg/cm^2)
1. LAYER	-4,24	5,00
2.LAYER	-16,41	9,52
3.LAYER	∞	19,71
qu=(0,024*Vs*(J.B.K+0,002*Vp)*0,71)/G.K		

LAYERS	||AVERAGE|| DEPTH	Allowable Bearing Capacity (qa,kg/cm^2)
1. LAYER	-4,24	1,67
2.LAYER	-16,41	3,17
3.LAYER	∞	6,57
qa=qu/G.K	G.K=3 empirical value	

5.2.10. WTG02 Vibration Period - T_0 (sec) / Ground Amplification (Ak)

PROFILES	To (sec)	Ta (sec)	Tb (sec)	Ak (Amplification)
1.PROFILE	0,30	0,20	0,45	1,74
2.PROFILE	0,19	0,13	0,29	1,23
3.PROFILE	0,24	0,16	0,36	1,41
4.PROFILE	0,32	0,21	0,47	1,63
5.PROFILE	0,44	0,29	0,66	2,03
6.PROFILE	0,43	0,29	0,65	2,07
7.PROFILE	0,47	0,31	0,70	1,92
8.PROFILE	0,28	0,19	0,43	1,57
9.PROFILE	0,28	0,19	0,42	1,58
10.PROFILE	0,26	0,17	0,39	1,44
11.PROFILE	0,42	0,28	0,63	1,85

AVERAGE			
To (sec)	Ta (sec)	Tb (sec)	Ak (Amplification)
0,33	0,22	0,50	1,68

$To = \sum 4H\ Vs\ n\ \iota$=1 (sec)……. (Zeevaert,1967)

Ak=68*$Vs_{30}^{-0,6}$……. (Midorikawa, 1987)

The Vibration Period and Ground Amplification calculated in the direction of the parameters obtained during the seismic studies made during the field survey are presented in the table above.

5. 3. WTG03

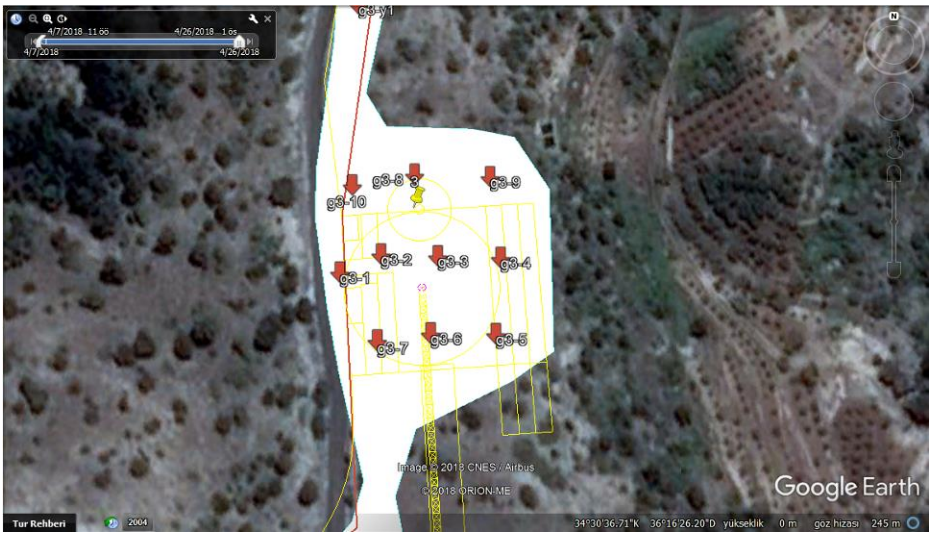
There are 10 measurements were taken on the WTG. Three layers were seen in this scale. Layer 1 was found to be between 0,00 m and 4,07 m in depth, Layer 2 was found between 4,07 m and 14,96 m in depth and Layer 3 was found at an average depth of 14,96 m. These layers parameters are given in the table below.

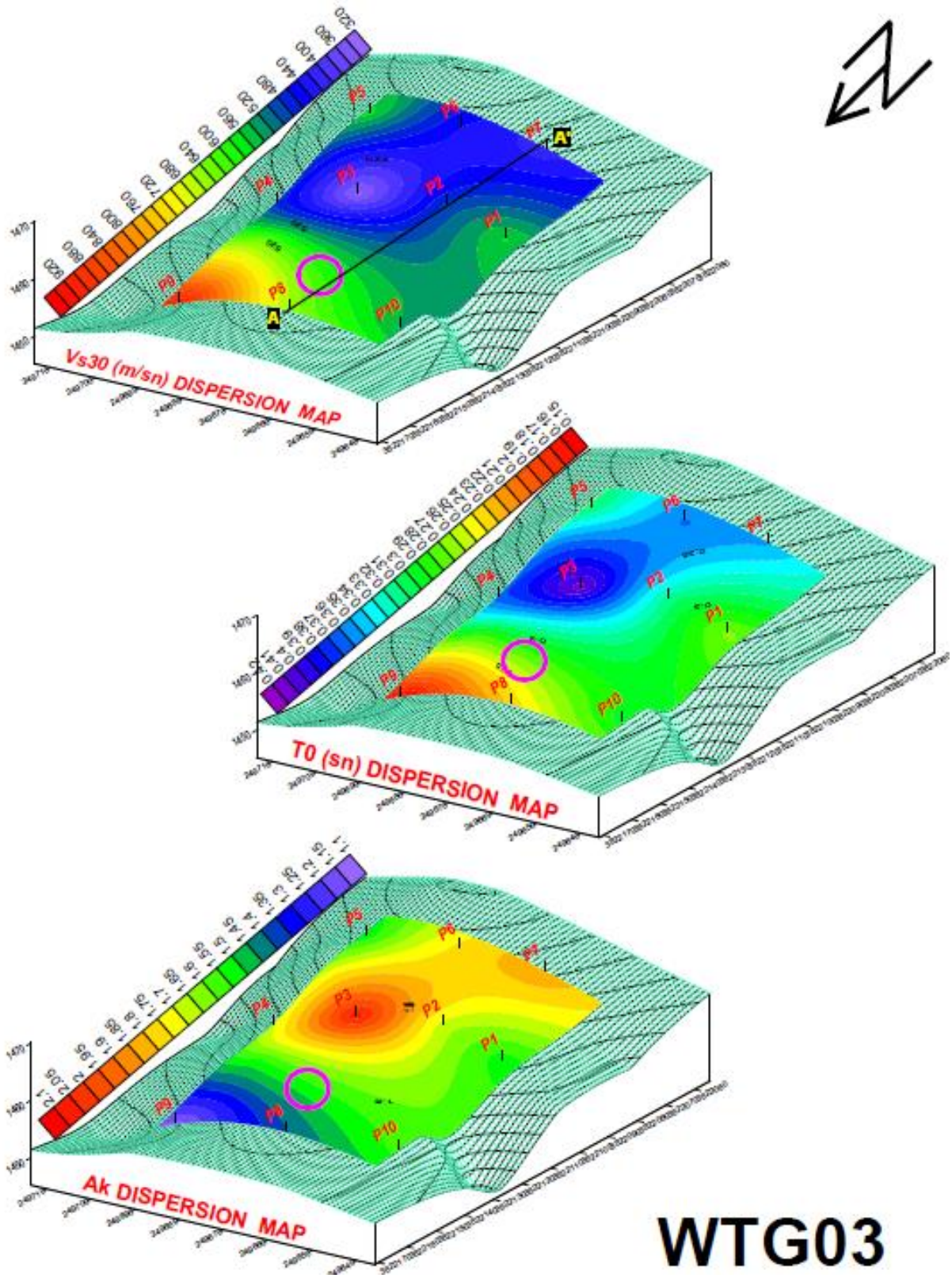
LAYERS	Vp_ Velocity	STRIPPABILITY
1. LAYER	754	Simple strippability
2.LAYER	1070	Simple strippability
3.LAYER	2214	Explosive
LAYERS	**Vs_ Velocity**	**GROUND GROUP**
1. LAYER	293	C
2.LAYER	525	B
3.LAYER	956	A
LAYERS	**G (kg/cm2)**	**ENDURANCE**
1. LAYER	1869	Medium
2.LAYER	5758	Sturdy
3.LAYER	22241	High sturdy
LAYERS	**E (kg/cm2)**	**ENDURANCE**
1. LAYER	5140	Medium
2.LAYER	15325	Sturdy
3.LAYER	61128	High sturdy

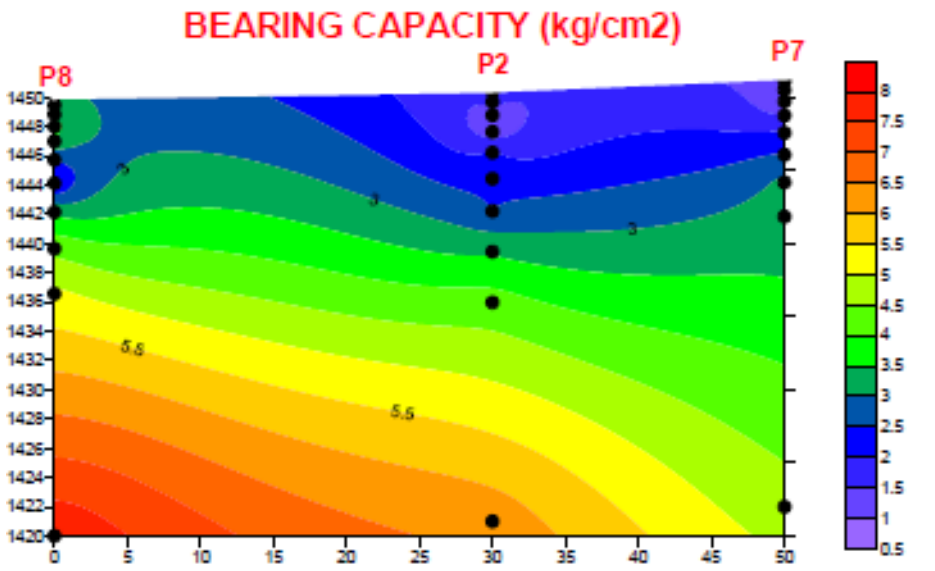
LAYERS	(σ)	POROSITY
1. LAYER	0,38	High Porosity
2.LAYER	0,34	Medium Porosity
3.LAYER	0,39	High Porosity
LAYERS	**ρ (gr/cm3)**	**DEFINITION**
1. LAYER	1,60	Medium
2.LAYER	1,76	Medium
3.LAYER	2,11	High
LAYERS	**D Y K (ton/m³)**	
1. LAYER	2238	
2.LAYER	3948	
3.LAYER	8125	
LAYERS	**Ground Carrying Capacity (qu,kg/cm2)**	**Secure Carrying Capacity (qa,kg/cm2)**
1. LAYER	5,60	1,87
2.LAYER	9,87	3,29
3.LAYER	20,31	6,77

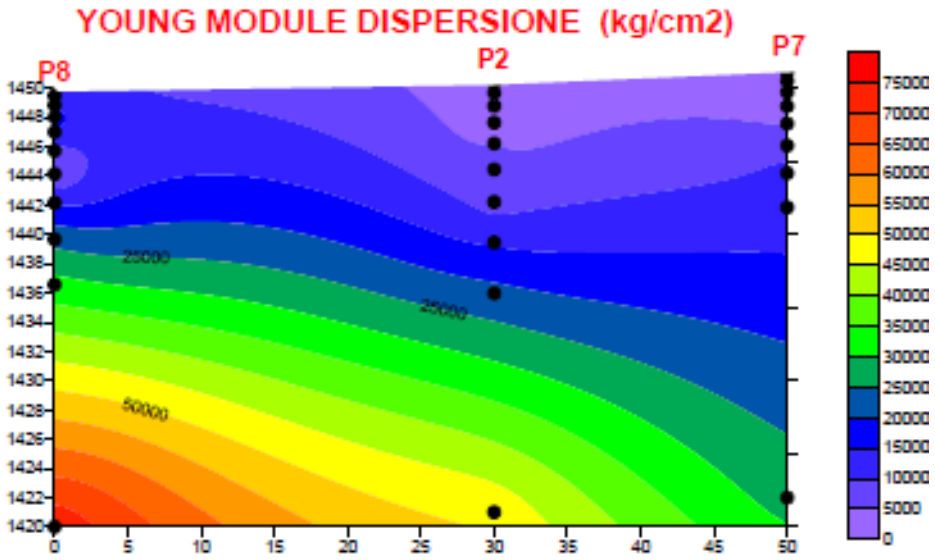
To (sec)	Ta (sec)	Tb (sec)	Vs30 (m/sec)	Ak (Amplification)
0,31	0,20	0,46	538	1,62

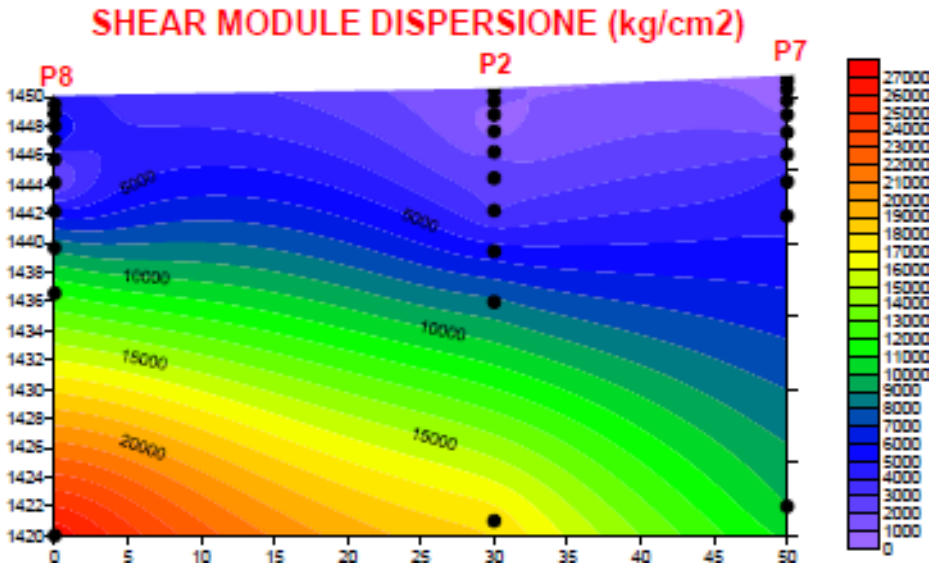
It is recommended to excavate the average of the first 2.50 meters from the ground level on the 3rd and 7th Profiles. Profile points should be viewed in engineering parameters section for detailed values considering the following application.




Vs30 (m/sn) DISPERSION MAP
T0 (sn) DISPERSION MAP
Ak DISPERSION MAP
WTG03


BEARING CAPACITY (kg/cm2)
P8
P2
P7
5.5
3
8
7.5
7
6.5
6
5.5
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5


YOUNG MODULE DISPERSIONE (kg/cm2)
P8
P2
P7
25000
50000
75000
70000
65000
60000
55000
50000
45000
40000
35000
30000
25000
20000
15000
10000
5000
0


SHEAR MODULE DISPERSIONE (kg/cm2)
P8
P2
P7
5000
10000
15000
20000
27000
26000
25000
24000
23000
22000
21000
20000
19000
18000
17000
16000
15000
14000
13000
12000
11000
10000
9000
8000
7000
6000
5000
4000
3000
2000
1000
0

5.3.1. WTG03 Seismic P wave velocity (*Compressional Wave Velocity* (Vp))

Vp VELOCITY				
PROFILES	LAYERS	DEPTH	Vp_ Velocity	STRIPPABILITY
1_PROFILE	1. LAYER	-3,18	614	Simple Strippability
	2.LAYER	-14,25	1104	Simple Strippability
	3.LAYER		2504	Explosive
2_PROFILE	1. LAYER	-3,36	571	Simple Strippability
	2. LAYER	-15,03	941	Simple Strippability
	3. LAYER		2043	High Difficult Strippability
3_PROFILE	1. LAYER	-1,86	267	High Simple Strippability
	2. LAYER	-8,33	647	Simple Strippability
	3. LAYER		1438	Medium Strippability
4_PROFILE	1. LAYER	-5,27	707	Simple Strippability
	2. LAYER	-23,58	1008	Simple Strippability
	3. LAYER		2019	High Difficult Strippability
5_PROFILE	1. LAYER	-9,03	1025	Simple Strippability
	2. LAYER	-20,70	1261	Medium Strippability
	3. LAYER		2257	Explosive
6_PROFILE	1. LAYER	-3,61	767	Simple Strippability
	2. LAYER	-16,16	896	Simple Strippability
	3. LAYER		1808	High Difficult Strippability
7_PROFILE	1. LAYER	-2,27	498	Simple Strippability
	2.LAYER	-10,15	799	Simple Strippability
	3.LAYER		1725	High Difficult Strippability
8_PROFILE	1. LAYER	-5,87	1233	Medium Strippability
	2. LAYER	-13,44	1360	Medium Strippability
	3. LAYER		2493	Explosive
9_PROFILE	1. LAYER	-2,44	1100	Simple Strippability
	2. LAYER	-10,92	1671	High Difficult Strippability
	3. LAYER		3634	Explosive
10_PROFILE	1. LAYER	-3,80	762	Simple Strippability
	2. LAYER	-17,00	1019	Simple Strippability
	3. LAYER		2215	Explosive

P Wave Velocity (m/sec)	Strippability
Vp<458	High Simple Strippability
458<Vp<1220	Simple Strippability
1220<Vp<11525	Medium Strippability
1525<Vp<11830	Difficult Strippability
1830<Vp<12135	High Difficult Strippability
Vp>2135	Explosive Strippability

Strippability of floors with P wave velocity (Church, 1981)

‖AVERAGE‖			
LAYERS	DEPTH	Vp_ Velocity	STRIPPABILITY
1. LAYER	-4,07	754	Simple Strippability
2.LAYER	-14,96	1070	Simple Strippability
3.LAYER	∞	2214	Explosive

P wave velocities of the grounds in the study area and strippability

The above table shows the change table and strippability properties of Vp velocity depth values in the direction of the seismic data obtained from the field studies.

5.3.2. WTG03 Seismic S wave velocity (*Transverse Wave Velocity* (Vs))

Vs VELOCITY				
PROFILES	LAYERS	DEPTH	Vs_ Velocity	GROUND GROUPS
1_PROFILE	1. LAYER	-3,18	252	C
	2.LAYER	-14,25	576	B
	3.LAYER		1055	A
2_PROFILE	1. LAYER	-3,36	239	C
	2. LAYER	-15,03	477	B
	3. LAYER		920	A
3_PROFILE	1. LAYER	-1,86	126	D
	2. LAYER	-8,33	327	C
	3. LAYER		601	B
4_PROFILE	1. LAYER	-5,27	259	C
	2. LAYER	-23,58	458	B
	3. LAYER		842	A
5_PROFILE	1. LAYER	-9,03	332	C
	2. LAYER	-20,70	592	B
	3. LAYER		862	A
6_PROFILE	1. LAYER	-3,61	341	C
	2. LAYER	-16,16	400	C
	3. LAYER		735	A
7_PROFILE	1. LAYER	-2,27	210	C
	2.LAYER	-10,15	416	B
	3.LAYER		708	A
8_PROFILE	1. LAYER	-5,87	387	C
	2. LAYER	-13,44	671	B
	3. LAYER		1105	A
9_PROFILE	1. LAYER	-2,44	418	B
	2. LAYER	-10,92	837	A
	3. LAYER		1776	A
10_PROFILE	1. LAYER	-3,80	369	C
	2. LAYER	-17,00	499	B
	3. LAYER		950	A

S Wave Velocity (m/sec)	Ground group
Vs<200	D
200<Vs<400	C
400<Vs<700	B
700<Vs	A

Ground groups according to slip wave velocity(Abyyhy, 1998)

||AVERAGE||			
LAYERS	DEPTH	Vs_ Velocity	GROUND GROUPS
1. LAYER	-4,07	293	C
2.LAYER	-14,96	525	B
3.LAYER	∞	956	A

S wave velocities of the grounds in the study area and ground group

Ground Group	Ground group and top ground layer thickness(h_1)
Z1	(A) Ground group h1< 15 m (B) Ground group
Z2	h_1> 15 m (B) Ground group h_1< 15 m (C) Ground group
Z3	15 m < h_1< 50 m (C) Ground group h_1< 10 m (D) Ground group
Z4	h_1> 50 m (C) Ground group h_1> 10 m (D) Ground group

Ground Group Class

The above table shows that Vs velocity values in the direction of the seismic data obtained in the field studies are the absolute change tables and that the layers are included in the ground groups.

5.3.3. WTG03 Vs30

PROFILES	Vs30 (m/sec)
1.PROFILE	562
2.PROFILE	482
3.PROFILE	333
4.PROFILE	474
5.PROFILE	565
6.PROFILE	439
7.PROFILE	408
8.PROFILE	652
9.PROFILE	928
10.PROFILE	538

Vs30 values in the direction of the seismic data obtained from the field studies are given in the table above.

5.3.4. WTG03 Shear Modulus-G (kg/cm²)

SHEAR MODULUS				
PROFILES	LAYERS	DEPTH	G(kg/cm^2)	ENDURANCE
1_PROFILE	1. LAYER	-3,18	1035	Weak
	2.LAYER	-14,25	6387	Sturdy
	3.LAYER		24399	Rock Highlid
2_PROFILE	1. LAYER	-3,36	939	Weak
	2. LAYER	-15,03	4228	Sturdy
	3. LAYER		17646	Rock Highlid
3_PROFILE	1. LAYER	-1,86	208	High Weak
	2. LAYER	-8,33	1805	Medium
	3. LAYER		6900	Sturdy
4_PROFILE	1. LAYER	-5,27	1082	Weak
	2. LAYER	-23,58	3771	Sturdy
	3. LAYER		14730	Rock Highlid
5_PROFILE	1. LAYER	-9,03	2912	Medium
	2. LAYER	-20,70	6503	Sturdy
	3. LAYER		15893	Rock Highlid
6_PROFILE	1. LAYER	-3,61	1972	Medium
	2. LAYER	-16,16	3021	Sturdy
	3. LAYER		10917	Rock Highlid
7_PROFILE	1. LAYER	-2,27	692	Weak
	2.LAYER	-10,15	3034	Sturdy
	3.LAYER		10020	Rock Highlid
8_PROFILE	1. LAYER	-5,87	4334	Sturdy
	2. LAYER	-13,44	8714	Sturdy
	3. LAYER		26767	Rock Highlid
9_PROFILE	1. LAYER	-2,44	3271	Sturdy
	2. LAYER	-10,92	15083	Rock Highlid
	3. LAYER		75956	Rock Highlid
10_PROFILE	1. LAYER	-3,80	2248	Medium
	2. LAYER	-17,00	5037	Sturdy
	3. LAYER		19181	Rock Highlid

Shear Modulus (kg/cm²)	Dayanım
G<400	High Weak
400<G<1500	Weak
1500<G<3000	Medium
3000<G<10000	Sturdy
10000<G	Rock Highlid

The endurance of ground or rocks according to Slip Module values(Keçeli, 1990)

$G = (d*Vs^2)/100$

‖AVERAGE‖			
LAYERS	DEPTH	G (kg/cm²)	ENDURANCE
1. LAYER	-4,07	1869	Medium
2.LAYER	-14,96	5758	Sturdy
3.LAYER	∞	22241	Rock Highlid

Shear modules and endurance of the grounds in the study area

Calculation of shear Modulus values in the direction of the seismic data obtained in the field studies and the table of variation are given in the table above.

5.3.5. WTG03 Elasticity Modulus-E (kg/cm²)

ELASTIC MODULUS				
PROFILES	LAYERS	DEPTH	E(kg/cm²)	ENDURANCE
1_PROFILE	1. LAYER	-3,18	2819	Weak
	2.LAYER	-14,25	16793	Sturdy
	3.LAYER		67933	Rock Highlid
2_PROFILE	1. LAYER	-3,36	2506	Weak
	2. LAYER	-15,03	11171	Sturdy
	3. LAYER		48448	Rock Highlid
3_PROFILE	1. LAYER	-1,86	555	High Weak
	2. LAYER	-8,33	4785	Weak
	3. LAYER		19237	Sturdy
4_PROFILE	1. LAYER	-5,27	3071	Weak
	2. LAYER	-23,58	10325	Sturdy
	3. LAYER		41089	Rock Highlid
5_PROFILE	1. LAYER	-9,03	8146	Medium
	2. LAYER	-20,70	17632	Sturdy
	3. LAYER		44960	Rock Highlid
6_PROFILE	1. LAYER	-3,61	5304	Medium
	2. LAYER	-16,16	8080	Medium
	3. LAYER		30591	Rock Highlid
7_PROFILE	1. LAYER	-2,27	1859	Weak
	2.LAYER	-10,15	7974	Medium
	3.LAYER		28029	Sturdy
8_PROFILE	1. LAYER	-5,87	12078	Sturdy
	2. LAYER	-13,44	23267	Sturdy
	3. LAYER		73750	Rock Highlid
9_PROFILE	1. LAYER	-2,44	9080	Medium
	2. LAYER	-10,92	40012	Rock Highlid
	3. LAYER		204019	Rock Highlid
10_PROFILE	1. LAYER	-3,80	5979	Medium
	2. LAYER	-17,00	13209	Sturdy
	3. LAYER		53223	Rock Highlid

Elastic Modulus (kg/cm^2)	Dayanım
E<1000	High Weak
1000<E<5000	Weak
5000<E<10000	Medium
10000<E<30000	Sturdy
30000<E	Rock Highlid

The endurance of ground or rocks according to Slip Module values(Keçeli, 1990)

$E=G*(3*V_p^2-4*V_s^2)/(V_p^2-V_s^2)$

‖AVERAGE‖			
LAYERS	DEPTH	E (kg/cm^2)	ENDURANCE
1. LAYER	-4,07	5140	Medium
2.LAYER	-14,96	15325	Sturdy
3.LAYER	∞	61128	Rock Highlid

Elasticity modules and endurance of the grounds in the study area

Calculation of the modulus of elasticity in the direction of the seismic data obtained in the field studies and the change table are given in the above table

5.3.6. WTG03 Poisson's Ratio - (б)

POISSON'S RATIO				
PROFILES	LAYERS	DEPTH	(σ)	POROSITY
1_PROFILE	1. LAYER	-3,18	0,39	High Porous
	2.LAYER	-14,25	0,31	Medium Porous
	3.LAYER		0,39	High Porous
2_PROFILE	1. LAYER	-3,36	0,37	High Porous
	2. LAYER	-15,03	0,33	Medium Porous
	3. LAYER		0,37	High Porous
3_PROFILE	1. LAYER	-1,86	0,34	Medium Porous
	2. LAYER	-8,33	0,33	Medium Porous
	3. LAYER		0,39	High Porous
4_PROFILE	1. LAYER	-5,27	0,42	High Porous
	2. LAYER	-23,58	0,37	High Porous
	3. LAYER		0,39	High Porous
5_PROFILE	1. LAYER	-9,03	0,40	High Porous
	2. LAYER	-20,70	0,36	High Porous
	3. LAYER		0,41	High Porous
6_PROFILE	1. LAYER	-3,61	0,37	High Porous
	2. LAYER	-16,16	0,36	High Porous
	3. LAYER		0,40	High Porous
7_PROFILE	1. LAYER	-2,27	0,38	High Porous
	2.LAYER	-10,15	0,31	Medium Porous
	3.LAYER		0,40	High Porous
8_PROFILE	1. LAYER	-5,87	0,41	High Porous
	2. LAYER	-13,44	0,34	Medium Porous
	3. LAYER		0,38	High Porous
9_PROFILE	1. LAYER	-2,44	0,41	High Porous
	2. LAYER	-10,92	0,33	Medium Porous
	3. LAYER		0,34	Medium Porous
10_PROFILE	1. LAYER	-3,80	0,34	Medium Porous
	2. LAYER	-17,00	0,34	Medium Porous
	3. LAYER		0,39	High Porous

Poisson's Ratio;(σ)	Porosity
0,00≤σ≤0,25	Nonporous
0,26≤σ≤0,35	Medium Porous
0,36≤σ≤0,50	High Porous

Poisson ratio classification

$\sigma=(Vp^2-2*Vs^2)/(2*Vp^2-2*Vs^2)$

‖AVERAGE‖			
LAYERS	DEPTH	(σ)	POROSITY
1. LAYER	-4,07	0,38	High Porous
2.LAYER	-14,96	0,34	Medium Porous
3.LAYER	∞	0,39	High Porous

Poisson's ratio values of the units in the study area, porosity

Calculation of poisson's ratio values in the direction of the seismic data obtained in the field studies and the change table are given in the above table.

5.3.7. WTG03 Density - ρ (gr/ cm^3)

DENSITY				
PROFILES	LAYERS	DEPTH	ρ (gr/cm^3)	DEFINITION
1_PROFILE	1. LAYER	-3,18	1,54	Medium
	2.LAYER	-14,25	1,77	Medium
	3.LAYER		2,19	High
2_PROFILE	1. LAYER	-3,36	1,52	Medium
	2. LAYER	-15,03	1,71	Medium
	3. LAYER		2,08	High
3_PROFILE	1. LAYER	-1,86	1,25	Low
	2. LAYER	-8,33	1,55	Medium
	3. LAYER		1,91	High
4_PROFILE	1. LAYER	-5,27	1,60	Medium
	2. LAYER	-23,58	1,74	Medium
	3. LAYER		2,08	High
5_PROFILE	1. LAYER	-9,03	1,75	Medium
	2. LAYER	-20,70	1,85	Medium
	3. LAYER		2,14	High
6_PROFILE	1. LAYER	-3,61	1,63	Medium
	2. LAYER	-16,16	1,69	Medium
	3. LAYER		2,02	High
7_PROFILE	1. LAYER	-2,27	1,46	Medium
	2.LAYER	-10,15	1,64	Medium
	3.LAYER		2,00	High
8_PROFILE	1. LAYER	-5,87	1,84	Medium
	2. LAYER	-13,44	1,88	Medium
	3. LAYER		2,19	High
9_PROFILE	1. LAYER	-2,44	1,79	Medium
	2. LAYER	-10,92	1,97	High
	3. LAYER		2,41	High
10_PROFILE	1. LAYER	-3,80	1,63	Medium
	2. LAYER	-17,00	1,74	Medium
	3. LAYER		2,13	High

Density: ρ (gr/cm³)	Tanımlama
ρ<1,20	High low
1,20<ρ<1,40	Low
1,40<ρ<1,90	Medium
1,90<ρ<2,20	High
2,20<ρ	Too High

Density Classification of Ground Units: (Keçeli, 1990)

*ρ =d=0.31*Vp0.25*

||AVERAGE||		
LAYERS	DEPTH	ρ (gr/cm³)	DEFINITION
1. LAYER	-4,07	1,60	Medium
2.LAYER	-14,96	1,76	Medium
3.LAYER	∞	2,11	High

Density values and description of the units in the study area

Calculation of the density values of the geological units in the direction of the seismic data obtained in the field studies and the table of variation are given in the above table.

5.3.8. WTG03 Modulus of Subgrade Reaction – D Y K (ton/m³)

Modulus of Subgrade Reaction			
PROFILES	LAYERS	DEPTH	D Y K (ton/m³)
1_PROFILE	1. LAYER	-3,18	1773
	2.LAYER	-14,25	4319
	3.LAYER		9062
2_PROFILE	1. LAYER	-3,36	1673
	2. LAYER	-15,03	3506
	3. LAYER		7559
3_PROFILE	1. LAYER	-1,86	851
	2. LAYER	-8,33	2324
	3. LAYER		4641
4_PROFILE	1. LAYER	-5,27	1848
	2. LAYER	-23,58	3380
	3. LAYER		6899
5_PROFILE	1. LAYER	-9,03	2988
	2. LAYER	-20,70	4486
	3. LAYER		7235
6_PROFILE	1. LAYER	-3,61	2445
	2. LAYER	-16,16	2917
	3. LAYER		5895
7_PROFILE	1. LAYER	-2,27	1456
	2.LAYER	-10,15	3006
	3.LAYER		5633
8_PROFILE	1. LAYER	-5,87	3597
	2. LAYER	-13,44	5150
	3. LAYER		9487
9_PROFILE	1. LAYER	-2,44	3110
	2. LAYER	-10,92	6684
	3. LAYER		16904
10_PROFILE	1. LAYER	-3,80	2644
	2. LAYER	-17,00	3708
	3. LAYER		7935

LAYERS	||AVERAGE|| DEPTH	D Y K (ton/m^3)
1. LAYER	-4,07	2238
2.LAYER	-14,96	3948
3.LAYER	∞	8125
kv= 40*(Gs)*qu ton/m^3 *(Bowles 1984)*		

The above table shows the Modulus of Subgrade Reaction obtained for each layer in the direction of the data obtained after the seismic measurements made in the study area.

5.3.9. WTG03 Bearing Capacity qu (kg/cm2) / Allowable Bearing Capacity qa (kg/cm2)

PROFILES	LAYERS	DEPTH	BEARING CAPACITY (qu,kg/cm^2)	ALLOWABLE BEARING CAPACITY (qa,kg/cm^2)
1_PROFILE	1. LAYER	-3,18	4,43	1,48
	2.LAYER	-14,25	10,80	3,60
	3.LAYER	-35,75	22,66	7,55
2_PROFILE	1. LAYER	-3,36	4,18	1,39
	2. LAYER	-15,03	8,76	2,92
	3. LAYER	-34,97	18,90	6,30
3_PROFILE	1. LAYER	-1,86	2,13	0,71
	2. LAYER	-8,33	5,81	1,94
	3. LAYER	-41,67	11,60	3,87
4_PROFILE	1. LAYER	-5,27	4,62	1,54
	2. LAYER	-23,58	8,45	2,82
	3. LAYER	-26,42	17,25	5,75
5_PROFILE	1. LAYER	-9,03	7,47	2,49
	2. LAYER	-20,70	11,22	3,74
	3. LAYER	-29,30	18,09	6,03
6_PROFILE	1. LAYER	-3,61	6,11	2,04
	2. LAYER	-16,16	7,29	2,43
	3. LAYER	-33,84	14,74	4,91
7_PROFILE	1. LAYER	-2,27	3,64	1,21
	2.LAYER	-10,15	7,51	2,50
	3.LAYER	-39,85	14,08	4,69
8_PROFILE	1. LAYER	-5,87	8,99	3,00
	2. LAYER	-13,44	12,87	4,29
	3. LAYER	-36,56	23,72	7,91
9_PROFILE	1. LAYER	-2,44	7,77	2,59
	2. LAYER	-10,92	16,71	5,57
	3. LAYER	-39,08	42,26	14,09
10_PROFILE	1. LAYER	-3,80	6,61	2,20
	2. LAYER	-17,00	9,27	3,09
	3. LAYER	-33,00	19,84	6,61

LAYERS	||AVERAGE|| DEPTH	Bearing Capacity (qu,kg/cm^2)
1. LAYER	-4,07	5,60
2.LAYER	-14,96	9,87
3.LAYER	∞	20,31

qu=(0,024*Vs*(J.B.K+0,002*Vp)*0,71)/G.K

BEARING CAPACITY CALCULATION	Geological unit factor 18	16	17	18	20
(Prof. Dr. SEMIH TEZCAN-2006)	Safety factor 50-100	CLAY	SAND	SEDIMENT	VOLATISILE

LAYERS	||AVERAGE|| DEPTH	Allowable Bearing Capacity (qa,kg/cm^2)
1. LAYER	-4,07	1,87
2.LAYER	-14,96	3,29
3.LAYER	∞	6,77

qa=qu/G.K G.K=3 empirical value

5.3.10. WTG03 Vibration Period - T_0 (sec) / Ground Amplification (Ak)

PROFILES	To (sec)	Ta (sec)	Tb (sec)	Ak (Amplification)
1.PROFILE	0,27	0,18	0,40	1,52
2.PROFILE	0,31	0,21	0,47	1,67
3.PROFILE	0,42	0,28	0,62	2,09
4.PROFILE	0,37	0,24	0,55	1,69
5.PROFILE	0,31	0,21	0,46	1,52
6.PROFILE	0,36	0,24	0,54	1,77
7.PROFILE	0,35	0,23	0,53	1,85
8.PROFILE	0,23	0,16	0,35	1,39
9.PROFILE	0,15	0,10	0,23	1,13
10.PROFILE	0,29	0,20	0,44	1,56

AVERAGE			
To (sec)	Ta (sec)	Tb (sec)	Ak (Amplification)
0,31	0,20	0,46	1,62

$To = \sum 4H\ Vs\ n\ \iota$=1 (sec)……. (Zeevaert,1967)

Ak=68*$Vs_{30}^{-0,6}$……. (Midorikawa, 1987)

The Vibration Period and Ground Amplification calculated in the direction of the parameters obtained during the seismic studies made during the field survey are presented in the table above.

5. 4. WTG04

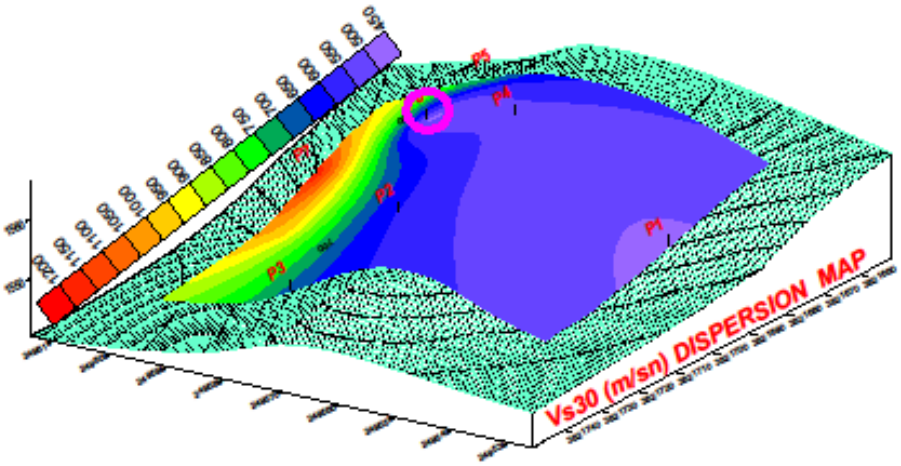
There are 7 measurements taken on the WTG. In these measurements 3 layers were observed. The first layer was found between 0,0 m and 5,51 m depth, the second layer between 5,51 m and 17,53 m depth and the third layer about 17,53 m depth. The parameters of these layers are given in the table below.

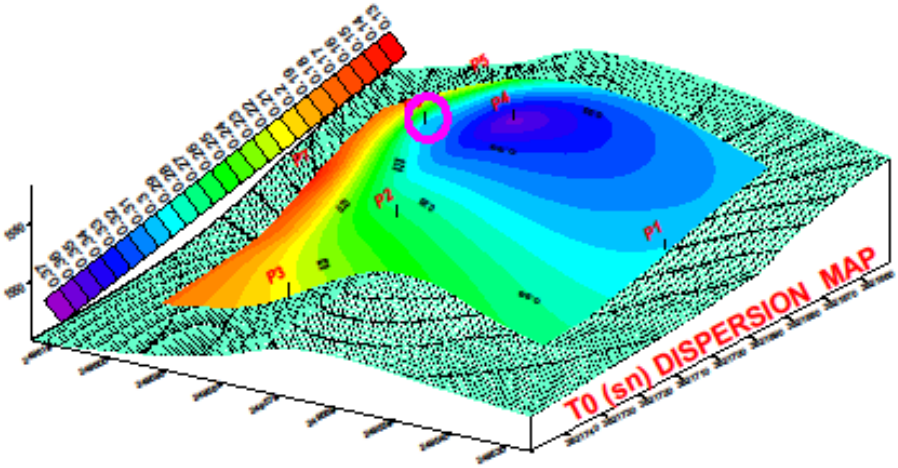
LAYERS	Vp_ Velocity	STRIPPABILITY
1. LAYER	984	Simple strippability
2.LAYER	1440	Medium-hard strippability
3.LAYER	2877	Explosive
LAYERS	**Vs_ Velocity**	**GROUND GROUP**
1. LAYER	393	C
2.LAYER	695	B
3.LAYER	1176	A
LAYERS	**G (kg/cm2)**	**ENDURANCE**
1. LAYER	4468	Sturdy
2.LAYER	10841	High sturdy
3.LAYER	34276	High sturdy
LAYERS	**E (kg/cm2)**	**ENDURANCE**
1. LAYER	12240	Sturdy
2.LAYER	29068	Sturdy
3.LAYER	96132	High sturdy

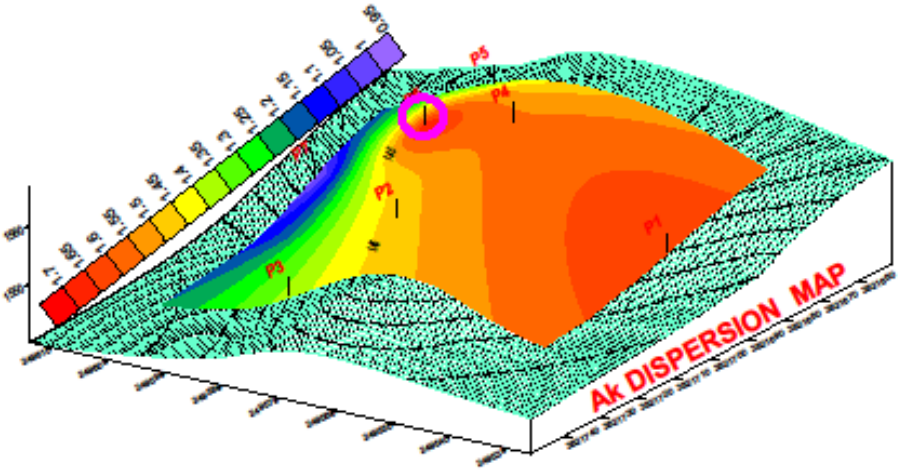
LAYERS	(σ)	POROSITY
1. LAYER	0,39	High Porosity
2.LAYER	0,34	Medium Porosity
3.LAYER	0,39	High Porosity
LAYERS	**ρ (gr/cm3)**	**DEFINITION**
1. LAYER	1,70	Medium
2.LAYER	1,89	Medium
3.LAYER	2,25	High
LAYERS	**D Y K (ton/m³)**	
1. LAYER	3093	
2.LAYER	5467	
3.LAYER	10685	
LAYERS	**Ground Carrying Capacity (qu,kg/cm2)**	**Secure Carrying Capacity (qa,kg/cm2)**
1. LAYER	7,73	2,58
2.LAYER	13,67	4,56
3.LAYER	26,71	8,90

To (sec)	Ta (sec)	Tb (sec)	Vs30 (m/sec)	Ak (Amplification)
0,26	0,17	0,39	668	1,43

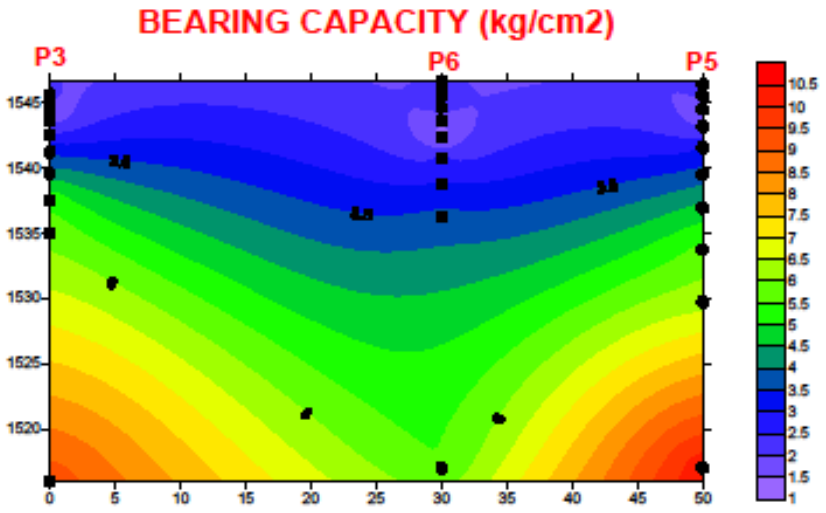
Profile points should be viewed in engineering parameters section for detailed values considering the following application.

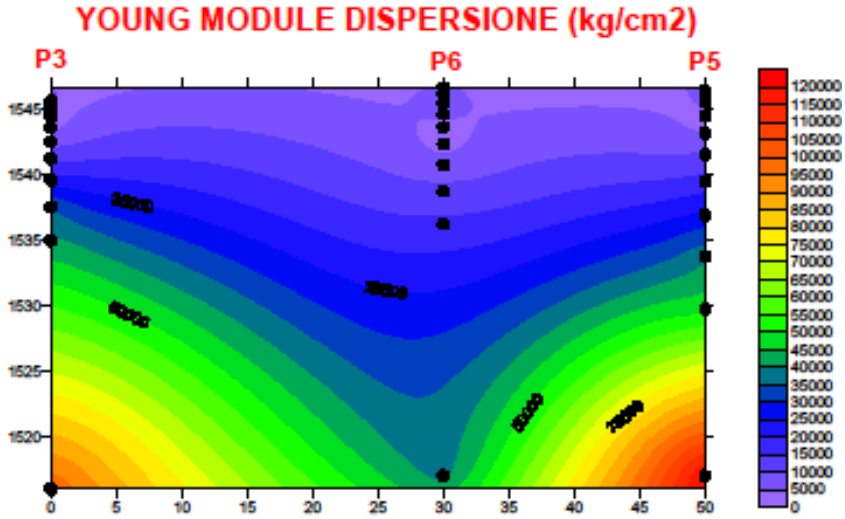

Vs30 (m/sn) DISPERSION MAP
P1
P2
P3
P4
P5

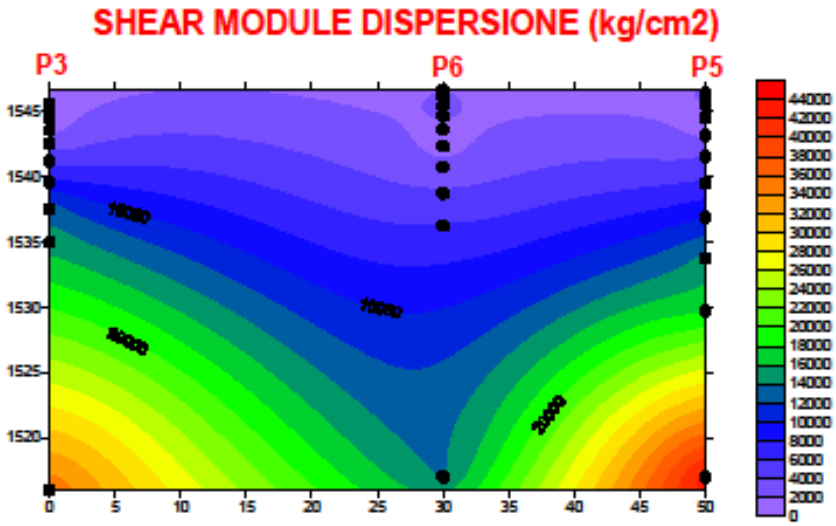

T0 (sn) DISPERSION MAP
P1
P2
P3
P4
P5


Ak DISPERSION MAP
P1
P2
P3
P4
P5

WTG04


BEARING CAPACITY (kg/cm2)
P3
P6
P5
1545
1540
1535
1530
1525
1520
0
5
10
15
20
25
30
35
40
45
50
10.5
10
9.5
9
8.5
8
7.5
7
6.5
6
5.5
5
4.5
4
3.5
3
2.5
2
1.5
1


YOUNG MODULE DISPERSIONE (kg/cm2)
P3
P6
P5
1545
1540
1535
1530
1525
1520
0
5
10
15
20
25
30
35
40
45
50
120000
115000
110000
105000
100000
95000
90000
85000
80000
75000
70000
65000
60000
55000
50000
45000
40000
35000
30000
25000
20000
15000
10000
5000
0


SHEAR MODULE DISPERSIONE (kg/cm2)
P3
P6
P5
1545
1540
1535
1530
1525
1520
0
5
10
15
20
25
30
35
40
45
50
44000
42000
40000
38000
36000
34000
32000
30000
28000
26000
24000
22000
20000
18000
16000
14000
12000
10000
8000
6000
4000
2000
0

5.4.1. WTG04 Seismic P wave velocity (*Compressional Wave Velocity* (Vp))

Vp VELOCITY				
PROFILES	LAYERS	DEPTH	Vp_ Velocity	STRIPPABILITY
1_PROFILE	1. LAYER	-5,52	702	Simple Strippability
	2.LAYER	-12,66	1083	Simple Strippability
	3.LAYER		2026	High Difficult Strippability
2_PROFILE	1. LAYER	-6,03	616	Simple Strippability
	2. LAYER	-18,95	1291	Medium Strippability
	3. LAYER		2666	Explosive
3_PROFILE	1. LAYER	-3,52	815	Simple Strippability
	2. LAYER	-11,06	1444	Medium Strippability
	3. LAYER		2998	Explosive
4_PROFILE	1. LAYER	-11,20	789	Simple Strippability
	2. LAYER	-35,21	1247	Medium Strippability
	3. LAYER		2391	Explosive
5_PROFILE	1. LAYER	-3,87	936	Simple Strippability
	2. LAYER	-17,30	1445	Medium Strippability
	3. LAYER		3258	Explosive
6_PROFILE	1. LAYER	-4,71	822	Simple Strippability
	2. LAYER	-10,80	971	Simple Strippability
	3. LAYER		1841	High Difficult Strippability
7_PROFILE	1. LAYER	-3,73	2209	Explosive
	2.LAYER	-16,70	2600	Explosive
	3.LAYER		4960	Explosive

P Wave Velocity (m/sec)	Strippability
Vp<458	High Simple Strippability
458<Vp<1220	Simple Strippability
1220<Vp<11525	Medium Strippability
1525<Vp<11830	Difficult Strippability
1830<Vp<12135	High Difficult Strippability
Vp>2135	Explosive Strippability

Strippability of floors with P wave velocity (Church, 1981)

||AVERAGE||			
LAYERS	DEPTH	Vp_ Velocity	STRIPPABILITY
1. LAYER	-5,51	984	Simple Strippability
2.LAYER	-17,53	1440	Medium Strippability
3.LAYER	∞	2877	Explosive

P wave velocities of the grounds in the study area and strippability

The above table shows the change table and strippability properties of Vp velocity depth values in the direction of the seismic data obtained from the field studies.

5.4.2. WTG04 Seismic S wave velocity (*Transverse Wave Velocity* (Vs))

Vs VELOCITY				
PROFILES	LAYERS	DEPTH	Vs_ Velocity	GROUND GROUPS
1_PROFILE	1. LAYER	-5,52	228	C
	2.LAYER	-12,66	537	B
	3.LAYER		904	A
2_PROFILE	1. LAYER	-6,03	288	C
	2. LAYER	-18,95	708	A
	3. LAYER		1180	A
3_PROFILE	1. LAYER	-3,52	321	C
	2. LAYER	-11,06	719	A
	3. LAYER		1242	A
4_PROFILE	1. LAYER	-11,20	332	C
	2. LAYER	-35,21	586	B
	3. LAYER		985	A
5_PROFILE	1. LAYER	-3,87	320	C
	2. LAYER	-17,30	714	A
	3. LAYER		1352	A
6_PROFILE	1. LAYER	-4,71	261	C
	2. LAYER	-10,80	500	B
	3. LAYER		824	A
7_PROFILE	1. LAYER	-3,73	999	A
	2.LAYER	-16,70	1100	A
	3.LAYER		1741	A

S Wave Velocity (m/sec)	Ground group
Vs<200	D
200<Vs<400	C
400<Vs<700	B
700<Vs	A

Ground groups according to slip wave velocity(Abyyhy, 1998)

||AVERAGE||			
LAYERS	DEPTH	Vs_ Velocity	GROUND GROUPS
1. LAYER	-5,51	393	C
2.LAYER	-17,53	695	B
3.LAYER	∞	1176	A

S wave velocities of the grounds in the study area and ground group

Ground Group	Ground group and top ground layer thickness(h_1)
Z1	(A) Ground group h1< 15 m (B) Ground group
Z2	h_1> 15 m (B) Ground group h_1< 15 m (C) Ground group
Z3	15 m < h_1< 50 m (C) Ground group h_1< 10 m (D) Ground group
Z4	h_1> 50 m (C) Ground group h_1> 10 m (D) Ground group

Ground Group Class

The above table shows that Vs velocity values in the direction of the seismic data obtained in the field studies are the absolute change tables and that the layers are included in the ground groups.

5.4.3. WTG04 Vs30

PROFILES	Vs30 (m/sec)
1.PROFILE	494
2.PROFILE	593
3.PROFILE	672
4.PROFILE	543
5.PROFILE	707
6.PROFILE	476
7.PROFILE	1189

Vs30 values in the direction of the seismic data obtained from the field studies are given in the table above.

5.4.4. WTG04 Shear Modulus-G (kg/cm²)

SHEAR MODULUS				
PROFILES	LAYERS	DEPTH	G(kg/cm^2)	ENDURANCE
1_PROFILE	1. LAYER	-5,52	1182	Weak
	2.LAYER	-12,66	5271	Sturdy
	3.LAYER		17002	Rock Highlid
2_PROFILE	1. LAYER	-6,03	1396	Weak
	2. LAYER	-18,95	9844	Sturdy
	3. LAYER		30992	Rock Highlid
3_PROFILE	1. LAYER	-3,52	1827	Medium
	2. LAYER	-11,06	10308	Rock Highlid
	3. LAYER		35402	Rock Highlid
4_PROFILE	1. LAYER	-11,20	1912	Medium
	2. LAYER	-35,21	6418	Sturdy
	3. LAYER		21034	Rock Highlid
5_PROFILE	1. LAYER	-3,87	1791	Medium
	2. LAYER	-17,30	10441	Rock Highlid
	3. LAYER		42838	Rock Highlid
6_PROFILE	1. LAYER	-4,71	1780	Medium
	2. LAYER	-10,80	4426	Sturdy
	3. LAYER		13794	Rock Highlid
7_PROFILE	1. LAYER	-3,73	21385	Rock Highlid
	2.LAYER	-16,70	29176	Rock Highlid
	3.LAYER		78870	Rock Highlid

Shear Modulus (kg/cm^2)	Dayanım
G<400	High Weak
400<G<1500	Weak
1500<G<3000	Medium
3000<G<10000	Sturdy
10000<G	Rock Highlid

The endurance of ground or rocks according to Slip Module values(Keçeli, 1990)

$G = (d*Vs^2)/100$

||AVERAGE||			
LAYERS	DEPTH	G (kg/cm^2)	ENDURANCE
1. LAYER	-5,51	4468	Sturdy
2.LAYER	-17,53	10841	Rock Highlid
3.LAYER	∞	34276	Rock Highlid

Shear modules and endurance of the grounds in the study area

Calculation of shear Modulus values in the direction of the seismic data obtained in the field studies and the table of variation are given in the table above.

5.4.5. WTG04 Elasticity Modulus-E (kg/cm²)

ELASTIC MODULUS				
PROFILES	LAYERS	DEPTH	E(kg/cm^2)	ENDURANCE
1_PROFILE	1. LAYER	-5,52	3333	Weak
	2.LAYER	-12,66	14071	Sturdy
	3.LAYER		46777	Rock Highlid
2_PROFILE	1. LAYER	-6,03	3696	Weak
	2. LAYER	-18,95	25286	Sturdy
	3. LAYER		85432	Rock Highlid
3_PROFILE	1. LAYER	-3,52	5021	Medium
	2. LAYER	-11,06	27535	Sturdy
	3. LAYER		98867	Rock Highlid
4_PROFILE	1. LAYER	-11,20	5274	Medium
	2. LAYER	-35,21	17439	Sturdy
	3. LAYER		58801	Rock Highlid
5_PROFILE	1. LAYER	-3,87	5111	Medium
	2. LAYER	-17,30	27982	Sturdy
	3. LAYER		119595	Rock Highlid
6_PROFILE	1. LAYER	-4,71	4946	Weak
	2. LAYER	-10,80	11685	Sturdy
	3. LAYER		37925	Rock Highlid
7_PROFILE	1. LAYER	-3,73	58296	Rock Highlid
	2.LAYER	-16,70	79477	Rock Highlid
	3.LAYER		225524	Rock Highlid

Elastic Modulus (kg/cm^2)	Dayanım
E<1000	High Weak
1000<E<5000	Weak
5000<E<10000	Medium
10000<E<30000	Sturdy
30000<E	Rock Highlid

The endurance of ground or rocks according to Slip Module values(Keçeli, 1990)

$E=G*(3*V_p^2-4*V_s^2)/(V_p^2-V_s^2)$

||AVERAGE||			
LAYERS	DEPTH	E (kg/cm^2)	ENDURANCE
1. LAYER	-5,51	12240	Sturdy
2.LAYER	-17,53	29068	Sturdy
3.LAYER	∞	96132	Rock Highlid

Elasticity modules and endurance of the grounds in the study area

Calculation of the modulus of elasticity in the direction of the seismic data obtained in the field studies and the change table are given in the above table

5.4.6. WTG04 Poisson's Ratio - (б)

POISSON'S RATIO				
PROFILES	LAYERS	DEPTH	(σ)	POROSITY
1_PROFILE	1. LAYER	-5,52	0,41	High Porous
	2.LAYER	-12,66	0,34	Medium Porous
	3.LAYER		0,38	High Porous
2_PROFILE	1. LAYER	-6,03	0,35	High Porous
	2. LAYER	-18,95	0,29	Medium Porous
	3. LAYER		0,38	High Porous
3_PROFILE	1. LAYER	-3,52	0,40	High Porous
	2. LAYER	-11,06	0,33	Medium Porous
	3. LAYER		0,40	High Porous
4_PROFILE	1. LAYER	-11,20	0,39	High Porous
	2. LAYER	-35,21	0,35	High Porous
	3. LAYER		0,40	High Porous
5_PROFILE	1. LAYER	-3,87	0,43	High Porous
	2. LAYER	-17,30	0,33	Medium Porous
	3. LAYER		0,40	High Porous
6_PROFILE	1. LAYER	-4,71	0,40	High Porous
	2. LAYER	-10,80	0,32	Medium Porous
	3. LAYER		0,37	High Porous
7_PROFILE	1. LAYER	-3,73	0,37	High Porous
	2.LAYER	-16,70	0,38	High Porous
	3.LAYER		0,43	High Porous

Poisson's Ratio;(σ)	Porosity
0,00≤σ≤0,25	Nonporous
0,26≤σ≤0,35	Medium Porous
0,36≤σ≤0,50	High Porous

Poisson ratio classification

$\sigma=(Vp^2-2*Vs^2)/(2*Vp^2-2*Vs^2)$

||AVERAGE||			
LAYERS	DEPTH	(σ)	POROSITY
1. LAYER	-5,51	0,39	High Porous
2.LAYER	-17,53	0,34	Medium Porous
3.LAYER	∞	0,39	High Porous

Poisson's ratio values of the units in the study area, porosity

Calculation of poisson's ratio values in the direction of the seismic data obtained in the field studies and the change table are given in the above table.

5.4.7. WTG04 Density - ρ (gr/ cm^3)

DENSITY				
PROFILES	LAYERS	DEPTH	ρ (gr/cm^3)	DEFINITION
1_PROFILE	1. LAYER	-5,52	1,60	Medium
	2.LAYER	-12,66	1,78	Medium
	3.LAYER		2,08	High
2_PROFILE	1. LAYER	-6,03	1,54	Medium
	2. LAYER	-18,95	1,85	Medium
	3. LAYER		2,23	High
3_PROFILE	1. LAYER	-3,52	1,66	Medium
	2. LAYER	-11,06	1,90	High
	3. LAYER		2,29	High
4_PROFILE	1. LAYER	-11,20	1,64	Medium
	2. LAYER	-35,21	1,84	Medium
	3. LAYER		2,17	High
5_PROFILE	1. LAYER	-3,87	1,71	Medium
	2. LAYER	-17,30	1,90	Medium
	3. LAYER		2,34	High
6_PROFILE	1. LAYER	-4,71	1,66	Medium
	2. LAYER	-10,80	1,73	Medium
	3. LAYER		2,03	High
7_PROFILE	1. LAYER	-3,73	2,13	High
	2.LAYER	-16,70	2,21	High
	3.LAYER		2,60	High

Density: ρ (gr/cm^3)	Tanımlama
ρ<1,20	High low
1,20<ρ<1,40	Low
1,40<ρ<1,90	Medium
1,90<ρ<2,20	High
2,20<ρ	Too High

Density Classification of Ground Units: (Keçeli, 1990)

$$\rho = d = 0.31 * Vp0.25$$

||AVERAGE||			
LAYERS	DEPTH	ρ (gr/cm^3)	DEFINITION
1. LAYER	-5,51	1,70	Medium
2.LAYER	-17,53	1,89	Medium
3.LAYER	∞	2,25	High

Density values and description of the units in the study area

Calculation of the density values of the geological units in the direction of the seismic data obtained in the field studies and the table of variation are given in the above table.

5.4.8. WTG04 Modulus of Subgrade Reaction – D Y K (ton/m^3)

Modulus of Subgrade Reaction			
PROFILES	LAYERS	DEPTH	D Y K (ton/m^3)
1_PROFILE	1. LAYER	-5,52	1913
	2.LAYER	-12,66	3998
	3.LAYER		7414
2_PROFILE	1. LAYER	-6,03	2032
	2. LAYER	-18,95	5409
	3. LAYER		10290
3_PROFILE	1. LAYER	-3,52	2314
	2. LAYER	-11,06	5582
	3. LAYER		11175
4_PROFILE	1. LAYER	-11,20	2392
	2. LAYER	-35,21	4439
	3. LAYER		8372
5_PROFILE	1. LAYER	-3,87	2341
	2. LAYER	-17,30	5561
	3. LAYER		12453
6_PROFILE	1. LAYER	-4,71	2317
	2. LAYER	-10,80	3674
	3. LAYER		6634
7_PROFILE	1. LAYER	-3,73	8341
	2.LAYER	-16,70	9604
	3.LAYER		18457

||AVERAGE||		
LAYERS	DEPTH	D Y K (ton/m^3)
1. LAYER	-5,51	3093
2.LAYER	-17,53	5467
3.LAYER	∞	10685
kv= 40*(Gs)*qu ton/m^3 *(Bowles 1984)*		

The above table shows the Modulus of Subgrade Reaction obtained for each layer in the direction of the data obtained after the seismic measurements made in the study area.

5.4.9. WTG04 Bearing Capacity qu (kg/cm2) / Allowable Bearing Capacity qa (kg/cm2)

PROFILES	LAYERS	DEPTH	BEARING CAPACITY (qu,kg/cm^2)	ALLOWABLE BEARING CAPACITY (qa,kg/cm^2)
1_PROFILE	1. LAYER	-5,52	4,78	1,59
	2.LAYER	-12,66	10,00	3,33
	3.LAYER	-37,34	18,54	6,18
2_PROFILE	1. LAYER	-6,03	5,08	1,69
	2. LAYER	-18,95	13,52	4,51
	3. LAYER	-31,05	25,73	8,58
3_PROFILE	1. LAYER	-3,52	5,79	1,93
	2. LAYER	-11,06	13,95	4,65
	3. LAYER	-38,94	27,94	9,31
4_PROFILE	1. LAYER	-11,20	5,98	1,99
	2. LAYER	-35,21	11,10	3,70
	3. LAYER	-14,79	20,93	6,98
5_PROFILE	1. LAYER	-3,87	5,85	1,95
	2. LAYER	-17,30	13,90	4,63
	3. LAYER	-32,70	31,13	10,38
6_PROFILE	1. LAYER	-4,71	5,79	1,93
	2. LAYER	-10,80	9,19	3,06
	3. LAYER	-39,20	16,59	5,53
7_PROFILE	1. LAYER	-3,73	20,85	6,95
	2.LAYER	-16,70	24,01	8,00
	3.LAYER	-33,30	46,14	15,38

||AVERAGE||

LAYERS	DEPTH	Bearing Capacity (qu,kg/cm^2)
1. LAYER	-5,51	7,73
2.LAYER	-17,53	13,67
3.LAYER	∞	26,71

qu=(0,024*Vs*(J.B.K+0,002*Vp)*0,71)/G.K

BEARING CAPACITY CALCULATION	Geological unit factor 18	16	17	18	20
(Prof. Dr. SEMIH TEZCAN-2006)	Safety factor 50-100	CLAY	SAND	SEDIMENT	VOLATISILE

||AVERAGE||

LAYERS	DEPTH	Allowable Bearing Capacity (qa,kg/cm^2)
1. LAYER	-5,51	2,58
2.LAYER	-17,53	4,56
3.LAYER	∞	8,90

qa=qu/G.K G.K=3 empirical value

5.4.10. WTG04 Vibration Period - T_0 (sec) / Ground Amplification (Ak)

PROFILES	To (sec)	Ta (sec)	Tb (sec)	Ak (Amplification)
1.PROFILE	0,30	0,20	0,45	1,65
2.PROFILE	0,27	0,18	0,40	1,47
3.PROFILE	0,21	0,14	0,32	1,37
4.PROFILE	0,36	0,24	0,55	1,56
5.PROFILE	0,22	0,15	0,33	1,33
6.PROFILE	0,30	0,20	0,46	1,68
7.PROFILE	0,14	0,09	0,21	0,97

AVERAGE			
To (sec)	Ta (sec)	Tb (sec)	Ak (Amplification)
0,26	0,17	0,39	1,43

$To = \sum 4H\ Vs\ n\ \iota$=1 (sec)……. (Zeevaert,1967)

Ak=68*$Vs_{30}^{-0,6}$……. (Midorikawa, 1987)

The Vibration Period and Ground Amplification calculated in the direction of the parameters obtained during the seismic studies made during the field survey are presented in the table above.

5. 5. WTG05

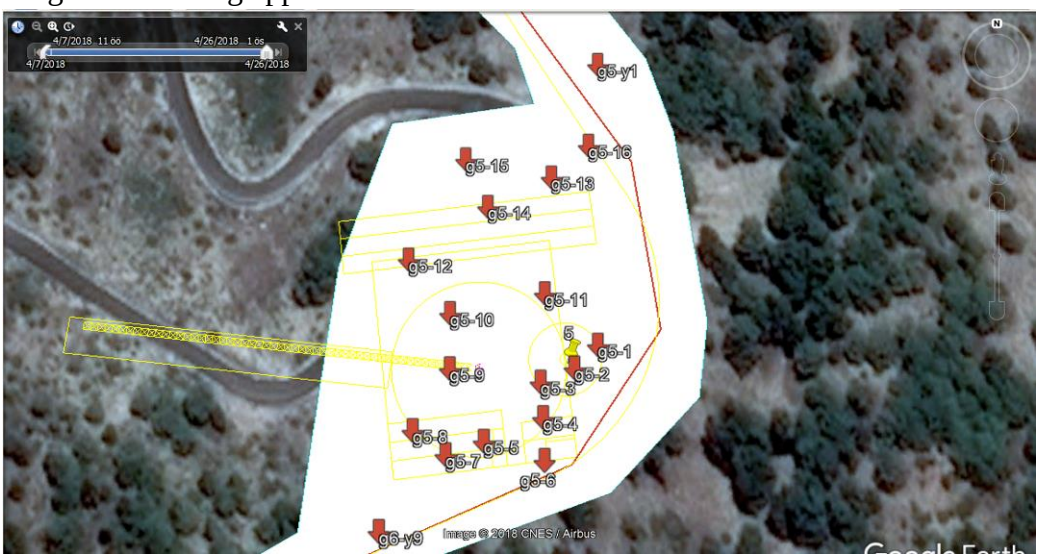
There are 16 measurements were taken on the WTG. These measurements showed 3 layers. Layer 1 was found at an average depth of 0,00 m to 4,25 m, Layer 2 at an average depth of 4,25 m to 15,97 m and Layer 3 at an average depth of 15,97 m. The parameters of these layers are given in the table below.

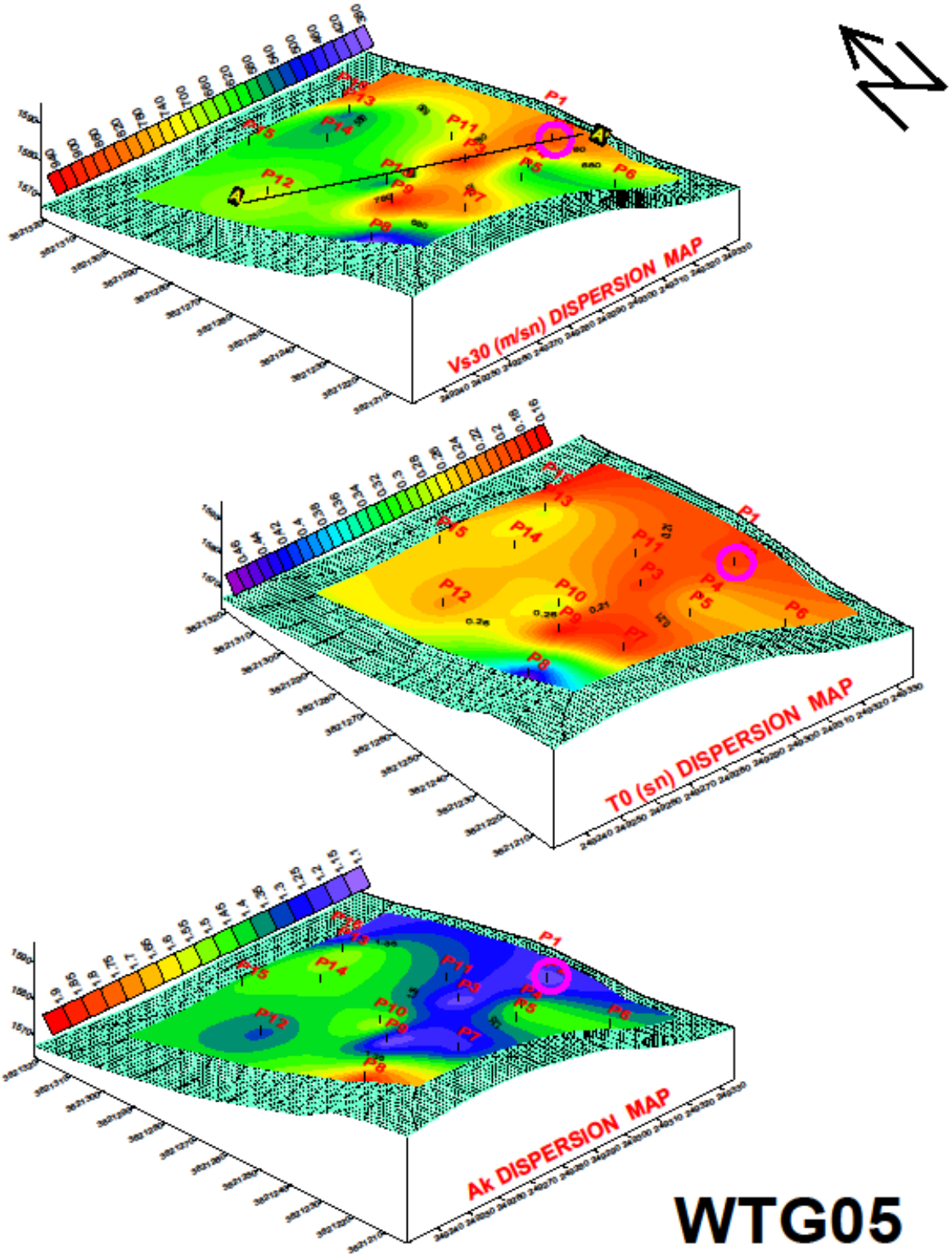
LAYERS	Vp_ Velocity	STRIPPABILITY
1. LAYER	1064	Simple strippability
2.LAYER	1422	Medium-hard strippability
3.LAYER	2855	Explosive
LAYERS	**Vs_ Velocity**	**GROUND GROUP**
1. LAYER	395	C
2.LAYER	669	B
3.LAYER	1234	A
LAYERS	**G (kg/cm2)**	**ENDURANCE**
1. LAYER	3082	Sturdy
2.LAYER	9550	Sturdy
3.LAYER	37562	High sturdy
LAYERS	**E (kg/cm2)**	**ENDURANCE**
1. LAYER	8629	Medium
2.LAYER	25736	Sturdy
3.LAYER	103507	High sturdy

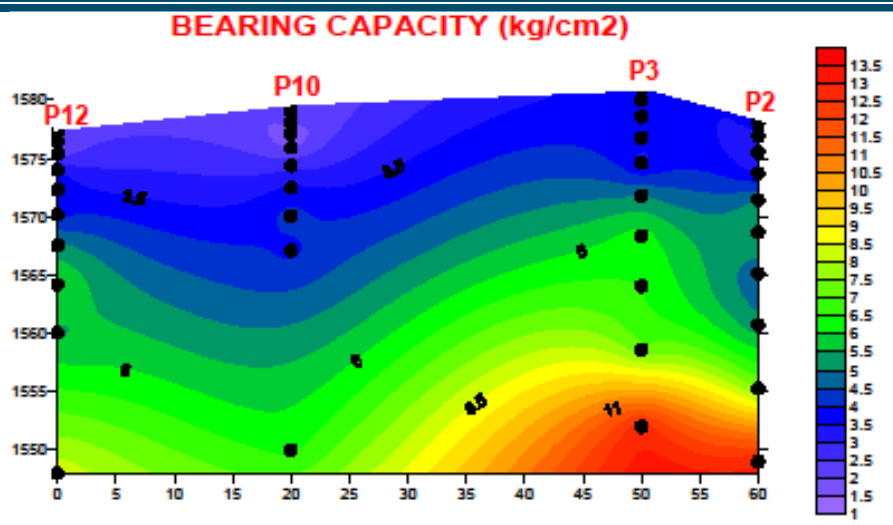
LAYERS	(σ)	POROSITY
1. LAYER	0,41	High Porosity
2.LAYER	0,35	High Porosity
3.LAYER	0,39	High Porosity
LAYERS	**ρ (gr/cm3)**	**DEFINITION**
1. LAYER	1,76	Medium
2.LAYER	1,89	Medium
3.LAYER	2,26	High
LAYERS	**D Y K (ton/m^3)**	
1. LAYER	2974	
2.LAYER	5217	
3.LAYER	11109	
LAYERS	**Ground Carrying Capacity (qu,kg/cm2)**	**Secure Carrying Capacity (qa,kg/cm2)**
1. LAYER	7,43	2,48
2.LAYER	13,04	4,35
3.LAYER	27,77	9,26

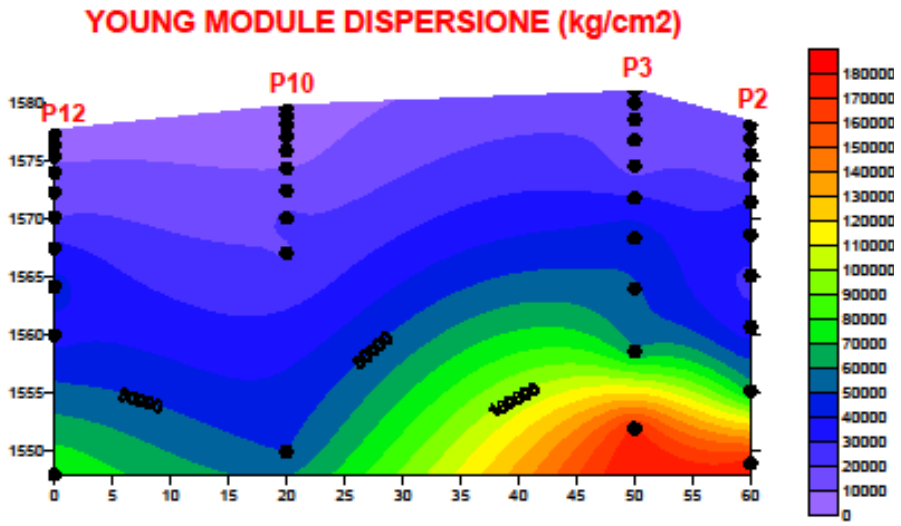
To (sec)	Ta (sec)	Tb (sec)	Vs30 (m/sec)	Ak (Amplification)
0,24	0,16	0,36	692	1,38

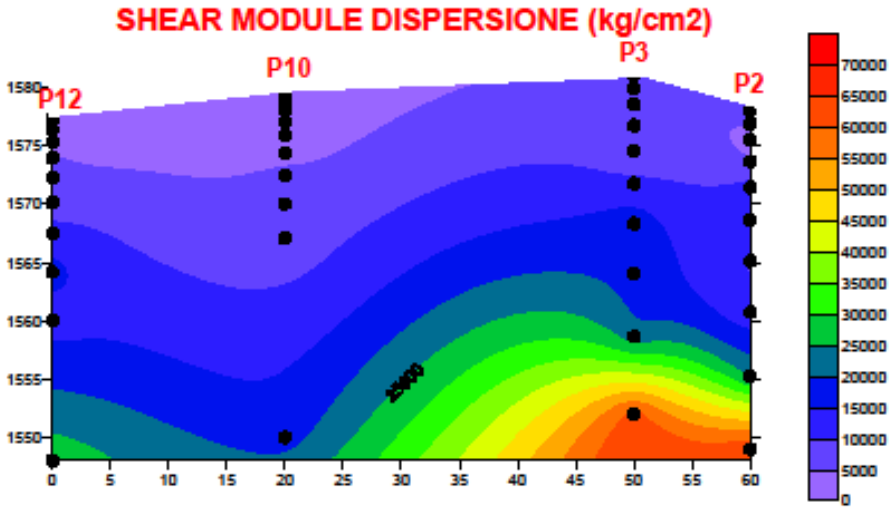
It is recommended to excavate the first 8,50 meters from the ground level on the 8th profiler. Profile points should be viewed in engineering parameters section for detailed values considering the following application.




Vs30 (m/sn) DISPERSION MAP
T0 (sn) DISPERSION MAP
Ak DISPERSION MAP
WTG05


BEARING CAPACITY (kg/cm2)
P12
P10
P3
P2
1580
1575
1570
1565
1560
1555
1550
0 5 10 15 20 25 30 35 40 45 50 55 60
13.5 13 12.5 12 11.5 11 10.5 10 9.5 9 8.5 8 7.5 7 6.5 6 5.5 5 4.5 4 3.5 3 2.5 2 1.5 1


YOUNG MODULE DISPERSIONE (kg/cm2)
P12
P10
P3
P2
1580
1575
1570
1565
1560
1555
1550
0 5 10 15 20 25 30 35 40 45 50 55 60
180000 170000 160000 150000 140000 130000 120000 110000 100000 90000 80000 70000 60000 50000 40000 30000 20000 10000 0


SHEAR MODULE DISPERSIONE (kg/cm2)
P12
P10
P3
P2
1580
1575
1570
1565
1560
1555
1550
0 5 10 15 20 25 30 35 40 45 50 55 60
70000 65000 60000 55000 50000 45000 40000 35000 30000 25000 20000 15000 10000 5000 0

5.5.1. WTG05 Seismic P wave velocity (*Compressional Wave Velocity* (Vp))

PROFILES	LAYERS	DEPTH	Vp_ Velocity	STRIPPABILITY
1_PROFILE	1. LAYER	-3,86	1204	Simple Strippability
	2.LAYER	-17,29	1623	High Difficult Strippability
	3.LAYER		3391	Explosive
2_PROFILE	1. LAYER	-5,31	1540	High Difficult Strippability
	2. LAYER	-23,75	1861	High Difficult Strippability
	3. LAYER		3547	Explosive
3_PROFILE	1. LAYER	-7,43	1478	Medium Strippability
	2. LAYER	-23,37	1997	High Difficult Strippability
	3. LAYER		3792	Explosive
4_PROFILE	1. LAYER	-3,88	927	Simple Strippability
	2. LAYER	-12,20	1150	Simple Strippability
	3. LAYER		2399	Explosive
5_PROFILE	1. LAYER	-3,65	1052	Simple Strippability
	2. LAYER	-11,47	1245	Medium Strippability
	3. LAYER		2545	Explosive
6_PROFILE	1. LAYER	-4,81	1027	Simple Strippability
	2. LAYER	-11,03	1263	Medium Strippability
	3. LAYER		2455	Explosive
7_PROFILE	1. LAYER	-4,46	1364	Medium Strippability
	2.LAYER	-14,01	1608	High Difficult Strippability
	3.LAYER		3296	Explosive
8_PROFILE	1. LAYER	-8,86	610	Simple Strippability
	2. LAYER	-27,85	856	Simple Strippability
	3. LAYER		1629	High Difficult Strippability
9_PROFILE	1. LAYER	-3,66	1121	Simple Strippability
	2. LAYER	-16,38	1896	High Difficult Strippability
	3. LAYER		3841	Explosive
10_PROFILE	1. LAYER	-4,11	816	Simple Strippability
	2. LAYER	-12,92	1185	Simple Strippability
	3. LAYER		2298	Explosive
11_PROFILE	1. LAYER	-3,07	961	Simple Strippability
	2. LAYER	-13,75	1455	Medium Strippability
	3. LAYER		2989	Explosive
12_PROFILE	1. LAYER	-2,65	1061	Simple Strippability
	2. LAYER	-17,96	1548	High Difficult Strippability
	3. LAYER		3057	Explosive
13_PROFILE	1. LAYER	-4,29	825	Simple Strippability
	2. LAYER	-13,51	1112	Simple Strippability
	3. LAYER		2343	Explosive
14_PROFILE	1. LAYER	-2,80	1034	Simple Strippability
	2. LAYER	-12,53	1144	Simple Strippability
	3. LAYER		2276	Explosive
15_PROFILE	1. LAYER	-3,38	1049	Simple Strippability
	2. LAYER	-15,13	1209	Simple Strippability
	3. LAYER		2410	Explosive
16_PROFILE	1. LAYER	-1,83	951	Simple Strippability
	2. LAYER	-12,38	1607	High Difficult Strippability
	3. LAYER		3418	Explosive

P Wave Velocity (m/sec)	Strippability
Vp<458	High Simple Strippability
458<Vp<1220	Simple Strippability
1220<Vp<11525	Medium Strippability
1525<Vp<11830	Difficult Strippability
1830<Vp<12135	High Difficult Strippability
Vp>2135	Explosive Strippability

Strippability of floors with P wave velocity (Church, 1981)

||AVERAGE||			
LAYERS	DEPTH	Vp_ Velocity	STRIPPABILITY
1. LAYER	-4,25	1064	Simple Strippability
2.LAYER	-15,97	1422	Medium Strippability
3.LAYER	∞	2855	Explosive

P wave velocities of the grounds in the study area and strippability

The above table shows the change table and strippability properties of Vp velocity depth values in the direction of the seismic data obtained from the field studies.

5.5.2. WTG05 Seismic S wave velocity (*Transverse Wave Velocity* (Vs))

Vs VELOCITY				
PROFILES	LAYERS	DEPTH	Vs_ Velocity	GROUND GROUPS
1_PROFILE	1. LAYER	-3,86	469	B
	2.LAYER	-17,29	761	A
	3.LAYER		1389	A
2_PROFILE	1. LAYER	-5,31	508	B
	2. LAYER	-23,75	819	A
	3. LAYER		1635	A
3_PROFILE	1. LAYER	-7,43	567	B
	2. LAYER	-23,37	905	A
	3. LAYER		1591	A
4_PROFILE	1. LAYER	-3,88	354	C
	2. LAYER	-12,20	578	B
	3. LAYER		1046	A
5_PROFILE	1. LAYER	-3,65	373	C
	2. LAYER	-11,47	602	B
	3. LAYER		1115	A
6_PROFILE	1. LAYER	-4,81	301	C
	2. LAYER	-11,03	629	B
	3. LAYER		1052	A
7_PROFILE	1. LAYER	-4,46	499	B
	2.LAYER	-14,01	783	A
	3.LAYER		1418	A
8_PROFILE	1. LAYER	-8,86	258	C
	2. LAYER	-27,85	405	B
	3. LAYER		704	A
9_PROFILE	1. LAYER	-3,66	406	B
	2. LAYER	-16,38	907	A
	3. LAYER		1922	A
10_PROFILE	1. LAYER	-4,11	332	C
	2. LAYER	-12,92	575	B
	3. LAYER		905	A
11_PROFILE	1. LAYER	-3,07	349	C
	2. LAYER	-13,75	681	B
	3. LAYER		1285	A
12_PROFILE	1. LAYER	-2,65	335	C

	2. LAYER	-17,96	705	A
	3. LAYER		1102	A
13_PROFILE	1. LAYER	-4,29	310	C
	2. LAYER	-13,51	558	B
	3. LAYER		984	A
14_PROFILE	1. LAYER	-2,80	493	B
	2. LAYER	-12,53	501	B
	3. LAYER		999	A
15_PROFILE	1. LAYER	-3,38	473	B
	2. LAYER	-15,13	526	B
	3. LAYER		1004	A
16_PROFILE	1. LAYER	-1,83	292	C
	2. LAYER	-12,38	772	A
	3. LAYER		1589	A

S Wave Velocity (m/sec)	Ground group
Vs<200	D
200<Vs<400	C
400<Vs<700	B
700<Vs	A

Ground groups according to slip wave velocity(Abyyhy, 1998)

||AVERAGE||			
LAYERS	**DEPTH**	**Vs_ Velocity**	**GROUND GROUPS**
1. LAYER	-4,25	395	C
2.LAYER	-15,97	669	B
3.LAYER	∞	1234	A

S wave velocities of the grounds in the study area and ground group

Ground Group	Ground group and top ground layer thickness(h_1)
Z1	(A) Ground group h1< 15 m (B) Ground group
Z2	h_1> 15 m (B) Ground group h_1< 15 m (C) Ground group
Z3	15 m < h_1< 50 m (C) Ground group h_1< 10 m (D) Ground group
Z4	h_1> 50 m (C) Ground group h_1> 10 m (D) Ground group

Ground Group Class

The above table shows that Vs velocity values in the direction of the seismic data obtained in the field studies are the absolute change tables and that the layers are included in the ground groups.

5.5.3. WTG05 Vs30

PROFILES	Vs30 (m/sec)
1.PROFILE	801
2.PROFILE	866
3.PROFILE	916
4.PROFILE	587
5.PROFILE	627
6.PROFILE	601
7.PROFILE	806
8.PROFILE	391
9.PROFILE	931
10.PROFILE	539
11.PROFILE	715
12.PROFILE	711
13.PROFILE	549
14.PROFILE	589
15.PROFILE	605
16.PROFILE	841

Vs30 values in the direction of the seismic data obtained from the field studies are given in the table above.

5.5.4. WTG05 Shear Modulus-G (kg/cm²)

SHEAR MODULUS				
PROFILES	LAYERS	DEPTH	G(kg/cm^2)	ENDURANCE
1_PROFILE	1. LAYER	-3,86	4105	Sturdy
	2.LAYER	-17,29	12282	Rock Highlid
	3.LAYER		45608	Rock Highlid
2_PROFILE	1. LAYER	-5,31	5062	Sturdy
	2. LAYER	-23,75	14093	Rock Highlid
	3. LAYER		63921	Rock Highlid
3_PROFILE	1. LAYER	-7,43	6185	Sturdy
	2. LAYER	-23,37	17205	Rock Highlid
	3. LAYER		61605	Rock Highlid
4_PROFILE	1. LAYER	-3,88	2225	Medium
	2. LAYER	-12,20	6392	Sturdy
	3. LAYER		23727	Rock Highlid
5_PROFILE	1. LAYER	-3,65	2528	Medium
	2. LAYER	-11,47	7058	Sturdy
	3. LAYER		27385	Rock Highlid
6_PROFILE	1. LAYER	-4,81	2426	Medium
	2. LAYER	-11,03	7508	Sturdy
	3. LAYER		24150	Rock Highlid
7_PROFILE	1. LAYER	-4,46	4787	Sturdy
	2.LAYER	-14,01	12775	Rock Highlid
	3.LAYER		47233	Rock Highlid
8_PROFILE	1. LAYER	-8,86	1095	Weak
	2. LAYER	-27,85	2815	Medium
	3. LAYER		9765	Sturdy
9_PROFILE	1. LAYER	-3,66	3356	Sturdy
	2. LAYER	-16,38	17871	Rock Highlid
	3. LAYER		90153	Rock Highlid
10_PROFILE	1. LAYER	-4,11	1908	Medium
	2. LAYER	-12,92	6123	Sturdy
	3. LAYER		17592	Rock Highlid
11_PROFILE	1. LAYER	-3,07	2134	Medium
	2. LAYER	-13,75	9203	Sturdy
	3. LAYER		37870	Rock Highlid

12_PROFILE	1. LAYER	-2,65	2042	Medium
	2. LAYER	-17,96	10088	Rock Highlid
	3. LAYER		28015	Rock Highlid
13_PROFILE	1. LAYER	-4,29	1658	Medium
	2. LAYER	-13,51	5835	Sturdy
	3. LAYER		20881	Rock Highlid
14_PROFILE	1. LAYER	-2,80	4304	Sturdy
	2. LAYER	-12,53	5257	Sturdy
	3. LAYER		21362	Rock Highlid
15_PROFILE	1. LAYER	-3,38	3976	Sturdy
	2. LAYER	-15,13	5709	Sturdy
	3. LAYER		21900	Rock Highlid
16_PROFILE	1. LAYER	-1,83	1521	Medium
	2. LAYER	-12,38	12588	Rock Highlid
	3. LAYER		59820	Rock Highlid

Shear Modulus (kg/cm^2)	Dayanım
G<400	High Weak
400<G<1500	Weak
1500<G<3000	Medium
3000<G<10000	Sturdy
10000<G	Rock Highlid

The endurance of ground or rocks according to Slip Module values(Keçeli, 1990)

$G = (d*Vs^2)/100$

‖AVERAGE‖			
LAYERS	DEPTH	G (kg/cm^2)	ENDURANCE
1. LAYER	-4,25	3082	Sturdy
2.LAYER	-15,97	9550	Sturdy
3.LAYER	∞	37562	Rock Highlid

Shear modules and endurance of the grounds in the study area

Calculation of shear Modulus values in the direction of the seismic data obtained in the field studies and the table of variation are given in the table above.

5.5.5. WTG05 Elasticity Modulus-E (kg/cm²)

ELASTIC MODULUS				
PROFILES	LAYERS	DEPTH	E(kg/cm^2)	ENDURANCE
1_PROFILE	1. LAYER	-3,86	11481	Sturdy
	2.LAYER	-17,29	33136	Rock Highlid
	3.LAYER		127637	Rock Highlid
2_PROFILE	1. LAYER	-5,31	14531	Sturdy
	2. LAYER	-23,75	38578	Rock Highlid
	3. LAYER		174528	Rock Highlid
3_PROFILE	1. LAYER	-7,43	17456	Sturdy
	2. LAYER	-23,37	47107	Rock Highlid
	3. LAYER		171646	Rock Highlid
4_PROFILE	1. LAYER	-3,88	6211	Medium
	2. LAYER	-12,20	16946	Sturdy
	3. LAYER		65615	Rock Highlid
5_PROFILE	1. LAYER	-3,65	7164	Medium
	2. LAYER	-11,47	18909	Sturdy
	3. LAYER		75648	Rock Highlid
6_PROFILE	1. LAYER	-4,81	6890	Medium
	2. LAYER	-11,03	20045	Sturdy

	3. LAYER		67017	Rock Highlid
7_PROFILE	1. LAYER	-4,46	13533	Sturdy
	2.LAYER	-14,01	34149	Rock Highlid
	3.LAYER		130969	Rock Highlid
8_PROFILE	1. LAYER	-8,86	2965	Weak
	2. LAYER	-27,85	7623	Medium
	3. LAYER		27051	Sturdy
9_PROFILE	1. LAYER	-3,66	9207	Medium
	2. LAYER	-16,38	47791	Rock Highlid
	3. LAYER		240345	Rock Highlid
10_PROFILE	1. LAYER	-4,11	5244	Medium
	2. LAYER	-12,92	16416	Sturdy
	3. LAYER		49543	Rock Highlid
11_PROFILE	1. LAYER	-3,07	6048	Medium
	2. LAYER	-13,75	25050	Sturdy
	3. LAYER		105019	Rock Highlid
12_PROFILE	1. LAYER	-2,65	5863	Medium
	2. LAYER	-17,96	27501	Sturdy
	3. LAYER		79858	Rock Highlid
13_PROFILE	1. LAYER	-4,29	4665	Weak
	2. LAYER	-13,51	15558	Sturdy
	3. LAYER		58173	Rock Highlid
14_PROFILE	1. LAYER	-2,80	11577	Sturdy
	2. LAYER	-12,53	13943	Sturdy
	3. LAYER		58990	Rock Highlid
15_PROFILE	1. LAYER	-3,38	10866	Sturdy
	2. LAYER	-15,13	15346	Sturdy
	3. LAYER		61099	Rock Highlid
16_PROFILE	1. LAYER	-1,83	4370	Weak
	2. LAYER	-12,38	33682	Rock Highlid
	3. LAYER		162976	Rock Highlid

Elastic Modulus (kg/cm^2)	Dayanım
E<1000	High Weak
1000<E<5000	Weak
5000<E<10000	Medium
10000<E<30000	Sturdy
30000<E	Rock Highlid

The endurance of ground or rocks according to Slip Module values(Keçeli, 1990)

$$E=G*(3*V_p^2-4*V_s^2)/(V_p^2-V_s^2)$$

‖AVERAGE‖			
LAYERS	**DEPTH**	**E (kg/cm^2)**	**ENDURANCE**
1. LAYER	-4,25	8629	Medium
2.LAYER	-15,97	25736	Sturdy
3.LAYER	∞	103507	Rock Highlid

Elasticity modules and endurance of the grounds in the study area

Calculation of the modulus of elasticity in the direction of the seismic data obtained in the field studies and the change table are given in the above table

5.5.6. WTG05 Poisson's Ratio - (б)

POISSON'S RATIO				
PROFILES	LAYERS	DEPTH	(σ)	POROSITY
1_PROFILE	1. LAYER	-3,86	0,41	High Porous
	2.LAYER	-17,29	0,36	High Porous
	3.LAYER		0,40	High Porous
2_PROFILE	1. LAYER	-5,31	0,44	High Porous
	2. LAYER	-23,75	0,37	High Porous
	3. LAYER		0,37	High Porous
3_PROFILE	1. LAYER	-7,43	0,41	High Porous
	2. LAYER	-23,37	0,37	High Porous
	3. LAYER		0,39	High Porous
4_PROFILE	1. LAYER	-3,88	0,41	High Porous
	2. LAYER	-12,20	0,33	Medium Porous
	3. LAYER		0,38	High Porous
5_PROFILE	1. LAYER	-3,65	0,42	High Porous
	2. LAYER	-11,47	0,35	Medium Porous
	3. LAYER		0,38	High Porous
6_PROFILE	1. LAYER	-4,81	0,42	High Porous
	2. LAYER	-11,03	0,34	Medium Porous
	3. LAYER		0,39	High Porous
7_PROFILE	1. LAYER	-4,46	0,42	High Porous
	2.LAYER	-14,01	0,35	Medium Porous
	3.LAYER		0,39	High Porous
8_PROFILE	1. LAYER	-8,86	0,38	High Porous
	2. LAYER	-27,85	0,35	High Porous
	3. LAYER		0,39	High Porous
9_PROFILE	1. LAYER	-3,66	0,41	High Porous
	2. LAYER	-16,38	0,35	Medium Porous
	3. LAYER		0,33	Medium Porous
10_PROFILE	1. LAYER	-4,11	0,39	High Porous
	2. LAYER	-12,92	0,34	Medium Porous
	3. LAYER		0,41	High Porous
11_PROFILE	1. LAYER	-3,07	0,42	High Porous
	2. LAYER	-13,75	0,36	High Porous
	3. LAYER		0,39	High Porous
12_PROFILE	1. LAYER	-2,65	0,44	High Porous
	2. LAYER	-17,96	0,37	High Porous
	3. LAYER		0,43	High Porous
13_PROFILE	1. LAYER	-4,29	0,42	High Porous
	2. LAYER	-13,51	0,33	Medium Porous
	3. LAYER		0,39	High Porous
14_PROFILE	1. LAYER	-2,80	0,35	High Porous
	2. LAYER	-12,53	0,37	High Porous
	3. LAYER		0,38	High Porous
15_PROFILE	1. LAYER	-3,38	0,37	High Porous
	2. LAYER	-15,13	0,38	High Porous
	3. LAYER		0,39	High Porous
16_PROFILE	1. LAYER	-1,83	0,45	High Porous
	2. LAYER	-12,38	0,35	Medium Porous
	3. LAYER		0,36	High Porous

Poisson's Ratio;(σ)	Porosity
0,00≤σ≤0,25	Nonporous
0,26≤σ≤0,35	Medium Porous
0,36≤σ≤0,50	High Porous

Poisson ratio classification

$\sigma=(Vp^2-2*Vs^2)/(2*Vp^2-2*Vs^2)$

‖AVERAGE‖			
LAYERS	DEPTH	(σ)	POROSITY
1. LAYER	-4,25	0,41	High Porous
2.LAYER	-15,97	0,35	High Porous
3.LAYER	∞	0,39	High Porous

Poisson's ratio values of the units in the study area, porosity

Calculation of poisson's ratio values in the direction of the seismic data obtained in the field studies and the change table are given in the above table.

5.5.7. WTG05 Density - ρ (gr/ cm^3)

DENSITY				
PROFILES	LAYERS	DEPTH	ρ (gr/cm^3)	DEFINITION
1_PROFILE	1. LAYER	-3,86	1,83	Medium
	2.LAYER	-17,29	1,96	High
	3.LAYER		2,37	High
2_PROFILE	1. LAYER	-5,31	1,94	High
	2. LAYER	-23,75	2,03	High
	3. LAYER		2,39	High
3_PROFILE	1. LAYER	-7,43	1,92	High
	2. LAYER	-23,37	2,07	High
	3. LAYER		2,43	High
4_PROFILE	1. LAYER	-3,88	1,71	Medium
	2. LAYER	-12,20	1,80	Medium
	3. LAYER		2,17	High
5_PROFILE	1. LAYER	-3,65	1,77	Medium
	2. LAYER	-11,47	1,84	Medium
	3. LAYER		2,20	High
6_PROFILE	1. LAYER	-4,81	1,75	Medium
	2. LAYER	-11,03	1,85	Medium
	3. LAYER		2,18	High
7_PROFILE	1. LAYER	-4,46	1,88	Medium
	2.LAYER	-14,01	1,96	High
	3.LAYER		2,35	High
8_PROFILE	1. LAYER	-8,86	1,54	Medium
	2. LAYER	-27,85	1,67	Medium
	3. LAYER		1,97	High
9_PROFILE	1. LAYER	-3,66	1,79	Medium
	2. LAYER	-16,38	2,04	High
	3. LAYER		2,44	High
10_PROFILE	1. LAYER	-4,11	1,66	Medium
	2. LAYER	-12,92	1,81	Medium
	3. LAYER		2,15	High
11_PROFILE	1. LAYER	-3,07	1,73	Medium
	2. LAYER	-13,75	1,91	High
	3. LAYER		2,29	High
12_PROFILE	1. LAYER	-2,65	1,77	Medium
	2. LAYER	-17,96	1,94	High
	3. LAYER		2,31	High
13_PROFILE	1. LAYER	-4,29	1,66	Medium
	2. LAYER	-13,51	1,78	Medium
	3. LAYER		2,16	High
14_PROFILE	1. LAYER	-2,80	1,76	Medium
	2. LAYER	-12,53	1,80	Medium
	3. LAYER		2,14	High
15_PROFILE	1. LAYER	-3,38	1,76	Medium
	2. LAYER	-15,13	1,82	Medium
	3. LAYER		2,17	High
16_PROFILE	1. LAYER	-1,83	1,72	Medium
	2. LAYER	-12,38	1,95	High
	3. LAYER		2,37	High

Density: ρ (gr/cm^3)	Tanımlama
ρ<1,20	High low
1,20<ρ<1,40	Low
1,40<ρ<1,90	Medium
1,90<ρ<2,20	High
2,20<ρ	Too High

Density Classification of Ground Units: (Keçeli, 1990)

*ρ =d=0.31*Vp0.25*

‖AVERAGE‖			
LAYERS	DEPTH	ρ (gr/cm^3)	DEFINITION
1. LAYER	-4,25	1,76	Medium
2.LAYER	-15,97	1,89	Medium
3.LAYER	∞	2,26	High

Density values and description of the units in the study area

Calculation of the density values of the geological units in the direction of the seismic data obtained in the field studies and the table of variation are given in the above table.

5.5.8. WTG05 Modulus of Subgrade Reaction – D Y K (ton/m^3)

Modulus of Subgrade Reaction			
PROFILES	LAYERS	DEPTH	D Y K (ton/m^3)
1_PROFILE	1. LAYER	-3,86	3528
	2.LAYER	-17,29	6040
	3.LAYER		12937
2_PROFILE	1. LAYER	-5,31	3962
	2. LAYER	-23,75	6625
	3. LAYER		15438
3_PROFILE	1. LAYER	-7,43	4391
	2. LAYER	-23,37	7417
	3. LAYER		15349
4_PROFILE	1. LAYER	-3,88	2582
	2. LAYER	-12,20	4348
	3. LAYER		8895
5_PROFILE	1. LAYER	-3,65	2763
	2. LAYER	-11,47	4570
	3. LAYER		9619
6_PROFILE	1. LAYER	-4,81	2728
	2. LAYER	-11,03	4780
	3. LAYER		8996
7_PROFILE	1. LAYER	-4,46	3820
	2.LAYER	-14,01	6187
	3.LAYER		13102
8_PROFILE	1. LAYER	-8,86	1815
	2. LAYER	-27,85	2935
	3. LAYER		5546
9_PROFILE	1. LAYER	-3,66	3036
	2. LAYER	-16,38	7383
	3. LAYER		18615
10_PROFILE	1. LAYER	-4,11	2390
	2. LAYER	-12,92	4325
	3. LAYER		7625
11_PROFILE	1. LAYER	-3,07	2560
	2. LAYER	-13,75	5290
	3. LAYER		11553

12_PROFILE	1. LAYER	-2,65	2480
	2. LAYER	-17,96	5530
	3. LAYER		9970
13_PROFILE	1. LAYER	-4,29	2240
	2. LAYER	-13,51	4177
	3. LAYER		8324
14_PROFILE	1. LAYER	-2,80	3643
	2. LAYER	-12,53	3768
	3. LAYER		8395
15_PROFILE	1. LAYER	-3,38	3504
	2. LAYER	-15,13	3982
	3. LAYER		8550
16_PROFILE	1. LAYER	-1,83	2138
	2. LAYER	-12,38	6110
	3. LAYER		14836

LAYERS	‖AVERAGE‖ DEPTH	D Y K (ton/m^3)
1. LAYER	-4,25	2974
2.LAYER	-15,97	5217
3.LAYER	∞	11109
kv= 40*(Gs)*qu ton/m^3 *(Bowles 1984)*		

The above table shows the Modulus of Subgrade Reaction obtained for each layer in the direction of the data obtained after the seismic measurements made in the study area.

5.5.9. WTG05 Bearing Capacity qu (kg/cm2) / Allowable Bearing Capacity qa (kg/cm2)

PROFILES	LAYERS	DEPTH	BEARING CAPACITY (qu,kg/cm^2)	ALLOWABLE BEARING CAPACITY (qa,kg/cm^2)
1_PROFILE	1. LAYER	-3,86	8,82	2,94
	2.LAYER	-17,29	15,10	5,03
	3.LAYER	-32,71	32,34	10,78
2_PROFILE	1. LAYER	-5,31	9,90	3,30
	2. LAYER	-23,75	16,56	5,52
	3. LAYER	-26,25	38,59	12,86
3_PROFILE	1. LAYER	-7,43	10,98	3,66
	2. LAYER	-23,37	18,54	6,18
	3. LAYER	-26,63	38,37	12,79
4_PROFILE	1. LAYER	-3,88	6,45	2,15
	2. LAYER	-12,20	10,87	3,62
	3. LAYER	-37,80	22,24	7,41
5_PROFILE	1. LAYER	-3,65	6,91	2,30
	2. LAYER	-11,47	11,42	3,81
	3. LAYER	-38,53	24,05	8,02
6_PROFILE	1. LAYER	-4,81	6,82	2,27
	2. LAYER	-11,03	11,95	3,98
	3. LAYER	-38,97	22,49	7,50
7_PROFILE	1. LAYER	-4,46	9,55	3,18
	2.LAYER	-14,01	15,47	5,16
	3.LAYER	-35,99	32,75	10,92
8_PROFILE	1. LAYER	-8,86	4,54	1,51
	2. LAYER	-27,85	7,34	2,45
	3. LAYER	-22,15	13,86	4,62
9_PROFILE	1. LAYER	-3,66	7,59	2,53

	2. LAYER	-16,38	18,46	6,15
	3. LAYER	-33,62	46,54	15,51
10_PROFILE	1. LAYER	-4,11	5,98	1,99
	2. LAYER	-12,92	10,81	3,60
	3. LAYER	-37,08	19,06	6,35
11_PROFILE	1. LAYER	-3,07	6,40	2,13
	2. LAYER	-13,75	13,22	4,41
	3. LAYER	-36,25	28,88	9,63
12_PROFILE	1. LAYER	-2,65	6,20	2,07
	2. LAYER	-17,96	13,82	4,61
	3. LAYER	-32,04	24,93	8,31
13_PROFILE	1. LAYER	-4,29	5,60	1,87
	2. LAYER	-13,51	10,44	3,48
	3. LAYER	-36,49	20,81	6,94
14_PROFILE	1. LAYER	-2,80	9,11	3,04
	2. LAYER	-12,53	9,42	3,14
	3. LAYER	-37,47	20,99	7,00
15_PROFILE	1. LAYER	-3,38	8,76	2,92
	2. LAYER	-15,13	9,96	3,32
	3. LAYER	-34,87	21,37	7,12
16_PROFILE	1. LAYER	-1,83	5,34	1,78
	2. LAYER	-12,38	15,27	5,09
	3. LAYER	-37,62	37,09	12,36

||AVERAGE||		
LAYERS	**DEPTH**	**Bearing Capacity (qu,kg/cm^2)**
1. LAYER	-4,25	7,43
2.LAYER	-15,97	13,04
3.LAYER	∞	27,77

qu=(0,024*Vs*(J.B.K+0,002*Vp)*0,71)/G.K

BEARING CAPACITY CALCULATION (Prof. Dr. SEMIH TEZCAN-2006)	Geological unit factor 18	16	17	18	20
	Safety factor 50-100	CLAY	SAND	SEDIMENT	VOLATISILE

||AVERAGE||		
LAYERS	**DEPTH**	**Allowable Bearing Capacity (qa,kg/cm^2)**
1. LAYER	-4,25	2,48
2.LAYER	-15,97	4,35
3.LAYER	∞	9,26

qa=qu/G.K G.K=3 empirical value

5.5.10. WTG05 Vibration Period - T_0 (sec) / Ground Amplification (Ak)

PROFILES	To (sec)	Ta (sec)	Tb (sec)	Ak (Amplification)
1.PROFILE	0,20	0,13	0,30	1,23
2.PROFILE	0,20	0,13	0,30	1,18
3.PROFILE	0,19	0,13	0,28	1,14
4.PROFILE	0,25	0,17	0,38	1,48
5.PROFILE	0,23	0,16	0,35	1,43
6.PROFILE	0,24	0,16	0,36	1,46
7.PROFILE	0,19	0,13	0,28	1,23
8.PROFILE	0,46	0,31	0,70	1,89
9.PROFILE	0,16	0,11	0,24	1,12
10.PROFILE	0,28	0,19	0,42	1,56
11.PROFILE	0,21	0,14	0,32	1,32
12.PROFILE	0,23	0,16	0,35	1,32
13.PROFILE	0,27	0,18	0,41	1,54
14.PROFILE	0,25	0,17	0,38	1,48
15.PROFILE	0,26	0,17	0,39	1,46
16.PROFILE	0,17	0,12	0,26	1,20

AVERAGE			
To (sec)	Ta (sec)	Tb (sec)	Ak (Amplification)
0,24	0,16	0,36	1,38

$To = \sum 4H\ Vs\ n\ \iota$=1 (sec)……. (Zeevaert,1967)

Ak=68*$Vs_{30}^{-0,6}$……. (Midorikawa, 1987)

The Vibration Period and Ground Amplification calculated in the direction of the parameters obtained during the seismic studies made during the field survey are presented in the table above.

5. 6. WTG06

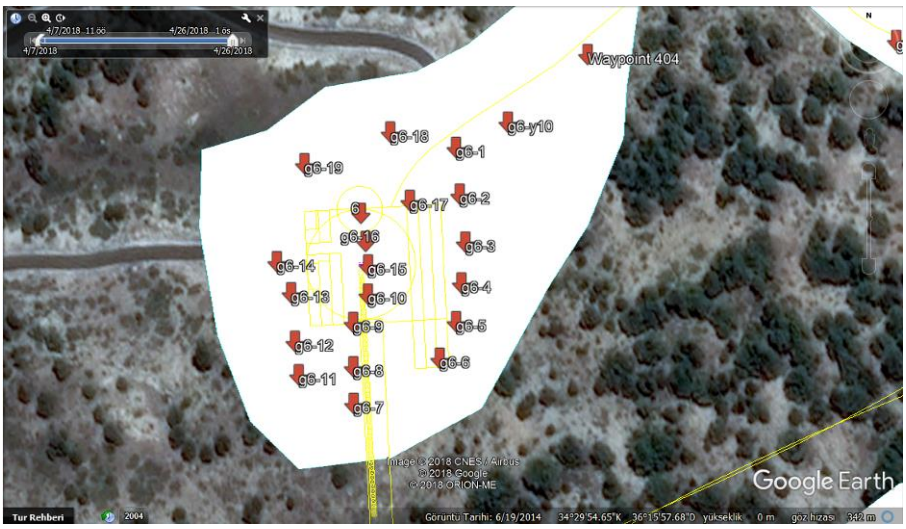
There are 19 measurements have been taken on the WTG. These measurements showed 3 layers. Layer 1 was found to be between 0,00 m and 4,05 m depth, Layer 2 between 4,05 m and 14,13 m depth, and Layer 3 at an average depth of 14,13 m. The parameters of these layers are given in the table below.

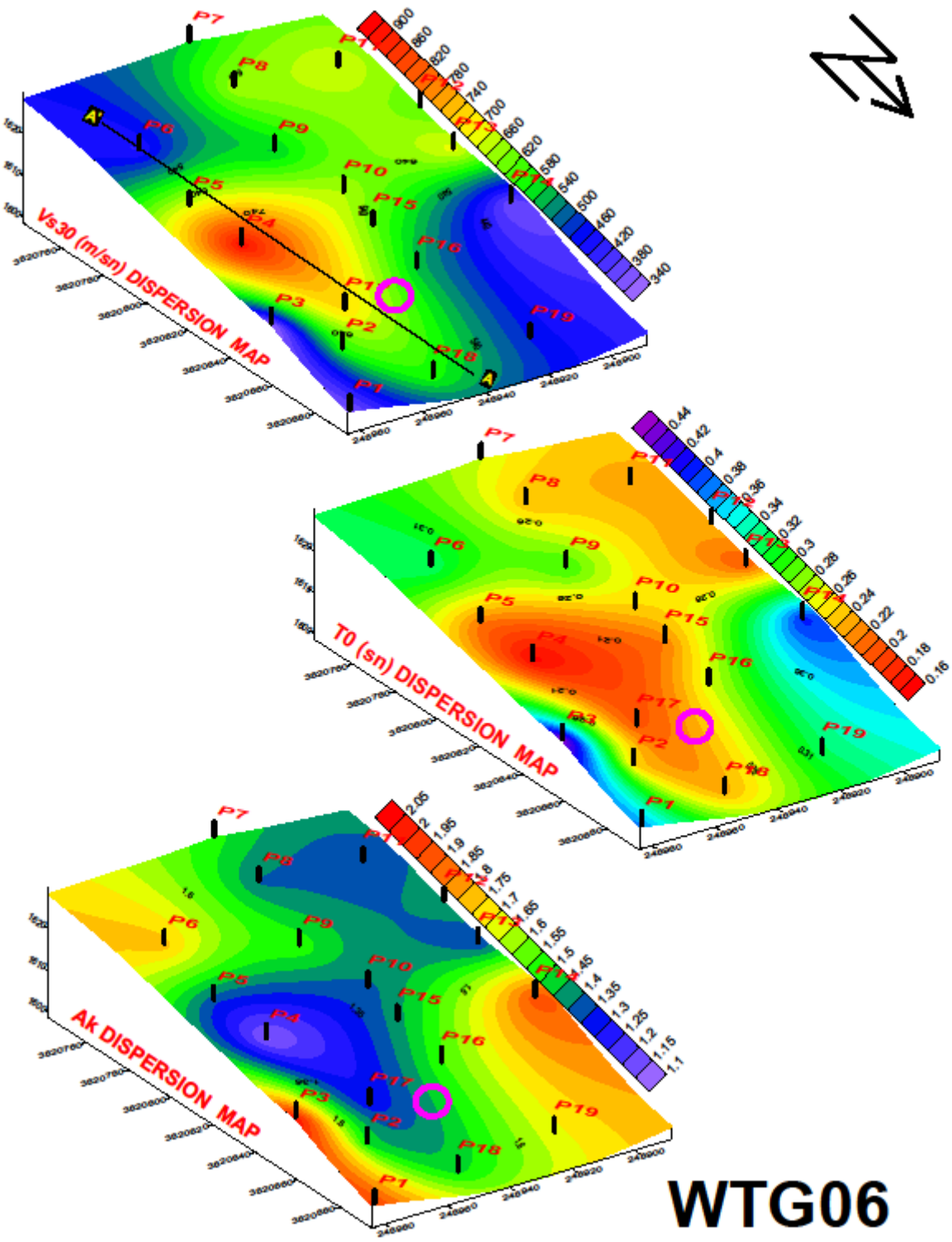
LAYERS	Vp_ Velocity	STRIPPABILITY
1. LAYER	758	Simple strippability
2.LAYER	1368	Medium-hard strippability
3.LAYER	2518	Explosive
LAYERS	**Vs_ Velocity**	**GROUND GROUP**
1. LAYER	297	C
2.LAYER	617	B
3.LAYER	1086	A
LAYERS	**G (kg/cm2)**	**ENDURANCE**
1. LAYER	1671	Medium
2.LAYER	8974	Sturdy
3.LAYER	28240	High sturdy
LAYERS	**E (kg/cm2)**	**ENDURANCE**
1. LAYER	4566	Weak
2.LAYER	24229	Sturdy
3.LAYER	78276	High sturdy

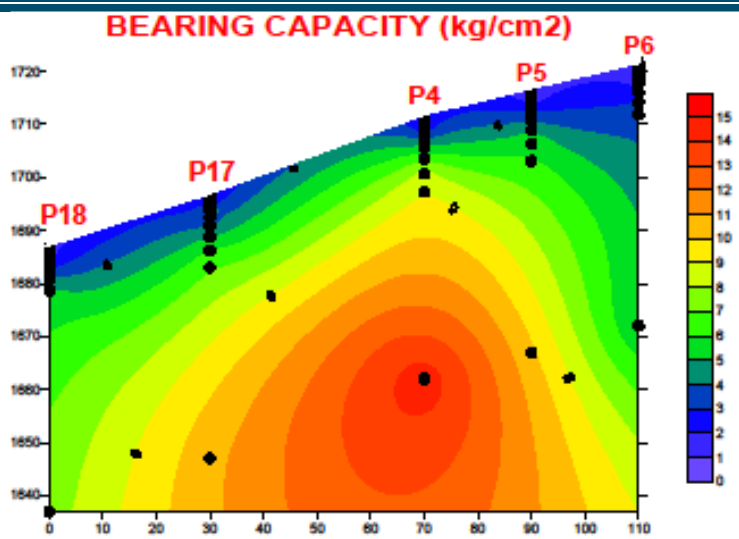
LAYERS	(σ)	POROSITY
1. LAYER	0,39	High Porosity
2.LAYER	0,33	Medium Porosity
3.LAYER	0,38	High Porosity
LAYERS	**ρ (gr/cm3)**	**DEFINITION**
1. LAYER	1,61	Medium
2.LAYER	1,83	Medium
3.LAYER	2,18	High
LAYERS	**D Y K (ton/m³)**	
1. LAYER	2159	
2.LAYER	4918	
3.LAYER	9493	
LAYERS	**Ground Carrying Capacity (qu,kg/cm2)**	**Secure Carrying Capacity (qa,kg/cm2)**
1. LAYER	5,40	1,80
2.LAYER	12,29	4,10
3.LAYER	23,73	7,91

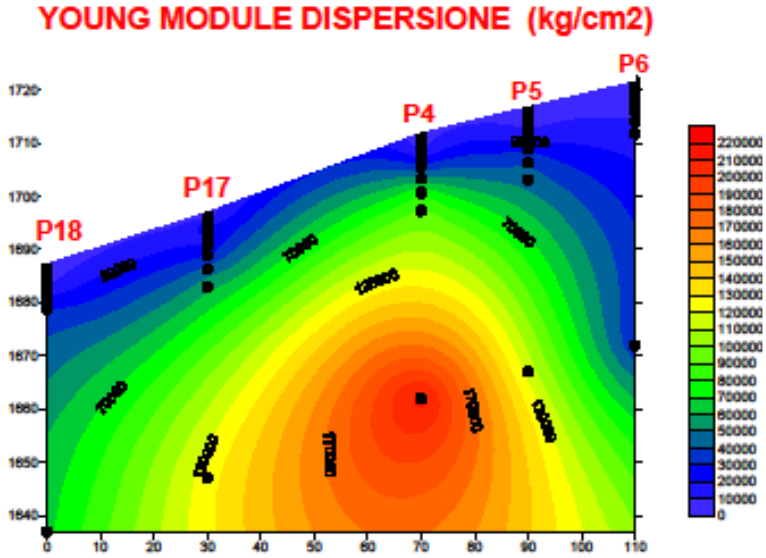
To (sec)	Ta (sec)	Tb (sec)	Vs30 (m/sec)	Ak (Amplification)
0,27	0,18	0,41	584	1,53

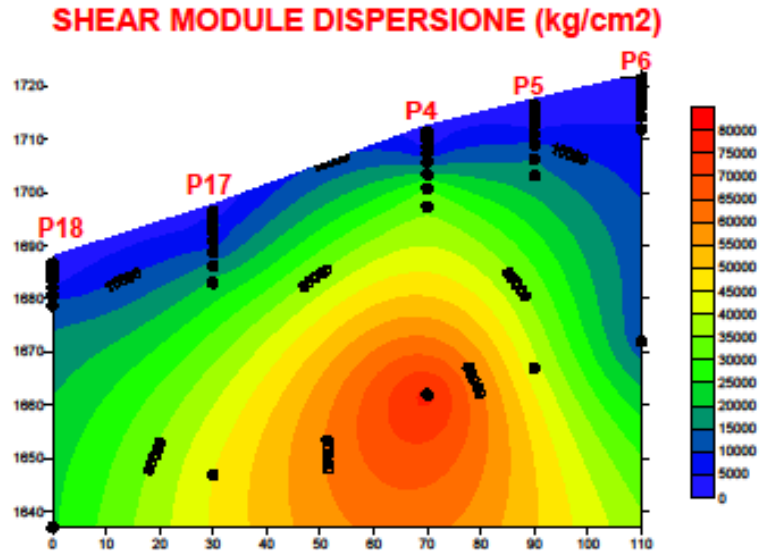
In the first profile (1) taken from the ground, it is recommended to excavate the first 2.50 metric units from the land level and to excavate the first 5,50 average from the land level in the third (3) profile. Measurements taken on the grounds suggest that the fourth and seventh (14) and seventeen (19) profiles should be used to excavate the first 3.50 mt from the land level. Taking into consideration the following applications, the profile points should be seen in the engineering parameters section for detailed values.




Vs30 (m/sn) DISPERSION MAP
T0 (sn) DISPERSION MAP
Ak DISPERSION MAP
WTG06







5.6.1. WTG06 Seismic P wave velocity (*Compressional Wave Velocity* (Vp))

Vp VELOCITY

PROFILES	LAYERS	DEPTH	Vp_ Velocity	STRIPPABILITY
1_PROFILE	1. LAYER	-2,13	515	Simple Strippability
	2.LAYER	-9,53	722	Simple Strippability
	3.LAYER		1430	Medium Strippability
2_PROFILE	1. LAYER	-3,66	745	Simple Strippability
	2. LAYER	-11,51	1234	Medium Strippability
	3. LAYER		2566	Explosive
3_PROFILE	1. LAYER	-5,30	429	High Simple Strippability
	2. LAYER	-16,66	698	Simple Strippability
	3. LAYER		1475	Medium Strippability
4_PROFILE	1. LAYER	-4,68	903	Simple Strippability
	2. LAYER	-14,72	1984	High Difficult Strippability
	3. LAYER		4188	Explosive
5_PROFILE	1. LAYER	-4,43	586	Simple Strippability
	2. LAYER	-13,91	1495	Medium Strippability
	3. LAYER		3221	Explosive
6_PROFILE	1. LAYER	-3,24	714	Simple Strippability
	2. LAYER	-10,20	889	Simple Strippability
	3. LAYER		1747	High Difficult Strippability
7_PROFILE	1. LAYER	-4,50	915	Simple Strippability
	2.LAYER	-14,15	1104	Simple Strippability
	3.LAYER		2265	Explosive
8_PROFILE	1. LAYER	-4,11	1080	Simple Strippability
	2. LAYER	-18,41	4371	Explosive
	3. LAYER		3010	Explosive
9_PROFILE	1. LAYER	-9,55	829	Simple Strippability
	2. LAYER	-21,90	1213	Simple Strippability
	3. LAYER		2331	Explosive
10_PROFILE	1. LAYER	-4,90	775	Simple Strippability
	2. LAYER	-21,91	1396	Medium Strippability
	3. LAYER		2920	Explosive
11_PROFILE	1. LAYER	-5,79	1020	Simple Strippability
	2. LAYER	-18,19	1405	Medium Strippability
	3. LAYER		2966	Explosive
12_PROFILE	1. LAYER	-3,79	995	Simple Strippability
	2. LAYER	-11,93	1208	Simple Strippability
	3. LAYER		2380	Explosive
13_PROFILE	1. LAYER	-3,22	955	Simple Strippability
	2. LAYER	-10,12	1376	Medium Strippability
	3. LAYER		2821	Explosive
14_PROFILE	1. LAYER	-3,58	523	Simple Strippability
	2. LAYER	-16,01	735	Simple Strippability
	3. LAYER		1740	High Difficult Strippability
15_PROFILE	1. LAYER	-2,44	963	Simple Strippability
	2. LAYER	-7,67	1285	Medium Strippability
	3. LAYER		2526	Explosive
16_PROFILE	1. LAYER	-4,14	545	Simple Strippability
	2. LAYER	-13,03	1175	Simple Strippability
	3. LAYER		2453	Explosive
17_PROFILE	1. LAYER	-2,07	720	Simple Strippability
	2.LAYER	-14,01	1707	High Difficult Strippability
	3.LAYER		3311	Explosive
18_PROFILE	1. LAYER	-1,85	628	Simple Strippability
	2. LAYER	-8,29	1078	Simple Strippability
	3. LAYER		2421	Explosive
19_PROFILE	1. LAYER	-3,66	560	Simple Strippability
	2. LAYER	-16,38	924	Simple Strippability
	3. LAYER		2075	High Difficult Strippability

P Wave Velocity (m/sec)	Strippability
Vp<458	High Simple Strippability
458<Vp<1220	Simple Strippability
1220<Vp<11525	Medium Strippability
1525<Vp<11830	Difficult Strippability
1830<Vp<12135	High Difficult Strippability
Vp>2135	Explosive Strippability

Strippability of floors with P wave velocity (Church, 1981)

‖AVERAGE‖			
LAYERS	DEPTH	Vp_ Velocity	STRIPPABILITY
1. LAYER	-4,05	758	Simple Strippability
2.LAYER	-14,13	1368	Medium Strippability
3.LAYER	∞	2518	Explosive

P wave velocities of the grounds in the study area and strippability

The above table shows the change table and strippability properties of Vp velocity depth values in the direction of the seismic data obtained from the field studies.

5.6.2. WTG06 Seismic S wave velocity (*Transverse Wave Velocity* (Vs))

Vs VELOCITY				
PROFILES	LAYERS	DEPTH	Vs_ Velocity	GROUND GROUPS
1_PROFILE	1. LAYER	-2,13	177	D
	2.LAYER	-9,53	328	C
	3.LAYER		669	B
2_PROFILE	1. LAYER	-3,66	286	C
	2. LAYER	-11,51	620	B
	3. LAYER		1069	A
3_PROFILE	1. LAYER	-5,30	185	D
	2. LAYER	-16,66	378	C
	3. LAYER		659	B
4_PROFILE	1. LAYER	-4,68	439	B
	2. LAYER	-14,72	1055	A
	3. LAYER		1753	A
5_PROFILE	1. LAYER	-4,43	298	C
	2. LAYER	-13,91	773	A
	3. LAYER		1327	A
6_PROFILE	1. LAYER	-3,24	286	C
	2. LAYER	-10,20	436	B
	3. LAYER		739	A
7_PROFILE	1. LAYER	-4,50	375	C
	2.LAYER	-14,15	577	B
	3.LAYER		990	A
8_PROFILE	1. LAYER	-4,11	293	C
	2. LAYER	-18,41	943	A
	3. LAYER		1283	A
9_PROFILE	1. LAYER	-9,55	290	C
	2. LAYER	-21,90	643	B
	3. LAYER		1014	A
10_PROFILE	1. LAYER	-4,90	336	C
	2. LAYER	-21,91	662	B
	3. LAYER		1359	A
11_PROFILE	1. LAYER	-5,79	381	C
	2. LAYER	-18,19	705	A
	3. LAYER		1245	A

12_PROFILE	1. LAYER	-3,79	409	B
	2. LAYER	-11,93	559	B
	3. LAYER		1080	A
13_PROFILE	1. LAYER	-3,22	343	C
	2. LAYER	-10,12	704	A
	3. LAYER		1238	A
14_PROFILE	1. LAYER	-3,58	183	D
	2. LAYER	-16,01	369	C
	3. LAYER		724	A
15_PROFILE	1. LAYER	-2,44	324	C
	2. LAYER	-7,67	566	B
	3. LAYER		1119	A
16_PROFILE	1. LAYER	-4,14	254	C
	2. LAYER	-13,03	617	B
	3. LAYER		1033	A
17_PROFILE	1. LAYER	-2,07	287	C
	2.LAYER	-14,01	754	A
	3.LAYER		1381	A
18_PROFILE	1. LAYER	-1,85	270	C
	2. LAYER	-8,29	559	B
	3. LAYER		1057	A
19_PROFILE	1. LAYER	-3,66	221	C
	2. LAYER	-16,38	483	B
	3. LAYER		901	A

S Wave Velocity (m/sec)	Ground group
Vs<200	D
200<Vs<400	C
400<Vs<700	B
700<Vs	A

Ground groups according to slip wave velocity(Abyyhy, 1998)

||AVERAGE||			
LAYERS	**DEPTH**	**Vs_ Velocity**	**GROUND GROUPS**
1. LAYER	-4,05	297	C
2.LAYER	-14,13	617	B
3.LAYER	∞	1086	A

S wave velocities of the grounds in the study area and ground group

Ground Group	Ground group and top ground layer thickness(h_1)
Z1	(A) Ground group h1< 15 m (B) Ground group
Z2	h_1> 15 m (B) Ground group h_1< 15 m (C) Ground group
Z3	15 m < h_1< 50 m (C) Ground group h_1< 10 m (D) Ground group
Z4	h_1> 50 m (C) Ground group h_1> 10 m (D) Ground group

Ground Group Class

The above table shows that Vs velocity values in the direction of the seismic data obtained in the field studies are the absolute change tables and that the layers are included in the ground groups.

5.6.3. WTG06 Vs30

PROFILES	Vs30 (m/sec)
1.PROFILE	370
2.PROFILE	586
3.PROFILE	343
4.PROFILE	916
5.PROFILE	683
6.PROFILE	437
7.PROFILE	562
8.PROFILE	652
9.PROFILE	556
10.PROFILE	660
11.PROFILE	678
12.PROFILE	615
13.PROFILE	689
14.PROFILE	380
15.PROFILE	625
16.PROFILE	552
17.PROFILE	719
18.PROFILE	586
19.PROFILE	477

Vs30 values in the direction of the seismic data obtained from the field studies are given in the table above.

5.6.4. WTG06 Shear Modulus-G (kg/cm²)

SHEAR MODULUS				
PROFILES	LAYERS	DEPTH	G(kg/cm^2)	ENDURANCE
1_PROFILE	1. LAYER	-2,13	476	Weak
	2.LAYER	-9,53	1846	Medium
	3.LAYER		8538	Sturdy
2_PROFILE	1. LAYER	-3,66	1412	Weak
	2. LAYER	-11,51	7386	Sturdy
	3. LAYER		25221	Rock Highlid
3_PROFILE	1. LAYER	-5,30	519	Weak
	2. LAYER	-16,66	2401	Medium
	3. LAYER		8331	Sturdy
4_PROFILE	1. LAYER	-4,68	3630	Sturdy
	2. LAYER	-14,72	23921	Rock Highlid
	3. LAYER		76671	Rock Highlid
5_PROFILE	1. LAYER	-4,43	1540	Medium
	2. LAYER	-13,91	11912	Rock Highlid
	3. LAYER		41116	Rock Highlid
6_PROFILE	1. LAYER	-3,24	1368	Weak
	2. LAYER	-10,20	3438	Sturdy
	3. LAYER		10953	Rock Highlid
7_PROFILE	1. LAYER	-4,50	2576	Medium
	2.LAYER	-14,15	6342	Sturdy
	3.LAYER		20979	Rock Highlid
8_PROFILE	1. LAYER	-4,11	1540	Medium
	2. LAYER	-18,41	31711	Rock Highlid
	3. LAYER		37794	Rock Highlid
9_PROFILE	1. LAYER	-9,55	2193	Medium
	2. LAYER	-21,90	7793	Sturdy
	3. LAYER		22144	Rock Highlid
10_PROFILE	1. LAYER	-4,90	2025	Medium
	2. LAYER	-21,91	8991	Sturdy

	3. LAYER		42058	Rock Highlid
11_PROFILE	1. LAYER	-5,79	2591	Medium
	2. LAYER	-18,19	9883	Sturdy
	3. LAYER		35475	Rock Highlid
12_PROFILE	1. LAYER	-3,79	2944	Medium
	2. LAYER	-11,93	6253	Sturdy
	3. LAYER		25248	Rock Highlid
13_PROFILE	1. LAYER	-3,22	2056	Medium
	2. LAYER	-10,12	9863	Sturdy
	3. LAYER		34610	Rock Highlid
14_PROFILE	1. LAYER	-3,58	509	Weak
	2. LAYER	-16,01	2401	Medium
	3. LAYER		10508	Rock Highlid
15_PROFILE	1. LAYER	-2,44	1895	Medium
	2. LAYER	-7,67	6020	Sturdy
	3. LAYER		27502	Rock Highlid
16_PROFILE	1. LAYER	-4,14	1043	Weak
	2. LAYER	-13,03	7250	Sturdy
	3. LAYER		23296	Rock Highlid
17_PROFILE	1. LAYER	-2,07	1461	Weak
	2.LAYER	-14,01	12601	Rock Highlid
	3.LAYER		44852	Rock Highlid
18_PROFILE	1. LAYER	-1,85	1204	Weak
	2. LAYER	-8,29	6142	Sturdy
	3. LAYER		24286	Rock Highlid
19_PROFILE	1. LAYER	-3,66	759	Weak
	2. LAYER	-16,38	4361	Sturdy
	3. LAYER		16971	Rock Highlid

Shear Modulus (kg/cm^2)	Dayanım
G<400	High Weak
400<G<1500	Weak
1500<G<3000	Medium
3000<G<10000	Sturdy
10000<G	Rock Highlid

The endurance of ground or rocks according to Slip Module values(Keçeli, 1990)

$G = (d*Vs^2)/100$

‖AVERAGE‖			
LAYERS	**DEPTH**	**G (kg/cm^2)**	**ENDURANCE**
1. LAYER	-4,05	1671	Medium
2.LAYER	-14,13	8974	Sturdy
3.LAYER	∞	28240	Rock Highlid

Shear modules and endurance of the grounds in the study area

Calculation of shear Modulus values in the direction of the seismic data obtained in the field studies and the table of variation are given in the table above.

5.6.5. WTG06 Elasticity Modulus-E (kg/cm²)

ELASTIC MODULUS				
PROFILES	LAYERS	DEPTH	E(kg/cm^2)	ENDURANCE
1_PROFILE	1. LAYER	-2,13	1352	Weak
	2.LAYER	-9,53	4997	Weak
	3.LAYER		23220	Sturdy
2_PROFILE	1. LAYER	-3,66	3896	Weak
	2. LAYER	-11,51	19673	Sturdy
	3. LAYER		70364	Rock Highlid
3_PROFILE	1. LAYER	-5,30	1393	Weak
	2. LAYER	-16,66	6207	Medium
	3. LAYER		22918	Sturdy
4_PROFILE	1. LAYER	-4,68	9447	Medium
	2. LAYER	-14,72	62275	Rock Highlid
	3. LAYER		213717	Rock Highlid
5_PROFILE	1. LAYER	-4,43	4022	Weak
	2. LAYER	-13,91	31327	Rock Highlid
	3. LAYER		114945	Rock Highlid
6_PROFILE	1. LAYER	-3,24	3779	Weak
	2. LAYER	-10,20	9153	Medium
	3. LAYER		30471	Rock Highlid
7_PROFILE	1. LAYER	-4,50	6961	Medium
	2.LAYER	-14,15	16577	Sturdy
	3.LAYER		57976	Rock Highlid
8_PROFILE	1. LAYER	-4,11	4349	Weak
	2. LAYER	-18,41	92893	Rock Highlid
	3. LAYER		104992	Rock Highlid
9_PROFILE	1. LAYER	-9,55	5962	Medium
	2. LAYER	-21,90	20325	Sturdy
	3. LAYER		61266	Rock Highlid
10_PROFILE	1. LAYER	-4,90	5425	Medium
	2. LAYER	-21,91	24191	Sturdy
	3. LAYER		114556	Rock Highlid
11_PROFILE	1. LAYER	-5,79	7313	Medium
	2. LAYER	-18,19	26348	Sturdy
	3. LAYER		98834	Rock Highlid
12_PROFILE	1. LAYER	-3,79	8195	Medium
	2. LAYER	-11,93	16688	Sturdy
	3. LAYER		69199	Rock Highlid
13_PROFILE	1. LAYER	-3,22	5836	Medium
	2. LAYER	-10,12	26089	Sturdy
	3. LAYER		95579	Rock Highlid
14_PROFILE	1. LAYER	-3,58	1444	Weak
	2. LAYER	-16,01	6400	Medium
	3. LAYER		29321	Sturdy
15_PROFILE	1. LAYER	-2,44	5373	Medium
	2. LAYER	-7,67	16566	Sturdy
	3. LAYER		75795	Rock Highlid
16_PROFILE	1. LAYER	-4,14	2791	Weak
	2. LAYER	-13,03	18986	Sturdy
	3. LAYER		64861	Rock Highlid
17_PROFILE	1. LAYER	-2,07	3883	Weak
	2.LAYER	-14,01	34188	Rock Highlid
	3.LAYER		125109	Rock Highlid
18_PROFILE	1. LAYER	-1,85	3230	Weak
	2. LAYER	-8,29	16057	Sturdy
	3. LAYER		67141	Rock Highlid

19_PROFILE	1. LAYER	-3,66	2109	Weak
	2. LAYER	-16,38	11411	Sturdy
	3. LAYER		46973	Rock Highlid

Elastic Modulus (kg/cm²)	Dayanım
E<1000	High Weak
1000<E<5000	Weak
5000<E<10000	Medium
10000<E<30000	Sturdy
30000<E	Rock Highlid

The endurance of ground or rocks according to Slip Module values(Keçeli, 1990)

$E=G*(3*V_p^2-4*V_s^2)/(V_p^2-V_s^2)$

‖AVERAGE‖			
LAYERS	DEPTH	E (kg/cm²)	ENDURANCE
1. LAYER	-4,05	4566	Weak
2.LAYER	-14,13	24229	Sturdy
3.LAYER	∞	78276	Rock Highlid

Elasticity modules and endurance of the grounds in the study area

Calculation of the modulus of elasticity in the direction of the seismic data obtained in the field studies and the change table are given in the above table

5.6.6. WTG06 Poisson's Ratio - (б)

POISSON'S RATIO				
PROFILES	LAYERS	DEPTH	(σ)	POROSITY
1_PROFILE	1. LAYER	-2,13	0,43	High Porous
	2.LAYER	-9,53	0,37	High Porous
	3.LAYER		0,36	High Porous
2_PROFILE	1. LAYER	-3,66	0,40	High Porous
	2. LAYER	-11,51	0,33	Medium Porous
	3. LAYER		0,39	High Porous
3_PROFILE	1. LAYER	-5,30	0,37	High Porous
	2. LAYER	-16,66	0,29	Medium Porous
	3. LAYER		0,38	High Porous
4_PROFILE	1. LAYER	-4,68	0,33	Medium Porous
	2. LAYER	-14,72	0,29	Medium Porous
	3. LAYER		0,39	High Porous
5_PROFILE	1. LAYER	-4,43	0,32	Medium Porous
	2. LAYER	-13,91	0,31	Medium Porous
	3. LAYER		0,40	High Porous
6_PROFILE	1. LAYER	-3,24	0,40	High Porous
	2. LAYER	-10,20	0,34	Medium Porous
	3. LAYER		0,39	High Porous
7_PROFILE	1. LAYER	-4,50	0,38	High Porous
	2.LAYER	-14,15	0,31	Medium Porous
	3.LAYER		0,38	High Porous
8_PROFILE	1. LAYER	-4,11	0,43	High Porous
	2. LAYER	-18,41	0,43	High Porous
	3. LAYER		0,39	High Porous
9_PROFILE	1. LAYER	-9,55	0,38	High Porous
	2. LAYER	-21,90	0,30	Medium Porous
	3. LAYER		0,38	High Porous
10_PROFILE	1. LAYER	-4,90	0,37	High Porous
	2. LAYER	-21,91	0,36	High Porous
	3. LAYER		0,36	High Porous
11_PROFILE	1. LAYER	-5,79	0,42	High Porous

	2. LAYER	-18,19	0,33	Medium Porous
	3. LAYER		0,39	High Porous
12_PROFILE	1. LAYER	-3,79	0,40	High Porous
	2. LAYER	-11,93	0,36	High Porous
	3. LAYER		0,37	High Porous
13_PROFILE	1. LAYER	-3,22	0,42	High Porous
	2. LAYER	-10,12	0,32	Medium Porous
	3. LAYER		0,38	High Porous
14_PROFILE	1. LAYER	-3,58	0,43	High Porous
	2. LAYER	-16,01	0,33	Medium Porous
	3. LAYER		0,40	High Porous
15_PROFILE	1. LAYER	-2,44	0,43	High Porous
	2. LAYER	-7,67	0,37	High Porous
	3. LAYER		0,38	High Porous
16_PROFILE	1. LAYER	-4,14	0,35	Medium Porous
	2. LAYER	-13,03	0,31	Medium Porous
	3. LAYER		0,39	High Porous
17_PROFILE	1. LAYER	-2,07	0,37	High Porous
	2.LAYER	-14,01	0,36	High Porous
	3.LAYER		0,39	High Porous
18_PROFILE	1. LAYER	-1,85	0,37	High Porous
	2. LAYER	-8,29	0,32	Medium Porous
	3. LAYER		0,38	High Porous
19_PROFILE	1. LAYER	-3,66	0,40	High Porous
	2. LAYER	-16,38	0,31	Medium Porous
	3. LAYER		0,38	High Porous

Poisson's Ratio;(σ)	Porosity
$0,00 \leq \sigma \leq 0,25$	Nonporous
$0,26 \leq \sigma \leq 0,35$	Medium Porous
$0,36 \leq \sigma \leq 0,50$	High Porous

Poisson ratio classification

$\sigma=(Vp^2-2*Vs^2)/(2*Vp^2-2*Vs^2)$

‖AVERAGE‖			
LAYERS	**DEPTH**	**(σ)**	**POROSITY**
1. LAYER	-4,05	0,39	High Porous
2.LAYER	-14,13	0,33	Medium Porous
3.LAYER	∞	0,38	High Porous

Poisson's ratio values of the units in the study area, porosity

Calculation of poisson's ratio values in the direction of the seismic data obtained in the field studies and the change table are given in the above table.

5.6.7. WTG06 Density - ρ (gr/ cm^3)

DENSITY				
PROFILES	LAYERS	DEPTH	ρ (gr/cm^3)	DEFINITION
1_PROFILE	1. LAYER	-2,13	1,48	Medium
	2.LAYER	-9,53	1,60	Medium
	3.LAYER		1,91	High
2_PROFILE	1. LAYER	-3,66	1,62	Medium
	2. LAYER	-11,51	1,83	Medium
	3. LAYER		2,21	High
3_PROFILE	1. LAYER	-5,30	1,41	Medium
	2. LAYER	-16,66	1,59	Medium
	3. LAYER		1,92	High
4_PROFILE	1. LAYER	-4,68	1,70	Medium
	2. LAYER	-14,72	2,06	High
	3. LAYER		2,49	High
5_PROFILE	1. LAYER	-4,43	1,52	Medium
	2. LAYER	-13,91	1,92	High
	3. LAYER		2,34	High
6_PROFILE	1. LAYER	-3,24	1,60	Medium
	2. LAYER	-10,20	1,69	Medium
	3. LAYER		2,00	High
7_PROFILE	1. LAYER	-4,50	1,71	Medium
	2.LAYER	-14,15	1,78	Medium
	3.LAYER		2,14	High
8_PROFILE	1. LAYER	-4,11	1,75	Medium
	2. LAYER	-18,41	2,36	High
	3. LAYER		2,30	High
9_PROFILE	1. LAYER	-9,55	1,66	Medium
	2. LAYER	-21,90	1,83	Medium
	3. LAYER		2,15	High
10_PROFILE	1. LAYER	-4,90	1,63	Medium
	2. LAYER	-21,91	1,89	Medium
	3. LAYER		2,28	High
11_PROFILE	1. LAYER	-5,79	1,75	Medium
	2. LAYER	-18,19	1,89	Medium
	3. LAYER		2,29	High
12_PROFILE	1. LAYER	-3,79	1,74	Medium
	2. LAYER	-11,93	1,82	Medium
	3. LAYER		2,17	High
13_PROFILE	1. LAYER	-3,22	1,72	Medium
	2. LAYER	-10,12	1,88	Medium
	3. LAYER		2,26	High
14_PROFILE	1. LAYER	-3,58	1,48	Medium
	2. LAYER	-16,01	1,60	Medium
	3. LAYER		2,00	High
15_PROFILE	1. LAYER	-2,44	1,73	Medium
	2. LAYER	-7,67	1,85	Medium
	3. LAYER		2,20	High
16_PROFILE	1. LAYER	-4,14	1,49	Medium
	2. LAYER	-13,03	1,81	Medium
	3. LAYER		2,18	High
17_PROFILE	1. LAYER	-2,07	1,61	Medium
	2.LAYER	-14,01	1,98	High
	3.LAYER		2,35	High
18_PROFILE	1. LAYER	-1,85	1,55	Medium
	2. LAYER	-8,29	1,77	Medium
	3. LAYER		2,17	High

19_PROFILE	1. LAYER	-3,66	1,51	Medium
	2. LAYER	-16,38	1,70	Medium
	3. LAYER		2,09	High

Density: ρ (gr/cm^3)	Tanımlama
ρ<1,20	High low
1,20<ρ<1,40	Low
1,40<ρ<1,90	Medium
1,90<ρ<2,20	High
2,20<ρ	Too High

Density Classification of Ground Units: (Keçeli, 1990)

*ρ =d=0.31*Vp0.25*

‖AVERAGE‖			
LAYERS	DEPTH	ρ (gr/cm^3)	DEFINITION
1. LAYER	-4,05	1,61	Medium
2.LAYER	-14,13	1,83	Medium
3.LAYER	∞	2,18	High

Density values and description of the units in the study area

Calculation of the density values of the geological units in the direction of the seismic data obtained in the field studies and the table of variation are given in the above table.

5.6.8. WTG06 Modulus of Subgrade Reaction – D Y K (ton/m^3)

Modulus of Subgrade Reaction			
PROFILES	LAYERS	DEPTH	D Y K (ton/m^3)
1_PROFILE	1. LAYER	-2,13	1232
	2.LAYER	-9,53	2347
	3.LAYER		5162
2_PROFILE	1. LAYER	-3,66	2047
	2. LAYER	-11,51	4706
	3. LAYER		9240
3_PROFILE	1. LAYER	-5,30	1277
	2. LAYER	-16,66	2696
	3. LAYER		5103
4_PROFILE	1. LAYER	-4,68	3208
	2. LAYER	-14,72	8671
	3. LAYER		17479
5_PROFILE	1. LAYER	-4,43	2103
	2. LAYER	-13,91	6031
	3. LAYER		12178
6_PROFILE	1. LAYER	-3,24	2041
	2. LAYER	-10,20	3184
	3. LAYER		5894
7_PROFILE	1. LAYER	-4,50	2731
	2.LAYER	-14,15	4320
	3.LAYER		8316
8_PROFILE	1. LAYER	-4,11	2151
	2. LAYER	-18,41	10989
	3. LAYER		11553
9_PROFILE	1. LAYER	-9,55	2565
	2. LAYER	-21,90	4860
	3. LAYER		8568

10_PROFILE	1. LAYER	-4,90	2415
	2. LAYER	-21,91	5125
	3. LAYER		12134
11_PROFILE	1. LAYER	-5,79	2814
	2. LAYER	-18,19	5451
	3. LAYER		11169
12_PROFILE	1. LAYER	-3,79	3010
	2. LAYER	-11,93	4228
	3. LAYER		9168
13_PROFILE	1. LAYER	-3,22	2509
	2. LAYER	-10,12	5432
	3. LAYER		10955
14_PROFILE	1. LAYER	-3,58	1273
	2. LAYER	-16,01	2654
	3. LAYER		5771
15_PROFILE	1. LAYER	-2,44	2375
	2. LAYER	-7,67	4304
	3. LAYER		9631
16_PROFILE	1. LAYER	-4,14	1782
	2. LAYER	-13,03	4653
	3. LAYER		8835
17_PROFILE	1. LAYER	-2,07	2042
	2.LAYER	-14,01	6063
	3.LAYER		12777
18_PROFILE	1. LAYER	-1,85	1902
	2. LAYER	-8,29	4180
	3. LAYER		9008
19_PROFILE	1. LAYER	-3,66	1550
	2. LAYER	-16,38	3545
	3. LAYER		7422

||AVERAGE||		
LAYERS	**DEPTH**	**D Y K (ton/m^3)**
1. LAYER	-4,05	2159
2.LAYER	-14,13	4918
3.LAYER	∞	9493
kv= 40*(Gs)*qu ton/m^3 *(Bowles 1984)*		

The above table shows the Modulus of Subgrade Reaction obtained for each layer in the direction of the data obtained after the seismic measurements made in the study area.

5.6.9. WTG06 Bearing Capacity qu (kg/cm2) / Allowable Bearing Capacity qa (kg/cm2)

PROFILES	LAYERS	DEPTH	BEARING CAPACITY (qu,kg/cm^2)	ALLOWABLE BEARING CAPACITY (qa,kg/cm^2)
1_PROFILE	1. LAYER	-2,13	3,08	1,03
	2.LAYER	-9,53	5,87	1,96
	3.LAYER	-40,47	12,90	4,30
2_PROFILE	1. LAYER	-3,66	5,12	1,71
	2. LAYER	-11,51	11,77	3,92
	3. LAYER	-38,49	23,10	7,70
3_PROFILE	1. LAYER	-5,30	3,19	1,06
	2. LAYER	-16,66	6,74	2,25
	3. LAYER	-33,34	12,76	4,25

4_PROFILE	1. LAYER	-4,68	8,02	2,67
	2. LAYER	-14,72	21,68	7,23
	3. LAYER	-35,28	43,70	14,57
5_PROFILE	1. LAYER	-4,43	5,26	1,75
	2. LAYER	-13,91	15,08	5,03
	3. LAYER	-36,09	30,44	10,15
6_PROFILE	1. LAYER	-3,24	5,10	1,70
	2. LAYER	-10,20	7,96	2,65
	3. LAYER	-39,80	14,73	4,91
7_PROFILE	1. LAYER	-4,50	6,83	2,28
	2.LAYER	-14,15	10,80	3,60
	3.LAYER	-35,85	20,79	6,93
8_PROFILE	1. LAYER	-4,11	5,38	1,79
	2. LAYER	-18,41	27,47	9,16
	3. LAYER	-31,59	28,88	9,63
9_PROFILE	1. LAYER	-9,55	6,41	2,14
	2. LAYER	-21,90	12,15	4,05
	3. LAYER	-28,10	21,42	7,14
10_PROFILE	1. LAYER	-4,90	6,04	2,01
	2. LAYER	-21,91	12,81	4,27
	3. LAYER	-28,09	30,34	10,11
11_PROFILE	1. LAYER	-5,79	7,04	2,35
	2. LAYER	-18,19	13,63	4,54
	3. LAYER	-31,81	27,92	9,31
12_PROFILE	1. LAYER	-3,79	7,52	2,51
	2. LAYER	-11,93	10,57	3,52
	3. LAYER	-38,07	22,92	7,64
13_PROFILE	1. LAYER	-3,22	6,27	2,09
	2. LAYER	-10,12	13,58	4,53
	3. LAYER	-39,88	27,39	9,13
14_PROFILE	1. LAYER	-3,58	3,18	1,06
	2. LAYER	-16,01	6,63	2,21
	3. LAYER	-33,99	14,43	4,81
15_PROFILE	1. LAYER	-2,44	5,94	1,98
	2. LAYER	-7,67	10,76	3,59
	3. LAYER	-42,33	24,08	8,03
16_PROFILE	1. LAYER	-4,14	4,45	1,48
	2. LAYER	-13,03	11,63	3,88
	3. LAYER	-36,97	22,09	7,36
17_PROFILE	1. LAYER	-2,07	5,11	1,70
	2.LAYER	-14,01	15,16	5,05
	3.LAYER	-35,99	31,94	10,65
18_PROFILE	1. LAYER	-1,85	4,76	1,59
	2. LAYER	-8,29	10,45	3,48
	3. LAYER	-41,71	22,52	7,51
19_PROFILE	1. LAYER	-3,66	3,88	1,29
	2. LAYER	-16,38	8,86	2,95
	3. LAYER	-33,62	18,55	6,18

||AVERAGE||		
LAYERS	DEPTH	Bearing Capacity (qu,kg/cm^2)
1. LAYER	-4,05	5,40
2.LAYER	-14,13	12,29
3.LAYER	∞	23,73

qu=(0,024*Vs*(J.B.K+0,002*Vp)*0,71)/G.K

BEARING CAPACITY CALCULATION	Geological unit factor 18	16	17	18	20
(Prof. Dr. SEMIH TEZCAN-2006)	Safety factor 50-100	CLAY	SAND	SEDIMENT	VOLATISILE

||AVERAGE||		
LAYERS	DEPTH	Allowable Bearing Capacity (qa,kg/cm^2)
1. LAYER	-4,05	1,80
2.LAYER	-14,13	4,10
3.LAYER	∞	7,91

qa=qu/G.K G.K=3 empirical value

5.6.10. WTG06 Vibration Period - T_0 (sec) / Ground Amplification (Ak)

PROFILES	To (sec)	Ta (sec)	Tb (sec)	Ak (Amplification)
1.PROFILE	0,38	0,25	0,57	1,96
2.PROFILE	0,25	0,17	0,37	1,49
3.PROFILE	0,45	0,30	0,68	2,05
4.PROFILE	0,16	0,11	0,25	1,14
5.PROFILE	0,22	0,15	0,33	1,35
6.PROFILE	0,33	0,22	0,49	1,77
7.PROFILE	0,27	0,18	0,41	1,52
8.PROFILE	0,24	0,16	0,36	1,39
9.PROFILE	0,30	0,20	0,45	1,53
10.PROFILE	0,25	0,16	0,37	1,38
11.PROFILE	0,24	0,16	0,35	1,36
12.PROFILE	0,24	0,16	0,36	1,44
13.PROFILE	0,21	0,14	0,31	1,35
14.PROFILE	0,40	0,27	0,61	1,93
15.PROFILE	0,22	0,15	0,33	1,43
16.PROFILE	0,27	0,18	0,40	1,54
17.PROFILE	0,21	0,14	0,31	1,31
18.PROFILE	0,24	0,16	0,35	1,48
19.PROFILE	0,32	0,22	0,49	1,68

AVERAGE			
To (sec)	Ta (sec)	Tb (sec)	Ak (Amplification)
0,27	0,18	0,41	1,53

$To = \sum 4H\ Vs\ n\ \iota$=1 (sec)……. (Zeevaert,1967)

Ak=68*$Vs_{30}^{-0,6}$…… (Midorikawa, 1987)

The Vibration Period and Ground Amplification calculated in the direction of the parameters obtained during the seismic studies made during the field survey are presented in the table above.

5. 7. WTG07

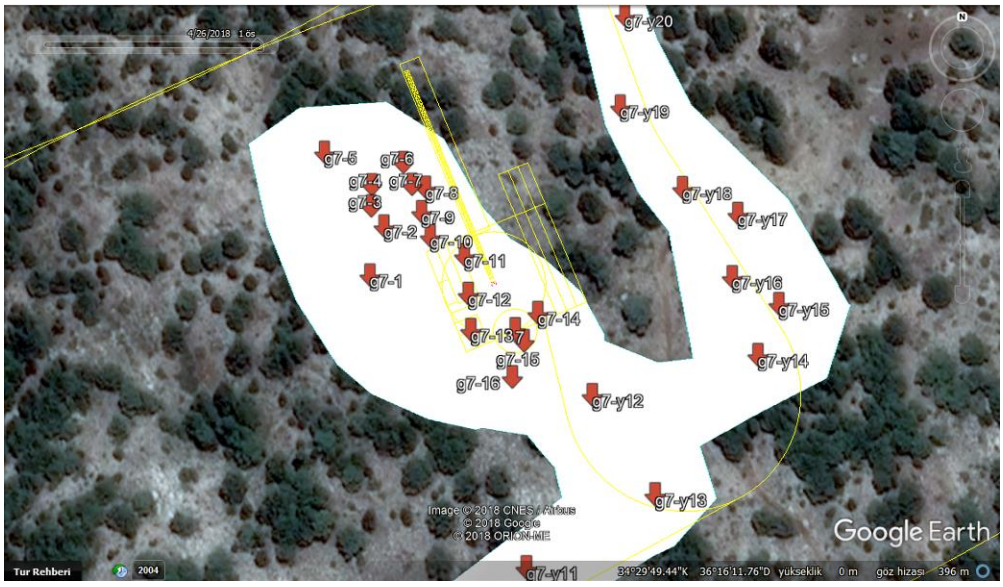
There are 16 measurements have been taken on the WTG. These measurements showed 3 layers. Layer 1 was found between 0,00 m and 4,63 m depth, Layer 2 between 4,63 m and 14,88 m depth and Layer 3 was found at an average depth of 14,88 m. The parameters of these layers are given in the table below.

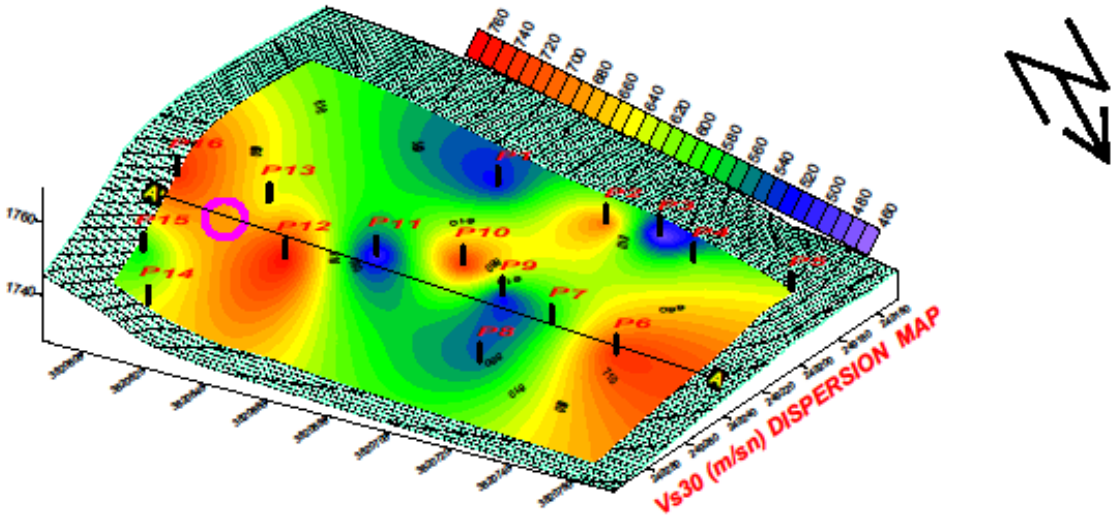
LAYERS	Vp_ Velocity	STRIPPABILITY
1. LAYER	888	Simple strippability
2.LAYER	1297	Medium-hard strippability
3.LAYER	2596	Explosive
LAYERS	**Vs_ Velocity**	**GROUND GROUP**
1. LAYER	354	C
2.LAYER	622	B
3.LAYER	1162	A
LAYERS	**G (kg/cm2)**	**ENDURANCE**
1. LAYER	2516	Medium
2.LAYER	7910	Sturdy
3.LAYER	31001	High sturdy
LAYERS	**E (kg/cm2)**	**ENDURANCE**
1. LAYER	6876	Medium
2.LAYER	21033	Sturdy
3.LAYER	84894	High sturdy

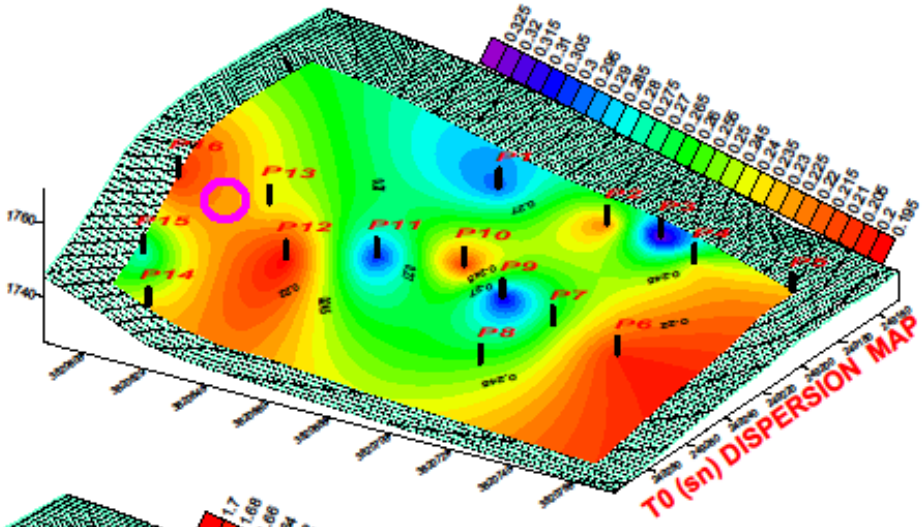
LAYERS	(σ)	POROSITY
1. LAYER	0,39	High Porosity
2.LAYER	0,34	Medium Porosity
3.LAYER	0,37	High Porosity
LAYERS	**ρ (gr/cm3)**	**DEFINITION**
1. LAYER	1,68	Medium
2.LAYER	1,85	Medium
3.LAYER	2,21	High
LAYERS	**D Y K (ton/m^3)**	
1. LAYER	2633	
2.LAYER	4765	
3.LAYER	10127	
LAYERS	**Ground Carrying Capacity (qu,kg/cm2)**	**Secure Carrying Capacity (qa,kg/cm2)**
1. LAYER	6,58	2,19
2.LAYER	11,91	3,97
3.LAYER	25,32	8,44

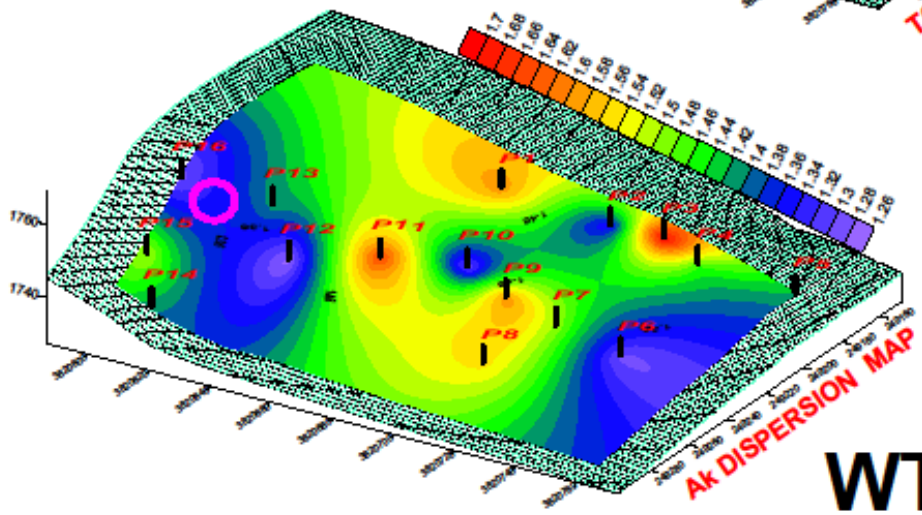
To (sec)	Ta (sec)	Tb (sec)	Vs30 (m/sec)	Ak (Amplification)
0,25	0,17	0,38	620	1,45

It is recommended that the eleventh (11) professions taken from the field should excavate the first 3.50 mt on average from the ground level. Taking into consideration the following applications, the profile points should be seen in the engineering parameters section for detailed values.

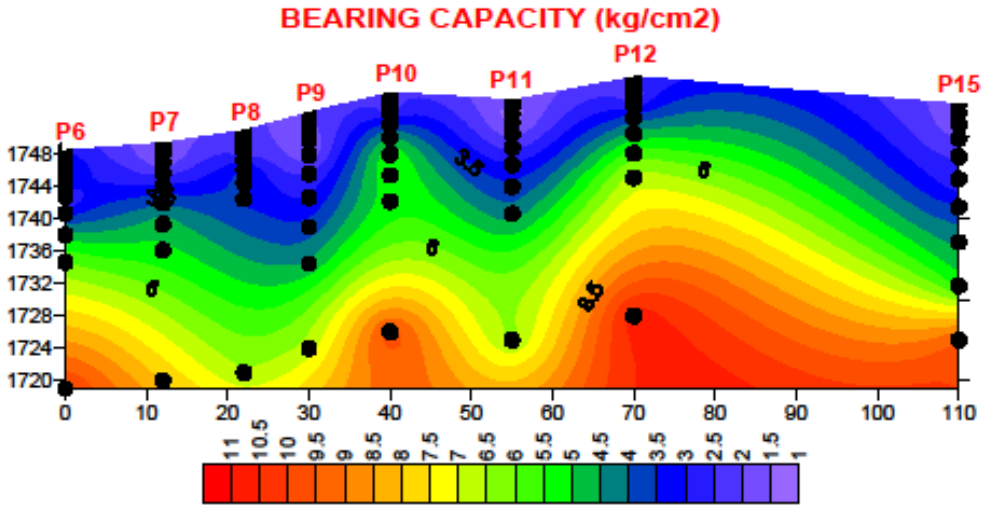


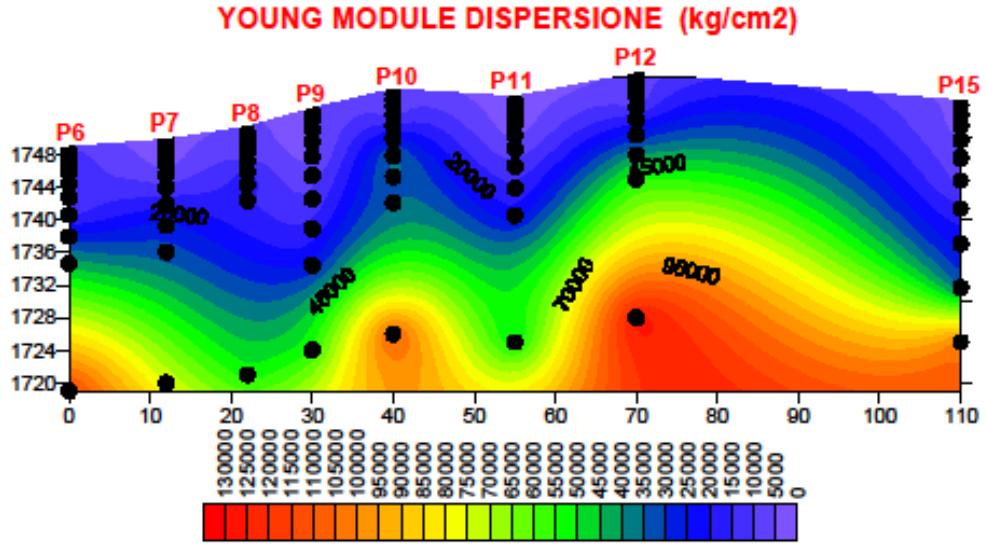

Vs30 (m/sn) DISPERSION MAP
P1
P2
P3
P4
P5
P6
P7
P8
P9
P10
P11
P12
P13
P14
P15
P16
1760
1740


T0 (sn) DISPERSION MAP
P1
P2
P3
P4
P5
P6
P7
P8
P9
P10
P11
P12
P13
P14
P15
P16
1760
1740


Ak DISPERSION MAP
P1
P2
P3
P4
P5
P6
P7
P8
P9
P10
P11
P12
P13
P14
P15
P16
1760
1740

WTG07


BEARING CAPACITY (kg/cm2)
P6
P7
P8
P9
P10
P11
P12
P15
1748
1744
1740
1736
1732
1728
1724
1720
0 10 20 30 40 50 60 70 80 90 100 110
11 10.5 10 9.5 9 8.5 8 7.5 7 6.5 6 5.5 5 4.5 4 3.5 3 2.5 2 1.5 1


YOUNG MODULE DISPERSIONE (kg/cm2)
P6
P7
P8
P9
P10
P11
P12
P15
1748
1744
1740
1736
1732
1728
1724
1720
0 10 20 30 40 50 60 70 80 90 100 110
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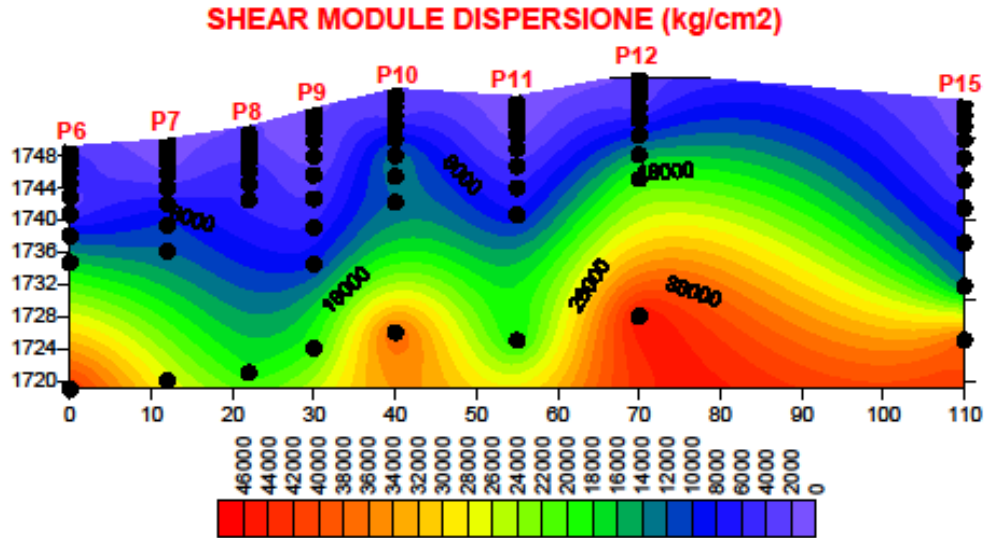
SHEAR MODULE DISPERSIONE (kg/cm2)
P6
P7
P8
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1736
1732
1728
1724
1720
0 10 20 30 40 50 60 70 80 90 100 110
46000 44000 42000 40000 38000 36000 34000 32000 30000 28000 26000 24000 22000 20000 18000 16000 14000 12000 10000 8000 6000 4000 2000 0

5.7.1. WTG07 Seismic P wave velocity (*Compressional Wave Velocity* (Vp))

Vp VELOCITY				
PROFILES	LAYERS	DEPTH	Vp_ Velocity	STRIPPABILITY
1_PROFILE	1. LAYER	-3,35	816	Simple Strippability
	2.LAYER	-14,99	1025	Simple Strippability
	3.LAYER		2122	High Difficult Strippability
2_PROFILE	1. LAYER	-5,70	802	Simple Strippability
	2. LAYER	-17,92	1498	Medium Strippability
	3. LAYER		3126	Explosive
3_PROFILE	1. LAYER	-6,19	692	Simple Strippability
	2. LAYER	-14,19	1037	Simple Strippability
	3. LAYER		1998	High Difficult Strippability
4_PROFILE	1. LAYER	-3,73	759	Simple Strippability
	2. LAYER	-11,72	1266	Medium Strippability
	3. LAYER		2494	Explosive
5_PROFILE	1. LAYER	-3,89	755	Simple Strippability
	2. LAYER	-12,24	1282	Medium Strippability
	3. LAYER		2633	Explosive
6_PROFILE	1. LAYER	-4,57	1131	Simple Strippability
	2. LAYER	-14,36	1484	Medium Strippability
	3. LAYER		2811	Explosive
7_PROFILE	1. LAYER	-4,43	601	Simple Strippability
	2.LAYER	-13,94	1248	Medium Strippability
	3.LAYER		2605	Explosive
8_PROFILE	1. LAYER	-2,75	981	Simple Strippability
	2. LAYER	-8,63	1215	Simple Strippability
	3. LAYER		2335	Explosive
9_PROFILE	1. LAYER	-8,54	812	Simple Strippability
	2. LAYER	-19,58	1153	Simple Strippability
	3. LAYER		2231	Explosive
10_PROFILE	1. LAYER	-3,11	1136	Simple Strippability
	2. LAYER	-13,91	1600	High Difficult Strippability
	3. LAYER		3191	Explosive
11_PROFILE	1. LAYER	-3,23	587	Simple Strippability
	2. LAYER	-14,45	976	Simple Strippability
	3. LAYER		2107	High Difficult Strippability
12_PROFILE	1. LAYER	-4,14	1097	Simple Strippability
	2. LAYER	-13,00	1585	High Difficult Strippability
	3. LAYER		3318	Explosive
13_PROFILE	1. LAYER	-3,55	1056	Simple Strippability
	2. LAYER	-15,90	1316	Medium Strippability
	3. LAYER		2555	Explosive
14_PROFILE	1. LAYER	-4,92	679	Simple Strippability
	2. LAYER	-15,47	1334	Medium Strippability
	3. LAYER		2683	Explosive
15_PROFILE	1. LAYER	-7,41	880	Simple Strippability
	2. LAYER	-23,31	1273	Medium Strippability
	3. LAYER		2590	Explosive
16_PROFILE	1. LAYER	-4,59	1426	Medium Strippability
	2. LAYER	-14,44	1468	Medium Strippability
	3. LAYER		2741	Explosive

P Wave Velocity (m/sec)	Strippability
Vp<458	High Simple Strippability
458<Vp<1220	Simple Strippability
1220<Vp<11525	Medium Strippability
1525<Vp<11830	Difficult Strippability
1830<Vp<12135	High Difficult Strippability
Vp>2135	Explosive Strippability

Strippability of floors with P wave velocity (Church, 1981)

‖AVERAGE‖			
LAYERS	DEPTH	Vp_ Velocity	STRIPPABILITY
1. LAYER	-4,63	888	Simple Strippability
2.LAYER	-14,88	1297	Medium Strippability
3.LAYER	∞	2596	Explosive

P wave velocities of the grounds in the study area and strippability

The above table shows the change table and strippability properties of Vp velocity depth values in the direction of the seismic data obtained from the field studies.

5.7.2. WTG07 Seismic S wave velocity (*Transverse Wave Velocity* (Vs))

Vs VELOCITY				
PROFILES	LAYERS	DEPTH	Vs_ Velocity	GROUND GROUPS
1_PROFILE	1. LAYER	-3,35	355	C
	2.LAYER	-14,99	469	B
	3.LAYER		884	A
2_PROFILE	1. LAYER	-5,70	367	C
	2. LAYER	-17,92	801	A
	3. LAYER		1469	A
3_PROFILE	1. LAYER	-6,19	223	C
	2. LAYER	-14,19	521	B
	3. LAYER		845	A
4_PROFILE	1. LAYER	-3,73	309	C
	2. LAYER	-11,72	604	B
	3. LAYER		1138	A
5_PROFILE	1. LAYER	-3,89	330	C
	2. LAYER	-12,24	666	B
	3. LAYER		1184	A
6_PROFILE	1. LAYER	-4,57	535	B
	2. LAYER	-14,36	619	B
	3. LAYER		1369	A
7_PROFILE	1. LAYER	-4,43	285	C
	2.LAYER	-13,94	664	B
	3.LAYER		1098	A
8_PROFILE	1. LAYER	-2,75	349	C
	2. LAYER	-8,63	538	B
	3. LAYER		926	A
9_PROFILE	1. LAYER	-8,54	262	C
	2. LAYER	-19,58	591	B
	3. LAYER		957	A
10_PROFILE	1. LAYER	-3,11	374	C
	2. LAYER	-13,91	733	A
	3. LAYER		1282	A
11_PROFILE	1. LAYER	-3,23	235	C
	2. LAYER	-14,45	486	B

	3. LAYER		920	A
12_PROFILE	1. LAYER	-4,14	390	C
	2. LAYER	-13,00	791	A
	3. LAYER		1394	A
13_PROFILE	1. LAYER	-3,55	339	C
	2. LAYER	-15,90	588	B
	3. LAYER		1203	A
14_PROFILE	1. LAYER	-4,92	331	C
	2. LAYER	-15,47	677	B
	3. LAYER		1291	A
15_PROFILE	1. LAYER	-7,41	314	C
	2. LAYER	-23,31	614	B
	3. LAYER		1315	A
16_PROFILE	1. LAYER	-4,59	657	B
	2. LAYER	-14,44	592	B
	3. LAYER		1320	A

S Wave Velocity (m/sec)	Ground group
Vs<200	D
200<Vs<400	C
400<Vs<700	B
700<Vs	A

Ground groups according to slip wave velocity(Abyyhy, 1998)

||AVERAGE||			
LAYERS	**DEPTH**	**Vs_ Velocity**	**GROUND GROUPS**
1. LAYER	-4,63	354	C
2.LAYER	-14,88	622	B
3.LAYER	∞	1162	A

S wave velocities of the grounds in the study area and ground group

Ground Group	Ground group and top ground layer thickness(h_1)
Z1	(A) Ground group h1< 15 m (B) Ground group
Z2	h_1> 15 m (B) Ground group h_1< 15 m (C) Ground group
Z3	15 m < h_1< 50 m (C) Ground group h_1< 10 m (D) Ground group
Z4	h_1> 50 m (C) Ground group h_1> 10 m (D) Ground group

Ground Group Class

The above table shows that Vs velocity values in the direction of the seismic data obtained in the field studies are the absolute change tables and that the layers are included in the ground groups.

5.7.3. WTG07 Vs30

PROFILES	Vs30 (m/sec)
1.PROFILE	521
2.PROFILE	702
3.PROFILE	468
4.PROFILE	603
5.PROFILE	633
6.PROFILE	741
7.PROFILE	582
8.PROFILE	549
9.PROFILE	521
10.PROFILE	742
11.PROFILE	493
12.PROFILE	765
13.PROFILE	641
14.PROFILE	644
15.PROFILE	574
16.PROFILE	741

Vs30 values in the direction of the seismic data obtained from the field studies are given in the table above.

5.7.4. WTG07 Shear Modulus-G (kg/cm²)

SHEAR MODULUS				
PROFILES	LAYERS	DEPTH	G(kg/cm^2)	ENDURANCE
1_PROFILE	1. LAYER	-3,35	2099	Medium
	2.LAYER	-14,99	4397	Sturdy
	3.LAYER		16434	Rock Highlid
2_PROFILE	1. LAYER	-5,70	2438	Medium
	2. LAYER	-17,92	13231	Rock Highlid
	3. LAYER		49991	Rock Highlid
3_PROFILE	1. LAYER	-6,19	1194	Weak
	2. LAYER	-14,19	4887	Sturdy
	3. LAYER		14814	Rock Highlid
4_PROFILE	1. LAYER	-3,73	1682	Medium
	2. LAYER	-11,72	7165	Sturdy
	3. LAYER		28377	Rock Highlid
5_PROFILE	1. LAYER	-3,89	1941	Medium
	2. LAYER	-12,24	8783	Sturdy
	3. LAYER		31150	Rock Highlid
6_PROFILE	1. LAYER	-4,57	5206	Sturdy
	2. LAYER	-14,36	8378	Sturdy
	3. LAYER		42304	Rock Highlid
7_PROFILE	1. LAYER	-4,43	1371	Weak
	2.LAYER	-13,94	8439	Sturdy
	3.LAYER		26694	Rock Highlid
8_PROFILE	1. LAYER	-2,75	2160	Medium
	2. LAYER	-8,63	5337	Sturdy
	3. LAYER		18478	Rock Highlid
9_PROFILE	1. LAYER	-8,54	1742	Medium
	2. LAYER	-19,58	6521	Sturdy
	3. LAYER		19498	Rock Highlid
10_PROFILE	1. LAYER	-3,11	2560	Medium
	2. LAYER	-13,91	10752	Rock Highlid
	3. LAYER		38300	Rock Highlid
11_PROFILE	1. LAYER	-3,23	896	Weak
	2. LAYER	-14,45	4498	Sturdy
	3. LAYER		17795	Rock Highlid

12_PROFILE	1. LAYER	-4,14	2765	Medium
	2. LAYER	-13,00	12795	Rock Highlid
	3. LAYER		45730	Rock Highlid
13_PROFILE	1. LAYER	-3,55	2066	Medium
	2. LAYER	-15,90	6691	Sturdy
	3. LAYER		31921	Rock Highlid
14_PROFILE	1. LAYER	-4,92	1937	Medium
	2. LAYER	-15,47	9402	Sturdy
	3. LAYER		37178	Rock Highlid
15_PROFILE	1. LAYER	-7,41	1739	Medium
	2. LAYER	-23,31	7522	Sturdy
	3. LAYER		38256	Rock Highlid
16_PROFILE	1. LAYER	-4,59	8466	Sturdy
	2. LAYER	-14,44	7760	Sturdy
	3. LAYER		39092	Rock Highlid

Shear Modulus (kg/cm^2)	Dayanım
G<400	High Weak
400<G<1500	Weak
1500<G<3000	Medium
3000<G<10000	Sturdy
10000<G	Rock Highlid

The endurance of ground or rocks according to Slip Module values(Keçeli, 1990)

$G = (d*Vs^2)/100$

‖AVERAGE‖			
LAYERS	DEPTH	G (kg/cm^2)	ENDURANCE
1. LAYER	-4,63	2516	Medium
2.LAYER	-14,88	7910	Sturdy
3.LAYER	∞	31001	Rock Highlid

Shear modules and endurance of the grounds in the study area

Calculation of shear Modulus values in the direction of the seismic data obtained in the field studies and the table of variation are given in the table above.

5.7.5. WTG07 Elasticity Modulus-E (kg/cm²)

ELASTIC MODULUS				
PROFILES	LAYERS	DEPTH	E(kg/cm^2)	ENDURANCE
1_PROFILE	1. LAYER	-3,35	5791	Medium
	2.LAYER	-14,99	11725	Sturdy
	3.LAYER		45852	Rock Highlid
2_PROFILE	1. LAYER	-5,70	6433	Medium
	2. LAYER	-17,92	34236	Rock Highlid
	3. LAYER		135815	Rock Highlid
3_PROFILE	1. LAYER	-6,19	3320	Weak
	2. LAYER	-14,19	13022	Sturdy
	3. LAYER		41212	Rock Highlid
4_PROFILE	1. LAYER	-3,73	4590	Weak
	2. LAYER	-11,72	19222	Sturdy
	3. LAYER		77666	Rock Highlid
5_PROFILE	1. LAYER	-3,89	5111	Medium
	2. LAYER	-12,24	22997	Sturdy
	3. LAYER		85548	Rock Highlid

6_PROFILE	1. LAYER	-4,57	13974	Sturdy
	2. LAYER	-14,36	22412	Sturdy
	3. LAYER		113759	Rock Highlid
7_PROFILE	1. LAYER	-4,43	3580	Weak
	2.LAYER	-13,94	21976	Sturdy
	3.LAYER		74316	Rock Highlid
8_PROFILE	1. LAYER	-2,75	6126	Medium
	2. LAYER	-8,63	14627	Sturdy
	3. LAYER		51987	Rock Highlid
9_PROFILE	1. LAYER	-8,54	4831	Weak
	2. LAYER	-19,58	17239	Sturdy
	3. LAYER		54101	Rock Highlid
10_PROFILE	1. LAYER	-3,11	7339	Medium
	2. LAYER	-13,91	29307	Sturdy
	3. LAYER		107527	Rock Highlid
11_PROFILE	1. LAYER	-3,23	2444	Weak
	2. LAYER	-14,45	11938	Sturdy
	3. LAYER		49188	Rock Highlid
12_PROFILE	1. LAYER	-4,14	7857	Medium
	2. LAYER	-13,00	34171	Rock Highlid
	3. LAYER		127385	Rock Highlid
13_PROFILE	1. LAYER	-3,55	5940	Medium
	2. LAYER	-15,90	18227	Sturdy
	3. LAYER		86661	Rock Highlid
14_PROFILE	1. LAYER	-4,92	5056	Medium
	2. LAYER	-15,47	24529	Sturdy
	3. LAYER		100336	Rock Highlid
15_PROFILE	1. LAYER	-7,41	4899	Weak
	2. LAYER	-23,31	20091	Sturdy
	3. LAYER		101475	Rock Highlid
16_PROFILE	1. LAYER	-4,59	22717	Sturdy
	2. LAYER	-14,44	20812	Sturdy
	3. LAYER		105468	Rock Highlid

Elastic Modulus (kg/cm^2)	Dayanım
E<1000	High Weak
1000<E<5000	Weak
5000<E<10000	Medium
10000<E<30000	Sturdy
30000<E	Rock Highlid

The endurance of ground or rocks according to Slip Module values(Keçeli, 1990)

$E=G*(3*V_p^2-4*V_s^2)/(V_p^2-V_s^2)$

||AVERAGE||		
LAYERS	**DEPTH**	**E (kg/cm^2)**	**ENDURANCE**
1. LAYER	-4,63	6876	Medium
2.LAYER	-14,88	21033	Sturdy
3.LAYER	∞	84894	Rock Highlid

Elasticity modules and endurance of the grounds in the study area

Calculation of the modulus of elasticity in the direction of the seismic data obtained in the field studies and the change table are given in the above table

5.7.6. WTG07 Poisson's Ratio - (б)

POISSON'S RATIO				
PROFILES	LAYERS	DEPTH	(σ)	POROSITY
1_PROFILE	1. LAYER	-3,35	0,38	High Porous
	2.LAYER	-14,99	0,36	High Porous
	3.LAYER		0,40	High Porous
2_PROFILE	1. LAYER	-5,70	0,35	Medium Porous
	2. LAYER	-17,92	0,30	Medium Porous
	3. LAYER		0,36	High Porous
3_PROFILE	1. LAYER	-6,19	0,41	High Porous
	2. LAYER	-14,19	0,33	Medium Porous
	3. LAYER		0,39	High Porous
4_PROFILE	1. LAYER	-3,73	0,39	High Porous
	2. LAYER	-11,72	0,35	High Porous
	3. LAYER		0,37	High Porous
5_PROFILE	1. LAYER	-3,89	0,36	High Porous
	2. LAYER	-12,24	0,32	Medium Porous
	3. LAYER		0,37	High Porous
6_PROFILE	1. LAYER	-4,57	0,35	High Porous
	2. LAYER	-14,36	0,38	High Porous
	3. LAYER		0,34	Medium Porous
7_PROFILE	1. LAYER	-4,43	0,34	Medium Porous
	2.LAYER	-13,94	0,30	Medium Porous
	3.LAYER		0,39	High Porous
8_PROFILE	1. LAYER	-2,75	0,42	High Porous
	2. LAYER	-8,63	0,37	High Porous
	3. LAYER		0,41	High Porous
9_PROFILE	1. LAYER	-8,54	0,40	High Porous
	2. LAYER	-19,58	0,32	Medium Porous
	3. LAYER		0,39	High Porous
10_PROFILE	1. LAYER	-3,11	0,44	High Porous
	2. LAYER	-13,91	0,36	High Porous
	3. LAYER		0,40	High Porous
11_PROFILE	1. LAYER	-3,23	0,39	High Porous
	2. LAYER	-14,45	0,34	Medium Porous
	3. LAYER		0,38	High Porous
12_PROFILE	1. LAYER	-4,14	0,43	High Porous
	2. LAYER	-13,00	0,33	Medium Porous
	3. LAYER		0,39	High Porous
13_PROFILE	1. LAYER	-3,55	0,44	High Porous
	2. LAYER	-15,90	0,37	High Porous
	3. LAYER		0,36	High Porous
14_PROFILE	1. LAYER	-4,92	0,33	Medium Porous
	2. LAYER	-15,47	0,33	Medium Porous
	3. LAYER		0,35	Medium Porous
15_PROFILE	1. LAYER	-7,41	0,42	High Porous
	2. LAYER	-23,31	0,35	Medium Porous
	3. LAYER		0,33	Medium Porous
16_PROFILE	1. LAYER	-4,59	0,36	High Porous
	2. LAYER	-14,44	0,39	High Porous
	3. LAYER		0,35	Medium Porous

Poisson's Ratio;(σ)	Porosity
0,00≤σ≤0,25	Nonporous
0,26≤σ≤0,35	Medium Porous
0,36≤σ≤0,50	High Porous

Poisson ratio classification

$\sigma=(Vp^2-2*Vs^2)/(2*Vp^2-2*Vs^2)$

‖AVERAGE‖			
LAYERS	DEPTH	(σ)	POROSITY
1. LAYER	-4,63	0,39	High Porous
2.LAYER	-14,88	0,34	Medium Porous
3.LAYER	∞	0,37	High Porous

Poisson's ratio values of the units in the study area, porosity

Calculation of poisson's ratio values in the direction of the seismic data obtained in the field studies and the change table are given in the above table.

5.7.7. WTG07 Density - ρ (gr/ cm^3)

POISSON'S RATIO				
PROFILES	LAYERS	DEPTH	(σ)	POROSITY
1_PROFILE	1. LAYER	-3,35	0,38	High Porous
	2.LAYER	-14,99	0,36	High Porous
	3.LAYER		0,40	High Porous
2_PROFILE	1. LAYER	-5,70	0,35	Medium Porous
	2. LAYER	-17,92	0,30	Medium Porous
	3. LAYER		0,36	High Porous
3_PROFILE	1. LAYER	-6,19	0,41	High Porous
	2. LAYER	-14,19	0,33	Medium Porous
	3. LAYER		0,39	High Porous
4_PROFILE	1. LAYER	-3,73	0,39	High Porous
	2. LAYER	-11,72	0,35	High Porous
	3. LAYER		0,37	High Porous
5_PROFILE	1. LAYER	-3,89	0,36	High Porous
	2. LAYER	-12,24	0,32	Medium Porous
	3. LAYER		0,37	High Porous
6_PROFILE	1. LAYER	-4,57	0,35	High Porous
	2. LAYER	-14,36	0,38	High Porous
	3. LAYER		0,34	Medium Porous
7_PROFILE	1. LAYER	-4,43	0,34	Medium Porous
	2.LAYER	-13,94	0,30	Medium Porous
	3.LAYER		0,39	High Porous
8_PROFILE	1. LAYER	-2,75	0,42	High Porous
	2. LAYER	-8,63	0,37	High Porous
	3. LAYER		0,41	High Porous

9_PROFILE	1. LAYER	-8,54	0,40	High Porous
	2. LAYER	-19,58	0,32	Medium Porous
	3. LAYER		0,39	High Porous
10_PROFILE	1. LAYER	-3,11	0,44	High Porous
	2. LAYER	-13,91	0,36	High Porous
	3. LAYER		0,40	High Porous
11_PROFILE	1. LAYER	-3,23	0,39	High Porous
	2. LAYER	-14,45	0,34	Medium Porous
	3. LAYER		0,38	High Porous
12_PROFILE	1. LAYER	-4,14	0,43	High Porous
	2. LAYER	-13,00	0,33	Medium Porous
	3. LAYER		0,39	High Porous
13_PROFILE	1. LAYER	-3,55	0,44	High Porous
	2. LAYER	-15,90	0,37	High Porous
	3. LAYER		0,36	High Porous
14_PROFILE	1. LAYER	-4,92	0,33	Medium Porous
	2. LAYER	-15,47	0,33	Medium Porous
	3. LAYER		0,35	Medium Porous
15_PROFILE	1. LAYER	-7,41	0,42	High Porous
	2. LAYER	-23,31	0,35	Medium Porous
	3. LAYER		0,33	Medium Porous
16_PROFILE	1. LAYER	-4,59	0,36	High Porous
	2. LAYER	-14,44	0,39	High Porous
	3. LAYER		0,35	Medium Porous

Density: ρ (gr/cm^3)	Tanımlama
ρ<1,20	High low
1,20<ρ<1,40	Low
1,40<ρ<1,90	Medium
1,90<ρ<2,20	High
2,20<ρ	Too High

Density Classification of Ground Units: (Keçeli, 1990)

$\rho = d = 0.31 * Vp0.25$

||AVERAGE||

LAYERS	DEPTH	ρ (gr/cm^3)	DEFINITION
1. LAYER	-4,63	0,39	High Porous
2.LAYER	-14,88	0,34	Medium Porous
3.LAYER	∞	0,37	High Porous

Density values and description of the units in the study area

Calculation of the density values of the geological units in the direction of the seismic data obtained in the field studies and the table of variation are given in the above table.

5.7.8. WTG07 Modulus of Subgrade Reaction – D Y K (ton/m^3)

Modulus of Subgrade Reaction			
PROFILES	LAYERS	DEPTH	D Y K (ton/m^3)
1_PROFILE	1. LAYER	-3,35	2561
	2.LAYER	-14,99	3487
	3.LAYER		7317
2_PROFILE	1. LAYER	-5,70	2648
	2. LAYER	-17,92	6265
	3. LAYER		13364
3_PROFILE	1. LAYER	-6,19	1913
	2. LAYER	-14,19	3857
	3. LAYER		6914
4_PROFILE	1. LAYER	-3,73	2213
	2. LAYER	-11,72	4597
	3. LAYER		9769
5_PROFILE	1. LAYER	-3,89	2362
	2. LAYER	-12,24	5085
	3. LAYER		10300
6_PROFILE	1. LAYER	-4,57	3993
	2. LAYER	-14,36	4825
	3. LAYER		12105
7_PROFILE	1. LAYER	-4,43	2008
	2.LAYER	-13,94	5045
	3.LAYER		9523
8_PROFILE	1. LAYER	-2,75	2566
	2. LAYER	-8,63	4059
	3. LAYER		7828
9_PROFILE	1. LAYER	-8,54	2294
	2. LAYER	-19,58	4438
	3. LAYER		8005
10_PROFILE	1. LAYER	-3,11	2796
	2. LAYER	-13,91	5775
	3. LAYER		11736
11_PROFILE	1. LAYER	-3,23	1649
	2. LAYER	-14,45	3593
	3. LAYER		7609
12_PROFILE	1. LAYER	-4,14	2904
	2. LAYER	-13,00	6235
	3. LAYER		12906
13_PROFILE	1. LAYER	-3,55	2513
	2. LAYER	-15,90	4491
	3. LAYER		10390
14_PROFILE	1. LAYER	-4,92	2359
	2. LAYER	-15,47	5206
	3. LAYER		11280
15_PROFILE	1. LAYER	-7,41	2285
	2. LAYER	-23,31	4686
	3. LAYER		11392
16_PROFILE	1. LAYER	-4,59	5064
	2. LAYER	-14,44	4605
	3. LAYER		11598

LAYERS	‖AVERAGE‖ DEPTH	D Y K (ton/m^3)
1. LAYER	-4,63	2633
2.LAYER	-14,88	4765
3.LAYER	∞	10127
kv= 40*(Gs)*qu ton/m^3 *(Bowles 1984)*		

The above table shows the Modulus of Subgrade Reaction obtained for each layer in the direction of the data obtained after the seismic measurements made in the study area.

5.7.9. WTG07 Bearing Capacity qu (kg/cm2) / Allowable Bearing Capacity qa (kg/cm2)

PROFILES	LAYERS	DEPTH	BEARING CAPACITY (qu,kg/cm^2)	ALLOWABLE BEARING CAPACITY (qa,kg/cm^2)
1_PROFILE	1. LAYER	-3,35	6,40	2,13
	2.LAYER	-14,99	8,72	2,91
	3.LAYER	-35,01	18,29	6,10
2_PROFILE	1. LAYER	-5,70	6,62	2,21
	2. LAYER	-17,92	15,66	5,22
	3. LAYER	-32,08	33,41	11,14
3_PROFILE	1. LAYER	-6,19	4,78	1,59
	2. LAYER	-14,19	9,64	3,21
	3. LAYER	-35,81	17,28	5,76
4_PROFILE	1. LAYER	-3,73	5,53	1,84
	2. LAYER	-11,72	11,49	3,83
	3. LAYER	-38,28	24,42	8,14
5_PROFILE	1. LAYER	-3,89	5,90	1,97
	2. LAYER	-12,24	12,71	4,24
	3. LAYER	-37,76	25,75	8,58
6_PROFILE	1. LAYER	-4,57	9,98	3,33
	2. LAYER	-14,36	12,06	4,02
	3. LAYER	-35,64	30,26	10,09
7_PROFILE	1. LAYER	-4,43	5,02	1,67
	2.LAYER	-13,94	12,61	4,20
	3.LAYER	-36,06	23,81	7,94
8_PROFILE	1. LAYER	-2,75	6,41	2,14
	2. LAYER	-8,63	10,15	3,38
	3. LAYER	-41,37	19,57	6,52
9_PROFILE	1. LAYER	-8,54	5,73	1,91
	2. LAYER	-19,58	11,10	3,70
	3. LAYER	-30,42	20,01	6,67
10_PROFILE	1. LAYER	-3,11	6,99	2,33
	2. LAYER	-13,91	14,44	4,81
	3. LAYER	-36,09	29,34	9,78
11_PROFILE	1. LAYER	-3,23	4,12	1,37
	2. LAYER	-14,45	8,98	2,99
	3. LAYER	-35,55	19,02	6,34
12_PROFILE	1. LAYER	-4,14	7,26	2,42
	2. LAYER	-13,00	15,59	5,20
	3. LAYER	-37,00	32,26	10,75
13_PROFILE	1. LAYER	-3,55	6,28	2,09
	2. LAYER	-15,90	11,23	3,74
	3. LAYER	-34,10	25,97	8,66
14_PROFILE	1. LAYER	-4,92	5,90	1,97
	2. LAYER	-15,47	13,02	4,34

	3. LAYER	-34,53	28,20	9,40
15_PROFILE	1. LAYER	-7,41	5,71	1,90
	2. LAYER	-23,31	11,71	3,90
	3. LAYER	-26,69	28,48	9,49
16_PROFILE	1. LAYER	-4,59	12,66	4,22
	2. LAYER	-14,44	11,51	3,84
	3. LAYER	-35,56	28,99	9,66

LAYERS	‖AVERAGE‖ DEPTH	Bearing Capacity (qu,kg/cm^2)
1. LAYER	-4,63	6,58
2.LAYER	-14,88	11,91
3.LAYER	∞	25,32

qu=(0,024*Vs*(J.B.K+0,002*Vp)*0,71)/G.K

BEARING CAPACITY CALCULATION (Prof. Dr. SEMIH TEZCAN-2006)	Geological unit factor 18	16	17	18	20
	Safety factor 50-100	CLAY	SAND	SEDIMENT	VOLATISILE

LAYERS	‖AVERAGE‖ DEPTH	Allowable Bearing Capacity (qa,kg/cm^2)
1. LAYER	-4,63	2,19
2.LAYER	-14,88	3,97
3.LAYER	∞	8,44

qa=qu/G.K G.K=3 empirical value

5.7.10 WTG07 Vibration Period - T_0 (sec) / Ground Amplification (Ak)

PROFILES	To (sec)	Ta (sec)	Tb (sec)	Ak (Amplification)
1.PROFILE	0,30	0,20	0,45	1,59
2.PROFILE	0,22	0,15	0,33	1,33
3.PROFILE	0,32	0,22	0,49	1,70
4.PROFILE	0,24	0,16	0,36	1,46
5.PROFILE	0,23	0,15	0,35	1,42
6.PROFILE	0,20	0,14	0,31	1,29
7.PROFILE	0,26	0,17	0,39	1,49
8.PROFILE	0,26	0,17	0,38	1,54
9.PROFILE	0,31	0,21	0,47	1,59
10.PROFILE	0,21	0,14	0,31	1,29
11.PROFILE	0,31	0,20	0,46	1,65
12.PROFILE	0,19	0,13	0,29	1,27
13.PROFILE	0,24	0,16	0,36	1,41
14.PROFILE	0,23	0,16	0,35	1,40
15.PROFILE	0,28	0,19	0,42	1,50
16.PROFILE	0,21	0,14	0,31	1,29

AVERAGE			
To (sec)	Ta (sec)	Tb (sec)	Ak (Amplification)
0,25	0,17	0,38	1,45

$To = \sum 4H\ Vs\ n\ \imath$=1 (sec)……. (Zeevaert,1967)

Ak=68*$Vs_{30}^{-0,6}$…… (Midorikawa, 1987)

The Vibration Period and Ground Amplification calculated in the direction of the parameters obtained during the seismic studies made during the field survey are presented in the table above.

5. 8. WTG08

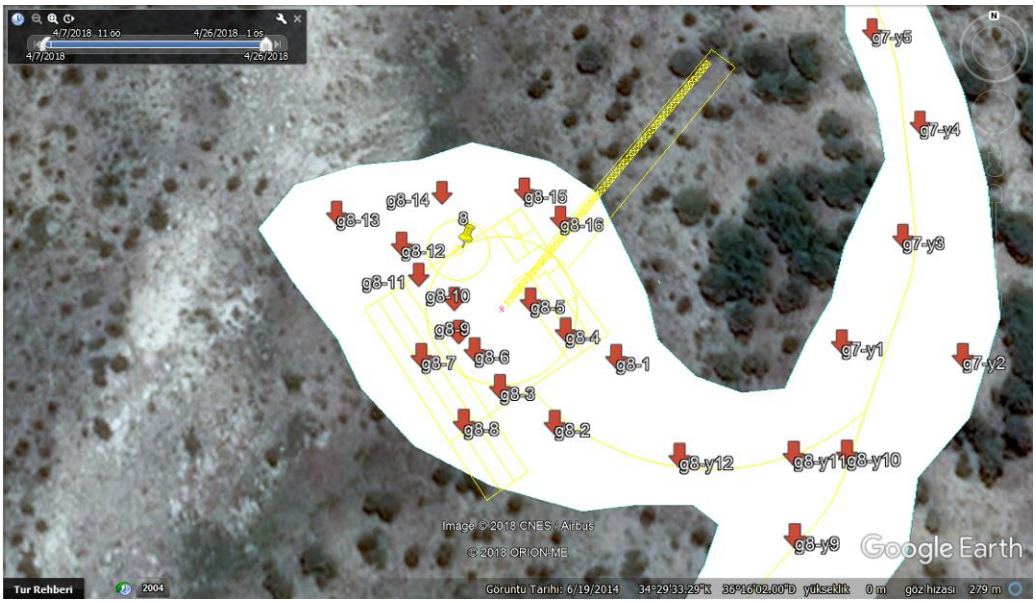
There are 16 measurements on the WTG. These measurements showed 3 layers. Layer 1 was found between 0,00 m and 4,70 m depths, Layer 2 between 4,70 m and 15,78 m depths and Layer 3 at an average depth of 15,78 m. These layer parameters are given in the table below.

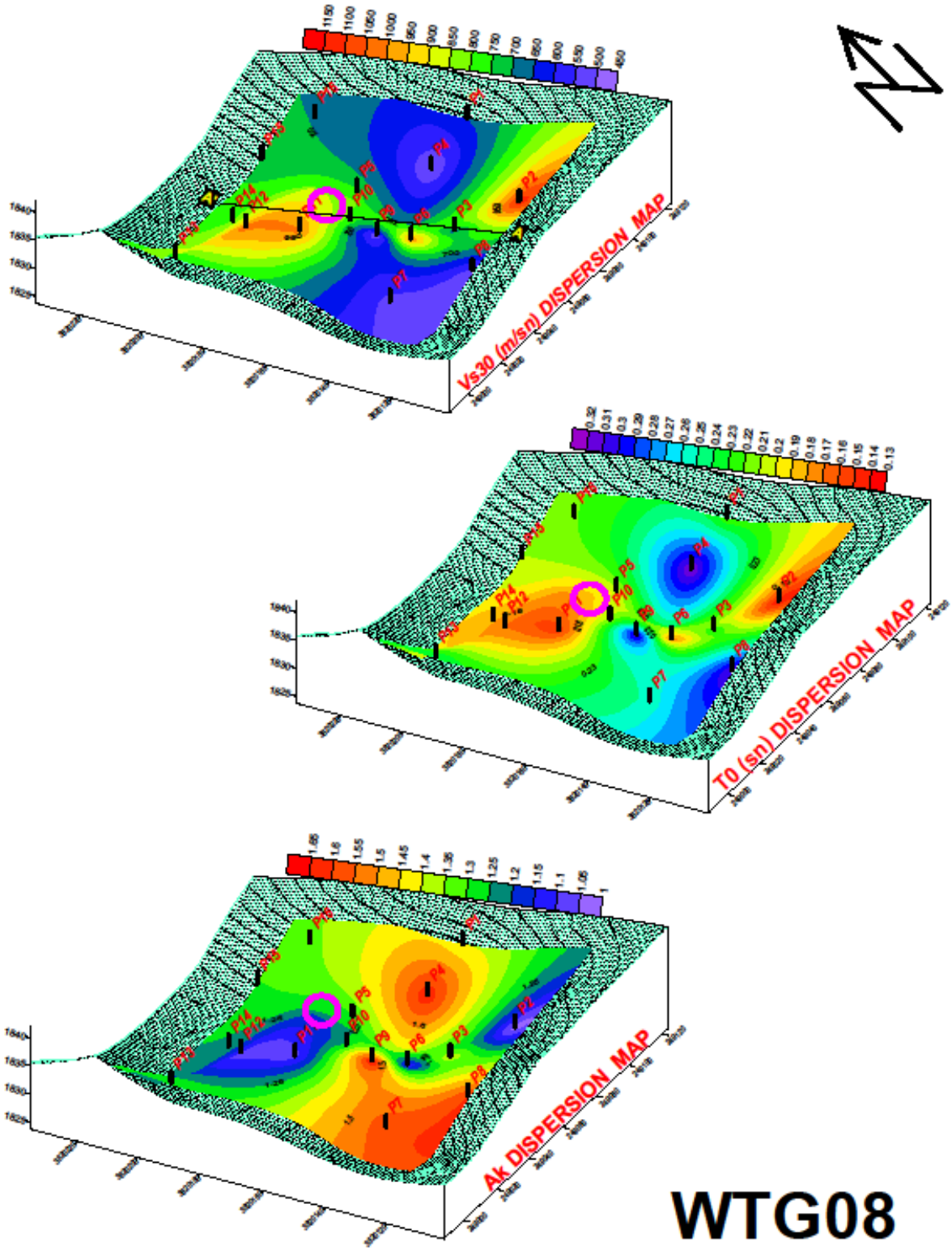
LAYERS	Vp_ Velocity	STRIPPABILITY
1. LAYER	1125	Simple strippability
2.LAYER	1552	High-hard strippability
3.LAYER	3042	Explosive
LAYERS	**Vs_ Velocity**	**GROUND GROUP**
1. LAYER	440	B
2.LAYER	729	A
3.LAYER	1360	A
LAYERS	**G (kg/cm2)**	**ENDURANCE**
1. LAYER	4615	Sturdy
2.LAYER	11950	High sturdy
3.LAYER	47244	High sturdy
LAYERS	**E (kg/cm2)**	**ENDURANCE**
1. LAYER	12602	Sturdy
2.LAYER	31879	High sturdy
3.LAYER	129462	High sturdy

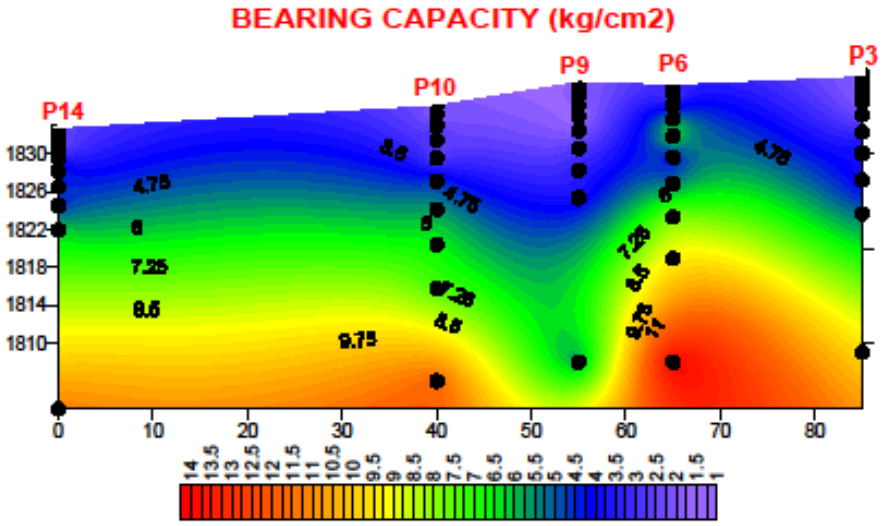
LAYERS	(σ)	POROSITY
1. LAYER	0,39	High Porosity
2.LAYER	0,35	Medium Porosity
3.LAYER	0,37	High Porosity
LAYERS	**ρ (gr/cm3)**	**DEFINITION**
1. LAYER	1,78	Medium
2.LAYER	1,93	High
3.LAYER	2,29	High
LAYERS	**D Y K (ton/m^3)**	
1. LAYER	3432	
2.LAYER	5776	
3.LAYER	12529	
LAYERS	**Ground Carrying Capacity (qu,kg/cm2)**	**Secure Carrying Capacity (qa,kg/cm2)**
1. LAYER	8,58	2,86
2.LAYER	14,44	4,81
3.LAYER	31,32	10,44

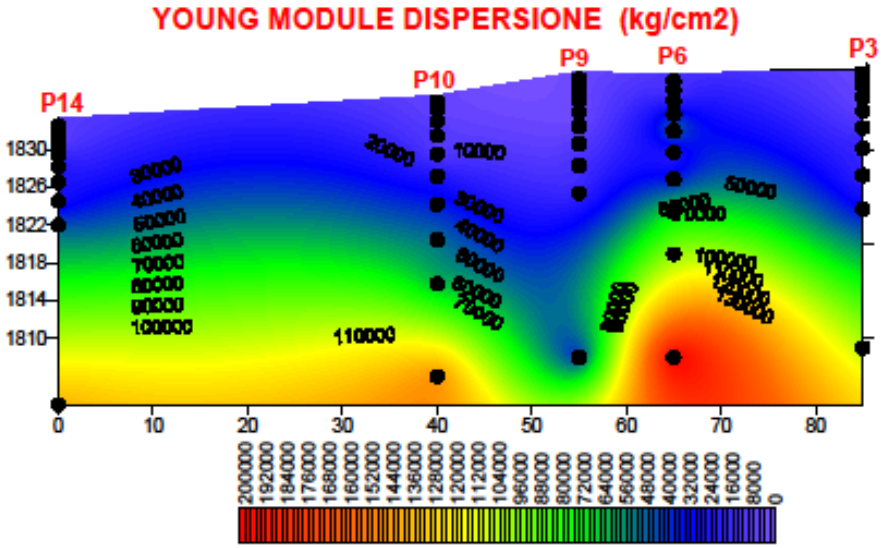
To (sec)	Ta (sec)	Tb (sec)	Vs30 (m/sec)	Ak (Amplification)
0,22	0,15	0,33	748	1,32

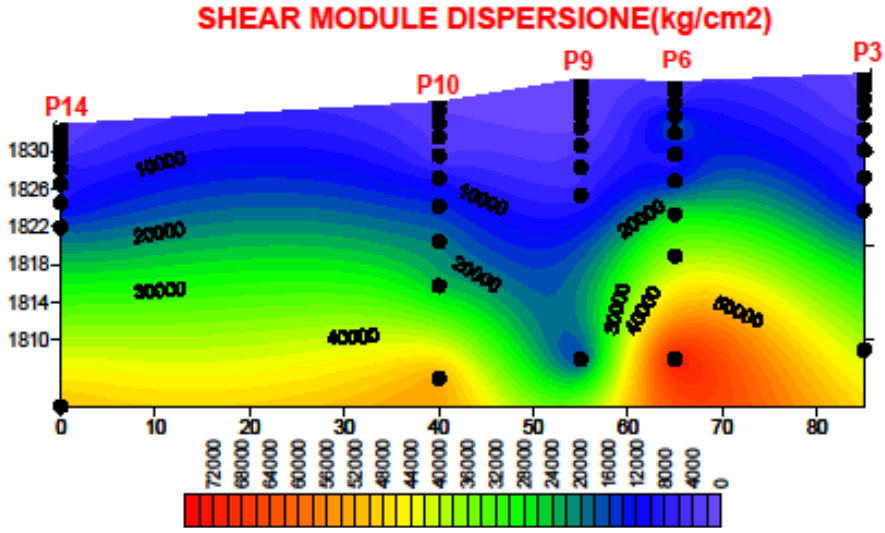
It is recommended to excavate the first 1.85 meter from the surface of the seventh (7) profile terrain. Taking into account the following applications, the profile points should be seen in the engineering parameters section for detailed values.




Vs30 (m/sn) DISPERSION MAP
T0 (sn) DISPERSION MAP
Ak DISPERSION MAP
WTG08


BEARING CAPACITY (kg/cm2)
P14
P10
P9
P6
P3
1830
1826
1822
1818
1814
1810
0 10 20 30 40 50 60 70 80
14 13.5 13 12.5 12 11.5 11 10.5 10 9.5 9 8.5 8 7.5 7 6.5 6 5.5 5 4.5 4 3.5 3 2.5 2 1.5 1


YOUNG MODULE DISPERSIONE (kg/cm2)
P14
P10
P9
P6
P3
1830
1826
1822
1818
1814
1810
0 10 20 30 40 50 60 70 80
200000 192000 184000 176000 168000 160000 152000 144000 136000 128000 120000 112000 104000 96000 88000 80000 72000 64000 56000 48000 40000 32000 24000 16000 8000 0


SHEAR MODULE DISPERSIONE(kg/cm2)
P14
P10
P9
P6
P3
1830
1826
1822
1818
1814
1810
0 10 20 30 40 50 60 70 80
72000 68000 64000 60000 56000 52000 48000 44000 40000 36000 32000 28000 24000 20000 16000 12000 8000 4000 0

5.8.1. WTG08 Seismic P wave velocity (*Compressional Wave Velocity* (Vp))

Vp VELOCITY				
PROFILES	LAYERS	DEPTH	Vp_ Velocity	STRIPPABILITY
1_PROFILE	1. LAYER	-3,40	833	Simple Strippability
	2.LAYER	-10,70	1378	Medium Strippability
	3.LAYER		2867	Explosive
2_PROFILE	1. LAYER	-2,35	1098	Simple Strippability
	2. LAYER	-15,94	2051	High Difficult Strippability
	3. LAYER		4828	Explosive
3_PROFILE	1. LAYER	-4,85	895	Simple Strippability
	2. LAYER	-15,26	1334	Medium Strippability
	3. LAYER		2635	Explosive
4_PROFILE	1. LAYER	-7,52	804	Simple Strippability
	2. LAYER	-17,23	1095	Simple Strippability
	3. LAYER		2065	High Difficult Strippability
5_PROFILE	1. LAYER	-3,20	782	Simple Strippability
	2. LAYER	-14,30	1625	High Difficult Strippability
	3. LAYER		3188	Explosive
6_PROFILE	1. LAYER	-2,82	1497	Medium Strippability
	2. LAYER	-19,06	2018	High Difficult Strippability
	3. LAYER		4054	Explosive
7_PROFILE	1. LAYER	-1,85	724	Simple Strippability
	2.LAYER	-5,82	1029	Simple Strippability
	3.LAYER		2089	High Difficult Strippability
8_PROFILE	1. LAYER	-7,50	911	Simple Strippability
	2. LAYER	-17,19	1164	Simple Strippability
	3. LAYER		2150	Explosive
9_PROFILE	1. LAYER	-5,50	760	Simple Strippability
	2. LAYER	-12,62	1073	Simple Strippability
	3. LAYER		1972	High Difficult Strippability
10_PROFILE	1. LAYER	-4,52	875	Simple Strippability
	2. LAYER	-20,23	1614	High Difficult Strippability
	3. LAYER		3442	Explosive
11_PROFILE	1. LAYER	-4,81	2114	High Difficult Strippability
	2. LAYER	-15,11	2077	High Difficult Strippability
	3. LAYER		3554	Explosive
12_PROFILE	1. LAYER	-7,41	1489	Medium Strippability
	2. LAYER	-23,31	2103	High Difficult Strippability
	3. LAYER		4303	Explosive
13_PROFILE	1. LAYER	-8,15	1381	Medium Strippability
	2. LAYER	-25,63	1657	High Difficult Strippability
	3. LAYER		2846	Explosive
14_PROFILE	1. LAYER	-3,50	1258	Medium Strippability
	2. LAYER	-11,02	1672	High Difficult Strippability
	3. LAYER		3152	Explosive
15_PROFILE	1. LAYER	-4,65	1377	Medium Strippability
	2. LAYER	-14,64	1634	High Difficult Strippability
	3. LAYER		2891	Explosive
16_PROFILE	1. LAYER	-3,21	1198	Simple Strippability
	2. LAYER	-14,38	1308	Medium Strippability
	3. LAYER		2633	Explosive

P Wave Velocity (m/sec)	Strippability
Vp<458	High Simple Strippability
458<Vp<1220	Simple Strippability
1220<Vp<11525	Medium Strippability
1525<Vp<11830	Difficult Strippability
1830<Vp<12135	High Difficult Strippability
Vp>2135	Explosive Strippability

Strippability of floors with P wave velocity (Church, 1981)

‖AVERAGE‖			
LAYERS	DEPTH	Vp_ Velocity	STRIPPABILITY
1. LAYER	-4,70	1125	Simple Strippability
2.LAYER	-15,78	1552	High Difficult Strippability
3.LAYER	∞	3042	Explosive

P wave velocities of the grounds in the study area and strippability

The above table shows the change table and strippability properties of Vp velocity depth values in the direction of the seismic data obtained from the field studies.

5.8.2. WTG08 Seismic S wave velocity (*Transverse Wave Velocity* (Vs))

Vs VELOCITY				
PROFILES	LAYERS	DEPTH	Vs_ Velocity	GROUND GROUPS
1_PROFILE	1. LAYER	-3,40	306	C
	2.LAYER	-10,70	674	B
	3.LAYER	-39,30	1184	A
2_PROFILE	1. LAYER	-2,35	479	B
	2. LAYER	-15,94	1068	A
	3. LAYER	-34,06	2181	A
3_PROFILE	1. LAYER	-4,85	325	C
	2. LAYER	-15,26	630	B
	3. LAYER		1334	A
4_PROFILE	1. LAYER	-7,52	265	C
	2. LAYER	-17,23	574	B
	3. LAYER		869	A
5_PROFILE	1. LAYER	-3,20	338	C
	2. LAYER	-14,30	846	A
	3. LAYER		1349	A
6_PROFILE	1. LAYER	-2,82	496	B
	2. LAYER	-19,06	932	A
	3. LAYER		1707	A
7_PROFILE	1. LAYER	-1,85	258	C
	2.LAYER	-5,82	493	B
	3.LAYER		925	A
8_PROFILE	1. LAYER	-7,50	289	C
	2. LAYER	-17,19	568	B
	3. LAYER		873	A
9_PROFILE	1. LAYER	-5,50	250	C
	2. LAYER	-12,62	536	B
	3. LAYER		833	A
10_PROFILE	1. LAYER	-4,52	383	C
	2. LAYER	-20,23	803	A

	3. LAYER		1492	A
11_PROFILE	1. LAYER	-4,81	1008	A
	2. LAYER	-15,11	787	A
	3. LAYER		1833	A
12_PROFILE	1. LAYER	-7,41	602	B
	2. LAYER	-23,31	1073	A
	3. LAYER		1892	A
13_PROFILE	1. LAYER	-8,15	521	B
	2. LAYER	-25,63	698	B
	3. LAYER		1311	A
14_PROFILE	1. LAYER	-3,50	431	B
	2. LAYER	-11,02	738	A
	3. LAYER		1474	A
15_PROFILE	1. LAYER	-4,65	514	B
	2. LAYER	-14,64	672	B
	3. LAYER		1275	A
16_PROFILE	1. LAYER	-3,21	576	B
	2. LAYER	-14,38	578	B
	3. LAYER		1232	A

S Wave Velocity (m/sec)	Ground group
Vs<200	D
200<Vs<400	C
400<Vs<700	B
700<Vs	A

Ground groups according to slip wave velocity(Abyyhy, 1998)

||AVERAGE||			
LAYERS	**DEPTH**	**Vs_ Velocity**	**GROUND GROUPS**
1. LAYER	-4,70	440	B
2.LAYER	-15,78	729	A
3.LAYER	∞	1360	A

S wave velocities of the grounds in the study area and ground group

Ground Group	Ground group and top ground layer thickness(h_1)
Z1	(A) Ground group h1< 15 m (B) Ground group
Z2	h_1> 15 m (B) Ground group h_1< 15 m (C) Ground group
Z3	15 m < h_1< 50 m (C) Ground group h_1< 10 m (D) Ground group
Z4	h_1> 50 m (C) Ground group h_1> 10 m (D) Ground group

Ground Group Class

The above table shows that Vs velocity values in the direction of the seismic data obtained in the field studies are the absolute change tables and that the layers are included in the ground groups.

5.8.3. WTG08 Vs30

PROFILES	Vs30 (m/sec)
1.PROFILE	648
2.PROFILE	1122
3.PROFILE	655
4.PROFILE	497
5.PROFILE	757
6.PROFILE	992
7.PROFILE	528
8.PROFILE	518
9.PROFILE	488
10.PROFILE	771
11.PROFILE	1004
12.PROFILE	1018
13.PROFILE	739
14.PROFILE	798
15.PROFILE	735
16.PROFILE	696

Vs30 values in the direction of the seismic data obtained from the field studies are given in the table above.

5.8.4. WTG08 Shear Modulus-G (kg/cm²)

SHEAR MODULUS				
PROFILES	LAYERS	DEPTH	G(kg/cm^2)	ENDURANCE
1_PROFILE	1. LAYER	-3,40	1652	Medium
	2.LAYER	-10,70	8924	Sturdy
	3.LAYER		31824	Rock Highlid
2_PROFILE	1. LAYER	-2,35	4506	Sturdy
	2. LAYER	-15,94	26869	Rock Highlid
	3. LAYER		122864	Rock Highlid
3_PROFILE	1. LAYER	-4,85	1807	Medium
	2. LAYER	-15,26	7660	Sturdy
	3. LAYER		39502	Rock Highlid
4_PROFILE	1. LAYER	-7,52	2040	Medium
	2. LAYER	-17,23	6010	Sturdy
	3. LAYER		15791	Rock Highlid
5_PROFILE	1. LAYER	-3,20	2076	Medium
	2. LAYER	-14,30	14992	Rock Highlid
	3. LAYER		42364	Rock Highlid
6_PROFILE	1. LAYER	-2,82	4833	Sturdy
	2. LAYER	-19,06	19326	Rock Highlid
	3. LAYER		72088	Rock Highlid
7_PROFILE	1. LAYER	-1,85	1078	Weak
	2.LAYER	-5,82	4567	Sturdy
	3.LAYER		17920	Rock Highlid
8_PROFILE	1. LAYER	-7,50	2509	Medium
	2. LAYER	-17,19	5876	Sturdy
	3. LAYER		16086	Rock Highlid
9_PROFILE	1. LAYER	-5,50	1519	Medium
	2. LAYER	-12,62	5171	Sturdy
	3. LAYER		14325	Rock Highlid
10_PROFILE	1. LAYER	-4,52	2685	Medium
	2. LAYER	-20,23	13964	Rock Highlid
	3. LAYER		52889	Rock Highlid
11_PROFILE	1. LAYER	-4,81	21672	Rock Highlid
	2. LAYER	-15,11	14701	Rock Highlid
	3. LAYER		80384	Rock Highlid

12_PROFILE	1. LAYER	-7,41	7071	Sturdy
	2. LAYER	-23,31	25600	Rock Highlid
	3. LAYER		89884	Rock Highlid
13_PROFILE	1. LAYER	-8,15	5457	Sturdy
	2. LAYER	-25,63	10181	Rock Highlid
	3. LAYER		38902	Rock Highlid
14_PROFILE	1. LAYER	-3,50	3664	Sturdy
	2. LAYER	-11,02	11049	Rock Highlid
	3. LAYER		50445	Rock Highlid
15_PROFILE	1. LAYER	-4,65	5163	Sturdy
	2. LAYER	-14,64	9149	Sturdy
	3. LAYER		36948	Rock Highlid
16_PROFILE	1. LAYER	-3,21	6110	Sturdy
	2. LAYER	-14,38	7161	Sturdy
	3. LAYER		33684	Rock Highlid

Shear Modulus (kg/cm^2)	Dayanım
G<400	High Weak
400<G<1500	Weak
1500<G<3000	Medium
3000<G<10000	Sturdy
10000<G	Rock Highlid

The endurance of ground or rocks according to Slip Module values(Keçeli, 1990)

$G = (d*Vs^2)/100$

‖AVERAGE‖			
LAYERS	**DEPTH**	**G (kg/cm^2)**	**ENDURANCE**
1. LAYER	-4,70	4615	Sturdy
2.LAYER	-15,78	11950	Rock Highlid
3.LAYER	∞	47244	Rock Highlid

Shear modules and endurance of the grounds in the study area

Calculation of shear Modulus values in the direction of the seismic data obtained in the field studies and the table of variation are given in the table above.

5.8.5. WTG08 Elasticity Modulus-E (kg/cm²)

ELASTIC MODULUS				
PROFILES	LAYERS	DEPTH	E(kg/cm^2)	ENDURANCE
1_PROFILE	1. LAYER	-3,40	4595	Weak
	2.LAYER	-10,70	23974	Sturdy
	3.LAYER		88922	Rock Highlid
2_PROFILE	1. LAYER	-2,35	11843	Sturdy
	2. LAYER	-15,94	70121	Rock Highlid
	3. LAYER		337108	Rock Highlid
3_PROFILE	1. LAYER	-4,85	5138	Medium
	2. LAYER	-15,26	20734	Sturdy
	3. LAYER		104902	Rock Highlid
4_PROFILE	1. LAYER	-7,52	5472	Medium
	2. LAYER	-17,23	15759	Sturdy
	3. LAYER		43971	Rock Highlid
5_PROFILE	1. LAYER	-3,20	5535	Medium
	2. LAYER	-14,30	39291	Rock Highlid
	3. LAYER		117858	Rock Highlid
6_PROFILE	1. LAYER	-2,82	13840	Sturdy
	2. LAYER	-19,06	51936	Rock Highlid
	3. LAYER		200725	Rock Highlid
7_PROFILE	1. LAYER	-1,85	3073	Weak
	2.LAYER	-5,82	12263	Sturdy
	3.LAYER		49394	Rock Highlid
8_PROFILE	1. LAYER	-7,50	6818	Medium
	2. LAYER	-17,19	15772	Sturdy
	3. LAYER		45082	Rock Highlid
9_PROFILE	1. LAYER	-5,50	4248	Weak
	2. LAYER	-12,62	13802	Sturdy
	3. LAYER		39867	Rock Highlid
10_PROFILE	1. LAYER	-4,52	7202	Medium
	2. LAYER	-20,23	36881	Rock Highlid
	3. LAYER		146421	Rock Highlid
11_PROFILE	1. LAYER	-4,81	57979	Rock Highlid
	2. LAYER	-15,11	39620	Rock Highlid
	3. LAYER		212037	Rock Highlid
12_PROFILE	1. LAYER	-7,41	19670	Sturdy
	2. LAYER	-23,31	67503	Rock Highlid
	3. LAYER		248108	Rock Highlid
13_PROFILE	1. LAYER	-8,15	15146	Sturdy
	2. LAYER	-25,63	27792	Sturdy
	3. LAYER		106233	Rock Highlid
14_PROFILE	1. LAYER	-3,50	10262	Sturdy
	2. LAYER	-11,02	30352	Rock Highlid
	3. LAYER		137222	Rock Highlid
15_PROFILE	1. LAYER	-4,65	14474	Sturdy
	2. LAYER	-14,64	25334	Sturdy
	3. LAYER		101925	Rock Highlid
16_PROFILE	1. LAYER	-3,21	16338	Sturdy
	2. LAYER	-14,38	18932	Sturdy
	3. LAYER		91617	Rock Highlid

Elastic Modulus (kg/cm^2)	Dayanım
E<1000	High Weak
1000<E<5000	Weak
5000<E<10000	Medium
10000<E<30000	Sturdy
30000<E	Rock Highlid

The endurance of ground or rocks according to Slip Module values(Keçeli, 1990)

$E=G*(3*V_p^2-4*V_s^2)/(V_p^2-V_s^2)$

||AVERAGE||			
LAYERS	DEPTH	E (kg/cm^2)	ENDURANCE
1. LAYER	-4,70	12602	Sturdy
2.LAYER	-15,78	31879	Rock Highlid
3.LAYER	∞	129462	Rock Highlid

Elasticity modules and endurance of the grounds in the study area

Calculation of the modulus of elasticity in the direction of the seismic data obtained in the field studies and the change table are given in the above table

5.8.6. WTG08 Poisson's Ratio - (б)

POISSON'S RATIO				
PROFILES	LAYERS	DEPTH	(σ)	POROSITY
1_PROFILE	1. LAYER	-3,40	0,41	High Porous
	2.LAYER	-10,70	0,34	Medium Porous
	3.LAYER		0,40	High Porous
2_PROFILE	1. LAYER	-2,35	0,36	High Porous
	2. LAYER	-15,94	0,31	Medium Porous
	3. LAYER		0,37	High Porous
3_PROFILE	1. LAYER	-4,85	0,42	High Porous
	2. LAYER	-15,26	0,35	High Porous
	3. LAYER		0,33	Medium Porous
4_PROFILE	1. LAYER	-7,52	0,38	High Porous
	2. LAYER	-17,23	0,31	Medium Porous
	3. LAYER		0,39	High Porous
5_PROFILE	1. LAYER	-3,20	0,36	High Porous
	2. LAYER	-14,30	0,32	Medium Porous
	3. LAYER		0,39	High Porous
6_PROFILE	1. LAYER	-2,82	0,44	High Porous
	2. LAYER	-19,06	0,36	High Porous
	3. LAYER		0,39	High Porous
7_PROFILE	1. LAYER	-1,85	0,43	High Porous
	2.LAYER	-5,82	0,35	High Porous
	3.LAYER		0,38	High Porous
8_PROFILE	1. LAYER	-7,50	0,39	High Porous
	2. LAYER	-17,19	0,34	Medium Porous

	3. LAYER		0,40	High Porous
9_PROFILE	1. LAYER	-5,50	0,40	High Porous
	2. LAYER	-12,62	0,33	Medium Porous
	3. LAYER		0,39	High Porous
10_PROFILE	1. LAYER	-4,52	0,37	High Porous
	2. LAYER	-20,23	0,33	Medium Porous
	3. LAYER		0,38	High Porous
11_PROFILE	1. LAYER	-4,81	0,35	Medium Porous
	2. LAYER	-15,11	0,39	High Porous
	3. LAYER		0,32	Medium Porous
12_PROFILE	1. LAYER	-7,41	0,40	High Porous
	2. LAYER	-23,31	0,33	Medium Porous
	3. LAYER		0,38	High Porous
13_PROFILE	1. LAYER	-8,15	0,41	High Porous
	2. LAYER	-25,63	0,39	High Porous
	3. LAYER		0,37	High Porous
14_PROFILE	1. LAYER	-3,50	0,42	High Porous
	2. LAYER	-11,02	0,37	High Porous
	3. LAYER		0,36	High Porous
15_PROFILE	1. LAYER	-4,65	0,41	High Porous
	2. LAYER	-14,64	0,39	High Porous
	3. LAYER		0,38	High Porous
16_PROFILE	1. LAYER	-3,21	0,35	Medium Porous
	2. LAYER	-14,38	0,36	High Porous
	3. LAYER		0,36	High Porous

Poisson's Ratio;(σ)	Porosity
$0,00 \leq \sigma \leq 0,25$	Nonporous
$0,26 \leq \sigma \leq 0,35$	Medium Porous
$0,36 \leq \sigma \leq 0,50$	High Porous

Poisson ratio classification

$\sigma=(Vp^2-2*Vs^2)/(2* Vp^2-2*Vs^2)$

LAYERS	DEPTH	‖AVERAGE‖ (σ)	POROSITY
1. LAYER	-4,70	0,39	High Porous
2.LAYER	-15,78	0,35	Medium Porous
3.LAYER	∞	0,37	High Porous

Poisson's ratio values of the units in the study area, porosity

Calculation of poisson's ratio values in the direction of the seismic data obtained in the field studies and the change table are given in the above table.

5.8.7. WTG08 Density - ρ (gr/ cm^3)

DENSITY				
PROFILES	LAYERS	DEPTH	ρ (gr/cm^3)	DEFINITION
1_PROFILE	1. LAYER	-3,40	1,67	Medium
	2.LAYER	-10,70	1,88	Medium
	3.LAYER		2,27	High
2_PROFILE	1. LAYER	-2,35	1,78	Medium
	2. LAYER	-15,94	2,07	High
	3. LAYER		2,58	High
3_PROFILE	1. LAYER	-4,85	1,70	Medium
	2. LAYER	-15,26	1,87	Medium
	3. LAYER		2,22	High
4_PROFILE	1. LAYER	-7,52	1,65	Medium
	2. LAYER	-17,23	1,78	Medium
	3. LAYER		2,09	High
5_PROFILE	1. LAYER	-3,20	1,64	Medium
	2. LAYER	-14,30	1,96	High
	3. LAYER		2,33	High
6_PROFILE	1. LAYER	-2,82	1,93	High
	2. LAYER	-19,06	2,07	High
	3. LAYER		2,47	High
7_PROFILE	1. LAYER	-1,85	1,61	Medium
	2.LAYER	-5,82	1,75	Medium
	3.LAYER		2,10	High
8_PROFILE	1. LAYER	-7,50	1,70	Medium
	2. LAYER	-17,19	1,81	Medium
	3. LAYER		2,11	High
9_PROFILE	1. LAYER	-5,50	1,63	Medium
	2. LAYER	-12,62	1,77	Medium
	3. LAYER		2,07	High
10_PROFILE	1. LAYER	-4,52	1,68	Medium
	2. LAYER	-20,23	1,96	High
	3. LAYER		2,37	High
11_PROFILE	1. LAYER	-4,81	2,10	High
	2. LAYER	-15,11	2,09	High
	3. LAYER		2,39	High
12_PROFILE	1. LAYER	-7,41	1,93	High
	2. LAYER	-23,31	2,09	High
	3. LAYER		2,51	High
13_PROFILE	1. LAYER	-8,15	1,89	Medium
	2. LAYER	-25,63	1,98	High
	3. LAYER		2,26	High
14_PROFILE	1. LAYER	-3,50	1,85	Medium
	2. LAYER	-11,02	1,98	High
	3. LAYER		2,32	High
15_PROFILE	1. LAYER	-4,65	1,89	Medium
	2. LAYER	-14,64	1,97	High
	3. LAYER		2,27	High
16_PROFILE	1. LAYER	-3,21	1,82	Medium
	2. LAYER	-14,38	1,86	Medium
	3. LAYER		2,22	High

Density: ρ (gr/cm³)	Tanımlama
ρ<1,20	High low
1,20<ρ<1,40	Low
1,40<ρ<1,90	Medium
1,90<ρ<2,20	High
2,20<ρ	Too High

Density Classification of Ground Units: (Keçeli, 1990)

*ρ =d=0.31*Vp0.25*

‖AVERAGE‖			
LAYERS	DEPTH	ρ (gr/cm³)	DEFINITION
1. LAYER	-4,70	1,78	Medium
2.LAYER	-15,78	1,93	High
3.LAYER	∞	2,29	High

Density values and description of the units in the study area

Calculation of the density values of the geological units in the direction of the seismic data obtained in the field studies and the table of variation are given in the above table.

5.8.8. WTG08 Modulus of Subgrade Reaction – D Y K (ton/m³)

Modulus of Subgrade Reaction			
PROFILES	LAYERS	DEPTH	D Y K (ton/m³)
1_PROFILE	1. LAYER	-3,40	2211
	2.LAYER	-10,70	5196
	3.LAYER		10528
2_PROFILE	1. LAYER	-2,35	3566
	2. LAYER	-15,94	8933
	3. LAYER		22879
3_PROFILE	1. LAYER	-4,85	2368
	2. LAYER	-15,26	4823
	3. LAYER		11601
4_PROFILE	1. LAYER	-7,52	2430
	2. LAYER	-17,23	4279
	3. LAYER		7156
5_PROFILE	1. LAYER	-3,20	2431
	2. LAYER	-14,30	6711
	3. LAYER		12341
6_PROFILE	1. LAYER	-2,82	3852
	2. LAYER	-19,06	7680
	3. LAYER		16831
7_PROFILE	1. LAYER	-1,85	1843
	2.LAYER	-5,82	3660
	3.LAYER		7631
8_PROFILE	1. LAYER	-7,50	2692
	2. LAYER	-17,19	4261
	3. LAYER		7247
9_PROFILE	1. LAYER	-5,50	2180
	2. LAYER	-12,62	3981
	3. LAYER		6792
10_PROFILE	1. LAYER	-4,52	2788
	2. LAYER	-20,23	6375
	3. LAYER		13967
11_PROFILE	1. LAYER	-4,81	8339
	2. LAYER	-15,11	6484
	3. LAYER		17318

12_PROFILE	1. LAYER	-7,41	4671
	2. LAYER	-23,31	8934
	3. LAYER		19040
13_PROFILE	1. LAYER	-8,15	4000
	2. LAYER	-25,63	5524
	3. LAYER		11628
14_PROFILE	1. LAYER	-3,50	3263
	2. LAYER	-11,02	5854
	3. LAYER		13442
15_PROFILE	1. LAYER	-4,65	3947
	2. LAYER	-14,64	5302
	3. LAYER		11357
16_PROFILE	1. LAYER	-3,21	4330
	2. LAYER	-14,38	4426
	3. LAYER		10711

LAYERS	‖AVERAGE‖ DEPTH	D Y K (ton/m^3)
1. LAYER	-4,70	3432
2.LAYER	-15,78	5776
3.LAYER	∞	12529
kv= 40*(Gs)*qu ton/m^3 *(Bowles 1984)*		

The above table shows the Modulus of Subgrade Reaction obtained for each layer in the direction of the data obtained after the seismic measurements made in the study area.

5.8.9. WTG08 Bearing Capacity qu (kg/cm2) / Allowable Bearing Capacity qa (kg/cm2)

PROFILES	LAYERS	DEPTH	BEARING CAPACITY (qu,kg/cm^2)	ALLOWABLE BEARING CAPACITY (qa,kg/cm^2)
1_PROFILE	1. LAYER	-3,40	5,53	1,84
	2.LAYER	-10,70	12,99	4,33
	3.LAYER	-39,30	26,32	8,77
2_PROFILE	1. LAYER	-2,35	8,91	2,97
	2. LAYER	-15,94	22,33	7,44
	3. LAYER	-34,06	57,20	19,07
3_PROFILE	1. LAYER	-4,85	5,92	1,97
	2. LAYER	-15,26	12,06	4,02
	3. LAYER	-34,74	29,00	9,67
4_PROFILE	1. LAYER	-7,52	6,07	2,02
	2. LAYER	-17,23	10,70	3,57
	3. LAYER	-32,77	17,89	5,96
5_PROFILE	1. LAYER	-3,20	6,08	2,03
	2. LAYER	-14,30	16,78	5,59
	3. LAYER	-35,70	30,85	10,28
6_PROFILE	1. LAYER	-2,82	9,63	3,21
	2. LAYER	-19,06	19,20	6,40
	3. LAYER	-30,94	42,08	14,03
7_PROFILE	1. LAYER	-1,85	4,61	1,54
	2.LAYER	-5,82	9,15	3,05

	3.LAYER	-44,18	19,08	6,36
8_PROFILE	1. LAYER	-7,50	6,73	2,24
	2. LAYER	-17,19	10,65	3,55
	3. LAYER	-32,81	18,12	6,04
9_PROFILE	1. LAYER	-5,50	5,45	1,82
	2. LAYER	-12,62	9,95	3,32
	3. LAYER	-37,38	16,98	5,66
10_PROFILE	1. LAYER	-4,52	6,97	2,32
	2. LAYER	-20,23	15,94	5,31
	3. LAYER	-29,77	34,92	11,64
11_PROFILE	1. LAYER	-4,81	20,85	6,95
	2. LAYER	-15,11	16,21	5,40
	3. LAYER	-34,89	43,30	14,43
12_PROFILE	1. LAYER	-7,41	11,68	3,89
	2. LAYER	-23,31	22,34	7,45
	3. LAYER	-26,69	47,60	15,87
13_PROFILE	1. LAYER	-8,15	10,00	3,33
	2. LAYER	-25,63	13,81	4,60
	3. LAYER	-24,37	29,07	9,69
14_PROFILE	1. LAYER	-3,50	8,16	2,72
	2. LAYER	-11,02	14,63	4,88
	3. LAYER	-38,98	33,61	11,20
15_PROFILE	1. LAYER	-4,65	9,87	3,29
	2. LAYER	-14,64	13,25	4,42
	3. LAYER	-35,36	28,39	9,46
16_PROFILE	1. LAYER	-3,21	10,82	3,61
	2. LAYER	-14,38	11,07	3,69
	3. LAYER	-35,62	26,78	8,93

||AVERAGE||		
LAYERS	**DEPTH**	**Bearing Capacity (qu,kg/cm^2)**
1. LAYER	-4,70	8,58
2.LAYER	-15,78	14,44
3.LAYER	∞	31,32

qu=(0,024*Vs*(J.B.K+0,002*Vp)*0,71)/G.K

BEARING CAPACITY CALCULATION	Geological unit factor 18	16	17	18	20
(Prof. Dr. SEMIH TEZCAN-2006)	Safety factor 50-100	CLAY	SAND	SEDIMENT	VOLATISILE

||AVERAGE||		
LAYERS	**DEPTH**	**Allowable Bearing Capacity (qa,kg/cm^2)**
1. LAYER	-4,70	2,86
2.LAYER	-15,78	4,81
3.LAYER	∞	10,44

qa=qu/G.K G.K=3 empirical value

5.8.10 WTG08 Vibration Period - T_0 (sec) / Ground Amplification (Ak)

PROFILES	To (sec)	Ta (sec)	Tb (sec)	Ak (Amplification)
1.PROFILE	0,22	0,15	0,33	1,40
2.PROFILE	0,14	0,09	0,20	1,01
3.PROFILE	0,23	0,15	0,34	1,39
4.PROFILE	0,32	0,21	0,48	1,64
5.PROFILE	0,20	0,13	0,30	1,27
6.PROFILE	0,17	0,11	0,25	1,08
7.PROFILE	0,25	0,17	0,38	1,58
8.PROFILE	0,31	0,21	0,47	1,60
9.PROFILE	0,31	0,20	0,46	1,66
10.PROFILE	0,21	0,14	0,31	1,26
11.PROFILE	0,15	0,10	0,23	1,07
12.PROFILE	0,17	0,11	0,25	1,07
13.PROFILE	0,24	0,16	0,36	1,29
14.PROFILE	0,18	0,12	0,27	1,23
15.PROFILE	0,21	0,14	0,31	1,30
16.PROFILE	0,22	0,15	0,33	1,34

AVERAGE			
To (sec)	Ta (sec)	Tb (sec)	Ak (Amplification)
0,22	0,15	0,33	1,32

$To = \sum 4H\ Vs\ n\ \iota$=1 (sec)……. (Zeevaert,1967)

$Ak=68*Vs_{30}^{-0,6}$……. (Midorikawa, 1987)

The Vibration Period and Ground Amplification calculated in the direction of the parameters obtained during the seismic studies made during the field survey are presented in the table above.

5. 9. WTG09

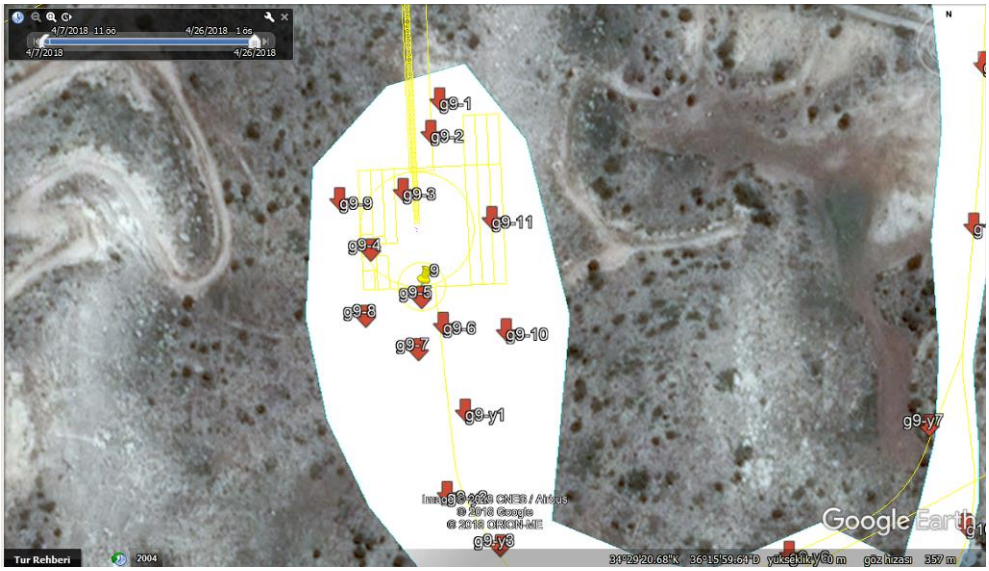
There are 11 measurements were taken. These measurements showed 3 layers. Layer 1 was found between 0,00 m and 3,50 m depth, Layer 2 between 3,50 m and 15,42 m depth, and Layer 3 was found at an average depth of 15,42 m. The parameters of this layer are given in the table below.

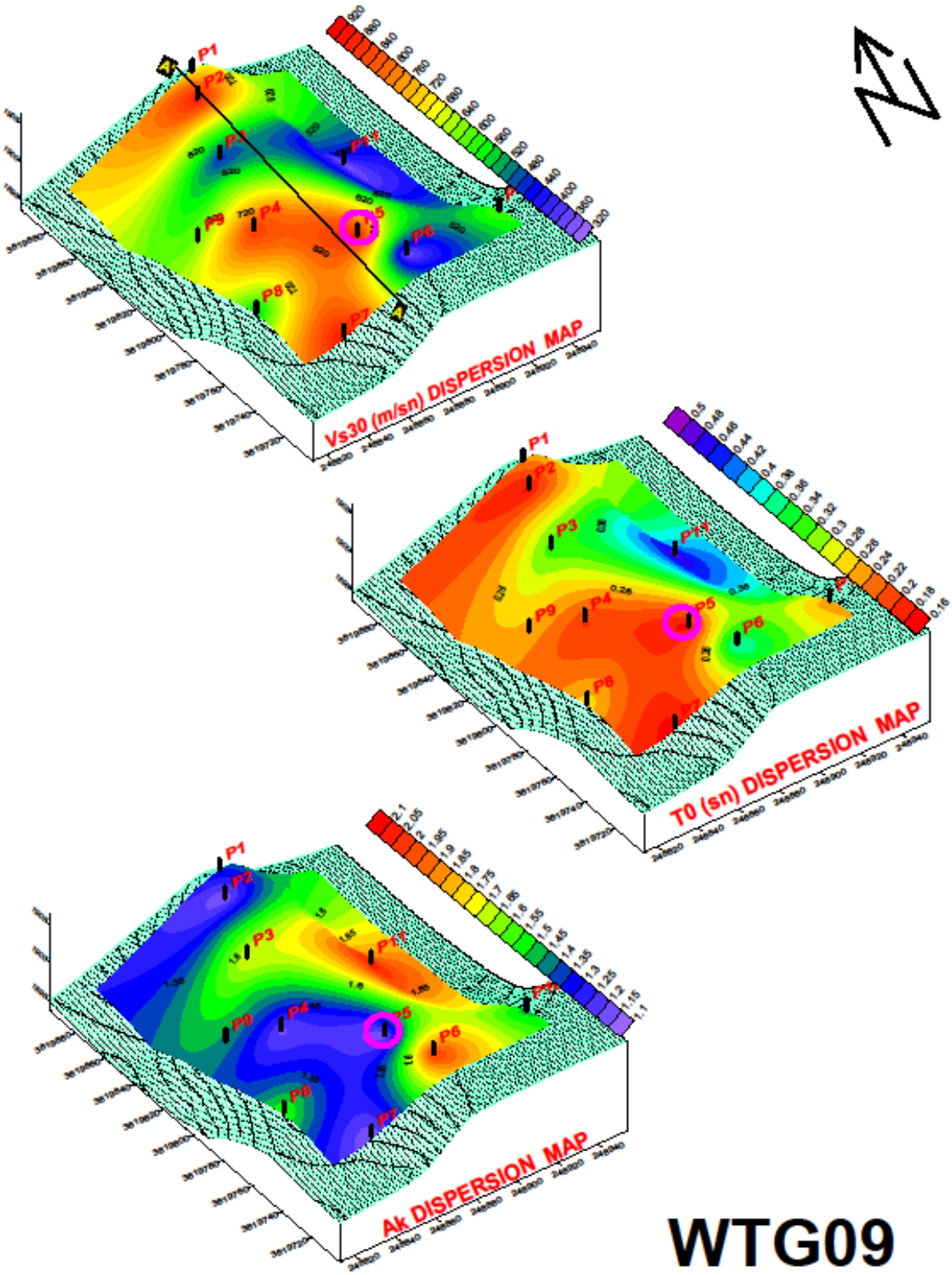
LAYERS	Vp_ Velocity	STRIPPABILITY
1. LAYER	872	Simple strippability
2.LAYER	1304	Medium-hard strippability
3.LAYER	2734	Explosive
LAYERS	**Vs_ Velocity**	**GROUND GROUP**
1. LAYER	343	C
2.LAYER	620	B
3.LAYER	1202	A
LAYERS	**G (kg/cm2)**	**ENDURANCE**
1. LAYER	2448	Medium
2.LAYER	8660	Sturdy
3.LAYER	38281	High sturdy
LAYERS	**E (kg/cm2)**	**ENDURANCE**
1. LAYER	6757	Medium
2.LAYER	23177	Sturdy
3.LAYER	104874	High sturdy

LAYERS	(σ)	POROSITY
1. LAYER	0,39	High Porosity
2.LAYER	0,35	Medium Porosity
3.LAYER	0,38	High Porosity
LAYERS	**ρ (gr/cm3)**	**DEFINITION**
1. LAYER	1,66	Medium
2.LAYER	1,84	Medium
3.LAYER	2,22	High
LAYERS	**D Y K (ton/m^3)**	
1. LAYER	2557	
2.LAYER	4808	
3.LAYER	10859	
LAYERS	**Ground Carrying Capacity (qu,kg/cm2)**	**Secure Carrying Capacity (qa,kg/cm2)**
1. LAYER	6,39	2,13
2.LAYER	12,02	4,01
3.LAYER	27,15	9,05

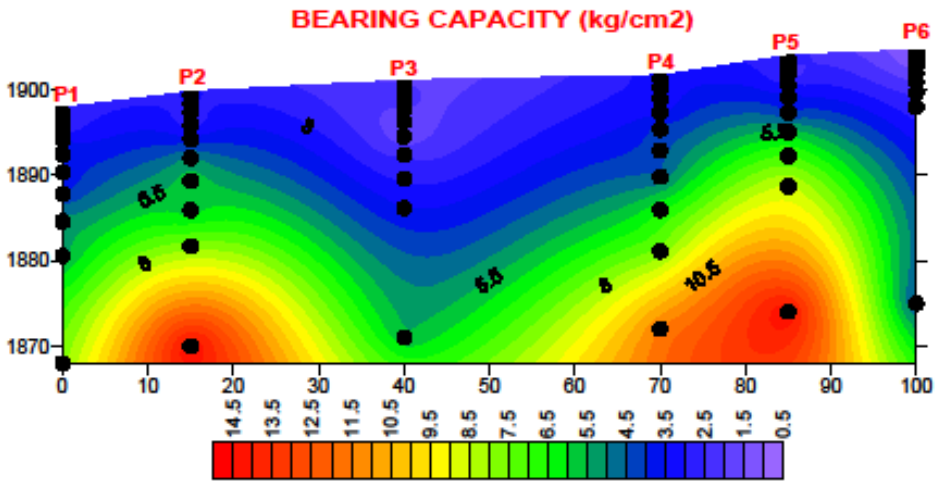
To (sec)	Ta (sec)	Tb (sec)	Vs30 (m/sec)	Ak (Amplification)
0,26	0,18	0,40	652	1,47

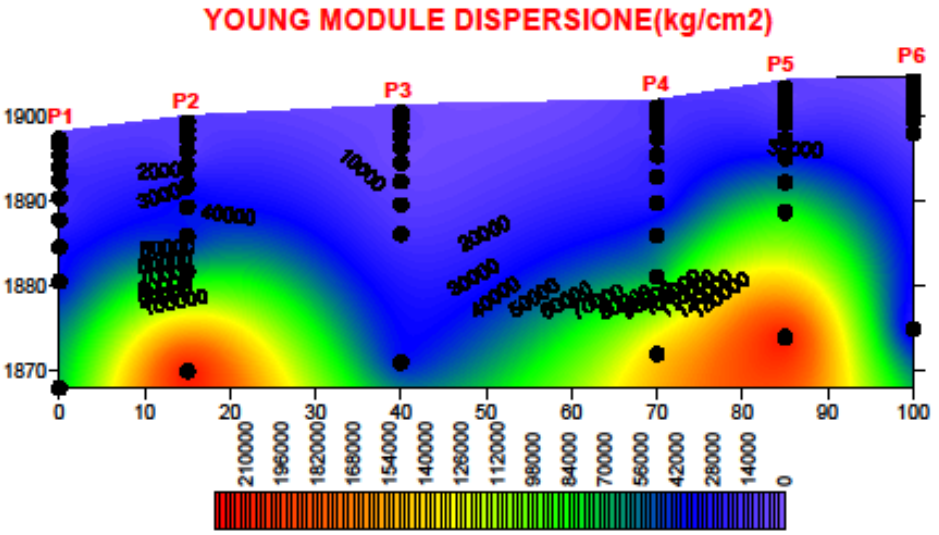
It is recommended to excavate the first 1.50 meter from the sixth (6) profile of the land taken from the ground and to excavate the average of the first 5.00 meters from the land elevation of eleventh (11) profile. Taking into consideration the following applications, the profile points should be seen in the engineering parameters section for detailed values.

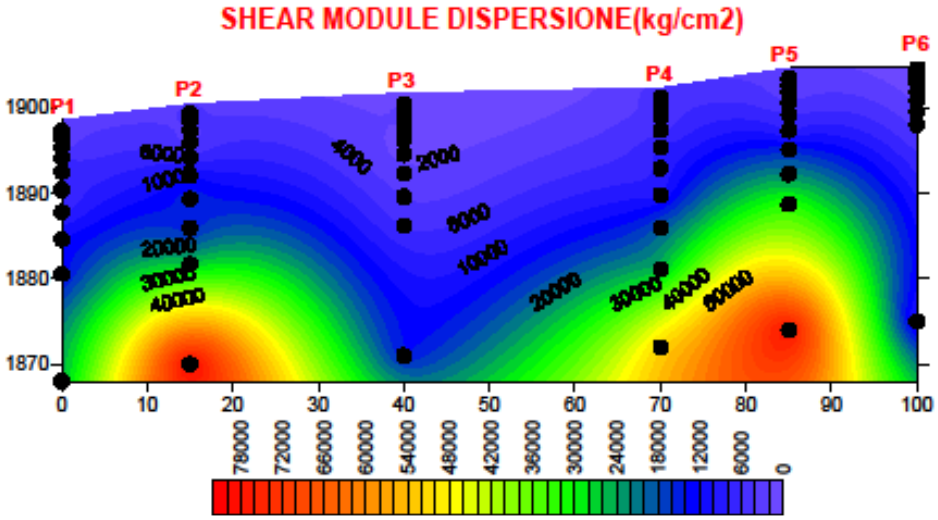



Vs30 (m/sn) DISPERSION MAP
T0 (sn) DISPERSION MAP
Ak DISPERSION MAP
P1
P2
P3
P4
P5
P6
P7
P8
P9
P11
N

WTG09


BEARING CAPACITY (kg/cm2)
P1
P2
P3
P4
P5
P6
1900
1890
1880
1870
0 10 20 30 40 50 60 70 80 90 100
14.5 13.5 12.5 11.5 10.5 9.5 8.5 7.5 6.5 5.5 4.5 3.5 2.5 1.5 0.5


YOUNG MODULE DISPERSIONE(kg/cm2)
P1
P2
P3
P4
P5
P6
1900
1890
1880
1870
0 10 20 30 40 50 60 70 80 90 100
210000 196000 182000 168000 154000 140000 126000 112000 98000 84000 70000 56000 42000 28000 14000 0


SHEAR MODULE DISPERSIONE(kg/cm2)
P1
P2
P3
P4
P5
P6
1900
1890
1880
1870
0 10 20 30 40 50 60 70 80 90 100
78000 72000 66000 60000 54000 48000 42000 36000 30000 24000 18000 12000 6000 0

5.9.1. WTG09 Seismic P wave velocity (*Compressional Wave Velocity* (Vp))

Vp VELOCITY				
PROFILES	LAYERS	DEPTH	Vp_ Velocity	STRIPPABILITY
1_PROFILE	1. LAYER	-3,90	1149	Simple Strippability
	2.LAYER	-17,46	1547	High Difficult Strippability
	3.LAYER		2856	Explosive
2_PROFILE	1. LAYER	-2,70	1176	Simple Strippability
	2. LAYER	-18,31	1687	High Difficult Strippability
	3. LAYER		3732	Explosive
3_PROFILE	1. LAYER	-6,48	832	Simple Strippability
	2. LAYER	-14,86	963	Simple Strippability
	3. LAYER		1830	High Difficult Strippability
4_PROFILE	1. LAYER	-4,67	1382	Medium Strippability
	2. LAYER	-20,90	1787	High Difficult Strippability
	3. LAYER		3556	Explosive
5_PROFILE	1. LAYER	-3,42	1059	Simple Strippability
	2. LAYER	-15,31	1735	High Difficult Strippability
	3. LAYER		3807	Explosive
6_PROFILE	1. LAYER	-1,57	332	High Simple Strippability
	2. LAYER	-7,03	670	Simple Strippability
	3. LAYER		1519	Medium Strippability
7_PROFILE	1. LAYER	-2,27	887	Simple Strippability
	2.LAYER	-15,38	1630	High Difficult Strippability
	3.LAYER		3942	Explosive
8_PROFILE	1. LAYER	-2,47	744	Simple Strippability
	2. LAYER	-11,04	1194	Simple Strippability
	3. LAYER		2220	Explosive
9_PROFILE	1. LAYER	-3,41	981	Simple Strippability
	2. LAYER	-15,28	1260	Medium Strippability
	3. LAYER		2499	Explosive
10_PROFILE	1. LAYER	-2,62	669	Simple Strippability
	2. LAYER	-11,72	1184	Simple Strippability
	3. LAYER		2521	Explosive
11_PROFILE	1. LAYER	-4,99	384	High Simple Strippability
	2. LAYER	-22,32	690	Simple Strippability
	3. LAYER		1596	High Difficult Strippability

P Wave Velocity (m/sec)	Strippability
Vp<458	High Simple Strippability
458<Vp<1220	Simple Strippability
1220<Vp<11525	Medium Strippability
1525<Vp<11830	Difficult Strippability
1830<Vp<12135	High Difficult Strippability
Vp>2135	Explosive Strippability

Strippability of floors with P wave velocity (Church, 1981)

‖AVERAGE‖			
LAYERS	DEPTH	Vp_ Velocity	STRIPPABILITY
1. LAYER	-3,50	872	Simple Strippability
2.LAYER	-15,42	1304	Medium Strippability
3.LAYER	∞	2734	Explosive

P wave velocities of the grounds in the study area and strippability

The above table shows the change table and strippability properties of Vp velocity depth values in the direction of the seismic data obtained from the field studies.

5.9.2. WTG09 Seismic S wave velocity (*Transverse Wave Velocity* (Vs))

Vs VELOCITY				
PROFILES	LAYERS	DEPTH	Vs_ Velocity	GROUND GROUPS
1_PROFILE	1. LAYER	-3,90	435	B
	2.LAYER	-17,46	674	B
	3.LAYER		1046	A
2_PROFILE	1. LAYER	-2,70	478	B
	2. LAYER	-18,31	757	A
	3. LAYER		1821	A
3_PROFILE	1. LAYER	-6,48	253	C
	2. LAYER	-14,86	483	B
	3. LAYER		824	A
4_PROFILE	1. LAYER	-4,67	505	B
	2. LAYER	-20,90	805	A
	3. LAYER		1465	A
5_PROFILE	1. LAYER	-3,42	405	B
	2. LAYER	-15,31	860	A
	3. LAYER		1796	A
6_PROFILE	1. LAYER	-1,57	147	D
	2. LAYER	-7,03	329	C
	3. LAYER		634	B
7_PROFILE	1. LAYER	-2,27	391	C
	2.LAYER	-15,38	850	A
	3.LAYER		1872	A
8_PROFILE	1. LAYER	-2,47	275	C
	2. LAYER	-11,04	528	B
	3. LAYER		920	A
9_PROFILE	1. LAYER	-3,41	434	B
	2. LAYER	-15,28	569	B
	3. LAYER		1038	A
10_PROFILE	1. LAYER	-2,62	284	C
	2. LAYER	-11,72	587	B
	3. LAYER		1115	A
11_PROFILE	1. LAYER	-4,99	165	D
	2. LAYER	-22,32	381	C
	3. LAYER		695	B

S wave velocities of the grounds in the study area and ground group

S Wave Velocity (m/sec)	Ground group
Vs<200	D
200<Vs<400	C
400<Vs<700	B
700<Vs	A

Ground groups according to slip wave velocity(Abyyhy, 1998)

||AVERAGE||			
LAYERS	DEPTH	Vs_ Velocity	GROUND GROUPS
1. LAYER	-3,50	343	C
2.LAYER	-15,42	620	B
3.LAYER	∞	1202	A

Ground Group	Ground group and top ground layer thickness(h_1)
Z1	(A) Ground group h1< 15 m (B) Ground group
Z2	h_1> 15 m (B) Ground group h_1< 15 m (C) Ground group
Z3	15 m < h_1< 50 m (C) Ground group h_1< 10 m (D) Ground group
Z4	h_1> 50 m (C) Ground group h_1> 10 m (D) Ground group

Ground Group Class

The above table shows that Vs velocity values in the direction of the seismic data obtained in the field studies are the absolute change tables and that the layers are included in the ground groups.

5.9.3. WTG09 Vs30

PROFILES	Vs30 (m/sec)
1.PROFILE	691
2.PROFILE	898
3.PROFILE	465
4.PROFILE	861
5.PROFILE	892
6.PROFILE	353
7.PROFILE	913
8.PROFILE	537
9.PROFILE	625
10.PROFILE	604
11.PROFILE	335

Vs30 values in the direction of the seismic data obtained from the field studies are given in the table above.

5.9.4. WTG09 Shear Modulus-G (kg/cm²)

SHEAR MODULUS				
PROFILES	LAYERS	DEPTH	G(kg/cm^2)	ENDURANCE
1_PROFILE	1. LAYER	-3,90	3538	Sturdy
	2.LAYER	-17,46	9075	Sturdy
	3.LAYER		24789	Rock Highlid
2_PROFILE	1. LAYER	-2,70	4163	Sturdy
	2. LAYER	-18,31	12682	Rock Highlid
	3. LAYER		80311	Rock Highlid
3_PROFILE	1. LAYER	-6,48	1668	Medium
	2. LAYER	-14,86	4107	Sturdy
	3. LAYER		13778	Rock Highlid
4_PROFILE	1. LAYER	-4,67	4835	Sturdy
	2. LAYER	-20,90	13865	Rock Highlid
	3. LAYER		51370	Rock Highlid
5_PROFILE	1. LAYER	-3,42	3100	Sturdy
	2. LAYER	-15,31	16390	Rock Highlid
	3. LAYER		78587	Rock Highlid
6_PROFILE	1. LAYER	-1,57	304	High Weak
	2. LAYER	-7,03	1849	Medium
	3. LAYER		7772	Sturdy
7_PROFILE	1. LAYER	-2,27	2884	Medium
	2.LAYER	-15,38	16309	Rock Highlid
	3.LAYER		86098	Rock Highlid
8_PROFILE	1. LAYER	-2,47	1320	Weak
	2. LAYER	-11,04	5113	Sturdy
	3. LAYER		18025	Rock Highlid
9_PROFILE	1. LAYER	-3,41	3327	Sturdy
	2. LAYER	-15,28	6689	Sturdy
	3. LAYER		23615	Rock Highlid
10_PROFILE	1. LAYER	-2,62	1371	Weak
	2. LAYER	-11,72	6642	Sturdy
	3. LAYER		27288	Rock Highlid
11_PROFILE	1. LAYER	-4,99	415	Weak
	2. LAYER	-22,32	2543	Medium
	3. LAYER		9457	Sturdy

Shear Modulus (kg/cm^2)	Dayanım
G<400	High Weak
400<G<1500	Weak
1500<G<3000	Medium
3000<G<10000	Sturdy
10000<G	Rock Highlid

The endurance of ground or rocks according to Slip Module values(Keçeli, 1990)

$G = (d*Vs^2)/100$

‖AVERAGE‖			
LAYERS	DEPTH	G (kg/cm^2)	ENDURANCE
1. LAYER	-3,50	2448	Medium
2.LAYER	-15,42	8660	Sturdy
3.LAYER	∞	38281	Rock Highlid

Shear modules and endurance of the grounds in the study area

Calculation of shear Modulus values in the direction of the seismic data obtained in the field studies and the table of variation are given in the table above.

5.9.5. WTG09 Elasticity Modulus-E (kg/cm²)

ELASTIC MODULUS				
PROFILES	LAYERS	DEPTH	E(kg/cm^2)	ENDURANCE
1_PROFILE	1. LAYER	-3,90	9907	Medium
	2.LAYER	-17,46	24947	Sturdy
	3.LAYER		70529	Rock Highlid
2_PROFILE	1. LAYER	-2,70	11651	Sturdy
	2. LAYER	-18,31	34467	Rock Highlid
	3. LAYER		215852	Rock Highlid
3_PROFILE	1. LAYER	-6,48	4687	Weak
	2. LAYER	-14,86	10945	Sturdy
	3. LAYER		37826	Rock Highlid
4_PROFILE	1. LAYER	-4,67	13740	Sturdy
	2. LAYER	-20,90	37774	Rock Highlid
	3. LAYER		143612	Rock Highlid
5_PROFILE	1. LAYER	-3,42	8545	Medium
	2. LAYER	-15,31	43361	Rock Highlid
	3. LAYER		213249	Rock Highlid
6_PROFILE	1. LAYER	-1,57	812	High Weak
	2. LAYER	-7,03	4952	Weak
	3. LAYER		21678	Sturdy
7_PROFILE	1. LAYER	-2,27	7502	Medium
	2.LAYER	-15,38	42338	Rock Highlid
	3.LAYER		233216	Rock Highlid
8_PROFILE	1. LAYER	-2,47	3657	Weak
	2. LAYER	-11,04	14008	Sturdy
	3. LAYER		50335	Rock Highlid
9_PROFILE	1. LAYER	-3,41	9068	Medium
	2. LAYER	-15,28	17853	Sturdy
	3. LAYER		65920	Rock Highlid
10_PROFILE	1. LAYER	-2,62	3662	Weak
	2. LAYER	-11,72	17776	Sturdy
	3. LAYER		75234	Rock Highlid
11_PROFILE	1. LAYER	-4,99	1098	Weak
	2. LAYER	-22,32	6521	Medium
	3. LAYER		26160	Sturdy

Elastic Modulus (kg/cm²)	Dayanım
E<1000	High Weak
1000<E<5000	Weak
5000<E<10000	Medium
10000<E<30000	Sturdy
30000<E	Rock Highlid

The endurance of ground or rocks according to Slip Module values(Keçeli, 1990)

$E=G*(3*V_p^2-4*V_s^2)/(V_p^2-V_s^2)$

||AVERAGE||			
LAYERS	DEPTH	E (kg/cm²)	ENDURANCE
1. LAYER	-3,50	6757	Medium
2.LAYER	-15,42	23177	Sturdy
3.LAYER	∞	104874	Rock Highlid

Elasticity modules and endurance of the grounds in the study area

Calculation of the modulus of elasticity in the direction of the seismic data obtained in the field studies and the change table are given in the above table

5.9.6. WTG09 Poisson's Ratio - (б)

POISSON'S RATIO				
PROFILES	LAYERS	DEPTH	(σ)	POROSITY
1_PROFILE	1. LAYER	-3,90	0,41	High Porous
	2.LAYER	-17,46	0,38	Porous
	3.LAYER		0,42	High Porous
2_PROFILE	1. LAYER	-2,70	0,40	High Porous
	2. LAYER	-18,31	0,37	Porous
	3. LAYER		0,34	Porous
3_PROFILE	1. LAYER	-6,48	0,41	High Porous
	2. LAYER	-14,86	0,33	Porous
	3. LAYER		0,37	Porous
4_PROFILE	1. LAYER	-4,67	0,42	High Porous
	2. LAYER	-20,90	0,37	Porous
	3. LAYER		0,40	High Porous
5_PROFILE	1. LAYER	-3,42	0,40	High Porous
	2. LAYER	-15,31	0,34	Porous
	3. LAYER		0,36	Porous
6_PROFILE	1. LAYER	-1,57	0,36	Porous
	2. LAYER	-7,03	0,34	Porous
	3. LAYER		0,39	High Porous
7_PROFILE	1. LAYER	-2,27	0,35	Porous
	2.LAYER	-15,38	0,31	Porous
	3.LAYER		0,35	Porous
8_PROFILE	1. LAYER	-2,47	0,41	High Porous
	2. LAYER	-11,04	0,37	Porous
	3. LAYER		0,40	High Porous
9_PROFILE	1. LAYER	-3,41	0,37	Porous
	2. LAYER	-15,28	0,37	Porous
	3. LAYER		0,40	High Porous
10_PROFILE	1. LAYER	-2,62	0,37	Porous
	2. LAYER	-11,72	0,33	Porous
	3. LAYER		0,38	Porous
11_PROFILE	1. LAYER	-4,99	0,36	Porous
	2. LAYER	-22,32	0,28	High Porous
	3. LAYER		0,38	Porous

Poisson's Ratio;(σ)	Porosity
0,00≤σ≤0,25	Nonporous
0,26≤σ≤0,35	Medium Porous
0,36≤σ≤0,50	High Porous

Poisson ratio classification

$\sigma=(Vp^2-2*Vs^2)/(2*Vp^2-2*Vs^2)$

‖AVERAGE‖			
LAYERS	DEPTH	(σ)	POROSITY
1. LAYER	-3,50	0,39	High Porous
2.LAYER	-15,42	0,35	Medium Porous
3.LAYER	∞	0,38	High Porous

Poisson's ratio values of the units in the study area, porosity

Calculation of poisson's ratio values in the direction of the seismic data obtained in the field studies and the change table are given in the above table.

5.9.7. WTG09 Density - ρ (gr/ cm^3)

DENSITY				
PROFILES	LAYERS	DEPTH	ρ (gr/cm^3)	DEFINITION
1_PROFILE	1. LAYER	-3,90	1,80	Medium
	2.LAYER	-17,46	1,94	High
	3.LAYER		2,27	High
2_PROFILE	1. LAYER	-2,70	1,82	Medium
	2. LAYER	-18,31	1,98	High
	3. LAYER		2,42	High
3_PROFILE	1. LAYER	-6,48	1,66	Medium
	2. LAYER	-14,86	1,72	Medium
	3. LAYER		2,03	High
4_PROFILE	1. LAYER	-4,67	1,89	Medium
	2. LAYER	-20,90	2,01	High
	3. LAYER		2,39	High
5_PROFILE	1. LAYER	-3,42	1,77	Medium
	2. LAYER	-15,31	1,99	High
	3. LAYER		2,44	High
6_PROFILE	1. LAYER	-1,57	1,32	Low
	2. LAYER	-7,03	1,57	Medium
	3. LAYER		1,94	High
7_PROFILE	1. LAYER	-2,27	1,69	Medium
	2.LAYER	-15,38	1,95	High
	3.LAYER		2,46	High
8_PROFILE	1. LAYER	-2,47	1,62	Medium
	2. LAYER	-11,04	1,82	Medium
	3. LAYER		2,13	High
9_PROFILE	1. LAYER	-3,41	1,73	Medium
	2. LAYER	-15,28	1,84	Medium
	3. LAYER		2,19	High
10_PROFILE	1. LAYER	-2,62	1,58	Medium
	2. LAYER	-11,72	1,81	Medium
	3. LAYER		2,20	High
11_PROFILE	1. LAYER	-4,99	1,37	Low
	2. LAYER	-22,32	1,58	Medium
	3. LAYER		1,96	High

Density: ρ (gr/cm^3)	Tanımlama
ρ<1,20	High low
1,20<ρ<1,40	Low
1,40<ρ<1,90	Medium
1,90<ρ<2,20	High
2,20<ρ	Too High

Density Classification of Ground Units: (Keçeli, 1990)

*ρ =d=0.31*Vp0.25*

||AVERAGE||			
LAYERS	DEPTH	ρ (gr/cm^3)	DEFINITION
1. LAYER	-3,50	1,66	Medium
2.LAYER	-15,42	1,84	Medium
3.LAYER	∞	2,22	High

Density values and description of the units in the study area

Calculation of the density values of the geological units in the direction of the seismic data obtained in the field studies and the table of variation are given in the above table.

5.9.8. WTG09 Modulus of Subgrade Reaction – D Y K (ton/m^3)

Modulus of Subgrade Reaction			
PROFILES	LAYERS	DEPTH	D Y K (ton/m^3)
1_PROFILE	1. LAYER	-3,90	3258
	2.LAYER	-17,46	5272
	3.LAYER		9287
2_PROFILE	1. LAYER	-2,70	3590
	2. LAYER	-18,31	6066
	3. LAYER		17470
3_PROFILE	1. LAYER	-6,48	2256
	2. LAYER	-14,86	3543
	3. LAYER		6628
4_PROFILE	1. LAYER	-4,67	3872
	2. LAYER	-20,90	6480
	3. LAYER		13846
5_PROFILE	1. LAYER	-3,42	3004
	2. LAYER	-15,31	6920
	3. LAYER		17349
6_PROFILE	1. LAYER	-1,57	1001
	2. LAYER	-7,03	2345
	3. LAYER		4934
7_PROFILE	1. LAYER	-2,27	2840
	2.LAYER	-15,38	6795
	3.LAYER		18287
8_PROFILE	1. LAYER	-2,47	1970
	2. LAYER	-11,04	3974
	3. LAYER		7694
9_PROFILE	1. LAYER	-3,41	3187
	2. LAYER	-15,28	4333
	3. LAYER		8913
10_PROFILE	1. LAYER	-2,62	2014
	2. LAYER	-11,72	4435
	3. LAYER		9591
11_PROFILE	1. LAYER	-4,99	1135
	2. LAYER	-22,32	2724
	3. LAYER		5453

||AVERAGE||		
LAYERS	DEPTH	D Y K (ton/m^3)
1. LAYER	-3,50	2557
2.LAYER	-15,42	4808
3.LAYER	∞	10859
kv= 40*(Gs)*qu ton/m^3 *(Bowles 1984)*		

The above table shows the Modulus of Subgrade Reaction obtained for each layer in the direction of the data obtained after the seismic measurements made in the study area.

5.9.9. WTG09 Bearing Capacity qu (kg/cm2) / Allowable Bearing Capacity qa (kg/cm2)

PROFILES	LAYERS	DEPTH	BEARING CAPACITY (qu,kg/cm^2)	ALLOWABLE BEARING CAPACITY (qa,kg/cm^2)
1_PROFILE	1. LAYER	-3,90	8,15	2,72
	2.LAYER	-17,46	13,18	4,39
	3.LAYER	-32,54	23,22	7,74
2_PROFILE	1. LAYER	-2,70	8,98	2,99
	2. LAYER	-18,31	15,16	5,05
	3. LAYER	-31,69	43,68	14,56
3_PROFILE	1. LAYER	-6,48	5,64	1,88
	2. LAYER	-14,86	8,86	2,95
	3. LAYER	-35,14	16,57	5,52
4_PROFILE	1. LAYER	-4,67	9,68	3,23
	2. LAYER	-20,90	16,20	5,40
	3. LAYER	-29,10	34,61	11,54
5_PROFILE	1. LAYER	-3,42	7,51	2,50
	2. LAYER	-15,31	17,30	5,77
	3. LAYER	-34,69	43,37	14,46
6_PROFILE	1. LAYER	-1,57	2,50	0,83
	2. LAYER	-7,03	5,86	1,95
	3. LAYER	-42,97	12,33	4,11
7_PROFILE	1. LAYER	-2,27	7,10	2,37
	2.LAYER	-15,38	16,99	5,66
	3.LAYER	-34,62	45,72	15,24
8_PROFILE	1. LAYER	-2,47	4,92	1,64
	2. LAYER	-11,04	9,93	3,31
	3. LAYER	-38,96	19,23	6,41
9_PROFILE	1. LAYER	-3,41	7,97	2,66
	2. LAYER	-15,28	10,83	3,61
	3. LAYER	-34,72	22,28	7,43
10_PROFILE	1. LAYER	-2,62	5,03	1,68
	2. LAYER	-11,72	11,09	3,70
	3. LAYER	-38,28	23,98	7,99
11_PROFILE	1. LAYER	-4,99	2,84	0,95
	2. LAYER	-22,32	6,81	2,27
	3. LAYER	-27,68	13,63	4,54

LAYERS	||AVERAGE|| DEPTH	Bearing Capacity (qu,kg/cm^2)
1. LAYER	-3,50	6,39
2.LAYER	-15,42	12,02
3.LAYER	∞	27,15
qu=(0,024*Vs*(J.B.K+0,002*Vp)*0,71)/G.K		

LAYERS	||AVERAGE|| DEPTH	Allowable Bearing Capacity (qa,kg/cm^2)
1. LAYER	-3,50	2,13
2.LAYER	-15,42	4,01
3.LAYER	∞	9,05
qa=qu/G.K	G.K=3 empirical value	

5.9.10. WTG09 Vibration Period - T_0 (sec) / Ground Amplification (Ak)

PROFILES	To (sec)	Ta (sec)	Tb (sec)	Ak (Amplification)
1.PROFILE	0,24	0,16	0,36	1,35
2.PROFILE	0,17	0,12	0,26	1,15
3.PROFILE	0,33	0,22	0,50	1,71
4.PROFILE	0,20	0,13	0,29	1,18
5.PROFILE	0,17	0,11	0,25	1,15
6.PROFILE	0,38	0,26	0,58	2,01
7.PROFILE	0,16	0,11	0,25	1,14
8.PROFILE	0,27	0,18	0,41	1,57
9.PROFILE	0,25	0,17	0,38	1,43
10.PROFILE	0,24	0,16	0,36	1,46
11.PROFILE	0,49	0,32	0,73	2,08

AVERAGE			
To (sec)	Ta (sec)	Tb (sec)	Ak (Amplification)
0,26	0,18	0,40	1,47

$To = \sum 4H\ Vs\ n\ \imath$=1 (sec)……. (Zeevaert,1967)

Ak=68*$Vs_{30}^{-0,6}$……. (Midorikawa, 1987)

The Vibration Period and Ground Amplification calculated in the direction of the parameters obtained during the seismic studies made during the field survey are presented in the table above.

5. 10. WTG10

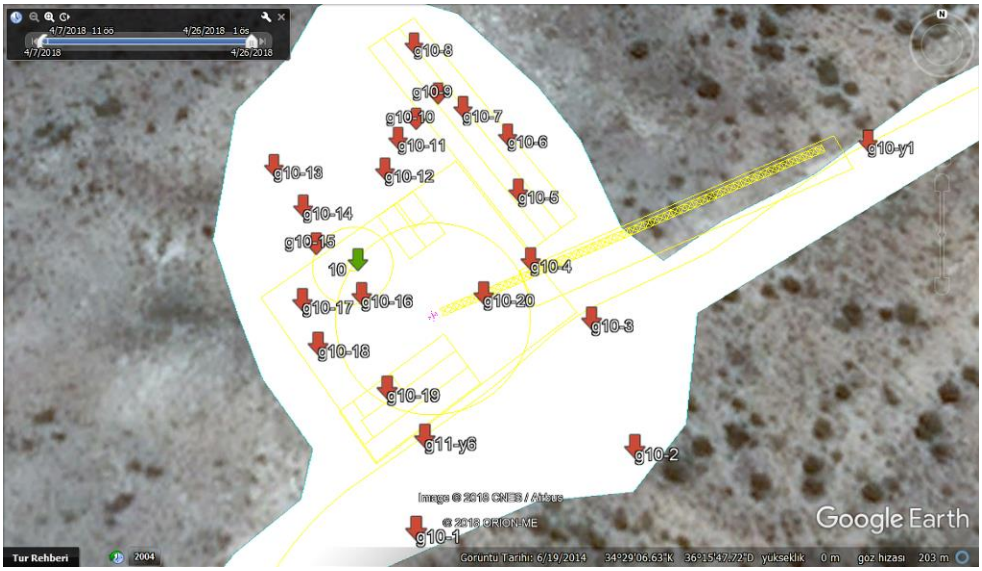
There are 20 measurements taken on the WTG. These measurements showed 3 layers. Layer 1 was found at an average depth of 0,00 m-3,95 m, Layer 2 at an average depth of 3.95 m-13,72 m and Layer 3 at an average depth of 13,72 m. These layer parameters are given in the table below.

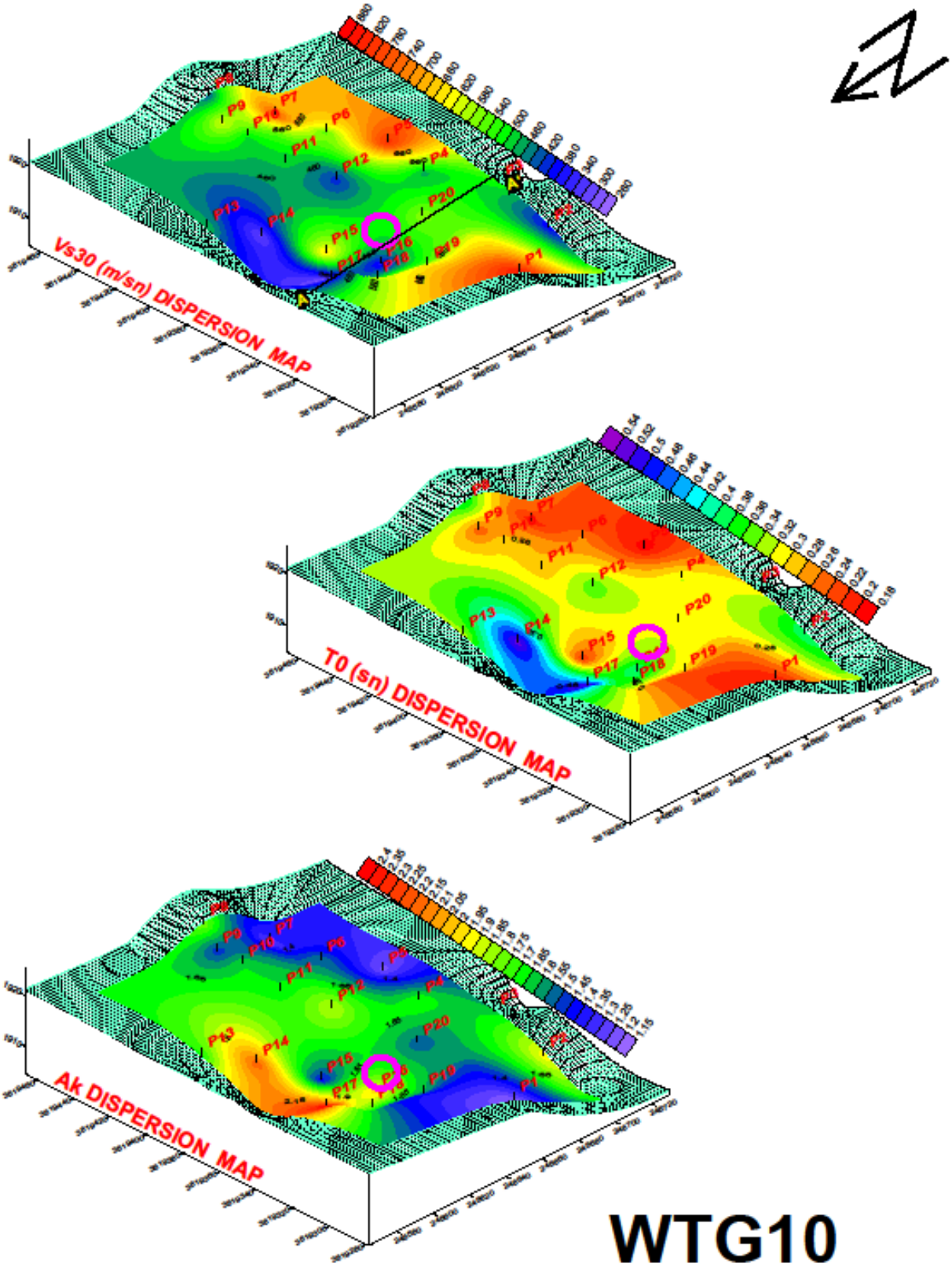
LAYERS	Vp_ Velocity	STRIPPABILITY
1. LAYER	830	Simple strippability
2.LAYER	1080	Simple strippability
3.LAYER	2110	High-hard STRIPPABILITY
LAYERS	**Vs_ Velocity**	**GROUND GROUP**
1. LAYER	318	C
2.LAYER	497	B
3.LAYER	939	A
LAYERS	**G (kg/cm2)**	**ENDURANCE**
1. LAYER	2207	Medium
2.LAYER	5330	Sturdy
3.LAYER	20836	High sturdy
LAYERS	**E (kg/cm2)**	**ENDURANCE**
1. LAYER	6132	Medium
2.LAYER	14340	Sturdy
3.LAYER	57189	High sturdy

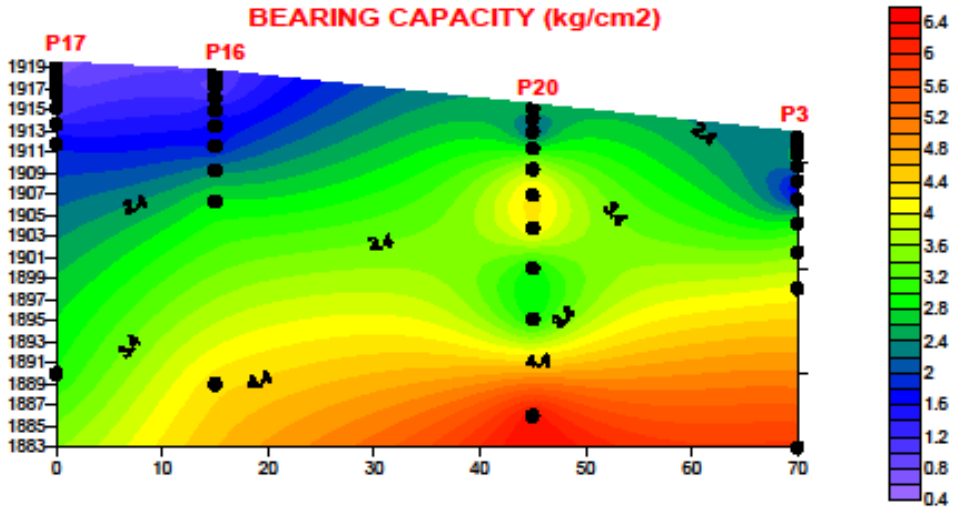
LAYERS	(σ)	POROSITY
1. LAYER	0,40	High Porosity
2.LAYER	0,36	High Porosity
3.LAYER	0,37	High Porosity
LAYERS	**ρ (gr/cm3)**	**DEFINITION**
1. LAYER	1,64	Medium
2.LAYER	1,76	Medium
3.LAYER	2,08	High
LAYERS	**D Y K (ton/m^3)**	
1. LAYER	2414	
2.LAYER	3749	
3.LAYER	7901	
LAYERS	**Ground Carrying Capacity (qu,kg/cm2)**	**Secure Carrying Capacity (qa,kg/cm2)**
1. LAYER	6,03	2,01
2.LAYER	9,37	3,12
3.LAYER	19,75	6,58

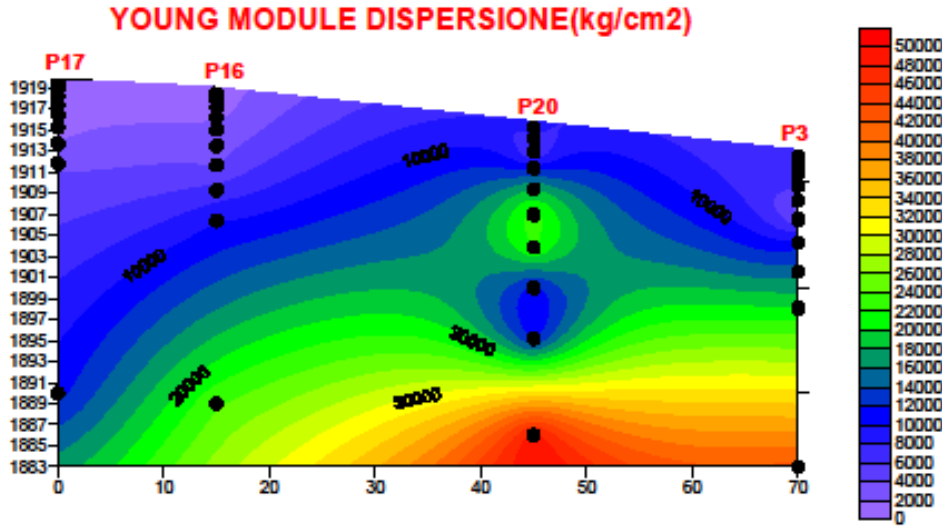
To (sec)	Ta (sec)	Tb (sec)	Vs30 (m/sec)	Ak (Amplification)
0,31	0,21	0,47	529	1,65

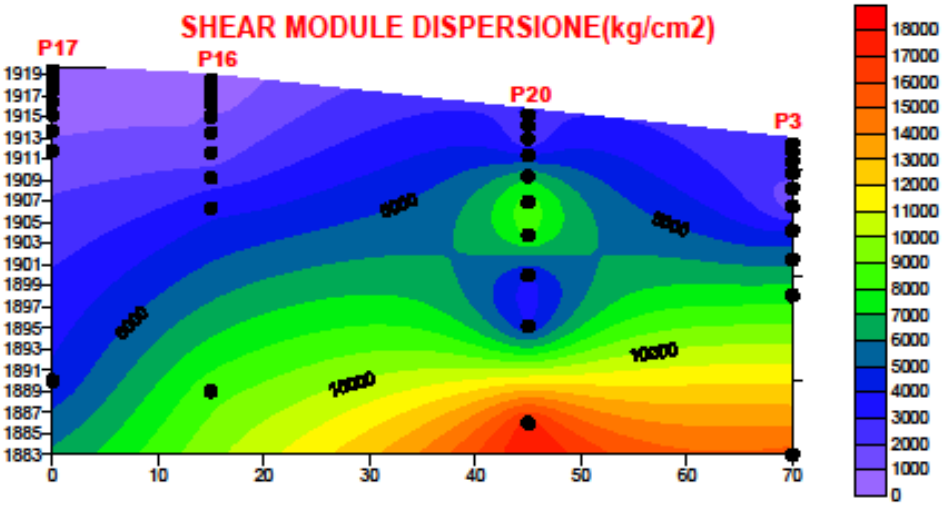
Taking into consideration the measurements taken in the field, it is suggested to slide the WTG weight point in the north-west direction and fit the 5-6-7 profile. Because 11-12-14-16 and 17 were observed to have weak top layers. Taking into account the following applications, the profile points should be seen in the engineering parameters section for detailed values.




Vs30 (m/sn) DISPERSION MAP
T0 (sn) DISPERSION MAP
Ak DISPERSION MAP
WTG10


BEARING CAPACITY (kg/cm2)
P17
P16
P20
P3
6.4
6
5.6
5.2
4.8
4.4
4
3.6
3.2
2.8
2.4
2
1.6
1.2
0.8
0.4


YOUNG MODULE DISPERSIONE(kg/cm2)
P17
P16
P20
P3
50000
48000
46000
44000
42000
40000
38000
36000
34000
32000
30000
28000
26000
24000
22000
20000
18000
16000
14000
12000
10000
8000
6000
4000
2000
0


SHEAR MODULE DISPERSIONE(kg/cm2)
P17
P16
P20
P3
18000
17000
16000
15000
14000
13000
12000
11000
10000
9000
8000
7000
6000
5000
4000
3000
2000
1000
0

5.10.1. WTG10 Seismic P wave velocity (*Compressional Wave Velocity* (Vp))

Vp VELOCITY				
PROFILES	LAYERS	DEPTH	Vp_ Velocity	STRIPPABILITY
1_PROFILE	1. LAYER	-9,47	1557	High Difficult Strippability
	2.LAYER	-21,70	1850	High Difficult Strippability
	3.LAYER		3302	Explosive
2_PROFILE	1. LAYER	-3,26	547	Simple Strippability
	2. LAYER	-14,58	745	Simple Strippability
	3. LAYER		1541	High Difficult Strippability
3_PROFILE	1. LAYER	-6,52	876	Simple Strippability
	2. LAYER	-14,94	1102	Simple Strippability
	3. LAYER		2031	High Difficult Strippability
4_PROFILE	1. LAYER	-4,32	915	Simple Strippability
	2. LAYER	-13,59	921	Simple Strippability
	3. LAYER		1741	High Difficult Strippability
5_PROFILE	1. LAYER	-4,76	1229	Medium Strippability
	2. LAYER	-14,98	1730	High Difficult Strippability
	3. LAYER		3371	Explosive
6_PROFILE	1. LAYER	-2,27	960	Simple Strippability
	2. LAYER	-10,17	1045	Simple Strippability
	3. LAYER		2097	High Difficult Strippability
7_PROFILE	1. LAYER	-4,72	1337	Medium Strippability
	2.LAYER	-14,83	1658	High Difficult Strippability
	3.LAYER		3023	Explosive
8_PROFILE	1. LAYER	-4,22	743	Simple Strippability
	2. LAYER	-18,89	840	Simple Strippability
	3. LAYER		1685	High Difficult Strippability
9_PROFILE	1. LAYER	-2,69	811	Simple Strippability
	2. LAYER	-12,06	1158	Simple Strippability
	3. LAYER		2577	Explosive
10_PROFILE	1. LAYER	-2,61	821	Simple Strippability
	2. LAYER	-11,70	957	Simple Strippability
	3. LAYER		1872	High Difficult Strippability
11_PROFILE	1. LAYER	-1,83	399	High Simple Strippability
	2. LAYER	-8,17	883	Simple Strippability
	3. LAYER		1997	High Difficult Strippability
12_PROFILE	1. LAYER	-3,38	549	Simple Strippability
	2. LAYER	-10,62	824	Simple Strippability
	3. LAYER		1763	High Difficult Strippability
13_PROFILE	1. LAYER	-3,22	775	Simple Strippability
	2. LAYER	-14,39	1062	Simple Strippability
	3. LAYER		2078	High Difficult Strippability
14_PROFILE	1. LAYER	-4,45	388	High Simple Strippability
	2. LAYER	-19,92	638	Simple Strippability
	3. LAYER		1339	Medium Strippability
15_PROFILE	1. LAYER	-3,50	1034	Simple Strippability
	2. LAYER	-8,03	1236	Medium Strippability
	3. LAYER		2236	Explosive
16_PROFILE	1. LAYER	-2,83	452	High Simple Strippability
	2. LAYER	-12,67	720	Simple Strippability
	3. LAYER		1489	Medium Strippability
17_PROFILE	1. LAYER	-2,61	395	High Simple Strippability
	2.LAYER	-8,22	506	Simple Strippability
	3.LAYER		989	Simple Strippability
18_PROFILE	1. LAYER	-4,16	834	Simple Strippability
	2. LAYER	-13,08	1202	Simple Strippability
	3. LAYER		2454	Explosive
19_PROFILE	1. LAYER	-3,49	867	Simple Strippability
	2. LAYER	-10,97	1185	Simple Strippability
	3. LAYER		2376	Explosive
20_PROFILE	1. LAYER	-4,66	1116	Simple Strippability
	2. LAYER	-20,84	1343	Medium Strippability
	3. LAYER		2242	Explosive

P Wave Velocity (m/sec)	Strippability
Vp<458	High Simple Strippability
458<Vp<1220	Simple Strippability
1220<Vp<11525	Medium Strippability
1525<Vp<11830	Difficult Strippability
1830<Vp<12135	High Difficult Strippability
Vp>2135	Explosive Strippability

Strippability of floors with P wave velocity (Church, 1981)

‖AVERAGE‖			
LAYERS	DEPTH	Vp_ Velocity	STRIPPABILITY
1. LAYER	-3,95	830	Simple Strippability
2.LAYER	-13,72	1080	Simple Strippability
3.LAYER	∞	2110	High Difficult Strippability

P wave velocities of the grounds in the study area and strippability

The above table shows the change table and strippability properties of Vp velocity depth values in the direction of the seismic data obtained from the field studies.

5.10.2. WTG10 Seismic S wave velocity (*Transverse Wave Velocity* (Vs))

Vs VELOCITY				
PROFILES	LAYERS	DEPTH	Vs_ Velocity	GROUND GROUPS
1_PROFILE	1. LAYER	-9,47	496	B
	2.LAYER	-21,70	801	A
	3.LAYER		1530	A
2_PROFILE	1. LAYER	-3,26	197	D
	2. LAYER	-14,58	338	C
	3. LAYER		714	A
3_PROFILE	1. LAYER	-6,52	286	C
	2. LAYER	-14,94	563	B
	3. LAYER		857	A
4_PROFILE	1. LAYER	-4,32	421	B
	2. LAYER	-13,59	405	B
	3. LAYER		831	A
5_PROFILE	1. LAYER	-4,76	439	B
	2. LAYER	-14,98	802	A
	3. LAYER		1529	A
6_PROFILE	1. LAYER	-2,27	446	B
	2. LAYER	-10,17	454	B
	3. LAYER		944	A
7_PROFILE	1. LAYER	-4,72	509	B
	2.LAYER	-14,83	717	A
	3.LAYER		1349	A
8_PROFILE	1. LAYER	-4,22	341	C
	2. LAYER	-18,89	368	C
	3. LAYER		738	A
9_PROFILE	1. LAYER	-2,69	306	C
	2. LAYER	-12,06	581	B
	3. LAYER		1100	A
10_PROFILE	1. LAYER	-2,61	354	C
	2. LAYER	-11,70	407	B
	3. LAYER		860	A

11_PROFILE	1. LAYER	-1,83	186	D
	2. LAYER	-8,17	449	B
	3. LAYER		906	A
12_PROFILE	1. LAYER	-3,38	206	C
	2. LAYER	-10,62	412	B
	3. LAYER		734	A
13_PROFILE	1. LAYER	-3,22	259	C
	2. LAYER	-14,39	482	B
	3. LAYER		787	A
14_PROFILE	1. LAYER	-4,45	171	D
	2. LAYER	-19,92	311	C
	3. LAYER		567	B
15_PROFILE	1. LAYER	-3,50	385	C
	2. LAYER	-8,03	531	B
	3. LAYER		1164	A
16_PROFILE	1. LAYER	-2,83	174	D
	2. LAYER	-12,67	338	C
	3. LAYER		667	B
17_PROFILE	1. LAYER	-2,61	134	D
	2.LAYER	-8,22	222	C
	3.LAYER		489	B
18_PROFILE	1. LAYER	-4,16	328	C
	2. LAYER	-13,08	627	B
	3. LAYER		1066	A
19_PROFILE	1. LAYER	-3,49	339	C
	2. LAYER	-10,97	572	B
	3. LAYER		1044	A
20_PROFILE	1. LAYER	-4,66	389	C
	2. LAYER	-20,84	565	B
	3. LAYER		904	A

S Wave Velocity (m/sec)	Ground group
Vs<200	D
200<Vs<400	C
400<Vs<700	B
700<Vs	A

Ground groups according to slip wave velocity(Abyyhy, 1998)

||AVERAGE||			
LAYERS	**DEPTH**	**Vs_ Velocity**	**GROUND GROUPS**
1. LAYER	-3,95	318	C
2.LAYER	-13,72	497	B
3.LAYER	∞	939	A

S wave velocities of the grounds in the study area and ground group

Ground Group	Ground group and top ground layer thickness(h_1)
Z1	(A) Ground group h1< 15 m (B) Ground group
Z2	h_1> 15 m (B) Ground group h_1< 15 m (C) Ground group
Z3	15 m < h_1< 50 m (C) Ground group h_1< 10 m (D) Ground group
Z4	h_1> 50 m (C) Ground group h_1> 10 m (D) Ground group

Ground Group Class

The above table shows that Vs velocity values in the direction of the seismic data obtained in the field studies are the absolute change tables and that the layers are included in the ground groups.

5.10.3. WTG10 Vs30

PROFILES	Vs30 (m/sec)
1.PROFILE	844
2.PROFILE	380
3.PROFILE	513
4.PROFILE	471
5.PROFILE	814
6.PROFILE	547
7.PROFILE	768
8.PROFILE	429
9.PROFILE	610
10.PROFILE	494
11.PROFILE	486
12.PROFILE	403
13.PROFILE	480
14.PROFILE	308
15.PROFILE	651
16.PROFILE	364
17.PROFILE	263
18.PROFILE	600
19.PROFILE	592
20.PROFILE	572

Vs30 values in the direction of the seismic data obtained from the field studies are given in the table above.

5.10.4. WTG10 Shear Modulus-G (kg/cm²)

SHEAR MODULUS				
PROFILES	LAYERS	DEPTH	G(kg/cm^2)	ENDURANCE
1_PROFILE	1. LAYER	-9,47	6865	Sturdy
	2.LAYER	-21,70	13773	Rock Highlid
	3.LAYER		55041	Rock Highlid
2_PROFILE	1. LAYER	-3,26	590	Weak
	2. LAYER	-14,58	1988	Medium
	3. LAYER		9897	Sturdy
3_PROFILE	1. LAYER	-6,52	2138	Medium
	2. LAYER	-14,94	5762	Sturdy
	3. LAYER		15299	Rock Highlid
4_PROFILE	1. LAYER	-4,32	3112	Sturdy
	2. LAYER	-13,59	3183	Sturdy
	3. LAYER		13833	Rock Highlid
5_PROFILE	1. LAYER	-4,76	3712	Sturdy
	2. LAYER	-14,98	13589	Rock Highlid
	3. LAYER		55223	Rock Highlid
6_PROFILE	1. LAYER	-2,27	3460	Sturdy
	2. LAYER	-10,17	4282	Sturdy
	3. LAYER		18686	Rock Highlid
7_PROFILE	1. LAYER	-4,72	4934	Sturdy
	2.LAYER	-14,83	10204	Rock Highlid
	3.LAYER		41830	Rock Highlid

8_PROFILE	1. LAYER	-4,22	1907	Medium
	2. LAYER	-18,89	2594	Medium
	3. LAYER		10815	Rock Highlid
9_PROFILE	1. LAYER	-2,69	1597	Medium
	2. LAYER	-12,06	6777	Sturdy
	3. LAYER		26743	Rock Highlid
10_PROFILE	1. LAYER	-2,61	2093	Medium
	2. LAYER	-11,70	3159	Sturdy
	3. LAYER		15089	Rock Highlid
11_PROFILE	1. LAYER	-1,83	509	Weak
	2. LAYER	-8,17	3795	Sturdy
	3. LAYER		17019	Rock Highlid
12_PROFILE	1. LAYER	-3,38	674	Weak
	2. LAYER	-10,62	2978	Medium
	3. LAYER		10836	Rock Highlid
13_PROFILE	1. LAYER	-3,22	1131	Weak
	2. LAYER	-14,39	4307	Sturdy
	3. LAYER		12968	Rock Highlid
14_PROFILE	1. LAYER	-4,45	439	Weak
	2. LAYER	-19,92	1607	Medium
	3. LAYER		6029	Sturdy
15_PROFILE	1. LAYER	-3,50	3706	Sturdy
	2. LAYER	-8,03	5790	Sturdy
	3. LAYER		28889	Rock Highlid
16_PROFILE	1. LAYER	-2,83	441	Weak
	2. LAYER	-12,67	1961	Medium
	3. LAYER		8563	Sturdy
17_PROFILE	1. LAYER	-2,61	265	High Weak
	2.LAYER	-8,22	781	Weak
	3.LAYER		4155	Sturdy
18_PROFILE	1. LAYER	-4,16	1833	Medium
	2. LAYER	-13,08	7525	Sturdy
	3. LAYER		24785	Rock Highlid
19_PROFILE	1. LAYER	-3,49	1948	Medium
	2. LAYER	-10,97	6392	Sturdy
	3. LAYER		23574	Rock Highlid
20_PROFILE	1. LAYER	-4,66	2780	Medium
	2. LAYER	-20,84	6162	Sturdy
	3. LAYER		17444	Rock Highlid

Shear Modulus (kg/cm^2)	Dayanım
G<400	High Weak
400<G<1500	Weak
1500<G<3000	Medium
3000<G<10000	Sturdy
10000<G	Rock Highlid

The endurance of ground or rocks according to Slip Module values(Keçeli, 1990)

$G = (d*Vs^2)/100$

||AVERAGE||			
LAYERS	**DEPTH**	**G (kg/cm^2)**	**ENDURANCE**
1. LAYER	-3,95	2207	Medium
2.LAYER	-13,72	5330	Sturdy
3.LAYER	∞	20836	Rock Highlid

Shear modules and endurance of the grounds in the study area

Calculation of shear Modulus values in the direction of the seismic data obtained in the field studies and the table of variation are given in the table above.

5.10.5. WTG10 Elasticity Modulus-E (kg/cm²)

ELASTIC MODULUS				
PROFILES	LAYERS	DEPTH	E(kg/cm^2)	ENDURANCE
1_PROFILE	1. LAYER	-9,47	19406	Sturdy
	2.LAYER	-21,70	37669	Rock Highlid
	3.LAYER		150065	Rock Highlid
2_PROFILE	1. LAYER	-3,26	1676	Weak
	2. LAYER	-14,58	5387	Medium
	3. LAYER		26987	Sturdy
3_PROFILE	1. LAYER	-6,52	5927	Medium
	2. LAYER	-14,94	15251	Sturdy
	3. LAYER		42579	Rock Highlid
4_PROFILE	1. LAYER	-4,32	8338	Medium
	2. LAYER	-13,59	8444	Medium
	3. LAYER		37416	Rock Highlid
5_PROFILE	1. LAYER	-4,76	10400	Sturdy
	2. LAYER	-14,98	36798	Rock Highlid
	3. LAYER		151366	Rock Highlid
6_PROFILE	1. LAYER	-2,27	9368	Medium
	2. LAYER	-10,17	11374	Sturdy
	3. LAYER		51311	Rock Highlid
7_PROFILE	1. LAYER	-4,72	13884	Sturdy
	2.LAYER	-14,83	28012	Sturdy
	3.LAYER		115089	Rock Highlid
8_PROFILE	1. LAYER	-4,22	5166	Medium
	2. LAYER	-18,89	6901	Medium
	3. LAYER		29879	Sturdy
9_PROFILE	1. LAYER	-2,69	4480	Weak
	2. LAYER	-12,06	17901	Sturdy
	3. LAYER		74267	Rock Highlid
10_PROFILE	1. LAYER	-2,61	5786	Medium
	2. LAYER	-11,70	8562	Medium
	3. LAYER		41227	Rock Highlid
11_PROFILE	1. LAYER	-1,83	1354	Weak
	2. LAYER	-8,17	9941	Medium
	3. LAYER		46643	Rock Highlid
12_PROFILE	1. LAYER	-3,38	1872	Weak
	2. LAYER	-10,62	7949	Medium
	3. LAYER		30233	Rock Highlid
13_PROFILE	1. LAYER	-3,22	3221	Weak
	2. LAYER	-14,39	11756	Sturdy
	3. LAYER		36733	Rock Highlid
14_PROFILE	1. LAYER	-4,45	1165	Weak
	2. LAYER	-19,92	4301	Weak
	3. LAYER		16770	Sturdy
15_PROFILE	1. LAYER	-3,50	10129	Sturdy
	2. LAYER	-8,03	15487	Sturdy
	3. LAYER		75925	Rock Highlid
16_PROFILE	1. LAYER	-2,83	1237	Weak
	2. LAYER	-12,67	5290	Medium
	3. LAYER		23541	Sturdy
17_PROFILE	1. LAYER	-2,61	743	High Weak
	2.LAYER	-8,22	2124	Weak
	3.LAYER		11122	Sturdy
18_PROFILE	1. LAYER	-4,16	5110	Medium
	2. LAYER	-13,08	19752	Sturdy
	3. LAYER		68593	Rock Highlid

19_PROFILE	1. LAYER	-3,49	5475	Medium
	2. LAYER	-10,97	17040	Sturdy
	3. LAYER		65087	Rock Highlid
20_PROFILE	1. LAYER	-4,66	7893	Medium
	2. LAYER	-20,84	16856	Sturdy
	3. LAYER		48943	Rock Highlid

Elastic Modulus (kg/cm^2)	Dayanım
E<1000	High Weak
1000<E<5000	Weak
5000<E<10000	Medium
10000<E<30000	Sturdy
30000<E	Rock Highlid

The endurance of ground or rocks according to Slip Module values(Keçeli, 1990)

$E=G*(3*V_p^2-4*V_s^2)/(V_p^2-V_s^2)$

||AVERAGE||		
LAYERS	DEPTH	E (kg/cm^2)	ENDURANCE
1. LAYER	-3,95	6132	Medium
2.LAYER	-13,72	14340	Sturdy
3.LAYER	∞	57189	Rock Highlid

Elasticity modules and endurance of the grounds in the study area

Calculation of the modulus of elasticity in the direction of the seismic data obtained in the field studies and the change table are given in the above table

5.10.6. WTG10 Poisson's Ratio - (б)

POISSON'S RATIO				
PROFILES	LAYERS	DEPTH	(σ)	POROSITY
1_PROFILE	1. LAYER	-9,47	0,41	High Porous
	2.LAYER	-21,70	0,38	High Porous
	3.LAYER		0,36	High Porous
2_PROFILE	1. LAYER	-3,26	0,42	High Porous
	2. LAYER	-14,58	0,37	High Porous
	3. LAYER		0,36	High Porous
3_PROFILE	1. LAYER	-6,52	0,40	High Porous
	2. LAYER	-14,94	0,32	Medium Porous
	3. LAYER		0,39	High Porous
4_PROFILE	1. LAYER	-4,32	0,36	High Porous
	2. LAYER	-13,59	0,36	High Porous
	3. LAYER		0,35	High Porous
5_PROFILE	1. LAYER	-4,76	0,42	High Porous
	2. LAYER	-14,98	0,36	High Porous
	3. LAYER		0,37	High Porous
6_PROFILE	1. LAYER	-2,27	0,36	High Porous
	2. LAYER	-10,17	0,37	High Porous
	3. LAYER		0,37	High Porous
7_PROFILE	1. LAYER	-4,72	0,41	High Porous
	2.LAYER	-14,83	0,38	High Porous
	3.LAYER		0,38	High Porous
8_PROFILE	1. LAYER	-4,22	0,36	High Porous
	2. LAYER	-18,89	0,37	High Porous
	3. LAYER		0,38	High Porous
9_PROFILE	1. LAYER	-2,69	0,41	High Porous
	2. LAYER	-12,06	0,33	Medium Porous

	3. LAYER		0,39	High Porous
10_PROFILE	1. LAYER	-2,61	0,38	High Porous
	2. LAYER	-11,70	0,38	High Porous
	3. LAYER		0,37	High Porous
11_PROFILE	1. LAYER	-1,83	0,35	Medium Porous
	2. LAYER	-8,17	0,32	Medium Porous
	3. LAYER		0,37	High Porous
12_PROFILE	1. LAYER	-3,38	0,41	High Porous
	2. LAYER	-10,62	0,33	Medium Porous
	3. LAYER		0,39	High Porous
13_PROFILE	1. LAYER	-3,22	0,43	High Porous
	2. LAYER	-14,39	0,37	High Porous
	3. LAYER		0,42	High Porous
14_PROFILE	1. LAYER	-4,45	0,36	High Porous
	2. LAYER	-19,92	0,34	Medium Porous
	3. LAYER		0,39	High Porous
15_PROFILE	1. LAYER	-3,50	0,38	High Porous
	2. LAYER	-8,03	0,37	High Porous
	3. LAYER		0,31	Medium Porous
16_PROFILE	1. LAYER	-2,83	0,41	High Porous
	2. LAYER	-12,67	0,36	High Porous
	3. LAYER		0,37	High Porous
17_PROFILE	1. LAYER	-2,61	0,43	High Porous
	2.LAYER	-8,22	0,38	High Porous
	3.LAYER		0,34	Medium Porous
18_PROFILE	1. LAYER	-4,16	0,40	High Porous
	2. LAYER	-13,08	0,31	Medium Porous
	3. LAYER		0,38	High Porous
19_PROFILE	1. LAYER	-3,49	0,41	High Porous
	2. LAYER	-10,97	0,35	Medium Porous
	3. LAYER		0,38	High Porous
20_PROFILE	1. LAYER	-4,66	0,43	High Porous
	2. LAYER	-20,84	0,38	High Porous
	3. LAYER		0,40	High Porous

Poisson's Ratio;(σ)	Porosity
0,00≤σ≤0,25	Nonporous
0,26≤σ≤0,35	Medium Porous
0,36≤σ≤0,50	High Porous

Poisson ratio classification

$\sigma=(Vp^2-2*Vs^2)/(2*Vp^2-2*Vs^2)$

‖AVERAGE‖			
LAYERS	**DEPTH**	**(σ)**	**POROSITY**
1. LAYER	-3,95	0,40	High Porous
2.LAYER	-13,72	0,36	High Porous
3.LAYER	∞	0,37	High Porous

Poisson's ratio values of the units in the study area, porosity

Calculation of poisson's ratio values in the direction of the seismic data obtained in the field studies and the change table are given in the above table.

5.10.7. WTG10 Density - ρ (gr/ cm^3)

DENSITY				
PROFILES	LAYERS	DEPTH	ρ (gr/cm^3)	DEFINITION
1_PROFILE	1. LAYER	-9,47	1,95	High
	2.LAYER	-21,70	2,03	High
	3.LAYER		2,35	High
2_PROFILE	1. LAYER	-3,26	1,50	Medium
	2. LAYER	-14,58	1,62	Medium
	3. LAYER		1,94	High
3_PROFILE	1. LAYER	-6,52	1,69	Medium
	2. LAYER	-14,94	1,78	Medium
	3. LAYER		2,08	High
4_PROFILE	1. LAYER	-4,32	1,70	Medium
	2. LAYER	-13,59	1,71	Medium
	3. LAYER		2,00	High
5_PROFILE	1. LAYER	-4,76	1,84	Medium
	2. LAYER	-14,98	2,00	High
	3. LAYER		2,36	High
6_PROFILE	1. LAYER	-2,27	1,73	Medium
	2. LAYER	-10,17	1,76	Medium
	3. LAYER		2,10	High
7_PROFILE	1. LAYER	-4,72	1,87	Medium
	2.LAYER	-14,83	1,98	High
	3.LAYER		2,30	High
8_PROFILE	1. LAYER	-4,22	1,62	Medium
	2. LAYER	-18,89	1,67	Medium
	3. LAYER		1,99	High
9_PROFILE	1. LAYER	-2,69	1,65	Medium
	2. LAYER	-12,06	1,80	Medium
	3. LAYER		2,21	High
10_PROFILE	1. LAYER	-2,61	1,66	Medium
	2. LAYER	-11,70	1,72	Medium
	3. LAYER		2,04	High
11_PROFILE	1. LAYER	-1,83	1,38	Low
	2. LAYER	-8,17	1,68	Medium
	3. LAYER		2,07	High
12_PROFILE	1. LAYER	-3,38	1,50	Medium
	2. LAYER	-10,62	1,65	Medium
	3. LAYER		2,01	High
13_PROFILE	1. LAYER	-3,22	1,64	Medium
	2. LAYER	-14,39	1,77	Medium
	3. LAYER		2,09	High
14_PROFILE	1. LAYER	-4,45	1,38	Low
	2. LAYER	-19,92	1,55	Medium
	3. LAYER		1,88	Medium
15_PROFILE	1. LAYER	-3,50	1,76	Medium
	2. LAYER	-8,03	1,84	Medium
	3. LAYER		2,13	High
16_PROFILE	1. LAYER	-2,83	1,43	Medium
	2. LAYER	-12,67	1,60	Medium
	3. LAYER		1,93	High
17_PROFILE	1. LAYER	-2,61	1,38	Low
	2.LAYER	-8,22	1,47	Medium
	3.LAYER		1,74	Medium
18_PROFILE	1. LAYER	-4,16	1,67	Medium

	2. LAYER	-13,08	1,82	Medium
	3. LAYER		2,18	High
19_PROFILE	1. LAYER	-3,49	1,68	Medium
	2. LAYER	-10,97	1,81	Medium
	3. LAYER		2,16	High
20_PROFILE	1. LAYER	-4,66	1,79	Medium
	2. LAYER	-20,84	1,88	Medium
	3. LAYER		2,13	High

Density: ρ (gr/cm^3)	Tanımlama
ρ<1,20	High low
1,20<ρ<1,40	Low
1,40<ρ<1,90	Medium
1,90<ρ<2,20	High
2,20<ρ	Too High

Density Classification of Ground Units: (Keçeli, 1990)

$\rho = d = 0.31 * Vp0.25$

‖AVERAGE‖			
LAYERS	DEPTH	ρ (gr/cm^3)	DEFINITION
1. LAYER	-3,95	1,64	Medium
2.LAYER	-13,72	1,76	Medium
3.LAYER	∞	2,08	High

Density values and description of the units in the study area

Calculation of the density values of the geological units in the direction of the seismic data obtained in the field studies and the table of variation are given in the above table.

5.10.8. WTG10 Modulus of Subgrade Reaction – D Y K (ton/m^3)

Modulus of Subgrade Reaction			
PROFILES	LAYERS	DEPTH	D Y K (ton/m^3)
1_PROFILE	1. LAYER	-9,47	4632
	2.LAYER	-21,70	6477
	3.LAYER		14148
2_PROFILE	1. LAYER	-3,26	1380
	2. LAYER	-14,58	2422
	3. LAYER		5571
3_PROFILE	1. LAYER	-6,52	2550
	2. LAYER	-14,94	4200
	3. LAYER		7035
4_PROFILE	1. LAYER	-4,32	3067
	2. LAYER	-13,59	2960
	3. LAYER		6622
5_PROFILE	1. LAYER	-4,76	3313
	2. LAYER	-14,98	6417
	3. LAYER		14221
6_PROFILE	1. LAYER	-2,27	3269
	2. LAYER	-10,17	3376
	3. LAYER		7794
7_PROFILE	1. LAYER	-4,72	3888
	2.LAYER	-14,83	5659
	3.LAYER		12162
8_PROFILE	1. LAYER	-4,22	2439
	2. LAYER	-18,89	2672
	3. LAYER		5845
9_PROFILE	1. LAYER	-2,69	2205
	2. LAYER	-12,06	4389
	3. LAYER		9519

10_PROFILE	1. LAYER	-2,61	2557
	2. LAYER	-11,70	2992
	3. LAYER		6946
11_PROFILE	1. LAYER	-1,83	1280
	2. LAYER	-8,17	3283
	3. LAYER		7410
12_PROFILE	1. LAYER	-3,38	1441
	2. LAYER	-10,62	2984
	3. LAYER		5865
13_PROFILE	1. LAYER	-3,22	1856
	2. LAYER	-14,39	3586
	3. LAYER		6488
14_PROFILE	1. LAYER	-4,45	1175
	2. LAYER	-19,92	2204
	3. LAYER		4331
15_PROFILE	1. LAYER	-3,50	3370
	2. LAYER	-8,03	4022
	3. LAYER		9746
16_PROFILE	1. LAYER	-2,83	1199
	2. LAYER	-12,67	2420
	3. LAYER		5176
17_PROFILE	1. LAYER	-2,61	923
	2.LAYER	-8,22	1550
	3.LAYER		3595
18_PROFILE	1. LAYER	-4,16	2372
	2. LAYER	-13,08	4741
	3. LAYER		9113
19_PROFILE	1. LAYER	-3,49	2460
	2. LAYER	-10,97	4314
	3. LAYER		8857
20_PROFILE	1. LAYER	-4,66	2898
	2. LAYER	-20,84	4315
	3. LAYER		7575

||AVERAGE||		
LAYERS	**DEPTH**	**D Y K (ton/m^3)**
1. LAYER	-3,95	2414
2.LAYER	-13,72	3749
3.LAYER	∞	7901
kv= 40*(Gs)*qu ton/m^3 *(Bowles 1984)*		

The above table shows the Modulus of Subgrade Reaction obtained for each layer in the direction of the data obtained after the seismic measurements made in the study area.

5.10.9. WTG10 Bearing Capacity qu (kg/cm2) / Allowable Bearing Capacity qa (kg/cm2)

PROFILES	LAYERS	DEPTH	BEARING CAPACITY (qu,kg/cm^2)	ALLOWABLE BEARING CAPACITY (qa,kg/cm^2)
1_PROFILE	1. LAYER	-9,47	11,58	3,86
	2.LAYER	-21,70	16,19	5,40
	3.LAYER	-28,30	35,37	11,79
2_PROFILE	1. LAYER	-3,26	3,45	1,15
	2. LAYER	-14,58	6,06	2,02
	3. LAYER	-35,42	13,93	4,64
3_PROFILE	1. LAYER	-6,52	6,38	2,13

	2. LAYER	-14,94	10,50	3,50
	3. LAYER	-35,06	17,59	5,86
4_PROFILE	1. LAYER	-4,32	7,67	2,56
	2. LAYER	-13,59	7,40	2,47
	3. LAYER	-36,41	16,56	5,52
5_PROFILE	1. LAYER	-4,76	8,28	2,76
	2. LAYER	-14,98	16,04	5,35
	3. LAYER	-35,02	35,55	11,85
6_PROFILE	1. LAYER	-2,27	8,17	2,72
	2. LAYER	-10,17	8,44	2,81
	3. LAYER	-39,83	19,49	6,50
7_PROFILE	1. LAYER	-4,72	9,72	3,24
	2.LAYER	-14,83	14,15	4,72
	3.LAYER	-35,17	30,41	10,14
8_PROFILE	1. LAYER	-4,22	6,10	2,03
	2. LAYER	-18,89	6,68	2,23
	3. LAYER	-31,11	14,61	4,87
9_PROFILE	1. LAYER	-2,69	5,51	1,84
	2. LAYER	-12,06	10,97	3,66
	3. LAYER	-37,94	23,80	7,93
10_PROFILE	1. LAYER	-2,61	6,39	2,13
	2. LAYER	-11,70	7,48	2,49
	3. LAYER	-38,30	17,36	5,79
11_PROFILE	1. LAYER	-1,83	3,20	1,07
	2. LAYER	-8,17	8,21	2,74
	3. LAYER	-41,83	18,53	6,18
12_PROFILE	1. LAYER	-3,38	3,60	1,20
	2. LAYER	-10,62	7,46	2,49
	3. LAYER	-39,38	14,66	4,89
13_PROFILE	1. LAYER	-3,22	4,64	1,55
	2. LAYER	-14,39	8,97	2,99
	3. LAYER	-35,61	16,22	5,41
14_PROFILE	1. LAYER	-4,45	2,94	0,98
	2. LAYER	-19,92	5,51	1,84
	3. LAYER	-30,08	10,83	3,61
15_PROFILE	1. LAYER	-3,50	8,42	2,81
	2. LAYER	-8,03	10,05	3,35
	3. LAYER	-41,97	24,37	8,12
16_PROFILE	1. LAYER	-2,83	3,00	1,00
	2. LAYER	-12,67	6,05	2,02
	3. LAYER	-37,33	12,94	4,31
17_PROFILE	1. LAYER	-2,61	2,31	0,77
	2.LAYER	-8,22	3,88	1,29
	3.LAYER	-41,78	8,99	3,00
18_PROFILE	1. LAYER	-4,16	5,93	1,98
	2. LAYER	-13,08	11,85	3,95
	3. LAYER	-36,92	22,78	7,59
19_PROFILE	1. LAYER	-3,49	6,15	2,05
	2. LAYER	-10,97	10,79	3,60
	3. LAYER	-39,03	22,14	7,38
20_PROFILE	1. LAYER	-4,66	7,25	2,42
	2. LAYER	-20,84	10,79	3,60
	3. LAYER	-29,16	18,94	6,31

LAYERS	||AVERAGE|| DEPTH	Bearing Capacity (qu,kg/cm^2)
1. LAYER	-3,95	6,03
2.LAYER	-13,72	9,37
3.LAYER	∞	19,75

qu=(0,024*Vs*(J.B.K+0,002*Vp)*0,71)/G.K

BEARING CAPACITY CALCULATION	Geological unit factor 18	16	17	18	20
(Prof. Dr. SEMIH TEZCAN-2006)	Safety factor 50-100	CLAY	SAND	SEDIMENT	VOLATISILE

LAYERS	||AVERAGE|| DEPTH	Allowable Bearing Capacity (qa,kg/cm^2)
1. LAYER	-3,95	2,01
2.LAYER	-13,72	3,12
3.LAYER	∞	6,58

qa=qu/G.K G.K=3 empirical value

5.10.10 WTG10 Vibration Period - T_0 (sec) / Ground Amplification (Ak)

PROFILES	To (sec)	Ta (sec)	Tb (sec)	Ak (Amplification)
1.PROFILE	0,20	0,13	0,30	1,19
2.PROFILE	0,40	0,26	0,60	1,92
3.PROFILE	0,30	0,20	0,46	1,61
4.PROFILE	0,32	0,21	0,48	1,69
5.PROFILE	0,19	0,12	0,28	1,22
6.PROFILE	0,26	0,18	0,39	1,55
7.PROFILE	0,20	0,13	0,30	1,26
8.PROFILE	0,38	0,25	0,57	1,79
9.PROFILE	0,24	0,16	0,36	1,45
10.PROFILE	0,30	0,20	0,45	1,65
11.PROFILE	0,28	0,19	0,42	1,66
12.PROFILE	0,36	0,24	0,53	1,86
13.PROFILE	0,32	0,22	0,48	1,67
14.PROFILE	0,53	0,35	0,80	2,19
15.PROFILE	0,21	0,14	0,32	1,39
16.PROFILE	0,41	0,27	0,61	1,98
17.PROFILE	0,52	0,35	0,79	2,40
18.PROFILE	0,25	0,17	0,37	1,46
19.PROFILE	0,24	0,16	0,37	1,48
20.PROFILE	0,30	0,20	0,45	1,51

AVERAGE			
To (sec)	Ta (sec)	Tb (sec)	Ak (Amplification)
0,31	0,21	0,47	1,65

$To = \sum 4H\ Vs\ n\ \imath$=1 (sec)……. (Zeevaert,1967)

Ak=68*$Vs_{30}^{-0,6}$…… (Midorikawa, 1987)

The Vibration Period and Ground Amplification calculated in the direction of the parameters obtained during the seismic studies made during the field survey are presented in the table above.

5. 11. WTG11

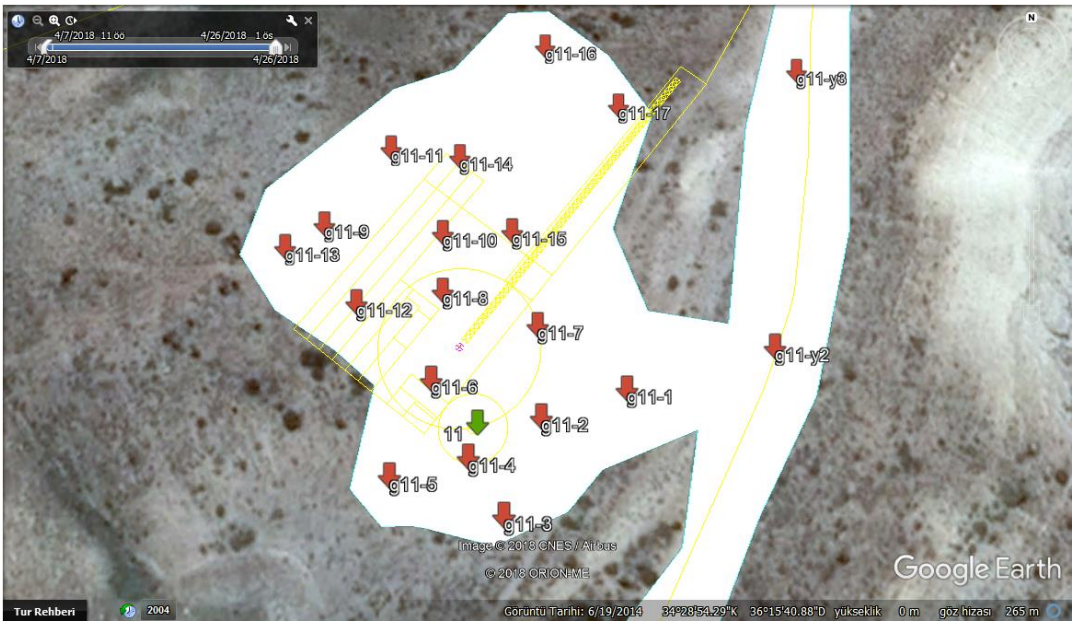
There are 17 measurements taken on the WTG. These measurements showed 3 layers. Layer 1 was found at an average depth of 0,00 m-3,61 m, Layer 2 at an average depth of 3,61 m-12,93 m and Layer 3 at an average depth of 12,93 m. The parameters of this layer are given in the table below.

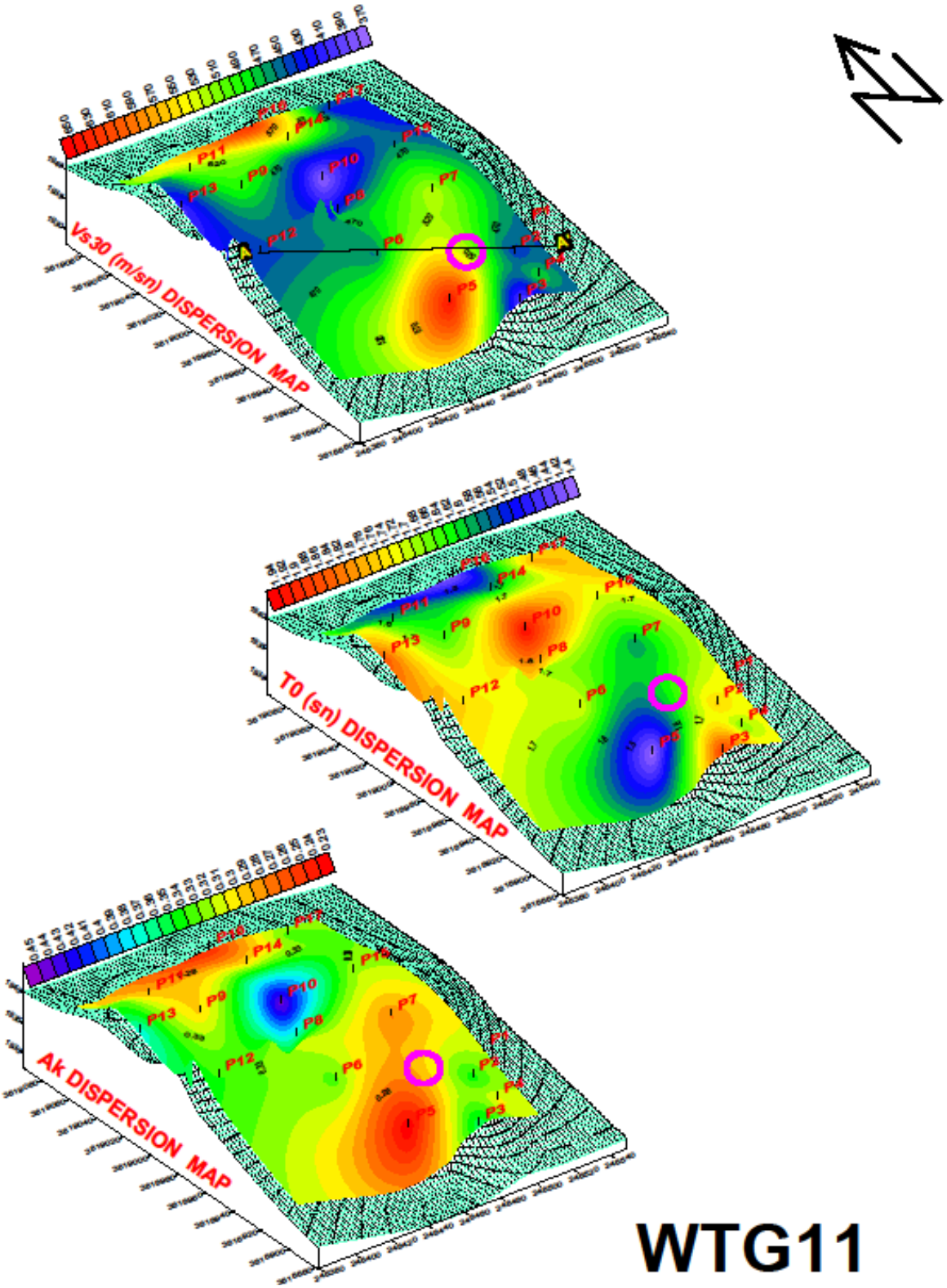
LAYERS	Vp_ Velocity	STRIPPABILITY
1. LAYER	794	Simple strippability
2.LAYER	992	Simple strippability
3.LAYER	1932	High-hard STRIPPABILITY
LAYERS	**Vs_ Velocity**	**GROUND GROUP**
1. LAYER	319	C
2.LAYER	459	B
3.LAYER	832	A
LAYERS	**G (kg/cm2)**	**ENDURANCE**
1. LAYER	1937	Medium
2.LAYER	4064	Sturdy
3.LAYER	14770	High sturdy
LAYERS	**E (kg/cm2)**	**ENDURANCE**
1. LAYER	5292	Medium
2.LAYER	10891	Sturdy
3.LAYER	40768	High sturdy

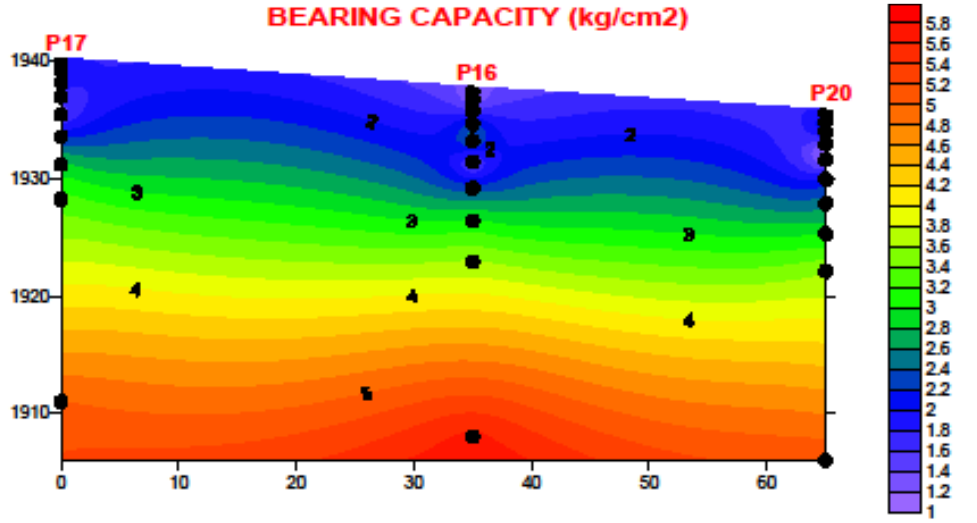
LAYERS	(σ)	POROSITY
1. LAYER	0,39	High Porosity
2.LAYER	0,36	High Porosity
3.LAYER	0,38	High Porosity
LAYERS	**ρ (gr/cm3)**	**DEFINITION**
1. LAYER	1,64	Medium
2.LAYER	1,73	Medium
3.LAYER	2,05	High
LAYERS	**D Y K (ton/m^3)**	
1. LAYER	2326	
2.LAYER	3393	
3.LAYER	6790	
LAYERS	**Ground Carrying Capacity (qu,kg/cm2)**	**Secure Carrying Capacity (qa,kg/cm2)**
1. LAYER	5,82	1,94
2.LAYER	8,48	2,83
3.LAYER	16,98	5,66

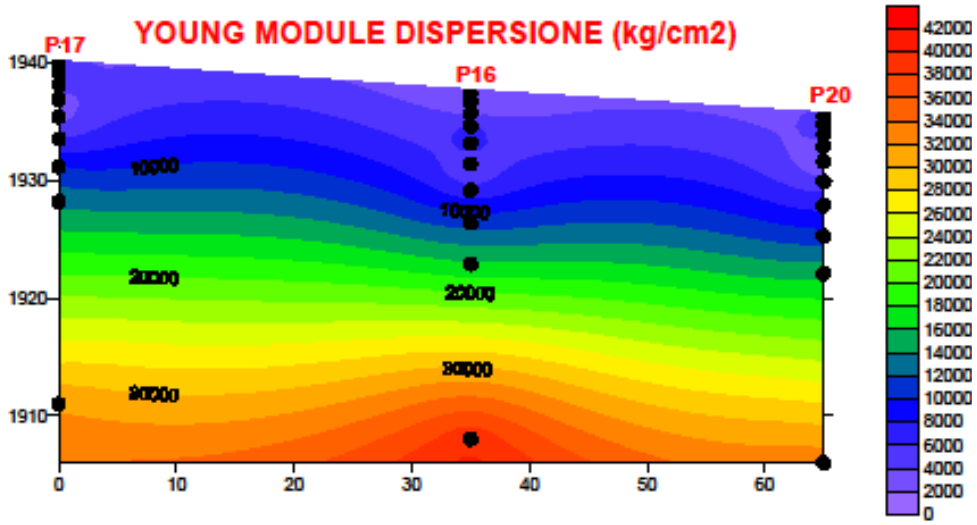
To (sec)	Ta (sec)	Tb (sec)	Vs30 (m/sec)	Ak (Amplification)
0,32	0,21	0,48	480	1,69

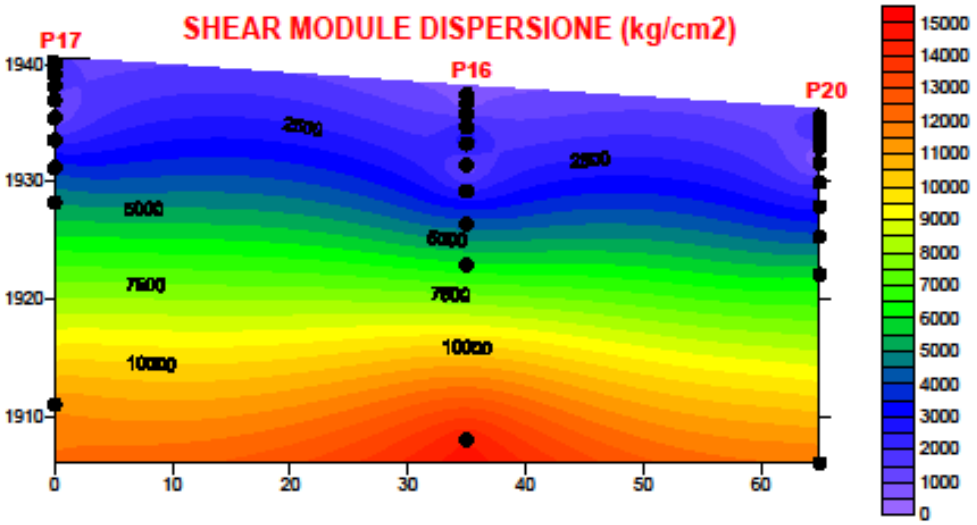
Taking into account the following applications, the profile points should be seen in the engineering parameters section for detailed values.




Vs30 (m/sn) DISPERSION MAP
T0 (sn) DISPERSION MAP
Ak DISPERSION MAP
WTG11


BEARING CAPACITY (kg/cm2)
P17
P16
P20
1940
1930
1920
1910
0
10
20
30
40
50
60
5.8
5.6
5.4
5.2
5
4.8
4.6
4.4
4.2
4
3.8
3.6
3.4
3.2
3
2.8
2.6
2.4
2.2
2
1.8
1.6
1.4
1.2
1


YOUNG MODULE DISPERSIONE (kg/cm2)
P17
P16
P20
1940
1930
1920
1910
0
10
20
30
40
50
60
42000
40000
38000
36000
34000
32000
30000
28000
26000
24000
22000
20000
18000
16000
14000
12000
10000
8000
6000
4000
2000
0


SHEAR MODULE DISPERSIONE (kg/cm2)
P17
P16
P20
1940
1930
1920
1910
0
10
20
30
40
50
60
15000
14000
13000
12000
11000
10000
9000
8000
7000
6000
5000
4000
3000
2000
1000
0

5.11.1. WTG11 Seismic P wave velocity (*Compressional Wave Velocity* (Vp))

Vp VELOCITY				
PROFILES	LAYERS	DEPTH	Vp_ Velocity	STRIPPABILITY
1_PROFILE	1. LAYER	-2,34	586	Simple Strippability
	2.LAYER	-10,47	891	Simple Strippability
	3.LAYER		1919	High Difficult Strippability
2_PROFILE	1. LAYER	-4,43	706	Simple Strippability
	2. LAYER	-13,92	862	Simple Strippability
	3. LAYER		1774	High Difficult Strippability
3_PROFILE	1. LAYER	-2,69	757	Simple Strippability
	2. LAYER	-8,46	1017	Simple Strippability
	3. LAYER		1739	High Difficult Strippability
4_PROFILE	1. LAYER	-2,67	593	Simple Strippability
	2. LAYER	-11,96	938	Simple Strippability
	3. LAYER		1976	High Difficult Strippability
5_PROFILE	1. LAYER	-3,86	990	Simple Strippability
	2. LAYER	-12,13	1293	Medium Strippability
	3. LAYER		2610	Explosive
6_PROFILE	1. LAYER	-4,81	745	Simple Strippability
	2. LAYER	-15,12	947	Simple Strippability
	3. LAYER		1841	High Difficult Strippability
7_PROFILE	1. LAYER	-2,72	761	Simple Strippability
	2.LAYER	-12,18	989	Simple Strippability
	3.LAYER		2086	High Difficult Strippability
8_PROFILE	1. LAYER	-5,19	772	Simple Strippability
	2. LAYER	-11,89	1005	Simple Strippability
	3. LAYER		1886	High Difficult Strippability
9_PROFILE	1. LAYER	-3,95	824	Simple Strippability
	2. LAYER	-12,41	967	Simple Strippability
	3. LAYER		1819	High Difficult Strippability
10_PROFILE	1. LAYER	-5,19	707	Simple Strippability
	2. LAYER	-16,33	918	Simple Strippability
	3. LAYER		1596	High Difficult Strippability
11_PROFILE	1. LAYER	-3,17	800	Simple Strippability
	2. LAYER	-14,16	1077	Simple Strippability
	3. LAYER		2075	High Difficult Strippability
12_PROFILE	1. LAYER	-2,86	761	Simple Strippability
	2. LAYER	-12,79	882	Simple Strippability
	3. LAYER		1774	High Difficult Strippability
13_PROFILE	1. LAYER	-4,53	749	Simple Strippability
	2. LAYER	-14,26	828	Simple Strippability
	3. LAYER		1585	High Difficult Strippability
14_PROFILE	1. LAYER	-3,73	1198	Simple Strippability
	2. LAYER	-16,69	1070	Simple Strippability
	3. LAYER		2008	High Difficult Strippability
15_PROFILE	1. LAYER	-2,78	908	Simple Strippability
	2. LAYER	-12,42	918	Simple Strippability
	3. LAYER		1730	High Difficult Strippability
16_PROFILE	1. LAYER	-3,18	997	Simple Strippability
	2. LAYER	-14,22	1386	Medium Strippability
	3. LAYER		2677	Explosive
17_PROFILE	1. LAYER	-3,33	645	Simple Strippability
	2.LAYER	-10,48	883	Simple Strippability
	3.LAYER		1752	High Difficult Strippability

P Wave Velocity (m/sec)	Strippability
Vp<458	High Simple Strippability
458<Vp<1220	Simple Strippability
1220<Vp<11525	Medium Strippability
1525<Vp<11830	Difficult Strippability
1830<Vp<12135	High Difficult Strippability
Vp>2135	Explosive Strippability

Strippability of floors with P wave velocity (Church, 1981)

||AVERAGE||			
LAYERS	DEPTH	Vp_ Velocity	STRIPPABILITY
1. LAYER	-3,61	794	Simple Strippability
2.LAYER	-12,93	992	Simple Strippability
3.LAYER	∞	1932	High Difficult Strippability

P wave velocities of the grounds in the study area and strippability

The above table shows the change table and strippability properties of Vp velocity depth values in the direction of the seismic data obtained from the field studies.

5.11.2. WTG11 Seismic S wave velocity (*Transverse Wave Velocity* (Vs))

Vs VELOCITY				
PROFILES	LAYERS	DEPTH	Vs_ Velocity	GROUND GROUPS
1_PROFILE	1. LAYER	-2,34	242	C
	2.LAYER	-10,47	442	B
	3.LAYER		791	A
2_PROFILE	1. LAYER	-4,43	280	C
	2. LAYER	-13,92	456	B
	3. LAYER		773	A
3_PROFILE	1. LAYER	-2,69	287	C
	2. LAYER	-8,46	435	B
	3. LAYER		638	B
4_PROFILE	1. LAYER	-2,67	239	C
	2. LAYER	-11,96	452	B
	3. LAYER		877	A
5_PROFILE	1. LAYER	-3,86	401	B
	2. LAYER	-12,13	665	B
	3. LAYER		1133	A
6_PROFILE	1. LAYER	-4,81	294	C
	2. LAYER	-15,12	421	B
	3. LAYER		844	A
7_PROFILE	1. LAYER	-2,72	301	C
	2.LAYER	-12,18	443	B
	3.LAYER		966	A
8_PROFILE	1. LAYER	-5,19	246	C
	2. LAYER	-11,89	515	B
	3. LAYER		827	A
9_PROFILE	1. LAYER	-3,95	320	C
	2. LAYER	-12,41	427	B

	3. LAYER		926	A
10_PROFILE	1. LAYER	-5,19	279	C
	2. LAYER	-16,33	417	B
	3. LAYER		518	B
11_PROFILE	1. LAYER	-3,17	276	C
	2. LAYER	-14,16	500	B
	3. LAYER		941	A
12_PROFILE	1. LAYER	-2,86	320	C
	2. LAYER	-12,79	376	C
	3. LAYER		751	A
13_PROFILE	1. LAYER	-4,53	299	C
	2. LAYER	-14,26	349	C
	3. LAYER		706	A
14_PROFILE	1. LAYER	-3,73	560	B
	2. LAYER	-16,69	437	B
	3. LAYER		917	A
15_PROFILE	1. LAYER	-2,78	430	B
	2. LAYER	-12,42	383	C
	3. LAYER		798	A
16_PROFILE	1. LAYER	-3,18	401	B
	2. LAYER	-14,22	650	B
	3. LAYER		994	A
17_PROFILE	1. LAYER	-3,33	244	C
	2.LAYER	-10,48	431	B
	3.LAYER		753	A

S Wave Velocity (m/sec)	Ground group
Vs<200	D
200<Vs<400	C
400<Vs<700	B
700<Vs	A

Ground groups according to slip wave velocity(Abyyhy, 1998)

||AVERAGE||			
LAYERS	DEPTH	Vs_ Velocity	GROUND GROUPS
1. LAYER	-3,61	319	C
2.LAYER	-12,93	459	B
3.LAYER	∞	832	A

S wave velocities of the grounds in the study area and ground group

Ground Group	Ground group and top ground layer thickness(h_1)
Z1	(A) Ground group h1< 15 m (B) Ground group
Z2	h_1> 15 m (B) Ground group h_1< 15 m (C) Ground group
Z3	15 m < h_1< 50 m (C) Ground group h_1< 10 m (D) Ground group
Z4	h_1> 50 m (C) Ground group h_1> 10 m (D) Ground group

Ground Group Class

The above table shows that Vs velocity values in the direction of the seismic data obtained in the field studies are the absolute change tables and that the layers are included in the ground groups.

5.11.3. WTG11 Vs30

PROFILES	Vs30 (m/sec)
1.PROFILE	452
2.PROFILE	439
3.PROFILE	393
4.PROFILE	483
5.PROFILE	646
6.PROFILE	458
7.PROFILE	527
8.PROFILE	478
9.PROFILE	493
10.PROFILE	374
11.PROFILE	512
12.PROFILE	442
13.PROFILE	405
14.PROFILE	530
15.PROFILE	462
16.PROFILE	628
17.PROFILE	432

Vs30 values in the direction of the seismic data obtained from the field studies are given in the table above.

5.11.4. WTG11 Shear Modulus-G (kg/cm²)

SHEAR MODULUS				
PROFILES	LAYERS	DEPTH	G(kg/cm^2)	ENDURANCE
1_PROFILE	1. LAYER	-2,34	963	Weak
	2.LAYER	-10,47	3471	Sturdy
	3.LAYER		12826	Rock Highlid
2_PROFILE	1. LAYER	-4,43	1366	Weak
	2. LAYER	-13,92	3660	Sturdy
	3. LAYER		12008	Rock Highlid
3_PROFILE	1. LAYER	-2,69	1396	Weak
	2. LAYER	-8,46	3441	Sturdy
	3. LAYER		8150	Sturdy
4_PROFILE	1. LAYER	-2,67	917	Weak
	2. LAYER	-11,96	3667	Sturdy
	3. LAYER		15897	Rock Highlid
5_PROFILE	1. LAYER	-3,86	3033	Sturdy
	2. LAYER	-12,13	8518	Sturdy
	3. LAYER		28454	Rock Highlid
6_PROFILE	1. LAYER	-4,81	1554	Medium
	2. LAYER	-15,12	3400	Sturdy
	3. LAYER		14471	Rock Highlid
7_PROFILE	1. LAYER	-2,72	1483	Weak
	2.LAYER	-12,18	3783	Sturdy
	3.LAYER		19530	Rock Highlid
8_PROFILE	1. LAYER	-5,19	1502	Medium
	2. LAYER	-11,89	4716	Sturdy
	3. LAYER		13985	Rock Highlid

9_PROFILE	1. LAYER	-3,95	1845	Medium
	2. LAYER	-12,41	3487	Sturdy
	3. LAYER		17345	Rock Highlid
10_PROFILE	1. LAYER	-5,19	1259	Weak
	2. LAYER	-16,33	3016	Sturdy
	3. LAYER		5251	Sturdy
11_PROFILE	1. LAYER	-3,17	1415	Weak
	2. LAYER	-14,16	4921	Sturdy
	3. LAYER		18518	Rock Highlid
12_PROFILE	1. LAYER	-2,86	1669	Medium
	2. LAYER	-12,79	2618	Medium
	3. LAYER		11337	Rock Highlid
13_PROFILE	1. LAYER	-4,53	1546	Medium
	2. LAYER	-14,26	2242	Medium
	3. LAYER		9747	Sturdy
14_PROFILE	1. LAYER	-3,73	5852	Sturdy
	2. LAYER	-16,69	3950	Sturdy
	3. LAYER		17435	Rock Highlid
15_PROFILE	1. LAYER	-2,78	3181	Sturdy
	2. LAYER	-12,42	2828	Medium
	3. LAYER		12722	Rock Highlid
16_PROFILE	1. LAYER	-3,18	2996	Medium
	2. LAYER	-14,22	8122	Sturdy
	3. LAYER		22050	Rock Highlid
17_PROFILE	1. LAYER	-3,33	948	Weak
	2.LAYER	-10,48	3250	Sturdy
	3.LAYER		11362	Rock Highlid

Shear Modulus (kg/cm^2)	Dayanım
G<400	High Weak
400<G<1500	Weak
1500<G<3000	Medium
3000<G<10000	Sturdy
10000<G	Rock Highlid

The endurance of ground or rocks according to Slip Module values(Keçeli, 1990)

$G = (d*Vs^2)/100$

||AVERAGE||			
LAYERS	**DEPTH**	**G (kg/cm^2)**	**ENDURANCE**
1. LAYER	-3,61	1937	Medium
2.LAYER	-12,93	4064	Sturdy
3.LAYER	∞	14770	Rock Highlid

Shear modules and endurance of the grounds in the study area

Calculation of shear Modulus values in the direction of the seismic data obtained in the field studies and the table of variation are given in the table above.

5.11.5. WTG11 Elasticity Modulus-E (kg/cm²)

ELASTIC MODULUS				
PROFILES	LAYERS	DEPTH	E(kg/cm^2)	ENDURANCE
1_PROFILE	1. LAYER	-2,34	2606	Weak
	2.LAYER	-10,47	9266	Medium
	3.LAYER		35855	Rock Highlid
2_PROFILE	1. LAYER	-4,43	3723	Weak
	2. LAYER	-13,92	9559	Medium
	3. LAYER		33215	Rock Highlid
3_PROFILE	1. LAYER	-2,69	3886	Weak
	2. LAYER	-8,46	9329	Medium
	3. LAYER		23181	Sturdy
4_PROFILE	1. LAYER	-2,67	2508	Weak
	2. LAYER	-11,96	9887	Medium
	3. LAYER		43792	Rock Highlid
5_PROFILE	1. LAYER	-3,86	8202	Medium
	2. LAYER	-12,13	22506	Sturdy
	3. LAYER		78752	Rock Highlid
6_PROFILE	1. LAYER	-4,81	4234	Weak
	2. LAYER	-15,12	9143	Medium
	3. LAYER		39561	Rock Highlid
7_PROFILE	1. LAYER	-2,72	4169	Weak
	2.LAYER	-12,18	10199	Sturdy
	3.LAYER		53265	Rock Highlid
8_PROFILE	1. LAYER	-5,19	4210	Weak
	2. LAYER	-11,89	12474	Sturdy
	3. LAYER		38622	Rock Highlid
9_PROFILE	1. LAYER	-3,95	5040	Medium
	2. LAYER	-12,41	9378	Medium
	3. LAYER		45974	Rock Highlid
10_PROFILE	1. LAYER	-5,19	3522	Weak
	2. LAYER	-16,33	8174	Medium
	3. LAYER		15136	Sturdy
11_PROFILE	1. LAYER	-3,17	3910	Weak
	2. LAYER	-14,16	13155	Sturdy
	3. LAYER		50762	Rock Highlid
12_PROFILE	1. LAYER	-2,86	4646	Weak
	2. LAYER	-12,79	7153	Medium
	3. LAYER		31538	Rock Highlid
13_PROFILE	1. LAYER	-4,53	4235	Weak
	2. LAYER	-14,26	6082	Medium
	3. LAYER		26830	Sturdy
14_PROFILE	1. LAYER	-3,73	15668	Sturdy
	2. LAYER	-16,69	10505	Sturdy
	3. LAYER		47717	Rock Highlid
15_PROFILE	1. LAYER	-2,78	8541	Medium
	2. LAYER	-12,42	7608	Medium
	3. LAYER		34731	Rock Highlid
16_PROFILE	1. LAYER	-3,18	8192	Medium
	2. LAYER	-14,22	21993	Sturdy
	3. LAYER		62620	Rock Highlid
17_PROFILE	1. LAYER	-3,33	2665	Weak
	2.LAYER	-10,48	8732	Medium
	3.LAYER		31515	Rock Highlid

Elastic Modulus (kg/cm^2)	Dayanım
E<1000	High Weak
1000<E<5000	Weak
5000<E<10000	Medium
10000<E<30000	Sturdy
30000<E	Rock Highlid

The endurance of ground or rocks according to Slip Module values(Keçeli, 1990)

$E=G*(3*V_p^2-4*V_s^2)/(V_p^2-V_s^2)$

||AVERAGE||			
LAYERS	DEPTH	E (kg/cm^2)	ENDURANCE
1. LAYER	-3,61	5292	Medium
2.LAYER	-12,93	10891	Sturdy
3.LAYER	∞	40768	Rock Highlid

Elasticity modules and endurance of the grounds in the study area

Calculation of the modulus of elasticity in the direction of the seismic data obtained in the field studies and the change table are given in the above table

5.11.6. WTG11 Poisson's Ratio - (б)

POISSON'S RATIO				
PROFILES	LAYERS	DEPTH	(σ)	POROSITY
1_PROFILE	1. LAYER	-2,34	0,38	High Porous
	2.LAYER	-10,47	0,33	Medium Porous
	3.LAYER		0,40	High Porous
2_PROFILE	1. LAYER	-4,43	0,39	High Porous
	2. LAYER	-13,92	0,31	Medium Porous
	3. LAYER		0,38	High Porous
3_PROFILE	1. LAYER	-2,69	0,41	High Porous
	2. LAYER	-8,46	0,37	High Porous
	3. LAYER		0,42	High Porous
4_PROFILE	1. LAYER	-2,67	0,39	High Porous
	2. LAYER	-11,96	0,34	Medium Porous
	3. LAYER		0,38	High Porous
5_PROFILE	1. LAYER	-3,86	0,39	High Porous
	2. LAYER	-12,13	0,32	Medium Porous
	3. LAYER		0,38	High Porous
6_PROFILE	1. LAYER	-4,81	0,40	High Porous
	2. LAYER	-15,12	0,37	High Porous
	3. LAYER		0,37	High Porous
7_PROFILE	1. LAYER	-2,72	0,41	High Porous
	2.LAYER	-12,18	0,37	High Porous
	3.LAYER		0,36	High Porous
8_PROFILE	1. LAYER	-5,19	0,41	High Porous
	2. LAYER	-11,89	0,32	Medium Porous
	3. LAYER		0,38	High Porous
9_PROFILE	1. LAYER	-3,95	0,40	High Porous

	2. LAYER	-12,41	0,37	High Porous
	3. LAYER		0,33	Medium Porous
10_PROFILE	1. LAYER	-5,19	0,40	High Porous
	2. LAYER	-16,33	0,36	High Porous
	3. LAYER		0,44	High Porous
11_PROFILE	1. LAYER	-3,17	0,42	High Porous
	2. LAYER	-14,16	0,36	High Porous
	3. LAYER		0,37	High Porous
12_PROFILE	1. LAYER	-2,86	0,39	High Porous
	2. LAYER	-12,79	0,39	High Porous
	3. LAYER		0,39	High Porous
13_PROFILE	1. LAYER	-4,53	0,40	High Porous
	2. LAYER	-14,26	0,39	High Porous
	3. LAYER		0,38	High Porous
14_PROFILE	1. LAYER	-3,73	0,35	High Porous
	2. LAYER	-16,69	0,38	High Porous
	3. LAYER		0,37	High Porous
15_PROFILE	1. LAYER	-2,78	0,35	High Porous
	2. LAYER	-12,42	0,38	High Porous
	3. LAYER		0,36	High Porous
16_PROFILE	1. LAYER	-3,18	0,39	High Porous
	2. LAYER	-14,22	0,35	Medium Porous
	3. LAYER		0,42	High Porous
17_PROFILE	1. LAYER	-3,33	0,41	High Porous
	2.LAYER	-10,48	0,34	Medium Porous
	3.LAYER		0,39	High Porous

Poisson's Ratio;(σ)	Porosity
0,00≤σ≤0,25	Nonporous
0,26≤σ≤0,35	Medium Porous
0,36≤σ≤0,50	High Porous

Poisson ratio classification

$\sigma=(Vp^2-2*Vs^2)/(2*Vp^2-2*Vs^2)$

||AVERAGE||			
LAYERS	**DEPTH**	**(σ)**	**POROSITY**
1. LAYER	-3,61	0,39	High Porous
2.LAYER	-12,93	0,36	High Porous
3.LAYER	∞	0,38	High Porous

Poisson's ratio values of the units in the study area, porosity

Calculation of poisson's ratio values in the direction of the seismic data obtained in the field studies and the change table are given in the above table.

5.11.7. WTG11 Density - ρ (gr/ cm^3)

PROFILES	LAYERS	DENSITY DEPTH	ρ (gr/cm^3)	DEFINITION
1_PROFILE	1. LAYER	-2,34	1,53	Medium
	2.LAYER	-10,47	1,69	Medium
	3.LAYER		2,05	High
2_PROFILE	1. LAYER	-4,43	1,60	Medium
	2. LAYER	-13,92	1,67	Medium
	3. LAYER		2,01	High
3_PROFILE	1. LAYER	-2,69	1,63	Medium
	2. LAYER	-8,46	1,75	Medium
	3. LAYER		2,00	High
4_PROFILE	1. LAYER	-2,67	1,53	Medium
	2. LAYER	-11,96	1,71	Medium
	3. LAYER		2,07	High
5_PROFILE	1. LAYER	-3,86	1,74	Medium
	2. LAYER	-12,13	1,85	Medium
	3. LAYER		2,22	High
6_PROFILE	1. LAYER	-4,81	1,62	Medium
	2. LAYER	-15,12	1,72	Medium
	3. LAYER		2,03	High
7_PROFILE	1. LAYER	-2,72	1,63	Medium
	2.LAYER	-12,18	1,73	Medium
	3.LAYER		2,10	High
8_PROFILE	1. LAYER	-5,19	1,63	Medium
	2. LAYER	-11,89	1,74	Medium
	3. LAYER		2,04	High
9_PROFILE	1. LAYER	-3,95	1,66	Medium
	2. LAYER	-12,41	1,73	Medium
	3. LAYER		2,02	High
10_PROFILE	1. LAYER	-5,19	1,60	Medium
	2. LAYER	-16,33	1,70	Medium
	3. LAYER		1,96	High
11_PROFILE	1. LAYER	-3,17	1,65	Medium
	2. LAYER	-14,16	1,77	Medium
	3. LAYER		2,09	High
12_PROFILE	1. LAYER	-2,86	1,63	Medium
	2. LAYER	-12,79	1,69	Medium
	3. LAYER		2,01	High
13_PROFILE	1. LAYER	-4,53	1,62	Medium
	2. LAYER	-14,26	1,66	Medium
	3. LAYER		1,96	High
14_PROFILE	1. LAYER	-3,73	1,82	Medium
	2. LAYER	-16,69	1,77	Medium
	3. LAYER		2,08	High
15_PROFILE	1. LAYER	-2,78	1,70	Medium
	2. LAYER	-12,42	1,71	Medium
	3. LAYER		2,00	High
16_PROFILE	1. LAYER	-3,18	1,74	Medium
	2. LAYER	-14,22	1,89	Medium
	3. LAYER		2,23	High
17_PROFILE	1. LAYER	-3,33	1,56	Medium
	2.LAYER	-10,48	1,69	Medium
	3.LAYER		2,01	High

Density: ρ (gr/cm^3)	Tanımlama
ρ<1,20	High low
1,20<ρ<1,40	Low
1,40<ρ<1,90	Medium
1,90<ρ<2,20	High
2,20<ρ	Too High

Density Classification of Ground Units: (Keçeli, 1990)

*ρ =d=0.31*Vp0.25*

‖AVERAGE‖			
LAYERS	DEPTH	ρ (gr/cm^3)	DEFINITION
1. LAYER	-3,61	1,64	Medium
2.LAYER	-12,93	1,73	Medium
3.LAYER	∞	2,05	High

Density values and description of the units in the study area

Calculation of the density values of the geological units in the direction of the seismic data obtained in the field studies and the table of variation are given in the above table.

5.11.8. WTG11 Modulus of Subgrade Reaction – D Y K (ton/m^3)

Modulus of Subgrade Reaction			
PROFILES	LAYERS	DEPTH	D Y K (ton/m^3)
1_PROFILE	1. LAYER	-2,34	1700
	2.LAYER	-10,47	3229
	3.LAYER		6414
2_PROFILE	1. LAYER	-4,43	1994
	2. LAYER	-13,92	3315
	3. LAYER		6176
3_PROFILE	1. LAYER	-2,69	2053
	2. LAYER	-8,46	3204
	3. LAYER		5082
4_PROFILE	1. LAYER	-2,67	1680
	2. LAYER	-11,96	3320
	3. LAYER		7156
5_PROFILE	1. LAYER	-3,86	2947
	2. LAYER	-12,13	5073
	3. LAYER		9834
6_PROFILE	1. LAYER	-4,81	2108
	2. LAYER	-15,12	3091
	3. LAYER		6795
7_PROFILE	1. LAYER	-2,72	2160
	2.LAYER	-12,18	3276
	3.LAYER		7965
8_PROFILE	1. LAYER	-5,19	2160
	2. LAYER	-11,89	3796
	3. LAYER		6690
9_PROFILE	1. LAYER	-3,95	2314
	2. LAYER	-12,41	3145
	3. LAYER		7434
10_PROFILE	1. LAYER	-5,19	1988
	2. LAYER	-16,33	3044
	3. LAYER		4063
11_PROFILE	1. LAYER	-3,17	1989
	2. LAYER	-14,16	3732

	3. LAYER		7753
12_PROFILE	1. LAYER	-2,86	2293
	2. LAYER	-12,79	2739
	3. LAYER		6001
13_PROFILE	1. LAYER	-4,53	2138
	2. LAYER	-14,26	2526
	3. LAYER		5534
14_PROFILE	1. LAYER	-3,73	4210
	2. LAYER	-16,69	3252
	3. LAYER		7503
15_PROFILE	1. LAYER	-2,78	3131
	2. LAYER	-12,42	2798
	3. LAYER		6348
16_PROFILE	1. LAYER	-3,18	2954
	2. LAYER	-14,22	5004
	3. LAYER		8684
17_PROFILE	1. LAYER	-3,33	1725
	2.LAYER	-10,48	3138
	3.LAYER		6004

LAYERS	‖AVERAGE‖ DEPTH	D Y K (ton/m^3)
1. LAYER	-4,92	2929
2.LAYER	-13,61	4525
3.LAYER	∞	8707
kv= 40*(Gs)*qu ton/m^3 *(Bowles 1984)*		

The above table shows the Modulus of Subgrade Reaction obtained for each layer in the direction of the data obtained after the seismic measurements made in the study area.

5.11.9. WTG11 Bearing Capacity qu (kg/cm2) / Allowable Bearing Capacity qa (kg/cm2)

PROFILES	LAYERS	DEPTH	BEARING CAPACITY (qu,kg/cm^2)	ALLOWABLE BEARING CAPACITY (qa,kg/cm^2)
1_PROFILE	1. LAYER	-2,34	4,25	1,42
	2.LAYER	-10,47	8,07	2,69
	3.LAYER	-39,53	16,04	5,35
2_PROFILE	1. LAYER	-4,43	4,99	1,66
	2. LAYER	-13,92	8,29	2,76
	3. LAYER	-36,08	15,44	5,15
3_PROFILE	1. LAYER	-2,69	5,13	1,71
	2. LAYER	-8,46	8,01	2,67
	3. LAYER	-41,54	12,71	4,24
4_PROFILE	1. LAYER	-2,67	4,20	1,40
	2. LAYER	-11,96	8,30	2,77
	3. LAYER	-38,04	17,89	5,96
5_PROFILE	1. LAYER	-3,86	7,37	2,46
	2. LAYER	-12,13	12,68	4,23
	3. LAYER	-37,87	24,59	8,20
6_PROFILE	1. LAYER	-4,81	5,27	1,76
	2. LAYER	-15,12	7,73	2,58
	3. LAYER	-34,88	16,99	5,66
7_PROFILE	1. LAYER	-2,72	5,40	1,80
	2.LAYER	-12,18	8,19	2,73
	3.LAYER	-37,82	19,91	6,64
8_PROFILE	1. LAYER	-5,19	5,40	1,80

	2. LAYER	-11,89	9,49	3,16
	3. LAYER	-38,11	16,73	5,58
9_PROFILE	1. LAYER	-3,95	5,78	1,93
	2. LAYER	-12,41	7,86	2,62
	3. LAYER	-37,59	18,58	6,19
10_PROFILE	1. LAYER	-5,19	4,97	1,66
	2. LAYER	-16,33	7,61	2,54
	3. LAYER	-33,67	10,16	3,39
11_PROFILE	1. LAYER	-3,17	4,97	1,66
	2. LAYER	-14,16	9,33	3,11
	3. LAYER	-35,84	19,38	6,46
12_PROFILE	1. LAYER	-2,86	5,73	1,91
	2. LAYER	-12,79	6,85	2,28
	3. LAYER	-37,21	15,00	5,00
13_PROFILE	1. LAYER	-4,53	5,35	1,78
	2. LAYER	-14,26	6,32	2,11
	3. LAYER	-35,74	13,84	4,61
14_PROFILE	1. LAYER	-3,73	10,53	3,51
	2. LAYER	-16,69	8,13	2,71
	3. LAYER	-33,31	18,76	6,25
15_PROFILE	1. LAYER	-2,78	7,83	2,61
	2. LAYER	-12,42	6,99	2,33
	3. LAYER	-37,58	15,87	5,29
16_PROFILE	1. LAYER	-3,18	7,38	2,46
	2. LAYER	-14,22	12,51	4,17
	3. LAYER	-35,78	21,71	7,24
17_PROFILE	1. LAYER	-3,33	4,31	1,44
	2.LAYER	-10,48	7,85	2,62
	3.LAYER	-39,52	15,01	5,00

||AVERAGE||		
LAYERS	**DEPTH**	**Bearing Capacity (qu,kg/cm^2)**
1. LAYER	-3,61	5,82
2.LAYER	-12,93	8,48
3.LAYER	∞	16,98

qu=(0,024*Vs*(J.B.K+0,002*Vp)*0,71)/G.K

BEARING CAPACITY CALCULATION	Geological unit factor 18	16	17	18	20
(Prof. Dr. SEMIH TEZCAN-2006)	Safety factor 50-100	CLAY	SAND	SEDIMENT	VOLATISILE

||AVERAGE||		
LAYERS	**DEPTH**	**Allowable Bearing Capacity (qa,kg/cm^2)**
1. LAYER	-3,61	1,94
2.LAYER	-12,93	2,83
3.LAYER	∞	5,66

qa=qu/G.K G.K=3 empirical value

5.11.10 WTG11 Vibration Period - T_0 (sec) / Ground Amplification (Ak)

PROFILES	To (sec)	Ta (sec)	Tb (sec)	Ak (Amplification)
1.PROFILE	0,32	0,21	0,48	1,74
2.PROFILE	0,35	0,23	0,52	1,77
3.PROFILE	0,36	0,24	0,54	1,89
4.PROFILE	0,30	0,20	0,45	1,67
5.PROFILE	0,23	0,15	0,34	1,40
6.PROFILE	0,33	0,22	0,50	1,72
7.PROFILE	0,28	0,19	0,42	1,58
8.PROFILE	0,31	0,21	0,46	1,68
9.PROFILE	0,30	0,20	0,45	1,65
10.PROFILE	0,45	0,30	0,67	1,94
11.PROFILE	0,29	0,20	0,44	1,61
12.PROFILE	0,34	0,23	0,51	1,76
13.PROFILE	0,38	0,25	0,57	1,85
14.PROFILE	0,30	0,20	0,45	1,58
15.PROFILE	0,32	0,21	0,48	1,71
16.PROFILE	0,25	0,17	0,37	1,42
17.PROFILE	0,33	0,22	0,50	1,78

AVERAGE			
To (sec)	Ta (sec)	Tb (sec)	Ak (Amplification)
0,32	0,21	0,48	1,69

$To = \sum 4H\ Vs\ n\ \iota=1$ (sec)……. (Zeevaert,1967)

$Ak=68*Vs_{30}^{-0,6}$…… (Midorikawa, 1987)

The Vibration Period and Ground Amplification calculated in the direction of the parameters obtained during the seismic studies made during the field survey are presented in the table above.

5. 12. WTG12

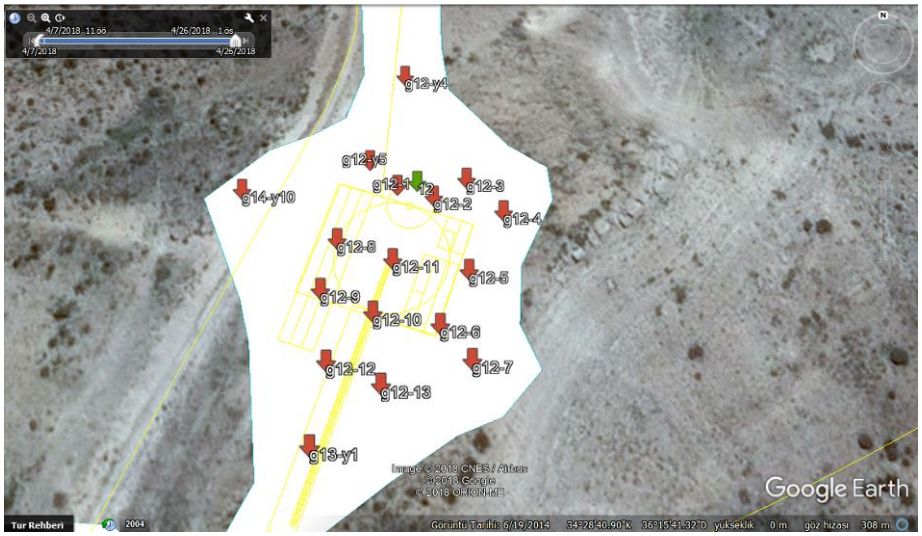
There are 12 measurements taken on the WTG. These measurements showed 3 layers. Layer 1 was found to be between 0.00 m and 3.92 m depth, Layer 2 was found between 3.92 m and 13.24 m depth, and Layer 3 was found from a mean depth of 13.24 m. The parameters of this layer are given in the table below.

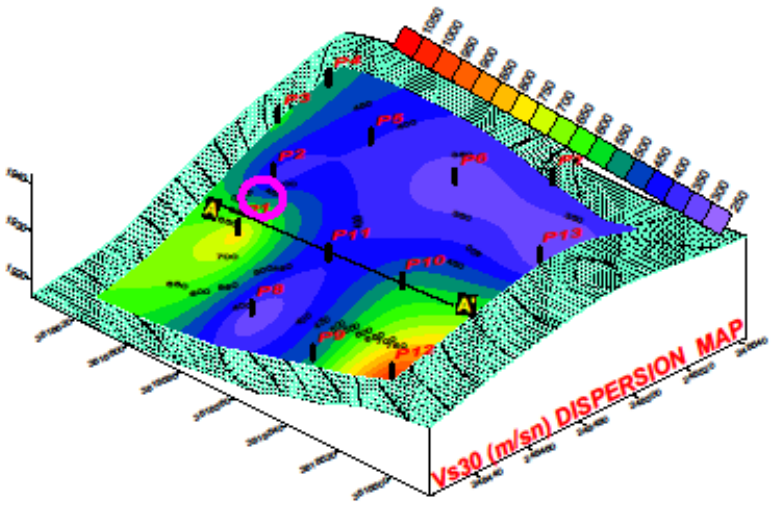
LAYERS	Vp_ Velocity	STRIPPABILITY
1. LAYER	779	Simple strippability
2.LAYER	1030	Simple strippability
3.LAYER	1958	High-hard STRIPPABILITY
LAYERS	**Vs_ Velocity**	**GROUND GROUP**
1. LAYER	315	C
2.LAYER	466	B
3.LAYER	899	A
LAYERS	**G (kg/cm2)**	**ENDURANCE**
1. LAYER	2526	Medium
2.LAYER	4807	Sturdy
3.LAYER	21238	High sturdy
LAYERS	**E (kg/cm2)**	**ENDURANCE**
1. LAYER	6915	Medium
2.LAYER	12941	Sturdy
3.LAYER	57223	High sturdy

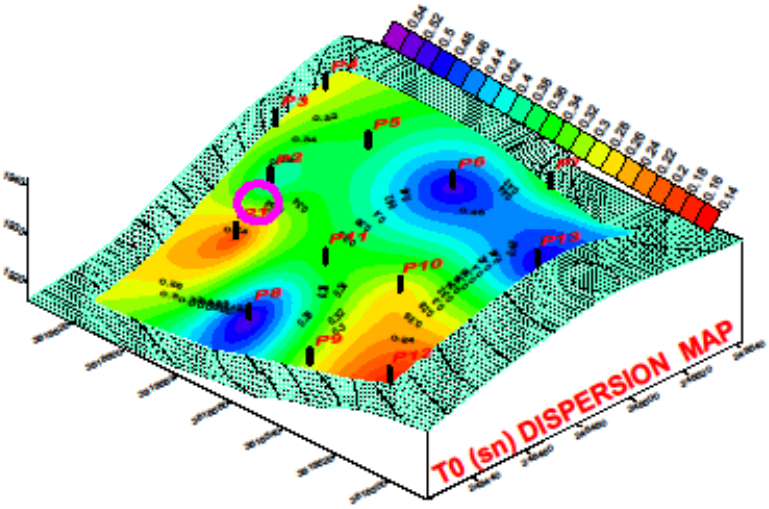
LAYERS	(σ)	POROSITY
1. LAYER	0,39	High Porosity
2.LAYER	0,36	High Porosity
3.LAYER	0,37	High Porosity
LAYERS	**ρ (gr/cm3)**	**DEFINITION**
1. LAYER	1,60	Medium
2.LAYER	1,73	Medium
3.LAYER	2,04	High
LAYERS	**D Y K (ton/m^3)**	
1. LAYER	2342	
2.LAYER	3503	
3.LAYER	7549	
LAYERS	**Ground Carrying Capacity (qu,kg/cm2)**	**Secure Carrying Capacity (qa,kg/cm2)**
1. LAYER	5,86	1,95
2.LAYER	8,76	2,92
3.LAYER	18,87	6,29

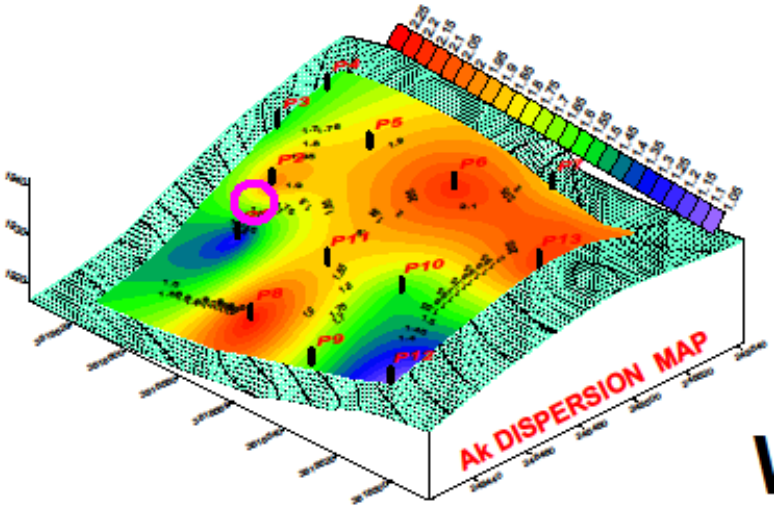
To (sec)	Ta (sec)	Tb (sec)	Vs30 (m/sec)	Ak (Amplification)
0,34	0,23	0,52	495	1,75

Taking into account the measurements taken in the field, it is suggested that the 1 and 12. WTG roads are shifted to the fifth profile by sliding the WTG weight point in the north-west direction the twelfth and thirteenth WTG roads in the south- Taking into account the following applications, the profile points should be seen in the engineering parameters section for detailed values.

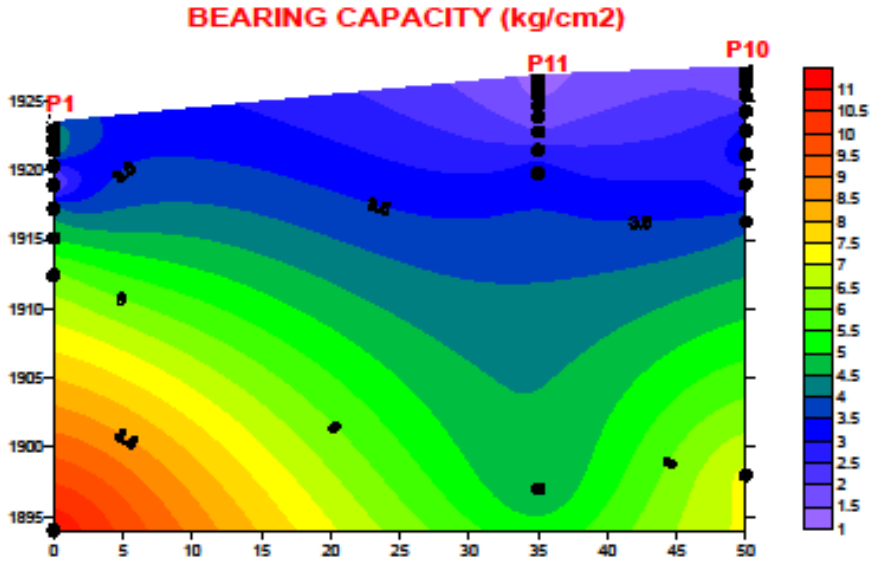


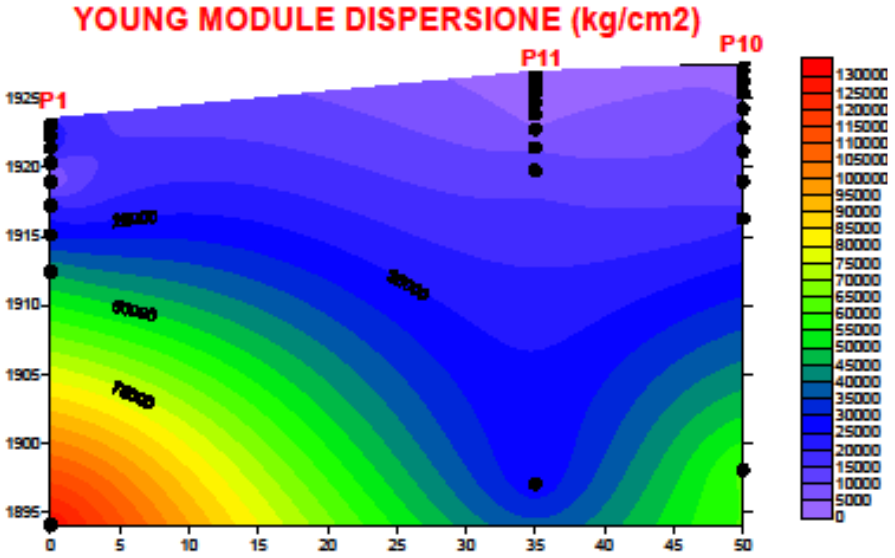

Vs30 (m/sn) DISPERSION MAP

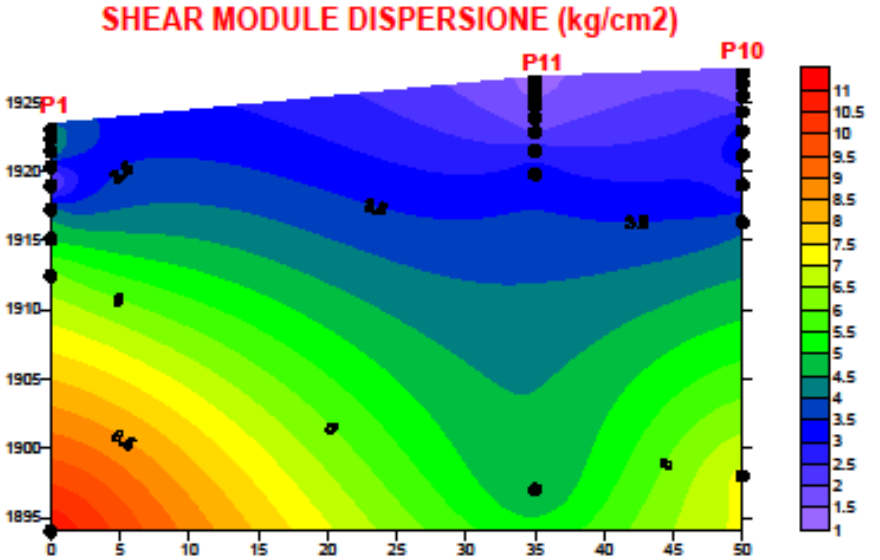

T0 (sn) DISPERSION MAP


AK DISPERSION MAP

WTG12


BEARING CAPACITY (kg/cm2)
P1
P11
P10
1925
1920
1915
1910
1905
1900
1895
0
5
10
15
20
25
30
35
40
45
50
11
10.5
10
9.5
9
8.5
8
7.5
7
6.5
6
5.5
5
4.5
4
3.5
3
2.5
2
1.5
1


YOUNG MODULE DISPERSIONE (kg/cm2)
P1
P11
P10
1925
1920
1915
1910
1905
1900
1895
0
5
10
15
20
25
30
35
40
45
50
130000
125000
120000
115000
110000
105000
100000
95000
90000
85000
80000
75000
70000
65000
60000
55000
50000
45000
40000
35000
30000
25000
20000
15000
10000
5000
0


SHEAR MODULE DISPERSIONE (kg/cm2)
P1
P11
P10
1925
1920
1915
1910
1905
1900
1895
0
5
10
15
20
25
30
35
40
45
50
11
10.5
10
9.5
9
8.5
8
7.5
7
6.5
6
5.5
5
4.5
4
3.5
3
2.5
2
1.5
1

5.12.1. WTG12 Seismic P wave velocity (*Compressional Wave Velocity* (Vp))

Vp VELOCITY				
PROFILES	LAYERS	DEPTH	Vp_ Velocity	STRIPPABILITY
1_PROFILE	1. LAYER	-3,68	1287	Medium Strippability
	2.LAYER	-11,57	1417	Medium Strippability
	3.LAYER		2806	Explosive
2_PROFILE	1. LAYER	-3,45	512	Simple Strippability
	2. LAYER	-10,84	756	Simple Strippability
	3. LAYER		1511	Medium Strippability
3_PROFILE	1. LAYER	-4,62	1049	Simple Strippability
	2. LAYER	-20,66	1128	Simple Strippability
	3. LAYER		2164	Explosive
4_PROFILE	1. LAYER	-2,86	767	Simple Strippability
	2. LAYER	-12,79	1213	Simple Strippability
	3. LAYER		2164	Explosive
5_PROFILE	1. LAYER	-2,76	400	High Simple Strippability
	2. LAYER	-12,37	766	Simple Strippability
	3. LAYER		1629	High Difficult Strippability
6_PROFILE	1. LAYER	-7,14	522	Simple Strippability
	2. LAYER	-16,35	673	Simple Strippability
	3. LAYER		1217	Simple Strippability
7_PROFILE	1. LAYER	-2,70	506	Simple Strippability
	2.LAYER	-8,50	841	Simple Strippability
	3.LAYER		1703	High Difficult Strippability
8_PROFILE	1. LAYER	-4,54	544	Simple Strippability
	2. LAYER	-14,26	630	Simple Strippability
	3. LAYER		1148	Simple Strippability
9_PROFILE	1. LAYER	-3,15	502	Simple Strippability
	2. LAYER	-14,09	1028	Simple Strippability
	3. LAYER		2097	High Difficult Strippability
10_PROFILE	1. LAYER	-3,72	858	Simple Strippability
	2. LAYER	-11,70	1167	Simple Strippability
	3. LAYER		2151	Explosive
11_PROFILE	1. LAYER	-2,29	656	Simple Strippability
	2. LAYER	-7,21	882	Simple Strippability
	3. LAYER		1703	High Difficult Strippability
12_PROFILE	1. LAYER	-5,16	1980	High Difficult Strippability
	2. LAYER	-16,23	2191	Explosive
	3. LAYER		3837	Explosive
13_PROFILE	1. LAYER	-4,93	550	Simple Strippability
	2. LAYER	-15,50	704	Simple Strippability
	3. LAYER		1327	Medium Strippability

P Wave Velocity (m/sec)	Strippability
Vp<458	High Simple Strippability
458<Vp<1220	Simple Strippability
1220<Vp<11525	Medium Strippability
1525<Vp<11830	Difficult Strippability
1830<Vp<12135	High Difficult Strippability
Vp>2135	Explosive Strippability

Strippability of floors with P wave velocity (Church, 1981)

||AVERAGE||			
LAYERS	DEPTH	Vp_ Velocity	STRIPPABILITY
1. LAYER	-3,92	779	Simple Strippability
2.LAYER	-13,24	1030	Simple Strippability
3.LAYER	∞	1958	High Difficult Strippability

P wave velocities of the grounds in the study area and strippability

The above table shows the change table and strippability properties of Vp velocity depth values in the direction of the seismic data obtained from the field studies.

5.12.2. WTG12 Seismic S wave velocity (*Transverse Wave Velocity* (Vs))

Vs VELOCITY				
PROFILES	LAYERS	DEPTH	Vs_ Velocity	GROUND GROUPS
1_PROFILE	1. LAYER	-3,68	617	B
	2.LAYER	-11,57	650	B
	3.LAYER		1483	A
2_PROFILE	1. LAYER	-3,45	220	C
	2. LAYER	-10,84	392	C
	3. LAYER		625	B
3_PROFILE	1. LAYER	-4,62	488	B
	2. LAYER	-20,66	474	B
	3. LAYER		1015	A
4_PROFILE	1. LAYER	-2,86	236	C
	2. LAYER	-12,79	523	B
	3. LAYER		992	A
5_PROFILE	1. LAYER	-2,76	172	D
	2. LAYER	-12,37	379	C
	3. LAYER		773	A
6_PROFILE	1. LAYER	-7,14	171	D
	2. LAYER	-16,35	306	C
	3. LAYER		536	B
7_PROFILE	1. LAYER	-2,70	198	D
	2.LAYER	-8,50	418	B
	3.LAYER		701	A
8_PROFILE	1. LAYER	-4,54	224	C
	2. LAYER	-14,26	268	C
	3. LAYER		488	B
9_PROFILE	1. LAYER	-3,15	220	C
	2. LAYER	-14,09	521	B
	3. LAYER		940	A
10_PROFILE	1. LAYER	-3,72	320	C
	2. LAYER	-11,70	509	B
	3. LAYER		1031	A
11_PROFILE	1. LAYER	-2,29	244	C
	2. LAYER	-7,21	393	C
	3. LAYER		678	B
12_PROFILE	1. LAYER	-5,16	781	A
	2. LAYER	-16,23	900	A
	3. LAYER		1925	A
13_PROFILE	1. LAYER	-4,93	210	C
	2. LAYER	-15,50	323	C
	3. LAYER		499	B

S Wave Velocity (m/sec)	Ground group
Vs<200	D
200<Vs<400	C
400<Vs<700	B
700<Vs	A

Ground groups according to slip wave velocity(Abyyhy, 1998)

||AVERAGE||			
LAYERS	DEPTH	Vs_ Velocity	GROUND GROUPS
1. LAYER	-3,92	315	C
2.LAYER	-13,24	466	B
3.LAYER	∞	899	A

S wave velocities of the grounds in the study area and ground group

Ground Group	Ground group and top ground layer thickness(h_1)
Z1	(A) Ground group h1< 15 m (B) Ground group
Z2	h_1> 15 m (B) Ground group h_1< 15 m (C) Ground group
Z3	15 m < h_1< 50 m (C) Ground group h_1< 10 m (D) Ground group
Z4	h_1> 50 m (C) Ground group h_1> 10 m (D) Ground group

Ground Group Class

The above table shows that Vs velocity values in the direction of the seismic data obtained in the field studies are the absolute change tables and that the layers are included in the ground groups.

5.12.3. WTG12 Vs30

PROFILES	Vs30 (m/sec)
1.PROFILE	782
2.PROFILE	358
3.PROFILE	563
4.PROFILE	523
5.PROFILE	398
6.PROFILE	305
7.PROFILE	401
8.PROFILE	293
9.PROFILE	512
10.PROFILE	560
11.PROFILE	404
12.PROFILE	1015
13.PROFILE	317

Vs30 values in the direction of the seismic data obtained from the field studies are given in the table above.

5.12.4. WTG12 Shear Modulus-G (kg/cm²)

PROFILES	LAYERS	SHEAR MODULUS DEPTH	G(kg/cm²)	ENDURANCE
1_PROFILE	1. LAYER	-3,68	7284	Sturdy
	2.LAYER	-11,57	9325	Sturdy
	3.LAYER		49628	Rock Highlid
2_PROFILE	1. LAYER	-3,45	784	Weak
	2. LAYER	-10,84	2576	Medium
	3. LAYER		7542	Sturdy
3_PROFILE	1. LAYER	-4,62	4263	Sturdy
	2. LAYER	-20,66	4499	Sturdy
	3. LAYER		21801	Rock Highlid
4_PROFILE	1. LAYER	-2,86	1020	Weak
	2. LAYER	-12,79	5470	Sturdy
	3. LAYER		20809	Rock Highlid
5_PROFILE	1. LAYER	-2,76	450	Weak
	2. LAYER	-12,37	2586	Medium
	3. LAYER		11758	Rock Highlid
6_PROFILE	1. LAYER	-7,14	601	Weak
	2. LAYER	-16,35	1573	Medium
	3. LAYER		5256	Sturdy
7_PROFILE	1. LAYER	-2,70	588	Weak
	2.LAYER	-8,50	3012	Sturdy
	3.LAYER		9792	Sturdy
8_PROFILE	1. LAYER	-4,54	784	Weak
	2. LAYER	-14,26	1127	Weak
	3. LAYER		4290	Sturdy
9_PROFILE	1. LAYER	-3,15	723	Weak
	2. LAYER	-14,09	4967	Sturdy
	3. LAYER		18527	Rock Highlid
10_PROFILE	1. LAYER	-3,72	1781	Medium
	2. LAYER	-11,70	4801	Sturdy
	3. LAYER		22459	Rock Highlid
11_PROFILE	1. LAYER	-2,29	946	Weak
	2. LAYER	-7,21	2816	Medium
	3. LAYER		9153	Sturdy
12_PROFILE	1. LAYER	-5,16	12956	Rock Highlid
	2. LAYER	-16,23	18016	Rock Highlid
	3. LAYER		90426	Rock Highlid
13_PROFILE	1. LAYER	-4,93	662	Weak
	2. LAYER	-15,50	1728	Medium
	3. LAYER		4651	Sturdy

Shear Modulus (kg/cm²)	Dayanım
G<400	High Weak
400<G<1500	Weak
1500<G<3000	Medium
3000<G<10000	Sturdy
10000<G	Rock Highlid

The endurance of ground or rocks according to Slip Module values(Keçeli, 1990)

$G = (d*Vs^2)/100$

||AVERAGE||			
LAYERS	DEPTH	G (kg/cm²)	ENDURANCE
1. LAYER	-3,92	2526	Medium
2.LAYER	-13,24	4807	Sturdy
3.LAYER	∞	21238	Rock Highlid

Shear modules and endurance of the grounds in the study area

Calculation of shear Modulus values in the direction of the seismic data obtained in the field studies and the table of variation are given in the table above.

5.12.5. WTG12 Elasticity Modulus-E (kg/cm²)

ELASTIC MODULUS				
PROFILES	LAYERS	DEPTH	E(kg/cm²)	ENDURANCE
1_PROFILE	1. LAYER	-3,68	19236	Sturdy
	2.LAYER	-11,57	24225	Sturdy
	3.LAYER		129646	Rock Highlid
2_PROFILE	1. LAYER	-3,45	2095	Weak
	2. LAYER	-10,84	6778	Medium
	3. LAYER		21072	Sturdy
3_PROFILE	1. LAYER	-4,62	11492	Sturdy
	2. LAYER	-20,66	12132	Sturdy
	3. LAYER		59246	Rock Highlid
4_PROFILE	1. LAYER	-2,86	2848	Weak
	2. LAYER	-12,79	14943	Sturdy
	3. LAYER		56891	Rock Highlid
5_PROFILE	1. LAYER	-2,76	1200	Weak
	2. LAYER	-12,37	6813	Medium
	3. LAYER		31860	Rock Highlid
6_PROFILE	1. LAYER	-7,14	1688	Weak
	2. LAYER	-16,35	4246	Weak
	3. LAYER		14505	Sturdy
7_PROFILE	1. LAYER	-2,70	1647	Weak
	2.LAYER	-8,50	8050	Medium
	3.LAYER		27378	Sturdy
8_PROFILE	1. LAYER	-4,54	2150	Weak
	2. LAYER	-14,26	3124	Weak
	3. LAYER		11926	Sturdy
9_PROFILE	1. LAYER	-3,15	1960	Weak
	2. LAYER	-14,09	13203	Sturdy
	3. LAYER		50924	Rock Highlid
10_PROFILE	1. LAYER	-3,72	4991	Weak
	2. LAYER	-11,70	13142	Sturdy
	3. LAYER		60672	Rock Highlid
11_PROFILE	1. LAYER	-2,29	2677	Weak
	2. LAYER	-7,21	7653	Medium
	3. LAYER		25735	Sturdy
12_PROFILE	1. LAYER	-5,16	36038	Rock Highlid
	2. LAYER	-16,23	49222	Rock Highlid
	3. LAYER		240856	Rock Highlid
13_PROFILE	1. LAYER	-4,93	1870	Weak
	2. LAYER	-15,50	4699	Weak
	3. LAYER		13190	Sturdy

Elastic Modulus (kg/cm²)	Dayanım
E<1000	High Weak
1000<E<5000	Weak
5000<E<10000	Medium
10000<E<30000	Sturdy
30000<E	Rock Highlid

The endurance of ground or rocks according to Slip Module values(Keçeli, 1990)

$$E=G*(3*V_p^2-4*V_s^2)/(V_p^2-V_s^2)$$

||AVERAGE||			
LAYERS	DEPTH	E (kg/cm²)	ENDURANCE
1. LAYER	-3,92	6915	Medium
2.LAYER	-13,24	12941	Sturdy
3.LAYER	∞	57223	Rock Highlid

Calculation of the modulus of elasticity in the direction of the seismic data obtained in the field studies and the change table are given in the above table

5.12.6. WTG12 Poisson's Ratio - (б)

POISSON'S RATIO				
PROFILES	LAYERS	DEPTH	(σ)	POROSITY
1_PROFILE	1. LAYER	-3,68	0,34	Medium Porous
	2.LAYER	-11,57	0,34	Medium Porous
	3.LAYER		0,31	Medium Porous
2_PROFILE	1. LAYER	-3,45	0,36	High Porous
	2. LAYER	-10,84	0,31	Medium Porous
	3. LAYER		0,40	High Porous
3_PROFILE	1. LAYER	-4,62	0,36	High Porous
	2. LAYER	-20,66	0,38	High Porous
	3. LAYER		0,36	High Porous
4_PROFILE	1. LAYER	-2,86	0,44	High Porous
	2. LAYER	-12,79	0,38	High Porous
	3. LAYER		0,37	High Porous
5_PROFILE	1. LAYER	-2,76	0,37	High Porous
	2. LAYER	-12,37	0,34	Medium Porous
	3. LAYER		0,35	High Porous
6_PROFILE	1. LAYER	-7,14	0,41	High Porous
	2. LAYER	-16,35	0,37	High Porous
	3. LAYER		0,38	High Porous
7_PROFILE	1. LAYER	-2,70	0,41	High Porous
	2.LAYER	-8,50	0,33	Medium Porous
	3.LAYER		0,40	High Porous
8_PROFILE	1. LAYER	-4,54	0,39	High Porous
	2. LAYER	-14,26	0,39	High Porous
	3. LAYER		0,39	High Porous
9_PROFILE	1. LAYER	-3,15	0,37	High Porous
	2. LAYER	-14,09	0,32	Medium Porous
	3. LAYER		0,37	High Porous
10_PROFILE	1. LAYER	-3,72	0,41	High Porous
	2. LAYER	-11,70	0,37	High Porous
	3. LAYER		0,35	High Porous
11_PROFILE	1. LAYER	-2,29	0,42	High Porous
	2. LAYER	-7,21	0,38	High Porous
	3. LAYER		0,41	High Porous
12_PROFILE	1. LAYER	-5,16	0,40	High Porous
	2. LAYER	-16,23	0,39	High Porous
	3. LAYER		0,33	Medium Porous
13_PROFILE	1. LAYER	-4,93	0,41	High Porous
	2. LAYER	-15,50	0,37	High Porous
	3. LAYER		0,42	High Porous

Poisson's Ratio;(σ)	Porosity
0,00≤σ≤0,25	Nonporous
0,26≤σ≤0,35	Medium Porous
0,36≤σ≤0,50	High Porous

Poisson ratio classification

$\sigma=(Vp^2-2*Vs^2)/(2*Vp^2-2*Vs^2)$

||AVERAGE||			
LAYERS	DEPTH	(σ)	POROSITY
1. LAYER	-3,92	0,39	High Porous
2.LAYER	-13,24	0,36	High Porous
3.LAYER	∞	0,37	High Porous

Poisson's ratio values of the units in the study area, porosity

Calculation of poisson's ratio values in the direction of the seismic data obtained in the field studies and the change table are given in the above table.

5.12.7. WTG12 Density - ρ (gr/ cm^3)

DENSITY				
PROFILES	LAYERS	DEPTH	ρ (gr/cm^3)	DEFINITION
1_PROFILE	1. LAYER	-3,68	1,86	Medium
	2.LAYER	-11,57	1,90	Medium
	3.LAYER		2,26	High
2_PROFILE	1. LAYER	-3,45	1,47	Medium
	2. LAYER	-10,84	1,62	Medium
	3. LAYER		1,93	High
3_PROFILE	1. LAYER	-4,62	1,76	Medium
	2. LAYER	-20,66	1,80	Medium
	3. LAYER		2,11	High
4_PROFILE	1. LAYER	-2,86	1,63	Medium
	2. LAYER	-12,79	1,82	Medium
	3. LAYER		2,11	High
5_PROFILE	1. LAYER	-2,76	1,39	Low
	2. LAYER	-12,37	1,62	Medium
	3. LAYER		1,97	High
6_PROFILE	1. LAYER	-7,14	1,48	Medium
	2. LAYER	-16,35	1,58	Medium
	3. LAYER		1,83	Medium
7_PROFILE	1. LAYER	-2,70	1,47	Medium
	2.LAYER	-8,50	1,66	Medium
	3.LAYER		1,99	High
8_PROFILE	1. LAYER	-4,54	1,50	Medium
	2. LAYER	-14,26	1,55	Medium
	3. LAYER		1,80	Medium
9_PROFILE	1. LAYER	-3,15	1,47	Medium
	2. LAYER	-14,09	1,75	Medium
	3. LAYER		2,10	High
10_PROFILE	1. LAYER	-3,72	1,68	Medium
	2. LAYER	-11,70	1,81	Medium
	3. LAYER		2,11	High
11_PROFILE	1. LAYER	-2,29	1,57	Medium
	2. LAYER	-7,21	1,69	Medium
	3. LAYER		1,99	High
12_PROFILE	1. LAYER	-5,16	2,07	High
	2. LAYER	-16,23	2,12	High
	3. LAYER		2,44	High
13_PROFILE	1. LAYER	-4,93	1,50	Medium
	2. LAYER	-15,50	1,59	Medium
	3. LAYER		1,87	Medium

Density: ρ (gr/cm³)	Tanımlama
ρ<1,20	High low
1,20<ρ<1,40	Low
1,40<ρ<1,90	Medium
1,90<ρ<2,20	High
2,20<ρ	Too High

Density Classification of Ground Units: (Keçeli, 1990)

$\rho = d = 0.31 * Vp0.25$

||AVERAGE||			
LAYERS	DEPTH	ρ (gr/cm³)	DEFINITION
1. LAYER	-3,92	1,60	Medium
2.LAYER	-13,24	1,73	Medium
3.LAYER	∞	2,04	High

Density values and description of the units in the study area

Calculation of the density values of the geological units in the direction of the seismic data obtained in the field studies and the table of variation are given in the above table.

5.12.8. WTG12 Modulus of Subgrade Reaction – D Y K (ton/m³)

Modulus of Subgrade Reaction			
PROFILES	LAYERS	DEPTH	D Y K (ton/m³)
1_PROFILE	1. LAYER	-3,68	4684
	2.LAYER	-11,57	5031
	3.LAYER		13108
2_PROFILE	1. LAYER	-3,45	1534
	2. LAYER	-10,84	2813
	3. LAYER		4860
3_PROFILE	1. LAYER	-4,62	3615
	2. LAYER	-20,66	3546
	3. LAYER		8442
4_PROFILE	1. LAYER	-2,86	1691
	2. LAYER	-12,79	3964
	3. LAYER		8247
5_PROFILE	1. LAYER	-2,76	1182
	2. LAYER	-12,37	2732
	3. LAYER		6085
6_PROFILE	1. LAYER	-7,14	1385
	2. LAYER	-16,35	2175
	3. LAYER		4039
7_PROFILE	1. LAYER	-2,70	1377
	2.LAYER	-8,50	3029
	3.LAYER		5565
8_PROFILE	1. LAYER	-4,54	1567
	2. LAYER	-14,26	1893
	3. LAYER		3648
9_PROFILE	1. LAYER	-3,15	1528
	2. LAYER	-14,09	3862
	3. LAYER		7761
10_PROFILE	1. LAYER	-3,72	2319
	2. LAYER	-11,70	3818
	3. LAYER		8564
11_PROFILE	1. LAYER	-2,29	1730
	2. LAYER	-7,21	2865
	3. LAYER		5380
12_PROFILE	1. LAYER	-5,16	6374
	2. LAYER	-16,23	7508
	3. LAYER		18639
13_PROFILE	1. LAYER	-4,93	1466
	2. LAYER	-15,50	2300
	3. LAYER		3804

||AVERAGE||		
LAYERS	DEPTH	D Y K (ton/m^3)
1. LAYER	-3,92	2342
2.LAYER	-13,24	3503
3.LAYER	∞	7549
kv= 40*(Gs)*qu ton/m^3 *(Bowles 1984)*		

The above table shows the Modulus of Subgrade Reaction obtained for each layer in the direction of the data obtained after the seismic measurements made in the study area.

5.12.9. WTG12 Bearing Capacity qu (kg/cm2) / Allowable Bearing Capacity qa (kg/cm2)

PROFILES	LAYERS	DEPTH	BEARING CAPACITY (qu,kg/cm^2)	ALLOWABLE BEARING CAPACITY (qa,kg/cm^2)
1_PROFILE	1. LAYER	-3,68	11,71	3,90
	2.LAYER	-11,57	12,58	4,19
	3.LAYER	-38,43	32,77	10,92
2_PROFILE	1. LAYER	-3,45	3,84	1,28
	2. LAYER	-10,84	7,03	2,34
	3. LAYER	-39,16	12,15	4,05
3_PROFILE	1. LAYER	-4,62	9,04	3,01
	2. LAYER	-20,66	8,87	2,96
	3. LAYER	-29,34	21,10	7,03
4_PROFILE	1. LAYER	-2,86	4,23	1,41
	2. LAYER	-12,79	9,91	3,30
	3. LAYER	-37,21	20,62	6,87
5_PROFILE	1. LAYER	-2,76	2,96	0,99
	2. LAYER	-12,37	6,83	2,28
	3. LAYER	-37,63	15,21	5,07
6_PROFILE	1. LAYER	-7,14	3,46	1,15
	2. LAYER	-16,35	5,44	1,81
	3. LAYER	-33,65	10,10	3,37
7_PROFILE	1. LAYER	-2,70	3,44	1,15
	2.LAYER	-8,50	7,57	2,52
	3.LAYER	-41,50	13,91	4,64
8_PROFILE	1. LAYER	-4,54	3,92	1,31
	2. LAYER	-14,26	4,73	1,58
	3. LAYER	-35,74	9,12	3,04
9_PROFILE	1. LAYER	-3,15	3,82	1,27
	2. LAYER	-14,09	9,66	3,22
	3. LAYER	-35,91	19,40	6,47
10_PROFILE	1. LAYER	-3,72	5,80	1,93
	2. LAYER	-11,70	9,54	3,18
	3. LAYER	-38,30	21,41	7,14
11_PROFILE	1. LAYER	-2,29	4,32	1,44
	2. LAYER	-7,21	7,16	2,39
	3. LAYER	-42,79	13,45	4,48
12_PROFILE	1. LAYER	-5,16	15,94	5,31
	2. LAYER	-16,23	18,77	6,26
	3. LAYER	-33,77	46,60	15,53
13_PROFILE	1. LAYER	-4,93	3,67	1,22
	2. LAYER	-15,50	5,75	1,92
	3. LAYER	-34,50	9,51	3,17

LAYERS	||AVERAGE|| DEPTH	Bearing Capacity (qu,kg/cm^2)
1. LAYER	-3,92	5,86
2.LAYER	-13,24	8,76
3.LAYER	∞	18,87

qu=(0,024*Vs*(J.B.K+0,002*Vp)*0,71)/G.K

BEARING CAPACITY CALCULATION (Prof. Dr. SEMIH TEZCAN-2006)	Geological unit factor 18	16	17	18	20
	Safety factor 50-100	CLAY	SAND	SEDIMENT	VOLATISILE

LAYERS	||AVERAGE|| DEPTH	Allowable Bearing Capacity (qa,kg/cm^2)
1. LAYER	-3,92	1,95
2.LAYER	-13,24	2,92
3.LAYER	∞	6,29

qa=qu/G.K G.K=3 empirical value

5.12.1 WTG12 Vibration Period - T_0 (sec) / Ground Amplification (Ak)

PROFILES	To (sec)	Ta (sec)	Tb (sec)	Ak (Amplification)
1.PROFILE	0,18	0,12	0,28	1,25
2.PROFILE	0,40	0,27	0,61	2,00
3.PROFILE	0,29	0,20	0,44	1,52
4.PROFILE	0,28	0,19	0,42	1,59
5.PROFILE	0,37	0,24	0,55	1,87
6.PROFILE	0,52	0,34	0,77	2,20
7.PROFILE	0,35	0,23	0,52	1,87
8.PROFILE	0,53	0,35	0,79	2,25
9.PROFILE	0,29	0,20	0,44	1,61
10.PROFILE	0,26	0,17	0,39	1,53
11.PROFILE	0,34	0,23	0,51	1,86
12.PROFILE	0,15	0,10	0,23	1,07
13.PROFILE	0,50	0,34	0,75	2,15

AVERAGE			
To (sec)	Ta (sec)	Tb (sec)	Ak (Amplification)
0,34	0,23	0,52	1,75

$To = \sum 4H\ Vs\ n\ \iota$=1 (sec)……. (Zeevaert,1967)

Ak=68*$Vs_{30}^{-0,6}$…… (Midorikawa, 1987)

The Vibration Period and Ground Amplification calculated in the direction of the parameters obtained during the seismic studies made during the field survey are presented in the table above.

5. 13. WTG13

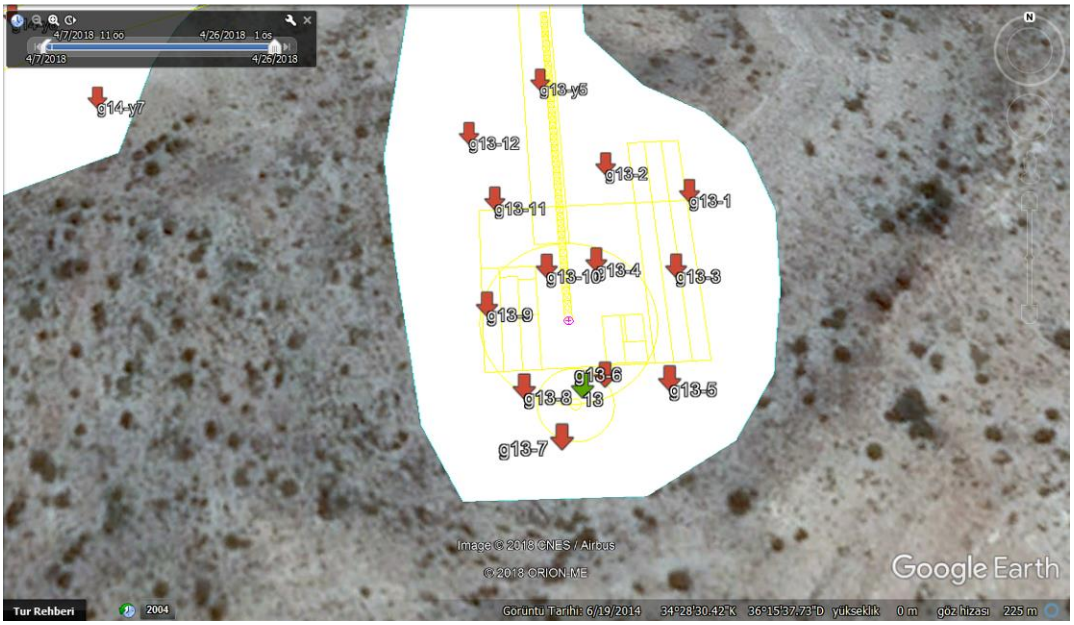
There are 12 measurements taken on the WTG. These measurements showed 3 layers. Layer 1 was found between the depths of 0,00 m-4,92 m on average, Layer 2 between 4,92 m-13,61 m depth and Layer 3 on the average depth of 13,61 m. The parameters of this layer are given in the table below.

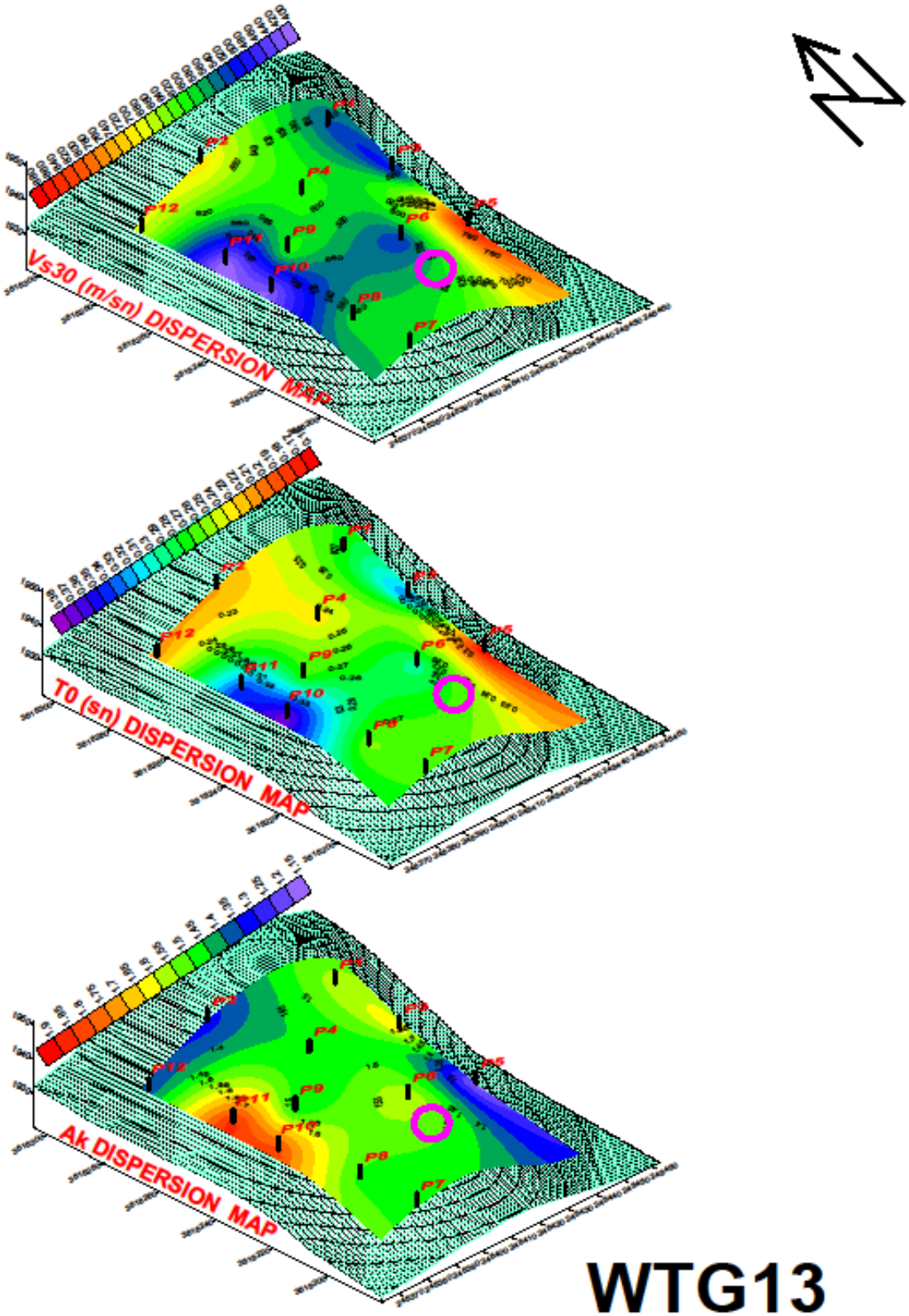
LAYERS	Vp_ Velocity	STRIPPABILITY
1. LAYER	962	Simple strippability
2.LAYER	1247	Medium-hard strippability
3.LAYER	2374	Explosive
LAYERS	**Vs_ Velocity**	**GROUND GROUP**
1. LAYER	367	C
2.LAYER	593	B
3.LAYER	1015	A
LAYERS	**G (kg/cm2)**	**ENDURANCE**
1. LAYER	3116	Sturdy
2.LAYER	7301	Sturdy
3.LAYER	23874	High sturdy
LAYERS	**E (kg/cm2)**	**ENDURANCE**
1. LAYER	8577	Medium
2.LAYER	19507	Sturdy
3.LAYER	66097	High sturdy

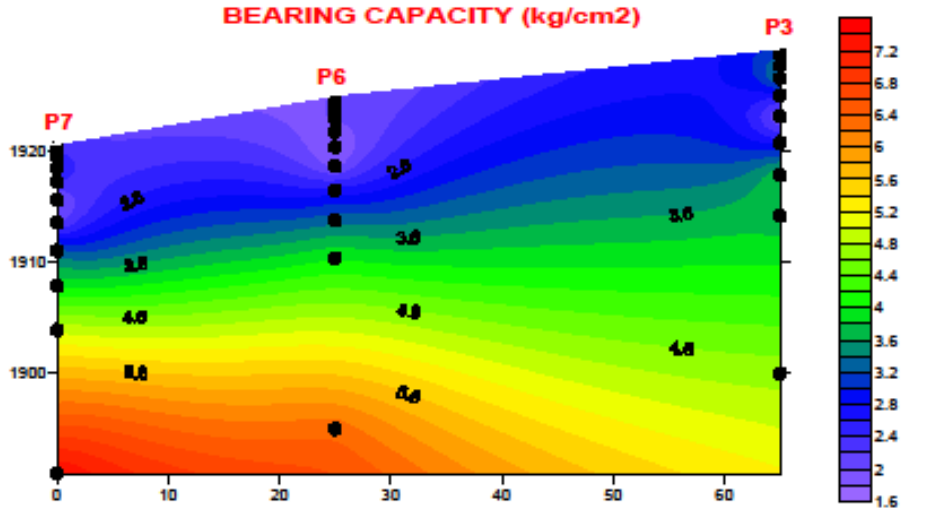
LAYERS	(σ)	POROSITY
1. LAYER	0,39	High Porosity
2.LAYER	0,35	Medium Porosity
3.LAYER	0,39	High Porosity
LAYERS	**ρ (gr/cm3)**	**DEFINITION**
1. LAYER	1,71	Medium
2.LAYER	1,83	Medium
3.LAYER	2,15	High
LAYERS	**D Y K (ton/m^3)**	
1. LAYER	2929	
2.LAYER	4525	
3.LAYER	8707	
LAYERS	**Ground Carrying Capacity (qu,kg/cm2)**	**Secure Carrying Capacity (qa,kg/cm2)**
1. LAYER	7,32	2,44
2.LAYER	11,31	3,77
3.LAYER	21,77	7,26

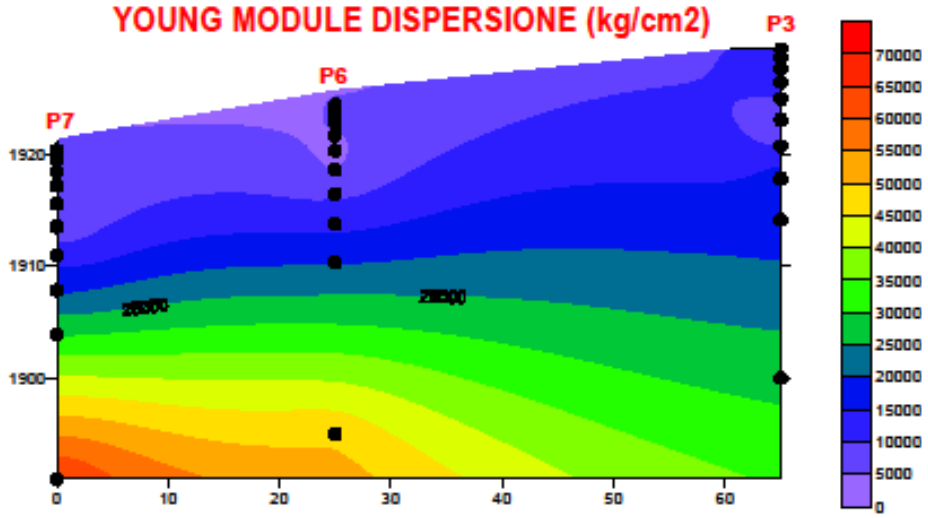
To (sec)	Ta (sec)	Tb (sec)	Vs30 (m/sec)	Ak (Amplification)
0,27	0,18	0,41	586	1,52

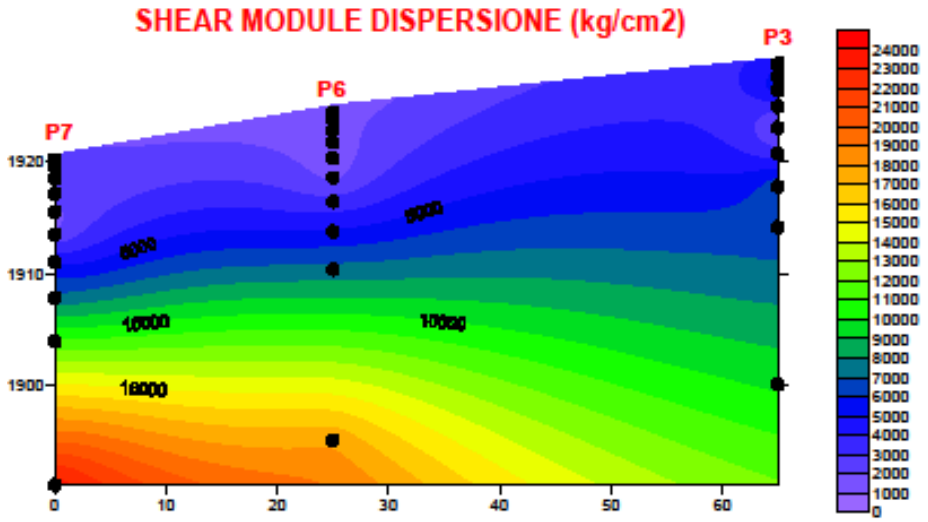
Taking into account the following applications, the profile points should be seen in the engineering parameters section for detailed values.




Vs30 (m/sn) DISPERSION MAP
T0 (sn) DISPERSION MAP
Ak DISPERSION MAP
P1
P2
P3
P4
P5
P6
P7
P8
P9
P10
P11
P12
WTG13


BEARING CAPACITY (kg/cm2)
P7
P6
P3
1920
1910
1900
0
10
20
30
40
50
60
7.2
6.8
6.4
6
5.6
5.2
4.8
4.4
4
3.6
3.2
2.8
2.4
2
1.6


YOUNG MODULE DISPERSIONE (kg/cm2)
P7
P6
P3
1920
1910
1900
0
10
20
30
40
50
60
70000
65000
60000
55000
50000
45000
40000
35000
30000
25000
20000
15000
10000
5000
0


SHEAR MODULE DISPERSIONE (kg/cm2)
P7
P6
P3
1920
1910
1900
0
10
20
30
40
50
60
24000
23000
22000
21000
20000
19000
18000
17000
16000
15000
14000
13000
12000
11000
10000
9000
8000
7000
6000
5000
4000
3000
2000
1000
0

5.13.1. WTG13 Seismic P wave velocity (*Compressional Wave Velocity* (Vp))

Vp VELOCITY				
PROFILES	LAYERS	DEPTH	Vp_ Velocity	STRIPPABILITY
1_PROFILE	1. LAYER	-4,89	1005	Simple Strippability
	2.LAYER	-11,21	1093	Simple Strippability
	3.LAYER		1953	High Difficult Strippability
2_PROFILE	1. LAYER	-4,47	1345	Medium Strippability
	2. LAYER	-14,05	1548	High Difficult Strippability
	3. LAYER		2945	Explosive
3_PROFILE	1. LAYER	-3,54	1101	Simple Strippability
	2. LAYER	-15,85	1168	Simple Strippability
	3. LAYER		2064	High Difficult Strippability
4_PROFILE	1. LAYER	-3,11	1193	Simple Strippability
	2. LAYER	-9,79	1221	Medium Strippability
	3. LAYER		2198	Explosive
5_PROFILE	1. LAYER	-4,34	1498	Medium Strippability
	2. LAYER	-9,95	1836	High Difficult Strippability
	3. LAYER		3493	Explosive
6_PROFILE	1. LAYER	-6,39	841	Simple Strippability
	2. LAYER	-14,65	1095	Simple Strippability
	3. LAYER		2053	High Difficult Strippability
7_PROFILE	1. LAYER	-7,47	944	Simple Strippability
	2.LAYER	-17,11	1240	Medium Strippability
	3.LAYER		2410	Explosive
8_PROFILE	1. LAYER	-4,71	713	Simple Strippability
	2. LAYER	-14,82	1228	Medium Strippability
	3. LAYER		2560	Explosive
9_PROFILE	1. LAYER	-8,62	1031	Simple Strippability
	2. LAYER	-19,76	1391	Medium Strippability
	3. LAYER		2560	Explosive
10_PROFILE	1. LAYER	-5,29	623	Simple Strippability
	2. LAYER	-16,63	897	Simple Strippability
	3. LAYER		1695	High Difficult Strippability
11_PROFILE	1. LAYER	-2,53	477	Simple Strippability
	2. LAYER	-7,95	866	Simple Strippability
	3. LAYER		1710	High Difficult Strippability
12_PROFILE	1. LAYER	-3,68	778	Simple Strippability
	2. LAYER	-11,55	1379	Medium Strippability
	3. LAYER		2851	Explosive

P Wave Velocity (m/sec)	Strippability
Vp<458	High Simple Strippability
458<Vp<1220	Simple Strippability
1220<Vp<11525	Medium Strippability
1525<Vp<11830	Difficult Strippability
1830<Vp<12135	High Difficult Strippability
Vp>2135	Explosive Strippability

Strippability of floors with P wave velocity (Church, 1981)

||AVERAGE||			
LAYERS	DEPTH	Vp_ Velocity	STRIPPABILITY
1. LAYER	-4,92	962	Simple Strippability
2.LAYER	-13,61	1247	Medium Strippability
3.LAYER	∞	2374	Explosive

P wave velocities of the grounds in the study area and strippability

The above table shows the change table and strippability properties of Vp velocity depth values in the direction of the seismic data obtained from the field studies.

5.13.2. WTG13 Seismic S wave velocity (*Transverse Wave Velocity* (Vs))

Vs VELOCITY				
PROFILES	LAYERS	DEPTH	Vs_ Velocity	GROUND GROUPS
1_PROFILE	1. LAYER	-4,89	350	C
	2.LAYER	-11,21	503	B
	3.LAYER		910	A
2_PROFILE	1. LAYER	-4,47	546	B
	2. LAYER	-14,05	719	A
	3. LAYER		1139	A
3_PROFILE	1. LAYER	-3,54	516	B
	2. LAYER	-15,85	468	B
	3. LAYER		685	B
4_PROFILE	1. LAYER	-3,11	552	B
	2. LAYER	-9,79	484	B
	3. LAYER		1053	A
5_PROFILE	1. LAYER	-4,34	449	B
	2. LAYER	-9,95	922	A
	3. LAYER		1515	A
6_PROFILE	1. LAYER	-6,39	266	C
	2. LAYER	-14,65	535	B
	3. LAYER		922	A
7_PROFILE	1. LAYER	-7,47	308	C
	2.LAYER	-17,11	638	B
	3.LAYER		1041	A
8_PROFILE	1. LAYER	-4,71	301	C
	2. LAYER	-14,82	642	B
	3. LAYER		1107	A
9_PROFILE	1. LAYER	-8,62	316	C
	2. LAYER	-19,76	649	B
	3. LAYER		1110	A
10_PROFILE	1. LAYER	-5,29	266	C
	2. LAYER	-16,63	406	B
	3. LAYER		748	A
11_PROFILE	1. LAYER	-2,53	201	C
	2. LAYER	-7,95	429	B
	3. LAYER		710	A
12_PROFILE	1. LAYER	-3,68	327	C
	2. LAYER	-11,55	718	A
	3. LAYER		1246	A

S Wave Velocity (m/sec)	Ground group
Vs<200	D
200<Vs<400	C
400<Vs<700	B
700<Vs	A

Ground groups according to slip wave velocity(Abyyhy, 1998)

||AVERAGE||			
LAYERS	DEPTH	Vs_ Velocity	GROUND GROUPS
1. LAYER	-4,92	367	C
2.LAYER	-13,61	593	B
3.LAYER	∞	1015	A

S wave velocities of the grounds in the study area and ground group

Ground Group	Ground group and top ground layer thickness(h_1)
Z1	(A) Ground group h1< 15 m (B) Ground group
Z2	h_1> 15 m (B) Ground group h_1< 15 m (C) Ground group
Z3	15 m < h_1< 50 m (C) Ground group h_1< 10 m (D) Ground group
Z4	h_1> 50 m (C) Ground group h_1> 10 m (D) Ground group

Ground Group Class

The above table shows that Vs velocity values in the direction of the seismic data obtained in the field studies are the absolute change tables and that the layers are included in the ground groups.

5.13.3. WTG13 Vs30

PROFILES	Vs30 (m/sec)
1.PROFILE	534
2.PROFILE	713
3.PROFILE	501
4.PROFILE	611
5.PROFILE	876
6.PROFILE	518
7.PROFILE	590
8.PROFILE	589
9.PROFILE	607
10.PROFILE	418
11.PROFILE	401
12.PROFILE	677

Vs30 values in the direction of the seismic data obtained from the field studies are given in the table above.

5.13.4. WTG13 Shear Modulus-G (kg/cm²)

SHEAR MODULUS				
PROFILES	LAYERS	DEPTH	G(kg/cm^2)	ENDURANCE
1_PROFILE	1. LAYER	-4,89	3215	Sturdy
	2.LAYER	-11,21	4854	Sturdy
	3.LAYER		17075	Rock Highlid
2_PROFILE	1. LAYER	-4,47	5949	Sturdy
	2. LAYER	-14,05	10444	Rock Highlid
	3. LAYER		29615	Rock Highlid
3_PROFILE	1. LAYER	-3,54	4784	Sturdy
	2. LAYER	-15,85	4215	Sturdy
	3. LAYER		9803	Sturdy
4_PROFILE	1. LAYER	-3,11	5617	Sturdy
	2. LAYER	-9,79	4943	Sturdy
	3. LAYER		23553	Rock Highlid
5_PROFILE	1. LAYER	-4,34	5953	Sturdy
	2. LAYER	-9,95	17762	Rock Highlid
	3. LAYER		54706	Rock Highlid
6_PROFILE	1. LAYER	-6,39	1743	Medium
	2. LAYER	-14,65	5241	Sturdy
	3. LAYER		17741	Rock Highlid
7_PROFILE	1. LAYER	-7,47	2441	Medium
	2.LAYER	-17,11	7726	Sturdy
	3.LAYER		23524	Rock Highlid
8_PROFILE	1. LAYER	-4,71	1549	Medium
	2. LAYER	-14,82	7885	Sturdy

	3. LAYER		27002	Rock Highlid
9_PROFILE	1. LAYER	-8,62	2509	Medium
	2. LAYER	-19,76	8178	Sturdy
	3. LAYER		27155	Rock Highlid
10_PROFILE	1. LAYER	-5,29	1155	Weak
	2. LAYER	-16,63	2840	Medium
	3. LAYER		11115	Rock Highlid
11_PROFILE	1. LAYER	-2,53	646	Weak
	2. LAYER	-7,95	3153	Sturdy
	3. LAYER		10053	Rock Highlid
12_PROFILE	1. LAYER	-3,68	1830	Medium
	2. LAYER	-11,55	10373	Rock Highlid
	3. LAYER		35144	Rock Highlid

Shear Modulus (kg/cm^2)	Dayanım
G<400	High Weak
400<G<1500	Weak
1500<G<3000	Medium
3000<G<10000	Sturdy
10000<G	Rock Highlid

The endurance of ground or rocks according to Slip Module values(Keçeli, 1990)

$G = (d*Vs^2)/100$

‖AVERAGE‖			
LAYERS	**DEPTH**	**G (kg/cm^2)**	**ENDURANCE**
1. LAYER	-4,92	3116	Sturdy
2.LAYER	-13,61	7301	Sturdy
3.LAYER	∞	23874	Rock Highlid

Shear modules and endurance of the grounds in the study area

Calculation of shear Modulus values in the direction of the seismic data obtained in the field studies and the table of variation are given in the table above.

5.13.5. WTG13 Elasticity Modulus-E (kg/cm²)

ELASTIC MODULUS				
PROFILES	LAYERS	DEPTH	E(kg/cm^2)	ENDURANCE
1_PROFILE	1. LAYER	-4,89	8795	Medium
	2.LAYER	-11,21	12949	Sturdy
	3.LAYER		46485	Rock Highlid
2_PROFILE	1. LAYER	-4,47	16288	Sturdy
	2. LAYER	-14,05	28235	Sturdy
	3. LAYER		83637	Rock Highlid
3_PROFILE	1. LAYER	-3,54	12945	Sturdy
	2. LAYER	-15,85	11629	Sturdy
	3. LAYER		28195	Sturdy
4_PROFILE	1. LAYER	-3,11	15175	Sturdy
	2. LAYER	-9,79	13263	Sturdy
	3. LAYER		63637	Rock Highlid
5_PROFILE	1. LAYER	-4,34	16837	Sturdy
	2. LAYER	-9,95	47300	Rock Highlid
	3. LAYER		151442	Rock Highlid
6_PROFILE	1. LAYER	-6,39	4921	Weak
	2. LAYER	-14,65	14040	Sturdy
	3. LAYER		48740	Rock Highlid
7_PROFILE	1. LAYER	-7,47	6816	Medium
	2.LAYER	-17,11	20392	Sturdy
	3.LAYER		65181	Rock Highlid
8_PROFILE	1. LAYER	-4,71	4175	Weak
	2. LAYER	-14,82	20715	Sturdy
	3. LAYER		74802	Rock Highlid
9_PROFILE	1. LAYER	-8,62	7098	Medium
	2. LAYER	-19,76	22204	Sturdy
	3. LAYER		75181	Rock Highlid
10_PROFILE	1. LAYER	-5,29	3129	Weak
	2. LAYER	-16,63	7762	Medium
	3. LAYER		30661	Rock Highlid
11_PROFILE	1. LAYER	-2,53	1737	Weak
	2. LAYER	-7,95	8428	Medium
	3. LAYER		28063	Sturdy
12_PROFILE	1. LAYER	-3,68	5014	Medium
	2. LAYER	-11,55	27172	Sturdy
	3. LAYER		97141	Rock Highlid

Elastic Modulus (kg/cm^2)	Dayanım
E<1000	High Weak
1000<E<5000	Weak
5000<E<10000	Medium
10000<E<30000	Sturdy
30000<E	Rock Highlid

The endurance of ground or rocks according to Slip Module values(Keçeli, 1990)

$E=G*(3*V_p^2-4*V_s^2)/(V_p^2-V_s^2)$

||AVERAGE||		
LAYERS	DEPTH	E (kg/cm^2)	ENDURANCE
1. LAYER	-4,92	8577	Medium
2.LAYER	-13,61	19507	Sturdy
3.LAYER	∞	66097	Rock Highlid

Elasticity modules and endurance of the grounds in the study area

Calculation of the modulus of elasticity in the direction of the seismic data obtained in the field studies and the change table are given in the above table

5.13.6. WTG13 Poisson's Ratio - (б)

POISSON'S RATIO				
PROFILES	LAYERS	DEPTH	(σ)	POROSITY
1_PROFILE	1. LAYER	-4,89	0,38	High Porous
	2.LAYER	-11,21	0,36	High Porous
	3.LAYER		0,36	High Porous
2_PROFILE	1. LAYER	-4,47	0,39	High Porous
	2. LAYER	-14,05	0,36	High Porous
	3. LAYER		0,41	High Porous
3_PROFILE	1. LAYER	-3,54	0,36	High Porous
	2. LAYER	-15,85	0,40	High Porous
	3. LAYER		0,44	High Porous
4_PROFILE	1. LAYER	-3,11	0,36	High Porous
	2. LAYER	-9,79	0,39	High Porous
	3. LAYER		0,35	High Porous
5_PROFILE	1. LAYER	-4,34	0,42	High Porous
	2. LAYER	-9,95	0,33	Medium Porous
	3. LAYER		0,38	High Porous
6_PROFILE	1. LAYER	-6,39	0,41	High Porous
	2. LAYER	-14,65	0,34	Medium Porous
	3. LAYER		0,37	High Porous
7_PROFILE	1. LAYER	-7,47	0,40	High Porous
	2.LAYER	-17,11	0,32	Medium Porous
	3.LAYER		0,39	High Porous
8_PROFILE	1. LAYER	-4,71	0,38	High Porous
	2. LAYER	-14,82	0,31	Medium Porous
	3. LAYER		0,39	High Porous
9_PROFILE	1. LAYER	-8,62	0,42	High Porous
	2. LAYER	-19,76	0,36	High Porous
	3. LAYER		0,38	High Porous
10_PROFILE	1. LAYER	-5,29	0,38	High Porous
	2. LAYER	-16,63	0,37	High Porous
	3. LAYER		0,38	High Porous
11_PROFILE	1. LAYER	-2,53	0,38	High Porous
	2. LAYER	-7,95	0,33	Medium Porous
	3. LAYER		0,40	High Porous
12_PROFILE	1. LAYER	-3,68	0,38	High Porous
	2. LAYER	-11,55	0,32	Medium Porous
	3. LAYER		0,38	High Porous

Poisson's Ratio;(σ)	Porosity
0,00≤σ≤0,25	Nonporous
0,26≤σ≤0,35	Medium Porous
0,36≤σ≤0,50	High Porous

Poisson ratio classification

$\sigma=(Vp^2-2*Vs^2)/(2*Vp^2-2*Vs^2)$

‖AVERAGE‖			
LAYERS	DEPTH	(σ)	POROSITY
1. LAYER	-4,92	0,39	High Porous
2.LAYER	-13,61	0,35	Medium Porous
3.LAYER	∞	0,39	High Porous

Poisson's ratio values of the units in the study area, porosity

Calculation of poisson's ratio values in the direction of the seismic data obtained in the field studies and the change table are given in the above table.

5.13.7. WTG13 Density - ρ (gr/ cm^3)

DENSITY				
PROFILES	LAYERS	DEPTH	ρ (gr/cm^3)	DEFINITION
1_PROFILE	1. LAYER	-4,89	1,75	Medium
	2.LAYER	-11,21	1,78	Medium
	3.LAYER		2,06	High
2_PROFILE	1. LAYER	-4,47	1,88	Medium
	2. LAYER	-14,05	1,94	High
	3. LAYER		2,28	High
3_PROFILE	1. LAYER	-3,54	1,79	Medium
	2. LAYER	-15,85	1,81	Medium
	3. LAYER		2,09	High
4_PROFILE	1. LAYER	-3,11	1,82	Medium
	2. LAYER	-9,79	1,83	Medium
	3. LAYER		2,12	High
5_PROFILE	1. LAYER	-4,34	1,93	High
	2. LAYER	-9,95	2,03	High
	3. LAYER		2,38	High
6_PROFILE	1. LAYER	-6,39	1,67	Medium
	2. LAYER	-14,65	1,78	Medium
	3. LAYER		2,09	High
7_PROFILE	1. LAYER	-7,47	1,72	Medium
	2.LAYER	-17,11	1,84	Medium
	3.LAYER		2,17	High
8_PROFILE	1. LAYER	-4,71	1,60	Medium
	2. LAYER	-14,82	1,83	Medium
	3. LAYER		2,21	High
9_PROFILE	1. LAYER	-8,62	1,76	Medium
	2. LAYER	-19,76	1,89	Medium
	3. LAYER		2,21	High
10_PROFILE	1. LAYER	-5,29	1,55	Medium
	2. LAYER	-16,63	1,69	Medium
	3. LAYER		1,99	High
11_PROFILE	1. LAYER	-2,53	1,45	Medium
	2. LAYER	-7,95	1,68	Medium
	3. LAYER		1,99	High
12_PROFILE	1. LAYER	-3,68	1,64	Medium
	2. LAYER	-11,55	1,88	Medium
	3. LAYER		2,27	High

Density: ρ (gr/cm^3)	Tanımlama
ρ<1,20	High low
1,20<ρ<1,40	Low
1,40<ρ<1,90	Medium
1,90<ρ<2,20	High
2,20<ρ	Too High

Density Classification of Ground Units: (Keçeli, 1990)

*ρ =d=0.31*Vp0.25*

‖AVERAGE‖			
LAYERS	DEPTH	ρ (gr/cm^3)	DEFINITION
1. LAYER	-4,92	1,71	Medium
2.LAYER	-13,61	1,83	Medium
3.LAYER	∞	2,15	High

Density values and description of the units in the study area

Calculation of the density values of the geological units in the direction of the seismic data obtained in the field studies and the table of variation are given in the above table.

5.13.8. WTG13 Modulus of Subgrade Reaction – D Y K (ton/m^3)

Modulus of Subgrade Reaction			
PROFILES	LAYERS	DEPTH	D Y K (ton/m^3)
1_PROFILE	1. LAYER	-4,89	3102
	2.LAYER	-11,21	3749
	3.LAYER		7410
2_PROFILE	1. LAYER	-4,47	4178
	2. LAYER	-14,05	5635
	3. LAYER		10194
3_PROFILE	1. LAYER	-3,54	3842
	2. LAYER	-15,85	3512
	3. LAYER		5638
4_PROFILE	1. LAYER	-3,11	4147
	2. LAYER	-9,79	3663
	3. LAYER		8786
5_PROFILE	1. LAYER	-4,34	4284
	2. LAYER	-9,95	7445
	3. LAYER		14242
6_PROFILE	1. LAYER	-6,39	2334
	2. LAYER	-14,65	3986
	3. LAYER		7582
7_PROFILE	1. LAYER	-7,47	2745
	2.LAYER	-17,11	4837
	3.LAYER		8861
8_PROFILE	1. LAYER	-4,71	2145
	2. LAYER	-14,82	4866
	3. LAYER		9558
9_PROFILE	1. LAYER	-8,62	2755
	2. LAYER	-19,76	4993
	3. LAYER		9585
10_PROFILE	1. LAYER	-5,29	1874
	2. LAYER	-16,63	2955
	3. LAYER		5928
11_PROFILE	1. LAYER	-2,53	1396
	2. LAYER	-7,95	3113
	3. LAYER		5640
12_PROFILE	1. LAYER	-3,68	2352
	2. LAYER	-11,55	5540
	3. LAYER		11055

||AVERAGE||		
LAYERS	DEPTH	D Y K (ton/m^3)
1. LAYER	-4,92	2929
2.LAYER	-13,61	4525
3.LAYER	∞	8707
kv= 40*(Gs)*qu ton/m^3 *(Bowles 1984)*		

The above table shows the Modulus of Subgrade Reaction obtained for each layer in the direction of the data obtained after the seismic measurements made in the study area.

5.13.9. WTG13 Bearing Capacity qu (kg/cm2) / Allowable Bearing Capacity qa (kg/cm2)

PROFILES	LAYERS	DEPTH	BEARING CAPACITY (qu,kg/cm^2)	ALLOWABLE BEARING CAPACITY (qa,kg/cm^2)
1_PROFILE	1. LAYER	-4,89	7,75	2,58
	2.LAYER	-11,21	9,37	3,12
	3.LAYER	-38,79	18,53	6,18
2_PROFILE	1. LAYER	-4,47	10,45	3,48
	2. LAYER	-14,05	14,09	4,70
	3. LAYER	-35,95	25,49	8,50
3_PROFILE	1. LAYER	-3,54	9,61	3,20
	2. LAYER	-15,85	8,78	2,93
	3. LAYER	-34,15	14,10	4,70
4_PROFILE	1. LAYER	-3,11	10,37	3,46
	2. LAYER	-9,79	9,16	3,05
	3. LAYER	-40,21	21,97	7,32
5_PROFILE	1. LAYER	-4,34	10,71	3,57
	2. LAYER	-9,95	18,61	6,20
	3. LAYER	-40,05	35,61	11,87
6_PROFILE	1. LAYER	-6,39	5,84	1,95
	2. LAYER	-14,65	9,97	3,32
	3. LAYER	-35,35	18,95	6,32
7_PROFILE	1. LAYER	-7,47	6,86	2,29
	2.LAYER	-17,11	12,09	4,03
	3.LAYER	-32,89	22,15	7,38
8_PROFILE	1. LAYER	-4,71	5,36	1,79
	2. LAYER	-14,82	12,16	4,05
	3. LAYER	-35,18	23,89	7,96
9_PROFILE	1. LAYER	-8,62	6,89	2,30
	2. LAYER	-19,76	12,48	4,16
	3. LAYER	-30,24	23,96	7,99
10_PROFILE	1. LAYER	-5,29	4,68	1,56
	2. LAYER	-16,63	7,39	2,46
	3. LAYER	-33,37	14,82	4,94
11_PROFILE	1. LAYER	-2,53	3,49	1,16
	2. LAYER	-7,95	7,78	2,59
	3. LAYER	-42,05	14,10	4,70
12_PROFILE	1. LAYER	-3,68	5,88	1,96
	2. LAYER	-11,55	13,85	4,62
	3. LAYER	-38,45	27,64	9,21

||AVERAGE||		
LAYERS	DEPTH	Bearing Capacity (qu,kg/cm^2)
1. LAYER	-4,92	7,32
2.LAYER	-13,61	11,31
3.LAYER	∞	21,77
qu=(0,024*Vs*(J.B.K+0,002*Vp)*0,71)/G.K		

||AVERAGE||		
LAYERS	DEPTH	Allowable Bearing Capacity (qa,kg/cm^2)
1. LAYER	-4,92	2,44
2.LAYER	-13,61	3,77
3.LAYER	∞	7,26
qa=qu/G.K	G.K=3 empirical value	

5.13.10 WTG13 Vibration Period - T_0 (sec) / Ground Amplification (Ak)

PROFILES	To (sec)	Ta (sec)	Tb (sec)	Ak (Amplification)
1.PROFILE	0,27	0,18	0,41	1,57
2.PROFILE	0,22	0,15	0,33	1,32
3.PROFILE	0,33	0,22	0,50	1,63
4.PROFILE	0,23	0,16	0,35	1,45
5.PROFILE	0,16	0,11	0,24	1,17
6.PROFILE	0,30	0,20	0,44	1,60
7.PROFILE	0,27	0,18	0,40	1,48
8.PROFILE	0,26	0,17	0,39	1,48
9.PROFILE	0,27	0,18	0,40	1,45
10.PROFILE	0,38	0,25	0,56	1,82
11.PROFILE	0,34	0,23	0,52	1,87
12.PROFILE	0,21	0,14	0,32	1,36

AVERAGE			
To (sec)	Ta (sec)	Tb (sec)	Ak (Amplification)
0,27	0,18	0,41	1,52

$To = \sum 4H\ Vs\ n\ \iota$=1 (sec)……. (Zeevaert,1967)

Ak=68*$Vs_{30}^{-0,6}$……. (Midorikawa, 1987)

The Vibration Period and Ground Amplification calculated in the direction of the parameters obtained during the seismic studies made during the field survey are presented in the table above.

5. 14. WTG14

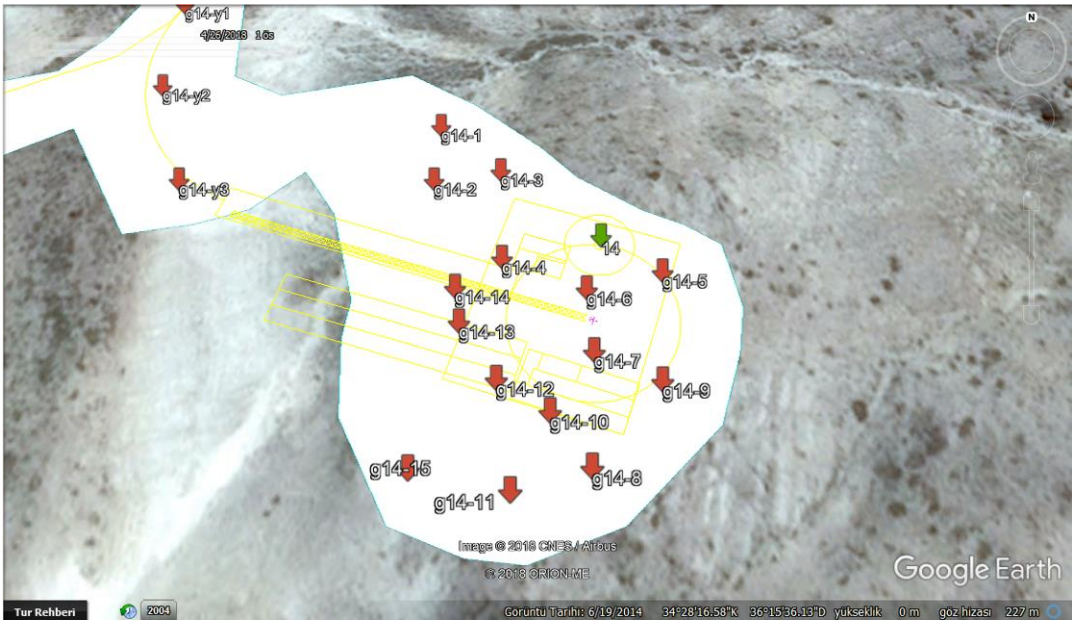
There are 15 measurements taken on the WTG. These measurements showed 3 layers. Layer 1 was found at an average depth of 0,00 m-3,79 m, Layer 2 at an average depth of 3,79 m-13,88 m and Layer 3 at an average depth of 13,88 m. The parameters of this layer are given in the table below.

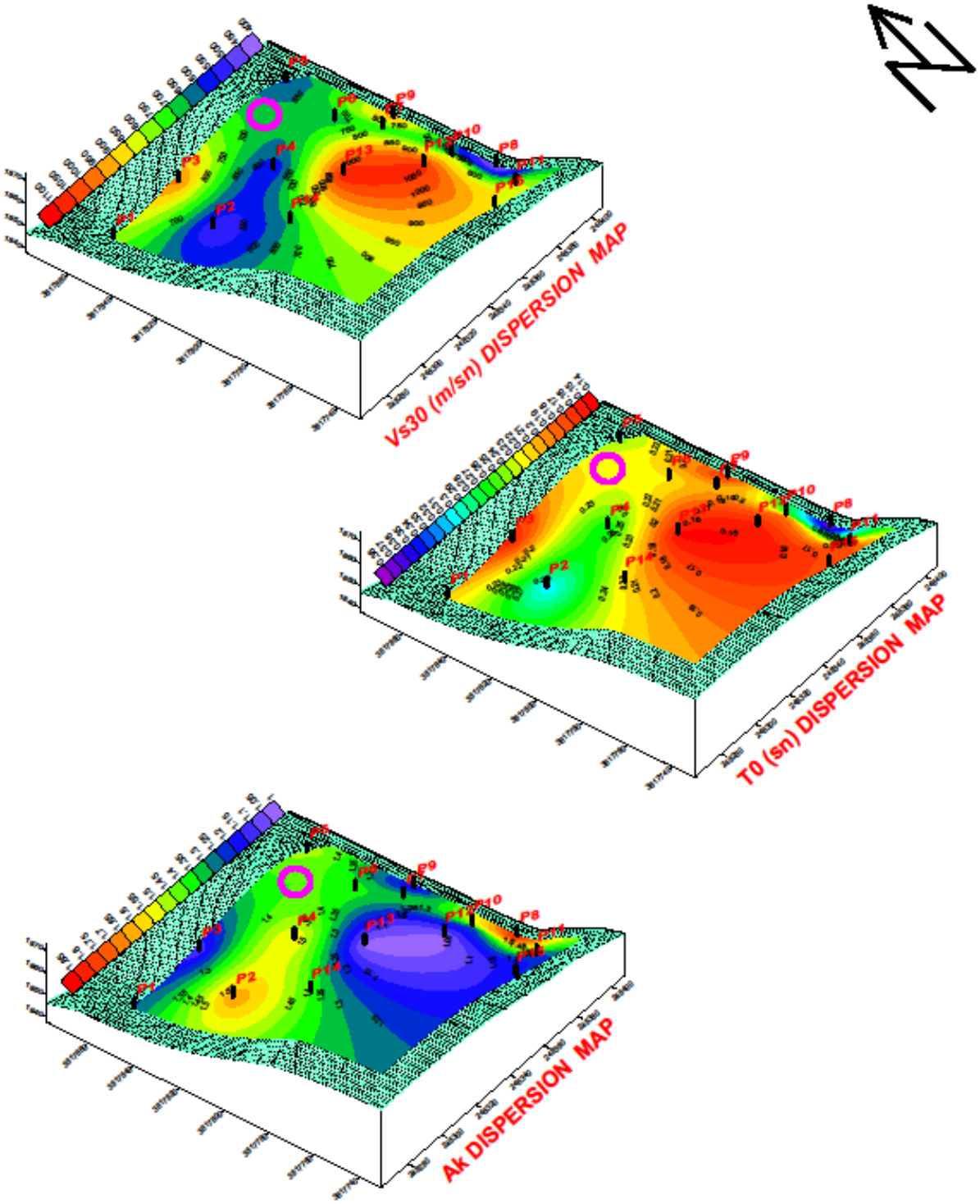
LAYERS	Vp_ Velocity	STRIPPABILITY
1. LAYER	1009	Simple strippability
2.LAYER	1506	Medium-hard STRIPPABILITY
3.LAYER	3189	Explosive
LAYERS	**Vs_ Velocity**	**GROUND GROUP**
1. LAYER	378	C
2.LAYER	739	A
3.LAYER	1386	A
LAYERS	**G (kg/cm2)**	**ENDURANCE**
1. LAYER	3741	Sturdy
2.LAYER	12331	High sturdy
3.LAYER	48789	High sturdy
LAYERS	**E (kg/cm2)**	**ENDURANCE**
1. LAYER	10332	Sturdy
2.LAYER	32839	High sturdy
3.LAYER	134601	High sturdy

LAYERS	(σ)	POROSITY
1. LAYER	0,39	High Porosity
2.LAYER	0,33	Medium Porosity
3.LAYER	0,38	High Porosity
LAYERS	**ρ (gr/cm3)**	**DEFINITION**
1. LAYER	1,71	Medium
2.LAYER	1,91	High
3.LAYER	2,32	High
LAYERS	**D Y K (ton/m^3)**	
1. LAYER	2984	
2.LAYER	5846	
3.LAYER	12900	
LAYERS	**Ground Carrying Capacity (qu,kg/cm2)**	**Secure Carrying Capacity (qa,kg/cm2)**
1. LAYER	7,46	2,49
2.LAYER	14,61	4,87
3.LAYER	32,25	10,75

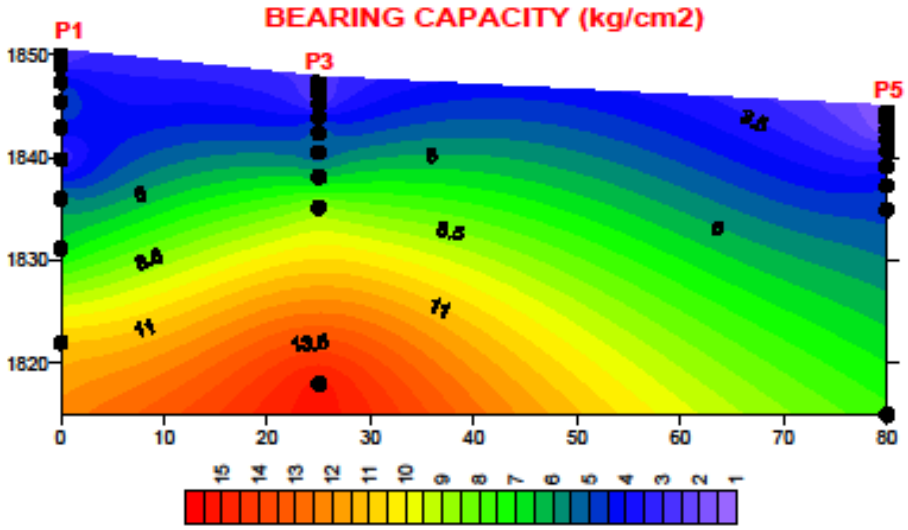
To (sec)	Ta (sec)	Tb (sec)	Vs30 (m/sec)	Ak (Amplification)
0,22	0,14	0,32	748	1,33

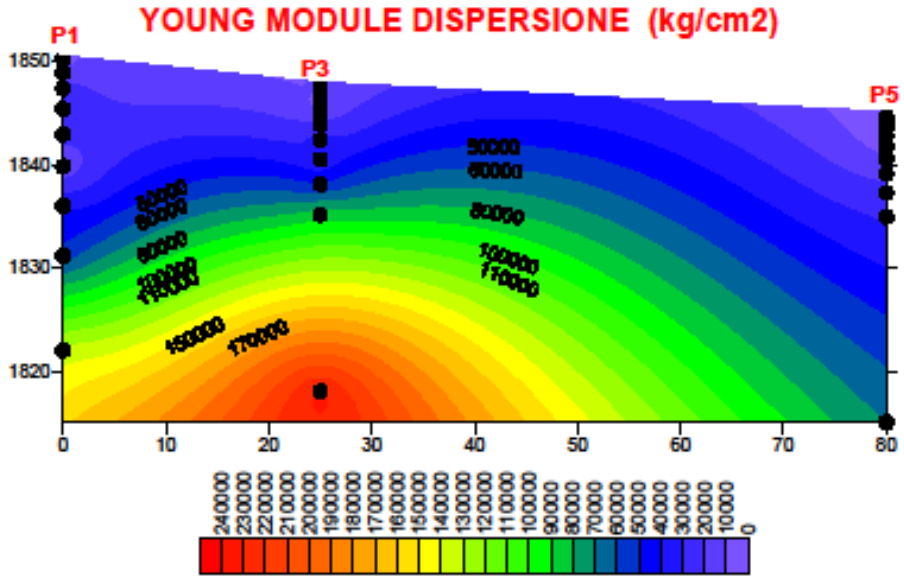
It is recommended to excavate the first 1.60 meters from the average of the tenth profile terrain taken from the field. Taking into consideration the following applications, the profile points should be seen in the engineering parameters section for detailed values.

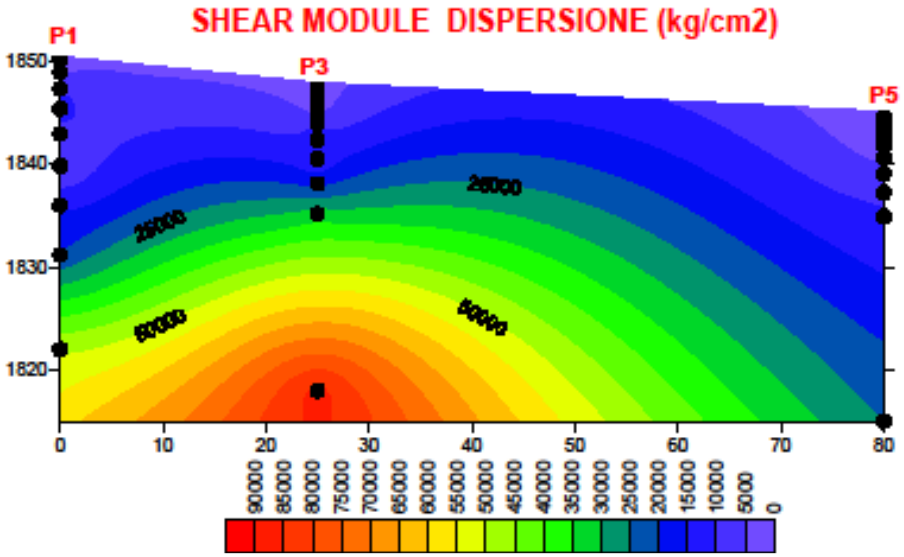



Vs30 (m/sn) DISPERSION MAP
T0 (sn) DISPERSION MAP
Ak DISPERSION MAP

WTG14


BEARING CAPACITY (kg/cm2)
P1
P3
P5
1850
1840
1830
1820
0
10
20
30
40
50
60
70
80
15 14 13 12 11 10 9 8 7 6 5 4 3 2 1


YOUNG MODULE DISPERSIONE (kg/cm2)
P1
P3
P5
1850
1840
1830
1820
0
10
20
30
40
50
60
70
80
240000 230000 220000 210000 200000 190000 180000 170000 160000 150000 140000 130000 120000 110000 100000 90000 80000 70000 60000 50000 40000 30000 20000 10000 0


SHEAR MODULE DISPERSIONE (kg/cm2)
P1
P3
P5
1850
1840
1830
1820
0
10
20
30
40
50
60
70
80
90000 85000 80000 75000 70000 65000 60000 55000 50000 45000 40000 35000 30000 25000 20000 15000 10000 5000 0

5.14.1. WTG14 Seismic P wave velocity (*Compressional Wave Velocity* (Vp))

Vp VELOCITY				
PROFILES	LAYERS	DEPTH	Vp_ Velocity	STRIPPABILITY
1_PROFILE	1. LAYER	-4,66	1364	Medium Strippability
	2.LAYER	-20,84	1642	High Difficult Strippability
	3.LAYER		3133	Explosive
2_PROFILE	1. LAYER	-3,38	663	Simple Strippability
	2. LAYER	-15,13	944	Simple Strippability
	3. LAYER		2104	High Difficult Strippability
3_PROFILE	1. LAYER	-2,88	1096	Simple Strippability
	2. LAYER	-12,87	1821	High Difficult Strippability
	3. LAYER		3831	Explosive
4_PROFILE	1. LAYER	-2,66	586	Simple Strippability
	2. LAYER	-11,88	1043	Simple Strippability
	3. LAYER		2340	Explosive
5_PROFILE	1. LAYER	-3,21	721	Simple Strippability
	2. LAYER	-10,09	1258	Medium Strippability
	3. LAYER		2565	Explosive
6_PROFILE	1. LAYER	-2,82	637	Simple Strippability
	2. LAYER	-12,60	1299	Medium Strippability
	3. LAYER		2895	Explosive
7_PROFILE	1. LAYER	-1,52	995	Simple Strippability
	2.LAYER	-10,26	1351	Medium Strippability
	3.LAYER		3045	Explosive
8_PROFILE	1. LAYER	-5,65	500	Simple Strippability
	2. LAYER	-17,77	920	Simple Strippability
	3. LAYER		1830	High Difficult Strippability
9_PROFILE	1. LAYER	-5,43	1701	High Difficult Strippability
	2. LAYER	-12,45	1911	High Difficult Strippability
	3. LAYER		3754	Explosive
10_PROFILE	1. LAYER	-1,62	402	High Simple Strippability
	2. LAYER	-10,94	1360	Medium Strippability
	3. LAYER		3518	Explosive
11_PROFILE	1. LAYER	-2,77	805	Simple Strippability
	2. LAYER	-12,41	1616	High Difficult Strippability
	3. LAYER		3826	Explosive
12_PROFILE	1. LAYER	-6,57	1867	High Difficult Strippability
	2. LAYER	-20,66	2062	High Difficult Strippability
	3. LAYER		4225	Explosive
13_PROFILE	1. LAYER	-7,81	2103	High Difficult Strippability
	2. LAYER	-17,90	2356	Explosive
	3. LAYER		4416	Explosive
14_PROFILE	1. LAYER	-3,09	896	Simple Strippability
	2. LAYER	-9,72	1424	Medium Strippability
	3. LAYER		2778	Explosive
15_PROFILE	1. LAYER	-2,82	803	Simple Strippability
	2. LAYER	-12,62	1577	High Difficult Strippability
	3. LAYER		3569	Explosive

P Wave Velocity (m/sec)	Strippability
Vp<458	High Simple Strippability
458<Vp<1220	Simple Strippability
1220<Vp<11525	Medium Strippability
1525<Vp<11830	Difficult Strippability
1830<Vp<12135	High Difficult Strippability
Vp>2135	Explosive Strippability

Strippability of floors with P wave velocity (Church, 1981)

||AVERAGE||			
LAYERS	DEPTH	Vp_ Velocity	STRIPPABILITY
1. LAYER	-3,79	1009	Simple Strippability
2.LAYER	-13,88	1506	Medium Strippability
3.LAYER	∞	3189	Explosive

P wave velocities of the grounds in the study area and strippability

The above table shows the change table and strippability properties of Vp velocity depth values in the direction of the seismic data obtained from the field studies.

5.14.2. WTG14 Seismic S wave velocity (*Transverse Wave Velocity* (Vs))

Vs VELOCITY				
PROFILES	LAYERS	DEPTH	Vs_ Velocity	GROUND GROUPS
1_PROFILE	1. LAYER	-4,66	486	B
	2.LAYER	-20,84	741	A
	3.LAYER		1451	A
2_PROFILE	1. LAYER	-3,38	257	C
	2. LAYER	-15,13	466	B
	3. LAYER		911	A
3_PROFILE	1. LAYER	-2,88	427	B
	2. LAYER	-12,87	875	A
	3. LAYER		1884	A
4_PROFILE	1. LAYER	-2,66	248	C
	2. LAYER	-11,88	549	B
	3. LAYER		1000	A
5_PROFILE	1. LAYER	-3,21	278	C
	2. LAYER	-10,09	623	B
	3. LAYER		1062	A
6_PROFILE	1. LAYER	-2,82	297	C
	2. LAYER	-12,60	702	A
	3. LAYER		1263	A
7_PROFILE	1. LAYER	-1,52	332	C
	2.LAYER	-10,26	609	B
	3.LAYER		1276	A
8_PROFILE	1. LAYER	-5,65	227	C
	2. LAYER	-17,77	477	B
	3. LAYER		788	A
9_PROFILE	1. LAYER	-5,43	536	B
	2. LAYER	-12,45	887	A
	3. LAYER		1599	A
10_PROFILE	1. LAYER	-1,62	179	D
	2. LAYER	-10,94	616	B
	3. LAYER		1436	A
11_PROFILE	1. LAYER	-2,77	327	C
	2. LAYER	-12,41	791	A
	3. LAYER		1569	A
12_PROFILE	1. LAYER	-6,57	816	A
	2. LAYER	-20,66	1036	A
	3. LAYER		1910	A
13_PROFILE	1. LAYER	-7,81	571	B
	2. LAYER	-17,90	1157	A
	3. LAYER		1955	A
14_PROFILE	1. LAYER	-3,09	346	C
	2. LAYER	-9,72	701	A
	3. LAYER		1132	A
15_PROFILE	1. LAYER	-2,82	344	C
	2. LAYER	-12,62	849	A
	3. LAYER			A

S Wave Velocity (m/sec)	Ground group
Vs<200	D
200<Vs<400	C
400<Vs<700	B
700<Vs	A

Ground groups according to slip wave velocity(Abyyhy, 1998)

||AVERAGE||			
LAYERS	DEPTH	Vs_ Velocity	GROUND GROUPS
1. LAYER	-3,79	378	C
2.LAYER	-13,88	739	A
3.LAYER	∞	1386	A

S wave velocities of the grounds in the study area and ground group

Ground Group	Ground group and top ground layer thickness(h_1)
Z1	(A) Ground group h1< 15 m (B) Ground group
Z2	h_1> 15 m (B) Ground group h_1< 15 m (C) Ground group
Z3	15 m < h_1< 50 m (C) Ground group h_1< 10 m (D) Ground group
Z4	h_1> 50 m (C) Ground group h_1> 10 m (D) Ground group

Ground Group Class

The above table shows that Vs velocity values in the direction of the seismic data obtained in the field studies are the absolute change tables and that the layers are included in the ground groups.

5.14.3. WTG14 Vs30

PROFILES	Vs30 (m/sec)
1.PROFILE	783
2.PROFILE	495
3.PROFILE	964
4.PROFILE	542
5.PROFILE	583
6.PROFILE	666
7.PROFILE	707
8.PROFILE	414
9.PROFILE	925
10.PROFILE	690
11.PROFILE	807
12.PROFILE	1059
13.PROFILE	1087
14.PROFILE	656
15.PROFILE	835

Vs30 values in the direction of the seismic data obtained from the field studies are given in the table above.

5.14.4. WTG14 Shear Modulus-G (kg/cm²)

PROFILES	LAYERS	SHEAR MODULUS DEPTH	G(kg/cm²)	ENDURANCE
1_PROFILE	1. LAYER	-4,66	4808	Sturdy
	2.LAYER	-20,84	11623	Rock Highlid
	3.LAYER		48808	Rock Highlid
2_PROFILE	1. LAYER	-3,38	1050	Weak
	2. LAYER	-15,13	4167	Sturdy
	3. LAYER		17437	Rock Highlid
3_PROFILE	1. LAYER	-2,88	3303	Sturdy
	2. LAYER	-12,87	16511	Rock Highlid
	3. LAYER		86535	Rock Highlid
4_PROFILE	1. LAYER	-2,66	1026	Weak
	2. LAYER	-11,88	5719	Sturdy
	3. LAYER		21571	Rock Highlid
5_PROFILE	1. LAYER	-3,21	1332	Weak
	2. LAYER	-10,09	7404	Sturdy
	3. LAYER		24880	Rock Highlid
6_PROFILE	1. LAYER	-2,82	1524	Medium
	2. LAYER	-12,60	9959	Sturdy
	3. LAYER		36299	Rock Highlid
7_PROFILE	1. LAYER	-1,52	1996	Medium
	2.LAYER	-10,26	7987	Sturdy
	3.LAYER		37497	Rock Highlid
8_PROFILE	1. LAYER	-5,65	830	Weak
	2. LAYER	-17,77	4029	Sturdy
	3. LAYER		12595	Rock Highlid
9_PROFILE	1. LAYER	-5,43	8552	Sturdy
	2. LAYER	-12,45	17040	Rock Highlid
	3. LAYER		62041	Rock Highlid
10_PROFILE	1. LAYER	-1,62	461	Weak
	2. LAYER	-10,94	8098	Sturdy
	3. LAYER		49242	Rock Highlid
11_PROFILE	1. LAYER	-2,77	1879	Medium
	2. LAYER	-12,41	13255	Rock Highlid
	3. LAYER		60054	Rock Highlid
12_PROFILE	1. LAYER	-6,57	14626	Rock Highlid
	2. LAYER	-20,66	24626	Rock Highlid
	3. LAYER		91173	Rock Highlid
13_PROFILE	1. LAYER	-7,81	10621	Rock Highlid
	2. LAYER	-17,90	29382	Rock Highlid
	3. LAYER		96538	Rock Highlid
14_PROFILE	1. LAYER	-3,09	2104	Medium
	2. LAYER	-9,72	9623	Sturdy
	3. LAYER		28843	Rock Highlid
15_PROFILE	1. LAYER	-2,82	1997	Medium
	2. LAYER	-12,62	15538	Rock Highlid
	3. LAYER		58326	Rock Highlid

Shear Modulus (kg/cm²)	Dayanım
G<400	High Weak
400<G<1500	Weak
1500<G<3000	Medium
3000<G<10000	Sturdy
10000<G	Rock Highlid

The endurance of ground or rocks according to Slip Module values(Keçeli, 1990)

$G = (d*Vs^2)/100$

LAYERS	‖AVERAGE‖ DEPTH	G (kg/cm²)	ENDURANCE
1. LAYER	-3,79	3741	Sturdy
2.LAYER	-13,88	12331	Rock Highlid
3.LAYER	∞	48789	Rock Highlid

Calculation of shear Modulus values in the direction of the seismic data obtained in the field studies and the table of variation are given in the table above.

5.14.5. WTG14 Elasticity Modulus-E (kg/cm²)

ELASTIC MODULUS				
PROFILES	LAYERS	DEPTH	E(kg/cm^2)	ENDURANCE
1_PROFILE	1. LAYER	-4,66	13339	Sturdy
	2.LAYER	-20,84	31272	Rock Highlid
	3.LAYER		133105	Rock Highlid
2_PROFILE	1. LAYER	-3,38	2953	Weak
	2. LAYER	-15,13	11015	Sturdy
	3. LAYER		48284	Rock Highlid
3_PROFILE	1. LAYER	-2,88	9235	Medium
	2. LAYER	-12,87	44199	Rock Highlid
	3. LAYER		232014	Rock Highlid
4_PROFILE	1. LAYER	-2,66	2721	Weak
	2. LAYER	-11,88	14996	Sturdy
	3. LAYER		59891	Rock Highlid
5_PROFILE	1. LAYER	-3,21	3671	Weak
	2. LAYER	-10,09	19800	Sturdy
	3. LAYER		69492	Rock Highlid
6_PROFILE	1. LAYER	-2,82	3922	Weak
	2. LAYER	-12,60	25765	Sturdy
	3. LAYER		100355	Rock Highlid
7_PROFILE	1. LAYER	-1,52	5687	Medium
	2.LAYER	-10,26	21580	Sturdy
	3.LAYER		104504	Rock Highlid
8_PROFILE	1. LAYER	-5,65	2190	Weak
	2. LAYER	-17,77	10615	Sturdy
	3. LAYER		34916	Rock Highlid
9_PROFILE	1. LAYER	-5,43	24081	Sturdy
	2. LAYER	-12,45	46070	Rock Highlid
	3. LAYER		172373	Rock Highlid
10_PROFILE	1. LAYER	-1,62	1266	Weak
	2. LAYER	-10,94	22265	Sturdy
	3. LAYER		137879	Rock Highlid
11_PROFILE	1. LAYER	-2,77	5125	Medium
	2. LAYER	-12,41	35643	Rock Highlid
	3. LAYER		168013	Rock Highlid
12_PROFILE	1. LAYER	-6,57	39106	Rock Highlid
	2. LAYER	-20,66	64561	Rock Highlid
	3. LAYER		250102	Rock Highlid
13_PROFILE	1. LAYER	-7,81	30390	Rock Highlid
	2. LAYER	-17,90	78813	Rock Highlid
	3. LAYER		266096	Rock Highlid
14_PROFILE	1. LAYER	-3,09	5867	Medium
	2. LAYER	-9,72	25777	Sturdy
	3. LAYER		80785	Rock Highlid
15_PROFILE	1. LAYER	-2,82	5429	Medium
	2. LAYER	-12,62	40210	Rock Highlid
	3. LAYER		161199	Rock Highlid

Elastic Modulus (kg/cm^2)	Dayanım
E<1000	High Weak
1000<E<5000	Weak
5000<E<10000	Medium
10000<E<30000	Sturdy
30000<E	Rock Highlid

The endurance of ground or rocks according to Slip Module values(Keçeli, 1990)

$E=G*(3*V_p^2-4*V_s^2)/(V_p^2-V_s^2)$

‖AVERAGE‖			
LAYERS	DEPTH	E (kg/cm^2)	ENDURANCE
1. LAYER	-3,79	10332	Sturdy
2.LAYER	-13,88	32839	Rock Highlid
3.LAYER	∞	134601	Rock Highlid

Elasticity modules and endurance of the grounds in the study area

Calculation of the modulus of elasticity in the direction of the seismic data obtained in the field studies and the change table are given in the above table

5.14.6. WTG14 Poisson's Ratio - (б)

POISSON'S RATIO				
PROFILES	LAYERS	DEPTH	(σ)	POROSITY
1_PROFILE	1. LAYER	-4,66	0,42	High Porous
	2.LAYER	-20,84	0,37	High Porous
	3.LAYER		0,36	High Porous
2_PROFILE	1. LAYER	-3,38	0,41	High Porous
	2. LAYER	-15,13	0,34	Medium Porous
	3. LAYER		0,38	High Porous
3_PROFILE	1. LAYER	-2,88	0,41	High Porous
	2. LAYER	-12,87	0,34	Medium Porous
	3. LAYER		0,34	Medium Porous
4_PROFILE	1. LAYER	-2,66	0,37	High Porous
	2. LAYER	-11,88	0,31	Medium Porous
	3. LAYER		0,39	High Porous
5_PROFILE	1. LAYER	-3,21	0,40	High Porous
	2. LAYER	-10,09	0,33	Medium Porous
	3. LAYER		0,40	High Porous
6_PROFILE	1. LAYER	-2,82	0,33	Medium Porous
	2. LAYER	-12,60	0,29	Medium Porous
	3. LAYER		0,38	High Porous
7_PROFILE	1. LAYER	-1,52	0,43	High Porous
	2.LAYER	-10,26	0,37	High Porous
	3.LAYER		0,39	High Porous
8_PROFILE	1. LAYER	-5,65	0,35	Medium Porous
	2. LAYER	-17,77	0,31	Medium Porous
	3. LAYER		0,39	High Porous
9_PROFILE	1. LAYER	-5,43	0,41	High Porous
	2. LAYER	-12,45	0,36	High Porous
	3. LAYER		0,39	High Porous
10_PROFILE	1. LAYER	-1,62	0,38	High Porous
	2. LAYER	-10,94	0,36	High Porous
	3. LAYER		0,40	High Porous
11_PROFILE	1. LAYER	-2,77	0,39	High Porous
	2. LAYER	-12,41	0,33	Medium Porous
	3. LAYER		0,40	High Porous
12_PROFILE	1. LAYER	-6,57	0,37	High Porous
	2. LAYER	-20,66	0,33	Medium Porous

	3. LAYER		0,37	High Porous
13_PROFILE	1. LAYER	-7,81	0,43	High Porous
	2. LAYER	-17,90	0,34	Medium Porous
	3. LAYER		0,38	High Porous
14_PROFILE	1. LAYER	-3,09	0,41	High Porous
	2. LAYER	-9,72	0,33	Medium Porous
	3. LAYER		0,40	High Porous
15_PROFILE	1. LAYER	-2,82	0,37	High Porous
	2. LAYER	-12,62	0,30	Medium Porous
	3. LAYER		0,38	High Porous

Poisson's Ratio;(σ)	Porosity
0,00≤σ≤0,25	Nonporous
0,26≤σ≤0,35	Medium Porous
0,36≤σ≤0,50	High Porous

Poisson ratio classification

$\sigma=(Vp^2-2*Vs^2)/(2*Vp^2-2*Vs^2)$

‖AVERAGE‖			
LAYERS	DEPTH	(σ)	POROSITY
1. LAYER	-3,79	0,39	High Porous
2.LAYER	-13,88	0,33	Medium Porous
3.LAYER	∞	0,38	High Porous

Poisson's ratio values of the units in the study area, porosity

Calculation of poisson's ratio values in the direction of the seismic data obtained in the field studies and the change table are given in the above table.

5.14.7. WTG14 Density - ρ (gr/ cm^3)

DENSITY				
PROFILES	LAYERS	DEPTH	ρ (gr/cm^3)	DEFINITION
1_PROFILE	1. LAYER	-4,66	1,88	Medium
	2.LAYER	-20,84	1,97	High
	3.LAYER		2,32	High
2_PROFILE	1. LAYER	-3,38	1,57	Medium
	2. LAYER	-15,13	1,71	Medium
	3. LAYER		2,10	High
3_PROFILE	1. LAYER	-2,88	1,78	Medium
	2. LAYER	-12,87	2,02	High
	3. LAYER		2,44	High
4_PROFILE	1. LAYER	-2,66	1,53	Medium
	2. LAYER	-11,88	1,75	Medium
	3. LAYER		2,16	High
5_PROFILE	1. LAYER	-3,21	1,61	Medium
	2. LAYER	-10,09	1,84	Medium
	3. LAYER		2,21	High
6_PROFILE	1. LAYER	-2,82	1,56	Medium
	2. LAYER	-12,60	1,85	Medium
	3. LAYER		2,27	High
7_PROFILE	1. LAYER	-1,52	1,74	Medium
	2.LAYER	-10,26	1,87	Medium

	3.LAYER		2,30	High
8_PROFILE	1. LAYER	-5,65	1,46	Medium
	2. LAYER	-17,77	1,70	Medium
	3. LAYER		2,03	High
9_PROFILE	1. LAYER	-5,43	1,99	High
	2. LAYER	-12,45	2,05	High
	3. LAYER		2,43	High
10_PROFILE	1. LAYER	-1,62	1,39	Low
	2. LAYER	-10,94	1,86	Medium
	3. LAYER		2,39	High
11_PROFILE	1. LAYER	-2,77	1,65	Medium
	2. LAYER	-12,41	1,95	High
	3. LAYER		2,44	High
12_PROFILE	1. LAYER	-6,57	2,04	High
	2. LAYER	-20,66	2,08	High
	3. LAYER		2,50	High
13_PROFILE	1. LAYER	-7,81	2,10	High
	2. LAYER	-17,90	2,16	High
	3. LAYER		2,53	High
14_PROFILE	1. LAYER	-3,09	1,70	Medium
	2. LAYER	-9,72	1,90	Medium
	3. LAYER		2,25	High
15_PROFILE	1. LAYER	-2,82	1,65	Medium
	2. LAYER	-12,62	1,94	High
	3. LAYER		2,40	High

Density: ρ (gr/cm^3)	Tanımlama
ρ<1,20	High low
1,20<ρ<1,40	Low
1,40<ρ<1,90	Medium
1,90<ρ<2,20	High
2,20<ρ	Too High

Density Classification of Ground Units: (Keçeli, 1990)

$\rho = d = 0.31 * Vp0.25$

||AVERAGE||			
LAYERS	**DEPTH**	**ρ (gr/cm^3)**	**DEFINITION**
1. LAYER	-3,79	1,71	Medium
2.LAYER	-13,88	1,91	High
3.LAYER	∞	2,32	High

Density values and description of the units in the study area

Calculation of the density values of the geological units in the direction of the seismic data obtained in the field studies and the table of variation are given in the above table.

5.14.8. WTG14 Modulus of Subgrade Reaction – D Y K (ton/m^3)

BULK MODULUS				
PROFILES	LAYERS	DEPTH	K	SIKIŞMA
1_PROFILE	1. LAYER	-4,66	28639	Medium
	2.LAYER	-20,84	38502	Medium
	3.LAYER		162575	Too High
2_PROFILE	1. LAYER	-3,38	5514	Az
	2. LAYER	-15,13	10796	Medium
	3. LAYER		69693	High
3_PROFILE	1. LAYER	-2,88	17048	Medium
	2. LAYER	-12,87	48814	High
	3. LAYER		242564	Too High
4_PROFILE	1. LAYER	-2,66	3874	Az
	2. LAYER	-11,88	13335	Medium
	3. LAYER		89297	High
5_PROFILE	1. LAYER	-3,21	6580	Az
	2. LAYER	-10,09	20927	Medium
	3. LAYER		111974	Too High
6_PROFILE	1. LAYER	-2,82	4282	Az
	2. LAYER	-12,60	21035	Medium
	3. LAYER		142179	Too High
7_PROFILE	1. LAYER	-1,52	14576	Medium
	2.LAYER	-10,26	26551	Medium
	3.LAYER		163521	Too High
8_PROFILE	1. LAYER	-5,65	2577	Az
	2. LAYER	-17,77	9748	Az
	3. LAYER		51108	High
9_PROFILE	1. LAYER	-5,43	46200	High
	2. LAYER	-12,45	54011	High
	3. LAYER		259237	Too High
10_PROFILE	1. LAYER	-1,62	1671	Az
	2. LAYER	-10,94	31266	Medium
	3. LAYER		229824	Too High
11_PROFILE	1. LAYER	-2,77	8189	Az
	2. LAYER	-12,41	40010	High
	3. LAYER		276821	Too High
12_PROFILE	1. LAYER	-6,57	51544	High
	2. LAYER	-20,66	60361	High
	3. LAYER		324576	Too High
13_PROFILE	1. LAYER	-7,81	78682	High
	2. LAYER	-17,90	82699	High
	3. LAYER		364090	Too High
14_PROFILE	1. LAYER	-3,09	10805	Medium
	2. LAYER	-9,72	27665	Medium
	3. LAYER		135226	Too High
15_PROFILE	1. LAYER	-2,82	8054	Az
	2. LAYER	-12,62	32574	Medium
	3. LAYER		227436	Too High

‖AVERAGE‖		
LAYERS	DEPTH	D Y K (ton/m^3)
1. LAYER	-3,79	2984
2.LAYER	-13,88	5846
3.LAYER	∞	12900
kv= 40*(Gs)*qu ton/m^3 *(Bowles 1984)*		

The above table shows the Modulus of Subgrade Reaction obtained for each layer in the direction of the data obtained after the seismic measurements made in the study area.

5.14.9. WTG14 Bearing Capacity qu (kg/cm2) / Allowable Bearing Capacity qa (kg/cm2)

PROFILES	LAYERS	DEPTH	BEARING	ALLOWABLE
1_PROFILE	1. LAYER	-4,66	9,32	3,11
	2.LAYER	-20,84	14,67	4,89
	3.LAYER	-29,16	33,02	11,01
2_PROFILE	1. LAYER	-3,38	4,55	1,52
	2. LAYER	-15,13	8,59	2,86
	3. LAYER	-34,87	18,83	6,28
3_PROFILE	1. LAYER	-2,88	7,94	2,65
	2. LAYER	-12,87	17,70	5,90
	3. LAYER	-37,13	45,57	15,19
4_PROFILE	1. LAYER	-2,66	4,36	1,45
	2. LAYER	-11,88	10,22	3,41
	3. LAYER	-38,12	21,15	7,05
5_PROFILE	1. LAYER	-3,21	4,96	1,65
	2. LAYER	-10,09	11,84	3,95
	3. LAYER	-39,91	22,94	7,65
6_PROFILE	1. LAYER	-2,82	5,25	1,75
	2. LAYER	-12,60	13,47	4,49
	3. LAYER	-37,40	28,15	9,38
7_PROFILE	1. LAYER	-1,52	6,11	2,04
	2.LAYER	-10,26	11,77	3,92
	3.LAYER	-39,74	28,82	9,61
8_PROFILE	1. LAYER	-5,65	3,94	1,31
	2. LAYER	-17,77	8,72	2,91
	3. LAYER	-32,23	15,84	5,28
9_PROFILE	1. LAYER	-5,43	12,93	4,31
	2. LAYER	-12,45	18,07	6,02
	3. LAYER	-37,55	38,43	12,81
10_PROFILE	1. LAYER	-1,62	3,08	1,03
	2. LAYER	-10,94	11,98	3,99
	3. LAYER	-39,06	33,82	11,27
11_PROFILE	1. LAYER	-2,77	5,89	1,96
	2. LAYER	-12,41	15,72	5,24
	3. LAYER	-37,59	37,95	12,65
12_PROFILE	1. LAYER	-6,57	16,47	5,49
	2. LAYER	-20,66	21,53	7,18
	3. LAYER	-29,34	47,74	15,91
13_PROFILE	1. LAYER	-7,81	14,58	4,86
	2. LAYER	-17,90	24,56	8,19
	3. LAYER	-32,10	49,62	16,54
14_PROFILE	1. LAYER	-3,09	6,30	2,10
	2. LAYER	-9,72	13,55	4,52
	3. LAYER	-40,28	24,95	8,32
15_PROFILE	1. LAYER	-2,82	6,20	2,07
	2. LAYER	-12,62	16,83	5,61
	3. LAYER	-37,38	36,91	12,30

||AVERAGE||		
LAYERS	DEPTH	Bearing Capacity (qu,kg/cm^2)
1. LAYER	-3,79	7,46
2.LAYER	-13,88	14,61
3.LAYER	∞	32,25

qu=(0,024*Vs*(J.B.K+0,002*Vp)*0,71)/G.K

BEARING CAPACITY CALCULATION	Geological unit factor 18	16	17	18	20
(Prof. Dr. SEMIH TEZCAN-2006)	Safety factor 50-100	CLAY	SAND	SEDIMENT	VOLATISILE

[redacted]

||AVERAGE||		
LAYERS	DEPTH	Allowable Bearing Capacity (qa,kg/cm^2)
1. LAYER	-3,79	2,49
2.LAYER	-13,88	4,87
3.LAYER	∞	10,75

qa=qu/G.K G.K=3 empirical value

5.14.10 WTG14 Vibration Period - T_0 (sec) / Ground Amplification (Ak)

PROFILES	To (sec)	Ta (sec)	Tb (sec)	Ak (Amplification)
1.PROFILE	0,21	0,14	0,32	1,25
2.PROFILE	0,31	0,21	0,46	1,64
3.PROFILE	0,15	0,10	0,23	1,10
4.PROFILE	0,27	0,18	0,40	1,56
5.PROFILE	0,24	0,16	0,37	1,49
6.PROFILE	0,22	0,15	0,33	1,38
7.PROFILE	0,20	0,13	0,30	1,33
8.PROFILE	0,38	0,25	0,57	1,83
9.PROFILE	0,16	0,11	0,24	1,13
10.PROFILE	0,20	0,14	0,31	1,35
11.PROFILE	0,18	0,12	0,27	1,23
12.PROFILE	0,16	0,10	0,23	1,04
13.PROFILE	0,15	0,10	0,22	1,03
14.PROFILE	0,22	0,14	0,33	1,39
15.PROFILE	0,18	0,12	0,26	1,20

AVERAGE			
To (sec)	Ta (sec)	Tb (sec)	Ak (Amplification)
0,22	0,14	0,32	1,33

$To = \sum 4H\ Vs\ n\ \iota$=1 (sec)……. (Zeevaert,1967)

Ak=68*$Vs_{30}^{-0,6}$……. (Midorikawa, 1987)

The Vibration Period and Ground Amplification calculated in the direction of the parameters obtained during the seismic studies made during the field survey are presented in the table above.

5. 15. WTG15

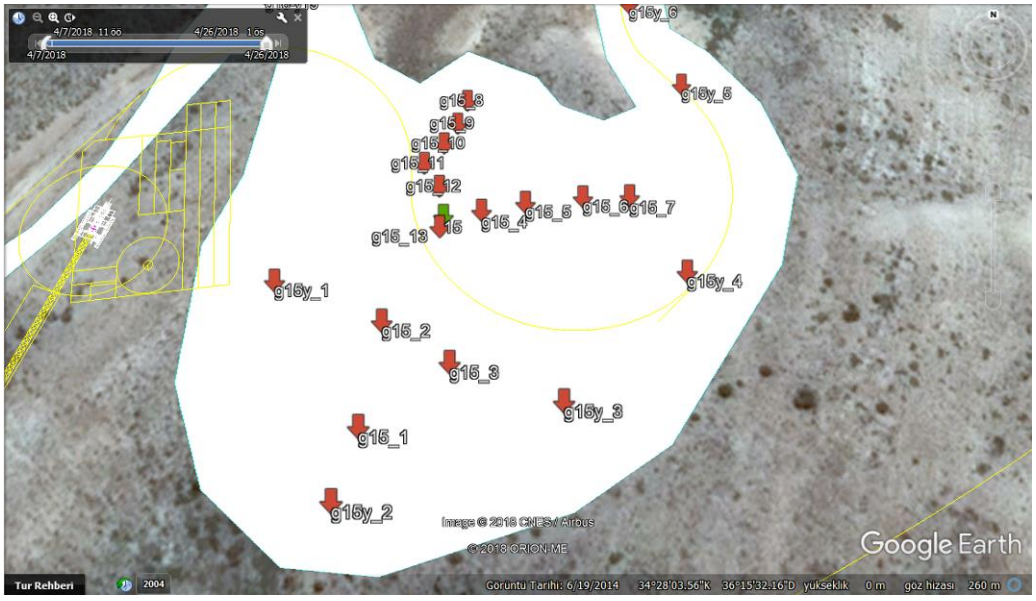
There are 13 measurements taken on the WTG. These measurements showed 3 layers. Layer 1 was found to be between 0.00 m and 3.96 m in depth, Layer 2 was found between 3.96 m and 12.8 m in depth, and Layer 3 was found at an average depth of 12,80 m. The parameters of this layer are given in the table below.

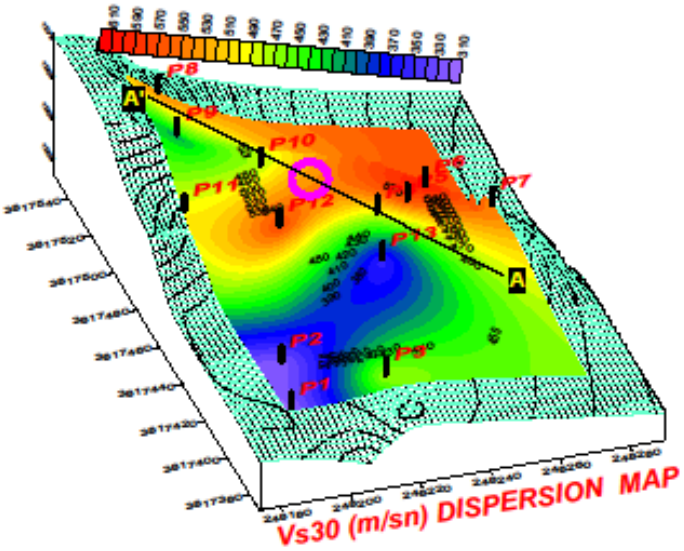
LAYERS	Vp_ Velocity	STRIPPABILITY
1. LAYER	731	Simple strippability
2.LAYER	976	Simple strippability
3.LAYER	1962	High-hard STRIPPABILITY
LAYERS	**Vs_ Velocity**	**GROUND GROUP**
1. LAYER	292	C
2.LAYER	475	B
3.LAYER	828	A
LAYERS	**G (kg/cm2)**	**ENDURANCE**
1. LAYER	1564	Medium
2.LAYER	4323	Sturdy
3.LAYER	14646	High sturdy
LAYERS	**E (kg/cm2)**	**ENDURANCE**
1. LAYER	4301	Weak
2.LAYER	11513	Sturdy
3.LAYER	40744	High sturdy

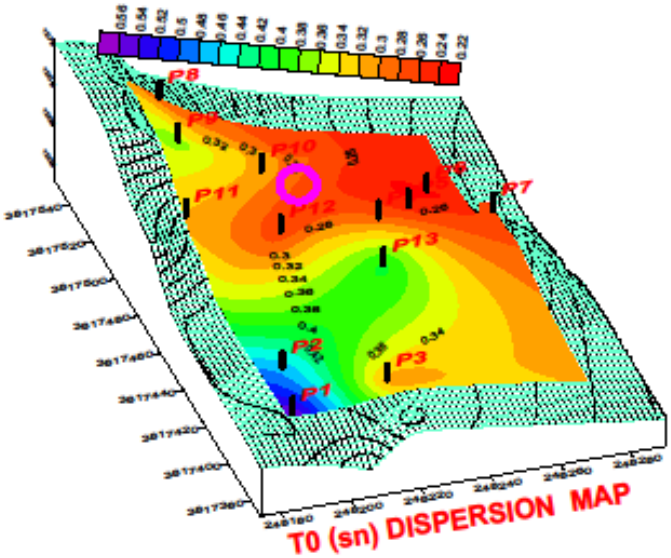
LAYERS	(σ)	POROSITY
1. LAYER	0,39	High Porosity
2.LAYER	0,34	Medium Porosity
3.LAYER	0,39	High Porosity
LAYERS	**ρ (gr/cm3)**	**DEFINITION**
1. LAYER	1,60	Medium
2.LAYER	1,72	Medium
3.LAYER	2,06	High
LAYERS	**D Y K (ton/m^3)**	
1. LAYER	2095	
2.LAYER	3514	
3.LAYER	6780	
LAYERS	**Ground Carrying Capacity (qu,kg/cm2)**	**Secure Carrying Capacity (qa,kg/cm2)**
1. LAYER	5,24	1,75
2.LAYER	8,78	2,93
3.LAYER	16,95	5,65

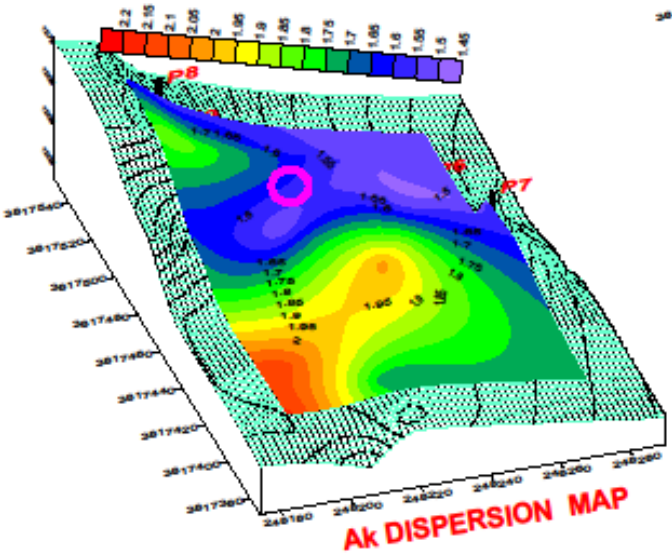
To (sec)	Ta (sec)	Tb (sec)	Vs30 (m/sec)	Ak (Amplification)
0,33	0,22	0,50	473	1,73

Problems were observed in the ground during the studies carried out in the field. For this reason, it is envisaged that the center of gravity of the WTG should be taken to the tenth (10) and eleventh (11) profiles. Taking into consideration the following applications, the profile points should be seen in the engineering parameters section for detailed values.

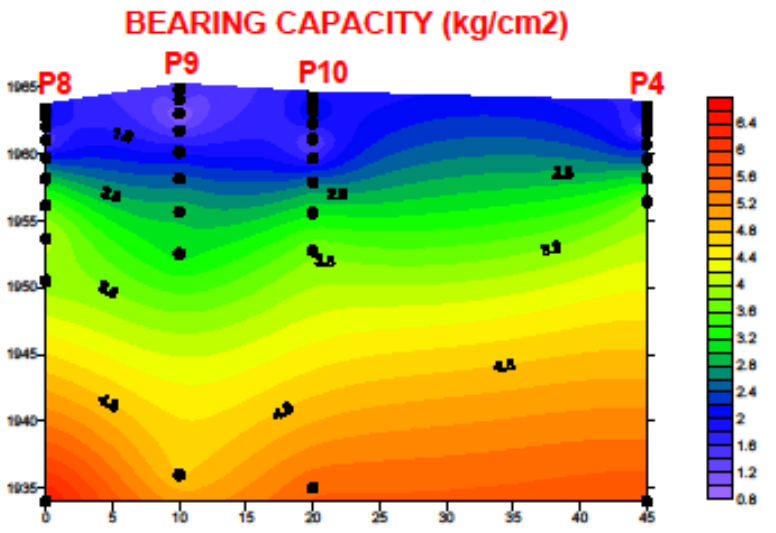


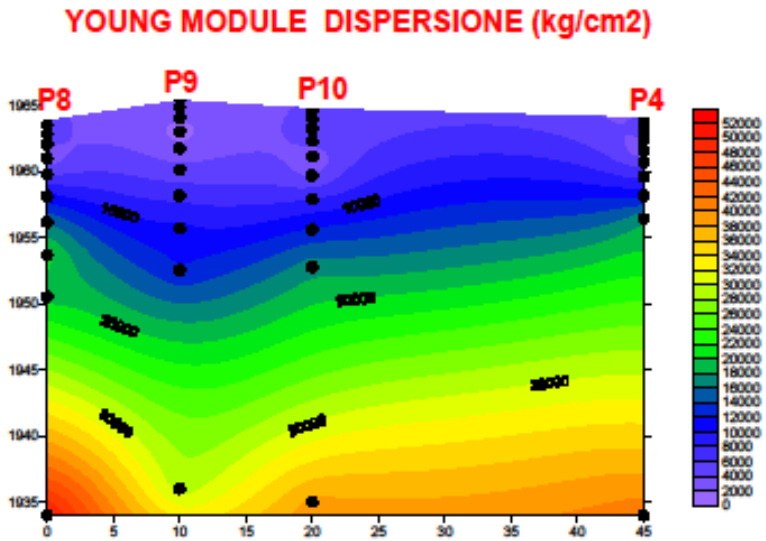

P8
A'
P9
P10
P11
P12
P13
P7
A
P2
P9
P1
Vs30 (m/sn) DISPERSION MAP

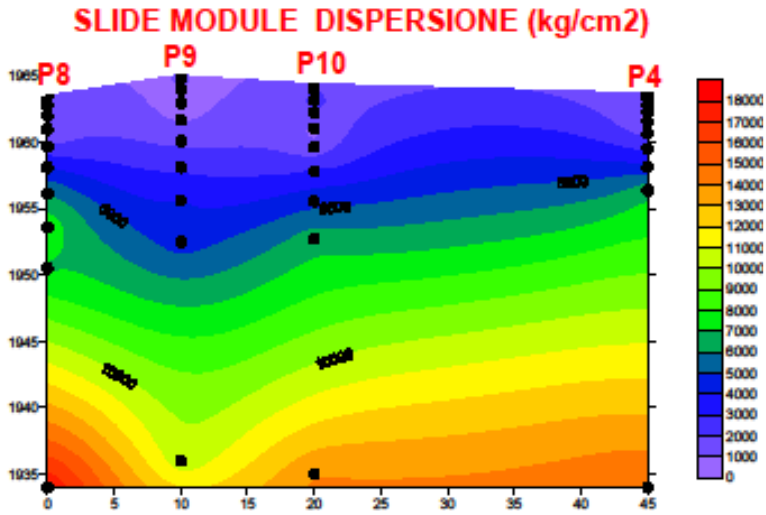

P8
P9
P10
P11
P12
P13
P7
P2
P3
P1
T0 (sn) DISPERSION MAP


P8
P7
Ak DISPERSION MAP

WTG15


BEARING CAPACITY (kg/cm2)
P8
P9
P10
P4
1965
1960
1955
1950
1945
1940
1935
0
5
10
15
20
25
30
35
40
45
6.4
6
5.6
5.2
4.8
4.4
4
3.6
3.2
2.8
2.4
2
1.6
1.2
0.8


YOUNG MODULE DISPERSIONE (kg/cm2)
P8
P9
P10
P4
1965
1960
1955
1950
1945
1940
1935
0
5
10
15
20
25
30
35
40
45
52000
50000
48000
46000
44000
42000
40000
38000
36000
34000
32000
30000
28000
26000
24000
22000
20000
18000
16000
14000
12000
10000
8000
6000
4000
2000
0


SLIDE MODULE DISPERSIONE (kg/cm2)
P8
P9
P10
P4
1965
1960
1955
1950
1945
1940
1935
0
5
10
15
20
25
30
35
40
45
18000
17000
16000
15000
14000
13000
12000
11000
10000
9000
8000
7000
6000
5000
4000
3000
2000
1000
0

5.15.1. WTG15 Seismic P wave velocity (*Compressional Wave Velocity* (Vp))

PROFILES	LAYERS	Vp VELOCITY DEPTH	Vp_ Velocity	STRIPPABILITY
1_PROFILE	1. LAYER	-8,77	416	High Simple Strippability
	2.LAYER	-27,58	693	Simple Strippability
	3.LAYER		1438	Medium Strippability
2_PROFILE	1. LAYER	-5,08	770	Simple Strippability
	2. LAYER	-15,98	723	Simple Strippability
	3. LAYER		1561	High Difficult Strippability
3_PROFILE	1. LAYER	-3,40	618	Simple Strippability
	2. LAYER	-10,68	951	Simple Strippability
	3. LAYER		1951	High Difficult Strippability
4_PROFILE	1. LAYER	-2,42	729	Simple Strippability
	2. LAYER	-7,60	894	Simple Strippability
	3. LAYER		1913	High Difficult Strippability
5_PROFILE	1. LAYER	-2,57	841	Simple Strippability
	2. LAYER	-8,07	1158	Simple Strippability
	3. LAYER		2331	Explosive
6_PROFILE	1. LAYER	-2,66	946	Simple Strippability
	2. LAYER	-8,37	1195	Simple Strippability
	3. LAYER		2331	Explosive
7_PROFILE	1. LAYER	-3,31	835	Simple Strippability
	2.LAYER	-10,40	1099	Simple Strippability
	3.LAYER		2150	Explosive
8_PROFILE	1. LAYER	-4,29	764	Simple Strippability
	2. LAYER	-13,49	1195	Simple Strippability
	3. LAYER		2302	Explosive
9_PROFILE	1. LAYER	-4,29	573	Simple Strippability
	2. LAYER	-13,48	858	Simple Strippability
	3. LAYER		1732	High Difficult Strippability
10_PROFILE	1. LAYER	-3,90	749	Simple Strippability
	2. LAYER	-12,25	945	Simple Strippability
	3. LAYER		1888	High Difficult Strippability
11_PROFILE	1. LAYER	-3,52	924	Simple Strippability
	2. LAYER	-15,75	1000	Simple Strippability
	3. LAYER		1988	High Difficult Strippability
12_PROFILE	1. LAYER	-4,03	880	Simple Strippability
	2. LAYER	-12,66	1257	Medium Strippability
	3. LAYER		2435	Explosive
13_PROFILE	1. LAYER	-3,22	462	Simple Strippability
	2. LAYER	-10,13	718	Simple Strippability
	3. LAYER		1485	Medium Strippability

P Wave Velocity (m/sec)	Strippability
Vp<458	High Simple Strippability
458<Vp<1220	Simple Strippability
1220<Vp<11525	Medium Strippability
1525<Vp<11830	Difficult Strippability
1830<Vp<12135	High Difficult Strippability
Vp>2135	Explosive Strippability

Strippability of floors with P wave velocity (Church, 1981)

||AVERAGE||			
LAYERS	DEPTH	Vp_ Velocity	STRIPPABILITY
1. LAYER	-3,96	731	Simple Strippability
2.LAYER	-12,80	976	Simple Strippability
3.LAYER	∞	1962	High Difficult Strippability

P wave velocities of the grounds in the study area and strippability

The above table shows the change table and strippability properties of Vp velocity depth values in the direction of the seismic data obtained from the field studies.

5.15.2. WTG15 Seismic S wave velocity (*Transverse Wave Velocity* (Vs))

Vs VELOCITY				
PROFILES	LAYERS	DEPTH	Vs_ Velocity	GROUND GROUPS
1_PROFILE	1. LAYER	-8,77	172	D
	2.LAYER	-27,58	368	C
	3.LAYER		617	B
2_PROFILE	1. LAYER	-5,08	180	D
	2. LAYER	-15,98	356	C
	3. LAYER		649	B
3_PROFILE	1. LAYER	-3,40	270	C
	2. LAYER	-10,68	517	B
	3. LAYER		832	A
4_PROFILE	1. LAYER	-2,42	278	C
	2. LAYER	-7,60	467	B
	3. LAYER		855	A
5_PROFILE	1. LAYER	-2,57	322	C
	2. LAYER	-8,07	554	B
	3. LAYER		966	A
6_PROFILE	1. LAYER	-2,66	400	C
	2. LAYER	-8,37	529	B
	3. LAYER		1040	A
7_PROFILE	1. LAYER	-3,31	340	C
	2.LAYER	-10,40	534	B
	3.LAYER		924	A
8_PROFILE	1. LAYER	-4,29	315	C
	2. LAYER	-13,49	575	B
	3. LAYER		914	A
9_PROFILE	1. LAYER	-4,29	230	C
	2. LAYER	-13,48	432	B
	3. LAYER		717	A
10_PROFILE	1. LAYER	-3,90	314	C
	2. LAYER	-12,25	454	B
	3. LAYER		825	A
11_PROFILE	1. LAYER	-3,52	464	B
	2. LAYER	-15,75	428	B
	3. LAYER		833	A
12_PROFILE	1. LAYER	-4,03	329	C
	2. LAYER	-12,66	604	B
	3. LAYER		964	A
13_PROFILE	1. LAYER	-3,22	178	D
	2. LAYER	-10,13	362	C
	3. LAYER		626	B

S Wave Velocity (m/sec)	Ground group
Vs<200	D
200<Vs<400	C
400<Vs<700	B
700<Vs	A

Ground groups according to slip wave velocity(Abyyhy, 1998)

||AVERAGE||			
LAYERS	DEPTH	Vs_ Velocity	GROUND GROUPS
1. LAYER	-3,96	292	C
2.LAYER	-12,80	475	B
3.LAYER	∞	828	A

S wave velocities of the grounds in the study area and ground group

Ground Group	Ground group and top ground layer thickness(h_1)
Z1	(A) Ground group h1< 15 m (B) Ground group
Z2	h_1> 15 m (B) Ground group h_1< 15 m (C) Ground group
Z3	15 m < h_1< 50 m (C) Ground group h_1< 10 m (D) Ground group
Z4	h_1> 50 m (C) Ground group h_1> 10 m (D) Ground group

Ground Group Class

The above table shows that Vs velocity values in the direction of the seismic data obtained in the field studies are the absolute change tables and that the layers are included in the ground groups.

5.15.3. WTG15 Vs30

PROFILES	Vs30 (m/sec)
1.PROFILE	316
2.PROFILE	322
3.PROFILE	471
4.PROFILE	482
5.PROFILE	563
6.PROFILE	604
7.PROFILE	541
8.PROFILE	539
9.PROFILE	408
10.PROFILE	475
11.PROFILE	499
12.PROFILE	572
13.PROFILE	352

Vs30 values in the direction of the seismic data obtained from the field studies are given in the table above.

5.15.4. WTG15 Shear Modulus-G (kg/cm²)

SHEAR MODULUS				
PROFILES	LAYERS	DEPTH	G(kg/cm²)	ENDURANCE
1_PROFILE	1. LAYER	-8,77	425	Weak
	2.LAYER	-27,58	2272	Medium
	3.LAYER		7278	Sturdy
2_PROFILE	1. LAYER	-5,08	676	Weak
	2. LAYER	-15,98	2199	Medium
	3. LAYER		8217	Sturdy
3_PROFILE	1. LAYER	-3,40	1224	Weak
	2. LAYER	-10,68	4877	Sturdy
	3. LAYER		14275	Rock Highlid
4_PROFILE	1. LAYER	-2,42	1337	Weak
	2. LAYER	-7,60	3901	Sturdy
	3. LAYER		14988	Rock Highlid
5_PROFILE	1. LAYER	-2,57	1761	Medium
	2. LAYER	-8,07	5814	Sturdy
	3. LAYER		20107	Rock Highlid

6_PROFILE	1. LAYER	-2,66	2753	Medium
	2. LAYER	-8,37	5643	Sturdy
	3. LAYER		23278	Rock Highlid
7_PROFILE	1. LAYER	-3,31	1965	Medium
	2.LAYER	-10,40	5508	Sturdy
	3.LAYER		18011	Rock Highlid
8_PROFILE	1. LAYER	-4,29	1682	Medium
	2. LAYER	-13,49	6108	Sturdy
	3. LAYER		17934	Rock Highlid
9_PROFILE	1. LAYER	-4,29	836	Weak
	2. LAYER	-13,48	3236	Sturdy
	3. LAYER		10288	Rock Highlid
10_PROFILE	1. LAYER	-3,90	1649	Medium
	2. LAYER	-12,25	3845	Sturdy
	3. LAYER		13905	Rock Highlid
11_PROFILE	1. LAYER	-3,52	3710	Sturdy
	2. LAYER	-15,75	3726	Sturdy
	3. LAYER		14366	Rock Highlid
12_PROFILE	1. LAYER	-4,03	1848	Medium
	2. LAYER	-12,66	6872	Sturdy
	3. LAYER		20217	Rock Highlid
13_PROFILE	1. LAYER	-3,22	462	Weak
	2. LAYER	-10,13	2202	Medium
	3. LAYER		7533	Sturdy

Shear Modulus (kg/cm^2)	Dayanım
G<400	High Weak
400<G<1500	Weak
1500<G<3000	Medium
3000<G<10000	Sturdy
10000<G	Rock Highlid

The endurance of ground or rocks according to Slip Module values(Keçeli, 1990)

$G = (d*Vs^2)/100$

||AVERAGE||			
LAYERS	**DEPTH**	**G (kg/cm^2)**	**ENDURANCE**
1. LAYER	-3,96	1564	Medium
2.LAYER	-12,80	4323	Sturdy
3.LAYER	∞	14646	Rock Highlid

Shear modules and endurance of the grounds in the study area

Calculation of shear Modulus values in the direction of the seismic data obtained in the field studies and the table of variation are given in the table above.

5.15.5. WTG15 Elasticity Modulus-E (kg/cm²)

ELASTIC MODULUS				
PROFILES	LAYERS	DEPTH	E(kg/cm²)	ENDURANCE
1_PROFILE	1. LAYER	-8,77	1177	Weak
	2.LAYER	-27,58	5925	Medium
	3.LAYER		20189	Sturdy
2_PROFILE	1. LAYER	-5,08	1945	Weak
	2. LAYER	-15,98	5884	Medium
	3. LAYER		22933	Sturdy
3_PROFILE	1. LAYER	-3,40	3254	Weak
	2. LAYER	-10,68	12586	Sturdy
	3. LAYER		39648	Rock Highlid
4_PROFILE	1. LAYER	-2,42	3694	Weak
	2. LAYER	-7,60	10236	Sturdy
	3. LAYER		41223	Rock Highlid
5_PROFILE	1. LAYER	-2,57	4950	Weak
	2. LAYER	-8,07	15664	Sturdy
	3. LAYER		56150	Rock Highlid
6_PROFILE	1. LAYER	-2,66	7652	Medium
	2. LAYER	-8,37	15210	Sturdy
	3. LAYER		64054	Rock Highlid
7_PROFILE	1. LAYER	-3,31	5451	Medium
	2.LAYER	-10,40	14630	Sturdy
	3.LAYER		49955	Rock Highlid
8_PROFILE	1. LAYER	-4,29	4631	Weak
	2. LAYER	-13,49	16429	Sturdy
	3. LAYER		50446	Rock Highlid
9_PROFILE	1. LAYER	-4,29	2311	Weak
	2. LAYER	-13,48	8611	Medium
	3. LAYER		28734	Sturdy
10_PROFILE	1. LAYER	-3,90	4529	Weak
	2. LAYER	-12,25	10183	Sturdy
	3. LAYER		38434	Rock Highlid
11_PROFILE	1. LAYER	-3,52	9803	Medium
	2. LAYER	-15,75	9934	Medium
	3. LAYER		40038	Rock Highlid
12_PROFILE	1. LAYER	-4,03	5221	Medium
	2. LAYER	-12,66	18512	Sturdy
	3. LAYER		56899	Rock Highlid
13_PROFILE	1. LAYER	-3,22	1297	Weak
	2. LAYER	-10,13	5864	Medium
	3. LAYER		20974	Sturdy

Elastic Modulus (kg/cm²)	Dayanım
E<1000	High Weak
1000<E<5000	Weak
5000<E<10000	Medium
10000<E<30000	Sturdy
30000<E	Rock Highlid

The endurance of ground or rocks according to Slip Module values(Keçeli, 1990)

$$E=G*(3*V_p^2-4*V_s^2)/(V_p^2-V_s^2)$$

||AVERAGE||		
LAYERS	DEPTH	E (kg/cm²)	ENDURANCE
1. LAYER	-3,96	4301	Weak
2.LAYER	-12,80	11513	Sturdy
3.LAYER	∞	40744	Rock Highlid

Elasticity modules and endurance of the grounds in the study area

Calculation of the modulus of elasticity in the direction of the seismic data obtained in the field studies and the change table are given in the above table

5.15.6. WTG15 Poisson's Ratio - (б)

DENSITY				
PROFILES	LAYERS	DEPTH	ρ (gr/cm^3)	DEFINITION
1_PROFILE	1. LAYER	-8,77	1,40	Low
	2.LAYER	-27,58	1,58	Medium
	3.LAYER		1,91	High
2_PROFILE	1. LAYER	-5,08	1,54	Medium
	2. LAYER	-15,98	1,60	Medium
	3. LAYER		1,95	High
3_PROFILE	1. LAYER	-3,40	1,55	Medium
	2. LAYER	-10,68	1,71	Medium
	3. LAYER		2,06	High
4_PROFILE	1. LAYER	-2,42	1,61	Medium
	2. LAYER	-7,60	1,69	Medium
	3. LAYER		2,05	High
5_PROFILE	1. LAYER	-2,57	1,67	Medium
	2. LAYER	-8,07	1,80	Medium
	3. LAYER		2,15	High
6_PROFILE	1. LAYER	-2,66	1,72	Medium
	2. LAYER	-8,37	1,82	Medium
	3. LAYER		2,15	High
7_PROFILE	1. LAYER	-3,31	1,67	Medium
	2.LAYER	-10,40	1,78	Medium
	3.LAYER		2,11	High
8_PROFILE	1. LAYER	-4,29	1,63	Medium
	2. LAYER	-13,49	1,82	Medium
	3. LAYER		2,15	High
9_PROFILE	1. LAYER	-4,29	1,52	Medium
	2. LAYER	-13,48	1,67	Medium
	3. LAYER		2,00	High
10_PROFILE	1. LAYER	-3,90	1,62	Medium
	2. LAYER	-12,25	1,72	Medium
	3. LAYER		2,04	High
11_PROFILE	1. LAYER	-3,52	1,71	Medium
	2. LAYER	-15,75	1,74	Medium
	3. LAYER		2,07	High
12_PROFILE	1. LAYER	-4,03	1,69	Medium
	2. LAYER	-12,66	1,84	Medium
	3. LAYER		2,18	High
13_PROFILE	1. LAYER	-3,22	1,44	Medium
	2. LAYER	-10,13	1,60	Medium
	3. LAYER		1,92	High

Poisson's Ratio;(σ)	Porosity
0,00≤σ≤0,25	Nonporous
0,26≤σ≤0,35	Medium Porous
0,36≤σ≤0,50	High Porous

Poisson ratio classification

$\sigma=(Vp^2-2*Vs^2)/(2*Vp^2-2*Vs^2)$

||AVERAGE||			
LAYERS	DEPTH	(σ)	POROSITY
1. LAYER	-3,96	0,39	High Porous
2.LAYER	-12,80	0,34	Medium Porous
3.LAYER	∞	0,39	High Porous

Poisson's ratio values of the units in the study area, porosity

Calculation of poisson's ratio values in the direction of the seismic data obtained in the field studies and the change table are given in the above table.

5.15.7. WTG15 Density - ρ (gr/ cm^3)

DENSITY				
PROFILES	LAYERS	DEPTH	ρ (gr/cm^3)	DEFINITION
1_PROFILE	1. LAYER	-8,77	1,40	Low
	2.LAYER	-27,58	1,58	Medium
	3.LAYER		1,91	High
2_PROFILE	1. LAYER	-5,08	1,54	Medium
	2. LAYER	-15,98	1,60	Medium
	3. LAYER		1,95	High
3_PROFILE	1. LAYER	-3,40	1,55	Medium
	2. LAYER	-10,68	1,71	Medium
	3. LAYER		2,06	High
4_PROFILE	1. LAYER	-2,42	1,61	Medium
	2. LAYER	-7,60	1,69	Medium
	3. LAYER		2,05	High
5_PROFILE	1. LAYER	-2,57	1,67	Medium
	2. LAYER	-8,07	1,80	Medium
	3. LAYER		2,15	High
6_PROFILE	1. LAYER	-2,66	1,72	Medium
	2. LAYER	-8,37	1,82	Medium
	3. LAYER		2,15	High
7_PROFILE	1. LAYER	-3,31	1,67	Medium
	2.LAYER	-10,40	1,78	Medium
	3.LAYER		2,11	High
8_PROFILE	1. LAYER	-4,29	1,63	Medium
	2. LAYER	-13,49	1,82	Medium
	3. LAYER		2,15	High
9_PROFILE	1. LAYER	-4,29	1,52	Medium
	2. LAYER	-13,48	1,67	Medium
	3. LAYER		2,00	High
10_PROFILE	1. LAYER	-3,90	1,62	Medium
	2. LAYER	-12,25	1,72	Medium
	3. LAYER		2,04	High
11_PROFILE	1. LAYER	-3,52	1,71	Medium
	2. LAYER	-15,75	1,74	Medium
	3. LAYER		2,07	High
12_PROFILE	1. LAYER	-4,03	1,69	Medium
	2. LAYER	-12,66	1,84	Medium
	3. LAYER		2,18	High
13_PROFILE	1. LAYER	-3,22	1,44	Medium
	2. LAYER	-10,13	1,60	Medium
	3. LAYER		1,92	High

Density: ρ (gr/cm^3)	Tanımlama
ρ<1,20	High low
1,20<ρ<1,40	Low
1,40<ρ<1,90	Medium
1,90<ρ<2,20	High
2,20<ρ	Too High

Density Classification of Ground Units: (Keçeli, 1990)

*ρ =d=0.31*Vp0.25*

||AVERAGE||			
LAYERS	DEPTH	ρ (gr/cm^3)	DEFINITION
1. LAYER	-3,96	1,60	Medium
2.LAYER	-12,80	1,72	Medium
3.LAYER	∞	2,06	High

Calculation of the density values of the geological units in the direction of the seismic data obtained in the field studies and the table of variation are given in the above table.

5.15.8. WTG15 Modulus of Subgrade Reaction – D Y K (ton/m^3)

Modulus of Subgrade Reaction			
PROFILES	LAYERS	DEPTH	D Y K (ton/m^3)
1_PROFILE	1. LAYER	-8,77	1181
	2.LAYER	-27,58	2624
	3.LAYER		4766
2_PROFILE	1. LAYER	-5,08	1325
	2. LAYER	-15,98	2550
	3. LAYER		5078
3_PROFILE	1. LAYER	-3,40	1904
	2. LAYER	-10,68	3802
	3. LAYER		6775
4_PROFILE	1. LAYER	-2,42	1985
	2. LAYER	-7,60	3409
	3. LAYER		6933
5_PROFILE	1. LAYER	-2,57	2331
	2. LAYER	-8,07	4167
	3. LAYER		8164
6_PROFILE	1. LAYER	-2,66	2925
	2. LAYER	-8,37	4000
	3. LAYER		8784
7_PROFILE	1. LAYER	-3,31	2454
	2.LAYER	-10,40	3995
	3.LAYER		7668
8_PROFILE	1. LAYER	-4,29	2260
	2. LAYER	-13,49	4329
	3. LAYER		7701
9_PROFILE	1. LAYER	-4,29	1612
	2. LAYER	-13,48	3138
	3. LAYER		5709
10_PROFILE	1. LAYER	-3,90	2246
	2. LAYER	-12,25	3331
	3. LAYER		6671
11_PROFILE	1. LAYER	-3,52	3386
	2. LAYER	-15,75	3163
	3. LAYER		6806
12_PROFILE	1. LAYER	-4,03	2386
	2. LAYER	-12,66	4584
	3. LAYER		8224
13_PROFILE	1. LAYER	-3,22	1231
	2. LAYER	-10,13	2588
	3. LAYER		4854

‖AVERAGE‖		
LAYERS	DEPTH	D Y K (ton/m^3)
1. LAYER	-3,96	2095
2.LAYER	-12,80	3514
3.LAYER	∞	6780
kv= 40*(Gs)*qu ton/m^3 *(Bowles 1984)*		

The above table shows the Modulus of Subgrade Reaction obtained for each layer in the direction of the data obtained after the seismic measurements made in the study area.

5.15.9. WTG15 Bearing Capacity qu (kg/cm2) / Allowable Bearing Capacity qa (kg/cm2)

PROFILES	LAYERS	DEPTH	BEARING	ALLOWABLE
1_PROFILE	1. LAYER	-8,77	2,95	0,98
	2.LAYER	-27,58	6,56	2,19
	3.LAYER	-22,42	11,92	3,97
2_PROFILE	1. LAYER	-5,08	3,31	1,10
	2. LAYER	-15,98	6,37	2,12
	3. LAYER	-34,02	12,70	4,23
3_PROFILE	1. LAYER	-3,40	4,76	1,59
	2. LAYER	-10,68	9,51	3,17
	3. LAYER	-39,32	16,94	5,65
4_PROFILE	1. LAYER	-2,42	4,96	1,65
	2. LAYER	-7,60	8,52	2,84
	3. LAYER	-42,40	17,33	5,78
5_PROFILE	1. LAYER	-2,57	5,83	1,94
	2. LAYER	-8,07	10,42	3,47
	3. LAYER	-41,93	20,41	6,80
6_PROFILE	1. LAYER	-2,66	7,31	2,44
	2. LAYER	-8,37	10,00	3,33
	3. LAYER	-41,63	21,96	7,32
7_PROFILE	1. LAYER	-3,31	6,14	2,05
	2.LAYER	-10,40	9,99	3,33
	3.LAYER	-39,60	19,17	6,39
8_PROFILE	1. LAYER	-4,29	5,65	1,88
	2. LAYER	-13,49	10,82	3,61
	3. LAYER	-36,51	19,25	6,42
9_PROFILE	1. LAYER	-4,29	4,03	1,34
	2. LAYER	-13,48	7,85	2,62
	3. LAYER	-36,52	14,27	4,76
10_PROFILE	1. LAYER	-3,90	5,62	1,87
	2. LAYER	-12,25	8,33	2,78
	3. LAYER	-37,75	16,68	5,56
11_PROFILE	1. LAYER	-3,52	8,47	2,82
	2. LAYER	-15,75	7,91	2,64
	3. LAYER	-34,25	17,01	5,67
12_PROFILE	1. LAYER	-4,03	5,97	1,99
	2. LAYER	-12,66	11,46	3,82
	3. LAYER	-37,34	20,56	6,85
13_PROFILE	1. LAYER	-3,22	3,08	1,03
	2. LAYER	-10,13	6,47	2,16
	3. LAYER	-39,87	12,13	4,04

||AVERAGE||		
LAYERS	DEPTH	Bearing Capacity (qu,kg/cm^2)
1. LAYER	-3,96	5,24
2.LAYER	-12,80	8,78
3.LAYER	∞	16,95
qu=(0,024*Vs*(J.B.K+0,002*Vp)*0,71)/G.K		
||AVERAGE||		
LAYERS	DEPTH	Allowable Bearing Capacity (qa,kg/cm^2)
1. LAYER	-3,96	1,75
2.LAYER	-12,80	2,93
3.LAYER	∞	5,65
qa=qu/G.K G.K=3 empirical value		

5.15.10 WTG15 Vibration Period - T_0 (sec) / Ground Amplification (Ak)

PROFILES	To (sec)	Ta (sec)	Tb (sec)	Ak (Amplification)
1.PROFILE	0,56	0,37	0,84	2,15
2.PROFILE	0,47	0,31	0,71	2,13
3.PROFILE	0,31	0,20	0,46	1,69
4.PROFILE	0,28	0,19	0,43	1,67
5.PROFILE	0,25	0,16	0,37	1,52
6.PROFILE	0,23	0,15	0,35	1,46
7.PROFILE	0,27	0,18	0,40	1,56
8.PROFILE	0,28	0,19	0,42	1,56
9.PROFILE	0,37	0,25	0,55	1,85
10.PROFILE	0,31	0,21	0,47	1,68
11.PROFILE	0,32	0,21	0,47	1,64
12.PROFILE	0,26	0,17	0,39	1,51
13.PROFILE	0,41	0,27	0,61	2,02

AVERAGE			
To (sec)	**Ta (sec)**	**Tb (sec)**	**Ak (Amplification)**
0,33	0,22	0,50	1,73

$To = \sum 4H\ Vs\ n\ \imath$=1 (sec)……. (Zeevaert,1967)

Ak=68*$Vs_{30}^{-0,6}$…….. (Midorikawa, 1987)

The Vibration Period and Ground Amplification calculated in the direction of the parameters obtained during the seismic studies made during the field survey are presented in the table above.

5. 16. WTG16

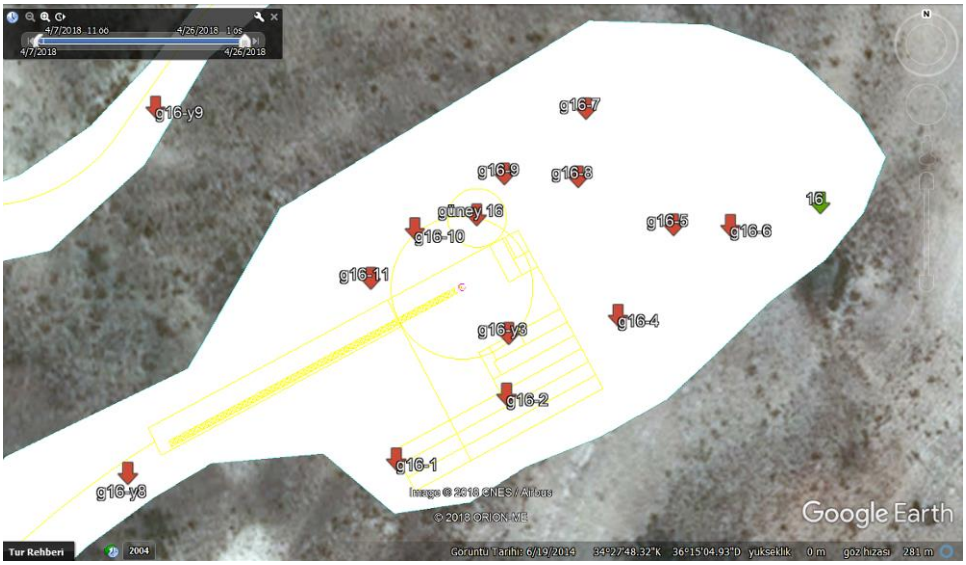
There are 11 measurements taken on the WTG. These measurements showed 3 layers. Layer 1 was found at an average depth of 0,00 m-3,63 m, Layer 2 at an average depth of 3,63 m-15,00 m and Layer 3 at an average depth of 15,00 m. The parameters of this layer are given in the table below.

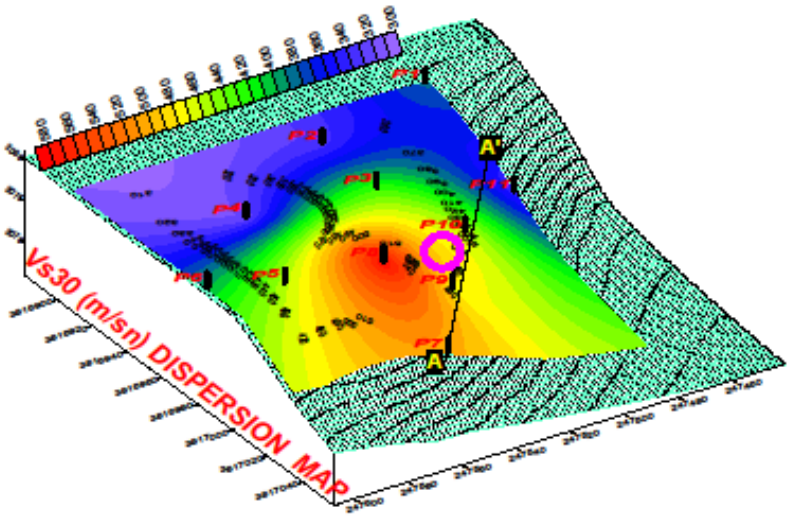
LAYERS	Vp_ Velocity	STRIPPABILITY
1. LAYER	537	Simple strippability
2.LAYER	887	Simple strippability
3.LAYER	1830	High-hard STRIPPABILITY
LAYERS	**Vs_ Velocity**	**GROUND GROUP**
1. LAYER	221	C
2.LAYER	424	B
3.LAYER	790	A
LAYERS	**G (kg/cm2)**	**ENDURANCE**
1. LAYER	847	Weak
2.LAYER	3373	Sturdy
3.LAYER	13073	High sturdy
LAYERS	**E (kg/cm2)**	**ENDURANCE**
1. LAYER	2310	Weak
2.LAYER	9031	Medium
3.LAYER	36154	High sturdy

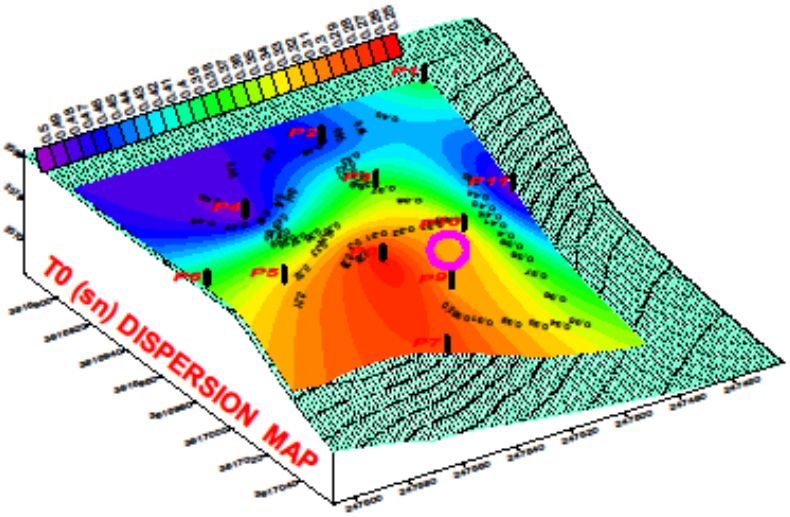
LAYERS	(σ)	POROSITY
1. LAYER	0,38	High Porosity
2.LAYER	0,34	Medium Porosity
3.LAYER	0,39	High Porosity
LAYERS	**ρ (gr/cm3)**	**DEFINITION**
1. LAYER	1,48	Medium
2.LAYER	1,68	Medium
3.LAYER	2,02	High
LAYERS	**D Y K (ton/m^3)**	
1. LAYER	1553	
2.LAYER	3101	
3.LAYER	6374	
LAYERS	**Ground Carrying Capacity (qu,kg/cm2)**	**Secure Carrying Capacity (qa,kg/cm2)**
1. LAYER	3,88	1,29
2.LAYER	7,75	2,58
3.LAYER	15,93	5,31

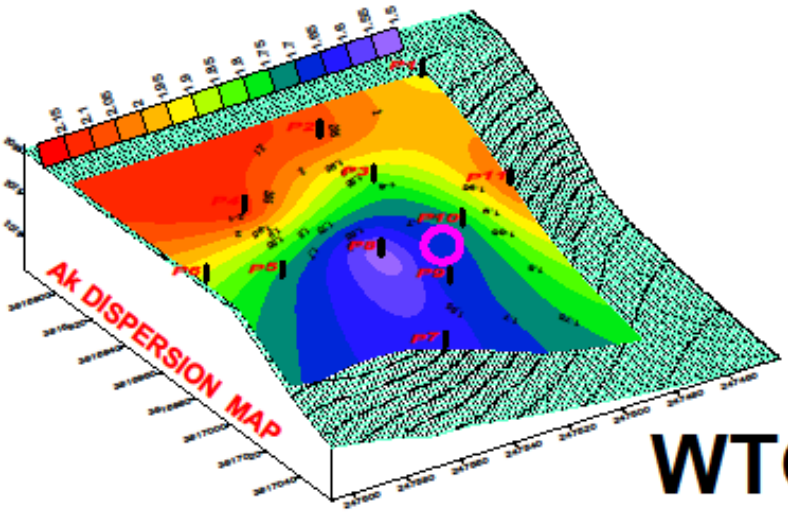
To (sec)	Ta (sec)	Tb (sec)	Vs30 (m/sec)	Ak (Amplification)
0,33	0,25	0,56	426	1,83

In the field studies, the first floor must be excavated in all profiles. Although this excavation would appear to be an average of 3.63 m, the detailed excavation depths should be determined according to the detailed profile depths in item 4. Taking into consideration the following applications, the profile points should be seen in the engineering parameters section for detailed values.

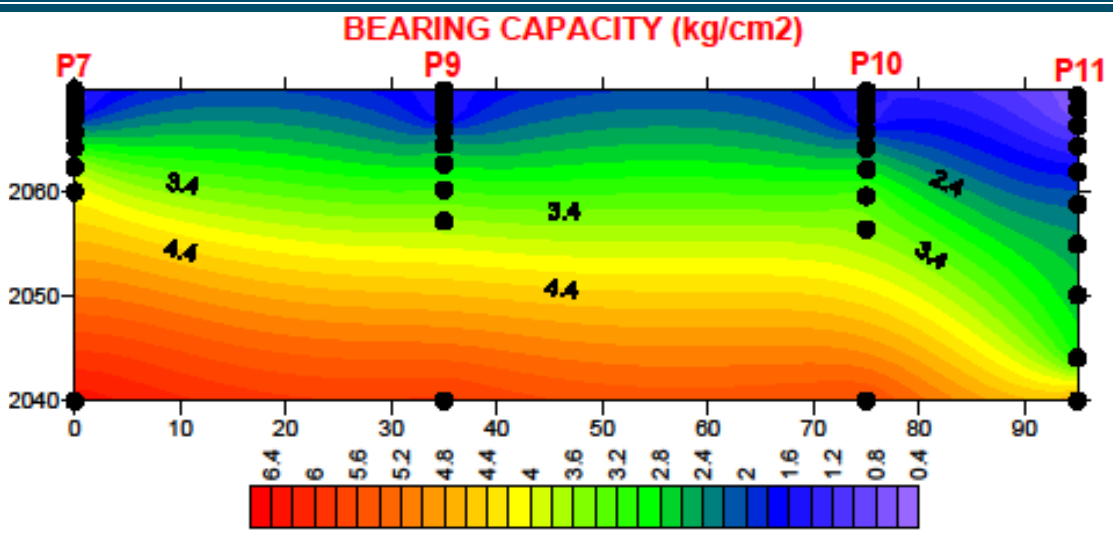


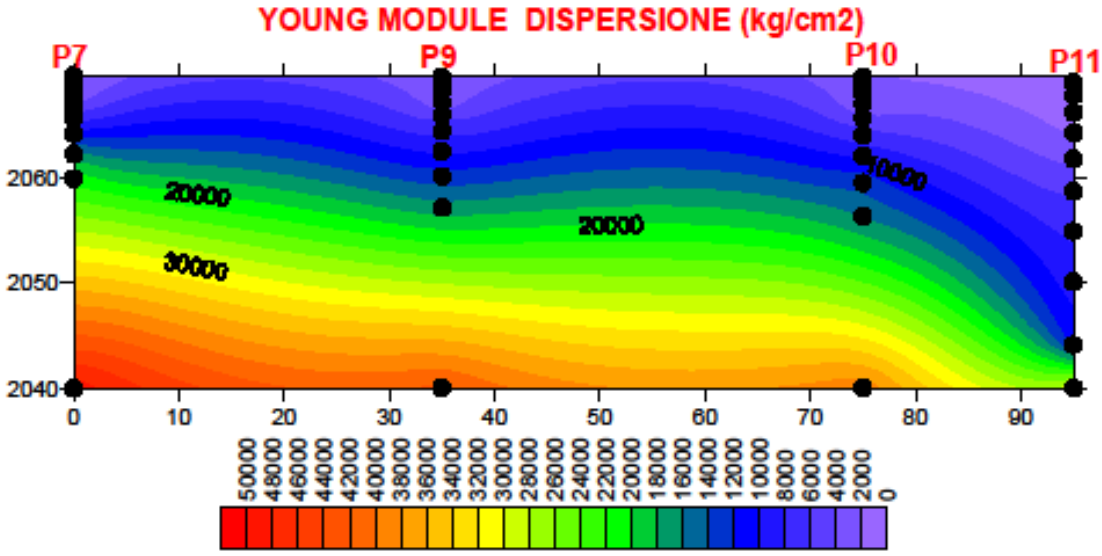

Vs30 (m/sn) DISPERSION MAP
A'
A

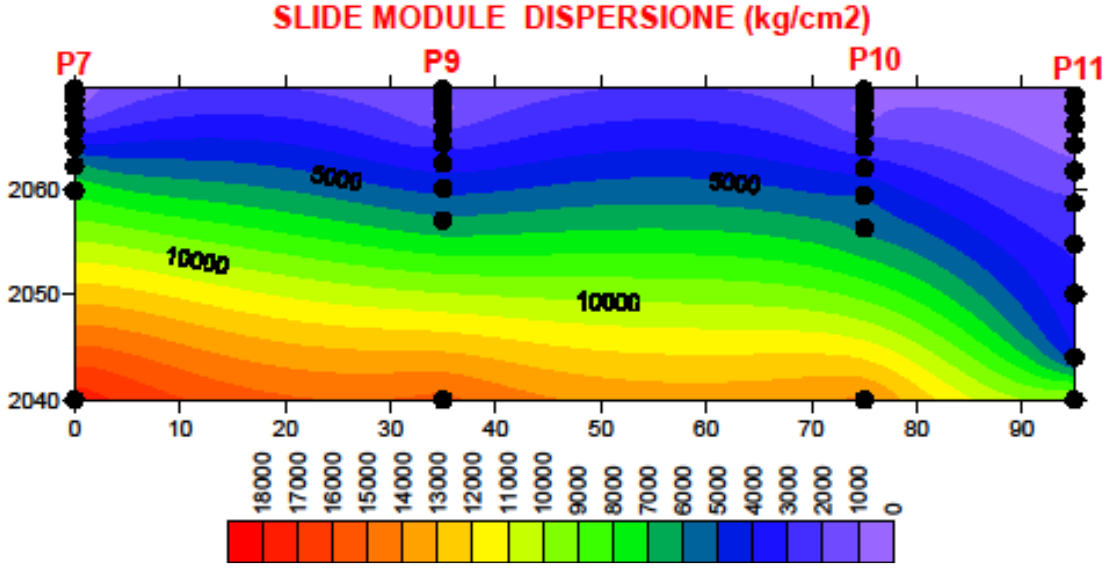

T0 (sn) DISPERSION MAP


Ak DISPERSION MAP

WTG16


BEARING CAPACITY (kg/cm2)
P7
P9
P10
P11
2060
2050
2040
3.4
4.4
3.4
4.4
2.4
3.4
0 10 20 30 40 50 60 70 80 90
6.4 6 5.6 5.2 4.8 4.4 4 3.6 3.2 2.8 2.4 2 1.6 1.2 0.8 0.4


YOUNG MODULE DISPERSIONE (kg/cm2)
P7
P9
P10
P11
2060
2050
2040
20000
30000
20000
10000
0 10 20 30 40 50 60 70 80 90
50000 48000 46000 44000 42000 40000 38000 36000 34000 32000 30000 28000 26000 24000 22000 20000 18000 16000 14000 12000 10000 8000 6000 4000 2000 0


SLIDE MODULE DISPERSIONE (kg/cm2)
P7
P9
P10
P11
2060
2050
2040
5000
10000
5000
10000
0 10 20 30 40 50 60 70 80 90
18000 17000 16000 15000 14000 13000 12000 11000 10000 9000 8000 7000 6000 5000 4000 3000 2000 1000 0

5.16.1. WTG16 Seismic P wave velocity (*Compressional Wave Velocity* (Vp))

Vp VELOCITY				
PROFILES	LAYERS	DEPTH	Vp_ Velocity	STRIPPABILITY
1_PROFILE	1. LAYER	-1,89	395	High Simple Strippability
	2.LAYER	-12,80	701	Simple Strippability
	3.LAYER		1713	High Difficult Strippability
2_PROFILE	1. LAYER	-5,29	473	Simple Strippability
	2. LAYER	-16,62	690	Simple Strippability
	3. LAYER		1400	Medium Strippability
3_PROFILE	1. LAYER	-3,94	505	Simple Strippability
	2. LAYER	-17,65	875	Simple Strippability
	3. LAYER		1878	High Difficult Strippability
4_PROFILE	1. LAYER	-4,00	417	High Simple Strippability
	2. LAYER	-17,88	668	Simple Strippability
	3. LAYER		1387	Medium Strippability
5_PROFILE	1. LAYER	-2,88	479	Simple Strippability
	2. LAYER	-12,91	902	Simple Strippability
	3. LAYER		1970	High Difficult Strippability
6_PROFILE	1. LAYER	-2,72	648	Simple Strippability
	2. LAYER	-12,19	987	Simple Strippability
	3. LAYER		1713	High Difficult Strippability
7_PROFILE	1. LAYER	-2,26	610	Simple Strippability
	2.LAYER	-10,11	984	Simple Strippability
	3.LAYER		2188	Explosive
8_PROFILE	1. LAYER	-3,89	874	Simple Strippability
	2. LAYER	-12,23	1186	Simple Strippability
	3. LAYER		2179	Explosive
9_PROFILE	1. LAYER	-2,88	575	Simple Strippability
	2. LAYER	-12,91	954	Simple Strippability
	3. LAYER		1989	High Difficult Strippability
10_PROFILE	1. LAYER	-4,36	587	Simple Strippability
	2. LAYER	-13,70	980	Simple Strippability
	3. LAYER		1951	High Difficult Strippability
11_PROFILE	1. LAYER	-5,79	342	High Simple Strippability
	2. LAYER	-25,91	835	Simple Strippability
	3. LAYER		1758	High Difficult Strippability

P Wave Velocity (m/sec)	Strippability
Vp<458	High Simple Strippability
458<Vp<1220	Simple Strippability
1220<Vp<11525	Medium Strippability
1525<Vp<11830	Difficult Strippability
1830<Vp<12135	High Difficult Strippability
Vp>2135	Explosive Strippability

Strippability of floors with P wave velocity (Church, 1981)

||AVERAGE||			
LAYERS	DEPTH	Vp_ Velocity	STRIPPABILITY
1. LAYER	-3,63	537	Simple Strippability
2.LAYER	-14,99	887	Simple Strippability
3.LAYER	∞	1830	High Difficult Strippability

P wave velocities of the grounds in the study area and strippability

The above table shows the change table and strippability properties of Vp velocity depth values in the direction of the seismic data obtained from the field studies.

5.16.2. WTG16 Seismic S wave velocity (*Transverse Wave Velocity* (Vs))

Vs VELOCITY				
PROFILES	LAYERS	DEPTH	Vs_ Velocity	GROUND GROUPS
1_PROFILE	1. LAYER	-1,89	163	D
	2.LAYER	-12,80	340	C
	3.LAYER		710	A
2_PROFILE	1. LAYER	-5,29	200	C
	2. LAYER	-16,62	341	C
	3. LAYER		632	B
3_PROFILE	1. LAYER	-3,94	204	C
	2. LAYER	-17,65	431	B
	3. LAYER		855	A
4_PROFILE	1. LAYER	-4,00	181	D
	2. LAYER	-17,88	319	C
	3. LAYER		596	B
5_PROFILE	1. LAYER	-2,88	212	C
	2. LAYER	-12,91	468	B
	3. LAYER		856	A
6_PROFILE	1. LAYER	-2,72	238	C
	2. LAYER	-12,19	425	B
	3. LAYER		686	B
7_PROFILE	1. LAYER	-2,26	215	C
	2.LAYER	-10,11	489	B
	3.LAYER		910	A
8_PROFILE	1. LAYER	-3,89	383	C
	2. LAYER	-12,23	507	B
	3. LAYER		1033	A
9_PROFILE	1. LAYER	-2,88	235	C
	2. LAYER	-12,91	462	B
	3. LAYER		859	A
10_PROFILE	1. LAYER	-4,36	253	C
	2. LAYER	-13,70	484	B
	3. LAYER		828	A
11_PROFILE	1. LAYER	-5,79	151	D
	2. LAYER	-25,91	395	C
	3. LAYER		720	A

S Wave Velocity (m/sec)	Ground group
Vs<200	D
200<Vs<400	C
400<Vs<700	B
700<Vs	A

Ground groups according to slip wave velocity(Abyyhy, 1998)

||AVERAGE||			
LAYERS	DEPTH	Vs_ Velocity	GROUND GROUPS
1. LAYER	-3,63	221	C
2.LAYER	-14,99	424	B
3.LAYER	∞	790	A

S wave velocities of the grounds in the study area and ground group

Ground Group	Ground group and top ground layer thickness(h_1)
Z1	(A) Ground group h1< 15 m (B) Ground group
Z2	h_1> 15 m (B) Ground group h_1< 15 m (C) Ground group
Z3	15 m < h_1< 50 m (C) Ground group h_1< 10 m (D) Ground group
Z4	h_1> 50 m (C) Ground group h_1> 10 m (D) Ground group

Ground Group Class

The above table shows that Vs velocity values in the direction of the seismic data obtained in the field studies are the absolute change tables and that the layers are included in the ground groups.

5.16.3. WTG16 Vs30

PROFILES	Vs30 (m/sec)
1.PROFILE	382
2.PROFILE	335
3.PROFILE	427
4.PROFILE	322
5.PROFILE	455
6.PROFILE	398
7.PROFILE	504
8.PROFILE	579
9.PROFILE	476
10.PROFILE	462
11.PROFILE	342

Vs30 values in the direction of the seismic data obtained from the field studies are given in the table above.

5.16.4. WTG16 Shear Modulus-G (kg/cm²)

PROFILES	SHEAR MODULUS			
	LAYERS	DEPTH	G(kg/cm^2)	ENDURANCE
1_PROFILE	1. LAYER	-1,89	376	High Weak
	2.LAYER	-12,80	2127	Medium
	3.LAYER		10063	Rock Highlid
2_PROFILE	1. LAYER	-5,29	627	Weak
	2. LAYER	-16,62	1953	Medium
	3. LAYER		7568	Sturdy
3_PROFILE	1. LAYER	-3,94	671	Weak
	2. LAYER	-17,65	3442	Sturdy
	3. LAYER		14928	Rock Highlid
4_PROFILE	1. LAYER	-4,00	502	Weak
	2. LAYER	-17,88	1695	Medium
	3. LAYER		6718	Sturdy
5_PROFILE	1. LAYER	-2,88	716	Weak
	2. LAYER	-12,91	4040	Sturdy
	3. LAYER		15138	Rock Highlid
6_PROFILE	1. LAYER	-2,72	898	Weak
	2. LAYER	-12,19	3611	Sturdy
	3. LAYER		9387	Sturdy
7_PROFILE	1. LAYER	-2,26	724	Weak
	2.LAYER	-10,11	4455	Sturdy
	3.LAYER		17556	Rock Highlid
8_PROFILE	1. LAYER	-3,89	2522	Medium
	2. LAYER	-12,23	5081	Sturdy
	3. LAYER		22607	Rock Highlid
9_PROFILE	1. LAYER	-2,88	895	Weak
	2. LAYER	-12,91	3829	Sturdy
	3. LAYER		15289	Rock Highlid
10_PROFILE	1. LAYER	-4,36	1045	Weak
	2. LAYER	-13,70	4173	Sturdy
	3. LAYER		14138	Rock Highlid
11_PROFILE	1. LAYER	-5,79	339	High Weak
	2. LAYER	-25,91	2696	Medium
	3. LAYER		10411	Rock Highlid

Shear Modulus (kg/cm^2)	Dayanım
G<400	High Weak
400<G<1500	Weak
1500<G<3000	Medium
3000<G<10000	Sturdy
10000<G	Rock Highlid

The endurance of ground or rocks according to Slip Module values(Keçeli, 1990)

$G = (d*Vs^2)/100$

||AVERAGE||			
LAYERS	DEPTH	G (kg/cm²)	ENDURANCE
1. LAYER	-3,63	847	Weak
2.LAYER	-14,99	3373	Sturdy
3.LAYER	∞	13073	Rock Highlid

Shear modules and endurance of the grounds in the study area

Calculation of shear Modulus values in the direction of the seismic data obtained in the field studies and the table of variation are given in the table above.

5.16.5. WTG16 Elasticity Modulus-E (kg/cm²)

ELASTIC MODULUS				
PROFILES	LAYERS	DEPTH	E(kg/cm²)	ENDURANCE
1_PROFILE	1. LAYER	-1,89	1040	Weak
	2.LAYER	-12,80	5678	Medium
	3.LAYER		28099	Sturdy
2_PROFILE	1. LAYER	-5,29	1692	Weak
	2. LAYER	-16,62	5199	Medium
	3. LAYER		20768	Sturdy
3_PROFILE	1. LAYER	-3,94	1811	Weak
	2. LAYER	-17,65	9075	Medium
	3. LAYER		40877	Rock Highlid
4_PROFILE	1. LAYER	-4,00	1339	Weak
	2. LAYER	-17,88	4569	Weak
	3. LAYER		18633	Sturdy
5_PROFILE	1. LAYER	-2,88	1889	Weak
	2. LAYER	-12,91	10617	Sturdy
	3. LAYER		41888	Rock Highlid
6_PROFILE	1. LAYER	-2,72	2541	Weak
	2. LAYER	-12,19	9770	Medium
	3. LAYER		26367	Sturdy
7_PROFILE	1. LAYER	-2,26	2059	Weak
	2.LAYER	-10,11	11920	Sturdy
	3.LAYER		48996	Rock Highlid
8_PROFILE	1. LAYER	-3,89	6890	Medium
	2. LAYER	-12,23	13705	Sturdy
	3. LAYER		61265	Rock Highlid
9_PROFILE	1. LAYER	-2,88	2427	Weak
	2. LAYER	-12,91	10324	Sturdy
	3. LAYER		42359	Rock Highlid
10_PROFILE	1. LAYER	-4,36	2808	Weak
	2. LAYER	-13,70	11175	Sturdy
	3. LAYER		39305	Rock Highlid
11_PROFILE	1. LAYER	-5,79	916	High Weak
	2. LAYER	-25,91	7311	Medium
	3. LAYER		29132	Sturdy

Elastic Modulus (kg/cm²)	Dayanım
E<1000	High Weak
1000<E<5000	Weak
5000<E<10000	Medium
10000<E<30000	Sturdy
30000<E	Rock Highlid

The endurance of ground or rocks according to Slip Module values(Keçeli, 1990)

$$E=G*(3*V_p^2-4*V_s^2)/(V_p^2-V_s^2)$$

||AVERAGE||			
LAYERS	DEPTH	E (kg/cm²)	ENDURANCE
1. LAYER	-3,63	2310	Weak
2.LAYER	-14,99	9031	Medium
3.LAYER	∞	36154	Rock Highlid

Elasticity modules and endurance of the grounds in the study area

Calculation of the modulus of elasticity in the direction of the seismic data obtained in the field studies and the change table are given in the above table

5.16.6. WTG16 Poisson's Ratio - (б)

POISSON'S RATIO				
PROFILES	LAYERS	DEPTH	(σ)	POROSITY
1_PROFILE	1. LAYER	-1,89	0,39	High Porous
	2.LAYER	-12,80	0,35	Medium Porous
	3.LAYER		0,40	High Porous
2_PROFILE	1. LAYER	-5,29	0,38	High Porous
	2. LAYER	-16,62	0,34	Medium Porous
	3. LAYER		0,37	High Porous
3_PROFILE	1. LAYER	-3,94	0,39	High Porous
	2. LAYER	-17,65	0,34	Medium Porous
	3. LAYER		0,37	High Porous
4_PROFILE	1. LAYER	-4,00	0,36	High Porous
	2. LAYER	-17,88	0,35	Medium Porous
	3. LAYER		0,39	High Porous
5_PROFILE	1. LAYER	-2,88	0,35	High Porous
	2. LAYER	-12,91	0,32	Medium Porous
	3. LAYER		0,38	High Porous
6_PROFILE	1. LAYER	-2,72	0,42	High Porous
	2. LAYER	-12,19	0,37	High Porous
	3. LAYER		0,40	High Porous
7_PROFILE	1. LAYER	-2,26	0,43	High Porous
	2.LAYER	-10,11	0,33	Medium Porous
	3.LAYER		0,40	High Porous
8_PROFILE	1. LAYER	-3,89	0,38	High Porous
	2. LAYER	-12,23	0,38	High Porous
	3. LAYER		0,36	High Porous
9_PROFILE	1. LAYER	-2,88	0,38	High Porous
	2. LAYER	-12,91	0,34	Medium Porous
	3. LAYER		0,39	High Porous
10_PROFILE	1. LAYER	-4,36	0,37	High Porous
	2. LAYER	-13,70	0,33	Medium Porous
	3. LAYER		0,39	High Porous
11_PROFILE	1. LAYER	-5,79	0,37	High Porous
	2. LAYER	-25,91	0,35	Medium Porous
	3. LAYER		0,40	High Porous

Poisson's Ratio;(σ)	Porosity
0,00≤σ≤0,25	Nonporous
0,26≤σ≤0,35	Medium Porous
0,36≤σ≤0,50	High Porous

Poisson ratio classification

$\sigma=(Vp^2-2*Vs^2)/(2*Vp^2-2*Vs^2)$

||AVERAGE||			
LAYERS	DEPTH	(σ)	POROSITY
1. LAYER	-3,63	0,38	High Porous
2.LAYER	-14,99	0,34	Medium Porous
3.LAYER	∞	0,39	High Porous

Poisson's ratio values of the units in the study area, porosity

Calculation of poisson's ratio values in the direction of the seismic data obtained in the field studies and the change table are given in the above table.

5.16.7. WTG16 Density - ρ (gr/ cm^3)

DENSITY				
PROFILES	LAYERS	DEPTH	ρ (gr/cm^3)	DEFINITION
1_PROFILE	1. LAYER	-1,89	1,38	Low
	2.LAYER	-12,80	1,58	Medium
	3.LAYER		1,99	High
2_PROFILE	1. LAYER	-5,29	1,45	Medium
	2. LAYER	-16,62	1,58	Medium
	3. LAYER		1,90	Medium
3_PROFILE	1. LAYER	-3,94	1,47	Medium
	2. LAYER	-17,65	1,68	Medium
	3. LAYER		2,04	High
4_PROFILE	1. LAYER	-4,00	1,40	Medium
	2. LAYER	-17,88	1,57	Medium
	3. LAYER		1,89	Medium
5_PROFILE	1. LAYER	-2,88	1,45	Medium
	2. LAYER	-12,91	1,69	Medium
	3. LAYER		2,07	High
6_PROFILE	1. LAYER	-2,72	1,56	Medium
	2. LAYER	-12,19	1,73	Medium
	3. LAYER		1,99	High
7_PROFILE	1. LAYER	-2,26	1,54	Medium
	2.LAYER	-10,11	1,72	Medium
	3.LAYER		2,12	High
8_PROFILE	1. LAYER	-3,89	1,69	Medium
	2. LAYER	-12,23	1,82	Medium
	3. LAYER		2,12	High
9_PROFILE	1. LAYER	-2,88	1,52	Medium
	2. LAYER	-12,91	1,72	Medium
	3. LAYER		2,07	High
10_PROFILE	1. LAYER	-4,36	1,53	Medium
	2. LAYER	-13,70	1,73	Medium
	3. LAYER		2,06	High
11_PROFILE	1. LAYER	-5,79	1,33	Low
	2. LAYER	-25,91	1,66	Medium
	3. LAYER		2,01	High

Density: ρ (gr/cm^3)	Tanımlama
ρ<1,20	High low
1,20<ρ<1,40	Low
1,40<ρ<1,90	Medium
1,90<ρ<2,20	High
2,20<ρ	Too High

Density Classification of Ground Units: (Keçeli, 1990)

*ρ =d=0.31*Vp0.25*

||AVERAGE||			
LAYERS	DEPTH	ρ (gr/cm^3)	DEFINITION
1. LAYER	-3,63	1,48	Medium
2.LAYER	-14,99	1,68	Medium
3.LAYER	∞	2,02	High

Density values and description of the units in the study area

Calculation of the density values of the geological units in the direction of the seismic data obtained in the field studies and the table of variation are given in the above table.

5.16.8. WTG16 Modulus of Subgrade Reaction – D Y K (ton/m^3)

Modulus of Subgrade Reaction			
PROFILES	LAYERS	DEPTH	D Y K (ton/m^3)
1_PROFILE	1. LAYER	-1,89	1123
	2.LAYER	-12,80	2439
	3.LAYER		5643
2_PROFILE	1. LAYER	-5,29	1390
	2. LAYER	-16,62	2430
	3. LAYER		4857
3_PROFILE	1. LAYER	-3,94	1423
	2. LAYER	-17,65	3141
	3. LAYER		6910
4_PROFILE	1. LAYER	-4,00	1243
	2. LAYER	-17,88	2270
	3. LAYER		4575
5_PROFILE	1. LAYER	-2,88	1468
	2. LAYER	-12,91	3426
	3. LAYER		6981
6_PROFILE	1. LAYER	-2,72	1683
	2. LAYER	-12,19	3141
	3. LAYER		5450
7_PROFILE	1. LAYER	-2,26	1514
	2.LAYER	-10,11	3615
	3.LAYER		7583
8_PROFILE	1. LAYER	-3,89	2780
	2. LAYER	-12,23	3818
	3. LAYER		8602
9_PROFILE	1. LAYER	-2,88	1651
	2. LAYER	-12,91	3398
	3. LAYER		7021
10_PROFILE	1. LAYER	-4,36	1776
	2. LAYER	-13,70	3567
	3. LAYER		6742
11_PROFILE	1. LAYER	-5,79	1034
	2. LAYER	-25,91	2865
	3. LAYER		5748

‖AVERAGE‖		
LAYERS	DEPTH	D Y K (ton/m^3)
1. LAYER	-3,63	1553
2.LAYER	-14,99	3101
3.LAYER	∞	6374
kv= 40*(Gs)*qu ton/m^3 *(Bowles 1984)*		

The above table shows the Modulus of Subgrade Reaction obtained for each layer in the direction of the data obtained after the seismic measurements made in the study area.

5.16.9. WTG16 Bearing Capacity qu (kg/cm2) / Allowable Bearing Capacity qa (kg/cm2)

PROFILES	LAYERS	DEPTH	BEARING	ALLOWABLE
1_PROFILE	1. LAYER	-1,89	2,81	0,94
	2.LAYER	-12,80	6,10	2,03
	3.LAYER	-37,20	14,11	4,70
2_PROFILE	1. LAYER	-5,29	3,48	1,16
	2. LAYER	-16,62	6,07	2,02
	3. LAYER	-33,38	12,14	4,05
3_PROFILE	1. LAYER	-3,94	3,56	1,19
	2. LAYER	-17,65	7,85	2,62
	3. LAYER	-32,35	17,28	5,76
4_PROFILE	1. LAYER	-4,00	3,11	1,04
	2. LAYER	-17,88	5,67	1,89
	3. LAYER	-32,12	11,44	3,81
5_PROFILE	1. LAYER	-2,88	3,67	1,22
	2. LAYER	-12,91	8,57	2,86
	3. LAYER	-37,09	17,45	5,82
6_PROFILE	1. LAYER	-2,72	4,21	1,40
	2. LAYER	-12,19	7,85	2,62
	3. LAYER	-37,81	13,63	4,54
7_PROFILE	1. LAYER	-2,26	3,79	1,26
	2.LAYER	-10,11	9,04	3,01
	3.LAYER	-39,89	18,96	6,32
8_PROFILE	1. LAYER	-3,89	6,95	2,32
	2. LAYER	-12,23	9,54	3,18
	3. LAYER	-37,77	21,50	7,17
9_PROFILE	1. LAYER	-2,88	4,13	1,38
	2. LAYER	-12,91	8,50	2,83
	3. LAYER	-37,09	17,55	5,85
10_PROFILE	1. LAYER	-4,36	4,44	1,48
	2. LAYER	-13,70	8,92	2,97
	3. LAYER	-36,30	16,86	5,62
11_PROFILE	1. LAYER	-5,79	2,59	0,86
	2. LAYER	-25,91	7,16	2,39
	3. LAYER	-24,09	14,37	4,79

||AVERAGE||		
LAYERS	DEPTH	Bearing Capacity (qu,kg/cm^2)
1. LAYER	-3,63	3,88
2.LAYER	-14,99	7,75
3.LAYER	∞	15,93
qu=(0,024*Vs*(J.B.K+0,002*Vp)*0,71)/G.K		
||AVERAGE||		
LAYERS	DEPTH	Allowable Bearing Capacity (qa,kg/cm^2)
1. LAYER	-3,63	1,29
2.LAYER	-14,99	2,58
3.LAYER	∞	5,31
qa=qu/G.K G.K=3 empirical value		

5.16.10 WTG16 Vibration Period - T_0 (sec) / Ground Amplification (Ak)

PROFILES	To (sec)	Ta (sec)	Tb (sec)	Ak (Amplification)
1.PROFILE	0,39	0,26	0,58	1,92
2.PROFILE	0,46	0,31	0,70	2,08
3.PROFILE	0,36	0,24	0,54	1,79
4.PROFILE	0,49	0,33	0,74	2,13
5.PROFILE	0,32	0,22	0,49	1,73
6.PROFILE	0,37	0,25	0,56	1,87
7.PROFILE	0,28	0,19	0,42	1,63
8.PROFILE	0,25	0,17	0,38	1,50
9.PROFILE	0,31	0,21	0,47	1,68
10.PROFILE	0,33	0,22	0,49	1,71
11.PROFILE	0,49	0,33	0,74	2,05

AVERAGE			
To (sec)	Ta (sec)	Tb (sec)	Ak (Amplification)
0,37	0,25	0,56	1,83

$To = \sum 4H\ Vs\ n\ \imath$=1 (sec)……. (Zeevaert,1967)

$Ak=68*Vs_{30}^{-0,6}$……. (Midorikawa, 1987)

The Vibration Period and Ground Amplification calculated in the direction of the parameters obtained during the seismic studies made during the field survey are presented in the table above.

5. 17. WTG17

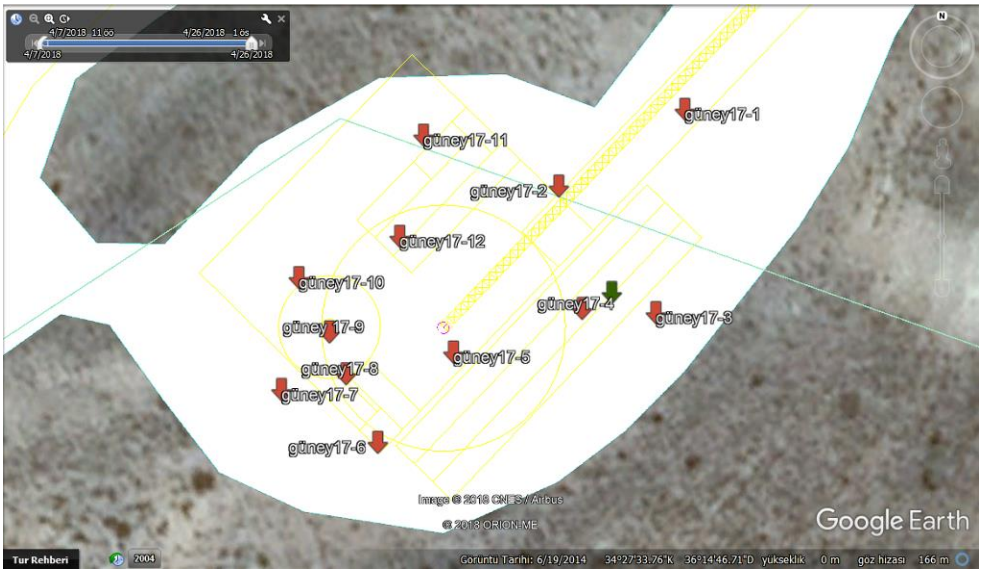
There are 12 measurements taken on the WTG. These measurements showed 3 layers. Layer 1 was found to be between 0,00 m and 6,02 m in depth, Layer 2 was found between 6,02 m and 18,48 m in depth and Layer 3 was found at an average depth of 18,48 m. The parameters of this layer are given in the table below.

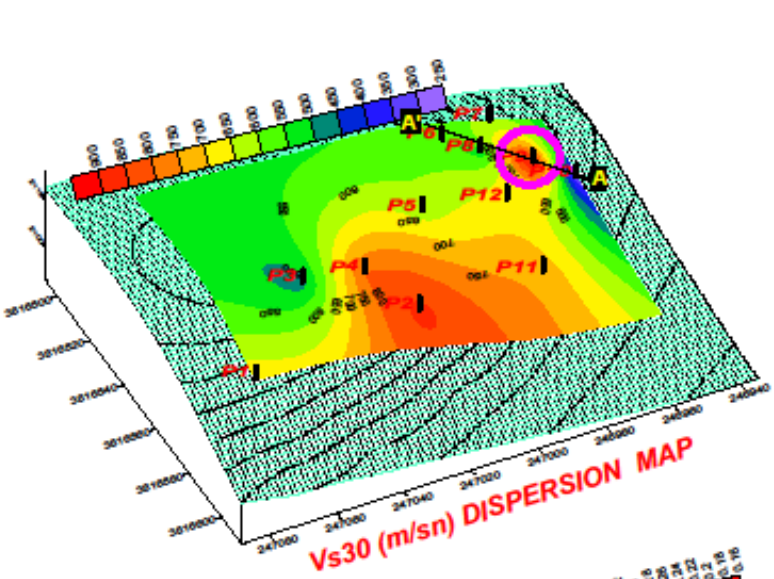
LAYERS	Vp_ Velocity	STRIPPABILITY
1. LAYER	945	Simple strippability
2.LAYER	1366	Medium-hard strippability
3.LAYER	2778	Explosive
LAYERS	**Vs_ Velocity**	**GROUND GROUP**
1. LAYER	371	C
2.LAYER	673	B
3.LAYER	1208	A
LAYERS	**G (kg/cm2)**	**ENDURANCE**
1. LAYER	3337	Sturdy
2.LAYER	10203	High sturdy
3.LAYER	36345	High sturdy
LAYERS	**E (kg/cm2)**	**ENDURANCE**
1. LAYER	9024	Medium
2.LAYER	27086	Sturdy
3.LAYER	100518	High sturdy

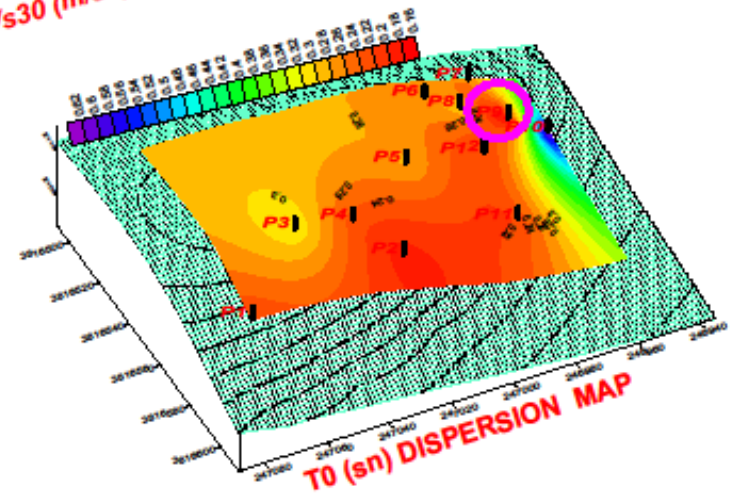
LAYERS	(σ)	POROSITY
1. LAYER	0,38	High Porosity
2.LAYER	0,33	Medium Porosity
3.LAYER	0,38	High Porosity
LAYERS	**ρ (gr/cm3)**	**DEFINITION**
1. LAYER	1,70	Medium
2.LAYER	1,86	Medium
3.LAYER	2,23	High
LAYERS	**D Y K (ton/m^3)**	
1. LAYER	2959	
2.LAYER	5251	
3.LAYER	10862	
LAYERS	**Ground Carrying Capacity (qu,kg/cm2)**	**Secure Carrying Capacity (qa,kg/cm2)**
1. LAYER	7,40	2,47
2.LAYER	13,13	4,38
3.LAYER	27,15	9,05

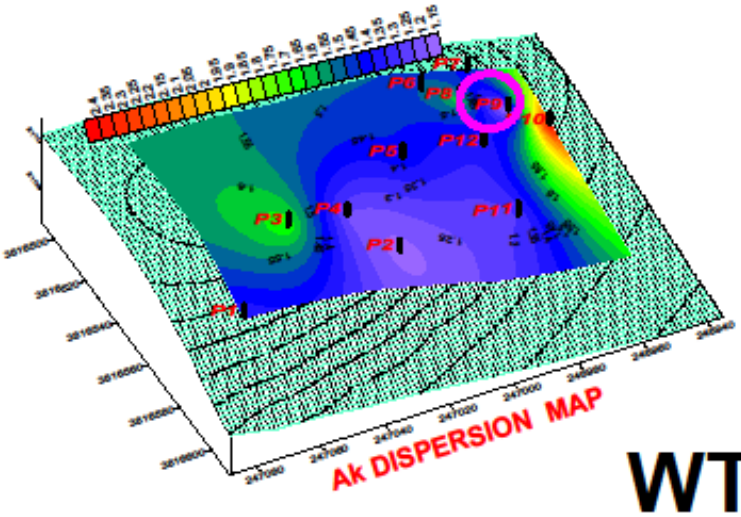
To (sec)	Ta (sec)	Tb (sec)	Vs30 (m/sec)	Ak (Amplification)
0,27	0,18	0,41	644	1,47

Because the tenth profile taken in the field is weak for the first 6.00 m, the WTG should be removed from this point, which is to be offset in the south-east direction of the center of gravity. Taking into consideration the following applications, the profile points should be seen in the engineering parameters section for detailed values.

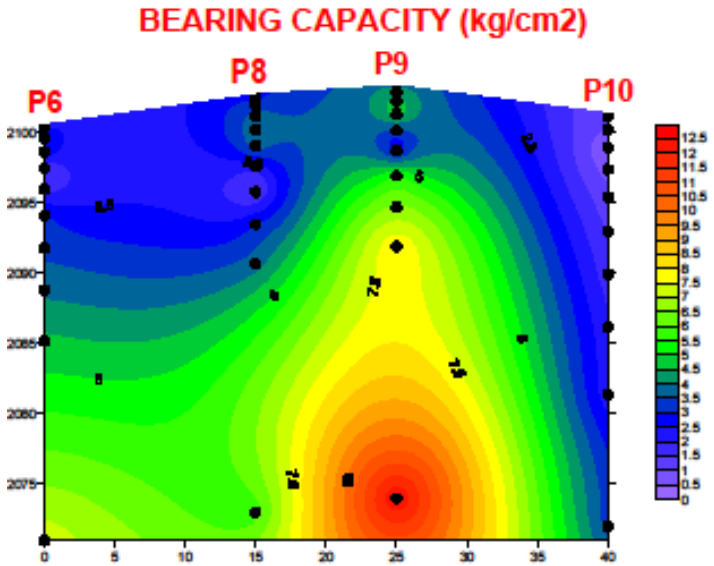


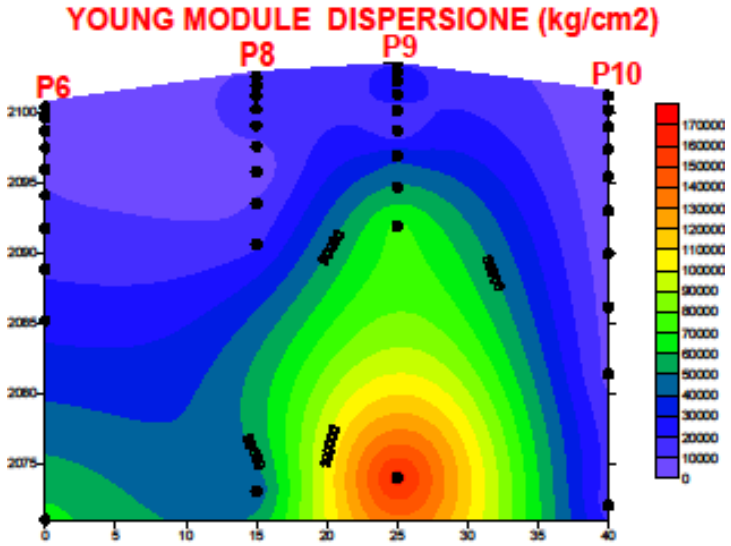

Vs30 (m/sn) DISPERSION MAP

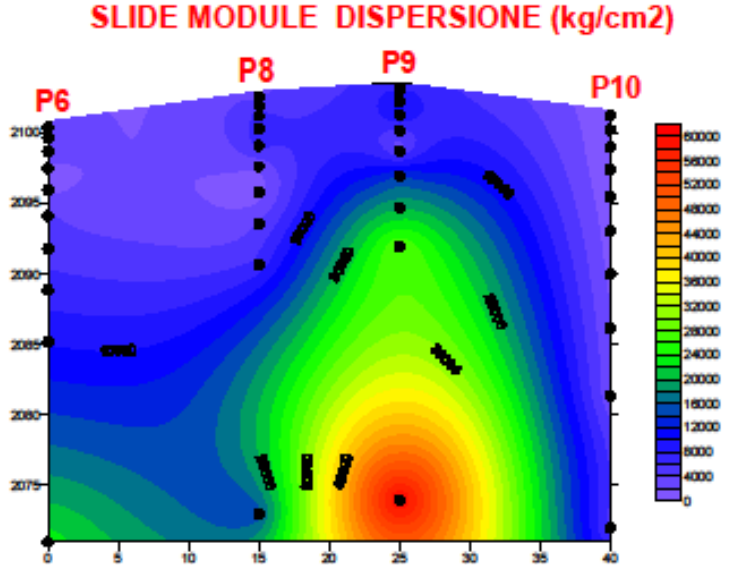

T0 (sn) DISPERSION MAP


Ak DISPERSION MAP

WTG17


BEARING CAPACITY (kg/cm2)
P6
P8
P9
P10


YOUNG MODULE DISPERSIONE (kg/cm2)
P6
P8
P9
P10


SLIDE MODULE DISPERSIONE (kg/cm2)
P6
P8
P9
P10

5.17.1. WTG17 Seismic P wave velocity (*Compressional Wave Velocity* (Vp))

Vp VELOCITY				
PROFILES	LAYERS	DEPTH	Vp_ Velocity	STRIPPABILITY
1_PROFILE	1. LAYER	-4,62	856	Simple Strippability
	2.LAYER	-14,53	1492	Medium Strippability
	3.LAYER		3288	Explosive
2_PROFILE	1. LAYER	-3,07	1040	Simple Strippability
	2. LAYER	-20,81	1627	High Difficult Strippability
	3. LAYER		3831	Explosive
3_PROFILE	1. LAYER	-2,17	457	High Simple Strippability
	2. LAYER	-14,65	871	Simple Strippability
	3. LAYER		2104	High Difficult Strippability
4_PROFILE	1. LAYER	-14,12	1136	Simple Strippability
	2. LAYER	-32,36	2095	High Difficult Strippability
	3. LAYER		3924	Explosive
5_PROFILE	1. LAYER	-9,05	821	Simple Strippability
	2. LAYER	-28,47	1387	Medium Strippability
	3. LAYER		2745	Explosive
6_PROFILE	1. LAYER	-3,53	900	Simple Strippability
	2. LAYER	-15,81	1125	Simple Strippability
	3. LAYER		2377	Explosive
7_PROFILE	1. LAYER	-8,13	956	Simple Strippability
	2.LAYER	-18,65	1350	Medium Strippability
	3.LAYER		2565	Explosive
8_PROFILE	1. LAYER	-5,39	1175	Simple Strippability
	2. LAYER	-12,35	1056	Simple Strippability
	3. LAYER		1865	High Difficult Strippability
9_PROFILE	1. LAYER	-3,85	1371	Medium Strippability
	2. LAYER	-12,09	1710	High Difficult Strippability
	3. LAYER		3499	Explosive
10_PROFILE	1. LAYER	-4,61	348	High Simple Strippability
	2. LAYER	-20,63	558	Simple Strippability
	3. LAYER		1225	Medium Strippability
11_PROFILE	1. LAYER	-8,56	1107	Simple Strippability
	2. LAYER	-19,62	1698	High Difficult Strippability
	3. LAYER		3288	Explosive
12_PROFILE	1. LAYER	-5,14	1174	Simple Strippability
	2. LAYER	-11,79	1420	Medium Strippability
	3. LAYER		2622	Explosive

P Wave Velocity (m/sec)	Strippability
Vp<458	High Simple Strippability
458<Vp<1220	Simple Strippability
1220<Vp<11525	Medium Strippability
1525<Vp<11830	Difficult Strippability
1830<Vp<12135	High Difficult Strippability
Vp>2135	Explosive Strippability

Strippability of floors with P wave velocity (Church, 1981)

‖AVERAGE‖			
LAYERS	DEPTH	Vp_ Velocity	STRIPPABILITY
1. LAYER	-6,02	945	Simple Strippability
2.LAYER	-18,48	1366	Medium Strippability
3.LAYER	∞	2778	Explosive

P wave velocities of the grounds in the study area and strippability

The above table shows the change table and strippability properties of Vp velocity depth values in the direction of the seismic data obtained from the field studies.

5.17.2. WTG17 Seismic S wave velocity (*Transverse Wave Velocity* (Vs))

Vs VELOCITY				
PROFILES	LAYERS	DEPTH	Vs_ Velocity	GROUND GROUPS
1_PROFILE	1. LAYER	-4,62	323	C
	2.LAYER	-14,53	726	A
	3.LAYER		1350	A
2_PROFILE	1. LAYER	-3,07	465	B
	2. LAYER	-20,81	815	A
	3. LAYER		1664	A
3_PROFILE	1. LAYER	-2,17	206	C
	2. LAYER	-14,65	466	B
	3. LAYER		912	A
4_PROFILE	1. LAYER	-14,12	462	B
	2. LAYER	-32,36	1027	A
	3. LAYER		1641	A
5_PROFILE	1. LAYER	-9,05	354	C
	2. LAYER	-28,47	711	A
	3. LAYER		1287	A
6_PROFILE	1. LAYER	-3,53	389	C
	2. LAYER	-15,81	528	B
	3. LAYER		1029	A
7_PROFILE	1. LAYER	-8,13	308	C
	2.LAYER	-18,65	684	B
	3.LAYER		1110	A
8_PROFILE	1. LAYER	-5,39	427	B
	2. LAYER	-12,35	429	B
	3. LAYER		845	A
9_PROFILE	1. LAYER	-3,85	640	B
	2. LAYER	-12,09	843	A
	3. LAYER		1592	A
10_PROFILE	1. LAYER	-4,61	136	D
	2. LAYER	-20,63	287	C
	3. LAYER		514	B
11_PROFILE	1. LAYER	-8,56	361	C
	2. LAYER	-19,62	853	A
	3. LAYER		1381	A
12_PROFILE	1. LAYER	-5,14	374	C
	2. LAYER	-11,79	707	A
	3. LAYER		1171	A

S Wave Velocity (m/sec)	Ground group
Vs<200	D
200<Vs<400	C
400<Vs<700	B
700<Vs	A

Ground groups according to slip wave velocity(Abyyhy, 1998)

||AVERAGE||			
LAYERS	DEPTH	Vs_ Velocity	GROUND GROUPS
1. LAYER	-6,02	371	C
2.LAYER	-18,48	673	B
3.LAYER	∞	1208	A

S wave velocities of the grounds in the study area and ground group

Ground Group	Ground group and top ground layer thickness(h_1)
Z1	(A) Ground group h1< 15 m (B) Ground group
Z2	h_1> 15 m (B) Ground group h_1< 15 m (C) Ground group
Z3	15 m < h_1< 50 m (C) Ground group h_1< 10 m (D) Ground group
Z4	h_1> 50 m (C) Ground group h_1> 10 m (D) Ground group

Ground Group Class

The above table shows that Vs velocity values in the direction of the seismic data obtained in the field studies are the absolute change tables and that the layers are included in the ground groups.

5.17.3. WTG17 Vs30

PROFILES	Vs30 (m/sec)
1.PROFILE	685
2.PROFILE	861
3.PROFILE	474
4.PROFILE	800
5.PROFILE	620
6.PROFILE	578
7.PROFILE	616
8.PROFILE	504
9.PROFILE	912
10.PROFILE	267
11.PROFILE	732
12.PROFILE	681

Vs30 values in the direction of the seismic data obtained from the field studies are given in the table above.

5.17.4. WTG17 Shear Modulus-G (kg/cm²)

SHEAR MODULUS				
PROFILES	LAYERS	DEPTH	G(kg/cm²)	ENDURANCE
1_PROFILE	1. LAYER	-4,62	1862	Medium
	2.LAYER	-14,53	10634	Rock Highlid
	3.LAYER		42752	Rock Highlid
2_PROFILE	1. LAYER	-3,07	4147	Sturdy
	2. LAYER	-20,81	14971	Rock Highlid
	3. LAYER		67567	Rock Highlid
3_PROFILE	1. LAYER	-2,17	706	Weak
	2. LAYER	-14,65	4130	Sturdy
	3. LAYER		17474	Rock Highlid
4_PROFILE	1. LAYER	-14,12	5361	Sturdy
	2. LAYER	-32,36	22270	Rock Highlid
	3. LAYER		66032	Rock Highlid
5_PROFILE	1. LAYER	-9,05	2199	Medium
	2. LAYER	-28,47	10118	Rock Highlid
	3. LAYER		37192	Rock Highlid
6_PROFILE	1. LAYER	-3,53	2765	Medium
	2. LAYER	-15,81	5471	Sturdy
	3. LAYER		22941	Rock Highlid
7_PROFILE	1. LAYER	-8,13	2317	Medium
	2.LAYER	-18,65	9028	Sturdy
	3.LAYER		27166	Rock Highlid
8_PROFILE	1. LAYER	-5,39	4951	Sturdy
	2. LAYER	-12,35	3748	Sturdy
	3. LAYER		14544	Rock Highlid
9_PROFILE	1. LAYER	-3,85	7901	Sturdy
	2. LAYER	-12,09	16072	Rock Highlid
	3. LAYER		60453	Rock Highlid
10_PROFILE	1. LAYER	-4,61	274	High Weak
	2. LAYER	-20,63	1321	Weak
	3. LAYER		4846	Sturdy
11_PROFILE	1. LAYER	-8,56	3683	Sturdy
	2. LAYER	-19,62	14920	Rock Highlid
	3. LAYER		44773	Rock Highlid
12_PROFILE	1. LAYER	-5,14	3876	Sturdy
	2. LAYER	-11,79	9747	Sturdy
	3. LAYER		30396	Rock Highlid

Shear Modulus (kg/cm²)	Dayanım
G<400	High Weak
400<G<1500	Weak
1500<G<3000	Medium
3000<G<10000	Sturdy
10000<G	Rock Highlid

The endurance of ground or rocks according to Slip Module values(Keçeli, 1990)

$G = (d*Vs^2)/100$

||AVERAGE||			
LAYERS	DEPTH	G (kg/cm²)	ENDURANCE
1. LAYER	-6,02	3337	Sturdy
2.LAYER	-18,48	10203	Rock Highlid
3.LAYER	∞	36345	Rock Highlid

Shear modules and endurance of the grounds in the study area

Calculation of shear Modulus values in the direction of the seismic data obtained in the field studies and the table of variation are given in the table above.

5.17.5. WTG17 Elasticity Modulus-E (kg/cm²)

ELASTIC MODULUS				
PROFILES	LAYERS	DEPTH	E(kg/cm^2)	ENDURANCE
1_PROFILE	1. LAYER	-4,62	5159	Medium
	2.LAYER	-14,53	28601	Sturdy
	3.LAYER		119594	Rock Highlid
2_PROFILE	1. LAYER	-3,07	10858	Sturdy
	2. LAYER	-20,81	39523	Rock Highlid
	3. LAYER		186980	Rock Highlid
3_PROFILE	1. LAYER	-2,17	1813	Weak
	2. LAYER	-14,65	10720	Sturdy
	3. LAYER		48376	Rock Highlid
4_PROFILE	1. LAYER	-14,12	14252	Sturdy
	2. LAYER	-32,36	59753	Rock Highlid
	3. LAYER		184109	Rock Highlid
5_PROFILE	1. LAYER	-9,05	5975	Medium
	2. LAYER	-28,47	26595	Sturdy
	3. LAYER		101088	Rock Highlid
6_PROFILE	1. LAYER	-3,53	7401	Medium
	2. LAYER	-15,81	14697	Sturdy
	3. LAYER		63525	Rock Highlid
7_PROFILE	1. LAYER	-8,13	6552	Medium
	2.LAYER	-18,65	23969	Sturdy
	3.LAYER		75242	Rock Highlid
8_PROFILE	1. LAYER	-5,39	13406	Sturdy
	2. LAYER	-12,35	10097	Sturdy
	3. LAYER		39875	Rock Highlid
9_PROFILE	1. LAYER	-3,85	21145	Sturdy
	2. LAYER	-12,09	41864	Rock Highlid
	3. LAYER		165569	Rock Highlid
10_PROFILE	1. LAYER	-4,61	748	High Weak
	2. LAYER	-20,63	3489	Weak
	3. LAYER		13502	Sturdy
11_PROFILE	1. LAYER	-8,56	10145	Sturdy
	2. LAYER	-19,62	39737	Rock Highlid
	3. LAYER		124727	Rock Highlid
12_PROFILE	1. LAYER	-5,14	10839	Sturdy
	2. LAYER	-11,79	25984	Sturdy
	3. LAYER		83623	Rock Highlid

Elastic Modulus (kg/cm^2)	Dayanım
E<1000	High Weak
1000<E<5000	Weak
5000<E<10000	Medium
10000<E<30000	Sturdy
30000<E	Rock Highlid

The endurance of ground or rocks according to Slip Module values(Keçeli, 1990)

$E=G*(3*V_p^2-4*V_s^2)/(V_p^2-V_s^2)$

||AVERAGE||		
LAYERS	DEPTH	E (kg/cm^2)	ENDURANCE
1. LAYER	-6,02	9024	Medium
2.LAYER	-18,48	27086	Sturdy
3.LAYER	∞	100518	Rock Highlid

Elasticity modules and endurance of the grounds in the study area

Calculation of the modulus of elasticity in the direction of the seismic data obtained in the field studies and the c hange table are given in the above table

5.17.6. WTG17 Poisson's Ratio - (б)

POISSON'S RATIO				
PROFILES	LAYERS	DEPTH	(σ)	POROSITY
1_PROFILE	1. LAYER	-4,62	0,41	High Porous
	2.LAYER	-14,53	0,34	Medium Porous
	3.LAYER		0,40	High Porous
2_PROFILE	1. LAYER	-3,07	0,35	Medium Porous
	2. LAYER	-20,81	0,33	Medium Porous
	3. LAYER		0,38	High Porous
3_PROFILE	1. LAYER	-2,17	0,34	Medium Porous
	2. LAYER	-14,65	0,29	Medium Porous
	3. LAYER		0,38	High Porous
4_PROFILE	1. LAYER	-14,12	0,36	High Porous
	2. LAYER	-32,36	0,34	Medium Porous
	3. LAYER		0,39	High Porous
5_PROFILE	1. LAYER	-9,05	0,38	High Porous
	2. LAYER	-28,47	0,32	Medium Porous
	3. LAYER		0,36	High Porous
6_PROFILE	1. LAYER	-3,53	0,37	High Porous
	2. LAYER	-15,81	0,36	High Porous
	3. LAYER		0,38	High Porous
7_PROFILE	1. LAYER	-8,13	0,41	High Porous
	2.LAYER	-18,65	0,33	Medium Porous
	3.LAYER		0,38	High Porous
8_PROFILE	1. LAYER	-5,39	0,37	High Porous
	2. LAYER	-12,35	0,39	High Porous
	3. LAYER		0,37	High Porous
9_PROFILE	1. LAYER	-3,85	0,35	High Porous
	2. LAYER	-12,09	0,33	Medium Porous
	3. LAYER		0,37	High Porous
10_PROFILE	1. LAYER	-4,61	0,39	High Porous
	2. LAYER	-20,63	0,31	Medium Porous
	3. LAYER		0,39	High Porous
11_PROFILE	1. LAYER	-8,56	0,40	High Porous
	2. LAYER	-19,62	0,33	Medium Porous
	3. LAYER		0,39	High Porous
12_PROFILE	1. LAYER	-5,14	0,41	High Porous
	2. LAYER	-11,79	0,34	Medium Porous
	3. LAYER		0,38	High Porous

Poisson's Ratio;(σ)	Porosity
0,00≤σ≤0,25	Nonporous
0,26≤σ≤0,35	Medium Porous
0,36≤σ≤0,50	High Porous

Poisson ratio classification

$\sigma=(Vp^2-2*Vs^2)/(2*Vp^2-2*Vs^2)$

‖AVERAGE‖			
LAYERS	DEPTH	(σ)	POROSITY
1. LAYER	-6,02	0,38	High Porous
2.LAYER	-18,48	0,33	Medium Porous
3.LAYER	∞	0,38	High Porous

Poisson's ratio values of the units in the study area, porosity

Calculation of poisson's ratio values in the direction of the seismic data obtained in the field studies and the change table are given in the above table.

5.17.7. WTG17 Density - ρ (gr/ cm^3)

DENSITY				
PROFILES	LAYERS	DEPTH	ρ (gr/cm^3)	DEFINITION
1_PROFILE	1. LAYER	-4,62	1,68	Medium
	2.LAYER	-14,53	1,92	High
	3.LAYER		2,35	High
2_PROFILE	1. LAYER	-3,07	1,76	Medium
	2. LAYER	-20,81	1,95	High
	3. LAYER		2,44	High
3_PROFILE	1. LAYER	-2,17	1,43	Medium
	2. LAYER	-14,65	1,67	Medium
	3. LAYER		2,10	High
4_PROFILE	1. LAYER	-14,12	1,79	Medium
	2. LAYER	-32,36	2,10	High
	3. LAYER		2,45	High
5_PROFILE	1. LAYER	-9,05	1,66	Medium
	2. LAYER	-28,47	1,89	Medium
	3. LAYER		2,24	High
6_PROFILE	1. LAYER	-3,53	1,70	Medium
	2. LAYER	-15,81	1,79	Medium
	3. LAYER		2,16	High
7_PROFILE	1. LAYER	-8,13	1,72	Medium
	2.LAYER	-18,65	1,88	Medium
	3.LAYER		2,21	High
8_PROFILE	1. LAYER	-5,39	1,81	Medium
	2. LAYER	-12,35	1,77	Medium
	3. LAYER		2,04	High
9_PROFILE	1. LAYER	-3,85	1,89	Medium
	2. LAYER	-12,09	1,99	High
	3. LAYER		2,38	High
10_PROFILE	1. LAYER	-4,61	1,34	Low
	2. LAYER	-20,63	1,50	Medium
	3. LAYER		1,83	Medium
11_PROFILE	1. LAYER	-8,56	1,79	Medium
	2. LAYER	-19,62	1,99	High
	3. LAYER		2,35	High
12_PROFILE	1. LAYER	-5,14	1,81	Medium
	2. LAYER	-11,79	1,90	High
	3. LAYER		2,22	High

Density: ρ (gr/cm^3)	Tanımlama
ρ<1,20	High low
1,20<ρ<1,40	Low
1,40<ρ<1,90	Medium
1,90<ρ<2,20	High
2,20<ρ	Too High

Density Classification of Ground Units: (Keçeli, 1990)

*ρ =d=0.31*Vp0.25*

||AVERAGE||			
LAYERS	DEPTH	ρ (gr/cm^3)	DEFINITION
1. LAYER	-6,02	1,70	Medium
2.LAYER	-18,48	1,86	Medium
3.LAYER	∞	2,23	High

Density values and description of the units in the study area

Calculation of the density values of the geological units in the direction of the seismic data obtained in the field studies and the table of variation are given in the above table.

5.17.8. WTG17 Modulus of Subgrade Reaction – D Y K (ton/m^3)

Modulus of Subgrade Reaction			
PROFILES	LAYERS	DEPTH	D Y K (ton/m^3)
1_PROFILE	1. LAYER	-4,62	2340
	2.LAYER	-14,53	5671
	3.LAYER		12460
2_PROFILE	1. LAYER	-3,07	3435
	2. LAYER	-20,81	6517
	3. LAYER		16107
3_PROFILE	1. LAYER	-2,17	1428
	2. LAYER	-14,65	3414
	3. LAYER		7539
4_PROFILE	1. LAYER	-14,12	3817
	2. LAYER	-32,36	8492
	3. LAYER		16000
5_PROFILE	1. LAYER	-9,05	2558
	2. LAYER	-28,47	5484
	3. LAYER		11315
6_PROFILE	1. LAYER	-3,53	2834
	2. LAYER	-15,81	3964
	3. LAYER		8738
7_PROFILE	1. LAYER	-8,13	2682
	2.LAYER	-18,65	5245
	3.LAYER		9589
8_PROFILE	1. LAYER	-5,39	3847
	2. LAYER	-12,35	3186
	3. LAYER		6818
9_PROFILE	1. LAYER	-3,85	4908
	2. LAYER	-12,09	6764
	3. LAYER		14976
10_PROFILE	1. LAYER	-4,61	931
	2. LAYER	-20,63	2017
	3. LAYER		3879
11_PROFILE	1. LAYER	-8,56	3291
	2. LAYER	-19,62	6796
	3. LAYER		12751
12_PROFILE	1. LAYER	-5,14	3431
	2. LAYER	-11,79	5457
	3. LAYER		10170

‖AVERAGE‖		
LAYERS	DEPTH	D Y K (ton/m^3)
1. LAYER	-6,02	2959
2.LAYER	-18,48	5251
3.LAYER	∞	10862
kv= 40*(Gs)*qu ton/m^3 *(Bowles 1984)*		

The above table shows the Modulus of Subgrade Reaction obtained for each layer in the direction of the data obtained after the seismic measurements made in the study area.

5.17.9. WTG17 Bearing Capacity qu (kg/cm2) / Allowable Bearing Capacity qa (kg/cm2)

PROFILES	LAYERS	DEPTH	BEARING CAPACITY (qu,kg/cm^2)	ALLOWABLE BEARING CAPACITY (qa,kg/cm^2)
1_PROFILE	1. LAYER	-4,62	5,85	1,95
	2.LAYER	-14,53	14,18	4,73
	3.LAYER	-35,47	31,15	10,38
2_PROFILE	1. LAYER	-3,07	8,59	2,86
	2. LAYER	-20,81	16,29	5,43
	3. LAYER	-29,19	40,27	13,42
3_PROFILE	1. LAYER	-2,17	3,57	1,19
	2. LAYER	-14,65	8,53	2,84
	3. LAYER	-35,35	18,85	6,28
4_PROFILE	1. LAYER	-14,12	9,54	3,18
	2. LAYER	-32,36	21,23	7,08
	3. LAYER	-17,64	40,00	13,33
5_PROFILE	1. LAYER	-9,05	6,40	2,13
	2. LAYER	-28,47	13,71	4,57
	3. LAYER	-21,53	28,29	9,43
6_PROFILE	1. LAYER	-3,53	7,09	2,36
	2. LAYER	-15,81	9,91	3,30
	3. LAYER	-34,19	21,84	7,28
7_PROFILE	1. LAYER	-8,13	6,70	2,23
	2.LAYER	-18,65	13,11	4,37
	3.LAYER	-31,35	23,97	7,99
8_PROFILE	1. LAYER	-5,39	9,62	3,21
	2. LAYER	-12,35	7,97	2,66
	3. LAYER	-37,65	17,04	5,68
9_PROFILE	1. LAYER	-3,85	12,27	4,09
	2. LAYER	-12,09	16,91	5,64
	3. LAYER	-37,91	37,44	12,48
10_PROFILE	1. LAYER	-4,61	2,33	0,78
	2. LAYER	-20,63	5,04	1,68
	3. LAYER	-29,37	9,70	3,23
11_PROFILE	1. LAYER	-8,56	8,23	2,74
	2. LAYER	-19,62	16,99	5,66
	3. LAYER	-30,38	31,88	10,63
12_PROFILE	1. LAYER	-5,14	8,58	2,86
	2. LAYER	-11,79	13,64	4,55
	3. LAYER	-38,21	25,42	8,47

‖AVERAGE‖		
LAYERS	DEPTH	Bearing Capacity (qu,kg/cm^2)
1. LAYER	-6,02	7,40
2.LAYER	-18,48	13,13
3.LAYER	∞	27,15
qu=(0,024*Vs*(J.B.K+0,002*Vp)*0,71)/G.K		
‖AVERAGE‖		
LAYERS	DEPTH	Allowable Bearing Capacity (qa,kg/cm^2)
1. LAYER	-6,02	2,47
2.LAYER	-18,48	4,38
3.LAYER	∞	9,05
qa=qu/G.K	G.K=3 empirical value	

5.17.10 WTG17 Vibration Period - T_0 (sec) / Ground Amplification (Ak)

PROFILES	To (sec)	Ta (sec)	Tb (sec)	Ak (Amplification)
1.PROFILE	0,22	0,15	0,33	1,35
2.PROFILE	0,19	0,13	0,28	1,18
3.PROFILE	0,32	0,21	0,48	1,69
4.PROFILE	0,23	0,15	0,34	1,23
5.PROFILE	0,28	0,19	0,42	1,44
6.PROFILE	0,27	0,18	0,40	1,50
7.PROFILE	0,26	0,17	0,39	1,44
8.PROFILE	0,30	0,20	0,44	1,63
9.PROFILE	0,16	0,11	0,24	1,14
10.PROFILE	0,61	0,41	0,92	2,38
11.PROFILE	0,22	0,15	0,33	1,30
12.PROFILE	0,22	0,14	0,32	1,36

AVERAGE			
To (sec)	**Ta (sec)**	**Tb (sec)**	**Ak (Amplification)**
0,27	0,18	0,41	1,47

$To = \sum 4H\ Vs\ n\ \imath$=1 (sec)……. (Zeevaert,1967)

Ak=68*$Vs_{30}^{-0,6}$……. (Midorikawa, 1987)

The Vibration Period and Ground Amplification calculated in the direction of the parameters obtained during the seismic studies made during the field survey are presented in the table above.

5. 18. WTG18

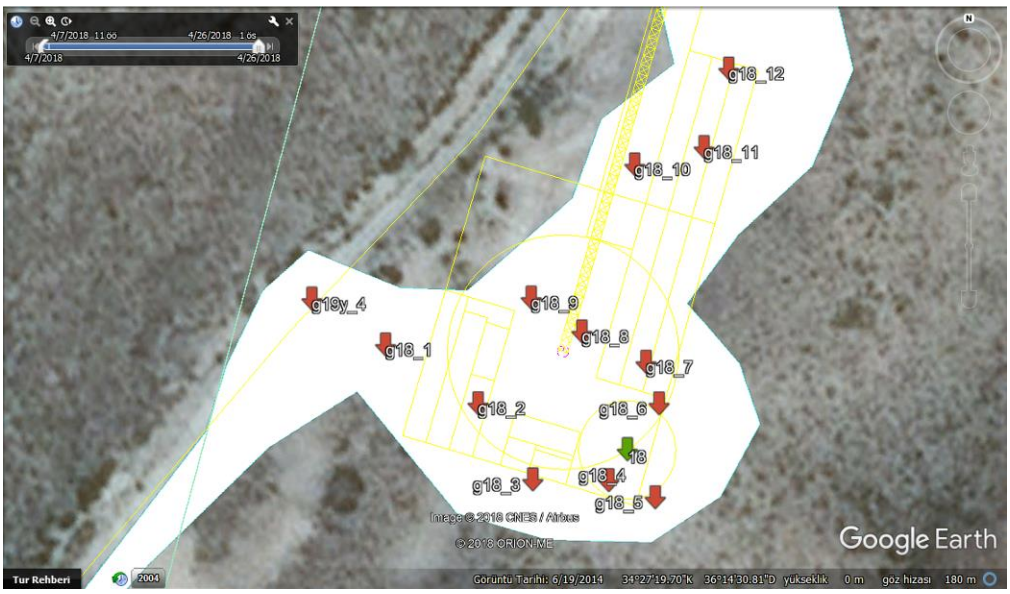
12 measurements were taken. These measurements showed 3 layers. Layer 1 was found between 0,00 m and 4,07 m depth, Layer 2 between 4,07 m and 19,31 m depth and Layer 3 averaging 19,31 m depth. The parameters of this layer are given in the table below.

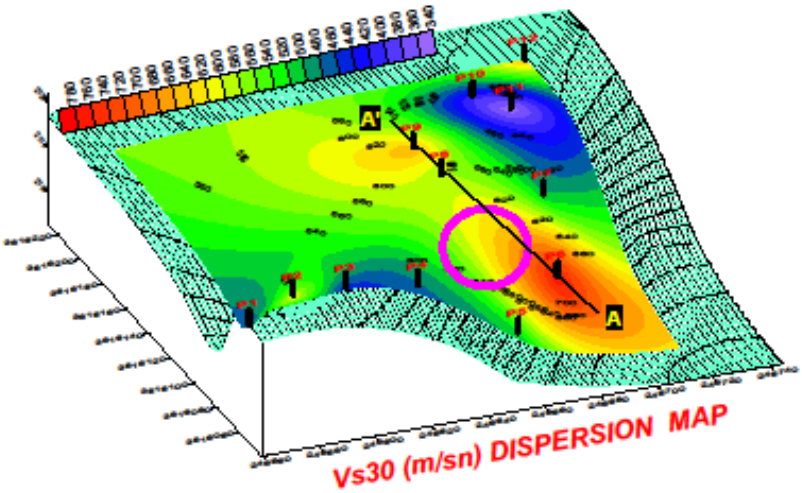
LAYERS	Vp_ Velocity	STRIPPABILITY
1. LAYER	704	Simple strippability
2.LAYER	1065	Simple strippability
3.LAYER	2270	Explosive
LAYERS	**Vs_ Velocity**	**GROUND GROUP**
1. LAYER	278	C
2.LAYER	520	B
3.LAYER	986	A
LAYERS	**G (kg/cm2)**	**ENDURANCE**
1. LAYER	1620	Medium
2.LAYER	5625	Sturdy
3.LAYER	22730	High sturdy
LAYERS	**E (kg/cm2)**	**ENDURANCE**
1. LAYER	4426	Weak
2.LAYER	14942	Sturdy
3.LAYER	62706	High sturdy

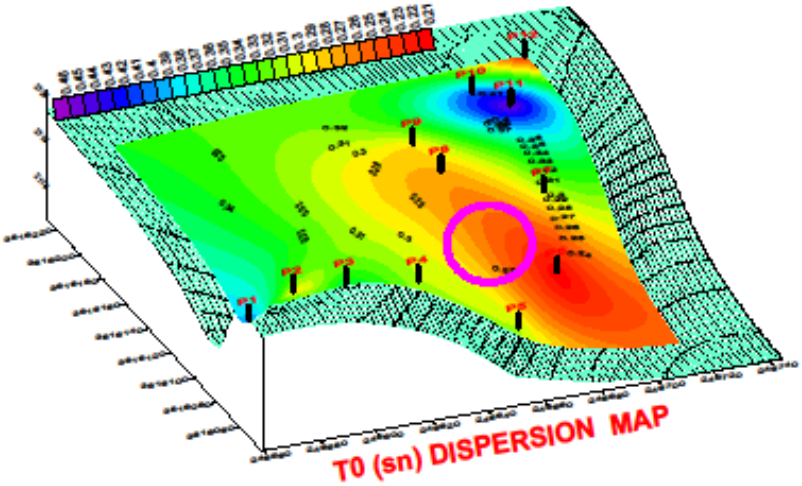
LAYERS	(σ)	POROSITY
1. LAYER	0,38	High Porosity
2.LAYER	0,34	Medium Porosity
3.LAYER	0,38	High Porosity
LAYERS	**ρ (gr/cm3)**	**DEFINITION**
1. LAYER	1,58	Medium
2.LAYER	1,75	Medium
3.LAYER	2,13	High
LAYERS	**D Y K (ton/m^3)**	
1. LAYER	2080	
2.LAYER	3903	
3.LAYER	8386	
LAYERS	**Ground Carrying Capacity (qu,kg/cm2)**	**Secure Carrying Capacity (qa,kg/cm2)**
1. LAYER	5,20	1,73
2.LAYER	9,76	3,25
3.LAYER	20,96	6,99

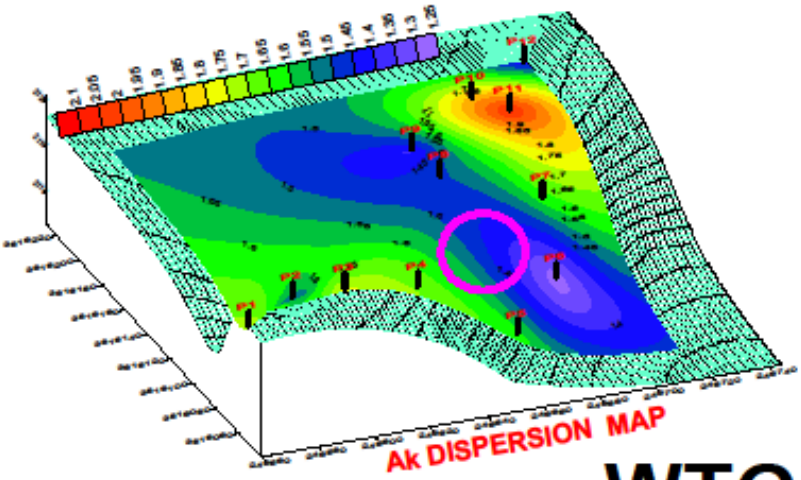
To (sec)	Ta (sec)	Tb (sec)	Vs30 (m/sec)	Ak (Amplification)
0,32	0,21	0,48	531	1,61

Due to the weakness of the first layer of 4 profiles taken from the area, the 3.00 m excavation should be removed from this point by sliding the Turbine center of gravity north or northeast. Taking into account the following applications, the profile parameters for detailed values should be seen in the engineering parameters section.

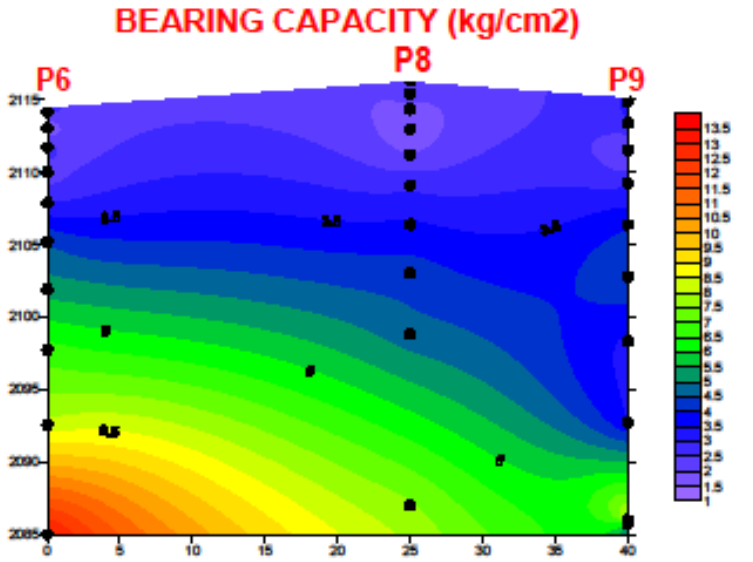


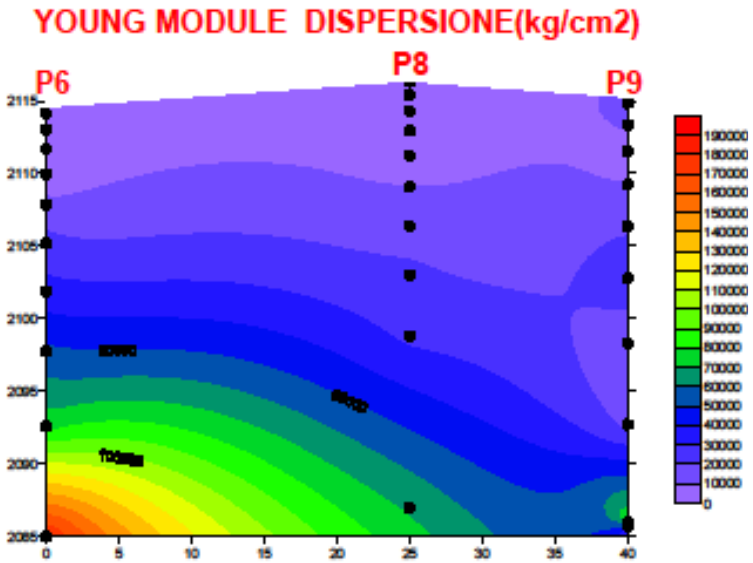

A'
A
Vs30 (m/sn) DISPERSION MAP

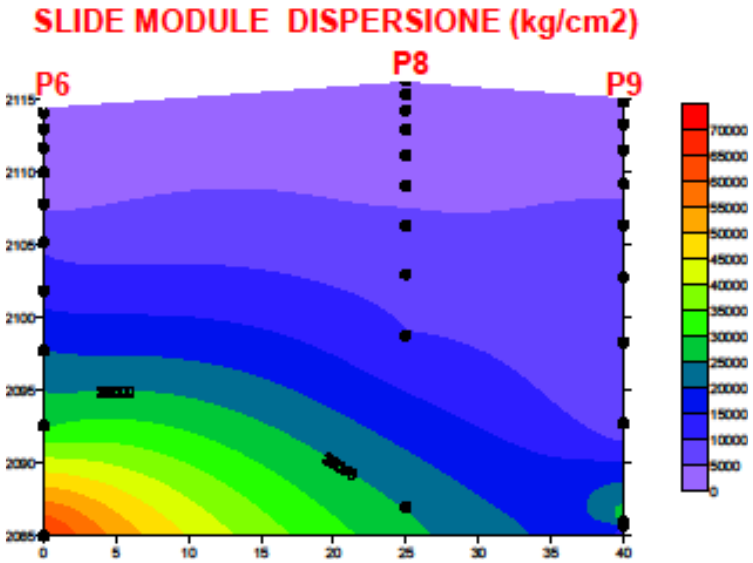

T0 (sn) DISPERSION MAP


Ak DISPERSION MAP

WTG18


BEARING CAPACITY (kg/cm2)
P6
P8
P9


YOUNG MODULE DISPERSIONE(kg/cm2)
P6
P8
P9


SLIDE MODULE DISPERSIONE (kg/cm2)
P6
P8
P9

5.18.1. WTG18 Seismic P wave velocity (*Compressional Wave Velocity* (Vp))

PROFILES	LAYERS	DEPTH	Vp_ Velocity	STRIPPABILITY
		VP VELOCITY		
1_PROFILE	1. LAYER	-4,49	335	High Simple Strippability
	2.LAYER	-30,37	965	Simple Strippability
	3.LAYER		2147	Explosive
2_PROFILE	1. LAYER	-8,86	1163	Simple Strippability
	2. LAYER	-20,30	1296	Medium Strippability
	3. LAYER		2274	Explosive
3_PROFILE	1. LAYER	-2,49	426	High Simple Strippability
	2. LAYER	-16,85	801	Simple Strippability
	3. LAYER		1837	High Difficult Strippability
4_PROFILE	1. LAYER	-1,81	477	Simple Strippability
	2. LAYER	-12,26	849	Simple Strippability
	3. LAYER		2017	High Difficult Strippability
5_PROFILE	1. LAYER	-2,65	571	Simple Strippability
	2. LAYER	-17,94	962	Simple Strippability
	3. LAYER		2293	Explosive
6_PROFILE	1. LAYER	-3,31	852	Simple Strippability
	2. LAYER	-22,43	1500	Medium Strippability
	3. LAYER		3540	Explosive
7_PROFILE	1. LAYER	-6,28	799	Simple Strippability
	2.LAYER	-14,39	1106	Simple Strippability
	3.LAYER		2055	High Difficult Strippability
8_PROFILE	1. LAYER	-4,06	817	Simple Strippability
	2. LAYER	-18,18	1150	Simple Strippability
	3. LAYER		2474	Explosive
9_PROFILE	1. LAYER	-6,76	1079	Simple Strippability
	2. LAYER	-30,27	1423	Medium Strippability
	3. LAYER		2593	Explosive
10_PROFILE	1. LAYER	-2,92	570	Simple Strippability
	2. LAYER	-19,74	788	Simple Strippability
	3. LAYER		1751	High Difficult Strippability
11_PROFILE	1. LAYER	-2,37	596	Simple Strippability
	2. LAYER	-16,01	679	Simple Strippability
	3. LAYER		1504	Medium Strippability
12_PROFILE	1. LAYER	-2,89	765	Simple Strippability
	2. LAYER	-12,94	1260	Medium Strippability
	3. LAYER		2752	Explosive

P Wave Velocity (m/sec)	Strippability
Vp<458	High Simple Strippability
458<Vp<1220	Simple Strippability
1220<Vp<11525	Medium Strippability
1525<Vp<11830	Difficult Strippability
1830<Vp<12135	High Difficult
Vp>2135	Explosive Strippability

Strippability of floors with P wave velocity (Church, 1981)

LAYERS	DEPTH	Vp_ Velocity	STRIPPABILITY
	||AVERAGE||		
1. LAYER	-4,07	704	Simple Strippability
2.LAYER	-19,31	1065	Simple Strippability
3.LAYER	∞	2270	Explosive

P wave velocities of the grounds in the study area and strippability

The above table shows the change table and strippability properties of Vp velocity depth values in the direction of the seismic data obtained from the field studies.

5.18.2. WTG18 Seismic S wave velocity (*Transverse Wave Velocity* (Vs))

PROFILES	LAYERS	Vs VELOCITY DEPTH	Vs_ Velocity	GROUND GROUPS
1_PROFILE	1. LAYER	-4,49	167	D
	2.LAYER	-30,37	497	B
	3.LAYER		889	A
2_PROFILE	1. LAYER	-8,86	381	C
	2. LAYER	-20,30	548	B
	3. LAYER		986	A
3_PROFILE	1. LAYER	-2,49	189	D
	2. LAYER	-16,85	455	B
	3. LAYER		852	A
4_PROFILE	1. LAYER	-1,81	216	C
	2. LAYER	-12,26	437	B
	3. LAYER		866	A
5_PROFILE	1. LAYER	-2,65	242	C
	2. LAYER	-17,94	507	B
	3. LAYER		974	A
6_PROFILE	1. LAYER	-3,31	379	C
	2. LAYER	-22,43	749	A
	3. LAYER		1669	A
7_PROFILE	1. LAYER	-6,28	265	C
	2.LAYER	-14,39	555	B
	3.LAYER		861	A
8_PROFILE	1. LAYER	-4,06	322	C
	2. LAYER	-18,18	553	B
	3. LAYER		1060	A
9_PROFILE	1. LAYER	-6,76	429	B
	2. LAYER	-30,27	626	B
	3. LAYER		1142	A
10_PROFILE	1. LAYER	-2,92	242	C
	2. LAYER	-19,74	370	C
	3. LAYER		718	A
11_PROFILE	1. LAYER	-2,37	204	C
	2. LAYER	-16,01	307	C
	3. LAYER		639	B
12_PROFILE	1. LAYER	-2,89	297	C
	2. LAYER	-12,94	632	B
	3. LAYER		1172	A

S Wave Velocity (m/sec)	Ground group
Vs<200	D
200<Vs<400	C
400<Vs<700	B
700<Vs	A

Ground groups according to slip wave velocity(Abyyhy, 1998)

LAYERS	||AVERAGE|| DEPTH	Vs_ Velocity	GROUND GROUPS
1. LAYER	-4,07	278	C
2.LAYER	-19,31	520	B
3.LAYER	∞	986	A

S wave velocities of the grounds in the study area and ground group

Ground Group	Ground group and top ground layer thickness(h_1)
Z1	(A) Ground group h1< 15 m (B) Ground group
Z2	h_1> 15 m (B) Ground group h_1< 15 m (C) Ground group
Z3	15 m < h_1< 50 m (C) Ground group h_1< 10 m (D) Ground group
Z4	h_1> 50 m (C) Ground group h_1> 10 m (D) Ground group

Ground Group Class

The above table shows that Vs velocity values in the direction of the seismic data obtained in the field studies are the absolute change tables and that the layers are included in the ground groups.

5.18.3. WTG18 Vs30

PROFILES	Vs30 (m/sec)
1.PROFILE	447
2.PROFILE	598
3.PROFILE	441
4.PROFILE	473
5.PROFILE	507
6.PROFILE	772
7.PROFILE	504
8.PROFILE	582
9.PROFILE	656
10.PROFILE	400
11.PROFILE	340
12.PROFILE	647

Vs30 values in the direction of the seismic data obtained from the field studies are given in the table above.

5.18.4. WTG18 Shear Modulus-G (kg/cm²)

PROFILES	SHEAR MODULUS			
	LAYERS	DEPTH	G(kg/cm^2)	ENDURANCE
1_PROFILE	1. LAYER	-4,49	427	Weak
	2.LAYER	-30,37	4657	Sturdy
	3.LAYER		16682	Rock Highlid
2_PROFILE	1. LAYER	-8,86	3857	Sturdy
	2. LAYER	-20,30	5814	Sturdy
	3. LAYER		20817	Rock Highlid
3_PROFILE	1. LAYER	-2,49	579	Weak
	2. LAYER	-16,85	3897	Sturdy
	3. LAYER		14744	Rock Highlid
4_PROFILE	1. LAYER	-1,81	733	Weak
	2. LAYER	-12,26	3724	Sturdy
	3. LAYER		15574	Rock Highlid
5_PROFILE	1. LAYER	-2,65	1022	Weak
	2. LAYER	-17,94	5086	Sturdy
	3. LAYER		20367	Rock Highlid
6_PROFILE	1. LAYER	-3,31	2637	Medium
	2. LAYER	-22,43	12818	Rock Highlid
	3. LAYER		66639	Rock Highlid
7_PROFILE	1. LAYER	-6,28	1798	Medium
	2.LAYER	-14,39	5570	Sturdy
	3.LAYER		15458	Rock Highlid
8_PROFILE	1. LAYER	-4,06	1748	Medium
	2. LAYER	-18,18	5993	Sturdy
	3. LAYER		24560	Rock Highlid
9_PROFILE	1. LAYER	-6,76	3408	Sturdy
	2. LAYER	-30,27	7618	Sturdy
	3. LAYER		28833	Rock Highlid
10_PROFILE	1. LAYER	-2,92	1006	Weak
	2. LAYER	-19,74	2461	Medium
	3. LAYER		10337	Rock Highlid
11_PROFILE	1. LAYER	-2,37	783	Weak
	2. LAYER	-16,01	1715	Medium
	3. LAYER		7886	Sturdy
12_PROFILE	1. LAYER	-2,89	1449	Weak
	2. LAYER	-12,94	8147	Sturdy
	3. LAYER		30859	Rock Highlid

Shear Modulus (kg/cm²)	Dayanım
G<400	High Weak
400<G<1500	Weak
1500<G<3000	Medium
3000<G<10000	Sturdy
10000<G	Rock Highlid

The endurance of ground or rocks according to Slip Module values(Keçeli, 1990)

$G = (d*Vs^2)/100$

‖AVERAGE‖			
LAYERS	DEPTH	G (kg/cm²)	ENDURANCE
1. LAYER	-4,07	1620	Medium
2.LAYER	-19,31	5625	Sturdy
3.LAYER	∞	22730	Rock Highlid

Shear modules and endurance of the grounds in the study area

Calculation of shear Modulus values in the direction of the seismic data obtained in the field studies and the table of variation are given in the table above.

5.18.5. WTG18 Elasticity Modulus-E (kg/cm²)

ELASTIC MODULUS				
PROFILES	LAYERS	DEPTH	E(kg/cm²)	ENDURANCE
1_PROFILE	1. LAYER	-4,49	1117	Weak
	2.LAYER	-30,37	12260	Sturdy
	3.LAYER		46593	Rock Highlid
2_PROFILE	1. LAYER	-8,86	10832	Sturdy
	2. LAYER	-20,30	16041	Sturdy
	3. LAYER		57631	Rock Highlid
3_PROFILE	1. LAYER	-2,49	1481	Weak
	2. LAYER	-16,85	9822	Medium
	3. LAYER		40186	Rock Highlid
4_PROFILE	1. LAYER	-1,81	1912	Weak
	2. LAYER	-12,26	9743	Medium
	3. LAYER		43205	Rock Highlid
5_PROFILE	1. LAYER	-2,65	2670	Weak
	2. LAYER	-17,94	13299	Sturdy
	3. LAYER		56613	Rock Highlid
6_PROFILE	1. LAYER	-3,31	6907	Medium
	2. LAYER	-22,43	33614	Rock Highlid
	3. LAYER		180859	Rock Highlid
7_PROFILE	1. LAYER	-6,28	4978	Weak
	2.LAYER	-14,39	14837	Sturdy
	3.LAYER		43087	Rock Highlid
8_PROFILE	1. LAYER	-4,06	4885	Weak
	2. LAYER	-18,18	16059	Sturdy
	3. LAYER		68159	Rock Highlid
9_PROFILE	1. LAYER	-6,76	9438	Medium
	2. LAYER	-30,27	20810	Sturdy
	3. LAYER		79566	Rock Highlid
10_PROFILE	1. LAYER	-2,92	2657	Weak
	2. LAYER	-19,74	6655	Medium
	3. LAYER		28922	Sturdy
11_PROFILE	1. LAYER	-2,37	2169	Weak
	2. LAYER	-16,01	4622	Weak
	3. LAYER		21920	Sturdy
12_PROFILE	1. LAYER	-2,89	4073	Weak
	2. LAYER	-12,94	21543	Sturdy
	3. LAYER		85737	Rock Highlid

Elastic Modulus (kg/cm^2)	Dayanım
E<1000	High Weak
1000<E<5000	Weak
5000<E<10000	Medium
10000<E<30000	Sturdy
30000<E	Rock Highlid

The endurance of ground or rocks according to Slip Module values(Keçeli, 1990)

$E=G*(3*V_p^2-4*V_s^2)/(V_p^2-V_s^2)$

‖AVERAGE‖			
LAYERS	DEPTH	E (kg/cm^2)	ENDURANCE
1. LAYER	-4,07	4426	Weak
2.LAYER	-19,31	14942	Sturdy
3.LAYER	∞	62706	Rock Highlid

Elasticity modules and endurance of the grounds in the study area

Calculation of the modulus of elasticity in the direction of the seismic data obtained in the field studies and the change table are given in the above table

5.18.6. WTG18 Poisson's Ratio - (б)

POISSON'S RATIO				
PROFILES	LAYERS	DEPTH	(σ)	POROSITY
1_PROFILE	1. LAYER	-4,49	0,34	Medium Porous
	2.LAYER	-30,37	0,31	Medium Porous
	3.LAYER		0,40	High Porous
2_PROFILE	1. LAYER	-8,86	0,41	High Porous
	2. LAYER	-20,30	0,39	High Porous
	3. LAYER		0,38	High Porous
3_PROFILE	1. LAYER	-2,49	0,34	Medium Porous
	2. LAYER	-16,85	0,26	Medium Porous
	3. LAYER		0,36	High Porous
4_PROFILE	1. LAYER	-1,81	0,35	Medium Porous
	2. LAYER	-12,26	0,32	Medium Porous
	3. LAYER		0,39	High Porous
5_PROFILE	1. LAYER	-2,65	0,36	High Porous
	2. LAYER	-17,94	0,31	Medium Porous
	3. LAYER		0,39	High Porous
6_PROFILE	1. LAYER	-3,31	0,35	High Porous
	2. LAYER	-22,43	0,34	Medium Porous
	3. LAYER		0,36	High Porous
7_PROFILE	1. LAYER	-6,28	0,39	High Porous
	2.LAYER	-14,39	0,33	Medium Porous
	3.LAYER		0,39	High Porous
8_PROFILE	1. LAYER	-4,06	0,40	High Porous
	2. LAYER	-18,18	0,35	Medium Porous
	3. LAYER		0,39	High Porous
9_PROFILE	1. LAYER	-6,76	0,40	High Porous
	2. LAYER	-30,27	0,37	High Porous
	3. LAYER		0,38	High Porous
10_PROFILE	1. LAYER	-2,92	0,36	High Porous
	2. LAYER	-19,74	0,36	High Porous
	3. LAYER		0,40	High Porous
11_PROFILE	1. LAYER	-2,37	0,43	High Porous
	2. LAYER	-16,01	0,36	High Porous
	3. LAYER		0,39	High Porous
12_PROFILE	1. LAYER	-2,89	0,41	High Porous
	2. LAYER	-12,94	0,33	Medium Porous
	3. LAYER		0,39	High Porous

Poisson's Ratio;(σ)	Porosity
0,00≤σ≤0,25	Nonporous
0,26≤σ≤0,35	Medium Porous
0,36≤σ≤0,50	High Porous

Poisson ratio classification

$\sigma=(Vp^2-2*Vs^2)/(2*Vp^2-2*Vs^2)$

‖AVERAGE‖			
LAYERS	DEPTH	(σ)	POROSITY
1. LAYER	-4,07	0,38	High Porous
2.LAYER	-19,31	0,34	Medium Porous
3.LAYER	∞	0,38	High Porous

Poisson's ratio values of the units in the study area, porosity

Calculation of poisson's ratio values in the direction of the seismic data obtained in the field studies and the change table are given in the above table.

5.18.7. WTG18 Density - ρ (gr/ cm^3)

DENSITY				
PROFILES	LAYERS	DEPTH	ρ (gr/cm^3)	DEFINITION
1_PROFILE	1. LAYER	-4,49	1,32	Low
	2.LAYER	-30,37	1,72	Medium
	3.LAYER		2,11	High
2_PROFILE	1. LAYER	-8,86	1,81	Medium
	2. LAYER	-20,30	1,86	Medium
	3. LAYER		2,14	High
3_PROFILE	1. LAYER	-2,49	1,41	Medium
	2. LAYER	-16,85	1,63	Medium
	3. LAYER		2,03	High
4_PROFILE	1. LAYER	-1,81	1,45	Medium
	2. LAYER	-12,26	1,66	Medium
	3. LAYER		2,08	High
5_PROFILE	1. LAYER	-2,65	1,52	Medium
	2. LAYER	-17,94	1,71	Medium
	3. LAYER		2,15	High
6_PROFILE	1. LAYER	-3,31	1,67	Medium
	2. LAYER	-22,43	1,92	High
	3. LAYER		2,39	High
7_PROFILE	1. LAYER	-6,28	1,65	Medium
	2.LAYER	-14,39	1,79	Medium
	3.LAYER		2,09	High
8_PROFILE	1. LAYER	-4,06	1,66	Medium
	2. LAYER	-18,18	1,80	Medium
	3. LAYER		2,19	High
9_PROFILE	1. LAYER	-6,76	1,78	Medium
	2. LAYER	-30,27	1,90	High
	3. LAYER		2,21	High
10_PROFILE	1. LAYER	-2,92	1,51	Medium
	2. LAYER	-19,74	1,63	Medium
	3. LAYER		2,01	High
11_PROFILE	1. LAYER	-2,37	1,53	Medium
	2. LAYER	-16,01	1,57	Medium
	3. LAYER		1,93	High
12_PROFILE	1. LAYER	-2,89	1,63	Medium
	2. LAYER	-12,94	1,84	Medium
	3. LAYER		2,25	High

Density: ρ (gr/cm^3)	Tanımlama
ρ<1,20	High low
1,20<ρ<1,40	Low
1,40<ρ<1,90	Medium
1,90<ρ<2,20	High
2,20<ρ	Too High

Density Classification of Ground Units: (Keçeli, 1990)

*ρ =d=0.31*Vp0.25*

‖AVERAGE‖			
LAYERS	DEPTH	ρ (gr/cm^3)	DEFINITION
1. LAYER	-4,07	1,58	Medium
2.LAYER	-19,31	1,75	Medium
3.LAYER	∞	2,13	High

Density values and description of the units in the study area

Calculation of the density values of the geological units in the direction of the seismic data obtained in the field studies and the table of variation are given in the above table.

5.18.8. WTG18 Modulus of Subgrade Reaction – D Y K (ton/m^3)

Modulus of Subgrade Reaction			
PROFILES	LAYERS	DEPTH	D Y K (ton/m^3)
1_PROFILE	1. LAYER	-4,49	1145
	2.LAYER	-30,37	3671
	3.LAYER		7379
2_PROFILE	1. LAYER	-8,86	3451
	2. LAYER	-20,30	4175
	3. LAYER		8287
3_PROFILE	1. LAYER	-2,49	1305
	2. LAYER	-16,85	3303
	3. LAYER		6858
4_PROFILE	1. LAYER	-1,81	1494
	2. LAYER	-12,26	3197
	3. LAYER		7094
5_PROFILE	1. LAYER	-2,65	1699
	2. LAYER	-17,94	3757
	3. LAYER		8203
6_PROFILE	1. LAYER	-3,31	2741
	2. LAYER	-22,43	5913
	3. LAYER		15757
7_PROFILE	1. LAYER	-6,28	2347
	2.LAYER	-14,39	4139
	3.LAYER		7078
8_PROFILE	1. LAYER	-4,06	2319
	2. LAYER	-18,18	4162
	3. LAYER		9080
9_PROFILE	1. LAYER	-6,76	3187
	2. LAYER	-30,27	4828
	3. LAYER		9892
10_PROFILE	1. LAYER	-2,92	1698
	2. LAYER	-19,74	2674
	3. LAYER		5726
11_PROFILE	1. LAYER	-2,37	1441
	2. LAYER	-16,01	2192
	3. LAYER		4968
12_PROFILE	1. LAYER	-2,89	2129
	2. LAYER	-12,94	4828
	3. LAYER		10310

||AVERAGE||		
LAYERS	DEPTH	D Y K (ton/m^3)
1. LAYER	-4,07	2080
2.LAYER	-19,31	3903
3.LAYER	∞	8386
kv= 40*(Gs)*qu ton/m^3 *(Bowles 1984)*		

The above table shows the Modulus of Subgrade Reaction obtained for each layer in the direction of the data obtained after the seismic measurements made in the study area.

5.18.9. WTG18 Bearing Capacity qu (kg/cm2) / Allowable Bearing Capacity qa (kg/cm2)

PROFILES	LAYERS	DEPTH	BEARING	ALLOWABLE
1_PROFILE	1. LAYER	-4,49	2,86	0,95
	2.LAYER	-30,37	9,18	3,06
	3.LAYER	-19,63	18,45	6,15
2_PROFILE	1. LAYER	-8,86	8,63	2,88
	2. LAYER	-20,30	10,44	3,48
	3. LAYER	-29,70	20,72	6,91
3_PROFILE	1. LAYER	-2,49	3,26	1,09
	2. LAYER	-16,85	8,26	2,75
	3. LAYER	-33,15	17,14	5,71
4_PROFILE	1. LAYER	-1,81	3,74	1,25
	2. LAYER	-12,26	7,99	2,66
	3. LAYER	-37,74	17,73	5,91
5_PROFILE	1. LAYER	-2,65	4,25	1,42
	2. LAYER	-17,94	9,39	3,13
	3. LAYER	-32,06	20,51	6,84
6_PROFILE	1. LAYER	-3,31	6,85	2,28
	2. LAYER	-22,43	14,78	4,93
	3. LAYER	-27,57	39,39	13,13
7_PROFILE	1. LAYER	-6,28	5,87	1,96
	2.LAYER	-14,39	10,35	3,45
	3.LAYER	-35,61	17,69	5,90
8_PROFILE	1. LAYER	-4,06	5,80	1,93
	2. LAYER	-18,18	10,40	3,47
	3. LAYER	-31,82	22,70	7,57
9_PROFILE	1. LAYER	-6,76	7,97	2,66
	2. LAYER	-30,27	12,07	4,02
	3. LAYER	-19,73	24,73	8,24
10_PROFILE	1. LAYER	-2,92	4,24	1,41
	2. LAYER	-19,74	6,69	2,23
	3. LAYER	-30,26	14,32	4,77
11_PROFILE	1. LAYER	-2,37	3,60	1,20
	2. LAYER	-16,01	5,48	1,83
	3. LAYER	-33,99	12,42	4,14
12_PROFILE	1. LAYER	-2,89	5,32	1,77
	2. LAYER	-12,94	12,07	4,02
	3. LAYER	-37,06	25,77	8,59

||AVERAGE||		
LAYERS	DEPTH	Bearing Capacity (qu,kg/cm^2)
1. LAYER	-4,07	5,20
2.LAYER	-19,31	9,76
3.LAYER	∞	20,96
qu=(0,024*Vs*(J.B.K+0,002*Vp)*0,71)/G.K		

||AVERAGE||		
LAYERS	DEPTH	Allowable Bearing Capacity (qa,kg/cm^2)
1. LAYER	-4,07	1,73

2.LAYER	-19,31	3,25
3.LAYER	∞	6,99
qa=qu/G.K	G.K=3 empirical value	

5.18.10 WTG18 Vibration Period - T_0 (sec) / Ground Amplification (Ak)

PROFILES	To (sec)	Ta (sec)	Tb (sec)	Ak (Amplification)
1.PROFILE	0,40	0,27	0,61	1,75
2.PROFILE	0,28	0,19	0,42	1,47
3.PROFILE	0,35	0,23	0,53	1,76
4.PROFILE	0,31	0,21	0,47	1,69
5.PROFILE	0,31	0,21	0,47	1,62
6.PROFILE	0,21	0,14	0,31	1,26
7.PROFILE	0,30	0,20	0,46	1,63
8.PROFILE	0,27	0,18	0,41	1,49
9.PROFILE	0,29	0,19	0,43	1,39
10.PROFILE	0,41	0,27	0,61	1,87
11.PROFILE	0,45	0,30	0,68	2,06
12.PROFILE	0,23	0,15	0,34	1,40

AVERAGE			
To (sec)	Ta (sec)	Tb (sec)	Ak (Amplification)
0,32	0,21	0,48	1,61

$To = \sum 4H\ Vs\ n\ \iota$=1 (sec)……. (Zeevaert,1967)

Ak=68*$Vs_{30}^{-0,6}$……. (Midorikawa, 1987)

The Vibration Period and Ground Amplification calculated in the direction of the parameters obtained during the seismic studies made during the field survey are presented in the table above.

5. 19. WTG19

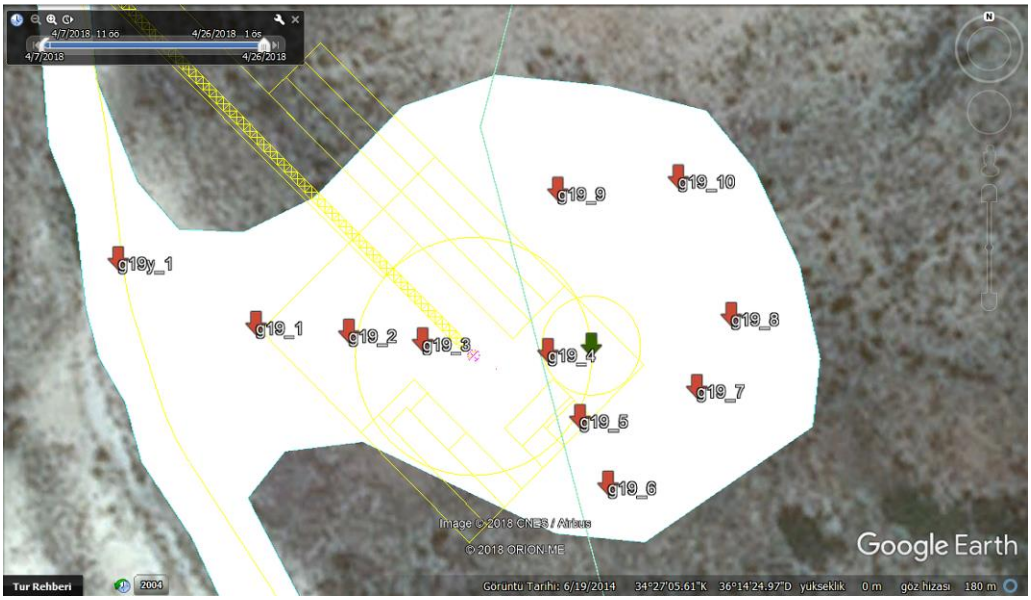
10 measurements were taken. These measurements showed 3 layers. Layer 1 was found to be between 0,00 m and 4,85 m in depth, Layer 2 was found between 4,85 m and 18,39 m in depth and Layer 3 was found at an average depth of 18,39 m. This layer is given in the following table.

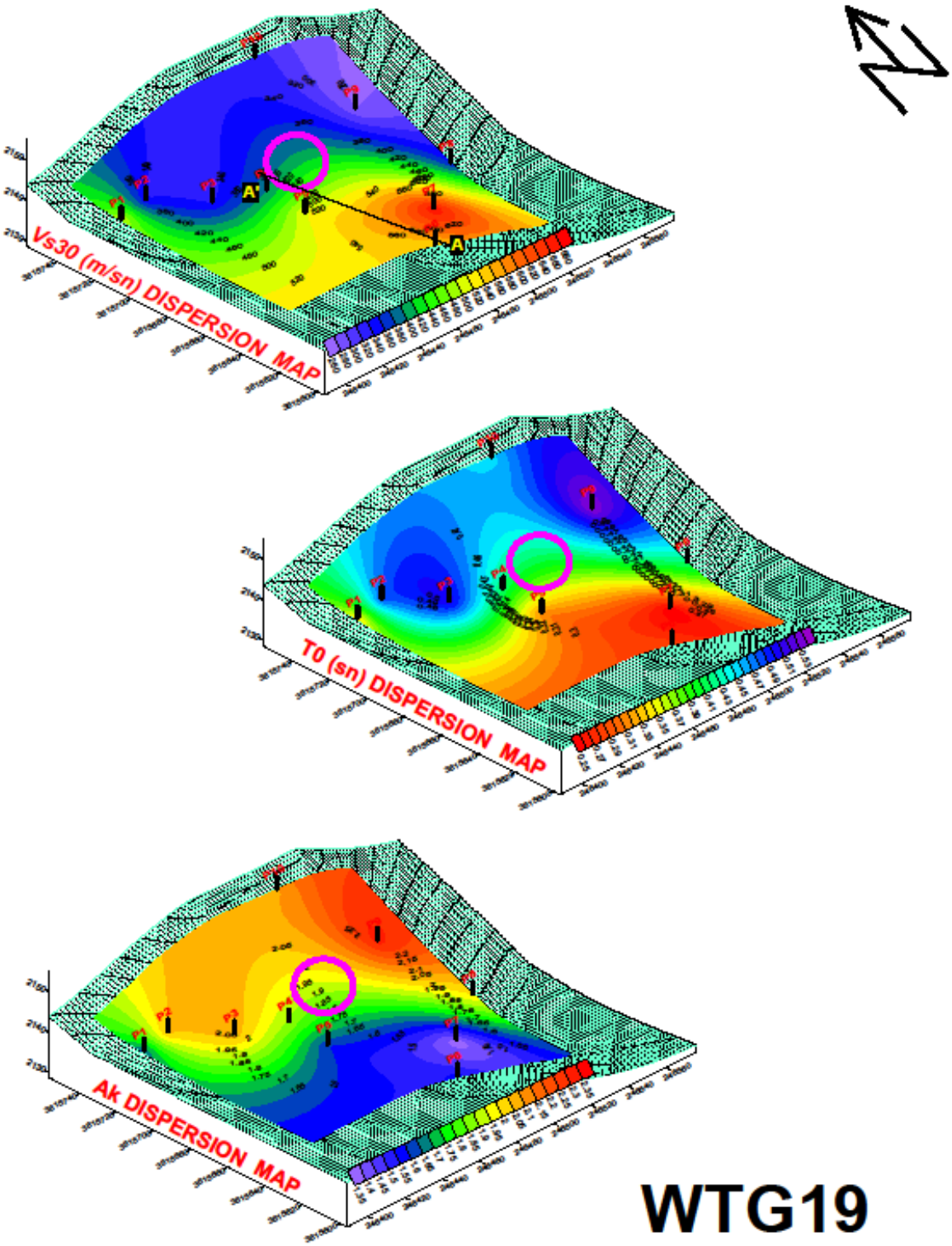
LAYERS	Vp_ Velocity	STRIPPABILITY
1. LAYER	626	Simple strippability
2.LAYER	899	Simple strippability
3.LAYER	1806	High-hard STRIPPABILITY
LAYERS	**Vs_ Velocity**	**GROUND GROUP**
1. LAYER	239	C
2.LAYER	422	B
3.LAYER	778	A
LAYERS	**G (kg/cm2)**	**ENDURANCE**
1. LAYER	1117	Weak
2.LAYER	3472	Sturdy
3.LAYER	13555	High sturdy
LAYERS	**E (kg/cm2)**	**ENDURANCE**
1. LAYER	3090	Weak
2.LAYER	9374	Medium
3.LAYER	37560	High sturdy

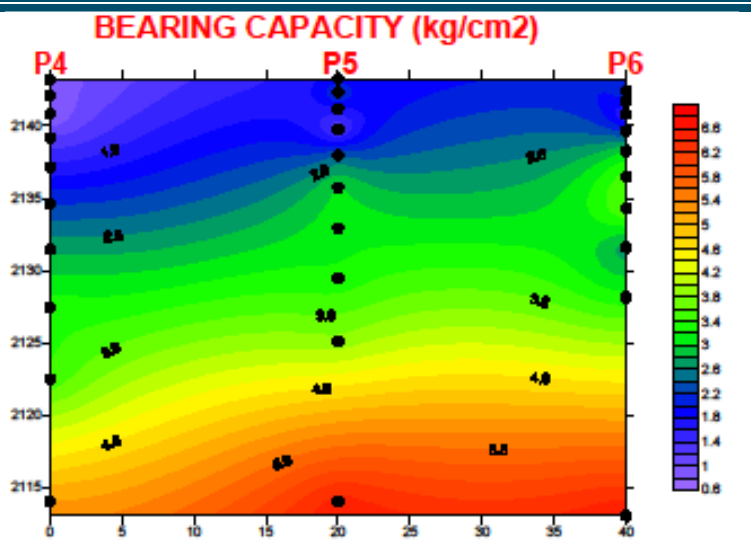
LAYERS	(σ)	POROSITY
1. LAYER	0,39	High Porosity
2.LAYER	0,35	Medium Porosity
3.LAYER	0,39	High Porosity
LAYERS	**ρ (gr/cm3)**	**DEFINITION**
1. LAYER	1,53	Medium
2.LAYER	1,68	Medium
3.LAYER	2,01	High
LAYERS	**D Y K (ton/m^3)**	
1. LAYER	1739	
2.LAYER	3106	
3.LAYER	6329	
LAYERS	**Ground Carrying Capacity (qu,kg/cm2)**	**Secure Carrying Capacity (qa,kg/cm2)**
1. LAYER	4,35	1,45
2.LAYER	7,76	2,59
3.LAYER	15,82	5,27

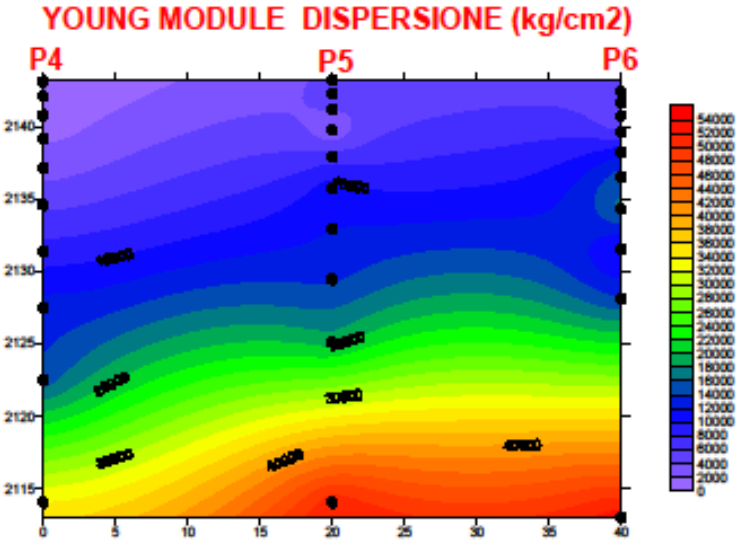
To (sec)	Ta (sec)	Tb (sec)	Vs30 (m/sec)	Ak (Amplification)
0,40	0,27	0,60	428	1,86

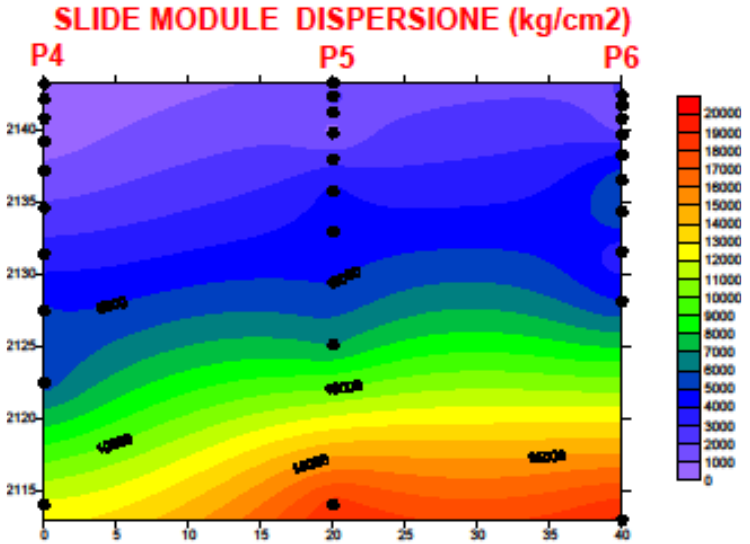
Because the first layer of the 3-4 and 8-9-10 profiles taken on the ground is very weak, the WTG should be removed from these points by shifting it between the profiles 5-6-7 of the center of gravity. Taking into account the following applications, the profile points should be seen in the engineering parameters section for detailed values.




Vs30 (m/sn) DISPERSION MAP
T0 (sn) DISPERSION MAP
Ak DISPERSION MAP
WTG19


BEARING CAPACITY (kg/cm2)
P4
P5
P6
2140
2135
2130
2125
2120
2115
0
5
10
15
20
25
30
35
40
6.6
6.2
5.8
5.4
5
4.6
4.2
3.8
3.4
3
2.6
2.2
1.8
1.4
1
0.6


YOUNG MODULE DISPERSIONE (kg/cm2)
P4
P5
P6
2140
2135
2130
2125
2120
2115
0
5
10
15
20
25
30
35
40
54000
52000
50000
48000
46000
44000
42000
40000
38000
36000
34000
32000
30000
28000
26000
24000
22000
20000
18000
16000
14000
12000
10000
8000
6000
4000
2000
0


SLIDE MODULE DISPERSIONE (kg/cm2)
P4
P5
P6
2140
2135
2130
2125
2120
2115
0
5
10
15
20
25
30
35
40
20000
19000
18000
17000
16000
15000
14000
13000
12000
11000
10000
9000
8000
7000
6000
5000
4000
3000
2000
1000
0

5.19.1. WTG19 Seismic P wave velocity (*Compressional Wave Velocity* (Vp))

PROFILES	LAYERS	DEPTH	Vp_ Velocity	STRIPPABILITY
		VD VELOCITY		
1_PROFILE	1. LAYER	-4,72	863	Simple Strippability
	2.LAYER	-21,13	1124	Simple Strippability
	3.LAYER		2017	High Difficult Strippability
2_PROFILE	1. LAYER	-8,50	611	Simple Strippability
	2. LAYER	-19,49	738	Simple Strippability
	3. LAYER		1406	Medium Strippability
3_PROFILE	1. LAYER	-7,41	477	Simple Strippability
	2. LAYER	-23,28	748	Simple Strippability
	3. LAYER		1470	Medium Strippability
4_PROFILE	1. LAYER	-3,18	326	High Simple Strippability
	2. LAYER	-21,52	755	Simple Strippability
	3. LAYER		1844	High Difficult Strippability
5_PROFILE	1. LAYER	-4,23	748	Simple Strippability
	2. LAYER	-18,92	1062	Simple Strippability
	3. LAYER		2205	Explosive
6_PROFILE	1. LAYER	-4,73	966	Simple Strippability
	2. LAYER	-14,87	1230	Medium Strippability
	3. LAYER		2188	Explosive
7_PROFILE	1. LAYER	-5,07	971	Simple Strippability
	2.LAYER	-22,71	1399	Medium Strippability
	3.LAYER		2867	Explosive
8_PROFILE	1. LAYER	-3,40	456	High Simple Strippability
	2. LAYER	-15,22	695	Simple Strippability
	3. LAYER		1533	High Difficult Strippability
9_PROFILE	1. LAYER	-4,29	427	High Simple Strippability
	2. LAYER	-13,47	584	Simple Strippability
	3. LAYER		1124	Simple Strippability
10_PROFILE	1. LAYER	-2,97	414	High Simple Strippability
	2. LAYER	-13,29	660	Simple Strippability
	3. LAYER		1409	Medium Strippability

P Wave Velocity (m/sec)	Strippability
Vp<458	High Simple Strippability
458<Vp<1220	Simple Strippability
1220<Vp<11525	Medium Strippability
1525<Vp<11830	Difficult Strippability
1830<Vp<12135	High Difficult Strippability
Vp>2135	Explosive Strippability

Strippability of floors with P wave velocity (Church, 1981)

LAYERS	DEPTH	Vp_ Velocity	STRIPPABILITY
	‖AVERAGE‖		
1. LAYER	-4,85	626	Simple Strippability
2.LAYER	-18,39	899	Simple Strippability
3.LAYER	∞	1806	High Difficult Strippability

P wave velocities of the grounds in the study area and strippability

The above table shows the change table and strippability properties of Vp velocity depth values in the direction of the seismic data obtained from the field studies.

5.19.2. WTG19 Seismic S wave velocity (*Transverse Wave Velocity* (Vs))

Vs VELOCITY				
PROFILES	LAYERS	DEPTH	Vs_ Velocity	GROUND GROUPS
1_PROFILE	1. LAYER	-4,72	307	C
	2.LAYER	-21,13	487	B
	3.LAYER		875	A
2_PROFILE	1. LAYER	-8,50	198	D
	2. LAYER	-19,49	393	C
	3. LAYER		604	B
3_PROFILE	1. LAYER	-7,41	199	D
	2. LAYER	-23,28	361	C
	3. LAYER		618	B
4_PROFILE	1. LAYER	-3,18	153	D
	2. LAYER	-21,52	402	B
	3. LAYER		774	A
5_PROFILE	1. LAYER	-4,23	290	C
	2. LAYER	-18,92	504	B
	3. LAYER		932	A
6_PROFILE	1. LAYER	-4,73	348	C
	2. LAYER	-14,87	516	B
	3. LAYER		952	A
7_PROFILE	1. LAYER	-5,07	374	C
	2.LAYER	-22,71	635	B
	3.LAYER		1239	A
8_PROFILE	1. LAYER	-3,40	168	D
	2. LAYER	-15,22	331	C
	3. LAYER		715	A
9_PROFILE	1. LAYER	-4,29	183	D
	2. LAYER	-13,47	256	C
	3. LAYER		492	B
10_PROFILE	1. LAYER	-2,97	168	D
	2. LAYER	-13,29	337	C
	3. LAYER		583	B

S Wave Velocity (m/sec)	Ground group
Vs<200	D
200<Vs<400	C
400<Vs<700	B
700<Vs	A

||AVERAGE||			
LAYERS	DEPTH	Vs_ Velocity	GROUND GROUPS
1. LAYER	-4,85	239	C
2.LAYER	-18,39	422	B
3.LAYER	∞	778	A

S wave velocities of the grounds in the study area and ground group

Ground Group	Ground group and top ground layer thickness(h_1)
Z1	**(A) Ground group h1< 15 m (B) Ground group**
Z2	**h_1> 15 m (B) Ground group h_1< 15 m (C) Ground group**
Z3	**15 m < h_1< 50 m (C) Ground group h_1< 10 m (D) Ground group**
Z4	**h_1> 50 m (C) Ground group h_1> 10 m (D) Ground group**

Ground Group Class

The above table shows that Vs velocity values in the direction of the seismic data obtained in the field studies are the absolute change tables and that the layers are included in the ground groups.

5.19.3. WTG19 Vs30

PROFILES	Vs30 (m/sec)
1.PROFILE	501
2.PROFILE	342
3.PROFILE	337
4.PROFILE	393
5.PROFILE	517
6.PROFILE	541
7.PROFILE	674
8.PROFILE	360
9.PROFILE	279
10.PROFILE	331

Vs30 values in the direction of the seismic data obtained from the field studies are given in the table above.

5.19.4. WTG19 Shear Modulus-G (kg/cm²)

SHEAR MODULUS				
PROFILES	LAYERS	DEPTH	G(kg/cm^2)	ENDURANCE
1_PROFILE	1. LAYER	-4,72	1686	Medium
	2.LAYER	-21,13	4443	Sturdy
	3.LAYER		15906	Rock Highlid
2_PROFILE	1. LAYER	-8,50	1106	Weak
	2. LAYER	-19,49	2576	Medium
	3. LAYER		6936	Sturdy
3_PROFILE	1. LAYER	-7,41	615	Weak
	2. LAYER	-23,28	2142	Medium
	3. LAYER		7331	Sturdy
4_PROFILE	1. LAYER	-3,18	318	High Weak
	2. LAYER	-21,52	2987	Medium
	3. LAYER		12175	Rock Highlid
5_PROFILE	1. LAYER	-4,23	1443	Weak
	2. LAYER	-18,92	4601	Sturdy
	3. LAYER		18468	Rock Highlid
6_PROFILE	1. LAYER	-4,73	2209	Medium
	2. LAYER	-14,87	4953	Sturdy
	3. LAYER		19210	Rock Highlid
7_PROFILE	1. LAYER	-5,07	2423	Medium
	2.LAYER	-22,71	8097	Sturdy
	3.LAYER		34822	Rock Highlid
8_PROFILE	1. LAYER	-3,40	411	Weak
	2. LAYER	-15,22	1916	Medium
	3. LAYER		9919	Sturdy
9_PROFILE	1. LAYER	-4,29	526	Weak
	2. LAYER	-13,47	1113	Weak
	3. LAYER		4339	Sturdy
10_PROFILE	1. LAYER	-2,97	429	Weak
	2. LAYER	-13,29	1890	Medium
	3. LAYER		6444	Sturdy

Shear Modulus (kg/cm^2)	Dayanım
G<400	High Weak
400<G<1500	Weak
1500<G<3000	Medium
3000<G<10000	Sturdy
10000<G	Rock Highlid

The endurance of ground or rocks according to Slip Module values(Keçeli, 1990) G =(d*Vs2)/100

||AVERAGE||			
LAYERS	DEPTH	G (kg/cm^2)	ENDURANCE
1. LAYER	-4,85	1117	Weak
2.LAYER	-18,39	3472	Sturdy
3.LAYER	∞	13555	Rock Highlid

Shear modules and endurance of the grounds in the study area

Calculation of shear Modulus values in the direction of the seismic data obtained in the field studies and the table of variation are given in the table above.

5.19.5. WTG19 Elasticity Modulus-E (kg/cm²)

ELASTIC MODULUS				
PROFILES	LAYERS	DEPTH	E(kg/cm^2)	ENDURANCE
1_PROFILE	1. LAYER	-4,72	4696	Weak
	2.LAYER	-21,13	12140	Sturdy
	3.LAYER		44032	Rock Highlid
2_PROFILE	1. LAYER	-8,50	2960	Weak
	2. LAYER	-19,49	6705	Medium
	3. LAYER		19236	Sturdy
3_PROFILE	1. LAYER	-7,41	1664	Weak
	2. LAYER	-23,28	5776	Medium
	3. LAYER		20420	Sturdy
4_PROFILE	1. LAYER	-3,18	832	High Weak
	2. LAYER	-21,52	7753	Medium
	3. LAYER		33919	Rock Highlid
5_PROFILE	1. LAYER	-4,23	3982	Weak
	2. LAYER	-18,92	12468	Sturdy
	3. LAYER		51384	Rock Highlid
6_PROFILE	1. LAYER	-4,73	6182	Medium
	2. LAYER	-14,87	13650	Sturdy
	3. LAYER		53147	Rock Highlid
7_PROFILE	1. LAYER	-5,07	6842	Medium
	2.LAYER	-22,71	22136	Sturdy
	3.LAYER		96469	Rock Highlid
8_PROFILE	1. LAYER	-3,40	1158	Weak
	2. LAYER	-15,22	5126	Medium
	3. LAYER		26998	Sturdy
9_PROFILE	1. LAYER	-4,29	1424	Weak
	2. LAYER	-13,47	2995	Weak
	3. LAYER		11991	Sturdy
10_PROFILE	1. LAYER	-2,97	1163	Weak
	2. LAYER	-13,29	4995	Weak
	3. LAYER		18005	Sturdy

Elastic Modulus (kg/cm^2)	Dayanım
E<1000	High Weak
1000<E<5000	Weak
5000<E<10000	Medium
10000<E<30000	Sturdy
30000<E	Rock Highlid

The endurance of ground or rocks according to Slip Module values(Keçeli, 1990)

$E=G*(3*V_p^2-4*V_s^2)/(V_p^2-V_s^2)$

||AVERAGE||		
LAYERS	DEPTH	E (kg/cm^2)	ENDURANCE
1. LAYER	-4,85	3090	Weak
2.LAYER	-18,39	9374	Medium
3.LAYER	∞	37560	Rock Highlid

Elasticity modules and endurance of the grounds in the study area

Calculation of the modulus of elasticity in the direction of the seismic data obtained in the field studies and the change table are given in the above table

5.19.6. WTG19 Poisson's Ratio - (б)

POISSON'S RATIO				
PROFILES	LAYERS	DEPTH	(σ)	POROSITY
1_PROFILE	1. LAYER	-4,72	0,42	High Porous
	2.LAYER	-21,13	0,38	High Porous
	3.LAYER		0,38	High Porous
2_PROFILE	1. LAYER	-8,50	0,37	High Porous
	2. LAYER	-19,49	0,30	Medium Porous
	3. LAYER		0,39	High Porous
3_PROFILE	1. LAYER	-7,41	0,38	High Porous
	2. LAYER	-23,28	0,34	Medium Porous
	3. LAYER		0,39	High Porous
4_PROFILE	1. LAYER	-3,18	0,33	Medium Porous
	2. LAYER	-21,52	0,30	Medium Porous
	3. LAYER		0,39	High Porous
5_PROFILE	1. LAYER	-4,23	0,40	High Porous
	2. LAYER	-18,92	0,35	Medium Porous
	3. LAYER		0,39	High Porous
6_PROFILE	1. LAYER	-4,73	0,42	High Porous
	2. LAYER	-14,87	0,39	High Porous
	3. LAYER		0,38	High Porous
7_PROFILE	1. LAYER	-5,07	0,41	High Porous
	2.LAYER	-22,71	0,37	High Porous
	3.LAYER		0,39	High Porous
8_PROFILE	1. LAYER	-3,40	0,42	High Porous
	2. LAYER	-15,22	0,35	High Porous
	3. LAYER		0,36	High Porous
9_PROFILE	1. LAYER	-4,29	0,38	High Porous
	2. LAYER	-13,47	0,38	High Porous
	3. LAYER		0,38	High Porous
10_PROFILE	1. LAYER	-2,97	0,39	High Porous
	2. LAYER	-13,29	0,32	Medium Porous
	3. LAYER		0,40	High Porous

Poisson's Ratio;(σ)	Porosity
$0,00 \leq \sigma \leq 0,25$	Nonporous
$0,26 \leq \sigma \leq 0,35$	Medium Porous
$0,36 \leq \sigma \leq 0,50$	High Porous

Poisson ratio classification

$\sigma=(Vp^2-2*Vs^2)/(2*Vp^2-2*Vs^2)$

‖AVERAGE‖			
LAYERS	DEPTH	(σ)	POROSITY
1. LAYER	-4,85	0,39	High Porous
2.LAYER	-18,39	0,35	Medium Porous
3.LAYER	∞	0,39	High Porous

Poisson's ratio values of the units in the study area, porosity

Calculation of poisson's ratio values in the direction of the seismic data obtained in the field studies and the change table are given in the above table.

5.19.7. WTG19 Density - ρ (gr/ cm^3)

DENSITY				
PROFILES	LAYERS	DEPTH	ρ (gr/cm^3)	DEFINITION
1_PROFILE	1. LAYER	-4,72	1,68	Medium
	2.LAYER	-21,13	1,79	Medium
	3.LAYER		2,08	High
2_PROFILE	1. LAYER	-8,50	1,54	Medium
	2. LAYER	-19,49	1,61	Medium
	3. LAYER		1,90	Medium
3_PROFILE	1. LAYER	-7,41	1,45	Medium
	2. LAYER	-23,28	1,62	Medium
	3. LAYER		1,92	High
4_PROFILE	1. LAYER	-3,18	1,32	Low
	2. LAYER	-21,52	1,61	Medium
	3. LAYER		2,03	High
5_PROFILE	1. LAYER	-4,23	1,62	Medium
	2. LAYER	-18,92	1,76	Medium
	3. LAYER		2,12	High
6_PROFILE	1. LAYER	-4,73	1,73	Medium
	2. LAYER	-14,87	1,84	Medium
	3. LAYER		2,12	High
7_PROFILE	1. LAYER	-5,07	1,73	Medium
	2.LAYER	-22,71	1,89	Medium
	3.LAYER		2,27	High
8_PROFILE	1. LAYER	-3,40	1,43	Medium
	2. LAYER	-15,22	1,59	Medium
	3. LAYER		1,94	High
9_PROFILE	1. LAYER	-4,29	1,41	Medium
	2. LAYER	-13,47	1,52	Medium
	3. LAYER		1,79	Medium
10_PROFILE	1. LAYER	-2,97	1,40	Low
	2. LAYER	-13,29	1,56	Medium
	3. LAYER		1,90	Medium

Density: ρ (gr/cm^3)	Tanımlama
ρ<1,20	High low
1,20<ρ<1,40	Low
1,40<ρ<1,90	Medium
1,90<ρ<2,20	High
2,20<ρ	Too High

Density Classification of Ground Units: (Keçeli, 1990)

$\rho = d = 0.31 * Vp0.25$

||AVERAGE||			
LAYERS	DEPTH	ρ (gr/cm^3)	DEFINITION
1. LAYER	-4,85	1,53	Medium
2.LAYER	-18,39	1,68	Medium
3.LAYER	∞	2,01	High

Density values and description of the units in the study area

Calculation of the density values of the geological units in the direction of the seismic data obtained in the field studies and the table of variation are given in the above table.

5.19.8. WTG19 Modulus of Subgrade Reaction – D Y K (ton/m^3)

Modulus of Subgrade Reaction			
PROFILES	LAYERS	DEPTH	D Y K (ton/m^3)
1_PROFILE	1. LAYER	-4,72	2223
	2.LAYER	-21,13	3638
	3.LAYER		7169
2_PROFILE	1. LAYER	-8,50	1796
	2. LAYER	-19,49	2817
	3. LAYER		4651
3_PROFILE	1. LAYER	-7,41	1382
	2. LAYER	-23,28	2584
	3. LAYER		4787
4_PROFILE	1. LAYER	-3,18	1043
	2. LAYER	-21,52	2906
	3. LAYER		6233
5_PROFILE	1. LAYER	-4,23	2075
	2. LAYER	-18,92	3743
	3. LAYER		7783
6_PROFILE	1. LAYER	-4,73	2551
	2. LAYER	-14,87	3895
	3. LAYER		7932
7_PROFILE	1. LAYER	-5,07	2743
	2.LAYER	-22,71	4910
	3.LAYER		11013
8_PROFILE	1. LAYER	-3,40	1161
	2. LAYER	-15,22	2363
	3. LAYER		5576
9_PROFILE	1. LAYER	-4,29	1266
	2. LAYER	-13,47	1803
	3. LAYER		3669
10_PROFILE	1. LAYER	-2,97	1155
	2. LAYER	-13,29	2398
	3. LAYER		4483

||AVERAGE||		
LAYERS	DEPTH	D Y K (ton/m^3)
1. LAYER	-4,85	1739
2.LAYER	-18,39	3106
3.LAYER	∞	6329
kv= 40*(Gs)*qu ton/m^3 *(Bowles 1984)*		

The above table shows the Modulus of Subgrade Reaction obtained for each layer in the direction of the data obtained after the seismic measurements made in the study area.

5.19.9. WTG19 Bearing Capacity qu (kg/cm2) / Allowable Bearing Capacity qa (kg/cm2)

PROFILES	LAYERS	DEPTH	BEARING CAPACITY (qu,kg/cm^2)	ALLOWABLE BEARING CAPACITY (qa,kg/cm^2)
1_PROFILE	1. LAYER	-4,72	5,56	1,85
	2.LAYER	-21,13	9,09	3,03
	3.LAYER	-28,87	17,92	5,97
2_PROFILE	1. LAYER	-8,50	4,49	1,50
	2. LAYER	-19,49	7,04	2,35
	3. LAYER	-30,51	11,63	3,88
3_PROFILE	1. LAYER	-7,41	3,45	1,15
	2. LAYER	-23,28	6,46	2,15
	3. LAYER	-26,72	11,97	3,99
4_PROFILE	1. LAYER	-3,18	2,61	0,87
	2. LAYER	-21,52	7,27	2,42
	3. LAYER	-28,48	15,58	5,19
5_PROFILE	1. LAYER	-4,23	5,19	1,73
	2. LAYER	-18,92	9,36	3,12
	3. LAYER	-31,08	19,46	6,49
6_PROFILE	1. LAYER	-4,73	6,38	2,13
	2. LAYER	-14,87	9,74	3,25
	3. LAYER	-35,13	19,83	6,61
7_PROFILE	1. LAYER	-5,07	6,86	2,29
	2.LAYER	-22,71	12,27	4,09
	3.LAYER	-27,29	27,53	9,18
8_PROFILE	1. LAYER	-3,40	2,90	0,97
	2. LAYER	-15,22	5,91	1,97
	3. LAYER	-34,78	13,94	4,65
9_PROFILE	1. LAYER	-4,29	3,16	1,05
	2. LAYER	-13,47	4,51	1,50
	3. LAYER	-36,53	9,17	3,06
10_PROFILE	1. LAYER	-2,97	2,89	0,96
	2. LAYER	-13,29	6,00	2,00
	3. LAYER	-36,71	11,21	3,74

‖AVERAGE‖		
LAYERS	DEPTH	Bearing Capacity (qu,kg/cm^2)
1. LAYER	-4,85	4,35
2.LAYER	-18,39	7,76
3.LAYER	∞	15,82
qu=(0,024*Vs*(J.B.K+0,002*Vp)*0,71)/G.K		

‖AVERAGE‖		
LAYERS	DEPTH	Allowable Bearing Capacity (qa,kg/cm^2)
1. LAYER	-4,85	1,45
2.LAYER	-18,39	2,59
3.LAYER	∞	5,27
qa=qu/G.K	G.K=3 empirical value	

5.19.10 WTG19 Vibration Period - T_0 (sec) / Ground Amplification (Ak)

PROFILES	To (sec)	Ta (sec)	Tb (sec)	Vs30 (m/sec)	Ak (Amplification)
1.PROFILE	0,34	0,22	0,50	501	1,63
2.PROFILE	0,48	0,32	0,72	342	2,05
3.PROFILE	0,51	0,34	0,76	337	2,07
4.PROFILE	0,42	0,28	0,62	393	1,89
5.PROFILE	0,31	0,21	0,47	517	1,60
6.PROFILE	0,28	0,19	0,43	541	1,56
7.PROFILE	0,25	0,17	0,38	674	1,37
8.PROFILE	0,42	0,28	0,63	360	1,99
9.PROFILE	0,54	0,36	0,81	279	2,32
10.PROFILE	0,45	0,30	0,68	331	2,09

AVERAGE			
To (sec)	Ta (sec)	Tb (sec)	Ak (Amplification)
0,40	0,27	0,60	1,86

$To = \sum 4H\ Vs\ n\ \iota$=1 (sec)… (Zeevaert,1967)

$Ak=68*Vs_{30}^{-0,6}$…… (Midorikawa, 1987)

The Vibration Period and Ground Amplification calculated in the direction of the parameters obtained during the seismic studies made during the field survey are presented in the table above.

5. 20. WTG20

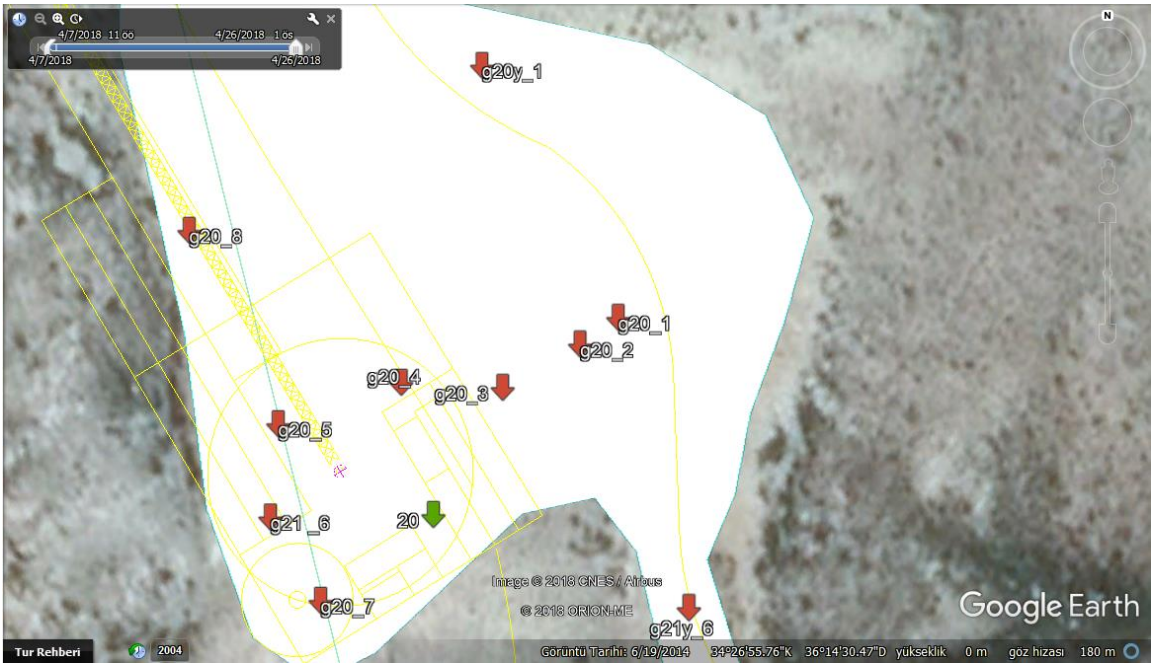
12 measurements were taken. These measurements showed 3 layers. Layer 1 was found between 0,00 m and 4,06 m depths, Layer 2 between 4,06 m and 17,39 m depths and Layer 3 at a depth of 17,39 m. The parameters of this layer are given in the table below.

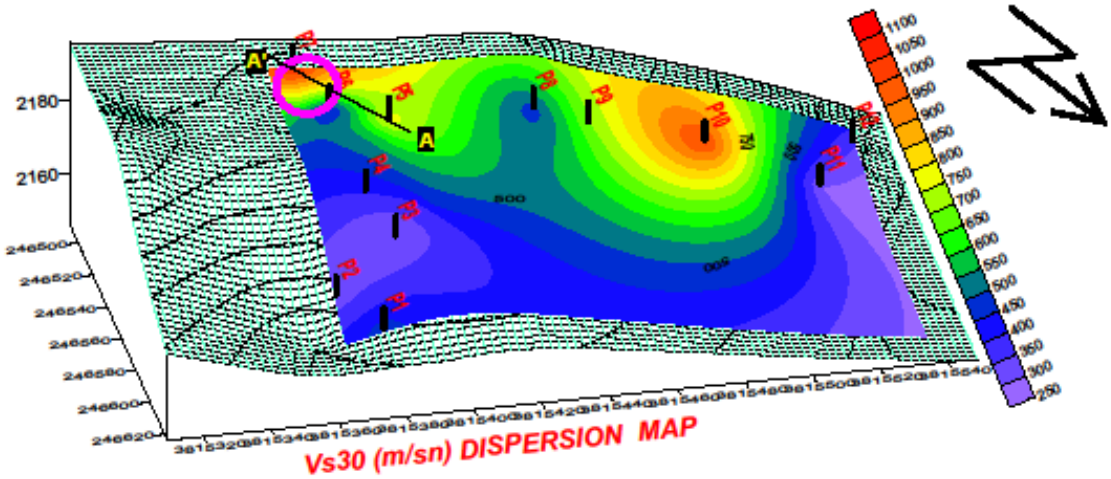
LAYERS	*Vp_ Velocity*	*STRIPPABILITY*
1. LAYER	*691*	*Simple strippability*
2.LAYER	*1122*	*Simple strippability*
3.LAYER	*2403*	*Explosive*
LAYERS	*Vs_ Velocity*	*GROUND GROUP*
1. LAYER	*286*	*C*
2.LAYER	*561*	*B*
3.LAYER	*1037*	*A*
LAYERS	*G (kg/cm2)*	*ENDURANCE*
1. LAYER	*1904*	*Medium*
2.LAYER	*8075*	*Sturdy*
3.LAYER	*32101*	*High sturdy*
LAYERS	*E (kg/cm2)*	*ENDURANCE*
1. LAYER	*5208*	*Medium*
2.LAYER	*21347*	*Sturdy*
3.LAYER	*88469*	*High sturdy*

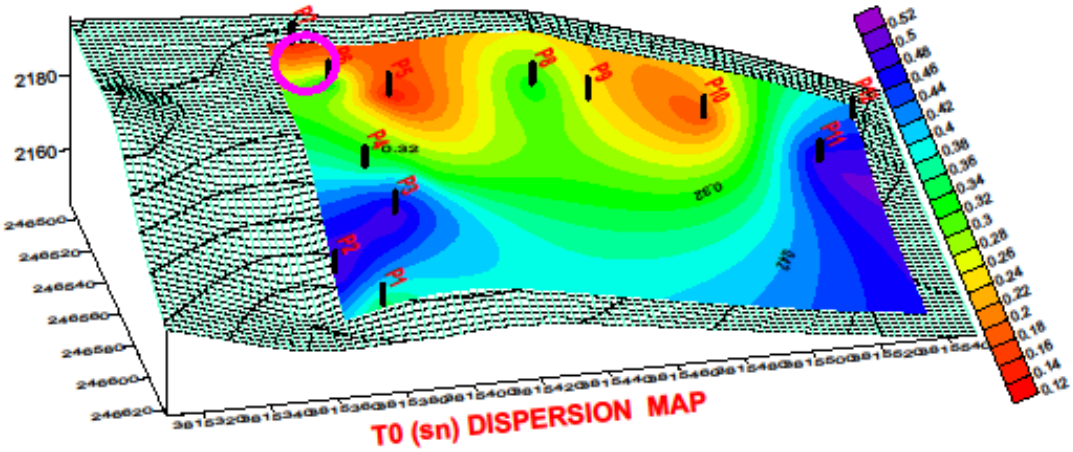
LAYERS	(σ)	POROSITY
1. LAYER	0,38	High Porosity
2.LAYER	0,33	Medium Porosity
3.LAYER	0,39	High Porosity
LAYERS	ρ (gr/cm3)	DEFINITION
1. LAYER	1,55	Medium
2.LAYER	1,75	Medium
3.LAYER	2,13	High
LAYERS	D Y K (ton/m^3)	
1. LAYER	2081	
2.LAYER	4331	
3.LAYER	9316	
LAYERS	Ground Carrying Capacity (qu,kg/cm2)	Secure Carrying Capacity (qa,kg/cm2)
1. LAYER	5,20	1,73
2.LAYER	10,83	3,61
3.LAYER	23,29	7,76

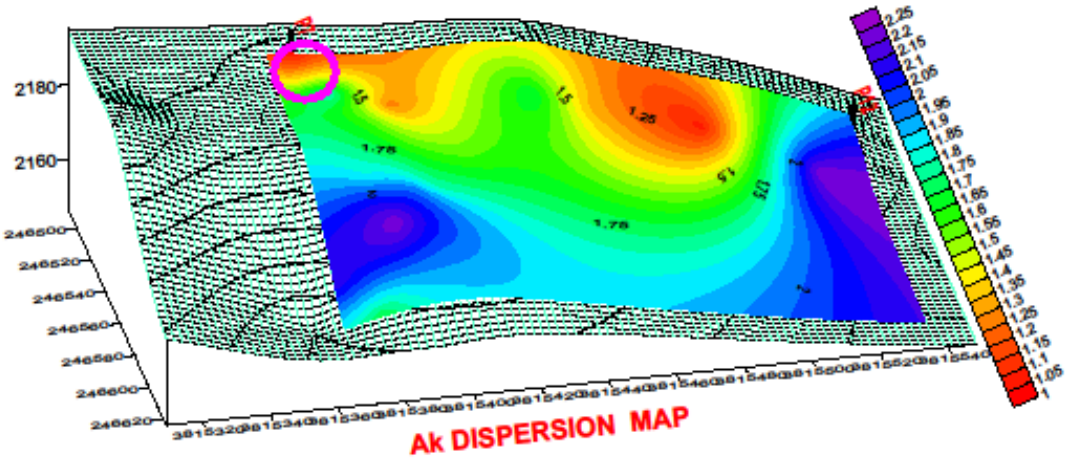
To (sec)	Ta (sec)	Tb (sec)	Vs30 (m/sec)	Ak (Amplification)
0,34	0,23	0,51	548	1,70

Taking into consideration the following applications, the profile points should be seen in the engineering parameters section for detailed values.

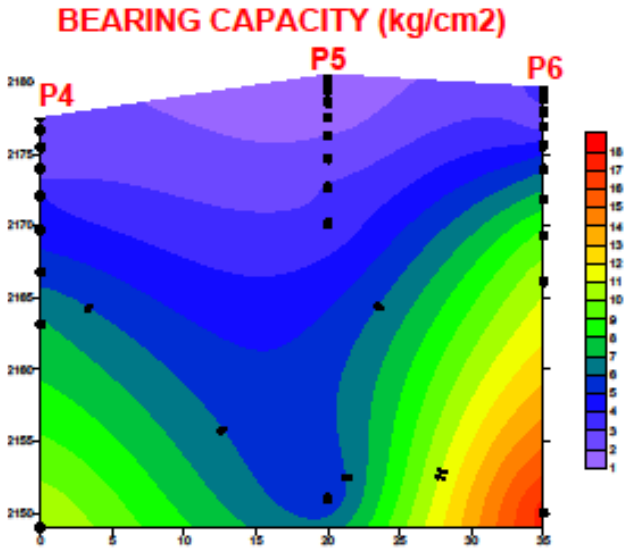


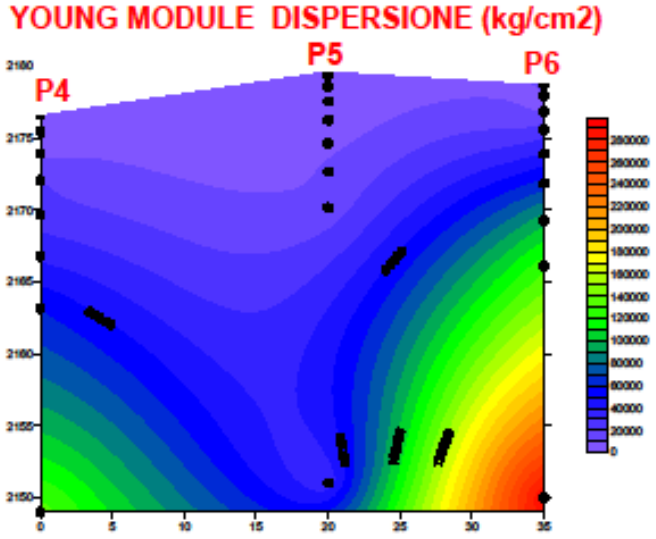

Vs30 (m/sn) DISPERSION MAP

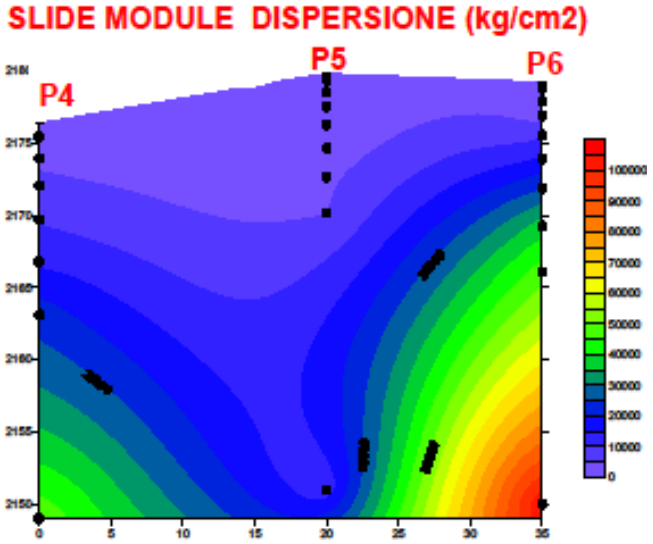

T0 (sn) DISPERSION MAP


Ak DISPERSION MAP

WTG20


BEARING CAPACITY (kg/cm2)
P4
P5
P6


YOUNG MODULE DISPERSIONE (kg/cm2)
P4
P5
P6


SLIDE MODULE DISPERSIONE (kg/cm2)
P4
P5
P6

5.20.1. WTG20 Seismic P wave velocity (*Compressional Wave Velocity* (Vp))

PROFILES	LAYERS	DEPTH	Vp_ Velocity	STRIPPABILITY
		VP VELOCITY		
1_PROFILE	1. LAYER	-2,94	663	Simple Strippability
	2.LAYER	-19,90	901	Simple Strippability
	3.LAYER		1974	High Difficult Strippability
2_PROFILE	1. LAYER	-4,08	437	High Simple Strippability
	2. LAYER	-18,24	667	Simple Strippability
	3. LAYER		1371	Medium Strippability
3_PROFILE	1. LAYER	-2,65	347	High Simple Strippability
	2. LAYER	-11,86	595	Simple Strippability
	3. LAYER		1248	Medium Strippability
4_PROFILE	1. LAYER	-3,37	474	Simple Strippability
	2. LAYER	-10,59	819	Simple Strippability
	3. LAYER		1719	High Difficult Strippability
5_PROFILE	1. LAYER	-5,05	1094	Simple Strippability
	2. LAYER	-15,87	1572	High Difficult Strippability
	3. LAYER		3342	Explosive
6_PROFILE	1. LAYER	-3,45	537	Simple Strippability
	2. LAYER	-10,83	906	Simple Strippability
	3. LAYER		1799	High Difficult Strippability
7_PROFILE	1. LAYER	-3,11	1041	Simple Strippability
	2.LAYER	-13,92	2039	High Difficult Strippability
	3.LAYER		4744	Explosive
8_PROFILE	1. LAYER	-3,72	567	Simple Strippability
	2. LAYER	-16,65	983	Simple Strippability
	3. LAYER		2065	High Difficult Strippability
9_PROFILE	1. LAYER	-6,26	896	Simple Strippability
	2. LAYER	-28,03	1471	Medium Strippability
	3. LAYER		3122	Explosive
10_PROFILE	1. LAYER	-7,02	1620	High Difficult Strippability
	2. LAYER	-31,42	2164	Explosive
	3. LAYER		4355	Explosive
11_PROFILE	1. LAYER	-3,03	259	High Simple Strippability
	2. LAYER	-13,58	605	Simple Strippability
	3. LAYER		1387	Medium Strippability
12_PROFILE	1. LAYER	-3,98	361	High Simple Strippability
	2. LAYER	-17,82	738	Simple Strippability
	3. LAYER		1715	High Difficult Strippability

Vp<458	High Simple Strippability
458<Vp<1220	Simple Strippability
1220<Vp<11525	Medium Strippability
1525<Vp<11830	Difficult Strippability
1830<Vp<12135	High Difficult Strippability
Vp>2135	Explosive Strippability

Strippability of floors with P wave velocity (Church, 1981)

LAYERS	DEPTH	Vp_ Velocity	STRIPPABILITY
	||AVERAGE||		
1. LAYER	-4,06	691	Simple Strippability
2.LAYER	-17,39	1122	Simple Strippability
3.LAYER	∞	2403	Explosive

P wave velocities of the grounds in the study area and strippability

The above table shows the change table and strippability properties of Vp velocity depth values in the direction of the seismic data obtained from the field studies.

5.20.2. WTG20 Seismic S wave velocity (*Transverse Wave Velocity* (Vs))

Vs VELOCITY				
PROFILES	LAYERS	DEPTH	Vs_ Velocity	GROUND GROUPS
1_PROFILE	1. LAYER	-2,94	293	C
	2.LAYER	-19,90	412	B
	3.LAYER		854	A
2_PROFILE	1. LAYER	-4,08	173	D
	2. LAYER	-18,24	304	C
	3. LAYER		570	B
3_PROFILE	1. LAYER	-2,65	133	D
	2. LAYER	-11,86	294	C
	3. LAYER		522	B
4_PROFILE	1. LAYER	-3,37	203	C
	2. LAYER	-10,59	424	B
	3. LAYER		723	A
5_PROFILE	1. LAYER	-5,05	406	B
	2. LAYER	-15,87	807	A
	3. LAYER		1434	A
6_PROFILE	1. LAYER	-3,45	209	C
	2. LAYER	-10,83	445	B
	3. LAYER		753	A
7_PROFILE	1. LAYER	-3,11	464	B
	2.LAYER	-13,92	1083	A
	3.LAYER		2013	A
8_PROFILE	1. LAYER	-3,72	247	C
	2. LAYER	-16,65	496	B
	3. LAYER		835	A
9_PROFILE	1. LAYER	-6,26	404	B
	2. LAYER	-28,03	760	A
	3. LAYER		1356	A
10_PROFILE	1. LAYER	-7,02	624	B
	2. LAYER	-31,42	1022	A
	3. LAYER		2100	A
11_PROFILE	1. LAYER	-3,03	120	D
	2. LAYER	-13,58	307	C
	3. LAYER		571	B
12_PROFILE	1. LAYER	-3,98	158	D
	2. LAYER	-17,82	377	C
	3. LAYER		708	A

S Wave Velocity (m/sec)	Ground group
Vs<200	D
200<Vs<400	C
400<Vs<700	B
700<Vs	A

Ground groups according to slip wave velocity(Abyyhy, 1998)

||AVERAGE||			
LAYERS	DEPTH	Vs_ Velocity	GROUND GROUPS
1. LAYER	-4,06	286	C
2.LAYER	-17,39	561	B
3.LAYER	∞	1037	A

S wave velocities of the grounds in the study area and ground group

Ground Group	Ground group and top ground layer thickness(h_1)
Z1	(A) Ground group h1< 15 m (B) Ground group
Z2	h_1> 15 m (B) Ground group h_1< 15 m (C) Ground group
Z3	15 m < h_1< 50 m (C) Ground group h_1< 10 m (D) Ground group
Z4	h_1> 50 m (C) Ground group h_1> 10 m (D) Ground group

Ground Group Class

The above table shows that Vs velocity values in the direction of the seismic data obtained in the field studies are the absolute change tables and that the layers are included in the ground groups.

5.20.3. WTG20 Vs30

PROFILES	Vs30 (m/sec)
1.PROFILE	477
2.PROFILE	320
3.PROFILE	295
4.PROFILE	401
5.PROFILE	771
6.PROFILE	426
7.PROFILE	1062
8.PROFILE	469
9.PROFILE	688
10.PROFILE	1011
11.PROFILE	298
12.PROFILE	353

Vs30 values in the direction of the seismic data obtained from the field studies are given in the table above.

5.20.4. WTG20 Shear Modulus-G (kg/cm²)

SHEAR MODULUS				
PROFILES	LAYERS	DEPTH	G(kg/cm^2)	ENDURANCE
1_PROFILE	1. LAYER	-2,94	1352	Weak
	2.LAYER	-19,90	3299	Sturdy
	3.LAYER		15070	Rock Highlid
2_PROFILE	1. LAYER	-4,08	450	Weak
	2. LAYER	-18,24	1583	Medium
	3. LAYER		6126	Sturdy
3_PROFILE	1. LAYER	-2,65	237	High Weak
	2. LAYER	-11,86	1411	Weak
	3. LAYER		5013	Sturdy
4_PROFILE	1. LAYER	-3,37	630	Weak
	2. LAYER	-10,59	3140	Sturdy
	3. LAYER		10427	Rock Highlid
5_PROFILE	1. LAYER	-5,05	2965	Medium
	2. LAYER	-15,87	13339	High Weak
	3. LAYER		48475	High Weak
6_PROFILE	1. LAYER	-3,45	654	Weak
	2. LAYER	-10,83	3483	Sturdy
	3. LAYER		11435	Rock Highlid
7_PROFILE	1. LAYER	-3,11	3991	Sturdy
	2.LAYER	-13,92	26616	Rock Highlid
	3.LAYER		104261	Rock Highlid
8_PROFILE	1. LAYER	-3,72	1019	Weak
	2. LAYER	-16,65	4513	Sturdy
	3. LAYER		14577	Rock Highlid
9_PROFILE	1. LAYER	-6,26	3103	Sturdy
	2. LAYER	-28,03	12108	Rock Highlid
	3. LAYER		42637	Rock Highlid
10_PROFILE	1. LAYER	-7,02	7899	Sturdy
	2. LAYER	-31,42	23387	Rock Highlid
	3. LAYER		111013	Rock Highlid
11_PROFILE	1. LAYER	-3,03	188	High Weak
	2. LAYER	-13,58	1550	Medium
	3. LAYER		6174	Sturdy
12_PROFILE	1. LAYER	-3,98	364	High Weak
	2. LAYER	-17,82	2468	Medium
	3. LAYER		10007	Rock Highlid

Shear Modulus (kg/cm²)	Dayanım
G<400	High Weak
400<G<1500	Weak
1500<G<3000	Medium
3000<G<10000	Sturdy
10000<G	Rock Highlid

The endurance of ground or rocks according to Slip Module values(Keçeli, 1990)

$G = (d*Vs^2)/100$

‖AVERAGE‖			
LAYERS	DEPTH	G (kg/cm²)	ENDURANCE
1. LAYER	-4,06	1904	Medium
2.LAYER	-17,39	8075	Sturdy
3.LAYER	∞	32101	Rock Highlid

Shear modules and endurance of the grounds in the study area

Calculation of shear Modulus values in the direction of the seismic data obtained in the field studies and the table of variation are given in the table above.

5.20.5. WTG20 Elasticity Modulus-E (kg/cm²)

ELASTIC MODULUS				
PROFILES	LAYERS	DEPTH	E(kg/cm²)	ENDURANCE
1_PROFILE	1. LAYER	-2,94	3721	Weak
	2.LAYER	-19,90	8812	Medium
	3.LAYER		41739	Rock Highlid
2_PROFILE	1. LAYER	-4,08	1246	Weak
	2. LAYER	-18,24	4289	Weak
	3. LAYER		17099	Sturdy
3_PROFILE	1. LAYER	-2,65	667	High Weak
	2. LAYER	-11,86	3773	Weak
	3. LAYER		13977	Sturdy
4_PROFILE	1. LAYER	-3,37	1699	Weak
	2. LAYER	-10,59	8277	Medium
	3. LAYER		29042	Sturdy
5_PROFILE	1. LAYER	-5,05	8392	Medium
	2. LAYER	-15,87	35244	Sturdy
	3. LAYER		134484	Rock Highlid
6_PROFILE	1. LAYER	-3,45	1844	Weak
	2. LAYER	-10,83	9337	Medium
	3. LAYER		31879	Rock Highlid
7_PROFILE	1. LAYER	-3,11	10605	Sturdy
	2.LAYER	-13,92	69365	Rock Highlid
	3.LAYER		289885	Rock Highlid
8_PROFILE	1. LAYER	-3,72	2704	Weak
	2. LAYER	-16,65	11994	Sturdy
	3. LAYER		40880	Rock Highlid
9_PROFILE	1. LAYER	-6,26	8117	Medium
	2. LAYER	-28,03	31722	Rock Highlid
	3. LAYER		117990	Rock Highlid
10_PROFILE	1. LAYER	-7,02	22041	Sturdy
	2. LAYER	-31,42	62706	Rock Highlid
	3. LAYER		299423	Rock Highlid
11_PROFILE	1. LAYER	-3,03	500	High Weak
	2. LAYER	-13,58	4116	Weak
	3. LAYER		17261	Sturdy
12_PROFILE	1. LAYER	-3,98	966	High Weak
	2. LAYER	-17,82	6534	Medium
	3. LAYER		27964	Sturdy

Elastic Modulus (kg/cm^2)	Dayanım
E<1000	High Weak
1000<E<5000	Weak
5000<E<10000	Medium
10000<E<30000	Sturdy
30000<E	Rock Highlid

The endurance of ground or rocks according to Slip Module values(Keçeli, 1990)

$E=G*(3*V_p^2-4*V_s^2)/(V_p^2-V_s^2)$

||AVERAGE||			
LAYERS	DEPTH	E (kg/cm^2)	ENDURANCE
1. LAYER	-4,06	5208	Medium
2.LAYER	-17,39	21347	Sturdy
3.LAYER	∞	88469	Rock Highlid

Elasticity modules and endurance of the grounds in the study area

Calculation of the modulus of elasticity in the direction of the seismic data obtained in the field studies and the change table are given in the above table

5.20.6. WTG20 Poisson's Ratio - (б)

POISSON'S RATIO				
PROFILES	LAYERS	DEPTH	(σ)	POROSITY
1_PROFILE	1. LAYER	-2,94	0,38	High Porous
	2.LAYER	-19,90	0,37	High Porous
	3.LAYER		0,38	High Porous
2_PROFILE	1. LAYER	-4,08	0,40	High Porous
	2. LAYER	-18,24	0,37	High Porous
	3. LAYER		0,40	High Porous
3_PROFILE	1. LAYER	-2,65	0,41	High Porous
	2. LAYER	-11,86	0,34	Medium Porous
	3. LAYER		0,39	High Porous
4_PROFILE	1. LAYER	-3,37	0,37	High Porous
	2. LAYER	-10,59	0,31	Medium Porous
	3. LAYER		0,39	High Porous
5_PROFILE	1. LAYER	-5,05	0,42	High Porous
	2. LAYER	-15,87	0,32	Medium Porous
	3. LAYER		0,39	High Porous
6_PROFILE	1. LAYER	-3,45	0,41	High Porous
	2. LAYER	-10,83	0,34	Medium Porous
	3. LAYER		0,39	High Porous
7_PROFILE	1. LAYER	-3,11	0,36	High Porous
	2.LAYER	-13,92	0,30	Medium Porous
	3.LAYER		0,39	High Porous
8_PROFILE	1. LAYER	-3,72	0,36	High Porous
	2. LAYER	-16,65	0,32	Medium Porous
	3. LAYER		0,40	High Porous
9_PROFILE	1. LAYER	-6,26	0,35	Medium Porous
	2. LAYER	-28,03	0,32	Medium Porous
	3. LAYER		0,38	High Porous
10_PROFILE	1. LAYER	-7,02	0,41	High Porous
	2. LAYER	-31,42	0,35	High Porous
	3. LAYER		0,35	Medium Porous
11_PROFILE	1. LAYER	-3,03	0,35	Medium Porous
	2. LAYER	-13,58	0,31	Medium Porous
	3. LAYER		0,40	High Porous
12_PROFILE	1. LAYER	-3,98	0,36	High Porous
	2. LAYER	-17,82	0,31	Medium Porous
	3. LAYER		0,40	High Porous

Poisson's Ratio;(σ)	Porosity
0,00≤σ≤0,25	Nonporous
0,26≤σ≤0,35	Medium Porous
0,36≤σ≤0,50	High Porous

Poisson ratio classification

$\sigma=(Vp^2-2*Vs^2)/(2*Vp^2-2*Vs^2)$

‖AVERAGE‖			
LAYERS	DEPTH	(σ)	POROSITY
1. LAYER	-4,06	0,38	High Porous
2.LAYER	-17,39	0,33	Medium Porous
3.LAYER	∞	0,39	High Porous

Poisson's ratio values of the units in the study area, porosity

Calculation of poisson's ratio values in the direction of the seismic data obtained in the field studies and the change table are given in the above table.

5.20.7. WTG20 Density - ρ (gr/ cm^3)

DENSITY				
PROFILES	LAYERS	DEPTH	ρ (gr/cm^3)	DEFINITION
1_PROFILE	1. LAYER	-2,94	1,57	Medium
	2.LAYER	-19,90	1,69	Medium
	3.LAYER		2,07	High
2_PROFILE	1. LAYER	-4,08	1,42	Medium
	2. LAYER	-18,24	1,57	Medium
	3. LAYER		1,89	Medium
3_PROFILE	1. LAYER	-2,65	1,34	Low
	2. LAYER	-11,86	1,52	Medium
	3. LAYER		1,84	Medium
4_PROFILE	1. LAYER	-3,37	1,45	Medium
	2. LAYER	-10,59	1,65	Medium
	3. LAYER		2,00	High
5_PROFILE	1. LAYER	-5,05	1,78	Medium
	2. LAYER	-15,87	1,95	High
	3. LAYER		2,36	High
6_PROFILE	1. LAYER	-3,45	1,49	Medium
	2. LAYER	-10,83	1,70	Medium
	3. LAYER		2,02	High
7_PROFILE	1. LAYER	-3,11	1,76	Medium
	2.LAYER	-13,92	2,07	High
	3.LAYER		2,57	High
8_PROFILE	1. LAYER	-3,72	1,51	Medium
	2. LAYER	-16,65	1,73	Medium
	3. LAYER		2,09	High
9_PROFILE	1. LAYER	-6,26	1,70	Medium
	2. LAYER	-28,03	1,91	High
	3. LAYER		2,32	High
10_PROFILE	1. LAYER	-7,02	1,97	High
	2. LAYER	-31,42	2,11	High
	3. LAYER		2,52	High
11_PROFILE	1. LAYER	-3,03	1,24	Low
	2. LAYER	-13,58	1,53	Medium
	3. LAYER		1,89	Medium
12_PROFILE	1. LAYER	-3,98	1,35	Low
	2. LAYER	-17,82	1,60	Medium
	3. LAYER		1,99	High

Density: ρ (gr/cm³)	Tanımlama
ρ<1,20	High low
1,20<ρ<1,40	Low
1,40<ρ<1,90	Medium
1,90<ρ<2,20	High
2,20<ρ	Too High

Density Classification of Ground Units: (Keçeli, 1990)

*ρ =d=0.31*Vp0.25*

||AVERAGE||			
LAYERS	DEPTH	ρ (gr/cm³)	DEFINITION
1. LAYER	-4,06	1,55	Medium
2.LAYER	-17,39	1,75	Medium
3.LAYER	∞	2,13	High

Density values and description of the units in the study area

Calculation of the density values of the geological units in the direction of the seismic data obtained in the field studies and the table of variation are given in the above table.

5.20.8. WTG20 Modulus of Subgrade Reaction – D Y K (ton/m³)

Modulus of Subgrade Reaction			
PROFILES	LAYERS	DEPTH	D Y K (ton/m³)
1_PROFILE	1. LAYER	-2,94	2074
	2.LAYER	-19,90	3020
	3.LAYER		6967
2_PROFILE	1. LAYER	-4,08	1193
	2. LAYER	-18,24	2165
	3. LAYER		4368
3_PROFILE	1. LAYER	-2,65	905
	2. LAYER	-11,86	2076
	3. LAYER		3945
4_PROFILE	1. LAYER	-3,37	1408
	2. LAYER	-10,59	3071
	3. LAYER		5745
5_PROFILE	1. LAYER	-5,05	3018
	2. LAYER	-15,87	6351
	3. LAYER		13304
6_PROFILE	1. LAYER	-3,45	1457
	2. LAYER	-10,83	3251
	3. LAYER		6032
7_PROFILE	1. LAYER	-3,11	3431
	2.LAYER	-13,92	9013
	3.LAYER		20983
8_PROFILE	1. LAYER	-3,72	1731
	2. LAYER	-16,65	3663
	3. LAYER		6876
9_PROFILE	1. LAYER	-6,26	2943
	2. LAYER	-28,03	5942
	3. LAYER		12340
10_PROFILE	1. LAYER	-7,02	4912
	2. LAYER	-31,42	8548
	3. LAYER		21217
11_PROFILE	1. LAYER	-3,03	811
	2. LAYER	-13,58	2169
	3. LAYER		4386
12_PROFILE	1. LAYER	-3,98	1081
	2. LAYER	-17,82	2708
	3. LAYER		5628

||AVERAGE||		
LAYERS	DEPTH	D Y K (ton/m^3)
1. LAYER	-4,06	2081
2.LAYER	-17,39	4331
3.LAYER	∞	9316
kv= 40*(Gs)*qu ton/m^3 *(Bowles 1984)*		

The above table shows the Modulus of Subgrade Reaction obtained for each layer in the direction of the data obtained after the seismic measurements made in the study area.

5.20.9. WTG20 Bearing Capacity qu (kg/cm2) / Allowable Bearing Capacity qa (kg/cm2)

PROFILES	LAYERS	DEPTH	BEARING CAPACITY (qu,kg/cm^2)	ALLOWABLE BEARING CAPACITY (qa,kg/cm^2)
1_PROFILE	1. LAYER	-2,94	5,19	1,73
	2.LAYER	-19,90	7,55	2,52
	3.LAYER	-30,10	17,42	5,81
2_PROFILE	1. LAYER	-4,08	2,98	0,99
	2. LAYER	-18,24	5,41	1,80
	3. LAYER	-31,76	10,92	3,64
3_PROFILE	1. LAYER	-2,65	2,26	0,75
	2. LAYER	-11,86	5,19	1,73
	3. LAYER	-38,14	9,86	3,29
4_PROFILE	1. LAYER	-3,37	3,52	1,17
	2. LAYER	-10,59	7,68	2,56
	3. LAYER	-39,41	14,36	4,79
5_PROFILE	1. LAYER	-5,05	7,55	2,52
	2. LAYER	-15,87	15,88	5,29
	3. LAYER		33,26	11,09
6_PROFILE	1. LAYER	-3,45	3,64	1,21
	2. LAYER	-10,83	8,13	2,71
	3. LAYER	-39,17	15,08	5,03
7_PROFILE	1. LAYER	-3,11	8,58	2,86
	2.LAYER	-13,92	22,53	7,51
	3.LAYER	-36,08	52,46	17,49
8_PROFILE	1. LAYER	-3,72	4,33	1,44
	2. LAYER	-16,65	9,16	3,05
	3. LAYER	-33,35	17,19	5,73
9_PROFILE	1. LAYER	-6,26	7,36	2,45
	2. LAYER	-28,03	14,85	4,95
	3. LAYER	-21,97	30,85	10,28
10_PROFILE	1. LAYER	-7,02	12,28	4,09
	2. LAYER	-31,42	21,37	7,12
	3. LAYER	-18,58	53,04	17,68
11_PROFILE	1. LAYER	-3,03	2,03	0,68
	2. LAYER	-13,58	5,42	1,81
	3. LAYER	-36,42	10,97	3,66
12_PROFILE	1. LAYER	-3,98	2,70	0,90
	2. LAYER	-17,82	6,77	2,26
	3. LAYER	-32,18	14,07	4,69

LAYERS	‖AVERAGE‖ DEPTH	Bearing Capacity (qu,kg/cm^2)
1. LAYER	-4,06	5,20
2.LAYER	-17,39	10,83
3.LAYER	∞	23,29
qu=(0,024*Vs*(J.B.K+0,002*Vp)*0,71)/G.K		
LAYERS	**‖AVERAGE‖ DEPTH**	**Allowable Bearing Capacity (qa,kg/cm^2)**
1. LAYER	-4,06	1,73
2.LAYER	-17,39	3,61
3.LAYER	∞	7,76
qa=qu/G.K G.K=3 empirical value		

5.20.10 WTG20 Vibration Period - T_0 (sec) / Ground Amplification (Ak)

PROFILES	To (sec)	Ta (sec)	Tb (sec)	Ak (Amplification)
1.PROFILE	0,34	0,23	0,52	1,68
2.PROFILE	0,50	0,34	0,75	2,14
3.PROFILE	0,50	0,33	0,75	2,24
4.PROFILE	0,36	0,24	0,54	1,86
5.PROFILE	0,20	0,13	0,30	1,26
6.PROFILE	0,34	0,23	0,51	1,80
7.PROFILE	0,14	0,09	0,21	1,04
8.PROFILE	0,34	0,22	0,50	1,70
9.PROFILE	0,26	0,17	0,39	1,35
10.PROFILE	0,18	0,12	0,27	1,07
11.PROFILE	0,50	0,33	0,75	2,23
12.PROFILE	0,44	0,29	0,66	2,01

AVERAGE			
To (sec)	**Ta (sec)**	**Tb (sec)**	**Ak (Amplification)**
0,34	0,23	0,51	1,70

$To = \sum 4H\ Vs\ n\ \iota$=1 (sec)… (Zeevaert,1967)

Ak=68*$Vs_{30}^{-0,6}$……. (Midorikawa, 1987)

The Vibration Period and Ground Amplification calculated in the direction of the parameters obtained during the seismic studies made during the field survey are presented in the table above.

5. 21. WTG21

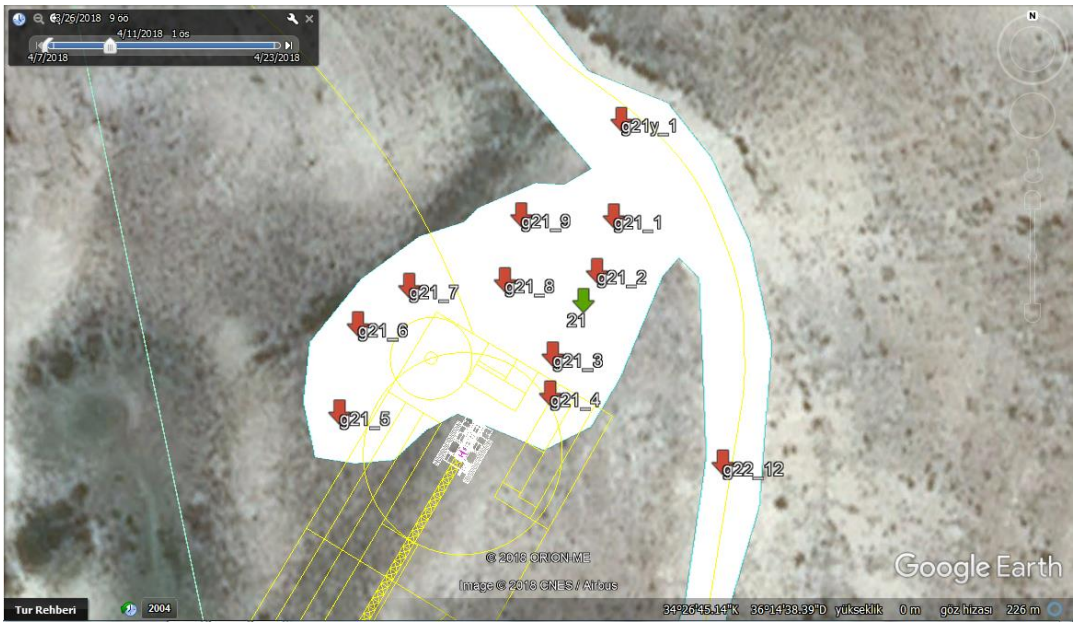
9 measurements were taken. These measurements showed 3 layers. Layer 1 was found between 0,00 m-4,05 m depths, Layer 2 between 4,05 m-20,28 m depths and Layer 3 at 20,28 m depths. The parameters of this layer are given in the table below.

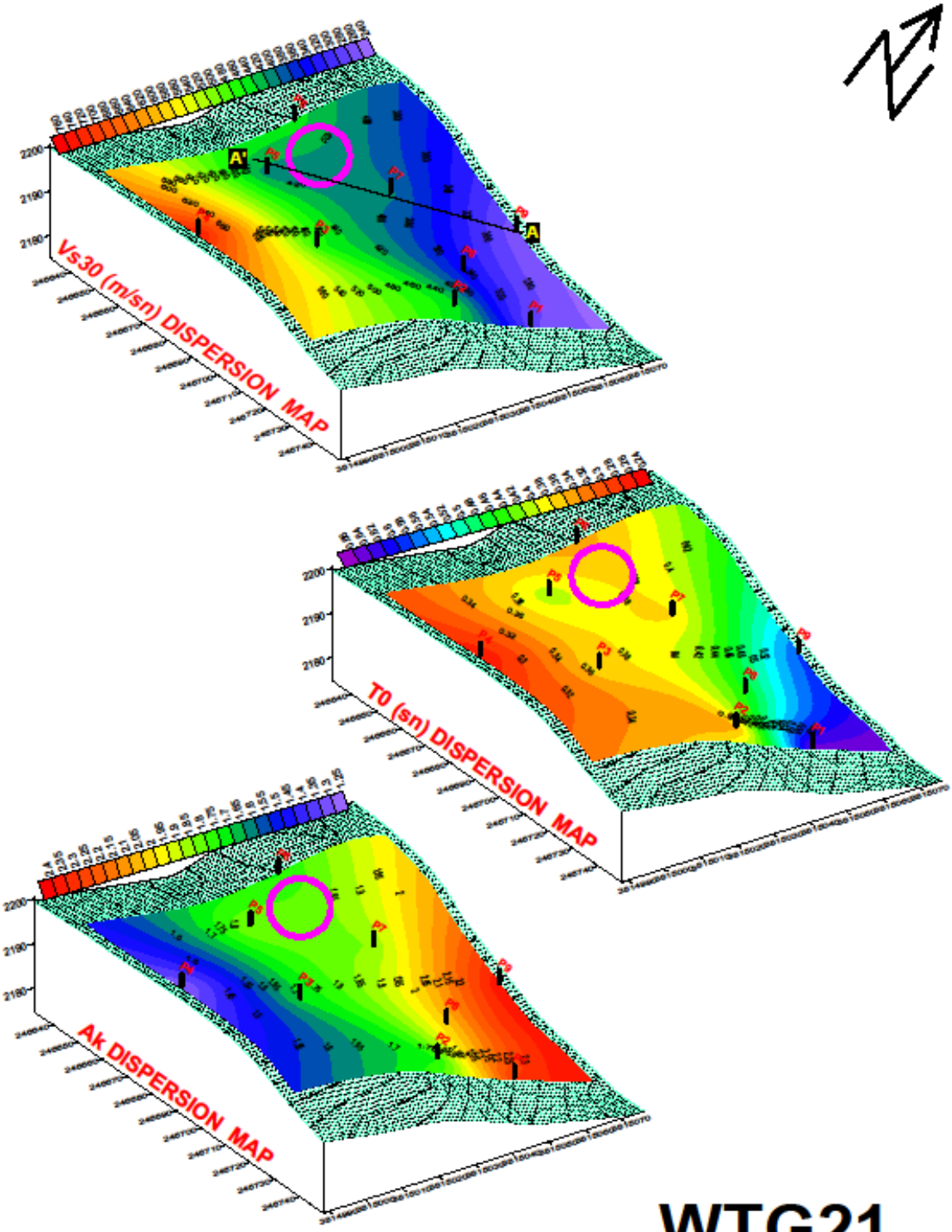
LAYERS	Vp_ Velocity	STRIPPABILITY
1. LAYER	515	Simple strippability
2.LAYER	876	Simple strippability
3.LAYER	1790	High-hard STRIPPABILITY
LAYERS	**Vs_ Velocity**	**GROUND GROUP**
1. LAYER	214	C
2.LAYER	430	B
3.LAYER	745	A
LAYERS	**G (kg/cm2)**	**ENDURANCE**
1. LAYER	959	Weak
2.LAYER	3945	Sturdy
3.LAYER	11884	High sturdy
LAYERS	**E (kg/cm2)**	**ENDURANCE**
1. LAYER	2628	Weak
2.LAYER	10485	Sturdy
3.LAYER	33050	High sturdy

LAYERS	(σ)	POROSITY
1. LAYER	0,38	High Porosity
2.LAYER	0,34	Medium Porosity
3.LAYER	0,39	High Porosity
LAYERS	**ρ (gr/cm3)**	**DEFINITION**
1. LAYER	1,45	Medium
2.LAYER	1,66	Medium
3.LAYER	2,00	High
LAYERS	**D Y K (ton/m^3)**	
1. LAYER	1516	
2.LAYER	3174	
3.LAYER	6021	
LAYERS	**Ground Carrying Capacity (qu,kg/cm2)**	**Secure Carrying Capacity (qa,kg/cm2)**
1. LAYER	3,79	1,26
2.LAYER	7,94	2,65
3.LAYER	15,05	5,02

To (sec)	Ta (sec)	Tb (sec)	Vs30 (m/sec)	Ak (Amplification)
0,42	0,28	0,63	424	1,88

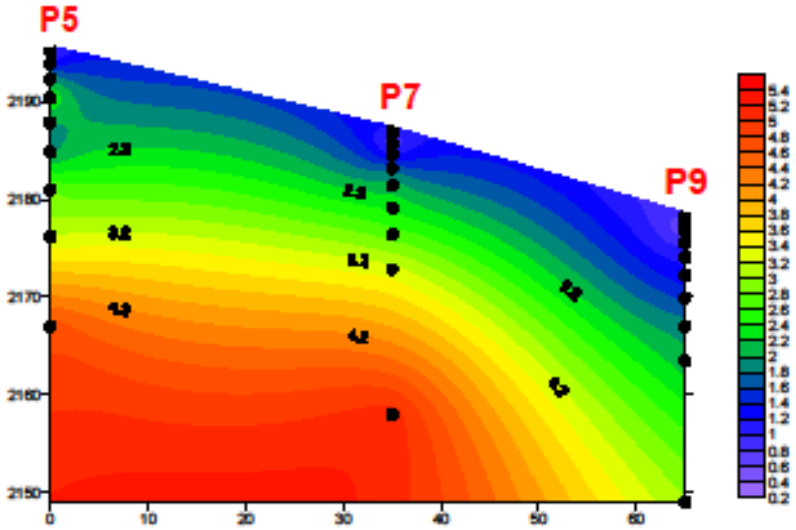
Except for the second (2) and fourth (4), the first layer of the profiles is very weak and it is foreseen to excavate an average of 4.00 m. Taking into account the following applications, the profile points should be seen in the engineering parameters section for detailed values.



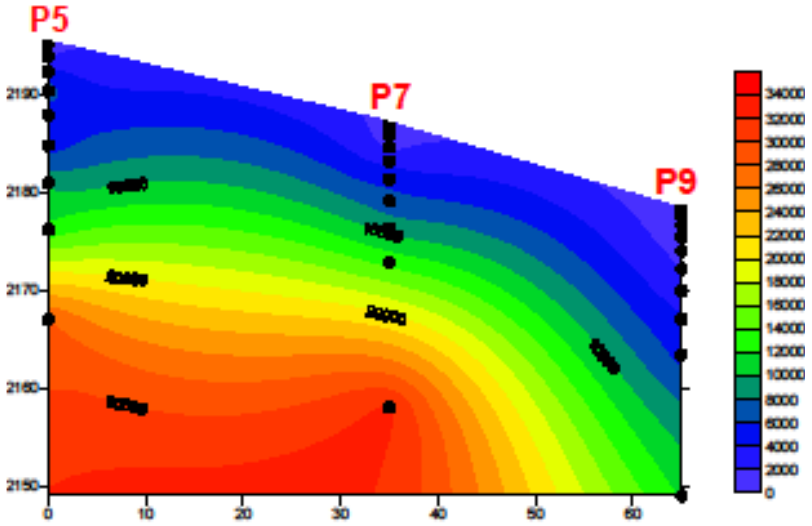

Vs30 (m/sn) DISPERSION MAP
T0 (sn) DISPERSION MAP
Ak DISPERSION MAP
A'
A

WTG21

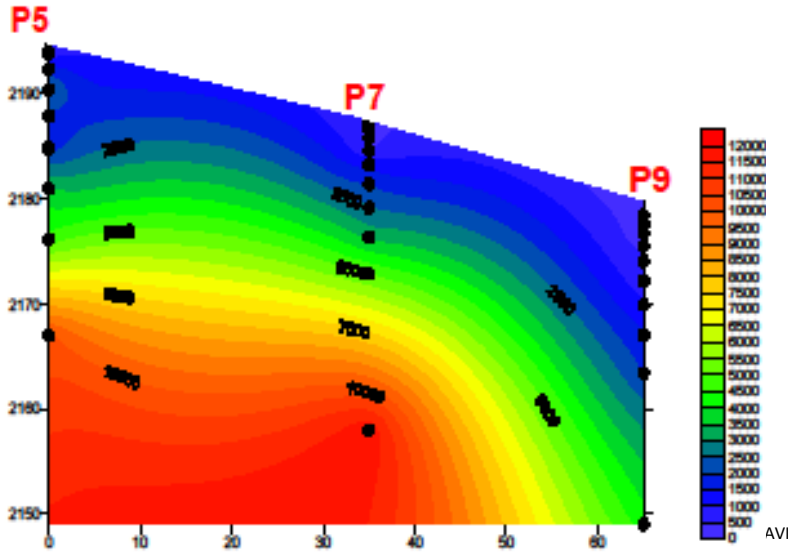
BEARING CAPACITY (kg/cm2)



YOUNG MODULE DISPERSIONE (kg/cm2)



SLIDE MODULE DISPERSIONE (kg/cm2)



5.21.1. WTG21 Seismic P wave velocity (*Compressional Wave Velocity* (Vp))

Vp VELOCITY				
PROFILES	LAYERS	DEPTH	Vp_ Velocity	STRIPPABILITY
1_PROFILE	1. LAYER	-3,96	409	High Simple Strippability
	2.LAYER	-26,77	572	Simple Strippability
	3.LAYER		1180	Simple Strippability
2_PROFILE	1. LAYER	-3,50	730	Simple Strippability
	2. LAYER	-15,64	872	Simple Strippability
	3. LAYER		1787	High Difficult Strippability
3_PROFILE	1. LAYER	-6,24	551	Simple Strippability
	2. LAYER	-27,92	1026	Simple Strippability
	3. LAYER		2104	High Difficult Strippability
4_PROFILE	1. LAYER	-7,24	1119	Simple Strippability
	2. LAYER	-22,76	1637	High Difficult Strippability
	3. LAYER		3011	Explosive
5_PROFILE	1. LAYER	-3,08	452	High Simple Strippability
	2. LAYER	-20,83	834	Simple Strippability
	3. LAYER		1675	High Difficult Strippability
6_PROFILE	1. LAYER	-2,42	398	High Simple Strippability
	2. LAYER	-16,35	876	Simple Strippability
	3. LAYER		1856	High Difficult Strippability
7_PROFILE	1. LAYER	-3,38	444	High Simple Strippability
	2.LAYER	-15,14	804	Simple Strippability
	3.LAYER		1685	High Difficult Strippability
8_PROFILE	1. LAYER	-3,19	231	High Simple Strippability
	2. LAYER	-21,57	718	Simple Strippability
	3. LAYER		1686	High Difficult Strippability
9_PROFILE	1. LAYER	-3,48	298	High Simple Strippability
	2. LAYER	-15,58	547	Simple Strippability
	3. LAYER		1124	Simple Strippability

P Wave Velocity (m/sec)	Strippability
Vp<458	High Simple Strippability
458<Vp<1220	Simple Strippability
1220<Vp<11525	Medium Strippability
1525<Vp<11830	Difficult Strippability
1830<Vp<12135	High Difficult Strippability
Vp>2135	Explosive Strippability

Strippability of floors with P wave velocity (Church, 1981)

||AVERAGE||			
LAYERS	DEPTH	Vp_ Velocity	STRIPPABILITY
1. LAYER	-4,05	515	Simple Strippability
2.LAYER	-20,28	876	Simple Strippability
3.LAYER	∞	1790	High Difficult Strippability

P wave velocities of the grounds in the study area and strippability

The above table shows the change table and strippability properties of Vp velocity depth values in the direction of the seismic data obtained from the field studies.

5.21.2. WTG21 Seismic S wave velocity (*Transverse Wave Velocity* (Vs))

PROFILES	LAYERS	Vs VELOCITY DEPTH	Vs_ Velocity	GROUND GROUPS
1_PROFILE	1. LAYER	-3,96	178	D
	2.LAYER	-26,77	257	C
	3.LAYER		480	B
2_PROFILE	1. LAYER	-3,50	311	C
	2. LAYER	-15,64	393	C
	3. LAYER		772	A
3_PROFILE	1. LAYER	-6,24	212	C
	2. LAYER	-27,92	537	B
	3. LAYER		939	A
4_PROFILE	1. LAYER	-7,24	466	B
	2. LAYER	-22,76	797	A
	3. LAYER		935	A
5_PROFILE	1. LAYER	-3,08	183	D
	2. LAYER	-20,83	390	C
	3. LAYER		712	A
6_PROFILE	1. LAYER	-2,42	158	D
	2. LAYER	-16,35	445	B
	3. LAYER		831	A
7_PROFILE	1. LAYER	-3,38	177	D
	2.LAYER	-15,14	401	B
	3.LAYER		771	A
8_PROFILE	1. LAYER	-3,19	120	D
	2. LAYER	-21,57	382	C
	3. LAYER		779	A
9_PROFILE	1. LAYER	-3,48	126	D
	2. LAYER	-15,58	268	C
	3. LAYER		484	B

S Wave Velocity (m/sec)	Ground group
Vs<200	D
200<Vs<400	C
400<Vs<700	B
700<Vs	A

Ground groups according to slip wave velocity(Abyyhy, 1998)

LAYERS	||AVERAGE|| DEPTH	Vs_ Velocity	GROUND GROUPS
1. LAYER	-4,05	214	C
2.LAYER	-20,28	430	B
3.LAYER	∞	745	A

S wave velocities of the grounds in the study area and ground group

Ground Group	Ground group and top ground layer thickness(h_1)
Z1	(A) Ground group h1< 15 m (B) Ground group
Z2	h_1> 15 m (B) Ground group h_1< 15 m (C) Ground group
Z3	15 m < h_1< 50 m (C) Ground group h_1< 10 m (D) Ground group
Z4	h_1> 50 m (C) Ground group h_1> 10 m (D) Ground group

Ground Group Class

The above table shows that Vs velocity values in the direction of the seismic data obtained in the field studies are the absolute change tables and that the layers are included in the ground groups.

5.21.3. WTG21 Vs30

PROFILES	Vs30 (m/sec)
1.PROFILE	284
2.PROFILE	449
3.PROFILE	467
4.PROFILE	743
5.PROFILE	406
6.PROFILE	449
7.PROFILE	404
8.PROFILE	348
9.PROFILE	265

Vs30 values in the direction of the seismic data obtained from the field studies are given in the table above.

5.21.4. WTG21 Shear Modulus-G (kg/cm²)

SHEAR MODULUS				
PROFILES	LAYERS	DEPTH	G(kg/cm²)	ENDURANCE
1_PROFILE	1. LAYER	-3,96	501	Weak
	2.LAYER	-26,77	1096	Weak
	3.LAYER		4192	Sturdy
2_PROFILE	1. LAYER	-3,50	1562	Medium
	2. LAYER	-15,64	2948	Medium
	3. LAYER		12006	Rock Highlid
3_PROFILE	1. LAYER	-6,24	747	Weak
	2. LAYER	-27,92	5356	Sturdy
	3. LAYER		18498	Rock Highlid
4_PROFILE	1. LAYER	-7,24	4055	Sturdy
	2. LAYER	-22,76	13142	Rock Highlid
	3. LAYER		20093	Rock Highlid
5_PROFILE	1. LAYER	-3,08	493	Weak
	2. LAYER	-20,83	2649	Medium
	3. LAYER		10052	Rock Highlid
6_PROFILE	1. LAYER	-2,42	365	High Weak
	2. LAYER	-16,35	3715	Sturdy
	3. LAYER		14059	Rock Highlid
7_PROFILE	1. LAYER	-3,38	464	Weak
	2.LAYER	-15,14	2801	Medium
	3.LAYER		11807	Rock Highlid
8_PROFILE	1. LAYER	-3,19	219	High Weak
	2. LAYER	-21,57	2650	Medium
	3. LAYER		12049	Rock Highlid
9_PROFILE	1. LAYER	-3,48	221	High Weak
	2. LAYER	-15,58	1150	Weak
	3. LAYER		4200	Sturdy

Shear Modulus (kg/cm²)	Dayanım
G<400	High Weak
400<G<1500	Weak
1500<G<3000	Medium
3000<G<10000	Sturdy
10000<G	Rock Highlid

The endurance of ground or rocks according to Slip Module values(Keçeli, 1990) G =(d*Vs2)/100

||AVERAGE||			
LAYERS	DEPTH	G (kg/cm²)	ENDURANCE
1. LAYER	-4,05	959	Weak
2.LAYER	-20,28	3945	Sturdy
3.LAYER	∞	11884	Rock Highlid

Shear modules and endurance of the grounds in the study area

Calculation of shear Modulus values in the direction of the seismic data obtained in the field studies and the table of variation are given in the table above.

5.21.5. WTG21 Elasticity Modulus-E (kg/cm²)

ELASTIC MODULUS				
PROFILES	LAYERS	DEPTH	E(kg/cm^2)	ENDURANCE
1_PROFILE	1. LAYER	-3,96	1332	Weak
	2.LAYER	-26,77	2979	Weak
	3.LAYER		11744	Sturdy
2_PROFILE	1. LAYER	-3,50	4332	Weak
	2. LAYER	-15,64	7883	Medium
	3. LAYER		33265	Rock Highlid
3_PROFILE	1. LAYER	-6,24	2042	Weak
	2. LAYER	-27,92	14053	Sturdy
	3. LAYER		50898	Rock Highlid
4_PROFILE	1. LAYER	-7,24	11105	Sturdy
	2. LAYER	-22,76	35126	Rock Highlid
	3. LAYER		58132	Rock Highlid
5_PROFILE	1. LAYER	-3,08	1370	Weak
	2. LAYER	-20,83	7155	Medium
	3. LAYER		27939	Sturdy
6_PROFILE	1. LAYER	-2,42	1021	Weak
	2. LAYER	-16,35	9773	Medium
	3. LAYER		38649	Rock Highlid
7_PROFILE	1. LAYER	-3,38	1278	Weak
	2.LAYER	-15,14	7479	Medium
	3.LAYER		32294	Rock Highlid
8_PROFILE	1. LAYER	-3,19	578	High Weak
	2. LAYER	-21,57	6835	Medium
	3. LAYER		32879	Rock Highlid
9_PROFILE	1. LAYER	-3,48	596	High Weak
	2. LAYER	-15,58	3081	Weak
	3. LAYER		11645	Sturdy

Elastic Modulus (kg/cm^2)	Dayanım
E<1000	High Weak
1000<E<5000	Weak
5000<E<10000	Medium
10000<E<30000	Sturdy
30000<E	Rock Highlid

The endurance of ground or rocks according to Slip Module values(Keçeli, 1990)

$E=G*(3*V_p^2-4*V_s^2)/(V_p^2-V_s^2)$

||AVERAGE||			
LAYERS	DEPTH	E (kg/cm^2)	ENDURANCE
1. LAYER	-4,05	2628	Weak
2.LAYER	-20,28	10485	Sturdy
3.LAYER	∞	33050	Rock Highlid

Elasticity modules and endurance of the grounds in the study area

Calculation of the modulus of elasticity in the direction of the seismic data obtained in the field studies and the change table are given in the above table

5.21.6. WTG21 Poisson's Ratio - (б)

POISSON'S RATIO				
PROFILES	LAYERS	DEPTH	(σ)	POROSITY
1_PROFILE	1. LAYER	-3,96	0,37	High Porous
	2.LAYER	-26,77	0,37	High Porous
	3.LAYER		0,40	High Porous
2_PROFILE	1. LAYER	-3,50	0,39	High Porous
	2. LAYER	-15,64	0,37	High Porous
	3. LAYER		0,39	High Porous
3_PROFILE	1. LAYER	-6,24	0,40	High Porous
	2. LAYER	-27,92	0,31	Medium Porous
	3. LAYER		0,38	High Porous
4_PROFILE	1. LAYER	-7,24	0,39	High Porous
	2. LAYER	-22,76	0,35	Medium Porous
	3. LAYER		0,45	High Porous
5_PROFILE	1. LAYER	-3,08	0,40	High Porous
	2. LAYER	-20,83	0,36	High Porous
	3. LAYER		0,39	High Porous
6_PROFILE	1. LAYER	-2,42	0,41	High Porous
	2. LAYER	-16,35	0,33	Medium Porous
	3. LAYER		0,37	High Porous
7_PROFILE	1. LAYER	-3,38	0,40	High Porous
	2.LAYER	-15,14	0,33	Medium Porous
	3.LAYER		0,37	High Porous
8_PROFILE	1. LAYER	-3,19	0,31	Medium Porous
	2. LAYER	-21,57	0,30	Medium Porous
	3. LAYER		0,36	High Porous
9_PROFILE	1. LAYER	-3,48	0,38	High Porous
	2. LAYER	-15,58	0,34	Medium Porous
	3. LAYER		0,39	High Porous

Poisson's Ratio;(σ)	Porosity
0,00≤σ≤0,25	Nonporous
0,26≤σ≤0,35	Medium Porous
0,36≤σ≤0,50	High Porous

Poisson ratio classification

$\sigma=(Vp^2-2*Vs^2)/(2*Vp^2-2*Vs^2)$

||AVERAGE||			
LAYERS	DEPTH	(σ)	POROSITY
1. LAYER	-4,05	0,38	High Porous
2.LAYER	-20,28	0,34	Medium Porous
3.LAYER	∞	0,39	High Porous

Poisson's ratio values of the units in the study area, porosity

Calculation of poisson's ratio values in the direction of the seismic data obtained in the field studies and the change table are given in the above table.

5.21.7. WTG21 Density - ρ (gr/ cm^3)

DENSITY				
PROFILES	LAYERS	DEPTH	ρ (gr/cm^3)	DEFINITION
1_PROFILE	1. LAYER	-3,96	1,39	Low
	2.LAYER	-26,77	1,51	Medium
	3.LAYER		1,82	Medium
2_PROFILE	1. LAYER	-3,50	1,61	Medium
	2. LAYER	-15,64	1,68	Medium
	3. LAYER		2,02	High
3_PROFILE	1. LAYER	-6,24	1,50	Medium
	2. LAYER	-27,92	1,75	Medium
	3. LAYER		2,10	High
4_PROFILE	1. LAYER	-7,24	1,79	Medium
	2. LAYER	-22,76	1,97	High
	3. LAYER		2,30	High
5_PROFILE	1. LAYER	-3,08	1,43	Medium
	2. LAYER	-20,83	1,66	Medium
	3. LAYER		1,98	High
6_PROFILE	1. LAYER	-2,42	1,38	Low
	2. LAYER	-16,35	1,68	Medium
	3. LAYER		2,03	High
7_PROFILE	1. LAYER	-3,38	1,42	Medium
	2.LAYER	-15,14	1,64	Medium
	3.LAYER		1,99	High
8_PROFILE	1. LAYER	-3,19	1,19	High low
	2. LAYER	-21,57	1,59	Medium
	3. LAYER		1,99	High
9_PROFILE	1. LAYER	-3,48	1,29	Low
	2. LAYER	-15,58	1,49	Medium
	3. LAYER		1,79	Medium

Density: ρ (gr/cm^3)	Tanımlama
ρ<1,20	High low
1,20<ρ<1,40	Low
1,40<ρ<1,90	Medium
1,90<ρ<2,20	High
2,20<ρ	Too High

Density Classification of Ground Units: (Keçeli, 1990)

$\rho = d = 0.31 * Vp0.25$

‖AVERAGE‖			
LAYERS	DEPTH	ρ (gr/cm^3)	DEFINITION
1. LAYER	-4,05	1,45	Medium
2.LAYER	-20,28	1,66	Medium
3.LAYER	∞	2,00	High

Density values and description of the units in the study area

Calculation of the density values of the geological units in the direction of the seismic data obtained in the field studies and the table of variation are given in the above table.

5.21.8. WTG21 Modulus of Subgrade Reaction – D Y K (ton/m^3)

Modulus of Subgrade Reaction			
PROFILES	LAYERS	DEPTH	D Y K (ton/m^3)
1_PROFILE	1. LAYER	-3,96	1225
	2.LAYER	-26,77	1806
	3.LAYER		3607
2_PROFILE	1. LAYER	-3,50	2219
	2. LAYER	-15,64	2866
	3. LAYER		6178
3_PROFILE	1. LAYER	-6,24	1482
	2. LAYER	-27,92	3987
	3. LAYER		7757
4_PROFILE	1. LAYER	-7,24	3476
	2. LAYER	-22,76	6312
	3. LAYER		8424
5_PROFILE	1. LAYER	-3,08	1263
	2. LAYER	-20,83	2823
	3. LAYER		5634
6_PROFILE	1. LAYER	-2,42	1086
	2. LAYER	-16,35	3254
	3. LAYER		6701
7_PROFILE	1. LAYER	-3,38	1225
	2.LAYER	-15,14	2898
	3.LAYER		6108
8_PROFILE	1. LAYER	-3,19	813
	2. LAYER	-21,57	2741
	3. LAYER		6170
9_PROFILE	1. LAYER	-3,48	856
	2. LAYER	-15,58	1882
	3. LAYER		3610

‖AVERAGE‖		
LAYERS	DEPTH	D Y K (ton/m^3)
1. LAYER	-4,05	1516
2.LAYER	-20,28	3174
3.LAYER	∞	6021
kv= 40*(Gs)*qu ton/m^3 *(Bowles 1984)*		

The above table shows the Modulus of Subgrade Reaction obtained for each layer in the direction of the data obtained after the seismic measurements made in the study area.

5.21.9. WTG21 Bearing Capacity qu (kg/cm2) / Allowable Bearing Capacity qa (kg/cm2)

PROFILES	LAYERS	DEPTH	BEARING CAPACITY	ALLOWABLE
1_PROFILE	1. LAYER	-3,96	3,06	1,02
	2.LAYER	-26,77	4,51	1,50
	3.LAYER	-23,23	9,02	3,01
2_PROFILE	1. LAYER	-3,50	5,55	1,85
	2. LAYER	-15,64	7,16	2,39
	3. LAYER	-34,36	15,45	5,15
3_PROFILE	1. LAYER	-6,24	3,70	1,23
	2. LAYER	-27,92	9,97	3,32
	3. LAYER	-22,08	19,39	6,46
4_PROFILE	1. LAYER	-7,24	8,69	2,90
	2. LAYER	-22,76	15,78	5,26
	3. LAYER	-27,24	21,06	7,02
5_PROFILE	1. LAYER	-3,08	3,16	1,05
	2. LAYER	-20,83	7,06	2,35
	3. LAYER	-29,17	14,08	4,69
6_PROFILE	1. LAYER	-2,42	2,72	0,91
	2. LAYER	-16,35	8,14	2,71
	3. LAYER	-33,65	16,75	5,58
7_PROFILE	1. LAYER	-3,38	3,06	1,02
	2.LAYER	-15,14	7,24	2,41
	3.LAYER	-34,86	15,27	5,09
8_PROFILE	1. LAYER	-3,19	2,03	0,68
	2. LAYER	-21,57	6,85	2,28
	3. LAYER	-28,43	15,43	5,14
9_PROFILE	1. LAYER	-3,48	2,14	0,71
	2. LAYER	-15,58	4,71	1,57
	3. LAYER	-34,42	9,02	3,01

||AVERAGE||		
LAYERS	DEPTH	Bearing Capacity (qu,kg/cm^2)
1. LAYER	-4,05	3,79
2.LAYER	-20,28	7,94
3.LAYER	∞	15,05
qu=(0,024*Vs*(J.B.K+0,002*Vp)*0,71)/G.K		
||AVERAGE||		
LAYERS	DEPTH	Allowable Bearing Capacity (qa,kg/cm^2)
1. LAYER	-4,05	1,26
2.LAYER	-20,28	2,65
3.LAYER	∞	5,02
qa=qu/G.K G.K=3 empirical value		

5.21.10 WTG21 Vibration Period - T_0 (sec) / Ground Amplification (Ak)

PROFILES	To (sec)	Ta (sec)	Tb (sec)	Ak (Amplification)
1.PROFILE	0,65	0,43	0,97	2,30
2.PROFILE	0,35	0,23	0,52	1,74
3.PROFILE	0,38	0,25	0,56	1,70
4.PROFILE	0,26	0,17	0,39	1,29
5.PROFILE	0,41	0,28	0,62	1,85
6.PROFILE	0,35	0,23	0,52	1,74
7.PROFILE	0,38	0,25	0,56	1,86
8.PROFILE	0,46	0,30	0,68	2,03
9.PROFILE	0,58	0,39	0,39	2,39

AVERAGE			
To (sec)	Ta (sec)	Tb (sec)	Ak (Amplification)
0,42	0,28	0,63	1,88

$To = \sum 4H\ Vs\ n\ \iota$=1 (sec)… (Zeevaert,1967)

Ak=68*$Vs_{30}^{-0,6}$…… (Midorikawa, 1987)

The Vibration Period and Ground Amplification calculated in the direction of the parameters obtained during the seismic studies made during the field survey are presented in the table above.

5. 22. WTG22

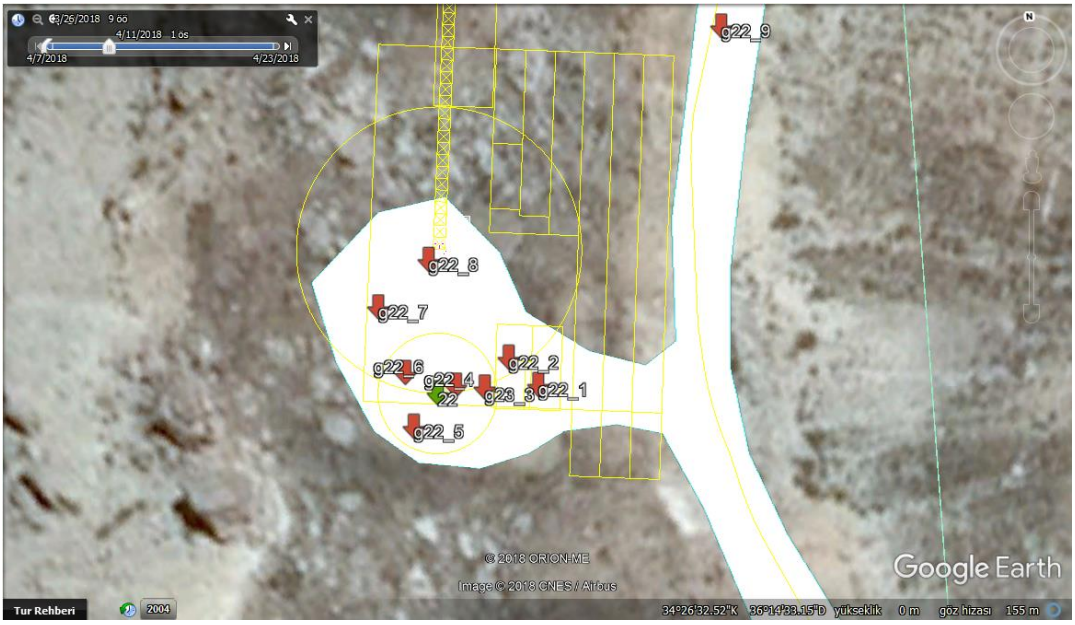
8 measurements were taken. These measurements showed 3 layers. Layer 1 was found between 0,00 m-4,42 m depth, Layer 2 between 4,42 m-24,30 m depth and Layer 3 at an average depth of 21,30 m. The parameters of this layer are given in the table below.

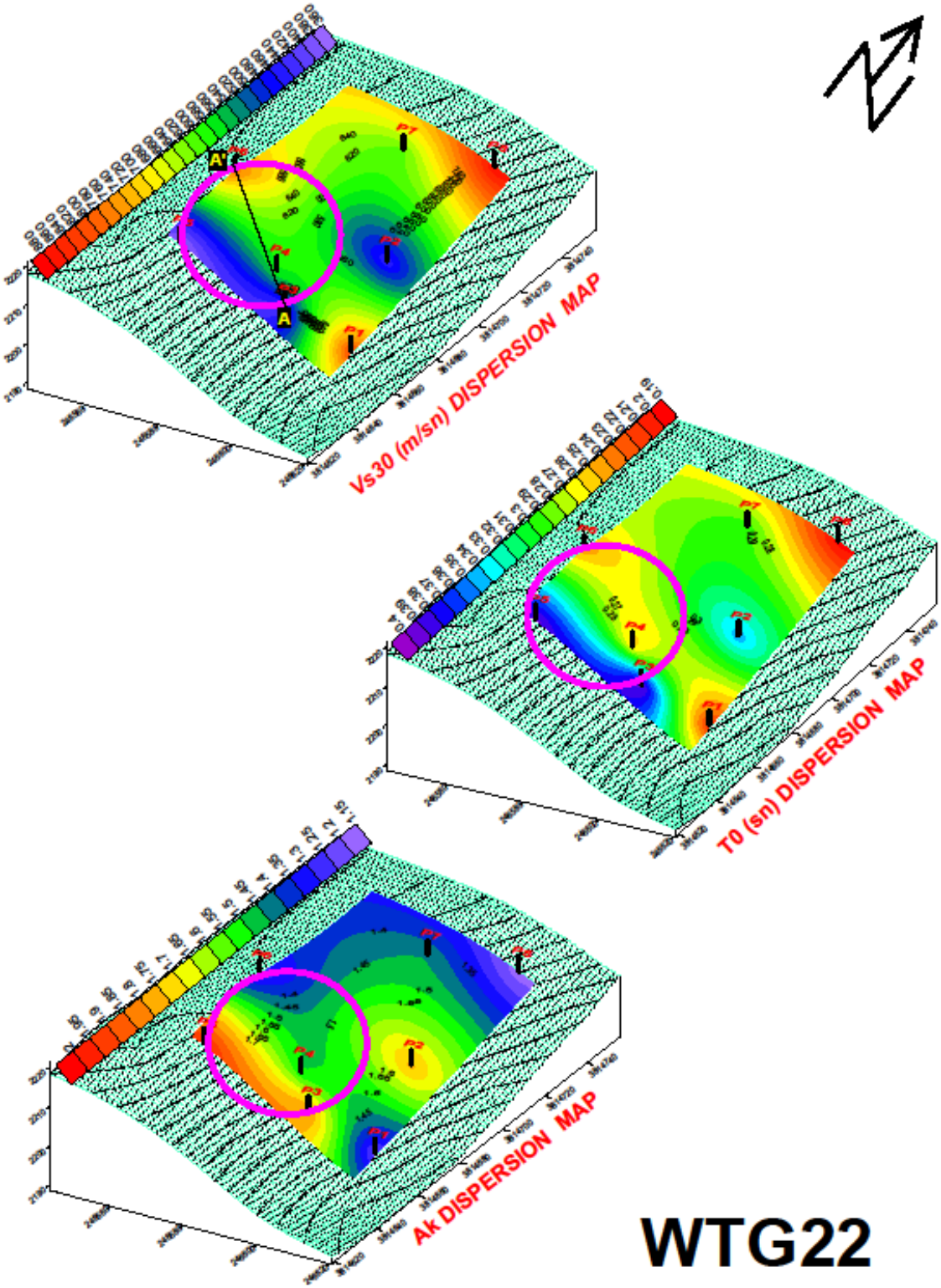
LAYERS	Vp_ Velocity	STRIPPABILITY
1. LAYER	827	Simple strippability
2.LAYER	1275	Medium-hard STRIPPABILITY
3.LAYER	2536	Explosive
LAYERS	**Vs_ Velocity**	**GROUND GROUP**
1. LAYER	331	C
2.LAYER	598	B
3.LAYER	1165	A
LAYERS	**G (kg/cm2)**	**ENDURANCE**
1. LAYER	2444	Medium
2.LAYER	8023	Sturdy
3.LAYER	34444	High sturdy
LAYERS	**E (kg/cm2)**	**ENDURANCE**
1. LAYER	6732	Medium
2.LAYER	21543	Sturdy
3.LAYER	93098	High sturdy

LAYERS	(σ)	POROSITY
1. LAYER	0,40	High Porosity
2.LAYER	0,35	High Porosity
3.LAYER	0,37	High Porosity
LAYERS	**ρ (gr/cm3)**	**DEFINITION**
1. LAYER	1,63	Medium
2.LAYER	1,82	Medium
3.LAYER	2,18	High
LAYERS	**D Y K (ton/m^3)**	
1. LAYER	2435	
2.LAYER	4625	
3.LAYER	10267	
LAYERS	**Ground Carrying Capacity (qu,kg/cm2)**	**Secure Carrying Capacity (qa,kg/cm2)**
1. LAYER	6,09	2,03
2.LAYER	11,56	3,85
3.LAYER	25,67	8,56

To (sec)	Ta (sec)	Tb (sec)	Vs30 (m/sec)	Ak (Amplification)
0,29	0,19	0,44	610	1,52

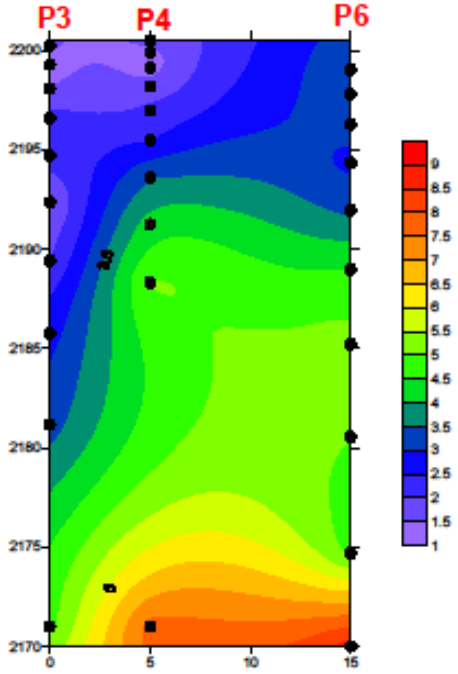
Except for the second (2) and fourth (4), the first layer of the profiles is very weak and it is foreseen to excavate an average of 4.00 m. Taking into account the following applications, the profile points should be seen in the engineering parameters section for detailed values.



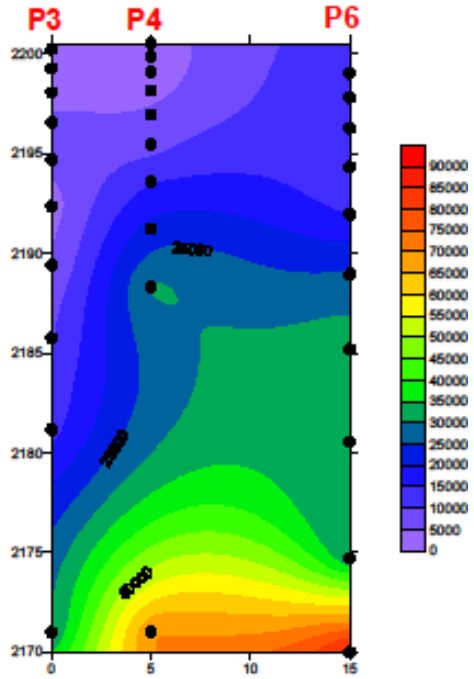

Vs30 (m/sn) DISPERSION MAP
T0 (sn) DISPERSION MAP
AK DISPERSION MAP
A'
A

WTG22

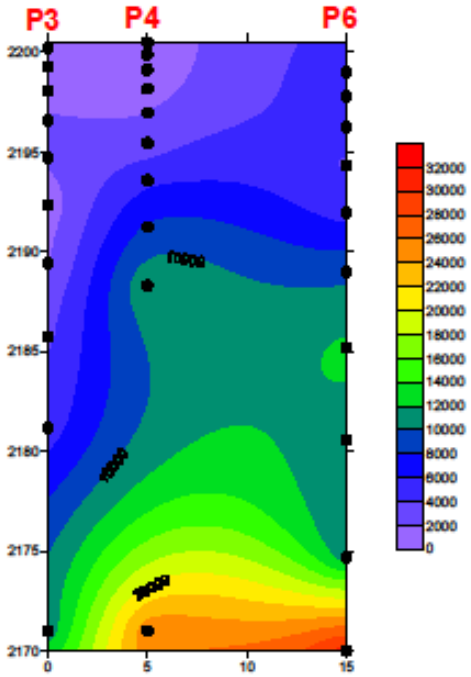
BEARING CAPACITY (kg/cm2)



YOUNG MODULE DISPERSIONE (kg/cm2)



SLIDE MODULE DISPERSIONE (kg/cm2)



5.22.1. WTG22 Seismic P wave velocity (*Compressional Wave Velocity* (Vp))

Vp VELOCITY				
PROFILES	LAYERS	DEPTH	Vp_ Velocity	STRIPPABILITY
1_PROFILE	1. LAYER	-7,25	1228	Medium Strippability
	2.LAYER	-22,78	1787	High Difficult Strippability
	3.LAYER		3415	Explosive
2_PROFILE	1. LAYER	-2,16	461	Simple Strippability
	2. LAYER	-14,60	845	Simple Strippability
	3. LAYER		1892	High Difficult Strippability
3_PROFILE	1. LAYER	-6,31	743	Simple Strippability
	2. LAYER	-19,84	885	Simple Strippability
	3. LAYER		1685	High Difficult Strippability
4_PROFILE	1. LAYER	-2,84	647	Simple Strippability
	2. LAYER	-12,69	1119	Simple Strippability
	3. LAYER		2435	Explosive
5_PROFILE	1. LAYER	-1,75	331	High Simple Strippability
	2. LAYER	-11,83	651	Simple Strippability
	3. LAYER		1460	Medium Strippability
6_PROFILE	1. LAYER	-5,66	1307	Medium Strippability
	2. LAYER	-25,31	1645	High Difficult Strippability
	3. LAYER		2982	Explosive
7_PROFILE	1. LAYER	-5,50	585	Simple Strippability
	2.LAYER	-37,19	1371	Medium Strippability
	3.LAYER		2900	Explosive
8_PROFILE	1. LAYER	-3,87	1314	Medium Strippability
	2. LAYER	-26,18	1901	High Difficult Strippability
	3. LAYER		3521	Explosive

P Wave Velocity (m/sec)	Strippability
Vp<458	High Simple Strippability
458<Vp<1220	Simple Strippability
1220<Vp<11525	Medium Strippability
1525<Vp<11830	Difficult Strippability
1830<Vp<12135	High Difficult Strippability
Vp>2135	Explosive Strippability

Strippability of floors with P wave velocity (Church, 1981)

||AVERAGE||			
LAYERS	DEPTH	Vp_ Velocity	STRIPPABILITY
1. LAYER	-4,42	827	Simple Strippability
2.LAYER	-21,30	1275	Medium Strippability
3.LAYER	∞	2536	Explosive

P wave velocities of the grounds in the study area and strippability

The above table shows the change table and strippability properties of Vp velocity depth values in the direction of the seismic data obtained from the field studies.

5.22.2. WTG22 Seismic S wave velocity (*Transverse Wave Velocity* (Vs))

Vs VELOCITY				
PROFILES	LAYERS	DEPTH	Vs_ Velocity	GROUND GROUPS
1_PROFILE	1. LAYER	-7,25	516	B
	2.LAYER	-22,78	817	A
	3.LAYER		1523	A
2_PROFILE	1. LAYER	-2,16	184	D
	2. LAYER	-14,60	412	B
	3. LAYER		799	A
3_PROFILE	1. LAYER	-6,31	293	C
	2. LAYER	-19,84	386	C
	3. LAYER		727	A
4_PROFILE	1. LAYER	-2,84	253	C
	2. LAYER	-12,69	549	B
	3. LAYER		1078	A
5_PROFILE	1. LAYER	-1,75	135	D
	2. LAYER	-11,83	339	C
	3. LAYER		697	B
6_PROFILE	1. LAYER	-5,66	504	B
	2. LAYER	-25,31	695	B
	3. LAYER		1163	A
7_PROFILE	1. LAYER	-5,50	258	C
	2.LAYER	-37,19	737	A
	3.LAYER		1502	A
8_PROFILE	1. LAYER	-3,87	505	B
	2. LAYER	-26,18	850	A
	3. LAYER		1831	A

S Wave Velocity (m/sec)	Ground group
Vs<200	D
200<Vs<400	C
400<Vs<700	B
700<Vs	A

Ground groups according to slip wave velocity(Abyyhy, 1998)

||AVERAGE||			
LAYERS	DEPTH	Vs_ Velocity	GROUND GROUPS
1. LAYER	-4,42	331	C
2.LAYER	-21,30	598	B
3.LAYER	∞	1165	A

S wave velocities of the grounds in the study area and ground group

Ground Group	Ground group and top ground layer thickness(h_1)
Z1	(A) Ground group h1< 15 m (B) Ground group
Z2	h_1> 15 m (B) Ground group h_1< 15 m (C) Ground group
Z3	15 m < h_1< 50 m (C) Ground group h_1< 10 m (D) Ground group
Z4	h_1> 50 m (C) Ground group h_1> 10 m (D) Ground group

Ground Group Class

The above table shows that Vs velocity values in the direction of the seismic data obtained in the field studies are the absolute change tables and that the layers are included in the ground groups.

5.22.3. WTG22 Vs30

PROFILES	Vs30 (m/sec)
1.PROFILE	814
2.PROFILE	440
3.PROFILE	421
4.PROFILE	575
5.PROFILE	369
6.PROFILE	771
7.PROFILE	614
8.PROFILE	877

Vs30 values in the direction of the seismic data obtained from the field studies are given in the table above.

5.22.4. WTG22 Shear Modulus-G (kg/cm²)

SHEAR MODULUS				
PROFILES	LAYERS	DEPTH	G(kg/cm^2)	ENDURANCE
1_PROFILE	1. LAYER	-7,25	5144	Sturdy
	2.LAYER	-22,78	13726	Rock Highlid
	3.LAYER		54995	Rock Highlid
2_PROFILE	1. LAYER	-2,16	505	Weak
	2. LAYER	-14,60	3195	Sturdy
	3. LAYER		13063	Rock Highlid
3_PROFILE	1. LAYER	-6,31	1461	Weak
	2. LAYER	-19,84	2766	Medium
	3. LAYER		10497	Rock Highlid
4_PROFILE	1. LAYER	-2,84	1026	Weak
	2. LAYER	-12,69	6008	Sturdy
	3. LAYER		25305	Rock Highlid
5_PROFILE	1. LAYER	-1,75	251	High Weak
	2. LAYER	-11,83	2065	Medium
	3. LAYER		9322	Sturdy
6_PROFILE	1. LAYER	-5,66	4762	Sturdy
	2. LAYER	-25,31	9733	Sturdy
	3. LAYER		30977	Rock Highlid
7_PROFILE	1. LAYER	-5,50	1203	Weak
	2.LAYER	-37,19	11248	Rock Highlid
	3.LAYER		51355	Rock Highlid
8_PROFILE	1. LAYER	-3,87	5200	Sturdy
	2. LAYER	-26,18	15441	Rock Highlid
	3. LAYER		80041	Rock Highlid

Shear Modulus (kg/cm^2)	Dayanım
G<400	High Weak
400<G<1500	Weak
1500<G<3000	Medium
3000<G<10000	Sturdy
10000<G	Rock Highlid

The endurance of ground or rocks according to Slip Module values(Keçeli, 1990)

$G = (d*Vs^2)/100$

||AVERAGE||			
LAYERS	DEPTH	G (kg/cm^2)	ENDURANCE
1. LAYER	-4,42	2444	Medium
2.LAYER	-21,30	8023	Sturdy
3.LAYER	∞	34444	Rock Highlid

Shear modules and endurance of the grounds in the study area

Calculation of shear Modulus values in the direction of the seismic data obtained in the field studies and the table of variation are given in the table above.

5.22.5. WTG22 Elasticity Modulus-E (kg/cm²)

PROFILES	LAYERS	DEPTH	ELASTIC MODULUS E(kg/cm²)	ENDURANCE
1_PROFILE	1. LAYER	-7,25	13981	Sturdy
	2.LAYER	-22,78	37424	Rock Highlid
	3.LAYER		151324	Rock Highlid
2_PROFILE	1. LAYER	-2,16	1389	Weak
	2. LAYER	-14,60	8491	Medium
	3. LAYER		36351	Rock Highlid
3_PROFILE	1. LAYER	-6,31	4036	Weak
	2. LAYER	-19,84	7499	Medium
	3. LAYER		29090	Sturdy
4_PROFILE	1. LAYER	-2,84	2869	Weak
	2. LAYER	-12,69	15955	Sturdy
	3. LAYER		69746	Rock Highlid
5_PROFILE	1. LAYER	-1,75	680	High Weak
	2. LAYER	-11,83	5385	Medium
	3. LAYER		25210	Sturdy
6_PROFILE	1. LAYER	-5,66	13429	Sturdy
	2. LAYER	-25,31	26942	Sturdy
	3. LAYER		87375	Rock Highlid
7_PROFILE	1. LAYER	-5,50	3229	Weak
	2.LAYER	-37,19	28913	Sturdy
	3.LAYER		135222	Rock Highlid
8_PROFILE	1. LAYER	-3,87	14241	Sturdy
	2. LAYER	-26,18	41735	Rock Highlid
	3. LAYER		210465	Rock Highlid

Elastic Modulus (kg/cm²)	Dayanım
E<1000	High Weak
1000<E<5000	Weak
5000<E<10000	Medium
10000<E<30000	Sturdy
30000<E	Rock Highlid

The endurance of ground or rocks according to Slip Module values(Keçeli, 1990)

$$E=G*(3*V_p^2-4*V_s^2)/(V_p^2-V_s^2)$$

||AVERAGE||			
LAYERS	DEPTH	E (kg/cm²)	ENDURANCE
1. LAYER	-4,42	6732	Medium
2.LAYER	-21,30	21543	Sturdy
3.LAYER	∞	93098	Rock Highlid

Elasticity modules and endurance of the grounds in the study area

Calculation of the modulus of elasticity in the direction of the seismic data obtained in the field studies and the change table are given in the above table

5.22.6. WTG22 Poisson's Ratio - (б)

POISSON'S RATIO				
PROFILES	LAYERS	DEPTH	(σ)	POROSITY
1_PROFILE	1. LAYER	-7,25	0,38	High Porous
	2.LAYER	-22,78	0,36	High Porous
	3.LAYER		0,38	High Porous
2_PROFILE	1. LAYER	-2,16	0,40	High Porous
	2. LAYER	-14,60	0,34	Medium Porous
	3. LAYER		0,39	High Porous
3_PROFILE	1. LAYER	-6,31	0,40	High Porous
	2. LAYER	-19,84	0,38	High Porous
	3. LAYER		0,39	High Porous
4_PROFILE	1. LAYER	-2,84	0,41	High Porous
	2. LAYER	-12,69	0,34	Medium Porous
	3. LAYER		0,38	High Porous
5_PROFILE	1. LAYER	-1,75	0,39	High Porous
	2. LAYER	-11,83	0,32	Medium Porous
	3. LAYER		0,35	High Porous
6_PROFILE	1. LAYER	-5,66	0,41	High Porous
	2. LAYER	-25,31	0,39	High Porous
	3. LAYER		0,41	High Porous
7_PROFILE	1. LAYER	-5,50	0,38	High Porous
	2.LAYER	-37,19	0,30	Medium Porous
	3.LAYER		0,32	Medium Porous
8_PROFILE	1. LAYER	-3,87	0,40	High Porous
	2. LAYER	-26,18	0,37	High Porous
	3. LAYER		0,31	Medium Porous

Poisson's Ratio;(σ)	Porosity
0,00≤σ≤0,25	Nonporous
0,26≤σ≤0,35	Medium Porous
0,36≤σ≤0,50	High Porous

Poisson ratio classification

$\sigma=(Vp^2-2*Vs^2)/(2*Vp^2-2*Vs^2)$

||AVERAGE||			
LAYERS	DEPTH	(σ)	POROSITY
1. LAYER	-4,42	0,40	High Porous
2.LAYER	-21,30	0,35	High Porous
3.LAYER	∞	0,37	High Porous

Poisson's ratio values of the units in the study area, porosity

Calculation of poisson's ratio values in the direction of the seismic data obtained in the field studies and the change table are given in the above table.

5.22.7. WTG22 Density - ρ (gr/ cm^3)

DENSITY				
PROFILES	LAYERS	DEPTH	ρ (gr/cm^3)	DEFINITION
1_PROFILE	1. LAYER	-7,25	1,84	Medium
	2.LAYER	-22,78	2,01	High
	3.LAYER		2,37	High
2_PROFILE	1. LAYER	-2,16	1,44	Medium
	2. LAYER	-14,60	1,66	Medium
	3. LAYER		2,04	High
3_PROFILE	1. LAYER	-6,31	1,62	Medium
	2. LAYER	-19,84	1,69	Medium
	3. LAYER		1,99	High
4_PROFILE	1. LAYER	-2,84	1,56	Medium
	2. LAYER	-12,69	1,78	Medium
	3. LAYER		2,18	High
5_PROFILE	1. LAYER	-1,75	1,32	Low
	2. LAYER	-11,83	1,55	Medium
	3. LAYER		1,92	High
6_PROFILE	1. LAYER	-5,66	1,86	Medium
	2. LAYER	-25,31	1,97	High
	3. LAYER		2,29	High
7_PROFILE	1. LAYER	-5,50	1,52	Medium
	2.LAYER	-37,19	1,88	Medium
	3.LAYER		2,27	High
8_PROFILE	1. LAYER	-3,87	1,87	Medium
	2. LAYER	-26,18	2,04	High
	3. LAYER		2,39	High

Density: ρ (gr/cm^3)	Tanımlama
ρ<1,20	High low
1,20<ρ<1,40	Low
1,40<ρ<1,90	Medium
1,90<ρ<2,20	High
2,20<ρ	Too High

Density Classification of Ground Units: (Keçeli, 1990)

$\rho = d = 0.31 * Vp0.25$

‖AVERAGE‖			
LAYERS	DEPTH	ρ (gr/cm^3)	DEFINITION
1. LAYER	-4,42	1,63	Medium
2.LAYER	-21,30	1,82	Medium
3.LAYER	∞	2,18	High

Density values and description of the units in the study area

Calculation of the density values of the geological units in the direction of the seismic data obtained in the field studies and the table of variation are given in the above table.

5.22.8. WTG22 Modulus of Subgrade Reaction – D Y K (ton/m^3)

Modulus of Subgrade Reaction			
PROFILES	LAYERS	DEPTH	D Y K (ton/m^3)
1_PROFILE	1. LAYER	-7,25	3896
	2.LAYER	-22,78	6552
	3.LAYER		14223
2_PROFILE	1. LAYER	-2,16	1272
	2. LAYER	-14,60	3001
	3. LAYER		6467
3_PROFILE	1. LAYER	-6,31	2097
	2. LAYER	-19,84	2813
	3. LAYER		5759
4_PROFILE	1. LAYER	-2,84	1791
	2. LAYER	-12,69	4128
	3. LAYER		9200
5_PROFILE	1. LAYER	-1,75	916
	2. LAYER	-11,83	2414
	3. LAYER		5397
6_PROFILE	1. LAYER	-5,66	3840
	2. LAYER	-25,31	5493
	3. LAYER		10445
7_PROFILE	1. LAYER	-5,50	1823
	2.LAYER	-37,19	5699
	3.LAYER		13395
8_PROFILE	1. LAYER	-3,87	3845
	2. LAYER	-26,18	6895
	3. LAYER		17252

‖AVERAGE‖		
LAYERS	DEPTH	D Y K (ton/m^3)
1. LAYER	-4,42	2435
2.LAYER	-21,30	4625
3.LAYER	∞	10267
kv= 40*(Gs)*qu ton/m^3 *(Bowles 1984)*		

The above table shows the Modulus of Subgrade Reaction obtained for each layer in the direction of the data obtained after the seismic measurements made in the study area.

5.22.9. WTG22 Bearing Capacity qu (kg/cm2) / Allowable Bearing Capacity qa (kg/cm2)

PROFILES	LAYERS	DEPTH	BEARING CAPACITY	ALLOWABLE
1_PROFILE	1. LAYER	-7,25	9,74	3,25
	2.LAYER	-22,78	16,38	5,46
	3.LAYER		35,56	11,85
2_PROFILE	1. LAYER	-2,16	3,18	1,06
	2. LAYER	-14,60	7,50	2,50
	3. LAYER		16,17	5,39
3_PROFILE	1. LAYER	-6,31	5,24	1,75
	2. LAYER	-19,84	7,03	2,34
	3. LAYER		14,40	4,80
4_PROFILE	1. LAYER	-2,84	4,48	1,49
	2. LAYER	-12,69	10,32	3,44
	3. LAYER		23,00	7,67
5_PROFILE	1. LAYER	-1,75	2,29	0,76
	2. LAYER	-11,83	6,04	2,01
	3. LAYER		13,49	4,50
6_PROFILE	1. LAYER	-5,66	9,60	3,20
	2. LAYER	-25,31	13,73	4,58
	3. LAYER		26,11	8,70
7_PROFILE	1. LAYER	-5,50	4,56	1,52
	2.LAYER	-37,19	14,25	4,75
	3.LAYER		33,49	11,16
8_PROFILE	1. LAYER	-3,87	9,61	3,20
	2. LAYER	-26,18	17,24	5,75
	3. LAYER		43,13	14,38

LAYERS	||AVERAGE|| DEPTH	Bearing Capacity (qu,kg/cm^2)
1. LAYER	-4,42	6,09
2.LAYER	-21,30	11,56
3.LAYER	∞	25,67
qu=(0,024*Vs*(J.B.K+0,002*Vp)*0,71)/G.K		

LAYERS	||AVERAGE|| DEPTH	Allowable Bearing Capacity (qa,kg/cm^2)
1. LAYER	-4,42	2,03
2.LAYER	-21,30	3,85
3.LAYER	∞	8,56
qa=qu/G.K G.K=3 empirical value		

5.22.10 WTG22 Vibration Period - T_0 (sec) / Ground Amplification (Ak)

PROFILES	To (sec)	Ta (sec)	Tb (sec)	Ak (Amplification)
1.PROFILE	0,21	0,14	0,31	1,22
2.PROFILE	0,35	0,23	0,52	1,76
3.PROFILE	0,39	0,26	0,59	1,81
4.PROFILE	0,26	0,17	0,38	1,50
5.PROFILE	0,39	0,26	0,59	1,96
6.PROFILE	0,24	0,16	0,36	1,26
7.PROFILE	0,29	0,20	0,44	1,44
8.PROFILE	0,19	0,13	0,29	1,17

AVERAGE			
To (sec)	Ta (sec)	Tb (sec)	Ak (Amplification)
0,29	0,19	0,44	1,52

$To = \sum 4H\ Vs\ n\ \iota$=1 (sec)……. (Zeevaert,1967)

Ak=68*$Vs_{30}^{-0,6}$……. (Midorikawa, 1987)

The Vibration Period and Ground Amplification calculated in the direction of the parameters obtained during the seismic studies made during the field survey are presented in the table above.

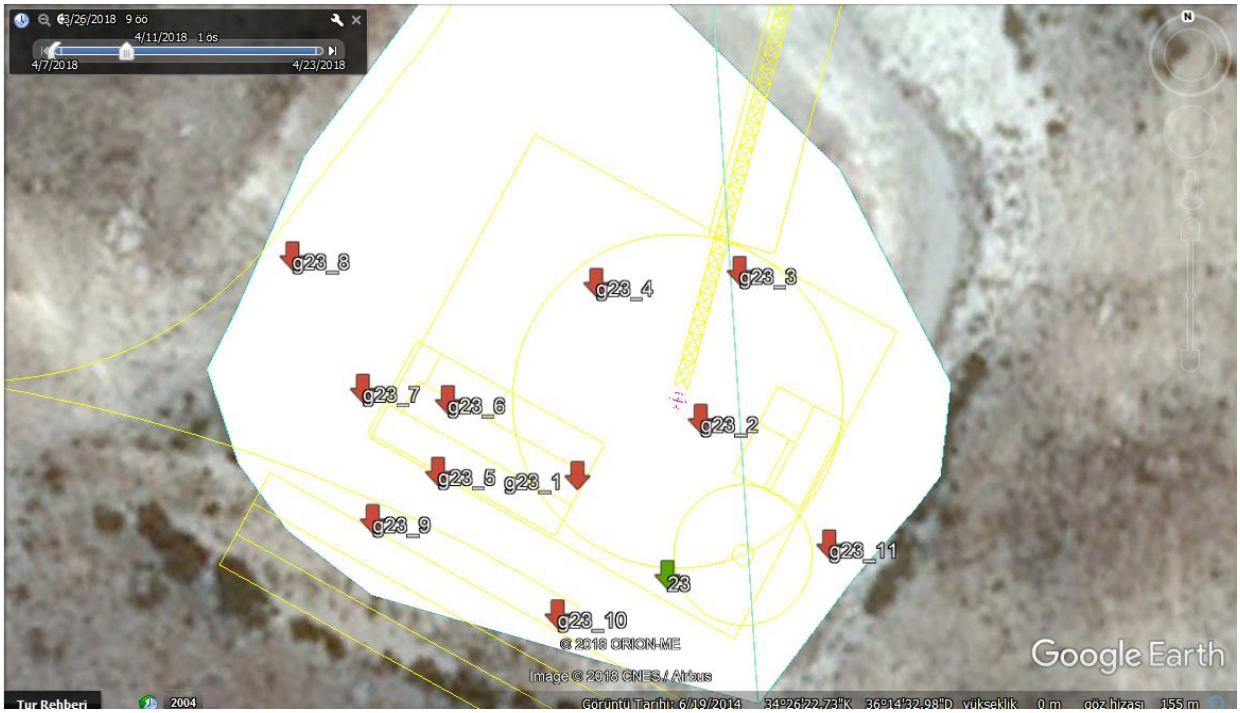
5. 23. WTG23

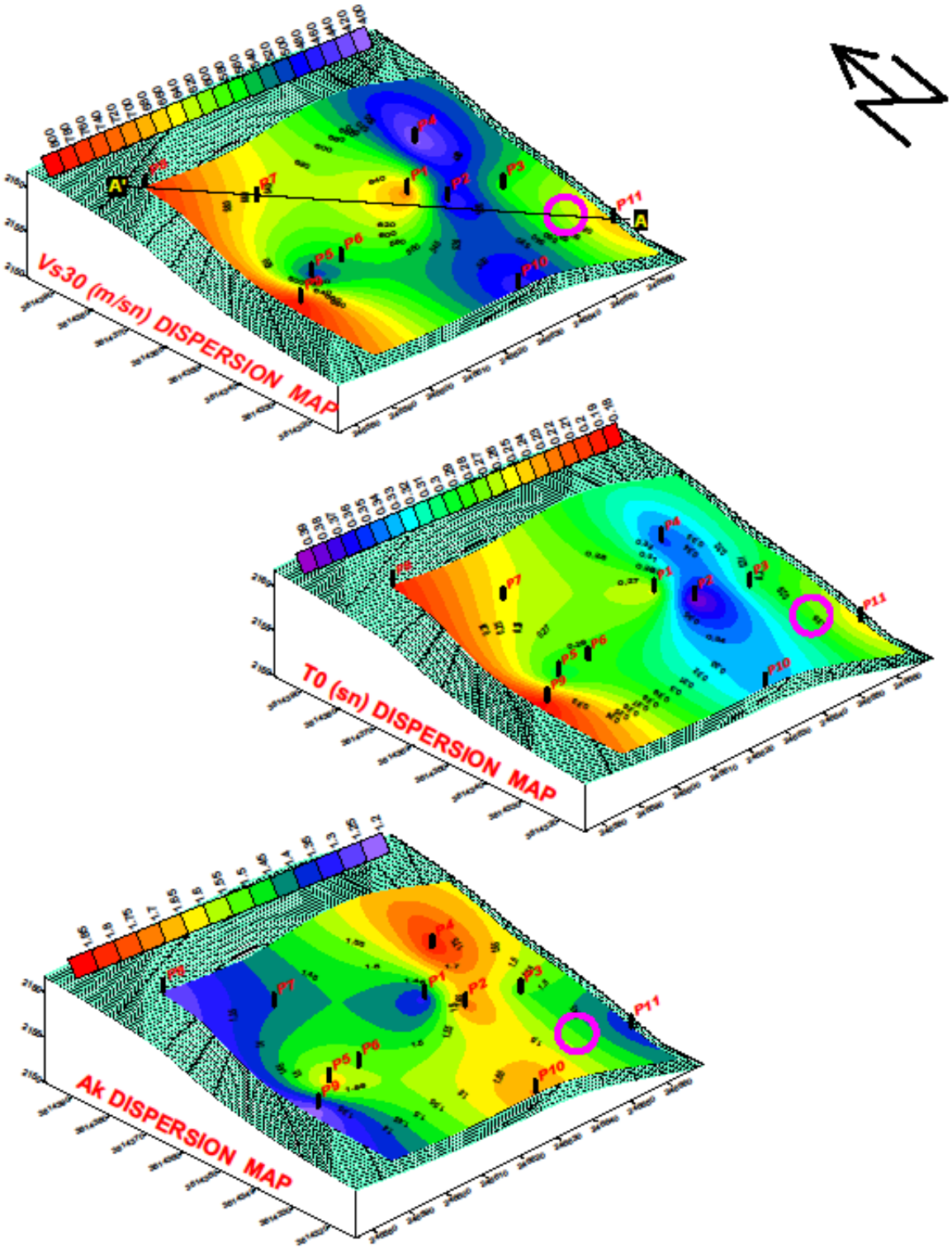
9 measurements were taken. These measurements showed 3 layers. Layer 1 was found at an average depth of 0,00 m-3,67 m, Layer 2 at an average depth of 3,67 m-18,46 m and Layer 3 at an average depth of 18,46 m. The parameters of this layer are given in the table below.

LAYERS	Vp_ Velocity	STRIPPABILITY
1. LAYER	890	Simple strippability
2.LAYER	1206	Simple strippability
3.LAYER	2495	Explosive
LAYERS	**Vs_ Velocity**	**GROUND GROUP**
1. LAYER	365	C
2.LAYER	567	B
3.LAYER	1083	A
LAYERS	**G (kg/cm2)**	**ENDURANCE**
1. LAYER	2491	Medium
2.LAYER	6981	Sturdy
3.LAYER	28264	High sturdy
LAYERS	**E (kg/cm2)**	**ENDURANCE**
1. LAYER	6833	Medium
2.LAYER	18580	Sturdy
3.LAYER	78099	High sturdy

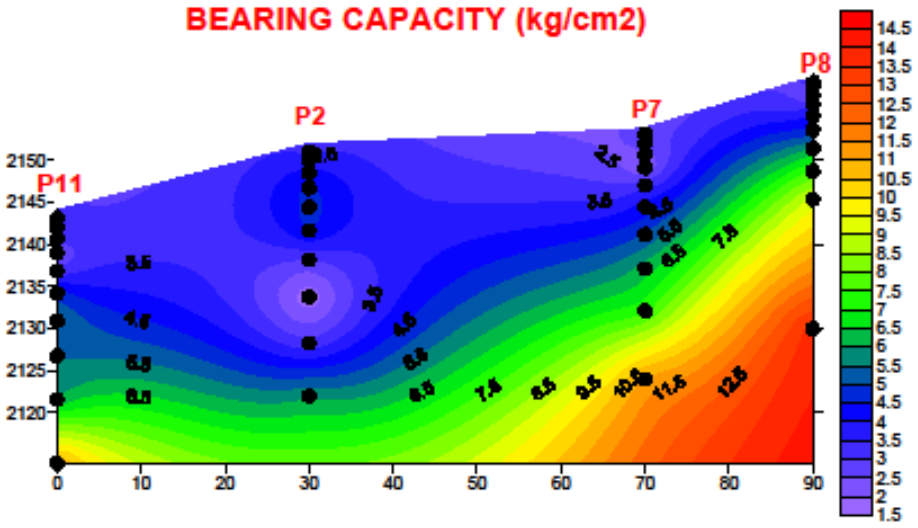
LAYERS	(σ)	POROSITY
1. LAYER	0,39	High Porosity
2.LAYER	0,35	High Porosity
3.LAYER	0,39	High Porosity
LAYERS	**ρ (gr/cm3)**	**DEFINITION**
1. LAYER	1,69	Medium
2.LAYER	1,81	Medium
3.LAYER	2,18	High
LAYERS	**D Y K (ton/m^3)**	
1. LAYER	3203	
2.LAYER	5155	
3.LAYER	11021	
LAYERS	**Ground Carrying Capacity (qu,kg/cm2)**	**Secure Carrying Capacity (qa,kg/cm2)**
1. LAYER	8,01	2,67
2.LAYER	12,89	4,30
3.LAYER	27,55	9,18

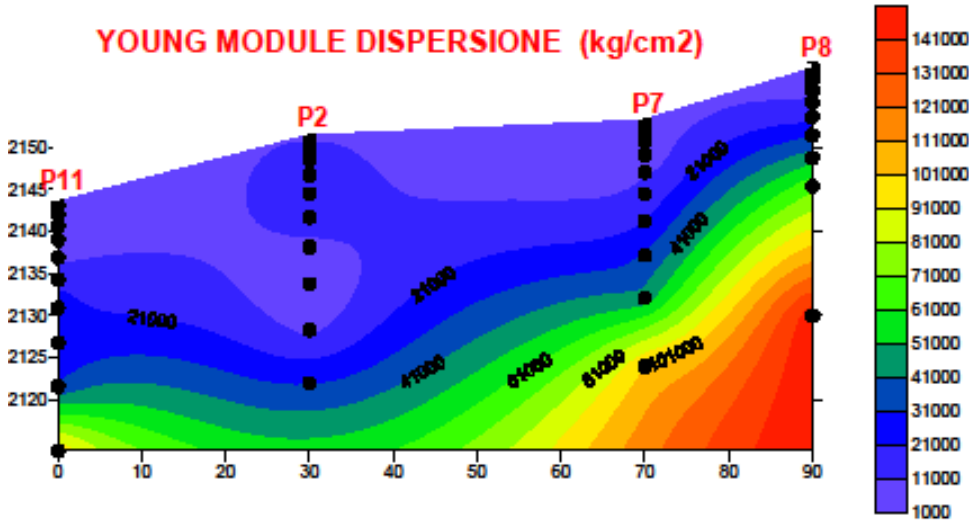
Taking into account the following applications, the profile points should be seen in the engineering parameters section for detailed values.

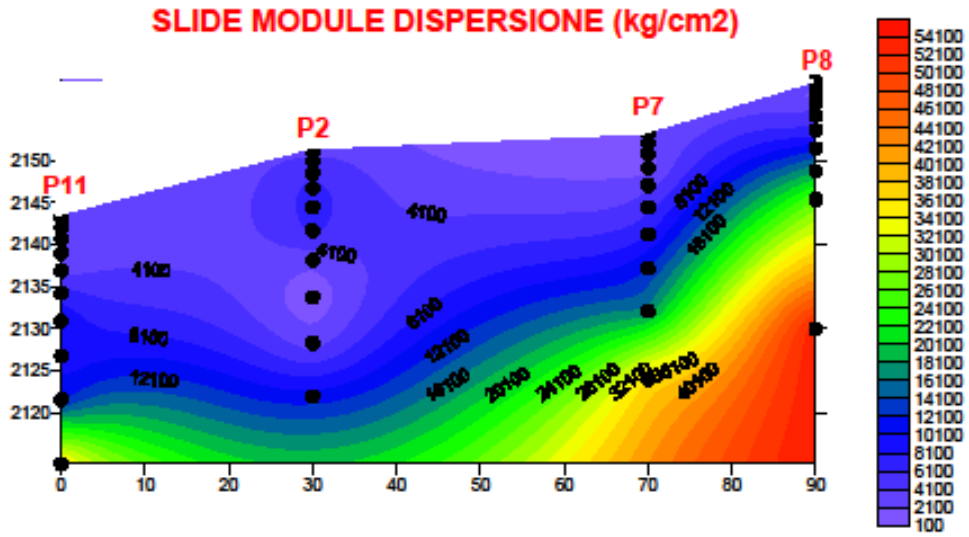



Vs30 (m/sn) DISPERSION MAP
T0 (sn) DISPERSION MAP
Ak DISPERSION MAP
A'
A
P1
P2
P3
P4
P5
P6
P7
P8
P9
P10
P11

WTG23


BEARING CAPACITY (kg/cm2)
P11
P2
P7
P8
2150
2145
2140
2135
2130
2125
2120
0
10
20
30
40
50
60
70
80
90
14.5
14
13.5
13
12.5
12
11.5
11
10.5
10
9.5
9
8.5
8
7.5
7
6.5
6
5.5
5
4.5
4
3.5
3
2.5
2
1.5


YOUNG MODULE DISPERSIONE (kg/cm2)
P11
P2
P7
P8
2150
2145
2140
2135
2130
2125
2120
0
10
20
30
40
50
60
70
80
90
141000
131000
121000
111000
101000
91000
81000
71000
61000
51000
41000
31000
21000
11000
1000


SLIDE MODULE DISPERSIONE (kg/cm2)
P11
P2
P7
P8
2150
2145
2140
2135
2130
2125
2120
0
10
20
30
40
50
60
70
80
90
54100
52100
50100
48100
46100
44100
42100
40100
38100
36100
34100
32100
30100
28100
26100
24100
22100
20100
18100
16100
14100
12100
10100
8100
6100
4100
2100
100

5.23.1. WTG23 Seismic P wave velocity (*Compressional Wave Velocity* (Vp))

VP VELOCITY				
PROFILES	LAYERS	DEPTH	Vp_ Velocity	STRIPPABILITY
1_PROFILE	1. LAYER	-4,19	1130	Simple Strippability
	2.LAYER	-28,32	1426	Medium Strippability
	3.LAYER		2973	Explosive
2_PROFILE	1. LAYER	-3,50	1208	Simple Strippability
	2. LAYER	-23,68	1156	Simple Strippability
	3. LAYER		1754	High Difficult Strippability
3_PROFILE	1. LAYER	-5,11	1061	Simple Strippability
	2. LAYER	-22,88	1140	Simple Strippability
	3. LAYER		2248	Explosive
4_PROFILE	1. LAYER	-2,31	645	Simple Strippability
	2. LAYER	-10,32	791	Simple Strippability
	3. LAYER		1656	High Difficult Strippability
5_PROFILE	1. LAYER	-1,74	714	Simple Strippability
	2. LAYER	-11,75	948	Simple Strippability
	3. LAYER		2031	High Difficult Strippability
6_PROFILE	1. LAYER	-3,65	702	Simple Strippability
	2. LAYER	-16,34	1135	Simple Strippability
	3. LAYER		2274	Explosive
7_PROFILE	1. LAYER	-4,89	846	Simple Strippability
	2.LAYER	-21,88	1306	Medium Strippability
	3.LAYER		2979	Explosive
8_PROFILE	1. LAYER	-2,16	865	Simple Strippability
	2. LAYER	-14,64	1425	Medium Strippability
	3. LAYER		3363	Explosive
9_PROFILE	1. LAYER	-3,33	861	Simple Strippability
	2. LAYER	-14,90	1551	High Difficult Strippability
	3. LAYER		3423	Explosive
10_PROFILE	1. LAYER	-2,36	730	Simple Strippability
	2. LAYER	-15,99	894	Simple Strippability
	3. LAYER		1836	High Difficult Strippability
11_PROFILE	1. LAYER	-7,12	1029	Simple Strippability
	2. LAYER	-22,38	1492	Medium Strippability
	3. LAYER		2910	Explosive

P Wave Velocity (m/sec)	Strippability
Vp<458	High Simple Strippability
458<Vp<1220	Simple Strippability
1220<Vp<11525	Medium Strippability
1525<Vp<11830	Difficult Strippability
1830<Vp<12135	High Difficult Strippability
Vp>2135	Explosive Strippability

Strippability of floors with P wave velocity (Church, 1981)

||AVERAGE||			
LAYERS	DEPTH	Vp_ Velocity	STRIPPABILITY
1. LAYER	-3,67	890	Simple Strippability
2.LAYER	-18,46	1206	Simple Strippability
3.LAYER	∞	2495	Explosive

P wave velocities of the grounds in the study area and strippability

The above table shows the change table and strippability properties of Vp velocity depth values in the direction of the seismic data obtained from the field studies.

5.23.2. WTG23 Seismic S wave velocity (*Transverse Wave Velocity* (Vs))

Vs VELOCITY				
PROFILES	LAYERS	DEPTH	Vs_ Velocity	GROUND GROUPS
1_PROFILE	1. LAYER	-4,19	415	B
	2.LAYER	-28,32	661	B
	3.LAYER		1282	A
2_PROFILE	1. LAYER	-3,50	486	B
	2. LAYER	-23,68	465	B
	3. LAYER		736	A
3_PROFILE	1. LAYER	-5,11	507	B
	2. LAYER	-22,88	490	B
	3. LAYER		963	A
4_PROFILE	1. LAYER	-2,31	283	C
	2. LAYER	-10,32	376	C
	3. LAYER		696	B
5_PROFILE	1. LAYER	-1,74	265	C
	2. LAYER	-11,75	428	B
	3. LAYER		849	A
6_PROFILE	1. LAYER	-3,65	271	C
	2. LAYER	-16,34	533	B
	3. LAYER		1000	A
7_PROFILE	1. LAYER	-4,89	331	C
	2.LAYER	-21,88	669	B
	3.LAYER		1255	A
8_PROFILE	1. LAYER	-2,16	362	C
	2. LAYER	-14,64	726	A
	3. LAYER		1504	A
9_PROFILE	1. LAYER	-3,33	387	C
	2. LAYER	-14,90	805	A
	3. LAYER		1574	A
10_PROFILE	1. LAYER	-2,36	301	C
	2. LAYER	-15,99	394	C
	3. LAYER		801	A
11_PROFILE	1. LAYER	-7,12	409	B
	2. LAYER	-22,38	691	B
	3. LAYER		1246	A

S Wave Velocity (m/sec)	Ground group
Vs<200	D
200<Vs<400	C
400<Vs<700	B
700<Vs	A

Ground groups according to slip wave velocity(Abyyhy, 1998)

||AVERAGE||			
LAYERS	DEPTH	Vs_ Velocity	GROUND GROUPS
1. LAYER	-3,67	365	C
2.LAYER	-18,46	567	B
3.LAYER	∞	1083	A

S wave velocities of the grounds in the study area and ground group

Ground Group	Ground group and top ground layer thickness(h_1)
Z1	(A) Ground group h1< 15 m (B) Ground group
Z2	h_1> 15 m (B) Ground group h_1< 15 m (C) Ground group
Z3	15 m < h_1< 50 m (C) Ground group h_1< 10 m (D) Ground group
Z4	h_1> 50 m (C) Ground group h_1> 10 m (D) Ground group

Ground Group Class

The above table shows that Vs velocity values in the direction of the seismic data obtained in the field studies are the absolute change tables and that the layers are included in the ground groups.

5.23.3. WTG23 Vs30

PROFILES	Vs30 (m/sec)
1.PROFILE	717
2.PROFILE	457
3.PROFILE	575
4.PROFILE	409
5.PROFILE	493
6.PROFILE	552
7.PROFILE	649
8.PROFILE	779
9.PROFILE	798
10.PROFILE	465
11.PROFILE	682

Vs30 values in the direction of the seismic data obtained from the field studies are given in the table above.

5.23.4. WTG23 Shear Modulus-G (kg/cm²)

SHEAR MODULUS				
PROFILES	LAYERS	DEPTH	G(kg/cm^2)	ENDURANCE
1_PROFILE	1. LAYER	-4,19	3271	Sturdy
	2.LAYER	-28,32	9216	Sturdy
	3.LAYER		37636	Rock Highlid
2_PROFILE	1. LAYER	-3,50	4345	Sturdy
	2. LAYER	-23,68	4328	Sturdy
	3. LAYER		10877	Rock Highlid
3_PROFILE	1. LAYER	-5,11	4594	Sturdy
	2. LAYER	-22,88	4980	Sturdy
	3. LAYER		19814	Rock Highlid
4_PROFILE	1. LAYER	-2,31	1283	Weak
	2. LAYER	-10,32	2684	Medium
	3. LAYER		9586	Sturdy
5_PROFILE	1. LAYER	-1,74	1125	Weak
	2. LAYER	-11,75	3502	Sturdy
	3. LAYER		15007	Rock Highlid
6_PROFILE	1. LAYER	-3,65	1189	Weak
	2. LAYER	-16,34	5410	Sturdy
	3. LAYER		21417	Rock Highlid
7_PROFILE	1. LAYER	-4,89	1896	Medium
	2.LAYER	-21,88	8993	Sturdy
	3.LAYER		36079	Rock Highlid
8_PROFILE	1. LAYER	-2,16	2487	Medium
	2. LAYER	-14,64	11503	Rock Highlid
	3. LAYER		53393	Rock Highlid
9_PROFILE	1. LAYER	-3,33	2775	Medium
	2. LAYER	-14,90	13996	Rock Highlid
	3. LAYER		58712	Rock Highlid
10_PROFILE	1. LAYER	-2,36	1465	Weak
	2. LAYER	-15,99	2913	Medium
	3. LAYER		13023	Rock Highlid
11_PROFILE	1. LAYER	-7,12	2975	Medium
	2. LAYER	-22,38	9263	Sturdy
	3. LAYER		35363	Rock Highlid

Shear Modulus (kg/cm^2)	Dayanım
G<400	High Weak
400<G<1500	Weak
1500<G<3000	Medium
3000<G<10000	Sturdy
10000<G	Rock Highlid

The endurance of ground or rocks according to Slip Module values(Keçeli, 1990)

$G = (d*Vs^2)/100$

‖AVERAGE‖			
LAYERS	DEPTH	G (kg/cm^2)	ENDURANCE
1. LAYER	-3,67	2491	Medium
2.LAYER	-18,46	6981	Sturdy
3.LAYER	∞	28264	Rock Highlid

Shear modules and endurance of the grounds in the study area

Calculation of shear Modulus values in the direction of the seismic data obtained in the field studies and the table of variation are given in the table above.

5.23.5. WTG23 Elasticity Modulus-E (kg/cm²)

ELASTIC MODULUS				
PROFILES	LAYERS	DEPTH	E(kg/cm^2)	ENDURANCE
1_PROFILE	1. LAYER	-4,19	9120	Medium
	2.LAYER	-28,32	24631	Sturdy
	3.LAYER		104308	Rock Highlid
2_PROFILE	1. LAYER	-3,50	12148	Sturdy
	2. LAYER	-23,68	11782	Sturdy
	3. LAYER		30304	Rock Highlid
3_PROFILE	1. LAYER	-5,11	12337	Sturdy
	2. LAYER	-22,88	13251	Sturdy
	3. LAYER		54984	Rock Highlid
4_PROFILE	1. LAYER	-2,31	3494	Weak
	2. LAYER	-10,32	7068	Medium
	3. LAYER		26699	Sturdy
5_PROFILE	1. LAYER	-1,74	3193	Weak
	2. LAYER	-11,75	9483	Medium
	3. LAYER		41841	Rock Highlid
6_PROFILE	1. LAYER	-3,65	3353	Weak
	2. LAYER	-16,34	14553	Sturdy
	3. LAYER		59113	Rock Highlid
7_PROFILE	1. LAYER	-4,89	5267	Medium
	2.LAYER	-21,88	23789	Sturdy
	3.LAYER		100449	Rock Highlid
8_PROFILE	1. LAYER	-2,16	6573	Medium
	2. LAYER	-14,64	30262	Rock Highlid
	3. LAYER		146831	Rock Highlid
9_PROFILE	1. LAYER	-3,33	7275	Medium
	2. LAYER	-14,90	36492	Rock Highlid
	3. LAYER		160405	Rock Highlid
10_PROFILE	1. LAYER	-2,36	4092	Weak
	2. LAYER	-15,99	7878	Medium
	3. LAYER		36007	Rock Highlid
11_PROFILE	1. LAYER	-7,12	8307	Medium
	2. LAYER	-22,38	25194	Sturdy
	3. LAYER		98145	Rock Highlid

Elastic Modulus (kg/cm^2)	Dayanım
E<1000	High Weak
1000<E<5000	Weak
5000<E<10000	Medium
10000<E<30000	Sturdy
30000<E	Rock Highlid

The endurance of ground or rocks according to Slip Module values(Keçeli, 1990)

$E=G*(3*V_p^2-4*V_s^2)/(V_p^2-V_s^2)$

‖AVERAGE‖			
LAYERS	DEPTH	E (kg/cm^2)	ENDURANCE
1. LAYER	-3,67	6833	Medium
2.LAYER	-18,46	18580	Sturdy
3.LAYER	∞	78099	Rock Highlid

Elasticity modules and endurance of the grounds in the study area

Calculation of the modulus of elasticity in the direction of the seismic data obtained in the field studies and the change table are given in the above table

5.23.6. WTG23 Poisson's Ratio - (б)

POISSON'S RATIO				
PROFILES	LAYERS	DEPTH	(σ)	POROSITY
1_PROFILE	1. LAYER	-4,19	0,41	High Porous
	2.LAYER	-28,32	0,36	High Porous
	3.LAYER		0,39	High Porous
2_PROFILE	1. LAYER	-3,50	0,40	High Porous
	2. LAYER	-23,68	0,39	High Porous
	3. LAYER		0,39	High Porous
3_PROFILE	1. LAYER	-5,11	0,35	Medium Porous
	2. LAYER	-22,88	0,37	High Porous
	3. LAYER		0,39	High Porous
4_PROFILE	1. LAYER	-2,31	0,37	High Porous
	2. LAYER	-10,32	0,34	Medium Porous
	3. LAYER		0,39	High Porous
5_PROFILE	1. LAYER	-1,74	0,42	High Porous
	2. LAYER	-11,75	0,37	High Porous
	3. LAYER		0,39	High Porous
6_PROFILE	1. LAYER	-3,65	0,41	High Porous
	2. LAYER	-16,34	0,35	High Porous
	3. LAYER		0,38	High Porous
7_PROFILE	1. LAYER	-4,89	0,40	High Porous
	2.LAYER	-21,88	0,32	Medium Porous
	3.LAYER		0,39	High Porous
8_PROFILE	1. LAYER	-2,16	0,37	High Porous
	2. LAYER	-14,64	0,33	Medium Porous
	3. LAYER		0,38	High Porous
9_PROFILE	1. LAYER	-3,33	0,35	Medium Porous
	2. LAYER	-14,90	0,32	Medium Porous
	3. LAYER		0,37	High Porous
10_PROFILE	1. LAYER	-2,36	0,40	High Porous
	2. LAYER	-15,99	0,38	High Porous
	3. LAYER		0,38	High Porous
11_PROFILE	1. LAYER	-7,12	0,40	High Porous
	2. LAYER	-22,38	0,36	High Porous
	3. LAYER		0,39	High Porous

Poisson's Ratio;(σ)	Porosity
0,00≤σ≤0,25	Nonporous
0,26≤σ≤0,35	Medium Porous
0,36≤σ≤0,50	High Porous

Poisson ratio classification

$\sigma=(Vp^2-2*Vs^2)/(2*Vp^2-2*Vs^2)$

‖AVERAGE‖			
LAYERS	DEPTH	(σ)	POROSITY
1. LAYER	-3,67	0,39	High Porous
2.LAYER	-18,46	0,35	High Porous
3.LAYER	∞	0,39	High Porous

Poisson's ratio values of the units in the study area, porosity

Calculation of poisson's ratio values in the direction of the seismic data obtained in the field studies and the change table are given in the above table.

5.23.7. WTG23 Density - ρ (gr/ cm^3)

DENSITY				
PROFILES	LAYERS	DEPTH	ρ (gr/cm^3)	DEFINITION
1_PROFILE	1. LAYER	-4,19	1,80	Medium
	2.LAYER	-28,32	1,90	High
	3.LAYER		2,29	High
2_PROFILE	1. LAYER	-3,50	1,83	Medium
	2. LAYER	-23,68	1,81	Medium
	3. LAYER		2,01	High
3_PROFILE	1. LAYER	-5,11	1,77	Medium
	2. LAYER	-22,88	1,80	Medium
	3. LAYER		2,13	High
4_PROFILE	1. LAYER	-2,31	1,56	Medium
	2. LAYER	-10,32	1,64	Medium
	3. LAYER		1,98	High
5_PROFILE	1. LAYER	-1,74	1,60	Medium
	2. LAYER	-11,75	1,71	Medium
	3. LAYER		2,08	High
6_PROFILE	1. LAYER	-3,65	1,60	Medium
	2. LAYER	-16,34	1,80	Medium
	3. LAYER		2,14	High
7_PROFILE	1. LAYER	-4,89	1,67	Medium
	2.LAYER	-21,88	1,85	Medium
	3.LAYER		2,29	High
8_PROFILE	1. LAYER	-2,16	1,68	Medium
	2. LAYER	-14,64	1,89	Medium
	3. LAYER		2,36	High
9_PROFILE	1. LAYER	-3,33	1,68	Medium
	2. LAYER	-14,90	1,93	High
	3. LAYER		2,37	High
10_PROFILE	1. LAYER	-2,36	1,61	Medium
	2. LAYER	-15,99	1,69	Medium
	3. LAYER		2,03	High
11_PROFILE	1. LAYER	-7,12	1,76	Medium
	2. LAYER	-22,38	1,92	High
	3. LAYER		2,28	High

Density: ρ (gr/cm³)	Tanımlama
ρ<1,20	High low
1,20<ρ<1,40	Low
1,40<ρ<1,90	Medium
1,90<ρ<2,20	High
2,20<ρ	Too High

Density Classification of Ground Units: (Keçeli, 1990)

*ρ =d=0.31*Vp0.25*

‖AVERAGE‖			
LAYERS	DEPTH	ρ (gr/cm³)	DEFINITION
1. LAYER	-3,67	1,69	Medium
2.LAYER	-18,46	1,81	Medium
3.LAYER	∞	2,18	High

Density values and description of the units in the study area

Calculation of the density values of the geological units in the direction of the seismic data obtained in the field studies and the table of variation are given in the above table.

5.23.8. WTG23 Modulus of Subgrade Reaction – D Y K (ton/m³)

Modulus of Subgrade Reaction			
PROFILES	LAYERS	DEPTH	D Y K (ton/m³)
1_PROFILE	1. LAYER	-4,19	3103
	2.LAYER	-28,32	5131
	3.LAYER		11508
2_PROFILE	1. LAYER	-3,50	4452
	2. LAYER	-23,68	4251
	3. LAYER		7079
3_PROFILE	1. LAYER	-5,11	4591
	2. LAYER	-22,88	4480
	3. LAYER		9652
4_PROFILE	1. LAYER	-2,31	2465
	2. LAYER	-10,32	3334
	3. LAYER		6638
5_PROFILE	1. LAYER	-1,74	2319
	2. LAYER	-11,75	3848
	3. LAYER		8356
6_PROFILE	1. LAYER	-3,65	2375
	2. LAYER	-16,34	4866
	3. LAYER		10041
7_PROFILE	1. LAYER	-4,89	2932
	2.LAYER	-21,88	6226
	3.LAYER		13324
8_PROFILE	1. LAYER	-2,16	3213
	2. LAYER	-14,64	6866
	3. LAYER		16437
9_PROFILE	1. LAYER	-3,33	3442
	2. LAYER	-14,90	7675
	3. LAYER		17276
10_PROFILE	1. LAYER	-2,36	2645
	2. LAYER	-15,99	3526
	3. LAYER		7755
11_PROFILE	1. LAYER	-7,12	3692
	2. LAYER	-22,38	6503
	3. LAYER		13160

‖AVERAGE‖		
LAYERS	DEPTH	D Y K (ton/m³)
1. LAYER	-3,67	3203
2.LAYER	-18,46	5155
3.LAYER	∞	11021

kv= 40*(Gs)*qu ton/m³ *(Bowles 1984)*

The above table shows the Modulus of Subgrade Reaction obtained for each layer in the direction of the data obtained after the seismic measurements made in the study area.

5.23.9. WTG23 Bearing Capacity qu (kg/cm2) / Allowable Bearing Capacity qa (kg/cm2)

PROFILES	LAYERS	DEPTH	BEARING CAPACITY (qu,kg/cm^2)	ALLOWABLE BEARING CAPACITY (qa,kg/cm^2)
1_PROFILE	1. LAYER	-4,19	7,76	2,59
	2.LAYER	-28,32	12,83	4,28
	3.LAYER	-21,68	28,77	9,59
2_PROFILE	1. LAYER	-3,50	11,13	3,71
	2. LAYER	-23,68	10,63	3,54
	3. LAYER	-26,32	17,70	5,90
3_PROFILE	1. LAYER	-5,11	11,48	3,83
	2. LAYER	-22,88	11,20	3,73
	3. LAYER	-27,12	24,13	8,04
4_PROFILE	1. LAYER	-2,31	6,16	2,05
	2. LAYER	-10,32	8,34	2,78
	3. LAYER	-39,68	16,59	5,53
5_PROFILE	1. LAYER	-1,74	5,80	1,93
	2. LAYER	-11,75	9,62	3,21
	3. LAYER	-38,25	20,89	6,96
6_PROFILE	1. LAYER	-3,65	5,94	1,98
	2. LAYER	-16,34	12,17	4,06
	3. LAYER	-33,66	25,10	8,37
7_PROFILE	1. LAYER	-4,89	7,33	2,44
	2.LAYER	-21,88	15,56	5,19
	3.LAYER	-28,12	33,31	11,10
8_PROFILE	1. LAYER	-2,16	8,03	2,68
	2. LAYER	-14,64	17,16	5,72
	3. LAYER	-35,36	41,09	13,70
9_PROFILE	1. LAYER	-3,33	8,61	2,87
	2. LAYER	-14,90	19,19	6,40
	3. LAYER	-35,10	43,19	14,40
10_PROFILE	1. LAYER	-2,36	6,61	2,20
	2. LAYER	-15,99	8,81	2,94
	3. LAYER	-34,01	19,39	6,46
11_PROFILE	1. LAYER	-7,12	9,23	3,08
	2. LAYER	-22,38	16,26	5,42
	3. LAYER	-27,62	32,90	10,97

LAYERS	||AVERAGE|| DEPTH	Bearing Capacity (qu,kg/cm^2)
1. LAYER	-3,67	8,01
2.LAYER	-18,46	12,89
3.LAYER	∞	27,55

qu=(0,024*Vs*(J.B.K+0,002*Vp)*0,71)/G.K

BEARING CAPACITY CALCULATION	Geological unit factor 18	16	17	18	20
(Prof. Dr. SEMIH TEZCAN-2006)	Safety factor 50-100	CLAY	SAND	SEDIMENT	VOLATISILE

[redacted]

||AVERAGE||		
LAYERS	DEPTH	Allowable Bearing Capacity (qa,kg/cm^2)
1. LAYER	-3,67	2,67
2.LAYER	-18,46	4,30
3.LAYER	∞	9,18
qa=qu/G.K G.K=3 empirical value		

5.23.10 WTG23 Vibration Period - T_0 (sec) / Ground Amplification (Ak)

PROFILES	To (sec)	Ta (sec)	Tb (sec)	Ak (Amplification)
1.PROFILE	0,26	0,17	0,38	1,32
2.PROFILE	0,39	0,26	0,59	1,73
3.PROFILE	0,30	0,20	0,46	1,50
4.PROFILE	0,35	0,24	0,53	1,84
5.PROFILE	0,30	0,20	0,45	1,65
6.PROFILE	0,28	0,19	0,42	1,54
7.PROFILE	0,25	0,17	0,38	1,40
8.PROFILE	0,19	0,13	0,29	1,25
9.PROFILE	0,19	0,13	0,28	1,23
10.PROFILE	0,34	0,23	0,51	1,71
11.PROFILE	0,25	0,17	0,37	1,36

AVERAGE			
To (sec)	Ta (sec)	Tb (sec)	Ak (Amplification)
0,28	0,19	0,42	1,50

$To = \sum 4H\ Vs\ n\ \iota$=1 (sec)… (Zeevaert,1967)

Ak=68*$Vs_{30}^{-0,6}$……. (Midorikawa, 1987)

The Vibration Period and Ground Amplification calculated in the direction of the parameters obtained during the seismic studies made during the field survey are presented in the table above.

5.24. SUBSTATION

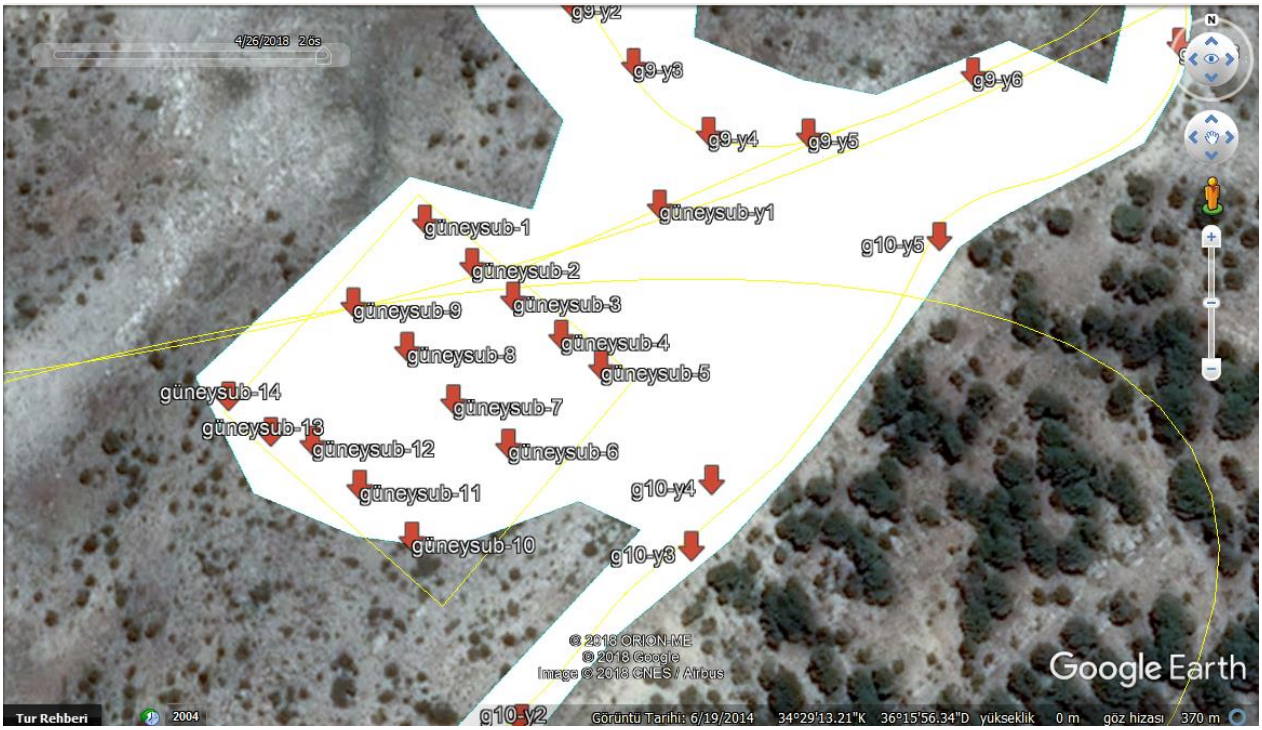
14 measurements were taken. These measurements showed 3 layers. Layer 1 was found between 0,00 m-3,70 m depths, Layer 2 between 3,70 m-16,14 m depths and Layer 3 at 16,14 m depths. The parameters of this layer are given in the table below.

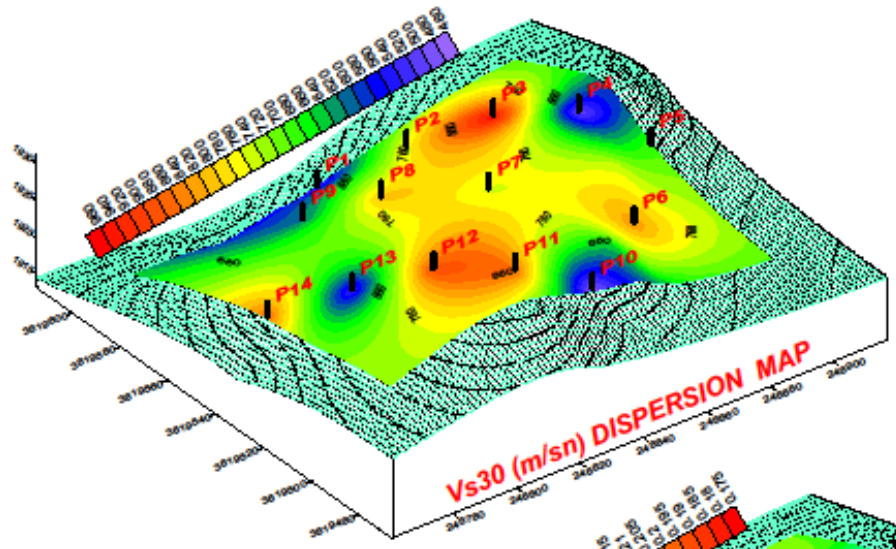
LAYERS	Vp_ Velocity	STRIPPABILITY
1. LAYER	626	Simple strippability
2.LAYER	899	Simple strippability
3.LAYER	1806	High-hard STRIPPABILITY
LAYERS	**Vs_ Velocity**	**GROUND GROUP**
1. LAYER	239	C
2.LAYER	422	B
3.LAYER	778	A
LAYERS	**G (kg/cm2)**	**ENDURANCE**
1. LAYER	1117	Weak
2.LAYER	3472	Sturdy
3.LAYER	13555	High sturdy
LAYERS	**E (kg/cm2)**	**ENDURANCE**
1. LAYER	3090	Weak
2.LAYER	9374	Sturdy
3.LAYER	37560	High sturdy

LAYERS	(σ)	POROSITY
1. LAYER	0,39	High Porosity
2.LAYER	0,35	Medium Porosity
3.LAYER	0,39	High Porosity
LAYERS	**ρ (gr/cm3)**	**DEFINITION**
1. LAYER	1,53	Medium
2.LAYER	1,68	Medium
3.LAYER	2,01	High
LAYERS	**D Y K (ton/m^3)**	
1. LAYER	2593	
2.LAYER	5652	
3.LAYER	12399	
LAYERS	**Ground Carrying Capacity (qu,kg/cm2)**	**Secure Carrying Capacity (qa,kg/cm2)**
1. LAYER	6,48	2,16
2.LAYER	14,13	4,71
3.LAYER	31,00	10,33

To (sec)	Ta (sec)	Tb (sec)	Vs30 (m/sec)	Ak (Amplification)
0,22	0,15	0,34	718	1,35

Taking into account the following applications, the profile points should be seen in the engineering parameters section for detailed values.

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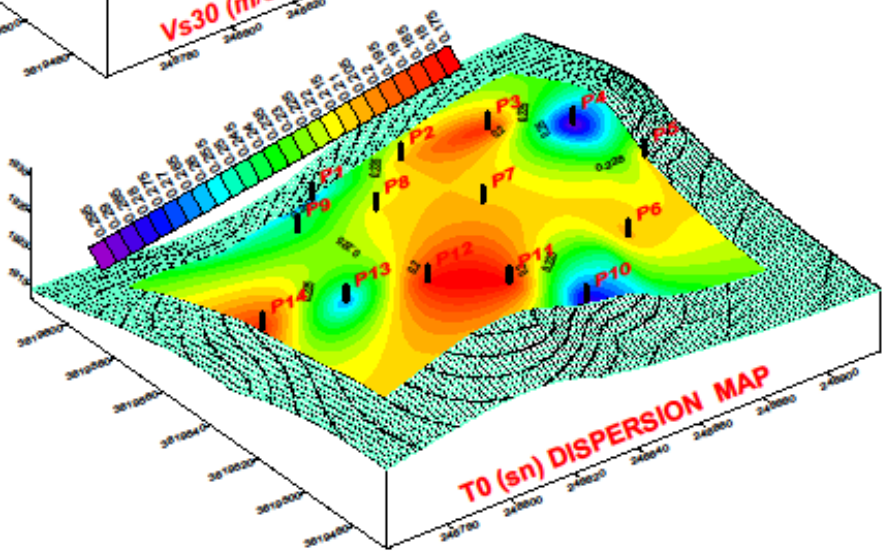
Vs30 (m/sn) DISPERSION MAP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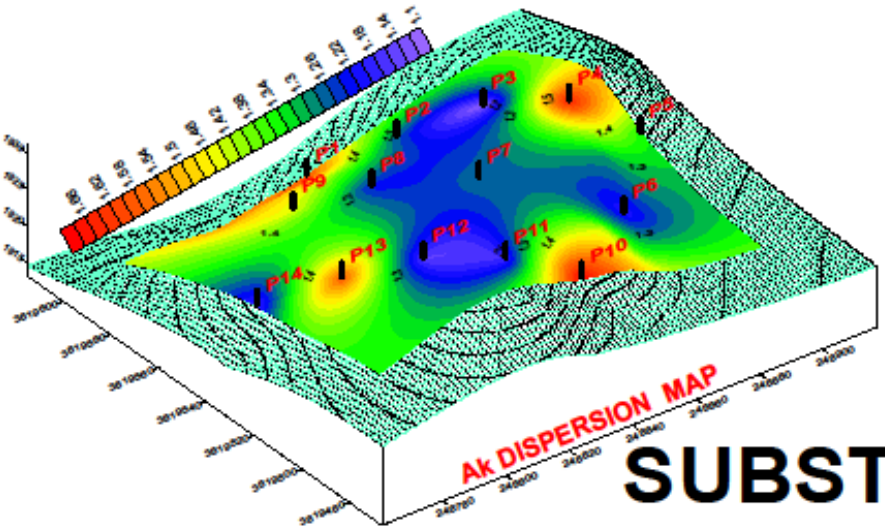
T0 (sn) DISPERSION MAP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Ak DISPERSION MAP

SUBSTATÝON

5.24.1. Substation Vibration Period - T_0 (sec) / Ground Amplification (Ak)

PROFILES	To (sec)	Ta (sec)	Tb (sec)	Vs30 (m/sec)	Ak (Amplification)
1.PROFILE	0,26	0,18	0,40	524	1,59
2.PROFILE	0,21	0,14	0,31	767	1,26
3.PROFILE	0,18	0,12	0,27	954	1,11
4.PROFILE	0,29	0,20	0,44	493	1,65
5.PROFILE	0,21	0,14	0,32	691	1,35
6.PROFILE	0,21	0,14	0,31	836	1,20
7.PROFILE	0,21	0,14	0,31	754	1,28
8.PROFILE	0,22	0,14	0,32	806	1,23
9.PROFILE	0,24	0,16	0,37	611	1,45
10.PROFILE	0,29	0,19	0,43	476	1,68
11.PROFILE	0,18	0,12	0,27	862	1,18
12.PROFILE	0,18	0,12	0,27	889	1,16
13.PROFILE	0,27	0,18	0,40	527	1,58
14.PROFILE	0,18	0,12	0,27	863	1,18

AVERAGE			
To (sec)	Ta (sec)	Tb (sec)	Ak (Amplification)
0,22	0,15	0,34	1,35

$To = \sum 4H\ Vs\ n\ \iota$=1 (sec)… (Zeevaert,1967)

Ak=68*$Vs_{30}^{-0,6}$……. (Midorikawa, 1987)

The Vibration Period and Ground Amplification calculated in the direction of the parameters obtained during the seismic studies made during the field survey are presented in the table above.

5.24.2. Substation Bearing Capacity qu (kg/cm2) / Allowable Bearing Capacity qa (kg/cm2)

PROFILES	LAYERS	DEPTH	BEARING	ALLOWABLE
1_PROFILE	1. LAYER	-2,62	4,72	1,57
	2.LAYER	-8,25	9,91	3,30
	3.LAYER	-41,75	19,36	6,45
2_PROFILE	1. LAYER	-5,99	8,28	2,76
	2. LAYER	-18,84	16,24	5,41
	3. LAYER	-31,16	32,79	10,93
3_PROFILE	1. LAYER	-4,00	9,14	3,05
	2. LAYER	-27,10	18,90	6,30
	3. LAYER	-22,90	48,30	16,10
4_PROFILE	1. LAYER	-2,48	4,28	1,43
	2. LAYER	-11,10	8,86	2,95
	3. LAYER	-38,90	18,26	6,09
5_PROFILE	1. LAYER	-3,93	6,52	2,17
	2. LAYER	-12,35	13,52	4,51
	3. LAYER	-37,65	28,49	9,50
6_PROFILE	1. LAYER	-3,21	7,66	2,55
	2. LAYER	-21,76	15,68	5,23
	3. LAYER	-28,24	31,84	10,61
7_PROFILE	1. LAYER	-3,99	6,76	2,25
	2.LAYER	-17,86	14,55	4,85
	3.LAYER	-32,14	32,93	10,98
8_PROFILE	1. LAYER	-5,81	7,46	2,49
	2. LAYER	-26,02	16,98	5,66
	3. LAYER	-23,98	36,99	12,33
9_PROFILE	1. LAYER	-3,92	5,88	1,96
	2. LAYER	-12,34	12,49	4,16

	3. LAYER	-37,66	22,68	7,56
10_PROFILE	1. LAYER	-3,15	5,40	1,80
	2. LAYER	-7,23	9,37	3,12
	3. LAYER	-42,77	16,71	5,57
11_PROFILE	1. LAYER	-3,76	7,00	2,33
	2. LAYER	-16,83	17,47	5,82
	3. LAYER	-33,17	42,59	14,20
12_PROFILE	1. LAYER	-2,79	6,16	2,05
	2. LAYER	-18,89	17,50	5,83
	3. LAYER	-31,11	43,36	14,45
13_PROFILE	1. LAYER	-2,12	3,73	1,24
	2. LAYER	-9,50	9,35	3,12
	3. LAYER	-40,50	20,27	6,76
14_PROFILE	1. LAYER	-3,99	7,78	2,59
	2. LAYER	-17,85	16,99	5,66
	3. LAYER	-32,15	39,41	13,14

LAYERS	‖AVERAGE‖ DEPTH	Bearing Capacity (qu,kg/cm^2)
1. LAYER	-3,70	6,48
2.LAYER	-16,14	14,13
3.LAYER	∞	31,00

qu=(0,024*Vs*(J.B.K+0,002*Vp)*0,71)/G.K

Prof. Dr. SEMİH TEZCAN TAŞIMA GÜCÜ FORMÜLÜ (2006)	Jeolojik Birim Katsayı	18	16	17	18	20
	Güvenlik Katsayısı	50-100	KİL	KUM	SEDİMAN	VOLKANİK

LAYERS	‖AVERAGE‖ DEPTH	Allowable Bearing Capacity (qa,kg/cm^2)
1. LAYER	-3,70	2,16
2.LAYER	-16,14	4,71
3.LAYER	∞	10,33

qa=qu/G.K G.K=3 empirical value

5.24.3. Substation Modulus of Subgrade Reaction – D Y K (ton/m3)

Modulus of Subgrade Reaction			
PROFILES	LAYERS	DEPTH	D Y K (ton/m^3)
1_PROFILE	1. LAYER	-2,62	1886
	2.LAYER	-8,25	3964
	3.LAYER		7742
2_PROFILE	1. LAYER	-5,99	3312
	2. LAYER	-18,84	6497
	3. LAYER		13116
3_PROFILE	1. LAYER	-4,00	3656
	2. LAYER	-27,10	7562
	3. LAYER		19321
4_PROFILE	1. LAYER	-2,48	1713
	2. LAYER	-11,10	3544
	3. LAYER		7305
5_PROFILE	1. LAYER	-3,93	2607
	2. LAYER	-12,35	5406
	3. LAYER		11396
6_PROFILE	1. LAYER	-3,21	3064
	2. LAYER	-21,76	6274
	3. LAYER		12738
7_PROFILE	1. LAYER	-3,99	2703
	2.LAYER	-17,86	5821
	3.LAYER		13172
8_PROFILE	1. LAYER	-5,81	2985
	2. LAYER	-26,02	6791
	3. LAYER		14794
9_PROFILE	1. LAYER	-3,92	2352
	2. LAYER	-12,34	4997
	3. LAYER		9070
10_PROFILE	1. LAYER	-3,15	2159
	2. LAYER	-7,23	3750
	3. LAYER		6682
11_PROFILE	1. LAYER	-3,76	2801
	2. LAYER	-16,83	6989
	3. LAYER		17037
12_PROFILE	1. LAYER	-2,79	2463
	2. LAYER	-18,89	7002
	3. LAYER		17344
13_PROFILE	1. LAYER	-2,12	1493
	2. LAYER	-9,50	3740
	3. LAYER		8109
14_PROFILE	1. LAYER	-3,99	3111
	2. LAYER	-17,85	6796
	3. LAYER		15765

||AVERAGE||		
LAYERS	DEPTH	D Y K (ton/m^3)
1. LAYER	-3,70	2593
2.LAYER	-16,14	5652
3.LAYER	∞	12399
kv= 40*(Gs)*qu ton/m^3 *(Bowles 1984)*		

The above table shows the Modulus of Subgrade Reaction obtained for each layer in the direction of the data obtained after the seismic measurements made in the study area.

5.24.4. Substation Density - ρ (gr/ cm^3)

DENSITY				
PROFILES	LAYERS	DEPTH	ρ (gr/cm^3)	DEFINITION
1_PROFILE	1. LAYER	-2,62	1,57	Medium
	2.LAYER	-8,25	1,78	Medium
	3.LAYER		2,13	High
2_PROFILE	1. LAYER	-5,99	1,75	Medium
	2. LAYER	-18,84	1,97	High
	3. LAYER		2,35	High
3_PROFILE	1. LAYER	-4,00	1,86	Medium
	2. LAYER	-27,10	2,04	High
	3. LAYER		2,50	High
4_PROFILE	1. LAYER	-2,48	1,51	Medium
	2. LAYER	-11,10	1,74	Medium
	3. LAYER		2,09	High
5_PROFILE	1. LAYER	-3,93	1,69	Medium
	2. LAYER	-12,35	1,89	Medium
	3. LAYER		2,26	High
6_PROFILE	1. LAYER	-3,21	1,80	Medium
	2. LAYER	-21,76	1,98	High
	3. LAYER		2,39	High
7_PROFILE	1. LAYER	-3,99	1,75	Medium
	2.LAYER	-17,86	1,92	High
	3.LAYER		2,37	High
8_PROFILE	1. LAYER	-5,81	1,76	Medium
	2. LAYER	-26,02	2,00	High
	3. LAYER		2,39	High
9_PROFILE	1. LAYER	-3,92	1,67	Medium
	2. LAYER	-12,34	1,87	Medium
	3. LAYER		2,21	High
10_PROFILE	1. LAYER	-3,15	1,59	Medium
	2. LAYER	-7,23	1,78	Medium
	3. LAYER		2,07	High
11_PROFILE	1. LAYER	-3,76	1,70	Medium
	2. LAYER	-16,83	1,99	High
	3. LAYER		2,42	High
12_PROFILE	1. LAYER	-2,79	1,73	Medium
	2. LAYER	-18,89	2,00	High
	3. LAYER		2,44	High
13_PROFILE	1. LAYER	-2,12	1,52	Medium
	2. LAYER	-9,50	1,75	Medium
	3. LAYER		2,15	High
14_PROFILE	1. LAYER	-3,99	1,77	Medium
	2. LAYER	-17,85	1,98	High
	3. LAYER		2,43	High

Density: ρ (gr/cm^3)	Tanımlama
ρ<1,20	High low
1,20<ρ<1,40	Low
1,40<ρ<1,90	Medium
1,90<ρ<2,20	High
2,20<ρ	Too High

Density Classification of Ground Units: (Keçeli, 1990)

ρ =d=0.31*Vp0.25			
‖AVERAGE‖			
LAYERS	DEPTH	ρ (gr/cm^3)	DEFINITION
1. LAYER	-3,70	1,69	Medium
2.LAYER	-16,14	1,90	High
3.LAYER	∞	2,30	High

Density values and description of the units in the study area

Calculation of the density values of the geological units in the direction of the seismic data obtained in the field studies and the table of variation are given in the above table.

5.24.5. Substation Poisson's Ratio - (б)

POISSON'S RATIO				
PROFILES	LAYERS	DEPTH	(σ)	POROSITY
1_PROFILE	1. LAYER	-2,62	0,39	High Porous
	2.LAYER	-8,25	0,34	Medium Porous
	3.LAYER		0,39	High Porous
2_PROFILE	1. LAYER	-5,99	0,36	High Porous
	2. LAYER	-18,84	0,33	Medium Porous
	3. LAYER		0,39	High Porous
3_PROFILE	1. LAYER	-4,00	0,41	High Porous
	2. LAYER	-27,10	0,35	High Porous
	3. LAYER		0,36	High Porous
4_PROFILE	1. LAYER	-2,48	0,36	High Porous
	2. LAYER	-11,10	0,35	Medium Porous
	3. LAYER		0,38	High Porous
5_PROFILE	1. LAYER	-3,93	0,39	High Porous
	2. LAYER	-12,35	0,33	Medium Porous
	3. LAYER		0,37	High Porous
6_PROFILE	1. LAYER	-3,21	0,42	High Porous
	2. LAYER	-21,76	0,36	High Porous
	3. LAYER		0,41	High Porous
7_PROFILE	1. LAYER	-3,99	0,42	High Porous
	2.LAYER	-17,86	0,34	Medium Porous
	3.LAYER		0,40	High Porous
8_PROFILE	1. LAYER	-5,81	0,40	High Porous
	2. LAYER	-26,02	0,35	Medium Porous
	3. LAYER		0,38	High Porous
9_PROFILE	1. LAYER	-3,92	0,41	High Porous
	2. LAYER	-12,34	0,34	Medium Porous
	3. LAYER		0,40	High Porous
10_PROFILE	1. LAYER	-3,15	0,37	High Porous
	2. LAYER	-7,23	0,35	High Porous
	3. LAYER		0,40	High Porous
11_PROFILE	1. LAYER	-3,76	0,38	High Porous
	2. LAYER	-16,83	0,33	Medium Porous
	3. LAYER		0,35	High Porous
12_PROFILE	1. LAYER	-2,79	0,43	High Porous
	2. LAYER	-18,89	0,34	Medium Porous
	3. LAYER		0,36	High Porous
13_PROFILE	1. LAYER	-2,12	0,42	High Porous
	2. LAYER	-9,50	0,34	Medium Porous
	3. LAYER		0,40	High Porous
14_PROFILE	1. LAYER	-3,99	0,41	High Porous
	2. LAYER	-17,85	0,34	Medium Porous
	3. LAYER		0,39	High Porous

Poisson's Ratio;(σ)	Porosity
0,00≤σ≤0,25	Nonporous
0,26≤σ≤0,35	Medium Porous
0,36≤σ≤0,50	High Porous

Poisson ratio classification σ=(Vp2-2*Vs2)/(2* Vp2-2*Vs2)

‖AVERAGE‖			
LAYERS	DEPTH	(σ)	POROSITY
1. LAYER	-3,70	0,40	High Porous
2.LAYER	-16,14	0,34	Medium Porous
3.LAYER	∞	0,39	High Porous

Poisson's ratio values of the units in the study area, porosity

Calculation of poisson's ratio values in the direction of the seismic data obtained in the field studies and the change table are given in the above table.

5.24.6. Substation Elasticity Modulus-E (kg/cm²)

ELASTIC MODULUS				
PROFILES	LAYERS	DEPTH	E(kg/cm^2)	ENDURANCE
1_PROFILE	1. LAYER	-2,62	3231	Weak
	2.LAYER	-8,25	13866	Sturdy
	3.LAYER		50910	Rock Highlid
2_PROFILE	1. LAYER	-5,99	10048	Sturdy
	2. LAYER	-18,84	36365	Rock Highlid
	3. LAYER		131225	Rock Highlid
3_PROFILE	1. LAYER	-4,00	12522	Sturdy
	2. LAYER	-27,10	51837	Rock Highlid
	3. LAYER		255432	Rock Highlid
4_PROFILE	1. LAYER	-2,48	2604	Weak
	2. LAYER	-11,10	11286	Sturdy
	3. LAYER		45605	Rock Highlid
5_PROFILE	1. LAYER	-3,93	6288	Medium
	2. LAYER	-12,35	25893	Sturdy
	3. LAYER		102523	Rock Highlid
6_PROFILE	1. LAYER	-3,21	8704	Medium
	2. LAYER	-21,76	35422	Rock Highlid
	3. LAYER		123377	Rock Highlid
7_PROFILE	1. LAYER	-3,99	6754	Medium
	2.LAYER	-17,86	30585	Rock Highlid
	3.LAYER		131791	Rock Highlid
8_PROFILE	1. LAYER	-5,81	8408	Medium
	2. LAYER	-26,02	41162	Rock Highlid
	3. LAYER		161867	Rock Highlid
9_PROFILE	1. LAYER	-3,92	5021	Medium
	2. LAYER	-12,34	21977	Sturdy
	3. LAYER		68015	Rock Highlid
10_PROFILE	1. LAYER	-3,15	4226	Weak
	2. LAYER	-7,23	12277	Sturdy
	3. LAYER		38746	Rock Highlid
11_PROFILE	1. LAYER	-3,76	7369	Medium
	2. LAYER	-16,83	44276	Rock Highlid
	3. LAYER		206790	Rock Highlid
12_PROFILE	1. LAYER	-2,79	5782	Medium
	2. LAYER	-18,89	43728	Rock Highlid
	3. LAYER		213021	Rock Highlid
13_PROFILE	1. LAYER	-2,12	1972	Weak
	2. LAYER	-9,50	12857	Sturdy
	3. LAYER		55461	Rock Highlid
14_PROFILE	1. LAYER	-3,99	8807	Medium

	2. LAYER	-17,85	41874	Rock Highlid
	3. LAYER		180131	Rock Highlid

Elastic Modulus (kg/cm²)	Dayanım
E<1000	High Weak
1000<E<5000	Weak
5000<E<10000	Medium
10000<E<30000	Sturdy
30000<E	Rock Highlid

The endurance of ground or rocks according to Slip Module values(Keçeli, 1990)

$E=G*(3*V_p^2-4*V_s^2)/(V_p^2-V_s^2)$

‖AVERAGE‖			
LAYERS	DEPTH	E (kg/cm²)	ENDURANCE
1. LAYER	-3,70	6553	Medium
2.LAYER	-16,14	30243	Rock Highlid
3.LAYER	∞	126064	Rock Highlid

Elasticity modules and endurance of the grounds in the study area

Calculation of the modulus of elasticity in the direction of the seismic data obtained in the field studies and the change table are given in the above table

5.24.7. Substation Shear Modulus-G (kg/cm²)

SHEAR MODULUS				
PROFILES	LAYERS	DEPTH	G(kg/cm²)	ENDURANCE
1_PROFILE	1. LAYER	-2,62	1183	Weak
	2.LAYER	-8,25	5154	Sturdy
	3.LAYER		18260	Rock Highlid
2_PROFILE	1. LAYER	-5,99	3748	Sturdy
	2. LAYER	-18,84	13637	Rock Highlid
	3. LAYER		47335	Rock Highlid
3_PROFILE	1. LAYER	-4,00	4466	Sturdy
	2. LAYER	-27,10	19405	Rock Highlid
	3. LAYER		93575	Rock Highlid
4_PROFILE	1. LAYER	-2,48	982	Weak
	2. LAYER	-11,10	4173	Sturdy
	3. LAYER		16474	Rock Highlid
5_PROFILE	1. LAYER	-3,93	2299	Medium
	2. LAYER	-12,35	9727	Sturdy
	3. LAYER		37396	Rock Highlid
6_PROFILE	1. LAYER	-3,21	3068	Sturdy
	2. LAYER	-21,76	13071	Rock Highlid
	3. LAYER		43650	Rock Highlid
7_PROFILE	1. LAYER	-3,99	2381	Medium
	2.LAYER	-17,86	11392	Rock Highlid
	3.LAYER		47159	Rock Highlid
8_PROFILE	1. LAYER	-5,81	3057	Sturdy
	2. LAYER	-26,02	15443	Rock Highlid
	3. LAYER		58673	Rock Highlid
9_PROFILE	1. LAYER	-3,92	1780	Medium
	2. LAYER	-12,34	8202	Sturdy
	3. LAYER		24261	Rock Highlid
10_PROFILE	1. LAYER	-3,15	1577	Medium
	2. LAYER	-7,23	4528	Sturdy
	3. LAYER		13834	Rock Highlid
11_PROFILE	1. LAYER	-3,76	2749	Medium

	2. LAYER	-16,83	16847	Rock Highlid
	3. LAYER		76438	Rock Highlid
12_PROFILE	1. LAYER	-2,79	2045	Medium
	2. LAYER	-18,89	16443	Rock Highlid
	3. LAYER		78175	Rock Highlid
13_PROFILE	1. LAYER	-2,12	696	Weak
	2. LAYER	-9,50	4764	Sturdy
	3. LAYER		19842	Rock Highlid
14_PROFILE	1. LAYER	-3,99	3132	Sturdy
	2. LAYER	-17,85	15824	Rock Highlid
	3. LAYER		64969	Rock Highlid

Shear Modulus (kg/cm^2)	Dayanım
G<400	High Weak
400<G<1500	Weak
1500<G<3000	Medium
3000<G<10000	Sturdy
10000<G	Rock Highlid

The endurance of ground or rocks according to Slip Module values(Keçeli, 1990)

$G = (d*Vs^2)/100$

‖AVERAGE‖			
LAYERS	**DEPTH**	**G (kg/cm^2)**	**ENDURANCE**
1. LAYER	-3,70	2369	Medium
2.LAYER	-16,14	11329	Rock Highlid
3.LAYER	∞	45717	Rock Highlid

Shear modules and endurance of the grounds in the study area

Calculation of shear Modulus values in the direction of the seismic data obtained in the field studies and the table of variation are given in the table above.

5.24.8. Substation Vs30

PROFILES	Vs30 (m/sec)
1.PROFILE	524
2.PROFILE	767
3.PROFILE	954
4.PROFILE	493
5.PROFILE	691
6.PROFILE	836
7.PROFILE	754
8.PROFILE	806
9.PROFILE	611
10.PROFILE	476
11.PROFILE	862
12.PROFILE	889
13.PROFILE	527
14.PROFILE	863

Vs30 values in the direction of the seismic data obtained from the field studies are given in the table above.

5.24.9. Substation Seismic S wave velocity (Transverse Wave Velocity (Vs))

Vs VELOCITY				
PROFILES	LAYERS	DEPTH	Vs_ Velocity	GROUND GROUPS
1_PROFILE	1. LAYER	-2,62	266	C
	2.LAYER	-8,25	532	B
	3.LAYER		927	A
2_PROFILE	1. LAYER	-5,99	449	B
	2. LAYER	-18,84	821	A
	3. LAYER		1420	A
3_PROFILE	1. LAYER	-4,00	481	B
	2. LAYER	-27,10	920	A
	3. LAYER		1937	A
4_PROFILE	1. LAYER	-2,48	245	C
	2. LAYER	-11,10	480	B
	3. LAYER		889	A
5_PROFILE	1. LAYER	-3,93	359	C
	2. LAYER	-12,35	700	B
	3. LAYER		1286	A
6_PROFILE	1. LAYER	-3,21	410	B
	2. LAYER	-21,76	786	A
	3. LAYER		1352	A
7_PROFILE	1. LAYER	-3,99	367	C
	2.LAYER	-17,86	741	A
	3.LAYER		1411	A
8_PROFILE	1. LAYER	-5,81	403	B
	2. LAYER	-26,02	846	A
	3. LAYER		1566	A
9_PROFILE	1. LAYER	-3,92	325	C
	2. LAYER	-12,34	653	B
	3. LAYER		1048	A
10_PROFILE	1. LAYER	-3,15	245	C
	2. LAYER	-7,23	505	B
	3. LAYER		817	A
11_PROFILE	1. LAYER	-3,76	384	C
	2. LAYER	-16,83	869	A
	3. LAYER		1777	A
12_PROFILE	1. LAYER	-2,79	336	C
	2. LAYER	-18,89	869	A
	3. LAYER		1789	A
13_PROFILE	1. LAYER	-2,12	213	C
	2. LAYER	-9,50	502	B
	3. LAYER		960	A
14_PROFILE	1. LAYER	-3,99	419	B
	2. LAYER	-17,85	847	A
	3. LAYER		1634	A

S Wave Velocity (m/sec)	Ground group
Vs<200	D
200<Vs<400	C
400<Vs<700	B
700<Vs	A

Ground groups according to slip wave velocity(Abyyhy, 1998)

||AVERAGE||			
LAYERS	DEPTH	Vs_ Velocity	GROUND GROUPS
1. LAYER	-3,70	350	C
2.LAYER	-16,14	719	A
3.LAYER	∞	1344	A

S wave velocities of the grounds in the study area and ground group

Ground Group	Ground group and top ground layer thickness(h_1)
Z1	(A) Ground group h1< 15 m (B) Ground group
Z2	h_1> 15 m (B) Ground group h_1< 15 m (C) Ground group
Z3	15 m < h_1< 50 m (C) Ground group h_1< 10 m (D) Ground group
Z4	h_1> 50 m (C) Ground group h_1> 10 m (D) Ground group

Ground Group Class

The above table shows that Vs velocity values in the direction of the seismic data obtained in the field studies are the absolute change tables and that the layers are included in the ground groups.

*5.24.10. Substation Seismic P wave velocity (*Compressional Wave Velocity *(Vp))*

Vp VELOCITY				
PROFILES	LAYERS	DEPTH	Vp_ Velocity	STRIPPABILITY
1_PROFILE	1. LAYER	-2,62	657	Simple Strippability
	2.LAYER	-8,25	1093	Simple Strippability
	3.LAYER		2216	Explosive
2_PROFILE	1. LAYER	-5,99	1022	Simple Strippability
	2. LAYER	-18,84	1637	High Difficult Strippability
	3. LAYER		3296	Explosive
3_PROFILE	1. LAYER	-4,00	1296	Medium Strippability
	2. LAYER	-27,10	1916	High Difficult Strippability
	3. LAYER		4198	Explosive
4_PROFILE	1. LAYER	-2,48	556	Simple Strippability
	2. LAYER	-11,10	1000	Simple Strippability
	3. LAYER		2049	High Difficult Strippability
5_PROFILE	1. LAYER	-3,93	875	Simple Strippability
	2. LAYER	-12,35	1397	Medium Strippability
	3. LAYER		2837	Explosive
6_PROFILE	1. LAYER	-3,21	1137	Simple Strippability
	2. LAYER	-21,76	1696	High Difficult Strippability
	3. LAYER		3517	Explosive
7_PROFILE	1. LAYER	-3,99	1019	Simple Strippability
	2.LAYER	-17,86	1516	Medium Strippability
	3.LAYER		3417	Explosive
8_PROFILE	1. LAYER	-5,81	1047	Simple Strippability
	2. LAYER	-26,02	1744	High Difficult Strippability
	3. LAYER		3552	Explosive
9_PROFILE	1. LAYER	-3,92	847	Simple Strippability
	2. LAYER	-12,34	1327	Medium Strippability
	3. LAYER		2585	Explosive
10_PROFILE	1. LAYER	-3,15	690	Simple Strippability
	2. LAYER	-7,23	1086	Simple Strippability
	3. LAYER		2004	High Difficult Strippability
11_PROFILE	1. LAYER	-3,76	902	Simple Strippability
	2. LAYER	-16,83	1721	High Difficult Strippability
	3. LAYER		3724	Explosive
12_PROFILE	1. LAYER	-2,79	967	Simple Strippability
	2. LAYER	-18,89	1761	High Difficult Strippability
	3. LAYER		3852	Explosive
13_PROFILE	1. LAYER	-2,12	577	Simple Strippability
	2. LAYER	-9,50	1039	Simple Strippability
	3. LAYER		2328	Explosive
14_PROFILE	1. LAYER	-3,99	1070	Simple Strippability
	2. LAYER	-17,85	1701	High Difficult Strippability
	3. LAYER		3796	Explosive

P Wave Velocity (m/sec)	Strippability
Vp<458	High Simple Strippability
458<Vp<1220	Simple Strippability
1220<Vp<11525	Medium Strippability
1525<Vp<11830	Difficult Strippability
1830<Vp<12135	High Difficult Strippability
Vp>2135	Explosive Strippability

Strippability of floors with P wave velocity (Church, 1981)

||AVERAGE||			
LAYERS	DEPTH	Vp_ Velocity	STRIPPABILITY
1. LAYER	-3,70	904	Simple Strippability
2.LAYER	-16,14	1474	Medium Strippability
3.LAYER	∞	3098	Explosive

Pwave velocities of the grounds in the study area and strippability

The above table shows the change table and strippability properties of Vp velocity depth values in the direction of the seismic data obtained from the field studies.

5. 25. All Roads

Measurements taken on transit routes were evaluated and no problems were observed in general. Only on the 15th Turbine road 13-14-15 Profiles need to be improved because of poor parameters and due to the fact that the curvature is the abyss.

During the project, the detailed data of the roads should be viewed from the engineering parameters section. In addition, maps of the Vs30 speed range of the road routes are given in the appendix.

5.25.1 Seismic P wave velocity(*Compressional Wave Velocity* (Vp))

*5.25.1.1. WTG01 Road Seismic P wave velocity (*Compressional Wave Velocity *(Vp))*

PROFILES	LAYERS	VP VELOCITY DEPTH	Vp_ Velocity	STRIPPABILITY
1_PROFILE	1. LAYER	-3,24	669	Simple Strippability
	2.LAYER	-10,20	875	Simple Strippability
	3.LAYER		1754	High Difficult Strippability
2_PROFILE	1. LAYER	-2,45	636	Simple Strippability
	2. LAYER	-10,98	806	Simple Strippability
	3. LAYER		1658	High Difficult Strippability
3_PROFILE	1. LAYER	-1,74	669	Simple Strippability
	2. LAYER	-7,79	1004	Simple Strippability
	3. LAYER		2210	Explosive
4_PROFILE	1. LAYER	-5,92	633	Simple Strippability
	2. LAYER	-26,50	1074	Simple Strippability
	3. LAYER		2346	Explosive
5_PROFILE	1. LAYER	-3,19	743	Simple Strippability
	2. LAYER	-14,28	1306	Medium Strippability
	3. LAYER		2911	Explosive
6_PROFILE	1. LAYER	-2,50	383	High Simple Strippability
	2. LAYER	-11,19	869	Simple Strippability
	3. LAYER		1909	High Difficult Strippability
7_PROFILE	1. LAYER	-5,47	598	Simple Strippability
	2.LAYER	-17,21	810	Simple Strippability
	3.LAYER		1614	High Difficult Strippability
8_PROFILE	1. LAYER	-2,61	393	High Simple Strippability
	2. LAYER	-11,68	787	Simple Strippability
	3. LAYER		1791	High Difficult Strippability
9_PROFILE	1. LAYER	-2,76	389	High Simple Strippability
	2. LAYER	-12,34	746	Simple Strippability
	3. LAYER		1644	High Difficult Strippability

P wave velocities of the grounds in the study area and strippability

The above table shows the change table and strippability properties of Vp velocity depth values in the direction of the seismic data obtained from the field studies.

*5.25.1.2. WTG02 Road Seismic P wave velocity (*Compressional Wave Velocity *(Vp))*

PROFILES	LAYERS	Vp VELOCITY DEPTH	Vp_ Velocity	STRIPPABILITY
1_PROFILE	1. LAYER	-6,19	861	Simple Strippability
	2.LAYER	-19,45	864	Simple Strippability
	3.LAYER		1459	Medium Strippability
2_PROFILE	1. LAYER	-6,03	863	Simple Strippability
	2. LAYER	-18,97	950	Simple Strippability
	3. LAYER		1718	High Difficult Strippability
3_PROFILE	1. LAYER	-2,70	348	High Simple Strippability
	2. LAYER	-12,07	737	Simple Strippability
	3. LAYER		1607	High Difficult Strippability
4_PROFILE	1. LAYER	-5,56	887	Simple Strippability
	2. LAYER	-12,74	1286	Medium Strippability
	3. LAYER		2425	Explosive
5_PROFILE	1. LAYER	-3,53	816	Simple Strippability
	2. LAYER	-11,09	1190	Simple Strippability
	3. LAYER		2276	Explosive
6_PROFILE	1. LAYER	-3,89	671	Simple Strippability
	2. LAYER	-12,22	1346	Medium Strippability
	3. LAYER		2702	Explosive
7_PROFILE	1. LAYER	-2,59	820	Simple Strippability
	2.LAYER	-8,14	1207	Simple Strippability
	3.LAYER		2543	Explosive

P wave velocities of the grounds in the study area and strippability

The above table shows the change table and strippability properties of Vp velocity depth values in the direction of the seismic data obtained from the field studies.

*5.25.1.3. WTG03 Road Seismic P wave velocity (*Compressional Wave Velocity *(Vp))*

PROFILES	LAYERS	Vp VELOCITY DEPTH	Vp_ Velocity	STRIPPABILITY
1_PROFILE	1. LAYER	-3,83	540	Simple Strippability
	2.LAYER	-25,93	1105	Simple Strippability
	3.LAYER		2354	Explosive
2_PROFILE	1. LAYER	-2,13	1347	Medium Strippability
	2. LAYER	-9,55	2261	Explosive
	3. LAYER		4876	Explosive
3_PROFILE	1. LAYER	-3,91	787	Simple Strippability
	2. LAYER	-17,48	1348	Medium Strippability
	3. LAYER		3131	Explosive
4_PROFILE	1. LAYER	-3,55	916	Simple Strippability
	2. LAYER	-15,87	1096	Simple Strippability
	3. LAYER		2350	Explosive
5_PROFILE	1. LAYER	-5,99	842	Simple Strippability
	2. LAYER	-13,73	1246	Medium Strippability
	3. LAYER		2440	Explosive
6_PROFILE	1. LAYER	-1,87	504	Simple Strippability
	2. LAYER	-5,88	812	Simple Strippability
	3. LAYER		1705	High Difficult Strippability

P wave velocities of the grounds in the study area and strippability

The above table shows the change table and strippability properties of Vp velocity depth values in the direction of the seismic data obtained from the field studies.

*5.25.1.4. WTG04 Road Seismic P wave velocity (*Compressional Wave Velocity *(Vp))*

Vp VELOCITY				
PROFILES	LAYERS	DEPTH	Vp_ Velocity	STRIPPABILITY
1_PROFILE	1. LAYER	-3,50	1024	Simple Strippability
	2.LAYER	-11,01	1408	Medium Strippability
	3.LAYER		2951	Explosive
2_PROFILE	1. LAYER	-2,30	648	Simple Strippability
	2. LAYER	-10,29	907	Simple Strippability
	3. LAYER		1953	High Difficult Strippability
3_PROFILE	1. LAYER	-2,51	1250	Medium Strippability
	2. LAYER	-11,21	1342	Medium Strippability
	3. LAYER		2655	Explosive
4_PROFILE	1. LAYER	-5,32	975	Simple Strippability
	2. LAYER	-16,73	1283	Medium Strippability
	3. LAYER		2678	Explosive
5_PROFILE	1. LAYER	-8,00	696	Simple Strippability
	2. LAYER	-25,15	1312	Medium Strippability
	3. LAYER		2650	Explosive
6_PROFILE	1. LAYER	-4,02	640	Simple Strippability
	2. LAYER	-12,65	1150	Simple Strippability
	3. LAYER		2166	Explosive
7_PROFILE	1. LAYER	-7,02	2030	High Difficult Strippability
	2.LAYER	-31,40	3120	Explosive
	3.LAYER		6062	Explosive
8_PROFILE	1. LAYER	-4,63	1204	Simple Strippability
	2. LAYER	-20,71	1556	High Difficult Strippability
	3. LAYER		3192	Explosive
9_PROFILE	1. LAYER	-3,49	714	Simple Strippability
	2. LAYER	-10,97	993	Simple Strippability
	3. LAYER		1820	High Difficult Strippability
10_PROFILE	1. LAYER	-4,84	813	Simple Strippability
	2. LAYER	-11,09	984	Simple Strippability
	3. LAYER		1754	High Difficult Strippability

P wave velocities of the grounds in the study area and strippability

The above table shows the change table and strippability properties of Vp velocity depth values in the direction of the seismic data obtained from the field studies.

*5.25.1.5. WTG05 Road Seismic P wave velocity (*Compressional Wave Velocity *(Vp))*

Vp VELOCITY				
PROFILES	LAYERS	DEPTH	Vp_ Velocity	STRIPPABILITY
1_PROFILE	1. LAYER	-3,27	644	Simple Strippability
	2.LAYER	-10,28	1070	Simple Strippability
	3.LAYER		2032	High Difficult Strippability
2_PROFILE	1. LAYER	-3,00	1186	Simple Strippability
	2. LAYER	-13,44	1679	High Difficult Strippability
	3. LAYER		3822	Explosive
3_PROFILE	1. LAYER	-3,04	597	Simple Strippability
	2. LAYER	-13,59	1000	Simple Strippability
	3. LAYER		2287	Explosive
4_PROFILE	1. LAYER	-4,54	570	Simple Strippability
	2. LAYER	-20,31	731	Simple Strippability
	3. LAYER		1596	High Difficult Strippability
5_PROFILE	1. LAYER	-3,85	643	Simple Strippability
	2. LAYER	-8,82	1155	Simple Strippability
	3. LAYER		2232	Explosive
6_PROFILE	1. LAYER	-3,84	1168	Simple Strippability
	2. LAYER	-12,08	1401	Medium Strippability
	3. LAYER		2861	Explosive

7_PROFILE	1. LAYER	-3,44	1251	Medium Strippability
	2.LAYER	-15,37	1557	High Difficult Strippability
	3.LAYER		3537	Explosive

P wave velocities of the grounds in the study area and strippability

The above table shows the change table and strippability properties of Vp velocity depth values in the direction of the seismic data obtained from the field studies.

*5.25.1.6. WTG06 Road Seismic P wave velocity (*Compressional Wave Velocity *(Vp))*

Vp VELOCITY				
PROFILES	LAYERS	DEPTH	Vp_ Velocity	STRIPPABILITY
1_PROFILE	1. LAYER	-2,20	1071	Simple Strippability
	2.LAYER	-14,88	1479	Medium Strippability
	3.LAYER		3190	Explosive
2_PROFILE	1. LAYER	-3,78	1058	Simple Strippability
	2. LAYER	-16,91	1631	High Difficult Strippability
	3. LAYER		3235	Explosive
3_PROFILE	1. LAYER	-3,85	1175	Simple Strippability
	2. LAYER	-17,25	1477	Medium Strippability
	3. LAYER		3101	Explosive
4_PROFILE	1. LAYER	-6,77	1331	Medium Strippability
	2. LAYER	-15,52	1615	High Difficult Strippability
	3. LAYER		2923	Explosive
5_PROFILE	1. LAYER	-3,48	661	Simple Strippability
	2. LAYER	-10,93	1333	Medium Strippability
	3. LAYER		2790	Explosive
6_PROFILE	1. LAYER	-4,23	1231	Medium Strippability
	2. LAYER	-13,29	1783	High Difficult Strippability
	3. LAYER		3611	Explosive
7_PROFILE	1. LAYER	-5,14	1205	Simple Strippability
	2.LAYER	-11,77	1828	High Difficult Strippability
	3.LAYER		3306	Explosive
8_PROFILE	1. LAYER	-3,86	1067	Simple Strippability
	2. LAYER	-12,14	1553	High Difficult Strippability
	3. LAYER		3056	Explosive
9_PROFILE	1. LAYER	-6,26	1139	Simple Strippability
	2. LAYER	-19,69	2070	High Difficult Strippability
	3. LAYER		3957	Explosive
10_PROFILE	1. LAYER	-4,26	999	Simple Strippability
	2. LAYER	-13,39	1367	Medium Strippability
	3. LAYER		2831	Explosive
11_PROFILE	1. LAYER	-5,84	1192	Simple Strippability
	2. LAYER	-18,35	1689	High Difficult Strippability
	3. LAYER		3122	Explosive

P wave velocities of the grounds in the study area and strippability

The above table shows the change table and strippability properties of Vp velocity depth values in the direction of the seismic data obtained from the field studies.

*5.25.1.7. WTG07 Road Seismic P wave velocity (*Compressional Wave Velocity *(Vp))*

PROFILES	LAYERS	VD VELOCITY DEPTH	Vp_ Velocity	STRIPPABILITY
1_PROFILE	1. LAYER	-5,46	768	Simple Strippability
	2.LAYER	-17,16	941	Simple Strippability
	3.LAYER		1852	High Difficult Strippability
2_PROFILE	1. LAYER	-5,57	893	Simple Strippability
	2. LAYER	-17,51	1494	Medium Strippability
	3. LAYER		3206	Explosive
3_PROFILE	1. LAYER	-5,53	796	Simple Strippability
	2. LAYER	-17,38	1000	Simple Strippability
	3. LAYER		1919	High Difficult Strippability
4_PROFILE	1. LAYER	-2,72	960	Simple Strippability
	2. LAYER	-8,55	1209	Simple Strippability
	3. LAYER		2666	Explosive
5_PROFILE	1. LAYER	-2,67	928	Simple Strippability
	2. LAYER	-8,39	1341	Medium Strippability
	3. LAYER		2744	Explosive
6_PROFILE	1. LAYER	-2,29	923	Simple Strippability
	2. LAYER	-10,25	1408	Medium Strippability
	3. LAYER		3023	Explosive
7_PROFILE	1. LAYER	-2,86	917	Simple Strippability
	2.LAYER	-6,55	1238	Medium Strippability
	3.LAYER		2291	Explosive
8_PROFILE	1. LAYER	-2,52	910	Simple Strippability
	2. LAYER	-11,29	1487	Medium Strippability
	3. LAYER		3101	Explosive
9_PROFILE	1. LAYER	-2,85	1350	Medium Strippability
	2. LAYER	-12,76	2534	Explosive
	3. LAYER		5476	Explosive
10_PROFILE	1. LAYER	-2,84	929	Simple Strippability
	2. LAYER	-8,91	1427	Medium Strippability
	3. LAYER		3054	Explosive
11_PROFILE	1. LAYER	-2,53	936	Simple Strippability
	2. LAYER	-11,33	1520	Medium Strippability
	3. LAYER		3312	Explosive
12_PROFILE	1. LAYER	-3,82	1289	Medium Strippability
	2. LAYER	-17,11	1467	Medium Strippability
	3. LAYER		2993	Explosive
13_PROFILE	1. LAYER	-2,07	1422	Medium Strippability
	2. LAYER	-13,99	1925	High Difficult Strippability
	3. LAYER		4154	Explosive
14_PROFILE	1. LAYER	-3,80	1370	Medium Strippability
	2. LAYER	-11,96	1917	High Difficult Strippability
	3. LAYER		3657	Explosive
15_PROFILE	1. LAYER	-4,71	889	Simple Strippability
	2. LAYER	-10,80	1248	Medium Strippability
	3. LAYER		2332	Explosive
16_PROFILE	1. LAYER	-7,20	767	Simple Strippability
	2. LAYER	-16,50	1118	Simple Strippability
	3. LAYER		2064	High Difficult Strippability
17_PROFILE	1. LAYER	-5,07	773	Simple Strippability
	2.LAYER	-15,93	959	Simple Strippability
	3.LAYER		1850	High Difficult Strippability
18_PROFILE	1. LAYER	-4,90	751	Simple Strippability
	2. LAYER	-15,40	1018	Simple Strippability
	3. LAYER		1960	High Difficult Strippability
19_PROFILE	1. LAYER	-2,17	1160	Simple Strippability
	2. LAYER	-9,73	1537	High Difficult Strippability
	3. LAYER		3391	Explosive
20_PROFILE	1. LAYER	-5,73	1158	Simple Strippability
	2. LAYER	-13,14	1467	Medium Strippability
	3. LAYER		2778	Explosive

21_PROFILE	1. LAYER	-7,08	453	High Simple Strippability
	2. LAYER	-16,23	866	Simple Strippability
	3. LAYER		1563	High Difficult Strippability
22_PROFILE	1. LAYER	-8,64	706	Simple Strippability
	2. LAYER	-19,80	1187	Simple Strippability
	3. LAYER		2298	Explosive
23_PROFILE	1. LAYER	-7,13	729	Simple Strippability
	2. LAYER	-16,34	1148	Simple Strippability
	3. LAYER		2187	Explosive
24_PROFILE	1. LAYER	-4,08	862	Simple Strippability
	2. LAYER	-12,84	1115	Simple Strippability
	3. LAYER		2354	Explosive

P wave velocities of the grounds in the study area and strippability

The above table shows the change table and strippability properties of Vp velocity depth values in the direction of the seismic data obtained from the field studies.

*5.25.1.8. WTG08 Road Seismic P wave velocity (*Compressional Wave Velocity *(Vp))*

Vp VELOCITY				
PROFILES	LAYERS	DEPTH	Vp_ Velocity	STRIPPABILITY
1_PROFILE	1. LAYER	-2,92	1027	Simple Strippability
	2.LAYER	-13,06	1125	Simple Strippability
	3.LAYER		2137	Explosive
2_PROFILE	1. LAYER	-2,91	1049	Simple Strippability
	2. LAYER	-13,00	1541	High Difficult Strippability
	3. LAYER		3212	Explosive
3_PROFILE	1. LAYER	-4,21	808	Simple Strippability
	2. LAYER	-18,84	1548	High Difficult Strippability
	3. LAYER		3642	Explosive
4_PROFILE	1. LAYER	-4,67	1053	Simple Strippability
	2. LAYER	-10,71	1396	Medium Strippability
	3. LAYER		2655	Explosive
5_PROFILE	1. LAYER	-8,27	1392	Medium Strippability
	2. LAYER	-18,95	1900	High Difficult Strippability
	3. LAYER		3612	Explosive
6_PROFILE	1. LAYER	-8,21	1241	Medium Strippability
	2. LAYER	-18,80	1780	High Difficult Strippability
	3. LAYER		3401	Explosive
7_PROFILE	1. LAYER	-4,01	683	Simple Strippability
	2.LAYER	-12,62	847	Simple Strippability
	3.LAYER		1718	High Difficult Strippability
8_PROFILE	1. LAYER	-3,31	870	Simple Strippability
	2. LAYER	-7,58	1131	Simple Strippability
	3. LAYER		2210	Explosive
9_PROFILE	1. LAYER	-6,12	1091	Simple Strippability
	2. LAYER	-14,04	1366	Medium Strippability
	3. LAYER		2543	Explosive
10_PROFILE	1. LAYER	-5,68	606	Simple Strippability
	2. LAYER	-17,86	996	Simple Strippability
	3. LAYER		2008	High Difficult Strippability
11_PROFILE	1. LAYER	-2,81	862	Simple Strippability
	2. LAYER	-12,58	1506	Medium Strippability
	3. LAYER		3312	Explosive
12_PROFILE	1. LAYER	-3,78	826	Simple Strippability
	2. LAYER	-11,88	1196	Simple Strippability
	3. LAYER		2504	Explosive

P wave velocities of the grounds in the study area and strippability

The above table shows the change table and strippability properties of Vp velocity depth values in the direction of the seismic data obtained from the field studies.

*5.25.1.9. WTG09 Road Seismic P wave velocity (*Compressional Wave Velocity *(Vp))*

PROFILES	LAYERS	Vp VELOCITY DEPTH	Vp_ Velocity	STRIPPABILITY
1_PROFILE	1. LAYER	-4,73	1118	Simple Strippability
	2.LAYER	-14,88	1886	High Difficult Strippability
	3.LAYER		3897	Explosive
2_PROFILE	1. LAYER	-2,44	1005	Simple Strippability
	2. LAYER	-10,90	1411	Medium Strippability
	3. LAYER		2889	Explosive
3_PROFILE	1. LAYER	-3,38	997	Simple Strippability
	2. LAYER	-15,14	1238	Medium Strippability
	3. LAYER		2443	Explosive
4_PROFILE	1. LAYER	-2,56	831	Simple Strippability
	2. LAYER	-11,48	1136	Simple Strippability
	3. LAYER		2291	Explosive
5_PROFILE	1. LAYER	-4,36	1106	Simple Strippability
	2. LAYER	-19,53	1566	High Difficult Strippability
	3. LAYER		3056	Explosive
6_PROFILE	1. LAYER	-4,45	332	High Simple Strippability
	2. LAYER	-19,93	807	Simple Strippability
	3. LAYER		1763	High Difficult Strippability
7_PROFILE	1. LAYER	-1,96	414	High Simple Strippability
	2.LAYER	-8,77	898	Simple Strippability
	3.LAYER		2097	High Difficult Strippability

P wave velocities of the grounds in the study area and strippability

The above table shows the change table and strippability properties of Vp velocity depth values in the direction of the seismic data obtained from the field studies.

*5.25.1.10. WTG10 Road Seismic P wave velocity (*Compressional Wave Velocity *(Vp))*

PROFILES	LAYERS	Vp VELOCITY DEPTH	Vp_ Velocity	STRIPPABILITY
1_PROFILE	1. LAYER	-4,06	518	Simple Strippability
	2.LAYER	-12,76	759	Simple Strippability
	3.LAYER		1563	High Difficult Strippability
2_PROFILE	1. LAYER	-4,54	626	Simple Strippability
	2. LAYER	-14,27	803	Simple Strippability
	3. LAYER		1555	High Difficult Strippability
3_PROFILE	1. LAYER	-3,18	933	Simple Strippability
	2. LAYER	-14,22	1371	Medium Strippability
	3. LAYER		2889	Explosive
4_PROFILE	1. LAYER	-4,45	1348	Medium Strippability
	2. LAYER	-19,94	1757	High Difficult Strippability
	3. LAYER		3386	Explosive
5_PROFILE	1. LAYER	-4,35	895	Simple Strippability
	2. LAYER	-13,68	1043	Simple Strippability
	3. LAYER		2140	Explosive
6_PROFILE	1. LAYER	-5,13	846	Simple Strippability
	2. LAYER	-22,94	933	Simple Strippability
	3. LAYER		1952	High Difficult Strippability
7_PROFILE	1. LAYER	-2,83	923	Simple Strippability
	2.LAYER	-12,65	1282	Medium Strippability
	3.LAYER		2811	Explosive

P wave velocities of the grounds in the study area and strippability

The above table shows the change table and strippability properties of Vp velocity depth values in the direction of the seismic data obtained from the field studies.

*5.25.1.11. WTG11 Road Seismic P wave velocity (*Compressional Wave Velocity *(Vp))*

Vp VELOCITY				
PROFILES	LAYERS	DEPTH	Vp_ Velocity	STRIPPABILITY
1_PROFILE	1. LAYER	-2,87	769	Simple Strippability
	2.LAYER	-12,85	1166	Simple Strippability
	3.LAYER		2075	High Difficult Strippability
2_PROFILE	1. LAYER	-2,54	695	Simple Strippability
	2. LAYER	-7,97	885	Simple Strippability
	3. LAYER		1911	High Difficult Strippability
3_PROFILE	1. LAYER	-2,46	893	Simple Strippability
	2. LAYER	-7,73	1118	Simple Strippability
	3. LAYER		2254	Explosive
4_PROFILE	1. LAYER	-2,45	687	Simple Strippability
	2. LAYER	-7,71	1003	Simple Strippability
	3. LAYER		1964	High Difficult Strippability
5_PROFILE	1. LAYER	-4,84	687	Simple Strippability
	2. LAYER	-15,21	861	Simple Strippability
	3. LAYER		1658	High Difficult Strippability
6_PROFILE	1. LAYER	-3,12	634	Simple Strippability
	2. LAYER	-9,80	1058	Simple Strippability
	3. LAYER		2209	Explosive

P wave velocities of the grounds in the study area and strippability

The above table shows the change table and strippability properties of Vp velocity depth values in the direction of the seismic data obtained from the field studies.

*5.25.1.12. WTG12 Road Seismic P wave velocity (*Compressional Wave Velocity *(Vp))*

Vp VELOCITY				
PROFILES	LAYERS	DEPTH	Vp_ Velocity	STRIPPABILITY
1_PROFILE	1. LAYER	-3,18	1116	Simple Strippability
	2.LAYER	-14,25	1291	Medium Strippability
	3.LAYER		2309	Explosive
2_PROFILE	1. LAYER	-4,33	1156	Simple Strippability
	2. LAYER	-19,37	1165	Simple Strippability
	3. LAYER		2225	Explosive
3_PROFILE	1. LAYER	-2,55	1226	Medium Strippability
	2. LAYER	-11,40	1566	High Difficult Strippability
	3. LAYER		2911	Explosive
4_PROFILE	1. LAYER	-4,44	896	Simple Strippability
	2. LAYER	-19,85	826	Simple Strippability
	3. LAYER		1644	High Difficult Strippability
5_PROFILE	1. LAYER	-2,72	832	Simple Strippability
	2. LAYER	-8,55	1085	Simple Strippability
	3. LAYER		2070	High Difficult Strippability

P wave velocities of the grounds in the study area and strippability

The above table shows the change table and strippability properties of Vp velocity depth values in the direction of the seismic data obtained from the field studies.

*5.25.1.13. WTG13 Road Seismic P wave velocity (*Compressional Wave Velocity *(Vp))*

Vp VELOCITY				
PROFILES	LAYERS	DEPTH	Vp_ Velocity	STRIPPABILITY
1_PROFILE	1. LAYER	-4,20	1166	Simple Strippability
	2.LAYER	-13,19	1231	Medium Strippability
	3.LAYER		2605	Explosive
2_PROFILE	1. LAYER	-6,28	1149	Simple Strippability
	2. LAYER	-14,40	1414	Medium Strippability
	3. LAYER		2722	Explosive
3_PROFILE	1. LAYER	-6,66	780	Simple Strippability
	2. LAYER	-20,95	1177	Simple Strippability
	3. LAYER		2298	Explosive
4_PROFILE	1. LAYER	-3,55	980	Simple Strippability
	2. LAYER	-11,16	1133	Simple Strippability
	3. LAYER		1975	High Difficult Strippability
5_PROFILE	1. LAYER	-1,72	503	Simple Strippability
	2. LAYER	-7,69	862	Simple Strippability
	3. LAYER		1953	High Difficult Strippability

P wave velocities of the grounds in the study area and strippability

The above table shows the change table and strippability properties of Vp velocity depth values in the direction of the seismic data obtained from the field studies.

*5.25.1.14. WTG14 Road Seismic P wave velocity (*Compressional Wave Velocity *(Vp))*

Vp VELOCITY				
PROFILES	LAYERS	DEPTH	Vp_ Velocity	STRIPPABILITY
1_PROFILE	1. LAYER	-3,26	1176	Simple Strippability
	2.LAYER	-14,61	1614	High Difficult Strippability
	3.LAYER		3605	Explosive
2_PROFILE	1. LAYER	-2,29	670	Simple Strippability
	2. LAYER	-10,27	1129	Simple Strippability
	3. LAYER		2465	Explosive
3_PROFILE	1. LAYER	-2,78	982	Simple Strippability
	2. LAYER	-12,43	1044	Simple Strippability
	3. LAYER		2209	Explosive
4_PROFILE	1. LAYER	-2,45	879	Simple Strippability
	2. LAYER	-10,97	1396	Medium Strippability
	3. LAYER		3045	Explosive
5_PROFILE	1. LAYER	-3,58	1273	Medium Strippability
	2. LAYER	-11,27	1698	High Difficult Strippability
	3. LAYER		3413	Explosive
6_PROFILE	1. LAYER	-3,35	1101	Simple Strippability
	2. LAYER	-10,54	1592	High Difficult Strippability
	3. LAYER		3246	Explosive
7_PROFILE	1. LAYER	-5,59	821	Simple Strippability
	2.LAYER	-12,82	1027	Simple Strippability
	3.LAYER		1869	High Difficult Strippability
8_PROFILE	1. LAYER	-4,84	874	Simple Strippability
	2. LAYER	-11,10	1143	Simple Strippability
	3. LAYER		2077	High Difficult Strippability
9_PROFILE	1. LAYER	-3,11	1360	Medium Strippability
	2. LAYER	-9,76	1536	High Difficult Strippability
	3. LAYER		2835	Explosive
10_PROFILE	1. LAYER	-4,22	863	Simple Strippability
	2. LAYER	-13,26	1299	Medium Strippability
	3. LAYER		2432	Explosive
11_PROFILE	1. LAYER	-3,99	990	Simple Strippability
	2. LAYER	-12,55	959	Simple Strippability
	3. LAYER		1696	High Difficult Strippability

P wave velocities of the grounds in the study area and strippability

The above table shows the change table and strippability properties of Vp velocity depth values in the direction of the seismic data obtained from the field studies.

*5.25.1.15. WTG15 Road Seismic P wave velocity (*Compressional Wave Velocity *(Vp))*

Vp VELOCITY				
PROFILES	LAYERS	DEPTH	Vp_ Velocity	STRIPPABILITY
1_PROFILE	1. LAYER	-4,23	950	Simple Strippability
	2.LAYER	-13,30	1236	Medium Strippability
	3.LAYER		2350	Explosive
2_PROFILE	1. LAYER	-3,50	717	Simple Strippability
	2. LAYER	-15,65	916	Simple Strippability
	3. LAYER		1647	High Difficult Strippability
3_PROFILE	1. LAYER	-2,77	1029	Simple Strippability
	2. LAYER	-12,40	1306	Medium Strippability
	3. LAYER		2536	Explosive
4_PROFILE	1. LAYER	-3,56	1061	Simple Strippability
	2. LAYER	-11,19	1325	Medium Strippability
	3. LAYER		2407	Explosive
5_PROFILE	1. LAYER	-3,34	1161	Simple Strippability
	2. LAYER	-10,50	1263	Medium Strippability
	3. LAYER		2147	Explosive
6_PROFILE	1. LAYER	-3,10	893	Simple Strippability
	2. LAYER	-9,75	1086	Simple Strippability
	3. LAYER		2198	Explosive
7_PROFILE	1. LAYER	-2,80	775	Simple Strippability
	2.LAYER	-8,81	733	Simple Strippability
	3.LAYER		1476	Medium Strippability
8_PROFILE	1. LAYER	-3,94	858	Simple Strippability
	2. LAYER	-12,40	921	Simple Strippability
	3. LAYER		1799	High Difficult Strippability
9_PROFILE	1. LAYER	-6,66	1459	Medium Strippability
	2. LAYER	-15,25	1845	High Difficult Strippability
	3. LAYER		3577	Explosive
10_PROFILE	1. LAYER	-8,12	1034	Simple Strippability
	2. LAYER	-18,61	1400	Medium Strippability
	3. LAYER		2699	Explosive
11_PROFILE	1. LAYER	-5,54	1082	Simple Strippability
	2. LAYER	-17,40	1704	High Difficult Strippability
	3. LAYER		3518	Explosive
12_PROFILE	1. LAYER	-3,48	967	Simple Strippability
	2. LAYER	-10,94	1231	Medium Strippability
	3. LAYER		2236	Explosive
13_PROFILE	1. LAYER	-3,13	476	Simple Strippability
	2. LAYER	-9,85	1010	Simple Strippability
	3. LAYER		1970	High Difficult Strippability
14_PROFILE	1. LAYER	-3,34	542	Simple Strippability
	2. LAYER	-14,94	1065	Simple Strippability
	3. LAYER		1932	High Difficult Strippability
15_PROFILE	1. LAYER	-3,48	686	Simple Strippability
	2. LAYER	-15,60	1082	Simple Strippability
	3. LAYER		2122	High Difficult Strippability
16_PROFILE	1. LAYER	-2,87	1287	Medium Strippability
	2. LAYER	-12,85	1589	High Difficult Strippability
	3. LAYER		3255	Explosive
17_PROFILE	1. LAYER	-5,81	1218	Simple Strippability
	2.LAYER	-18,27	1621	High Difficult Strippability
	3.LAYER		3109	Explosive
18_PROFILE	1. LAYER	-4,83	880	Simple Strippability
	2. LAYER	-15,19	1195	Simple Strippability
	3. LAYER		2387	Explosive

P wave velocities of the grounds in the study area and strippability

The above table shows the change table and strippability properties of Vp velocity depth values in the direction of the seismic data obtained from the field studies.

*5.25.1.16. WTG16 Road Seismic P wave velocity (*Compressional Wave Velocity *(Vp))*

Vp VELOCITY				
PROFILES	LAYERS	DEPTH	Vp_ Velocity	STRIPPABILITY
1_PROFILE	1. LAYER	-2,78	490	Simple Strippability
	2.LAYER	-8,75	777	Simple Strippability
	3.LAYER		1590	High Difficult Strippability
2_PROFILE	1. LAYER	-4,28	568	Simple Strippability
	2. LAYER	-19,17	915	Simple Strippability
	3. LAYER		1974	High Difficult Strippability
3_PROFILE	1. LAYER	-6,18	640	Simple Strippability
	2. LAYER	-19,43	1021	Simple Strippability
	3. LAYER		2103	High Difficult Strippability
4_PROFILE	1. LAYER	-2,89	454	High Simple Strippability
	2. LAYER	-12,92	663	Simple Strippability
	3. LAYER		1457	Medium Strippability
5_PROFILE	1. LAYER	-3,43	412	High Simple Strippability
	2. LAYER	-15,35	738	Simple Strippability
	3. LAYER		1685	High Difficult Strippability
6_PROFILE	1. LAYER	-3,75	721	Simple Strippability
	2. LAYER	-16,78	1106	Simple Strippability
	3. LAYER		2169	Explosive
7_PROFILE	1. LAYER	-2,29	490	Simple Strippability
	2.LAYER	-10,26	970	Simple Strippability
	3.LAYER		2198	Explosive
8_PROFILE	1. LAYER	-3,33	852	Simple Strippability
	2. LAYER	-10,48	1165	Simple Strippability
	3. LAYER		2236	Explosive
9_PROFILE	1. LAYER	-4,48	1236	Medium Strippability
	2. LAYER	-14,07	1867	High Difficult Strippability
	3. LAYER		3724	Explosive
10_PROFILE	1. LAYER	-6,87	1470	Medium Strippability
	2. LAYER	-21,60	1353	Medium Strippability
	3. LAYER		2435	Explosive
11_PROFILE	1. LAYER	-3,93	793	Simple Strippability
	2. LAYER	-26,63	1504	Medium Strippability
	3. LAYER		3479	Explosive
12_PROFILE	1. LAYER	-2,18	619	Simple Strippability
	2. LAYER	-14,74	976	Simple Strippability
	3. LAYER		2084	High Difficult Strippability
13_PROFILE	1. LAYER	-3,89	402	High Simple Strippability
	2. LAYER	-17,40	762	Simple Strippability
	3. LAYER		1713	High Difficult Strippability
14_PROFILE	1. LAYER	-4,44	1107	Simple Strippability
	2. LAYER	-10,17	1443	Medium Strippability
	3. LAYER		2722	Explosive
15_PROFILE	1. LAYER	-4,63	892	Simple Strippability
	2. LAYER	-14,57	1323	Medium Strippability
	3. LAYER		2749	Explosive
16_PROFILE	1. LAYER	-6,05	1251	Medium Strippability
	2. LAYER	-19,02	1859	High Difficult Strippability
	3. LAYER		3890	Explosive
17_PROFILE	1. LAYER	-2,56	685	Simple Strippability
	2.LAYER	-8,05	1065	Simple Strippability
	3.LAYER		2198	Explosive
18_PROFILE	1. LAYER	-6,05	716	Simple Strippability
	2. LAYER	-27,07	1224	Medium Strippability
	3. LAYER		2416	Explosive
19_PROFILE	1. LAYER	-9,75	1246	Medium Strippability
	2. LAYER	-30,66	1530	High Difficult Strippability
	3. LAYER		2824	Explosive

P wave velocities of the grounds in the study area and strippability

The above table shows the change table and strippability properties of Vp velocity depth values in the direction of the seismic data obtained from the field studies.

*5.25.1.17. WTG17 Road Seismic P wave velocity (*Compressional Wave Velocity *(Vp))*

Vp VELOCITY				
PROFILES	LAYERS	DEPTH	Vp_ Velocity	STRIPPABILITY
1_PROFILE	1. LAYER	-7,19	793	Simple Strippability
	2.LAYER	-16,48	1118	Simple Strippability
	3.LAYER		2118	High Difficult Strippability
2_PROFILE	1. LAYER	-2,18	604	Simple Strippability
	2. LAYER	-9,77	609	Simple Strippability
	3. LAYER		991	Simple Strippability
3_PROFILE	1. LAYER	-4,10	756	Simple Strippability
	2. LAYER	-18,33	1082	Simple Strippability
	3. LAYER		2184	Explosive
4_PROFILE	1. LAYER	-3,52	368	High Simple Strippability
	2. LAYER	-15,77	838	Simple Strippability
	3. LAYER		1873	High Difficult Strippability
5_PROFILE	1. LAYER	-12,11	574	Simple Strippability
	2. LAYER	-27,75	708	Simple Strippability
	3. LAYER		1229	Medium Strippability

P wave velocities of the grounds in the study area and strippability

The above table shows the change table and strippability properties of Vp velocity depth values in the direction of the seismic data obtained from the field studies.

*5.25.1.18. WTG18 Road Seismic P wave velocity (*Compressional Wave Velocity *(Vp))*

Vp VELOCITY				
PROFILES	LAYERS	DEPTH	Vp_ Velocity	STRIPPABILITY
1_PROFILE	1. LAYER	-6,61	1163	Simple Strippability
	2.LAYER	-29,60	1555	High Difficult Strippability
	3.LAYER		2896	Explosive
2_PROFILE	1. LAYER	-3,64	846	Simple Strippability
	2. LAYER	-16,30	1173	Simple Strippability
	3. LAYER		2377	Explosive
3_PROFILE	1. LAYER	-3,66	659	Simple Strippability
	2. LAYER	-16,37	992	Simple Strippability
	3. LAYER		2103	High Difficult Strippability
4_PROFILE	1. LAYER	-4,98	469	Simple Strippability
	2. LAYER	-33,73	736	Simple Strippability
	3. LAYER		1614	High Difficult Strippability
5_PROFILE	1. LAYER	-1,56	232	High Simple Strippability
	2. LAYER	-10,57	551	Simple Strippability
	3. LAYER		1295	Medium Strippability
6_PROFILE	1. LAYER	-2,52	323	High Simple Strippability
	2. LAYER	-11,29	511	Simple Strippability
	3. LAYER		1010	Simple Strippability
7_PROFILE	1. LAYER	-6,37	405	High Simple Strippability
	2.LAYER	-20,02	664	Simple Strippability
	3.LAYER		1369	Medium Strippability
8_PROFILE	1. LAYER	-6,29	410	High Simple Strippability
	2. LAYER	-28,17	866	Simple Strippability
	3. LAYER		1910	High Difficult Strippability
9_PROFILE	1. LAYER	-4,59	808	Simple Strippability
	2. LAYER	-31,09	1269	Medium Strippability
	3. LAYER		2842	Explosive
10_PROFILE	1. LAYER	-4,19	491	Simple Strippability
	2. LAYER	-28,36	804	Simple Strippability
	3. LAYER		1742	High Difficult Strippability
11_PROFILE	1. LAYER	-2,41	496	Simple Strippability
	2. LAYER	-16,31	681	Simple Strippability
	3. LAYER		1533	High Difficult Strippability

P wave velocities of the grounds in the study area and strippability

The above table shows the change table and strippability properties of Vp velocity depth values in the direction of the seismic data obtained from the field studies.

*5.25.1.19. WTG19 Road Seismic P wave velocity (*Compressional Wave Velocity *(Vp))*

Vp VELOCITY				
PROFILES	LAYERS	DEPTH	Vp_ Velocity	STRIPPABILITY
1_PROFILE	1. LAYER	-3,22	993	Simple Strippability
	2.LAYER	-14,43	1772	High Difficult Strippability
	3.LAYER		4045	Explosive
2_PROFILE	1. LAYER	-3,30	479	Simple Strippability
	2. LAYER	-22,34	822	Simple Strippability
	3. LAYER		1713	High Difficult Strippability
3_PROFILE	1. LAYER	-4,61	410	High Simple Strippability
	2. LAYER	-20,65	465	Simple Strippability
	3. LAYER		962	Simple Strippability
4_PROFILE	1. LAYER	-3,04	532	Simple Strippability
	2. LAYER	-20,57	1062	Simple Strippability
	3. LAYER		2226	Explosive

P wave velocities of the grounds in the study area and strippability

The above table shows the change table and strippability properties of Vp velocity depth values in the direction of the seismic data obtained from the field studies.

*5.25.1.20. WTG20 Road Seismic P wave velocity (*Compressional Wave Velocity *(Vp))*

Vp VELOCITY				
PROFILES	LAYERS	DEPTH	Vp_ Velocity	STRIPPABILITY
1_PROFILE	1. LAYER	-8,11	405	High Simple Strippability
	2.LAYER	-25,49	709	Simple Strippability
	3.LAYER		1383	Medium Strippability
2_PROFILE	1. LAYER	-5,30	404	High Simple Strippability
	2. LAYER	-16,65	912	Simple Strippability
	3. LAYER		1827	High Difficult Strippability
3_PROFILE	1. LAYER	-6,61	570	Simple Strippability
	2. LAYER	-29,56	1146	Simple Strippability
	3. LAYER		2390	Explosive
4_PROFILE	1. LAYER	-2,19	335	High Simple Strippability
	2. LAYER	-14,82	707	Simple Strippability
	3. LAYER		1735	High Difficult Strippability

P wave velocities of the grounds in the study area and strippability

The above table shows the change table and strippability properties of Vp velocity depth values in the direction of the seismic data obtained from the field studies.

*5.25.1.21. WTG21 Road Seismic P wave velocity (*Compressional Wave Velocity *(Vp))*

Vp VELOCITY				
PROFILES	LAYERS	DEPTH	Vp_ Velocity	STRIPPABILITY
1_PROFILE	1. LAYER	-5,93	399	High Simple Strippability
	2.LAYER	-18,64	644	Simple Strippability
	3.LAYER		1219	Simple Strippability
2_PROFILE	1. LAYER	-3,36	1122	Simple Strippability
	2. LAYER	-15,06	1704	High Difficult Strippability
	3. LAYER		3463	Explosive
3_PROFILE	1. LAYER	-2,18	1009	Simple Strippability
	2. LAYER	-14,76	1390	Medium Strippability
	3. LAYER		3083	Explosive
4_PROFILE	1. LAYER	-6,15	992	Simple Strippability

	2. LAYER	-19,32	1601	High Difficult Strippability
	3. LAYER		2977	Explosive
5_PROFILE	1. LAYER	-5,57	1017	Simple Strippability
	2. LAYER	-12,76	956	Simple Strippability
	3. LAYER		1700	High Difficult Strippability
6_PROFILE	1. LAYER	-6,22	692	Simple Strippability
	2. LAYER	-14,25	888	Simple Strippability
	3. LAYER		1628	High Difficult Strippability

P wave velocities of the grounds in the study area and strippability

The above table shows the change table and strippability properties of Vp velocity depth values in the direction of the seismic data obtained from the field studies.

*5.25.1.22. WTG22 Road Seismic P wave velocity (*Compressional Wave Velocity *(Vp))*

Vp VELOCITY				
PROFILES	**LAYERS**	**DEPTH**	**Vp_ Velocity**	**STRIPPABILITY**
1_PROFILE	1. LAYER	-6,00	1203	Simple Strippability
	2.LAYER	-26,85	1400	Medium Strippability
	3.LAYER		2723	Explosive
2_PROFILE	1. LAYER	-3,78	939	Simple Strippability
	2. LAYER	-16,92	1367	Medium Strippability
	3. LAYER		2766	Explosive
3_PROFILE	1. LAYER	-3,56	1124	Simple Strippability
	2. LAYER	-15,94	1519	Medium Strippability
	3. LAYER		3126	Explosive
4_PROFILE	1. LAYER	-3,89	889	Simple Strippability
	2. LAYER	-17,42	1444	Medium Strippability
	3. LAYER		3026	Explosive

P wave velocities of the grounds in the study area and strippability

The above table shows the change table and strippability properties of Vp velocity depth values in the direction of the seismic data obtained from the field studies.

*5.25.1.23. WTG23 Road Seismic P wave velocity (*Compressional Wave Velocity *(Vp))*

Vp VELOCITY				
PROFILES	**LAYERS**	**DEPTH**	**Vp_ Velocity**	**STRIPPABILITY**
1_PROFILE	1. LAYER	-2,94	606	Simple Strippability
	2.LAYER	-19,90	933	Simple Strippability
	3.LAYER		1846	High Difficult Strippability
2_PROFILE	1. LAYER	-4,61	1186	Simple Strippability
	2. LAYER	-20,61	1468	Medium Strippability
	3. LAYER		2844	Explosive
3_PROFILE	1. LAYER	-4,22	855	Simple Strippability
	2. LAYER	-18,89	1606	High Difficult Strippability
	3. LAYER		3400	Explosive

P wave velocities of the grounds in the study area and strippability

The above table shows the change table and strippability properties of Vp velocity depth values in the direction of the seismic data obtained from the field studies.

*5.25.1.24. Substation Road Seismic P wave velocity (*Compressional Wave Velocity *(Vp))*

Vp VELOCITY				
PROFILES	LAYERS	DEPTH	Vp_ Velocity	STRIPPABILITY
1_PROFILE	1. LAYER	-5,90	1497	Medium Strippability
	2.LAYER	-26,41	1885	High Difficult Strippability
	3.LAYER		3792	Explosive

P wave velocities of the grounds in the study area and strippability

The above table shows the change table and strippability properties of Vp velocity depth values in the direction of the seismic data obtained from the field studies.

5.25.2 Seismic S wave velocity (*Transverse wave Velocity* (Vs))

*5.25.2.1. WTG01 Road Seismic S wave velocity (*Transverse Wave Velocity *(Vs))*

Vs VELOCITY				
PROFILES	LAYERS	DEPTH	Vs_ Velocity	GROUND GROUPS
1_PROFILE	1. LAYER	-3,24	261	C
	2.LAYER	-10,20	436	B
	3.LAYER		763	A
2_PROFILE	1. LAYER	-2,45	295	C
	2. LAYER	-10,98	368	C
	3. LAYER		684	B
3_PROFILE	1. LAYER	-1,74	231	C
	2. LAYER	-7,79	476	B
	3. LAYER		991	A
4_PROFILE	1. LAYER	-5,92	271	C
	2. LAYER	-26,50	571	B
	3. LAYER		1081	A
5_PROFILE	1. LAYER	-3,19	317	C
	2. LAYER	-14,28	679	B
	3. LAYER		1416	A
6_PROFILE	1. LAYER	-2,50	181	D
	2. LAYER	-11,19	454	B
	3. LAYER		803	A
7_PROFILE	1. LAYER	-5,47	238	C
	2.LAYER	-17,21	371	C
	3.LAYER		736	A
8_PROFILE	1. LAYER	-2,61	172	D
	2. LAYER	-11,68	402	B
	3. LAYER		746	A
9_PROFILE	1. LAYER	-2,76	178	D
	2. LAYER	-12,34	390	C
	3. LAYER		719	A

S wave velocities of the grounds in the study area and ground group

Ground Group	Ground group and top ground layer thickness(h_1)
Z1	(A) Ground group h_1< 15 m (B) Ground group
Z2	h_1> 15 m (B) Ground group h_1< 15 m (C) Ground group
Z3	15 m < h_1< 50 m (C) Ground group h_1< 10 m (D) Ground group
Z4	h_1> 50 m (C) Ground group h_1> 10 m (D) Ground group

Ground Group Class

The above table shows that Vs velocity values in the direction of the seismic data obtained in the field studies are the absolute change tables and that the layers are included in the ground groups.

*5.25.2.2. WTG02 Road Seismic S wave velocity (*Transverse Wave Velocity *(Vs))*

Vs VELOCITY				
PROFILES	LAYERS	DEPTH	Vs_ Velocity	GROUND GROUPS
1_PROFILE	1. LAYER	-6,19	392	C
	2.LAYER	-19,45	324	C
	3.LAYER		694	B
2_PROFILE	1. LAYER	-6,03	402	B
	2. LAYER	-18,97	395	C
	3. LAYER		892	A
3_PROFILE	1. LAYER	-2,70	164	D
	2. LAYER	-12,07	387	C
	3. LAYER		717	A
4_PROFILE	1. LAYER	-5,56	301	C
	2. LAYER	-12,74	679	B
	3. LAYER		1037	A
5_PROFILE	1. LAYER	-3,53	330	C
	2. LAYER	-11,09	542	B
	3. LAYER		1109	A
6_PROFILE	1. LAYER	-3,89	324	C
	2. LAYER	-12,22	698	B
	3. LAYER		1192	A
7_PROFILE	1. LAYER	-2,59	291	C
	2.LAYER	-8,14	600	B
	3.LAYER		1070	A

S wave velocities of the grounds in the study area and ground group

Ground Group	Ground group and top ground layer thickness(h_1)
Z1	(A) Ground group h_1< 15 m (B) Ground group
Z2	h_1> 15 m (B) Ground group h_1< 15 m (C) Ground group
Z3	15 m < h_1< 50 m (C) Ground group h_1< 10 m (D) Ground group
Z4	h_1> 50 m (C) Ground group h_1> 10 m (D) Ground group

Ground Group Class

The above table shows that Vs velocity values in the direction of the seismic data obtained in the field studies are the absolute change tables and that the layers are included in the ground groups.

*5.25.2.3. WTG03 Road Seismic S wave velocity (*Transverse Wave Velocity *(Vs))*

Vs VELOCITY				
PROFILES	LAYERS	DEPTH	Vs_ Velocity	GROUND GROUPS
1_PROFILE	1. LAYER	-3,83	232	C
	2.LAYER	-25,93	549	B
	3.LAYER		1062	A
2_PROFILE	1. LAYER	-2,13	550	B
	2. LAYER	-9,55	1126	A
	3. LAYER		2107	A
3_PROFILE	1. LAYER	-3,91	298	C
	2. LAYER	-17,48	690	B
	3. LAYER		1311	A
4_PROFILE	1. LAYER	-3,55	381	C
	2. LAYER	-15,87	529	B
	3. LAYER		1014	A
5_PROFILE	1. LAYER	-5,99	260	C
	2. LAYER	-13,73	618	B
	3. LAYER		1022	A
6_PROFILE	1. LAYER	-1,87	208	C
	2. LAYER	-5,88	433	B
	3. LAYER		741	A

S wave velocities of the grounds in the study area and ground group

Ground Group	Ground group and top ground layer thickness(h_1)
Z1	(A) Ground group h_1< 15 m (B) Ground group
Z2	h_1> 15 m (B) Ground group h_1< 15 m (C) Ground group
Z3	15 m < h_1< 50 m (C) Ground group h_1< 10 m (D) Ground group
Z4	h_1> 50 m (C) Ground group h_1> 10 m (D) Ground group

Ground Group Class

The above table shows that Vs velocity values in the direction of the seismic data obtained in the field studies are the absolute change tables and that the layers are included in the ground groups.

*5.25.2.4. WTG04 Road Seismic S wave velocity (*Transverse Wave Velocity *(Vs))*

Vs VELOCITY				
PROFILES	LAYERS	DEPTH	Vs_ Velocity	GROUND GROUPS
1_PROFILE	1. LAYER	-3,50	365	C
	2.LAYER	-11,01	689	B
	3.LAYER		1229	A
2_PROFILE	1. LAYER	-2,30	236	C
	2. LAYER	-10,29	448	B
	3. LAYER		816	A
3_PROFILE	1. LAYER	-2,51	474	B
	2. LAYER	-11,21	560	B
	3. LAYER		1156	A
4_PROFILE	1. LAYER	-5,32	382	C
	2. LAYER	-16,73	673	B
	3. LAYER		1169	A
5_PROFILE	1. LAYER	-8,00	305	C
	2. LAYER	-25,15	708	A
	3. LAYER		1183	A
6_PROFILE	1. LAYER	-4,02	248	C
	2. LAYER	-12,65	558	B
	3. LAYER		1105	A
7_PROFILE	1. LAYER	-7,02	766	A
	2.LAYER	-31,40	1416	A
	3.LAYER		2453	A
8_PROFILE	1. LAYER	-4,63	455	B
	2. LAYER	-20,71	740	A
	3. LAYER		1278	A
9_PROFILE	1. LAYER	-3,49	258	C
	2. LAYER	-10,97	432	B
	3. LAYER		804	A
10_PROFILE	1. LAYER	-4,84	255	C
	2. LAYER	-11,09	440	B
	3. LAYER		733	A

S wave velocities of the grounds in the study area and ground group

Ground Group	Ground group and top ground layer thickness(h_1)
Z1	(A) Ground group h_1< 15 m (B) Ground group
Z2	h_1> 15 m (B) Ground group h_1< 15 m (C) Ground group
Z3	15 m < h_1< 50 m (C) Ground group h_1< 10 m (D) Ground group
Z4	h_1> 50 m (C) Ground group h_1> 10 m (D) Ground group

Ground Group Class

The above table shows that Vs velocity values in the direction of the seismic data obtained in the field studies are the absolute change tables and that the layers are included in the ground groups.

*5.25.2.5. WTG05 Road Seismic S wave velocity (*Transverse Wave Velocity *(Vs))*

Vs VELOCITY				
PROFILES	LAYERS	DEPTH	Vs_ Velocity	GROUND GROUPS
1_PROFILE	1. LAYER	-3,27	312	C
	2.LAYER	-10,28	505	B
	3.LAYER		921	A
2_PROFILE	1. LAYER	-3,00	404	B
	2. LAYER	-13,44	833	A
	3. LAYER		1605	A
3_PROFILE	1. LAYER	-3,04	238	C
	2. LAYER	-13,59	526	B
	3. LAYER		967	A
4_PROFILE	1. LAYER	-4,54	226	C
	2. LAYER	-20,31	374	C
	3. LAYER		667	B
5_PROFILE	1. LAYER	-3,85	235	C
	2. LAYER	-8,82	572	B
	3. LAYER		1010	A
6_PROFILE	1. LAYER	-3,84	421	B
	2. LAYER	-12,08	690	B
	3. LAYER		1275	A
7_PROFILE	1. LAYER	-3,44	414	B
	2.LAYER	-15,37	743	A
	3.LAYER		1479	A

S wave velocities of the grounds in the study area and ground group

Ground Group	Ground group and top ground layer thickness(h_1)
Z1	(A) Ground group h_1< 15 m (B) Ground group
Z2	h_1> 15 m (B) Ground group h_1< 15 m (C) Ground group
Z3	15 m < h_1< 50 m (C) Ground group h_1< 10 m (D) Ground group
Z4	h_1> 50 m (C) Ground group h_1> 10 m (D) Ground group

Ground Group Class

The above table shows that Vs velocity values in the direction of the seismic data obtained in the field studies are the absolute change tables and that the layers are included in the ground groups.

*5.25.2.6. WTG06 Road Seismic S wave velocity (*Transverse Wave Velocity *(Vs))*

Vs VELOCITY				
PROFILES	LAYERS	DEPTH	Vs_ Velocity	GROUND GROUPS
1_PROFILE	1. LAYER	-2,20	351	C
	2.LAYER	-14,88	679	B
	3.LAYER		1457	A
2_PROFILE	1. LAYER	-3,78	403	B
	2. LAYER	-16,91	748	A
	3. LAYER		1445	A
3_PROFILE	1. LAYER	-3,85	474	B
	2. LAYER	-17,25	681	B
	3. LAYER		1342	A
4_PROFILE	1. LAYER	-6,77	408	B
	2. LAYER	-15,52	781	A
	3. LAYER		1140	A
5_PROFILE	1. LAYER	-3,48	305	C
	2. LAYER	-10,93	684	B
	3. LAYER		1162	A
6_PROFILE	1. LAYER	-4,23	442	B
	2. LAYER	-13,29	883	A
	3. LAYER		1513	A
7_PROFILE	1. LAYER	-5,14	378	C
	2.LAYER	-11,77	895	A
	3.LAYER		1357	A
8_PROFILE	1. LAYER	-3,86	420	B
	2. LAYER	-12,14	769	A
	3. LAYER		1241	A
9_PROFILE	1. LAYER	-6,26	509	B
	2. LAYER	-19,69	1042	A
	3. LAYER		1647	A
10_PROFILE	1. LAYER	-4,26	351	C
	2. LAYER	-13,39	680	B
	3. LAYER		1191	A
11_PROFILE	1. LAYER	-5,84	462	B
	2. LAYER	-18,35	728	A
	3. LAYER		1399	A

S wave velocities of the grounds in the study area and ground group

Ground Group	Ground group and top ground layer thickness(h_1)
Z1	(A) Ground group h_1< 15 m (B) Ground group
Z2	h_1> 15 m (B) Ground group h_1< 15 m (C) Ground group
Z3	15 m < h_1< 50 m (C) Ground group h_1< 10 m (D) Ground group
Z4	h_1> 50 m (C) Ground group h_1> 10 m (D) Ground group

Ground Group Class

The above table shows that Vs velocity values in the direction of the seismic data obtained in the field studies are the absolute change tables and that the layers are included in the ground groups.

*5.25.2.7. WTG07 Road Seismic S wave velocity (*Transverse Wave Velocity *(Vs))*

Vs VELOCITY				
PROFILES	LAYERS	DEPTH	Vs_ Velocity	GROUND GROUPS
1_PROFILE	1. LAYER	-5,46	307	C
	2.LAYER	-17,16	472	B
	3.LAYER		733	A
2_PROFILE	1. LAYER	-5,57	336	C
	2. LAYER	-17,51	757	A
	3. LAYER		1342	A
3_PROFILE	1. LAYER	-5,53	296	C
	2. LAYER	-17,38	451	B
	3. LAYER		813	A
4_PROFILE	1. LAYER	-2,72	343	C
	2. LAYER	-8,55	617	B
	3. LAYER		1131	A
5_PROFILE	1. LAYER	-2,67	350	C
	2. LAYER	-8,39	640	B
	3. LAYER		1304	A
6_PROFILE	1. LAYER	-2,29	326	C
	2. LAYER	-10,25	695	B
	3. LAYER		1270	A
7_PROFILE	1. LAYER	-2,86	291	C
	2.LAYER	-6,55	615	B
	3.LAYER		912	A
8_PROFILE	1. LAYER	-2,52	334	C
	2. LAYER	-11,29	743	A
	3. LAYER		1281	A
9_PROFILE	1. LAYER	-2,85	592	B
	2. LAYER	-12,76	1281	A
	3. LAYER		2648	A
10_PROFILE	1. LAYER	-2,84	389	C
	2. LAYER	-8,91	757	A
	3. LAYER		1338	A
11_PROFILE	1. LAYER	-2,53	371	C
	2. LAYER	-11,33	771	A
	3. LAYER		1436	A
12_PROFILE	1. LAYER	-3,82	555	B
	2. LAYER	-17,11	648	B
	3. LAYER		1335	A
13_PROFILE	1. LAYER	-2,07	426	B
	2. LAYER	-13,99	896	A
	3. LAYER		1870	A
14_PROFILE	1. LAYER	-3,80	485	B
	2. LAYER	-11,96	865	A
	3. LAYER		1668	A
15_PROFILE	1. LAYER	-4,71	304	C
	2. LAYER	-10,80	659	B
	3. LAYER		1021	A
16_PROFILE	1. LAYER	-7,20	252	C
	2. LAYER	-16,50	537	B
	3. LAYER		848	A
17_PROFILE	1. LAYER	-5,07	308	C
	2.LAYER	-15,93	437	B
	3.LAYER		809	A
18_PROFILE	1. LAYER	-4,90	314	C
	2. LAYER	-15,40	472	B
	3. LAYER		902	A
19_PROFILE	1. LAYER	-2,17	395	C
	2. LAYER	-9,73	739	A
	3. LAYER		1427	A
20_PROFILE	1. LAYER	-5,73	383	C
	2. LAYER	-13,14	774	A
	3. LAYER		1231	A

21_PROFILE	1. LAYER	-7,08	183	D
	2. LAYER	-16,23	452	B
	3. LAYER		695	B
22_PROFILE	1. LAYER	-8,64	251	C
	2. LAYER	-19,80	613	B
	3. LAYER		980	A
23_PROFILE	1. LAYER	-7,13	252	C
	2. LAYER	-16,34	603	B
	3. LAYER		941	A
24_PROFILE	1. LAYER	-4,08	348	C
	2. LAYER	-12,84	594	B
	3. LAYER		1017	A

S wave velocities of the grounds in the study area and ground group

Ground Group	Ground group and top ground layer thickness(h_1)
Z1	(A) Ground group h_1< 15 m (B) Ground group
Z2	h_1> 15 m (B) Ground group h_1< 15 m (C) Ground group
Z3	15 m < h_1< 50 m (C) Ground group h_1< 10 m (D) Ground group
Z4	h_1> 50 m (C) Ground group h_1> 10 m (D) Ground group

Ground Group Class

The above table shows that Vs velocity values in the direction of the seismic data obtained in the field studies are the absolute change tables and that the layers are included in the ground groups.

*5.25.2.8. WTG08 Road Seismic S wave velocity (*Transverse Wave Velocity *(Vs))*

Vs VELOCITY				
PROFILES	LAYERS	DEPTH	Vs_ Velocity	GROUND GROUPS
1_PROFILE	1. LAYER	-2,92	435	B
	2.LAYER	-13,06	466	B
	3.LAYER		947	A
2_PROFILE	1. LAYER	-2,91	384	C
	2. LAYER	-13,00	730	A
	3. LAYER		1307	A
3_PROFILE	1. LAYER	-4,21	353	C
	2. LAYER	-18,84	829	A
	3. LAYER		1539	A
4_PROFILE	1. LAYER	-4,67	324	C
	2. LAYER	-10,71	707	A
	3. LAYER		1170	A
5_PROFILE	1. LAYER	-8,27	446	B
	2. LAYER	-18,95	968	A
	3. LAYER		1572	A
6_PROFILE	1. LAYER	-8,21	408	B
	2. LAYER	-18,80	926	A
	3. LAYER		1466	A
7_PROFILE	1. LAYER	-4,01	231	C
	2.LAYER	-12,62	423	B
	3.LAYER		746	A
8_PROFILE	1. LAYER	-3,31	253	C
	2. LAYER	-7,58	562	B
	3. LAYER		944	A
9_PROFILE	1. LAYER	-6,12	331	C
	2. LAYER	-14,04	688	B
	3. LAYER		1116	A
10_PROFILE	1. LAYER	-5,68	266	C
	2. LAYER	-17,86	517	B
	3. LAYER		828	A

11_PROFILE	1. LAYER	-2,81	338	C
	2. LAYER	-12,58	771	A
	3. LAYER		1386	A
12_PROFILE	1. LAYER	-3,78	333	C
	2. LAYER	-11,88	624	B
	3. LAYER		1104	A

S wave velocities of the grounds in the study area and ground group

Ground Group	Ground group and top ground layer thickness(h_1)
Z1	(A) Ground group h_1< 15 m (B) Ground group
Z2	h_1> 15 m (B) Ground group h_1< 15 m (C) Ground group
Z3	15 m < h_1< 50 m (C) Ground group h_1< 10 m (D) Ground group
Z4	h_1> 50 m (C) Ground group h_1> 10 m (D) Ground group

Ground Group Class

The above table shows that Vs velocity values in the direction of the seismic data obtained in the field studies are the absolute change tables and that the layers are included in the ground groups.

*5.25.2.9. WTG09 Road Seismic S wave velocity (*Transverse Wave Velocity *(Vs))*

Vs VELOCITY				
PROFILES	LAYERS	DEPTH	Vs_ Velocity	GROUND GROUPS
1_PROFILE	1. LAYER	-4,73	440	B
	2.LAYER	-14,88	956	A
	3.LAYER		1639	A
2_PROFILE	1. LAYER	-2,44	419	B
	2. LAYER	-10,90	646	B
	3. LAYER		1177	A
3_PROFILE	1. LAYER	-3,38	329	C
	2. LAYER	-15,14	564	B
	3. LAYER		1208	A
4_PROFILE	1. LAYER	-2,56	304	C
	2. LAYER	-11,48	516	B
	3. LAYER		859	A
5_PROFILE	1. LAYER	-4,36	393	C
	2. LAYER	-19,53	697	B
	3. LAYER		1325	A
6_PROFILE	1. LAYER	-4,45	161	D
	2. LAYER	-19,93	425	B
	3. LAYER		743	A
7_PROFILE	1. LAYER	-1,96	189	D
	2.LAYER	-8,77	461	B
	3.LAYER		881	A

S wave velocities of the grounds in the study area and ground group

Ground Group	Ground group and top ground layer thickness(h_1)
Z1	(A) Ground group h_1< 15 m (B) Ground group
Z2	h_1> 15 m (B) Ground group h_1< 15 m (C) Ground group
Z3	15 m < h_1< 50 m (C) Ground group h_1< 10 m (D) Ground group
Z4	h_1> 50 m (C) Ground group h_1> 10 m (D) Ground group

Ground Group Class

The above table shows that Vs velocity values in the direction of the seismic data obtained in the field studies are the absolute change tables and that the layers are included in the ground groups.

*5.25.2.10. WTG10 Road Seismic S wave velocity (*Transverse Wave Velocity *(Vs))*

Vs VELOCITY				
PROFILES	LAYERS	DEPTH	Vs_ Velocity	GROUND GROUPS
1_PROFILE	1. LAYER	-4,06	210	C
	2.LAYER	-12,76	402	B
	3.LAYER		677	B
2_PROFILE	1. LAYER	-4,54	254	C
	2. LAYER	-14,27	379	C
	3. LAYER		644	B
3_PROFILE	1. LAYER	-3,18	363	C
	2. LAYER	-14,22	640	B
	3. LAYER		1251	A
4_PROFILE	1. LAYER	-4,45	438	B
	2. LAYER	-19,94	784	A
	3. LAYER		1366	A
5_PROFILE	1. LAYER	-4,35	320	C
	2. LAYER	-13,68	533	B
	3. LAYER		914	A
6_PROFILE	1. LAYER	-5,13	379	C
	2. LAYER	-22,94	428	B
	3. LAYER		836	A
7_PROFILE	1. LAYER	-2,83	335	C
	2.LAYER	-12,65	642	B
	3.LAYER		1468	A

S wave velocities of the grounds in the study area and ground group

Ground Group	Ground group and top ground layer thickness(h_1)
Z1	(A) Ground group h_1< 15 m (B) Ground group
Z2	h_1> 15 m (B) Ground group h_1< 15 m (C) Ground group
Z3	15 m < h_1< 50 m (C) Ground group h_1< 10 m (D) Ground group
Z4	h_1> 50 m (C) Ground group h_1> 10 m (D) Ground group

Ground Group Class

The above table shows that Vs velocity values in the direction of the seismic data obtained in the field studies are the absolute change tables and that the layers are included in the ground groups.

*5.25.2.11. WTG11 Road Seismic S wave velocity (*Transverse Wave Velocity *(Vs))*

Vs VELOCITY				
PROFILES	LAYERS	DEPTH	Vs_ Velocity	GROUND GROUPS
1_PROFILE	1. LAYER	-2,87	256	C
	2.LAYER	-12,85	500	B
	3.LAYER		1036	A
2_PROFILE	1. LAYER	-2,54	232	C
	2. LAYER	-7,97	445	B
	3. LAYER		807	A
3_PROFILE	1. LAYER	-2,46	397	C
	2. LAYER	-7,73	507	B
	3. LAYER		1043	A
4_PROFILE	1. LAYER	-2,45	245	C
	2. LAYER	-7,71	466	B
	3. LAYER		789	A
5_PROFILE	1. LAYER	-4,84	278	C
	2. LAYER	-15,21	385	C
	3. LAYER		724	A
6_PROFILE	1. LAYER	-3,12	256	C
	2. LAYER	-9,80	556	B
	3. LAYER		943	A

S wave velocities of the grounds in the study area and ground group

Ground Group	Ground group and top ground layer thickness(h_1)
Z1	(A) Ground group h_1< 15 m (B) Ground group
Z2	h_1> 15 m (B) Ground group h_1< 15 m (C) Ground group
Z3	15 m < h_1< 50 m (C) Ground group h_1< 10 m (D) Ground group
Z4	h_1> 50 m (C) Ground group h_1> 10 m (D) Ground group

Ground Group Class

The above table shows that Vs velocity values in the direction of the seismic data obtained in the field studies are the absolute change tables and that the layers are included in the ground groups.

*5.25.2.12. WTG12 Road Seismic S wave velocity (*Transverse Wave Velocity *(Vs))*

Vs VELOCITY				
PROFILES	LAYERS	DEPTH	Vs_ Velocity	GROUND GROUPS
1_PROFILE	1. LAYER	-3,18	395	C
	2.LAYER	-14,25	531	B
	3.LAYER		1011	A
2_PROFILE	1. LAYER	-4,33	561	B
	2. LAYER	-19,37	459	B
	3. LAYER		1023	A
3_PROFILE	1. LAYER	-2,55	392	C
	2. LAYER	-11,40	688	B
	3. LAYER		1391	A
4_PROFILE	1. LAYER	-4,44	397	C
	2. LAYER	-19,85	353	C
	3. LAYER		734	A
5_PROFILE	1. LAYER	-2,72	309	C
	2. LAYER	-8,55	477	B
	3. LAYER		921	A

S wave velocities of the grounds in the study area and ground group

Ground Group	Ground group and top ground layer thickness(h_1)
Z1	(A) Ground group h_1< 15 m (B) Ground group
Z2	h_1> 15 m (B) Ground group h_1< 15 m (C) Ground group
Z3	15 m < h_1< 50 m (C) Ground group h_1< 10 m (D) Ground group
Z4	h_1> 50 m (C) Ground group h_1> 10 m (D) Ground group

Ground Group Class

The above table shows that Vs velocity values in the direction of the seismic data obtained in the field studies are the absolute change tables and that the layers are included in the ground groups.

*5.25.2.13. WTG13 Road Seismic S wave velocity (*Transverse Wave Velocity *(Vs))*

Vs VELOCITY				
PROFILES	LAYERS	DEPTH	Vs_ Velocity	GROUND GROUPS
1_PROFILE	1. LAYER	-4,20	463	B
	2.LAYER	-13,19	614	B
	3.LAYER		1138	A
2_PROFILE	1. LAYER	-6,28	348	C
	2. LAYER	-14,40	692	B
	3. LAYER		1154	A
3_PROFILE	1. LAYER	-6,66	307	C
	2. LAYER	-20,95	566	B
	3. LAYER		944	A
4_PROFILE	1. LAYER	-3,55	344	C
	2. LAYER	-11,16	466	B
	3. LAYER		844	A
5_PROFILE	1. LAYER	-1,72	211	C
	2. LAYER	-7,69	445	B
	3. LAYER		838	A

S wave velocities of the grounds in the study area and ground group

Ground Group	Ground group and top ground layer thickness(h_1)
Z1	(A) Ground group h_1< 15 m (B) Ground group
Z2	h_1> 15 m (B) Ground group h_1< 15 m (C) Ground group
Z3	15 m < h_1< 50 m (C) Ground group h_1< 10 m (D) Ground group
Z4	h_1> 50 m (C) Ground group h_1> 10 m (D) Ground group

Ground Group Class

The above table shows that Vs velocity values in the direction of the seismic data obtained in the field studies are the absolute change tables and that the layers are included in the ground groups.

*5.25.2.14. WTG14 Road Seismic S wave velocity (*Transverse Wave Velocity *(Vs))*

Vs VELOCITY				
PROFILES	LAYERS	DEPTH	Vs_ Velocity	GROUND GROUPS
1_PROFILE	1. LAYER	-3,26	419	B
	2.LAYER	-14,61	777	A
	3.LAYER		1514	A
2_PROFILE	1. LAYER	-2,29	277	C
	2. LAYER	-10,27	590	B
	3. LAYER		1042	A
3_PROFILE	1. LAYER	-2,78	464	B
	2. LAYER	-12,43	483	B
	3. LAYER		1004	A
4_PROFILE	1. LAYER	-2,45	336	C
	2. LAYER	-10,97	691	B
	3. LAYER		1421	A
5_PROFILE	1. LAYER	-3,58	442	B
	2. LAYER	-11,27	848	A
	3. LAYER		1439	A
6_PROFILE	1. LAYER	-3,35	388	C
	2. LAYER	-10,54	794	A
	3. LAYER		1370	A
7_PROFILE	1. LAYER	-5,59	267	C
	2.LAYER	-12,82	449	B
	3.LAYER		932	A
8_PROFILE	1. LAYER	-4,84	293	C
	2. LAYER	-11,10	519	B

	3. LAYER		894	A
9_PROFILE	1. LAYER	-3,11	641	B
	2. LAYER	-9,76	607	B
	3. LAYER		1364	A
10_PROFILE	1. LAYER	-4,22	357	C
	2. LAYER	-13,26	595	B
	3. LAYER		987	A
11_PROFILE	1. LAYER	-3,99	461	B
	2. LAYER	-12,55	372	C
	3. LAYER		794	A

S wave velocities of the grounds in the study area and ground group

Ground Group	Ground group and top ground layer thickness(h_1)
Z1	(A) Ground group h_1< 15 m (B) Ground group
Z2	h_1> 15 m (B) Ground group h_1< 15 m (C) Ground group
Z3	15 m < h_1< 50 m (C) Ground group h_1< 10 m (D) Ground group
Z4	h_1> 50 m (C) Ground group h_1> 10 m (D) Ground group

Ground Group Class

The above table shows that Vs velocity values in the direction of the seismic data obtained in the field studies are the absolute change tables and that the layers are included in the ground groups.

*5.25.2.15. WTG15 Road Seismic S wave velocity (*Transverse Wave Velocity *(Vs))*

Vs VELOCITY				
PROFILES	LAYERS	DEPTH	Vs_ Velocity	GROUND GROUPS
1_PROFILE	1. LAYER	-4,23	369	C
	2.LAYER	-13,30	570	B
	3.LAYER		903	A
2_PROFILE	1. LAYER	-3,50	257	C
	2. LAYER	-15,65	396	C
	3. LAYER		703	A
3_PROFILE	1. LAYER	-2,77	433	B
	2. LAYER	-12,40	555	B
	3. LAYER		1268	A
4_PROFILE	1. LAYER	-3,56	399	C
	2. LAYER	-11,19	574	B
	3. LAYER		1072	A
5_PROFILE	1. LAYER	-3,34	433	B
	2. LAYER	-10,50	490	B
	3. LAYER		862	A
6_PROFILE	1. LAYER	-3,10	354	C
	2. LAYER	-9,75	567	B
	3. LAYER		962	A
7_PROFILE	1. LAYER	-2,80	305	C
	2.LAYER	-8,81	328	C
	3.LAYER		647	B
8_PROFILE	1. LAYER	-3,94	380	C
	2. LAYER	-12,40	421	B
	3. LAYER		842	A
9_PROFILE	1. LAYER	-6,66	449	B
	2. LAYER	-15,25	930	A
	3. LAYER		1549	A
10_PROFILE	1. LAYER	-8,12	312	C
	2. LAYER	-18,61	706	A
	3. LAYER		1156	A
11_PROFILE	1. LAYER	-5,54	395	C
	2. LAYER	-17,40	851	A

	3. LAYER		1475	A
12_PROFILE	1. LAYER	-3,48	350	C
	2. LAYER	-10,94	525	B
	3. LAYER		1057	A
13_PROFILE	1. LAYER	-3,13	224	C
	2. LAYER	-9,85	512	B
	3. LAYER		822	A
14_PROFILE	1. LAYER	-3,34	223	C
	2. LAYER	-14,94	514	B
	3. LAYER		703	A
15_PROFILE	1. LAYER	-3,48	256	C
	2. LAYER	-15,60	523	B
	3. LAYER		978	A
16_PROFILE	1. LAYER	-2,87	381	C
	2. LAYER	-12,85	732	A
	3. LAYER		1544	A
17_PROFILE	1. LAYER	-5,81	418	B
	2.LAYER	-18,27	736	A
	3.LAYER		1411	A
18_PROFILE	1. LAYER	-4,83	347	C
	2. LAYER	-15,19	565	B
	3. LAYER		1105	A

S wave velocities of the grounds in the study area and ground group

Ground Group	Ground group and top ground layer thickness(h_1)
Z1	(A) Ground group h_1< 15 m (B) Ground group
Z2	h_1> 15 m (B) Ground group h_1< 15 m (C) Ground group
Z3	15 m < h_1< 50 m (C) Ground group h_1< 10 m (D) Ground group
Z4	h_1> 50 m (C) Ground group h_1> 10 m (D) Ground group

Ground Group Class

The above table shows that Vs velocity values in the direction of the seismic data obtained in the field studies are the absolute change tables and that the layers are included in the ground groups.

*5.25.2.16. WTG16 Road Seismic S wave velocity (*Transverse Wave Velocity *(Vs))*

Vs VELOCITY				
PROFILES	LAYERS	DEPTH	Vs_ Velocity	GROUND GROUPS
1_PROFILE	1. LAYER	-2,78	202	C
	2.LAYER	-8,75	371	C
	3.LAYER		698	B
2_PROFILE	1. LAYER	-4,28	255	C
	2. LAYER	-19,17	456	B
	3. LAYER		866	A
3_PROFILE	1. LAYER	-6,18	252	C
	2. LAYER	-19,43	524	B
	3. LAYER		938	A
4_PROFILE	1. LAYER	-2,89	202	C
	2. LAYER	-12,92	324	C
	3. LAYER		657	B
5_PROFILE	1. LAYER	-3,43	164	D
	2. LAYER	-15,35	385	C
	3. LAYER		711	A
6_PROFILE	1. LAYER	-3,75	291	C
	2. LAYER	-16,78	488	B
	3. LAYER		867	A
7_PROFILE	1. LAYER	-2,29	221	C
	2.LAYER	-10,26	511	B

	3.LAYER		930	A
8_PROFILE	1. LAYER	-3,33	306	C
	2. LAYER	-10,48	527	B
	3. LAYER		970	A
9_PROFILE	1. LAYER	-4,48	451	B
	2. LAYER	-14,07	903	A
	3. LAYER		1659	A
10_PROFILE	1. LAYER	-6,87	684	B
	2. LAYER	-21,60	522	B
	3. LAYER		1158	A
11_PROFILE	1. LAYER	-3,93	359	C
	2. LAYER	-26,63	821	A
	3. LAYER		1495	A
12_PROFILE	1. LAYER	-2,18	204	C
	2. LAYER	-14,74	461	B
	3. LAYER		926	A
13_PROFILE	1. LAYER	-3,89	188	D
	2. LAYER	-17,40	425	B
	3. LAYER		833	A
14_PROFILE	1. LAYER	-4,44	337	C
	2. LAYER	-10,17	727	A
	3. LAYER		1187	A
15_PROFILE	1. LAYER	-4,63	325	C
	2. LAYER	-14,57	661	B
	3. LAYER		1158	A
16_PROFILE	1. LAYER	-6,05	471	B
	2. LAYER	-19,02	963	A
	3. LAYER		1674	A
17_PROFILE	1. LAYER	-2,56	273	C
	2.LAYER	-8,05	531	B
	3.LAYER		923	A
18_PROFILE	1. LAYER	-6,05	300	C
	2. LAYER	-27,07	587	B
	3. LAYER		1004	A
19_PROFILE	1. LAYER	-9,75	492	B
	2. LAYER	-30,66	675	B
	3. LAYER		1192	A

S wave velocities of the grounds in the study area and ground group

Ground Group	Ground group and top ground layer thickness(h_1)
Z1	(A) Ground group h_1< 15 m (B) Ground group
Z2	h_1> 15 m (B) Ground group h_1< 15 m (C) Ground group
Z3	15 m < h_1< 50 m (C) Ground group h_1< 10 m (D) Ground group
Z4	h_1> 50 m (C) Ground group h_1> 10 m (D) Ground group

Ground Group Class

The above table shows that Vs velocity values in the direction of the seismic data obtained in the field studies are the absolute change tables and that the layers are included in the ground groups.

*5.25.2.17. WTG17 Road Seismic S wave velocity (*Transverse Wave Velocity *(Vs))*

PROFILES	LAYERS	Vs VELOCITY DEPTH	Vs_ Velocity	GROUND GROUPS
1_PROFILE	1. LAYER	-7,19	242	C
	2.LAYER	-16,48	554	B
	3.LAYER		887	A
2_PROFILE	1. LAYER	-2,18	228	C
	2. LAYER	-9,77	251	C
	3. LAYER		403	B
3_PROFILE	1. LAYER	-4,10	275	C
	2. LAYER	-18,33	496	B
	3. LAYER		922	A
4_PROFILE	1. LAYER	-3,52	174	D
	2. LAYER	-15,77	434	B
	3. LAYER		778	A
5_PROFILE	1. LAYER	-12,11	188	D
	2. LAYER	-27,75	331	C
	3. LAYER		468	B

S wave velocities of the grounds in the study area and ground group

Ground Group	Ground group and top ground layer thickness(h_1)
Z1	(A) Ground group h_1< 15 m (B) Ground group
Z2	h_1> 15 m (B) Ground group h_1< 15 m (C) Ground group
Z3	15 m < h_1< 50 m (C) Ground group h_1< 10 m (D) Ground group
Z4	h_1> 50 m (C) Ground group h_1> 10 m (D) Ground group

Ground Group Class

The above table shows that Vs velocity values in the direction of the seismic data obtained in the field studies are the absolute change tables and that the layers are included in the ground groups.

*5.25.2.18. WTG18 Road Seismic S wave velocity (*Transverse Wave Velocity *(Vs))*

PROFILES	LAYERS	Vs VELOCITY DEPTH	Vs_ Velocity	GROUND GROUPS
1_PROFILE	1. LAYER	-6,61	409	B
	2.LAYER	-29,60	687	B
	3.LAYER		1231	A
2_PROFILE	1. LAYER	-3,64	311	C
	2. LAYER	-16,30	533	B
	3. LAYER		1117	A
3_PROFILE	1. LAYER	-3,66	265	C
	2. LAYER	-16,37	485	B
	3. LAYER		902	A
4_PROFILE	1. LAYER	-4,98	174	D
	2. LAYER	-33,73	357	C
	3. LAYER		683	B
5_PROFILE	1. LAYER	-1,56	101	D
	2. LAYER	-10,57	273	C
	3. LAYER		544	B
6_PROFILE	1. LAYER	-2,52	129	D
	2. LAYER	-11,29	241	C
	3. LAYER		407	B
7_PROFILE	1. LAYER	-6,37	165	D
	2.LAYER	-20,02	346	C
	3.LAYER		585	B
8_PROFILE	1. LAYER	-6,29	184	D
	2. LAYER	-28,17	478	B
	3. LAYER		834	A

9_PROFILE	1. LAYER	-4,59	318	C
	2. LAYER	-31,09	614	B
	3. LAYER		1253	A
10_PROFILE	1. LAYER	-4,19	205	C
	2. LAYER	-28,36	386	C
	3. LAYER		730	A
11_PROFILE	1. LAYER	-2,41	162	D
	2. LAYER	-16,31	321	C
	3. LAYER		705	A

S wave velocities of the grounds in the study area and ground group

Ground Group	Ground group and top ground layer thickness(h_1)
Z1	(A) Ground group h_1< 15 m (B) Ground group
Z2	h_1> 15 m (B) Ground group h_1< 15 m (C) Ground group
Z3	15 m < h_1< 50 m (C) Ground group h_1< 10 m (D) Ground group
Z4	h_1> 50 m (C) Ground group h_1> 10 m (D) Ground group

Ground Group Class

The above table shows that Vs velocity values in the direction of the seismic data obtained in the field studies are the absolute change tables and that the layers are included in the ground groups.

*5.25.2.19. WTG19 Road Seismic S wave velocity (*Transverse Wave Velocity *(Vs))*

Vs VELOCITY				
PROFILES	LAYERS	DEPTH	Vs_ Velocity	GROUND GROUPS
1_PROFILE	1. LAYER	-3,22	454	B
	2.LAYER	-14,43	959	A
	3.LAYER		1788	A
2_PROFILE	1. LAYER	-3,30	184	D
	2. LAYER	-22,34	376	C
	3. LAYER		706	A
3_PROFILE	1. LAYER	-4,61	158	D
	2. LAYER	-20,65	214	C
	3. LAYER		399	C
4_PROFILE	1. LAYER	-3,04	223	C
	2. LAYER	-20,57	509	B
	3. LAYER		947	A

S wave velocities of the grounds in the study area and ground group

Ground Group	Ground group and top ground layer thickness(h_1)
Z1	(A) Ground group h_1< 15 m (B) Ground group
Z2	h_1> 15 m (B) Ground group h_1< 15 m (C) Ground group
Z3	15 m < h_1< 50 m (C) Ground group h_1< 10 m (D) Ground group
Z4	h_1> 50 m (C) Ground group h_1> 10 m (D) Ground group

Ground Group Class

The above table shows that Vs velocity values in the direction of the seismic data obtained in the field studies are the absolute change tables and that the layers are included in the ground groups.

*5.25.2.20. WTG20 Road Seismic S wave velocity (*Transverse Wave Velocity *(Vs))*

Vs VELOCITY				
PROFILES	LAYERS	DEPTH	Vs_ Velocity	GROUND GROUPS
1_PROFILE	1. LAYER	-8,11	190	D
	2.LAYER	-25,49	352	C
	3.LAYER		590	B
2_PROFILE	1. LAYER	-5,30	189	D
	2. LAYER	-16,65	502	B
	3. LAYER		801	A
3_PROFILE	1. LAYER	-6,61	250	C
	2. LAYER	-29,56	578	B
	3. LAYER		1013	A
4_PROFILE	1. LAYER	-2,19	150	D
	2. LAYER	-14,82	375	C
	3. LAYER		722	A

S wave velocities of the grounds in the study area and ground group

Ground Group	Ground group and top ground layer thickness(h_1)
Z1	(A) Ground group h_1< 15 m (B) Ground group
Z2	h_1> 15 m (B) Ground group h_1< 15 m (C) Ground group
Z3	15 m < h_1< 50 m (C) Ground group h_1< 10 m (D) Ground group
Z4	h_1> 50 m (C) Ground group h_1> 10 m (D) Ground group

Ground Group Class

The above table shows that Vs velocity values in the direction of the seismic data obtained in the field studies are the absolute change tables and that the layers are included in the ground groups.

*5.25.2.21. WTG21 Road Seismic S wave velocity (*Transverse Wave Velocity *(Vs))*

Vs VELOCITY				
PROFILES	LAYERS	DEPTH	Vs_ Velocity	GROUND GROUPS
1_PROFILE	1. LAYER	-5,93	159	D
	2.LAYER	-18,64	305	C
	3.LAYER		493	B
2_PROFILE	1. LAYER	-3,36	410	B
	2. LAYER	-15,06	807	A
	3. LAYER		1621	A
3_PROFILE	1. LAYER	-2,18	516	B
	2. LAYER	-14,76	653	B
	3. LAYER		1308	A
4_PROFILE	1. LAYER	-6,15	381	C
	2. LAYER	-19,32	727	A
	3. LAYER		1218	A
5_PROFILE	1. LAYER	-5,57	378	C
	2. LAYER	-12,76	374	C
	3. LAYER		814	A
6_PROFILE	1. LAYER	-6,22	232	C
	2. LAYER	-14,25	403	B
	3. LAYER		716	A

S wave velocities of the grounds in the study area and ground group

Ground Group	Ground group and top ground layer thickness(h_1)
Z1	(A) Ground group h_1< 15 m (B) Ground group
Z2	h_1> 15 m (B) Ground group h_1< 15 m (C) Ground group
Z3	15 m < h_1< 50 m (C) Ground group h_1< 10 m (D) Ground group
Z4	h_1> 50 m (C) Ground group h_1> 10 m (D) Ground group

Ground Group Class

The above table shows that Vs velocity values in the direction of the seismic data obtained in the field studies are the absolute change tables and that the layers are included in the ground groups.

*5.25.2.22. WTG22 Road Seismic S wave velocity (*Transverse Wave Velocity *(Vs))*

Vs VELOCITY				
PROFILES	LAYERS	DEPTH	Vs_ Velocity	GROUND GROUPS
1_PROFILE	1. LAYER	-6,00	532	B
	2.LAYER	-26,85	623	B
	3.LAYER		1076	A
2_PROFILE	1. LAYER	-3,78	341	C
	2. LAYER	-16,92	626	B
	3. LAYER		1098	A
3_PROFILE	1. LAYER	-3,56	403	B
	2. LAYER	-15,94	697	B
	3. LAYER		1390	A
4_PROFILE	1. LAYER	-3,89	332	C
	2. LAYER	-17,42	686	B
	3. LAYER		1395	A

S wave velocities of the grounds in the study area and ground group

Ground Group	Ground group and top ground layer thickness(h_1)
Z1	(A) Ground group h_1< 15 m (B) Ground group
Z2	h_1> 15 m (B) Ground group h_1< 15 m (C) Ground group
Z3	15 m < h_1< 50 m (C) Ground group h_1< 10 m (D) Ground group
Z4	h_1> 50 m (C) Ground group h_1> 10 m (D) Ground group

Ground Group Class

The above table shows that Vs velocity values in the direction of the seismic data obtained in the field studies are the absolute change tables and that the layers are included in the ground groups.

*5.25.2.23. WTG23 Road Seismic S wave velocity (*Transverse Wave Velocity *(Vs))*

Vs VELOCITY				
PROFILES	LAYERS	DEPTH	Vs_ Velocity	GROUND GROUPS
1_PROFILE	1. LAYER	-2,94	231	C
	2.LAYER	-19,90	406	B
	3.LAYER		777	A
2_PROFILE	1. LAYER	-4,61	419	B
	2. LAYER	-20,61	656	B
	3. LAYER		1351	A
3_PROFILE	1. LAYER	-4,22	368	C
	2. LAYER	-18,89	793	A
	3. LAYER		1464	A

S wave velocities of the grounds in the study area and ground group

Ground Group	Ground group and top ground layer thickness(h_1)
Z1	(A) Ground group h_1< 15 m (B) Ground group
Z2	h_1> 15 m (B) Ground group h_1< 15 m (C) Ground group
Z3	15 m < h_1< 50 m (C) Ground group h_1< 10 m (D) Ground group
Z4	h_1> 50 m (C) Ground group h_1> 10 m (D) Ground group

Ground Group Class

The above table shows that Vs velocity values in the direction of the seismic data obtained in the field studies are the absolute change tables and that the layers are included in the ground groups.

*5.25.2.24. Substation Road Seismic S wave velocity (*Transverse Wave Velocity *(Vs))*

Vs VELOCITY				
PROFILES	LAYERS	DEPTH	Vs_ Velocity	GROUND GROUPS
1_PROFILE	1. LAYER	-5,90	599	B
	2.LAYER	-26,41	861	A
	3.LAYER		1581	A

S wave velocities of the grounds in the study area and ground group

Ground Group	Ground group and top ground layer thickness(h_1)
Z1	(A) Ground group h_1< 15 m (B) Ground group
Z2	h_1> 15 m (B) Ground group h_1< 15 m (C) Ground group
Z3	15 m < h_1< 50 m (C) Ground group h_1< 10 m (D) Ground group
Z4	h_1> 50 m (C) Ground group h_1> 10 m (D) Ground group

Ground Group Class

The above table shows that Vs velocity values in the direction of the seismic data obtained in the field studies are the absolute change tables and that the layers are included in the ground groups.

5.25.3. Surface Waves

5.25.3.1. WTG01 Road Vs30

PROFILES	Vs30 (m/sec)
1.PROFILE	440
2.PROFILE	407
3.PROFILE	545
4.PROFILE	511
5.PROFILE	690
6.PROFILE	442
7.PROFILE	387
8.PROFILE	400
9.PROFILE	383

Vs30 values in the direction of the seismic data obtained from the field studies are given in the table above.

5.25.3.2. WTG02 Road Vs30

PROFILES	Vs30 (m/sec)
1.PROFILE	398
2.PROFILE	476
3.PROFILE	384
4.PROFILE	596
5.PROFILE	597
6.PROFILE	635
7.PROFILE	602

Vs30 values in the direction of the seismic data obtained from the field studies are given in the table above.

5.25.3.3. WTG03 Road Vs30

PROFILES	Vs30 (m/sec)
1.PROFILE	539
2.PROFILE	1180
3.PROFILE	668
4.PROFILE	575
5.PROFILE	558
6.PROFILE	426

Vs30 values in the direction of the seismic data obtained from the field studies are given in the table above.

5.25.3.4. WTG04 Road Vs30

PROFILES	Vs30 (m/sec)
1.PROFILE	691
2.PROFILE	464
3.PROFILE	668
4.PROFILE	646
5.PROFILE	588
6.PROFILE	550
7.PROFILE	1431
8.PROFILE	751
9.PROFILE	455
10.PROFILE	441

Vs30 values in the direction of the seismic data obtained from the field studies are given in the table above.

5.25.3.5. WTG05 Road Vs30

PROFILES	Vs30 (m/sec)
1.PROFILE	516
2.PROFILE	866
3.PROFILE	521
4.PROFILE	367
5.PROFILE	540
6.PROFILE	710
7.PROFILE	791

Vs30 values in the direction of the seismic data obtained from the field studies are given in the table above.

5.25.3.6. WTG06 Road Vs30

PROFILES	Vs30 (m/sec)
1.PROFILE	774
2.PROFILE	785
3.PROFILE	758
4.PROFILE	714
5.PROFILE	625
6.PROFILE	847
7.PROFILE	781
8.PROFILE	730
9.PROFILE	907
10.PROFILE	662
11.PROFILE	756

Vs30 values in the direction of the seismic data obtained from the field studies are given in the table above.

5.25.3.7. WTG07 Road Vs30

PROFILES	Vs30 (m/sec)
1.PROFILE	445
2.PROFILE	681
3.PROFILE	471
4.PROFILE	638
5.PROFILE	707
6.PROFILE	714
7.PROFILE	546
8.PROFILE	733
9.PROFILE	1325
10.PROFILE	737
11.PROFILE	788
12.PROFILE	758
13.PROFILE	1002
14.PROFILE	905
15.PROFILE	589
16.PROFILE	485
17.PROFILE	468
18.PROFILE	489
19.PROFILE	800
20.PROFILE	703
21.PROFILE	367
22.PROFILE	521
23.PROFILE	520
24.PROFILE	576

Vs30 values in the direction of the seismic data obtained from the field studies are given in the table above.

5.25.3.8. WTG08 Road Vs30

PROFILES	Vs30 (m/sec)
1.PROFILE	560
2.PROFILE	753
3.PROFILE	768
4.PROFILE	663
5.PROFILE	875
6.PROFILE	810
7.PROFILE	417
8.PROFILE	541
9.PROFILE	641
10.PROFILE	469
11.PROFILE	753
12.PROFILE	614

Vs30 values in the direction of the seismic data obtained from the field studies are given in the table above.

5.25.3.9. WTG09 Road Vs30

PROFILES	Vs30 (m/sec)
1.PROFILE	881
2.PROFILE	699
3.PROFILE	620
4.PROFILE	523
5.PROFILE	725
6.PROFILE	387
7.PROFILE	482

Vs30 values in the direction of the seismic data obtained from the field studies are given in the table above.

5.25.3.10. WTG10 Road Vs30

PROFILES	Vs30 (m/sec)
1.PROFILE	382
2.PROFILE	372
3.PROFILE	693
4.PROFILE	795
5.PROFILE	524
6.PROFILE	475
7.PROFILE	724

Vs30 values in the direction of the seismic data obtained from the field studies are given in the table above.

5.25.3.11. WTG11 Road Vs30

PROFILES	Vs30 (m/sec)
1.PROFILE	526
2.PROFILE	455
3.PROFILE	595
4.PROFILE	460
5.PROFILE	411
6.PROFILE	527

Vs30 values in the direction of the seismic data obtained from the field studies are given in the table above.

5.25.3.12. WTG12 Road Vs30

PROFILES	Vs30 (m/sec)
1.PROFILE	596
2.PROFILE	572
3.PROFILE	759
4.PROFILE	410
5.PROFILE	526

Vs30 values in the direction of the seismic data obtained from the field studies are given in the table above.

5.25.3.13. WTG13 Road Vs30

PROFILES	Vs30 (m/sec)
1.PROFILE	653
2.PROFILE	661
3.PROFILE	541
4.PROFILE	498
5.PROFILE	471

Vs30 values in the direction of the seismic data obtained from the field studies are given in the table above.

5.25.3.14. WTG14 Road Vs30

PROFILES	Vs30 (m/sec)
1.PROFILE	825
2.PROFILE	588
3.PROFILE	566
4.PROFILE	755
5.PROFILE	821
6.PROFILE	769
7.PROFILE	500
8.PROFILE	520
9.PROFILE	771
10.PROFILE	579
11.PROFILE	465

Vs30 values in the direction of the seismic data obtained from the field studies are given in the table above.

5.25.3.15. WTG15 Road Vs30

PROFILES	Vs30 (m/sec)
1.PROFILE	561
2.PROFILE	412
3.PROFILE	679
4.PROFILE	620
5.PROFILE	519
6.PROFILE	555
7.PROFILE	377
8.PROFILE	478
9.PROFILE	873
10.PROFILE	627
11.PROFILE	778
12.PROFILE	586
13.PROFILE	454
14.PROFILE	443
15.PROFILE	518
16.PROFILE	797
17.PROFILE	735
18.PROFILE	597

Vs30 values in the direction of the seismic data obtained from the field studies are given in the table above.

5.25.3.16. WTG16 Road Vs30

PROFILES	Vs30 (m/sec)
1.PROFILE	386
2.PROFILE	446
3.PROFILE	487
4.PROFILE	361
5.PROFILE	375
6.PROFILE	514
7.PROFILE	502
8.PROFILE	550
9.PROFILE	890
10.PROFILE	636
11.PROFILE	768
12.PROFILE	501
13.PROFILE	391
14.PROFILE	682
15.PROFILE	632
16.PROFILE	885
17.PROFILE	525
18.PROFILE	563
19.PROFILE	728

Vs30 values in the direction of the seismic data obtained from the field studies are given in the table above.

5.25.3.17. WTG17 Road Vs30

PROFILES	Vs30 (m/sec)
1.PROFILE	491
2.PROFILE	247
3.PROFILE	521
4.PROFILE	408
5.PROFILE	320

Vs30 values in the direction of the seismic data obtained from the field studies are given in the table above.

5.25.3.18. WTG18 Road Vs30

PROFILES	Vs30 (m/sec)
1.PROFILE	710
2.PROFILE	589
3.PROFILE	492
4.PROFILE	362
5.PROFILE	296
6.PROFILE	239
7.PROFILE	314
8.PROFILE	388
9.PROFILE	627
10.PROFILE	405
11.PROFILE	362

Vs30 values in the direction of the seismic data obtained from the field studies are given in the table above.

5.25.3.19. WTG19 Road Vs30

PROFILES	Vs30 (m/sec)
1.PROFILE	955
2.PROFILE	402
3.PROFILE	234
4.PROFILE	523

Vs30 values in the direction of the seismic data obtained from the field studies are given in the table above.

5.25.3.20. WTG20 Road Vs30

PROFILES	Vs30 (m/sec)
1.PROFILE	310
2.PROFILE	420
3.PROFILE	504
4.PROFILE	380

Vs30 values in the direction of the seismic data obtained from the field studies are given in the table above.

5.25.3.21. WTG21 Road Vs30

PROFILES	Vs30 (m/sec)
1.PROFILE	286
2.PROFILE	843
3.PROFILE	755
4.PROFILE	685
5.PROFILE	465
6.PROFILE	411

Vs30 values in the direction of the seismic data obtained from the field studies are given in the table above.

5.25.3.22. WTG22 Road Vs30

PROFILES	Vs30 (m/sec)
1.PROFILE	700
2.PROFILE	644
3.PROFILE	760
4.PROFILE	702

Vs30 values in the direction of the seismic data obtained from the field studies are given in the table above.

5.25.3.23. WTG23 Road Vs30

PROFILES	Vs30 (m/sec)
1.PROFILE	444
2.PROFILE	711
3.PROFILE	772

Vs30 values in the direction of the seismic data obtained from the field studies are given in the table above.

5.25.3.24. Substation Road Vs30

PROFILES	Vs30 (m/sec)
1.PROFILE	936

Vs30 values in the direction of the seismic data obtained from the field studies are given in the table above.

5.25.4. Shear Modulus-G (kg/cm²)

5.25.4.1. WTG01 Road Shear Modulus-G (kg/cm²)

SHEAR MODULUS				
PROFILES	LAYERS	DEPTH	G(kg/cm²)	ENDURANCE
1_PROFILE	1. LAYER	-3,24	1105	Weak
	2.LAYER	-10,20	3431	Sturdy
	3.LAYER		11678	Rock Highlid
2_PROFILE	1. LAYER	-2,45	1370	Weak
	2. LAYER	-10,98	2563	Medium
	3. LAYER		9253	Sturdy
3_PROFILE	1. LAYER	-1,74	848	Weak
	2. LAYER	-7,79	4339	Sturdy
	3. LAYER		20879	Rock Highlid
4_PROFILE	1. LAYER	-5,92	1236	Weak
	2. LAYER	-26,50	6452	Sturdy
	3. LAYER		25200	Rock Highlid
5_PROFILE	1. LAYER	-3,19	1793	Medium
	2. LAYER	-14,28	9420	Sturdy
	3. LAYER		45687	Rock Highlid
6_PROFILE	1. LAYER	-2,50	465	Weak
	2. LAYER	-11,19	3746	Sturdy
	3. LAYER		13197	Rock Highlid
7_PROFILE	1. LAYER	-5,47	977	Weak
	2.LAYER	-17,21	2536	Medium
	3.LAYER		10654	Rock Highlid
8_PROFILE	1. LAYER	-2,61	432	Weak
	2. LAYER	-11,68	2879	Medium
	3. LAYER		11232	Rock Highlid
9_PROFILE	1. LAYER	-2,76	480	Weak
	2. LAYER	-12,34	2725	Medium
	3. LAYER		10199	Rock Highlid

Shear modules and endurance of the grounds in the study area

Calculation of shear Modulus values in the direction of the seismic data obtained in the field studies and the table of variation are given in the table above.

5.25.4.2. WTG02 Road Shear Modulus-G (kg/cm²)

SHEAR MODULUS				
PROFILES	LAYERS	DEPTH	G(kg/cm²)	ENDURANCE
1_PROFILE	1. LAYER	-6,19	2621	Medium
	2.LAYER	-19,45	1947	Medium
	3.LAYER		9220	Sturdy
2_PROFILE	1. LAYER	-6,03	2742	Medium
	2. LAYER	-18,97	3023	Sturdy
	3. LAYER		15876	Rock Highlid
3_PROFILE	1. LAYER	-2,70	383	High Weak
	2. LAYER	-12,07	2660	Medium
	3. LAYER		10088	Rock Highlid
4_PROFILE	1. LAYER	-5,56	2509	Medium
	2. LAYER	-12,74	8757	Sturdy
	3. LAYER		23404	Rock Highlid
5_PROFILE	1. LAYER	-3,53	1867	Medium
	2. LAYER	-11,09	5623	Sturdy
	3. LAYER		26334	Rock Highlid
6_PROFILE	1. LAYER	-3,89	1838	Medium
	2. LAYER	-12,22	9780	Sturdy
	3. LAYER		31752	Rock Highlid
7_PROFILE	1. LAYER	-2,59	1432	Weak
	2.LAYER	-8,14	6891	Sturdy
	3.LAYER		25203	Rock Highlid

Shear modules and endurance of the grounds in the study area

Calculation of shear Modulus values in the direction of the seismic data obtained in the field studies and the table of variation are given in the table above.

5.25.4.3. WTG03 Road Shear Modulus-G (kg/cm²)

SHEAR MODULUS				
PROFILES	LAYERS	DEPTH	G(kg/cm²)	ENDURANCE
1_PROFILE	1. LAYER	-3,83	885	Weak
	2.LAYER	-25,93	5903	Sturdy
	3.LAYER		24352	Rock Highlid
2_PROFILE	1. LAYER	-2,13	5949	Sturdy
	2. LAYER	-9,55	28672	Rock Highlid
	3. LAYER		114995	Rock Highlid
3_PROFILE	1. LAYER	-3,91	1518	Medium
	2. LAYER	-17,48	9666	Sturdy
	3. LAYER		39869	Rock Highlid
4_PROFILE	1. LAYER	-3,55	2567	Medium
	2. LAYER	-15,87	5694	Sturdy
	3. LAYER		22213	Rock Highlid
5_PROFILE	1. LAYER	-5,99	1709	Medium
	2. LAYER	-13,73	7221	Sturdy
	3. LAYER		22747	Rock Highlid
6_PROFILE	1. LAYER	-1,87	657	Weak
	2. LAYER	-5,88	3282	Sturdy
	3. LAYER		10951	Rock Highlid

Shear modules and endurance of the grounds in the study area

Calculation of shear Modulus values in the direction of the seismic data obtained in the field studies and the table of variation are given in the table above.

5.25.4.4. WTG04 Road Shear Modulus-G (kg/cm²)

SHEAR MODULUS				
PROFILES	LAYERS	DEPTH	G(kg/cm²)	ENDURANCE
1_PROFILE	1. LAYER	-3,50	2362	Medium
	2.LAYER	-11,01	9446	Sturdy
	3.LAYER		34519	Rock Highlid
2_PROFILE	1. LAYER	-2,30	912	Weak
	2. LAYER	-10,29	3658	Sturdy
	3. LAYER		13731	Rock Highlid
3_PROFILE	1. LAYER	-2,51	4152	Sturdy
	2. LAYER	-11,21	6567	Sturdy
	3. LAYER		29755	Rock Highlid
4_PROFILE	1. LAYER	-5,32	2618	Medium
	2. LAYER	-16,73	8825	Sturdy
	3. LAYER		30466	Rock Highlid
5_PROFILE	1. LAYER	-8,00	1557	Medium
	2. LAYER	-25,15	9909	Sturdy
	3. LAYER		31134	Rock Highlid
6_PROFILE	1. LAYER	-4,02	1097	Weak
	2. LAYER	-12,65	5786	Sturdy
	3. LAYER		25844	Rock Highlid
7_PROFILE	1. LAYER	-7,02	12818	Rock Highlid
	2.LAYER	-31,40	48618	Rock Highlid
	3.LAYER		164595	Rock Highlid
8_PROFILE	1. LAYER	-4,63	4047	Sturdy
	2. LAYER	-20,71	10951	Rock Highlid
	3. LAYER		38054	Rock Highlid
9_PROFILE	1. LAYER	-3,49	1126	Weak
	2. LAYER	-10,97	3310	Sturdy
	3. LAYER		13087	Rock Highlid

10_PROFILE	1. LAYER	-4,84	1597	Medium
	2. LAYER	-11,09	3413	Sturdy
	3. LAYER		10787	Rock Highlid

Shear modules and endurance of the grounds in the study area

Calculation of shear Modulus values in the direction of the seismic data obtained in the field studies and the table of variation are given in the table above.

5.25.4.5. WTG05 Road Shear Modulus-G (kg/cm²)

SHEAR MODULUS				
PROFILES	LAYERS	DEPTH	G(kg/cm^2)	ENDURANCE
1_PROFILE	1. LAYER	-3,27	1693	Medium
	2.LAYER	-10,28	4933	Sturdy
	3.LAYER		17641	Rock Highlid
2_PROFILE	1. LAYER	-3,00	3034	Sturdy
	2. LAYER	-13,44	14941	Rock Highlid
	3. LAYER		62803	Rock Highlid
3_PROFILE	1. LAYER	-3,04	919	Weak
	2. LAYER	-13,59	5252	Sturdy
	3. LAYER		20065	Rock Highlid
4_PROFILE	1. LAYER	-4,54	858	Weak
	2. LAYER	-20,31	2403	Medium
	3. LAYER		8726	Sturdy
5_PROFILE	1. LAYER	-3,85	1443	Weak
	2. LAYER	-8,82	6152	Sturdy
	3. LAYER		21731	Rock Highlid
6_PROFILE	1. LAYER	-3,84	3324	Sturdy
	2. LAYER	-12,08	9497	Sturdy
	3. LAYER		36843	Rock Highlid
7_PROFILE	1. LAYER	-3,44	3249	Sturdy
	2.LAYER	-15,37	11812	Rock Highlid
	3.LAYER		52288	Rock Highlid

Shear modules and endurance of the grounds in the study area

Calculation of shear Modulus values in the direction of the seismic data obtained in the field studies and the table of variation are given in the table above.

5.25.4.6. WTG06 Road Shear Modulus-G (kg/cm²)

SHEAR MODULUS				
PROFILES	LAYERS	DEPTH	G(kg/cm^2)	ENDURANCE
1_PROFILE	1. LAYER	-2,20	2242	Medium
	2.LAYER	-14,88	9611	Sturdy
	3.LAYER		49450	Rock Highlid
2_PROFILE	1. LAYER	-3,78	2962	Medium
	2. LAYER	-16,91	11349	Rock Highlid
	3. LAYER		48847	Rock Highlid
3_PROFILE	1. LAYER	-3,85	4079	Sturdy
	2. LAYER	-17,25	9974	Sturdy
	3. LAYER		41633	Rock Highlid
4_PROFILE	1. LAYER	-6,77	4785	Sturdy
	2. LAYER	-15,52	12071	Rock Highlid
	3. LAYER		29614	Rock Highlid
5_PROFILE	1. LAYER	-3,48	1609	Medium
	2. LAYER	-10,93	9081	Sturdy
	3. LAYER		30446	Rock Highlid
6_PROFILE	1. LAYER	-4,23	3649	Sturdy
	2. LAYER	-13,29	16326	Rock Highlid
	3. LAYER		55035	Rock Highlid

7_PROFILE	1. LAYER	-5,14	4014	Sturdy
	2.LAYER	-11,77	16487	Rock Highlid
	3.LAYER		43291	Rock Highlid
8_PROFILE	1. LAYER	-3,86	3188	Sturdy
	2. LAYER	-12,14	11795	Rock Highlid
	3. LAYER		35472	Rock Highlid
9_PROFILE	1. LAYER	-6,26	5109	Sturdy
	2. LAYER	-19,69	23127	Rock Highlid
	3. LAYER		66699	Rock Highlid
10_PROFILE	1. LAYER	-4,26	2183	Medium
	2. LAYER	-13,39	9141	Sturdy
	3. LAYER		32066	Rock Highlid
11_PROFILE	1. LAYER	-5,84	4272	Sturdy
	2. LAYER	-18,35	10922	Rock Highlid
	3. LAYER		45367	Rock Highlid

Shear modules and endurance of the grounds in the study area

Calculation of shear Modulus values in the direction of the seismic data obtained in the field studies and the table of variation are given in the table above.

5.25.4.7. WTG07 Road Shear Modulus-G (kg/cm²)

SHEAR MODULUS				
PROFILES	LAYERS	DEPTH	G(kg/cm^2)	ENDURANCE
1_PROFILE	1. LAYER	-5,46	1706	Medium
	2.LAYER	-17,16	3917	Sturdy
	3.LAYER		10926	Rock Highlid
2_PROFILE	1. LAYER	-5,57	2043	Medium
	2. LAYER	-17,51	11707	Rock Highlid
	3. LAYER		42037	Rock Highlid
3_PROFILE	1. LAYER	-5,53	1442	Weak
	2. LAYER	-17,38	3699	Sturdy
	3. LAYER		13551	Rock Highlid
4_PROFILE	1. LAYER	-2,72	2070	Medium
	2. LAYER	-8,55	7496	Sturdy
	3. LAYER		28516	Rock Highlid
5_PROFILE	1. LAYER	-2,67	2158	Medium
	2. LAYER	-8,39	8093	Sturdy
	3. LAYER		38167	Rock Highlid
6_PROFILE	1. LAYER	-2,29	1874	Medium
	2. LAYER	-10,25	9686	Sturdy
	3. LAYER		37094	Rock Highlid
7_PROFILE	1. LAYER	-2,86	2247	Medium
	2.LAYER	-6,55	7065	Sturdy
	3.LAYER		17848	Rock Highlid
8_PROFILE	1. LAYER	-2,52	1945	Medium
	2. LAYER	-11,29	11205	Rock Highlid
	3. LAYER		37986	Rock Highlid
9_PROFILE	1. LAYER	-2,85	7242	Sturdy
	2. LAYER	-12,76	38149	Rock Highlid
	3. LAYER		186927	Rock Highlid
10_PROFILE	1. LAYER	-2,84	2782	Medium
	2. LAYER	-8,91	11543	Rock Highlid
	3. LAYER		41234	Rock Highlid
11_PROFILE	1. LAYER	-2,53	2545	Medium
	2. LAYER	-11,33	12344	Rock Highlid
	3. LAYER		48474	Rock Highlid
12_PROFILE	1. LAYER	-3,82	5741	Sturdy
	2. LAYER	-17,11	9105	Sturdy
	3. LAYER		40865	Rock Highlid
13_PROFILE	1. LAYER	-2,07	3564	Sturdy
	2. LAYER	-13,99	17955	Rock Highlid
	3. LAYER		87034	Rock Highlid

14_PROFILE	1. LAYER	-3,80	4729	Sturdy
	2. LAYER	-11,96	16048	Rock Highlid
	3. LAYER		67072	Rock Highlid
15_PROFILE	1. LAYER	-4,71	2513	Medium
	2. LAYER	-10,80	8234	Sturdy
	3. LAYER		22478	Rock Highlid
16_PROFILE	1. LAYER	-7,20	1690	Medium
	2. LAYER	-16,50	5193	Sturdy
	3. LAYER		15039	Rock Highlid
17_PROFILE	1. LAYER	-5,07	1554	Medium
	2.LAYER	-15,93	3553	Sturdy
	3.LAYER		13299	Rock Highlid
18_PROFILE	1. LAYER	-4,90	1700	Medium
	2. LAYER	-15,40	3981	Sturdy
	3. LAYER		16771	Rock Highlid
19_PROFILE	1. LAYER	-2,17	2907	Medium
	2. LAYER	-9,73	11721	Rock Highlid
	3. LAYER		48158	Rock Highlid
20_PROFILE	1. LAYER	-5,73	4469	Sturdy
	2. LAYER	-13,14	11756	Rock Highlid
	3. LAYER		34108	Rock Highlid
21_PROFILE	1. LAYER	-7,08	632	Weak
	2. LAYER	-16,23	3499	Sturdy
	3. LAYER		9407	Sturdy
22_PROFILE	1. LAYER	-8,64	1461	Weak
	2. LAYER	-19,80	7048	Sturdy
	3. LAYER		20605	Rock Highlid
23_PROFILE	1. LAYER	-7,13	1614	Medium
	2. LAYER	-16,34	6718	Sturdy
	3. LAYER		18761	Rock Highlid
24_PROFILE	1. LAYER	-4,08	2146	Medium
	2. LAYER	-12,84	6683	Sturdy
	3. LAYER		22350	Rock Highlid

Shear modules and endurance of the grounds in the study area

Calculation of shear Modulus values in the direction of the seismic data obtained in the field studies and the table of variation are given in the table above.

5.25.4.8. WTG08 Road Shear Modulus-G (kg/cm²)

SHEAR MODULUS				
PROFILES	LAYERS	DEPTH	G(kg/cm^2)	ENDURANCE
1_PROFILE	1. LAYER	-2,92	3319	Sturdy
	2.LAYER	-13,06	4225	Sturdy
	3.LAYER		18893	Rock Highlid
2_PROFILE	1. LAYER	-2,91	2629	Medium
	2. LAYER	-13,00	10988	Rock Highlid
	3. LAYER		39847	Rock Highlid
3_PROFILE	1. LAYER	-4,21	2215	Medium
	2. LAYER	-18,84	14607	Rock Highlid
	3. LAYER		57064	Rock Highlid
4_PROFILE	1. LAYER	-4,67	2823	Medium
	2. LAYER	-10,71	9715	Sturdy
	3. LAYER		30440	Rock Highlid
5_PROFILE	1. LAYER	-8,27	5647	Sturdy
	2. LAYER	-18,95	19658	Rock Highlid
	3. LAYER		59410	Rock Highlid
6_PROFILE	1. LAYER	-8,21	4862	Sturdy
	2. LAYER	-18,80	17718	Rock Highlid

	3. LAYER		50886	Rock Highlid
7_PROFILE	1. LAYER	-4,01	866	Weak
	2.LAYER	-12,62	3121	Sturdy
	3.LAYER		11094	Rock Highlid
8_PROFILE	1. LAYER	-3,31	1649	Medium
	2. LAYER	-7,58	5849	Sturdy
	3. LAYER		18959	Rock Highlid
9_PROFILE	1. LAYER	-6,12	2975	Medium
	2. LAYER	-14,04	9105	Sturdy
	3. LAYER		27438	Rock Highlid
10_PROFILE	1. LAYER	-5,68	1136	Weak
	2. LAYER	-17,86	4790	Sturdy
	3. LAYER		14232	Rock Highlid
11_PROFILE	1. LAYER	-2,81	2053	Medium
	2. LAYER	-12,58	12334	Rock Highlid
	3. LAYER		45203	Rock Highlid
12_PROFILE	1. LAYER	-3,78	1879	Medium
	2. LAYER	-11,88	7489	Sturdy
	3. LAYER		26705	Rock Highlid

Shear modules and endurance of the grounds in the study area

Calculation of shear Modulus values in the direction of the seismic data obtained in the field studies and the table of variation are given in the table above.

5.25.4.9. WTG09 Road Shear Modulus-G (kg/cm²)

SHEAR MODULUS				
PROFILES	LAYERS	DEPTH	G(kg/cm^2)	ENDURANCE
1_PROFILE	1. LAYER	-4,73	3662	Sturdy
	2.LAYER	-14,88	19586	Rock Highlid
	3.LAYER		65804	Rock Highlid
2_PROFILE	1. LAYER	-2,44	3064	Sturdy
	2. LAYER	-10,90	8864	Sturdy
	3. LAYER		31489	Rock Highlid
3_PROFILE	1. LAYER	-3,38	1995	Medium
	2. LAYER	-15,14	6225	Sturdy
	3. LAYER		31798	Rock Highlid
4_PROFILE	1. LAYER	-2,56	1554	Medium
	2. LAYER	-11,48	5018	Sturdy
	3. LAYER		15818	Rock Highlid
5_PROFILE	1. LAYER	-4,36	2868	Medium
	2. LAYER	-19,53	9660	Sturdy
	3. LAYER		40435	Rock Highlid
6_PROFILE	1. LAYER	-4,45	360	High Weak
	2. LAYER	-19,93	3202	Sturdy
	3. LAYER		11085	Rock Highlid
7_PROFILE	1. LAYER	-1,96	513	Weak
	2.LAYER	-8,77	3954	Sturdy
	3.LAYER		16299	Rock Highlid

Shear modules and endurance of the grounds in the study area

Calculation of shear Modulus values in the direction of the seismic data obtained in the field studies and the table of variation are given in the table above.

5.25.4.10. WTG10 Road Shear Modulus-G (kg/cm²)

SHEAR MODULUS				
PROFILES	LAYERS	DEPTH	G(kg/cm²)	ENDURANCE
1_PROFILE	1. LAYER	-4,06	670	Weak
	2.LAYER	-12,76	2755	Medium
	3.LAYER		8921	Sturdy
2_PROFILE	1. LAYER	-4,54	1102	Weak
	2. LAYER	-14,27	2395	Medium
	3. LAYER		8065	Sturdy
3_PROFILE	1. LAYER	-3,18	2310	Medium
	2. LAYER	-14,22	8640	Sturdy
	3. LAYER		35545	Rock Highlid
4_PROFILE	1. LAYER	-4,45	3678	Sturdy
	2. LAYER	-19,94	12488	Rock Highlid
	3. LAYER		44142	Rock Highlid
5_PROFILE	1. LAYER	-4,35	1807	Medium
	2. LAYER	-13,68	5261	Sturdy
	3. LAYER		17617	Rock Highlid
6_PROFILE	1. LAYER	-5,13	2454	Medium
	2. LAYER	-22,94	3615	Sturdy
	3. LAYER		14386	Rock Highlid
7_PROFILE	1. LAYER	-2,83	2069	Medium
	2.LAYER	-12,65	8391	Sturdy
	3.LAYER		48661	Rock Highlid

Shear modules and endurance of the grounds in the study area

Calculation of shear Modulus values in the direction of the seismic data obtained in the field studies and the table of variation are given in the table above.

5.25.4.11. WTG11 Road Shear Modulus-G (kg/cm²)

SHEAR MODULUS				
PROFILES	LAYERS	DEPTH	G(kg/cm²)	ENDURANCE
1_PROFILE	1. LAYER	-2,87	1112	Weak
	2.LAYER	-12,85	4990	Sturdy
	3.LAYER		22450	Rock Highlid
2_PROFILE	1. LAYER	-2,54	875	Weak
	2. LAYER	-7,97	3558	Sturdy
	3. LAYER		13342	Rock Highlid
3_PROFILE	1. LAYER	-2,46	2714	Medium
	2. LAYER	-7,73	5199	Sturdy
	3. LAYER		23237	Rock Highlid
4_PROFILE	1. LAYER	-2,45	964	Weak
	2. LAYER	-7,71	3848	Sturdy
	3. LAYER		12837	Rock Highlid
5_PROFILE	1. LAYER	-4,84	1339	Weak
	2. LAYER	-15,21	2799	Medium
	3. LAYER		10357	Rock Highlid
6_PROFILE	1. LAYER	-3,12	1047	Weak
	2. LAYER	-9,80	5790	Sturdy
	3. LAYER		18880	Rock Highlid

Shear modules and endurance of the grounds in the study area

Calculation of shear Modulus values in the direction of the seismic data obtained in the field studies and the table of variation are given in the table above.

5.25.4.12. WTG12 Road Shear Modulus-G (kg/cm²)

SHEAR MODULUS				
PROFILES	LAYERS	DEPTH	G(kg/cm²)	ENDURANCE
1_PROFILE	1. LAYER	-3,18	2840	Medium
	2.LAYER	-14,25	5260	Sturdy
	3.LAYER		21969	Rock Highlid
2_PROFILE	1. LAYER	-4,33	5764	Sturdy
	2. LAYER	-19,37	4369	Sturdy
	3. LAYER		22268	Rock Highlid
3_PROFILE	1. LAYER	-2,55	2921	Medium
	2. LAYER	-11,40	9857	Sturdy
	3. LAYER		44058	Rock Highlid
4_PROFILE	1. LAYER	-4,44	2755	Medium
	2. LAYER	-19,85	2416	Medium
	3. LAYER		10624	Rock Highlid
5_PROFILE	1. LAYER	-2,72	1680	Medium
	2. LAYER	-8,55	4417	Sturdy
	3. LAYER		17731	Rock Highlid

Shear modules and endurance of the grounds in the study area

Calculation of shear Modulus values in the direction of the seismic data obtained in the field studies and the table of variation are given in the table above.

5.25.4.13. WTG13 Road Shear Modulus-G (kg/cm²)

SHEAR MODULUS				
PROFILES	LAYERS	DEPTH	G(kg/cm²)	ENDURANCE
1_PROFILE	1. LAYER	-4,20	4094	Sturdy
	2.LAYER	-13,19	7599	Sturdy
	3.LAYER		28694	Rock Highlid
2_PROFILE	1. LAYER	-6,28	3333	Sturdy
	2. LAYER	-14,40	9367	Sturdy
	3. LAYER		29825	Rock Highlid
3_PROFILE	1. LAYER	-6,66	1545	Medium
	2. LAYER	-20,95	5898	Sturdy
	3. LAYER		19136	Rock Highlid
4_PROFILE	1. LAYER	-3,55	2072	Medium
	2. LAYER	-11,16	3956	Sturdy
	3. LAYER		14734	Rock Highlid
5_PROFILE	1. LAYER	-1,72	678	Weak
	2. LAYER	-7,69	3733	Sturdy
	3. LAYER		14461	Rock Highlid

Shear modules and endurance of the grounds in the study area

Calculation of shear Modulus values in the direction of the seismic data obtained in the field studies and the table of variation are given in the table above.

5.25.4.14. WTG14 Road Shear Modulus-G (kg/cm²)

SHEAR MODULUS				
PROFILES	LAYERS	DEPTH	G(kg/cm²)	ENDURANCE
1_PROFILE	1. LAYER	-3,26	3234	Sturdy
	2.LAYER	-14,61	12977	Rock Highlid
	3.LAYER		55091	Rock Highlid
2_PROFILE	1. LAYER	-2,29	1295	Weak
	2. LAYER	-10,27	6667	Sturdy
	3. LAYER		23737	Rock Highlid
3_PROFILE	1. LAYER	-2,78	3805	Sturdy
	2. LAYER	-12,43	4859	Sturdy
	3. LAYER		21418	Rock Highlid

4_PROFILE	1. LAYER	-2,45	1976	Medium
	2. LAYER	-10,97	9865	Sturdy
	3. LAYER		46496	Rock Highlid
5_PROFILE	1. LAYER	-3,58	3678	Sturdy
	2. LAYER	-11,27	14985	Rock Highlid
	3. LAYER		49037	Rock Highlid
6_PROFILE	1. LAYER	-3,35	2745	Medium
	2. LAYER	-10,54	12946	Rock Highlid
	3. LAYER		43893	Rock Highlid
7_PROFILE	1. LAYER	-5,59	1684	Medium
	2.LAYER	-12,82	3799	Sturdy
	3.LAYER		17698	Rock Highlid
8_PROFILE	1. LAYER	-4,84	2427	Medium
	2. LAYER	-11,10	4875	Sturdy
	3. LAYER		16740	Rock Highlid
9_PROFILE	1. LAYER	-3,11	7817	Sturdy
	2. LAYER	-9,76	8060	Sturdy
	3. LAYER		42115	Rock Highlid
10_PROFILE	1. LAYER	-4,22	2281	Medium
	2. LAYER	-13,26	6622	Sturdy
	3. LAYER		21196	Rock Highlid
11_PROFILE	1. LAYER	-3,99	3751	Sturdy
	2. LAYER	-12,55	2790	Medium
	3. LAYER		12557	Rock Highlid

Shear modules and endurance of the grounds in the study area

Calculation of shear Modulus values in the direction of the seismic data obtained in the field studies and the table of variation are given in the table above.

5.25.4.15. WTG15 Road Shear Modulus-G (kg/cm²)

SHEAR MODULUS				
PROFILES	LAYERS	DEPTH	G(kg/cm^2)	ENDURANCE
1_PROFILE	1. LAYER	-4,23	2357	Medium
	2.LAYER	-13,30	6488	Sturdy
	3.LAYER		17604	Rock Highlid
2_PROFILE	1. LAYER	-3,50	1133	Weak
	2. LAYER	-15,65	2746	Medium
	3. LAYER		9747	Sturdy
3_PROFILE	1. LAYER	-2,77	3374	Sturdy
	2. LAYER	-12,40	6059	Sturdy
	3. LAYER		35364	Rock Highlid
4_PROFILE	1. LAYER	-3,56	2853	Medium
	2. LAYER	-11,19	6286	Sturdy
	3. LAYER		24932	Rock Highlid
5_PROFILE	1. LAYER	-3,34	3511	Sturdy
	2. LAYER	-10,50	4734	Sturdy
	3. LAYER		15666	Rock Highlid
6_PROFILE	1. LAYER	-3,10	2287	Medium
	2. LAYER	-9,75	6054	Sturdy
	3. LAYER		19645	Rock Highlid
7_PROFILE	1. LAYER	-2,80	1574	Medium
	2.LAYER	-8,81	1960	Medium
	3.LAYER		8036	Sturdy
8_PROFILE	1. LAYER	-3,94	2500	Medium
	2. LAYER	-12,40	3438	Sturdy
	3. LAYER		14328	Rock Highlid

9_PROFILE	1. LAYER	-6,66	5818	Sturdy
	2. LAYER	-15,25	17988	Rock Highlid
	3. LAYER		57558	Rock Highlid
10_PROFILE	1. LAYER	-8,12	2638	Medium
	2. LAYER	-18,61	9713	Sturdy
	3. LAYER		29880	Rock Highlid
11_PROFILE	1. LAYER	-5,54	2888	Medium
	2. LAYER	-17,40	15077	Rock Highlid
	3. LAYER		51909	Rock Highlid
12_PROFILE	1. LAYER	-3,48	2162	Medium
	2. LAYER	-10,94	5155	Sturdy
	3. LAYER		23830	Rock Highlid
13_PROFILE	1. LAYER	-3,13	815	Weak
	2. LAYER	-9,85	4678	Sturdy
	3. LAYER		13954	Rock Highlid
14_PROFILE	1. LAYER	-3,34	821	Weak
	2. LAYER	-14,94	4783	Sturdy
	3. LAYER		10163	Rock Highlid
15_PROFILE	1. LAYER	-3,48	1212	Weak
	2. LAYER	-15,60	5181	Sturdy
	3. LAYER		20120	Rock Highlid
16_PROFILE	1. LAYER	-2,87	2926	Medium
	2. LAYER	-12,85	11029	Rock Highlid
	3. LAYER		55787	Rock Highlid
17_PROFILE	1. LAYER	-5,81	3408	Sturdy
	2.LAYER	-18,27	11043	Rock Highlid
	3.LAYER		46116	Rock Highlid
18_PROFILE	1. LAYER	-4,83	2030	Medium
	2. LAYER	-15,19	6276	Sturdy
	3. LAYER		26464	Rock Highlid

Shear modules and endurance of the grounds in the study area

Calculation of shear Modulus values in the direction of the seismic data obtained in the field studies and the table of variation are given in the table above.

5.25.4.16. WTG16 Road Shear Modulus-G (kg/cm²)

SHEAR MODULUS				
PROFILES	LAYERS	DEPTH	G(kg/cm^2)	ENDURANCE
1_PROFILE	1. LAYER	-2,78	634	Weak
	2.LAYER	-8,75	2309	Medium
	3.LAYER		9539	Sturdy
2_PROFILE	1. LAYER	-4,28	1107	Weak
	2. LAYER	-19,17	3798	Sturdy
	3. LAYER		15485	Rock Highlid
3_PROFILE	1. LAYER	-6,18	989	Weak
	2. LAYER	-19,43	5059	Sturdy
	3. LAYER		18476	Rock Highlid
4_PROFILE	1. LAYER	-2,89	586	Weak
	2. LAYER	-12,92	1905	Medium
	3. LAYER		8257	Sturdy
5_PROFILE	1. LAYER	-3,43	390	High Weak
	2. LAYER	-15,35	2594	Medium
	3. LAYER		10050	Rock Highlid
6_PROFILE	1. LAYER	-3,75	1449	Weak
	2. LAYER	-16,78	4490	Sturdy

	3. LAYER		15898	Rock Highlid
7_PROFILE	1. LAYER	-2,29	782	Weak
	2.LAYER	-10,26	4926	Sturdy
	3.LAYER		18354	Rock Highlid
8_PROFILE	1. LAYER	-3,33	1594	Medium
	2. LAYER	-10,48	5082	Sturdy
	3. LAYER		20059	Rock Highlid
9_PROFILE	1. LAYER	-4,48	3834	Sturdy
	2. LAYER	-14,07	17683	Rock Highlid
	3. LAYER		66686	Rock Highlid
10_PROFILE	1. LAYER	-6,87	9177	Sturdy
	2. LAYER	-21,60	6125	Sturdy
	3. LAYER		29186	Rock Highlid
11_PROFILE	1. LAYER	-3,93	2383	Medium
	2. LAYER	-26,63	14535	Rock Highlid
	3. LAYER		53207	Rock Highlid
12_PROFILE	1. LAYER	-2,18	657	Weak
	2. LAYER	-14,74	3995	Sturdy
	3. LAYER		17952	Rock Highlid
13_PROFILE	1. LAYER	-3,89	557	Weak
	2. LAYER	-17,40	3267	Sturdy
	3. LAYER		13854	Rock Highlid
14_PROFILE	1. LAYER	-4,44	3061	Sturdy
	2. LAYER	-10,17	10324	Rock Highlid
	3. LAYER		31574	Rock Highlid
15_PROFILE	1. LAYER	-4,63	1814	Medium
	2. LAYER	-14,57	8492	Sturdy
	3. LAYER		30117	Rock Highlid
16_PROFILE	1. LAYER	-6,05	4203	Sturdy
	2. LAYER	-19,02	19894	Rock Highlid
	3. LAYER		68590	Rock Highlid
17_PROFILE	1. LAYER	-2,56	1229	Weak
	2.LAYER	-8,05	5155	Sturdy
	3.LAYER		18076	Rock Highlid
18_PROFILE	1. LAYER	-6,05	1553	Medium
	2. LAYER	-27,07	6479	Sturdy
	3. LAYER		21924	Rock Highlid
19_PROFILE	1. LAYER	-9,75	4560	Sturdy
	2. LAYER	-30,66	9492	Sturdy
	3. LAYER		32104	Rock Highlid

Shear modules and endurance of the grounds in the study area

Calculation of shear Modulus values in the direction of the seismic data obtained in the field studies and the table of variation are given in the table above.

5.25.4.17. WTG17 Road Shear Modulus-G (kg/cm²)

SHEAR MODULUS				
PROFILES	LAYERS	DEPTH	G(kg/cm²)	ENDURANCE
1_PROFILE	1. LAYER	-7,19	1588	Medium
	2.LAYER	-16,48	5609	Sturdy
	3.LAYER		16562	Rock Highlid
2_PROFILE	1. LAYER	-2,18	846	Weak
	2. LAYER	-9,77	1074	Weak
	3. LAYER		2829	Medium
3_PROFILE	1. LAYER	-4,10	1245	Weak
	2. LAYER	-18,33	4668	Sturdy
	3. LAYER		18007	Rock Highlid
4_PROFILE	1. LAYER	-3,52	444	Weak
	2. LAYER	-15,77	3314	Sturdy
	3. LAYER		12347	Rock Highlid
5_PROFILE	1. LAYER	-12,11	936	Weak
	2. LAYER	-27,75	1756	Medium
	3. LAYER		4019	Sturdy

Shear modules and endurance of the grounds in the study area

Calculation of shear Modulus values in the direction of the seismic data obtained in the field studies and the table of variation are given in the table above.

5.25.4.18. WTG18 Road Shear Modulus-G (kg/cm²)

SHEAR MODULUS				
PROFILES	LAYERS	DEPTH	G(kg/cm²)	ENDURANCE
1_PROFILE	1. LAYER	-6,61	3060	Sturdy
	2.LAYER	-29,60	9249	Sturdy
	3.LAYER		34481	Rock Highlid
2_PROFILE	1. LAYER	-3,64	1654	Medium
	2. LAYER	-16,30	5531	Sturdy
	3. LAYER		27031	Rock Highlid
3_PROFILE	1. LAYER	-3,66	1217	Weak
	2. LAYER	-16,37	4272	Sturdy
	3. LAYER		17078	Rock Highlid
4_PROFILE	1. LAYER	-4,98	448	Weak
	2. LAYER	-33,73	2287	Medium
	3. LAYER		9176	Sturdy
5_PROFILE	1. LAYER	-1,56	128	High Weak
	2. LAYER	-10,57	1297	Weak
	3. LAYER		5510	Sturdy
6_PROFILE	1. LAYER	-2,52	237	High Weak
	2. LAYER	-11,29	879	Weak
	3. LAYER		2889	Medium
7_PROFILE	1. LAYER	-6,37	386	High Weak
	2.LAYER	-20,02	1968	Medium
	3.LAYER		6458	Sturdy
8_PROFILE	1. LAYER	-6,29	557	Weak
	2. LAYER	-28,17	4260	Sturdy
	3. LAYER		14253	Rock Highlid
9_PROFILE	1. LAYER	-4,59	1702	Medium
	2. LAYER	-31,09	7966	Sturdy
	3. LAYER		35513	Rock Highlid
10_PROFILE	1. LAYER	-4,19	614	Weak
	2. LAYER	-28,36	2744	Medium
	3. LAYER		10671	Rock Highlid
11_PROFILE	1. LAYER	-2,41	388	High Weak
	2. LAYER	-16,31	1791	Medium
	3. LAYER		9640	Sturdy

Shear modules and endurance of the grounds in the study area

Calculation of shear Modulus values in the direction of the seismic data obtained in the field studies and the table of variation are given in the table above.

5.25.4.19. WTG19 Road Shear Modulus-G (kg/cm²)

SHEAR MODULUS				
PROFILES	LAYERS	DEPTH	G(kg/cm²)	ENDURANCE
1_PROFILE	1. LAYER	-3,22	3764	Sturdy
	2.LAYER	-14,43	20503	Rock Highlid
	3.LAYER		79075	Rock Highlid
2_PROFILE	1. LAYER	-3,30	492	Weak
	2. LAYER	-22,34	2480	Medium
	3. LAYER		9943	Sturdy
3_PROFILE	1. LAYER	-4,61	387	High Weak
	2. LAYER	-20,65	692	Weak
	3. LAYER		2755	Medium
4_PROFILE	1. LAYER	-3,04	798	Weak
	2. LAYER	-20,57	4855	Sturdy
	3. LAYER		19109	Rock Highlid

Shear modules and endurance of the grounds in the study area

Calculation of shear Modulus values in the direction of the seismic data obtained in the field studies and the table of variation are given in the table above.

5.25.4.20. WTG20 Road Shear Modulus-G (kg/cm²)

SHEAR MODULUS				
PROFILES	LAYERS	DEPTH	G(kg/cm^2)	ENDURANCE
1_PROFILE	1. LAYER	-8,11	553	Weak
	2.LAYER	-25,49	2071	Medium
	3.LAYER		6586	Sturdy
2_PROFILE	1. LAYER	-5,30	542	Weak
	2. LAYER	-16,65	4518	Sturdy
	3. LAYER		13017	Rock Highlid
3_PROFILE	1. LAYER	-6,61	1053	Weak
	2. LAYER	-29,56	6468	Sturdy
	3. LAYER		22255	Rock Highlid
4_PROFILE	1. LAYER	-2,19	326	High Weak
	2. LAYER	-14,82	2532	Medium
	3. LAYER		10415	Rock Highlid

Shear modules and endurance of the grounds in the study area

Calculation of shear Modulus values in the direction of the seismic data obtained in the field studies and the table of variation are given in the table above.

5.25.4.21. WTG21 Road Shear Modulus-G (kg/cm²)

SHEAR MODULUS				
PROFILES	LAYERS	DEPTH	G(kg/cm^2)	ENDURANCE
1_PROFILE	1. LAYER	-5,93	377	High Weak
	2.LAYER	-18,64	1475	Weak
	3.LAYER		4459	Sturdy
2_PROFILE	1. LAYER	-3,36	3251	Sturdy
	2. LAYER	-15,06	13930	Rock Highlid
	3. LAYER		62452	Rock Highlid
3_PROFILE	1. LAYER	-2,18	4677	Sturdy
	2. LAYER	-14,76	9562	Sturdy
	3. LAYER		39541	Rock Highlid
4_PROFILE	1. LAYER	-6,15	2670	Medium
	2. LAYER	-19,32	10391	Rock Highlid
	3. LAYER		33975	Rock Highlid
5_PROFILE	1. LAYER	-5,57	3692	Sturdy
	2. LAYER	-12,76	2825	Medium
	3. LAYER		13204	Rock Highlid
6_PROFILE	1. LAYER	-6,22	1403	Weak
	2. LAYER	-14,25	2788	Medium
	3. LAYER		10094	Rock Highlid

Shear modules and endurance of the grounds in the study area

Calculation of shear Modulus values in the direction of the seismic data obtained in the field studies and the table of variation are given in the table above.

5.25.4.22. WTG22 Road Shear Modulus-G (kg/cm²)

PROFILES	LAYERS	SHEAR MODULUS DEPTH	G(kg/cm²)	ENDURANCE
1_PROFILE	1. LAYER	-6,00	5339	Sturdy
	2.LAYER	-26,85	7940	Sturdy
	3.LAYER		25934	Rock Highlid
2_PROFILE	1. LAYER	-3,78	2040	Medium
	2. LAYER	-16,92	7934	Sturdy
	3. LAYER		27080	Rock Highlid
3_PROFILE	1. LAYER	-3,56	2939	Medium
	2. LAYER	-15,94	10189	Rock Highlid
	3. LAYER		44795	Rock Highlid
4_PROFILE	1. LAYER	-3,89	2037	Medium
	2. LAYER	-17,42	9696	Sturdy
	3. LAYER		44715	Rock Highlid

Shear modules and endurance of the grounds in the study area

Calculation of shear Modulus values in the direction of the seismic data obtained in the field studies and the table of variation are given in the table above.

5.25.4.23. WTG23 Road Shear Modulus-G (kg/cm²)

PROFILES	LAYERS	SHEAR MODULUS DEPTH	G(kg/cm²)	ENDURANCE
1_PROFILE	1. LAYER	-2,94	822	Weak
	2.LAYER	-19,90	2960	Medium
	3.LAYER		12256	Rock Highlid
2_PROFILE	1. LAYER	-4,61	3245	Sturdy
	2. LAYER	-20,61	8742	Sturdy
	3. LAYER		41294	Rock Highlid
3_PROFILE	1. LAYER	-4,22	2457	Medium
	2. LAYER	-18,89	13015	Rock Highlid
	3. LAYER		50705	Rock Highlid

Shear modules and endurance of the grounds in the study area

Calculation of shear Modulus values in the direction of the seismic data obtained in the field studies and the table of variation are given in the table above.

5.25.4.24 Substation Road Shear Modulus-G (kg/cm²)

PROFILES	LAYERS	SHEAR MODULUS DEPTH	G(kg/cm²)	ENDURANCE
1_PROFILE	1. LAYER	-5,90	6964	Sturdy
	2.LAYER	-26,41	16549	Rock Highlid
	3.LAYER		60835	Rock Highlid

Shear modules and endurance of the grounds in the study area

Calculation of shear Modulus values in the direction of the seismic data obtained in the field studies and the table of variation are given in the table above.

5.25.5. Elasticity Modulus-E (kg/cm²)

5.25.5.1. WTG01 Road Elasticity Modulus-E (kg/cm²)

ELASTIC MODULUS				
PROFILES	LAYERS	DEPTH	E(kg/cm²)	ENDURANCE
1_PROFILE	1. LAYER	-3,24	3083	Weak
	2.LAYER	-10,20	9102	Medium
	3.LAYER		32310	Rock Highlid
2_PROFILE	1. LAYER	-2,45	3698	Weak
	2. LAYER	-10,98	6831	Medium
	3. LAYER		25862	Sturdy
3_PROFILE	1. LAYER	-1,74	2423	Weak
	2. LAYER	-7,79	11690	Sturdy
	3. LAYER		57381	Rock Highlid
4_PROFILE	1. LAYER	-5,92	3305	Weak
	2. LAYER	-26,50	16703	Sturdy
	3. LAYER		68811	Rock Highlid
5_PROFILE	1. LAYER	-3,19	4766	Weak
	2. LAYER	-14,28	24677	Sturdy
	3. LAYER		122888	Rock Highlid
6_PROFILE	1. LAYER	-2,50	1235	Weak
	2. LAYER	-11,19	9816	Medium
	3. LAYER		36757	Rock Highlid
7_PROFILE	1. LAYER	-5,47	2652	Weak
	2.LAYER	-17,21	6785	Medium
	3.LAYER		29161	Sturdy
8_PROFILE	1. LAYER	-2,61	1163	Weak
	2. LAYER	-11,68	7620	Medium
	3. LAYER		31336	Rock Highlid
9_PROFILE	1. LAYER	-2,76	1250	Weak
	2. LAYER	-12,34	7107	Medium
	3. LAYER		28188	Sturdy

Elasticity modules and endurance of the grounds in the study area

Calculation of the modulus of elasticity in the direction of the seismic data obtained in the field studies and the change table are given in the above table

5.25.5.2. WTG02 Road Elasticity Modulus-E (kg/cm²)

ELASTIC MODULUS				
PROFILES	LAYERS	DEPTH	E(kg/cm²)	ENDURANCE
1_PROFILE	1. LAYER	-6,19	7099	Medium
	2.LAYER	-19,45	5349	Medium
	3.LAYER		24966	Sturdy
2_PROFILE	1. LAYER	-6,03	7405	Medium
	2. LAYER	-18,97	8080	Medium
	3. LAYER		41771	Rock Highlid
3_PROFILE	1. LAYER	-2,70	1007	Weak
	2. LAYER	-12,07	6933	Medium
	3. LAYER		27757	Sturdy
4_PROFILE	1. LAYER	-5,56	6793	Medium
	2. LAYER	-12,74	22891	Sturdy
	3. LAYER		64970	Rock Highlid
5_PROFILE	1. LAYER	-3,53	5178	Medium
	2. LAYER	-11,09	15196	Sturdy
	3. LAYER		70803	Rock Highlid
6_PROFILE	1. LAYER	-3,89	4770	Weak

	2. LAYER	-12,22	25584	Sturdy
	3. LAYER		87584	Rock Highlid
7_PROFILE	1. LAYER	-2,59	4071	Weak
	2.LAYER	-8,14	18427	Sturdy
	3.LAYER		70188	Rock Highlid

Elasticity modules and endurance of the grounds in the study area

Calculation of the modulus of elasticity in the direction of the seismic data obtained in the field studies and the change table are given in the above table

5.25.5.3. WTG03 Road Elasticity Modulus-E (kg/cm²)

ELASTIC MODULUS				
PROFILES	LAYERS	DEPTH	E(kg/cm^2)	ENDURANCE
1_PROFILE	1. LAYER	-3,83	2362	Weak
	2.LAYER	-25,93	15640	Sturdy
	3.LAYER		66834	Rock Highlid
2_PROFILE	1. LAYER	-2,13	16275	Sturdy
	2. LAYER	-9,55	76642	Rock Highlid
	3. LAYER		318584	Rock Highlid
3_PROFILE	1. LAYER	-3,91	4240	Weak
	2. LAYER	-17,48	25609	Sturdy
	3. LAYER		111127	Rock Highlid
4_PROFILE	1. LAYER	-3,55	7047	Medium
	2. LAYER	-15,87	14979	Sturdy
	3. LAYER		61552	Rock Highlid
5_PROFILE	1. LAYER	-5,99	4780	Weak
	2. LAYER	-13,73	19319	Sturdy
	3. LAYER		63403	Rock Highlid
6_PROFILE	1. LAYER	-1,87	1800	Weak
	2. LAYER	-5,88	8538	Medium
	3. LAYER		30299	Rock Highlid

Elasticity modules and endurance of the grounds in the study area

Calculation of the modulus of elasticity in the direction of the seismic data obtained in the field studies and the change table are given in the above table

5.25.5.4. WTG04 Road Elasticity Modulus-E (kg/cm²)

ELASTIC MODULUS				
PROFILES	LAYERS	DEPTH	E(kg/cm^2)	ENDURANCE
1_PROFILE	1. LAYER	-3,50	6723	Medium
	2.LAYER	-11,01	25385	Sturdy
	3.LAYER		96311	Rock Highlid
2_PROFILE	1. LAYER	-2,30	2559	Weak
	2. LAYER	-10,29	9782	Medium
	3. LAYER		38288	Rock Highlid
3_PROFILE	1. LAYER	-2,51	11743	Sturdy
	2. LAYER	-11,21	17796	Sturdy
	3. LAYER		82300	Rock Highlid
4_PROFILE	1. LAYER	-5,32	7265	Medium
	2. LAYER	-16,73	23128	Sturdy
	3. LAYER		84229	Rock Highlid
5_PROFILE	1. LAYER	-8,00	4227	Weak
	2. LAYER	-25,15	25636	Sturdy
	3. LAYER		85652	Rock Highlid

6_PROFILE	1. LAYER	-4,02	3031	Weak
	2. LAYER	-12,65	15512	Sturdy
	3. LAYER		68430	Rock Highlid
7_PROFILE	1. LAYER	-7,02	35756	Rock Highlid
	2.LAYER	-31,40	132623	Rock Highlid
	3.LAYER		461557	Rock Highlid
8_PROFILE	1. LAYER	-4,63	11231	Sturdy
	2. LAYER	-20,71	29582	Sturdy
	3. LAYER		106899	Rock Highlid
9_PROFILE	1. LAYER	-3,49	3150	Weak
	2. LAYER	-10,97	9117	Medium
	3. LAYER		36088	Rock Highlid
10_PROFILE	1. LAYER	-4,84	4511	Weak
	2. LAYER	-11,09	9378	Medium
	3. LAYER		30078	Rock Highlid

Elasticity modules and endurance of the grounds in the study area

Calculation of the modulus of elasticity in the direction of the seismic data obtained in the field studies and the change table are given in the above table

5.25.5.5. WTG05 Road Elasticity Modulus-E (kg/cm²)

ELASTIC MODULUS				
PROFILES	LAYERS	DEPTH	E(kg/cm^2)	ENDURANCE
1_PROFILE	1. LAYER	-3,27	4403	Weak
	2.LAYER	-10,28	13069	Sturdy
	3.LAYER		48367	Rock Highlid
2_PROFILE	1. LAYER	-3,00	8648	Medium
	2. LAYER	-13,44	39882	Rock Highlid
	3. LAYER		174960	Rock Highlid
3_PROFILE	1. LAYER	-3,04	2513	Weak
	2. LAYER	-13,59	13761	Sturdy
	3. LAYER		55821	Rock Highlid
4_PROFILE	1. LAYER	-4,54	2323	Weak
	2. LAYER	-20,31	6360	Medium
	3. LAYER		24330	Sturdy
5_PROFILE	1. LAYER	-3,85	3832	Weak
	2. LAYER	-8,82	16400	Sturdy
	3. LAYER		59599	Rock Highlid
6_PROFILE	1. LAYER	-3,84	9380	Medium
	2. LAYER	-12,08	25343	Sturdy
	3. LAYER		101403	Rock Highlid
7_PROFILE	1. LAYER	-3,44	9281	Medium
	2.LAYER	-15,37	31742	Rock Highlid
	3.LAYER		145785	Rock Highlid

Elasticity modules and endurance of the grounds in the study area

Calculation of the modulus of elasticity in the direction of the seismic data obtained in the field studies and the change table are given in the above table

5.25.5.6. WTG06 Road Elasticity Modulus-E (kg/cm²)

ELASTIC MODULUS				
PROFILES	LAYERS	DEPTH	E(kg/cm²)	ENDURANCE
1_PROFILE	1. LAYER	-2,20	6418	Medium
	2.LAYER	-14,88	26035	Sturdy
	3.LAYER		135316	Rock Highlid
2_PROFILE	1. LAYER	-3,78	8306	Medium
	2. LAYER	-16,91	30934	Rock Highlid
	3. LAYER		134356	Rock Highlid
3_PROFILE	1. LAYER	-3,85	11436	Sturdy
	2. LAYER	-17,25	26701	Sturdy
	3. LAYER		115313	Rock Highlid
4_PROFILE	1. LAYER	-6,77	13486	Sturdy
	2. LAYER	-15,52	32528	Rock Highlid
	3. LAYER		83532	Rock Highlid
5_PROFILE	1. LAYER	-3,48	4235	Weak
	2. LAYER	-10,93	23991	Sturdy
	3. LAYER		84941	Rock Highlid
6_PROFILE	1. LAYER	-4,23	10355	Sturdy
	2. LAYER	-13,29	43700	Rock Highlid
	3. LAYER		153378	Rock Highlid
7_PROFILE	1. LAYER	-5,14	11155	Sturdy
	2.LAYER	-11,77	44260	Rock Highlid
	3.LAYER		121100	Rock Highlid
8_PROFILE	1. LAYER	-3,86	8892	Medium
	2. LAYER	-12,14	31534	Rock Highlid
	3. LAYER		99417	Rock Highlid
9_PROFILE	1. LAYER	-6,26	13556	Sturdy
	2. LAYER	-19,69	61488	Rock Highlid
	3. LAYER		186121	Rock Highlid
10_PROFILE	1. LAYER	-4,26	6213	Medium
	2. LAYER	-13,39	24431	Sturdy
	3. LAYER		89304	Rock Highlid
11_PROFILE	1. LAYER	-5,84	11755	Sturdy
	2. LAYER	-18,35	29962	Sturdy
	3. LAYER		124697	Rock Highlid

Elasticity modules and endurance of the grounds in the study area

Calculation of the modulus of elasticity in the direction of the seismic data obtained in the field studies and the change table are given in the above table

5.25.5.7. WTG07 Road Elasticity Modulus-E (kg/cm²)

ELASTIC MODULUS				
PROFILES	LAYERS	DEPTH	E(kg/cm²)	ENDURANCE
1_PROFILE	1. LAYER	-5,46	4613	Weak
	2.LAYER	-17,16	10427	Sturdy
	3.LAYER		30748	Rock Highlid
2_PROFILE	1. LAYER	-5,57	5656	Medium
	2. LAYER	-17,51	31112	Rock Highlid
	3. LAYER		117175	Rock Highlid
3_PROFILE	1. LAYER	-5,53	4091	Weak
	2. LAYER	-17,38	10112	Sturdy
	3. LAYER		37691	Rock Highlid
4_PROFILE	1. LAYER	-2,72	5874	Medium
	2. LAYER	-8,55	19848	Sturdy
	3. LAYER		79284	Rock Highlid
5_PROFILE	1. LAYER	-2,67	6061	Medium
	2. LAYER	-8,39	21784	Sturdy
	3. LAYER		103362	Rock Highlid

6_PROFILE	1. LAYER	-2,29	5297	Medium
	2. LAYER	-10,25	25960	Sturdy
	3. LAYER		103327	Rock Highlid
7_PROFILE	1. LAYER	-2,86	6276	Medium
	2.LAYER	-6,55	18892	Sturdy
	3.LAYER		50182	Rock Highlid
8_PROFILE	1. LAYER	-2,52	5488	Medium
	2. LAYER	-11,29	29887	Sturdy
	3. LAYER		106135	Rock Highlid
9_PROFILE	1. LAYER	-2,85	19151	Sturdy
	2. LAYER	-12,76	101420	Rock Highlid
	3. LAYER		503755	Rock Highlid
10_PROFILE	1. LAYER	-2,84	7524	Medium
	2. LAYER	-8,91	30116	Rock Highlid
	3. LAYER		113914	Rock Highlid
11_PROFILE	1. LAYER	-2,53	6916	Medium
	2. LAYER	-11,33	32796	Rock Highlid
	3. LAYER		134207	Rock Highlid
12_PROFILE	1. LAYER	-3,82	15892	Sturdy
	2. LAYER	-17,11	24366	Sturdy
	3. LAYER		112445	Rock Highlid
13_PROFILE	1. LAYER	-2,07	10275	Sturdy
	2. LAYER	-13,99	48456	Rock Highlid
	3. LAYER		238980	Rock Highlid
14_PROFILE	1. LAYER	-3,80	13215	Sturdy
	2. LAYER	-11,96	43622	Rock Highlid
	3. LAYER		183596	Rock Highlid
15_PROFILE	1. LAYER	-4,71	6832	Medium
	2. LAYER	-10,80	21511	Sturdy
	3. LAYER		62098	Rock Highlid
16_PROFILE	1. LAYER	-7,20	4638	Weak
	2. LAYER	-16,50	13994	Sturdy
	3. LAYER		42059	Rock Highlid
17_PROFILE	1. LAYER	-5,07	4364	Weak
	2.LAYER	-15,93	9577	Medium
	3.LAYER		36754	Rock Highlid
18_PROFILE	1. LAYER	-4,90	4622	Weak
	2. LAYER	-15,40	10813	Sturdy
	3. LAYER		45811	Rock Highlid
19_PROFILE	1. LAYER	-2,17	8278	Medium
	2. LAYER	-9,73	31431	Rock Highlid
	3. LAYER		134114	Rock Highlid
20_PROFILE	1. LAYER	-5,73	12152	Sturdy
	2. LAYER	-13,14	30735	Rock Highlid
	3. LAYER		93988	Rock Highlid
21_PROFILE	1. LAYER	-7,08	1726	Weak
	2. LAYER	-16,23	9183	Medium
	3. LAYER		25906	Sturdy
22_PROFILE	1. LAYER	-8,64	4034	Weak
	2. LAYER	-19,80	18580	Sturdy
	3. LAYER		57238	Rock Highlid
23_PROFILE	1. LAYER	-7,13	4401	Weak
	2. LAYER	-16,34	17605	Sturdy
	3. LAYER		52024	Rock Highlid
24_PROFILE	1. LAYER	-4,08	5865	Medium
	2. LAYER	-12,84	17403	Sturdy
	3. LAYER		61916	Rock Highlid

Elasticity modules and endurance of the grounds in the study area

Calculation of the modulus of elasticity in the direction of the seismic data obtained in the field studies and the change table are given in the above table

5.25.5.8. WTG08 Road Elasticity Modulus-E (kg/cm²)

ELASTIC MODULUS				
PROFILES	LAYERS	DEPTH	E(kg/cm^2)	ENDURANCE
1_PROFILE	1. LAYER	-2,92	9228	Medium
	2.LAYER	-13,06	11579	Sturdy
	3.LAYER		52066	Rock Highlid
2_PROFILE	1. LAYER	-2,91	7451	Medium
	2. LAYER	-13,00	29670	Sturdy
	3. LAYER		111638	Rock Highlid
3_PROFILE	1. LAYER	-4,21	5900	Medium
	2. LAYER	-18,84	38022	Rock Highlid
	3. LAYER		158780	Rock Highlid
4_PROFILE	1. LAYER	-4,67	7956	Medium
	2. LAYER	-10,71	25800	Sturdy
	3. LAYER		83989	Rock Highlid
5_PROFILE	1. LAYER	-8,27	15861	Sturdy
	2. LAYER	-18,95	52073	Rock Highlid
	3. LAYER		164341	Rock Highlid
6_PROFILE	1. LAYER	-8,21	13372	Sturdy
	2. LAYER	-18,80	46582	Rock Highlid
	3. LAYER		141043	Rock Highlid
7_PROFILE	1. LAYER	-4,01	2472	Weak
	2.LAYER	-12,62	8319	Medium
	3.LAYER		30708	Rock Highlid
8_PROFILE	1. LAYER	-3,31	4681	Weak
	2. LAYER	-7,58	15629	Sturdy
	3. LAYER		52641	Rock Highlid
9_PROFILE	1. LAYER	-6,12	8411	Medium
	2. LAYER	-14,04	24215	Sturdy
	3. LAYER		75763	Rock Highlid
10_PROFILE	1. LAYER	-5,68	3047	Weak
	2. LAYER	-17,86	12598	Sturdy
	3. LAYER		39779	Rock Highlid
11_PROFILE	1. LAYER	-2,81	5651	Medium
	2. LAYER	-12,58	32630	Rock Highlid
	3. LAYER		126005	Rock Highlid
12_PROFILE	1. LAYER	-3,78	5203	Medium
	2. LAYER	-11,88	19635	Sturdy
	3. LAYER		73679	Rock Highlid

Elasticity modules and endurance of the grounds in the study area

Calculation of the modulus of elasticity in the direction of the seismic data obtained in the field studies and the change table are given in the above table

5.25.5.9. WTG09 Road Elasticity Modulus-E (kg/cm²)

ELASTIC MODULUS				
PROFILES	LAYERS	DEPTH	E(kg/cm²)	ENDURANCE
1_PROFILE	1. LAYER	-4,73	10091	Sturdy
	2.LAYER	-14,88	52042	Rock Highlid
	3.LAYER		183270	Rock Highlid
2_PROFILE	1. LAYER	-2,44	8546	Medium
	2. LAYER	-10,90	23818	Sturdy
	3. LAYER		88200	Rock Highlid
3_PROFILE	1. LAYER	-3,38	5635	Medium
	2. LAYER	-15,14	16731	Sturdy
	3. LAYER		85105	Rock Highlid
4_PROFILE	1. LAYER	-2,56	4411	Weak
	2. LAYER	-11,48	13622	Sturdy
	3. LAYER		44867	Rock Highlid
5_PROFILE	1. LAYER	-4,36	8074	Medium
	2. LAYER	-19,53	26465	Sturdy
	3. LAYER		111953	Rock Highlid
6_PROFILE	1. LAYER	-4,45	962	High Weak
	2. LAYER	-19,93	8363	Medium
	3. LAYER		30862	Rock Highlid
7_PROFILE	1. LAYER	-1,96	1375	Weak
	2.LAYER	-8,77	10430	Sturdy
	3.LAYER		45400	Rock Highlid

Elasticity modules and endurance of the grounds in the study area

Calculation of the modulus of elasticity in the direction of the seismic data obtained in the field studies and the change table are given in the above table

5.25.5.10. WTG10 Road Elasticity Modulus-E (kg/cm²)

ELASTIC MODULUS				
PROFILES	LAYERS	DEPTH	E(kg/cm²)	ENDURANCE
1_PROFILE	1. LAYER	-4,06	1848	Weak
	2.LAYER	-12,76	7193	Medium
	3.LAYER		24706	Sturdy
2_PROFILE	1. LAYER	-4,54	2997	Weak
	2. LAYER	-14,27	6488	Medium
	3. LAYER		22528	Sturdy
3_PROFILE	1. LAYER	-3,18	6472	Medium
	2. LAYER	-14,22	23125	Sturdy
	3. LAYER		98438	Rock Highlid
4_PROFILE	1. LAYER	-4,45	10551	Sturdy
	2. LAYER	-19,94	34155	Rock Highlid
	3. LAYER		123841	Rock Highlid
5_PROFILE	1. LAYER	-4,35	5106	Medium
	2. LAYER	-13,68	13927	Sturdy
	3. LAYER		48919	Rock Highlid
6_PROFILE	1. LAYER	-5,13	6649	Medium
	2. LAYER	-22,94	9592	Medium
	3. LAYER		39930	Rock Highlid
7_PROFILE	1. LAYER	-2,83	5701	Medium
	2.LAYER	-12,65	22198	Sturdy
	3.LAYER		127727	Rock Highlid

Elasticity modules and endurance of the grounds in the study area

Calculation of the modulus of elasticity in the direction of the seismic data obtained in the field studies and the change table are given in the above table

5.25.5.11. WTG11 Road Elasticity Modulus-E (kg/cm²)

ELASTIC MODULUS				
PROFILES	LAYERS	DEPTH	E(kg/cm²)	ENDURANCE
1_PROFILE	1. LAYER	-2,87	3169	Weak
	2.LAYER	-12,85	13460	Sturdy
	3.LAYER		59897	Rock Highlid
2_PROFILE	1. LAYER	-2,54	2500	Weak
	2. LAYER	-7,97	9473	Medium
	3. LAYER		37133	Rock Highlid
3_PROFILE	1. LAYER	-2,46	7406	Medium
	2. LAYER	-7,73	13829	Sturdy
	3. LAYER		63379	Rock Highlid
4_PROFILE	1. LAYER	-2,45	2741	Weak
	2. LAYER	-7,71	10477	Sturdy
	3. LAYER		36042	Rock Highlid
5_PROFILE	1. LAYER	-4,84	3648	Weak
	2. LAYER	-15,21	7497	Medium
	3. LAYER		28636	Sturdy
6_PROFILE	1. LAYER	-3,12	2907	Weak
	2. LAYER	-9,80	15164	Sturdy
	3. LAYER		52439	Rock Highlid

Elasticity modules and endurance of the grounds in the study area

Calculation of the modulus of elasticity in the direction of the seismic data obtained in the field studies and the change table are given in the above table

5.25.5.12. WTG12 Road Elasticity Modulus-E (kg/cm²)

ELASTIC MODULUS				
PROFILES	LAYERS	DEPTH	E(kg/cm²)	ENDURANCE
1_PROFILE	1. LAYER	-3,18	8078	Medium
	2.LAYER	-14,25	14644	Sturdy
	3.LAYER		60695	Rock Highlid
2_PROFILE	1. LAYER	-4,33	15361	Sturdy
	2. LAYER	-19,37	11898	Sturdy
	3. LAYER		60841	Rock Highlid
3_PROFILE	1. LAYER	-2,55	8354	Medium
	2. LAYER	-11,40	26788	Sturdy
	3. LAYER		119136	Rock Highlid
4_PROFILE	1. LAYER	-4,44	7433	Medium
	2. LAYER	-19,85	6404	Medium
	3. LAYER		29230	Sturdy
5_PROFILE	1. LAYER	-2,72	4677	Weak
	2. LAYER	-8,55	11972	Sturdy
	3. LAYER		48817	Rock Highlid

Elasticity modules and endurance of the grounds in the study area

Calculation of the modulus of elasticity in the direction of the seismic data obtained in the field studies and the change table are given in the above table

5.25.5.13. WTG13 Road Elasticity Modulus-E (kg/cm²)

ELASTIC MODULUS				
PROFILES	LAYERS	DEPTH	E(kg/cm²)	ENDURANCE
1_PROFILE	1. LAYER	-4,20	11286	Sturdy
	2.LAYER	-13,19	20108	Sturdy
	3.LAYER		79310	Rock Highlid
2_PROFILE	1. LAYER	-6,28	9431	Medium
	2. LAYER	-14,40	25138	Sturdy
	3. LAYER		82938	Rock Highlid
3_PROFILE	1. LAYER	-6,66	4340	Weak
	2. LAYER	-20,95	15902	Sturdy
	3. LAYER		53520	Rock Highlid
4_PROFILE	1. LAYER	-3,55	5905	Medium
	2. LAYER	-11,16	10923	Sturdy
	3. LAYER		40906	Rock Highlid
5_PROFILE	1. LAYER	-1,72	1818	Weak
	2. LAYER	-7,69	9764	Medium
	3. LAYER		40122	Rock Highlid

Elasticity modules and endurance of the grounds in the study area

Calculation of the modulus of elasticity in the direction of the seismic data obtained in the field studies and the change table are given in the above table.

5.25.5.14. WTG14 Road Elasticity Modulus-E (kg/cm²)

ELASTIC MODULUS				
PROFILES	LAYERS	DEPTH	E(kg/cm²)	ENDURANCE
1_PROFILE	1. LAYER	-3,26	9191	Medium
	2.LAYER	-14,61	34790	Rock Highlid
	3.LAYER		153467	Rock Highlid
2_PROFILE	1. LAYER	-2,29	3478	Weak
	2. LAYER	-10,27	17524	Sturdy
	3. LAYER		66042	Rock Highlid
3_PROFILE	1. LAYER	-2,78	10175	Sturdy
	2. LAYER	-12,43	12772	Sturdy
	3. LAYER		58680	Rock Highlid
4_PROFILE	1. LAYER	-2,45	5505	Medium
	2. LAYER	-10,97	26214	Sturdy
	3. LAYER		126544	Rock Highlid
5_PROFILE	1. LAYER	-3,58	10483	Sturdy
	2. LAYER	-11,27	39998	Rock Highlid
	3. LAYER		136517	Rock Highlid
6_PROFILE	1. LAYER	-3,35	7799	Medium
	2. LAYER	-10,54	34568	Rock Highlid
	3. LAYER		122171	Rock Highlid
7_PROFILE	1. LAYER	-5,59	4734	Weak
	2.LAYER	-12,82	10299	Sturdy
	3.LAYER		47239	Rock Highlid
8_PROFILE	1. LAYER	-4,84	6580	Medium
	2. LAYER	-11,10	13334	Sturdy
	3. LAYER		46409	Rock Highlid
9_PROFILE	1. LAYER	-3,11	21023	Sturdy
	2. LAYER	-9,76	21979	Sturdy
	3. LAYER		113647	Rock Highlid
10_PROFILE	1. LAYER	-4,22	6200	Medium
	2. LAYER	-13,26	18000	Sturdy
	3. LAYER		59412	Rock Highlid
11_PROFILE	1. LAYER	-3,99	10099	Sturdy
	2. LAYER	-12,55	7480	Medium
	3. LAYER		34141	Rock Highlid

Elasticity modules and endurance of the grounds in the study area

Calculation of the modulus of elasticity in the direction of the seismic data obtained in the field studies and the change table are given in the above table

5.25.5.15. WTG15 Road Elasticity Modulus-E (kg/cm²)

ELASTIC MODULUS				
PROFILES	LAYERS	DEPTH	E(kg/cm^2)	ENDURANCE
1_PROFILE	1. LAYER	-4,23	6639	Medium
	2.LAYER	-13,30	17412	Sturdy
	3.LAYER		49761	Rock Highlid
2_PROFILE	1. LAYER	-3,50	3153	Weak
	2. LAYER	-15,65	7521	Medium
	3. LAYER		27073	Sturdy
3_PROFILE	1. LAYER	-2,77	9283	Medium
	2. LAYER	-12,40	16574	Sturdy
	3. LAYER		94307	Rock Highlid
4_PROFILE	1. LAYER	-3,56	8051	Medium
	2. LAYER	-11,19	17291	Sturdy
	3. LAYER		68633	Rock Highlid
5_PROFILE	1. LAYER	-3,34	9837	Medium
	2. LAYER	-10,50	13025	Sturdy
	3. LAYER		43991	Rock Highlid
6_PROFILE	1. LAYER	-3,10	6250	Medium
	2. LAYER	-9,75	15885	Sturdy
	3. LAYER		54279	Rock Highlid
7_PROFILE	1. LAYER	-2,80	4380	Weak
	2.LAYER	-8,81	5238	Medium
	3.LAYER		22200	Sturdy
8_PROFILE	1. LAYER	-3,94	6758	Medium
	2. LAYER	-12,40	9041	Medium
	3. LAYER		38961	Rock Highlid
9_PROFILE	1. LAYER	-6,66	16439	Sturdy
	2. LAYER	-15,25	47841	Rock Highlid
	3. LAYER		159378	Rock Highlid
10_PROFILE	1. LAYER	-8,12	7373	Medium
	2. LAYER	-18,61	25828	Sturdy
	3. LAYER		82921	Rock Highlid
11_PROFILE	1. LAYER	-5,54	8053	Medium
	2. LAYER	-17,40	40253	Rock Highlid
	3. LAYER		144664	Rock Highlid
12_PROFILE	1. LAYER	-3,48	6119	Medium
	2. LAYER	-10,94	14160	Sturdy
	3. LAYER		64627	Rock Highlid
13_PROFILE	1. LAYER	-3,13	2104	Weak
	2. LAYER	-9,85	12399	Sturdy
	3. LAYER		38922	Rock Highlid
14_PROFILE	1. LAYER	-3,34	2229	Weak
	2. LAYER	-14,94	12772	Sturdy
	3. LAYER		28938	Sturdy
15_PROFILE	1. LAYER	-3,48	3287	Weak
	2. LAYER	-15,60	13697	Sturdy
	3. LAYER		54935	Rock Highlid
16_PROFILE	1. LAYER	-2,87	8332	Medium
	2. LAYER	-12,85	29713	Sturdy
	3. LAYER		151176	Rock Highlid
17_PROFILE	1. LAYER	-5,81	9547	Medium
	2.LAYER	-18,27	30125	Rock Highlid
	3.LAYER		126375	Rock Highlid
18_PROFILE	1. LAYER	-4,83	5715	Medium
	2. LAYER	-15,19	16766	Sturdy
	3. LAYER		72171	Rock Highlid

Elasticity modules and endurance of the grounds in the study area

Calculation of the modulus of elasticity in the direction of the seismic data obtained in the field studies and the change table are given in the above table

5.25.5.16. WTG16 Road Elasticity Modulus-E (kg/cm²)

ELASTIC MODULUS				
PROFILES	LAYERS	DEPTH	E(kg/cm^2)	ENDURANCE
1_PROFILE	1. LAYER	-2,78	1726	Weak
	2.LAYER	-8,75	6251	Medium
	3.LAYER		26340	Sturdy
2_PROFILE	1. LAYER	-4,28	2900	Weak
	2. LAYER	-19,17	10097	Sturdy
	3. LAYER		42767	Rock Highlid
3_PROFILE	1. LAYER	-6,18	2782	Weak
	2. LAYER	-19,43	13345	Sturdy
	3. LAYER		50837	Rock Highlid
4_PROFILE	1. LAYER	-2,89	1607	Weak
	2. LAYER	-12,92	4989	Weak
	3. LAYER		22668	Sturdy
5_PROFILE	1. LAYER	-3,43	1075	Weak
	2. LAYER	-15,35	6817	Medium
	3. LAYER		27970	Sturdy
6_PROFILE	1. LAYER	-3,75	3992	Weak
	2. LAYER	-16,78	12298	Sturdy
	3. LAYER		44671	Rock Highlid
7_PROFILE	1. LAYER	-2,29	2043	Weak
	2.LAYER	-10,26	12884	Sturdy
	3.LAYER		51061	Rock Highlid
8_PROFILE	1. LAYER	-3,33	4528	Weak
	2. LAYER	-10,48	13912	Sturdy
	3. LAYER		55526	Rock Highlid
9_PROFILE	1. LAYER	-4,48	10835	Sturdy
	2. LAYER	-14,07	47383	Rock Highlid
	3. LAYER		183535	Rock Highlid
10_PROFILE	1. LAYER	-6,87	24615	Sturdy
	2. LAYER	-21,60	16368	Sturdy
	3. LAYER		79035	Rock Highlid
11_PROFILE	1. LAYER	-3,93	6121	Medium
	2. LAYER	-26,63	37500	Rock Highlid
	3. LAYER		147571	Rock Highlid
12_PROFILE	1. LAYER	-2,18	1882	Weak
	2. LAYER	-14,74	10699	Sturdy
	3. LAYER		49441	Rock Highlid
13_PROFILE	1. LAYER	-3,89	1443	Weak
	2. LAYER	-17,40	8288	Medium
	3. LAYER		37265	Rock Highlid
14_PROFILE	1. LAYER	-4,44	8664	Medium
	2. LAYER	-10,17	27467	Sturdy
	3. LAYER		87301	Rock Highlid
15_PROFILE	1. LAYER	-4,63	5142	Medium
	2. LAYER	-14,57	22664	Sturdy
	3. LAYER		83848	Rock Highlid
16_PROFILE	1. LAYER	-6,05	11815	Sturdy
	2. LAYER	-19,02	52395	Rock Highlid
	3. LAYER		190186	Rock Highlid
17_PROFILE	1. LAYER	-2,56	3401	Weak
	2.LAYER	-8,05	13771	Sturdy
	3.LAYER		50359	Rock Highlid
18_PROFILE	1. LAYER	-6,05	4238	Weak
	2. LAYER	-27,07	17514	Sturdy
	3. LAYER		61191	Rock Highlid
19_PROFILE	1. LAYER	-9,75	12748	Sturdy
	2. LAYER	-30,66	25806	Sturdy
	3. LAYER		89353	Rock Highlid

Elasticity modules and endurance of the grounds in the study area

Calculation of the modulus of elasticity in the direction of the seismic data obtained in the field studies and the change table are given in the above table.

5.25.5.17. WTG17Road Elasticity Modulus-E (kg/cm²)

ELASTIC MODULUS				
PROFILES	LAYERS	DEPTH	E(kg/cm²)	ENDURANCE
1_PROFILE	1. LAYER	-7,19	4414	Weak
	2.LAYER	-16,48	15009	Sturdy
	3.LAYER		46159	Rock Highlid
2_PROFILE	1. LAYER	-2,18	2343	Weak
	2. LAYER	-9,77	2932	Weak
	3. LAYER		7926	Medium
3_PROFILE	1. LAYER	-4,10	3536	Weak
	2. LAYER	-18,33	12655	Sturdy
	3. LAYER		50118	Rock Highlid
4_PROFILE	1. LAYER	-3,52	1167	Weak
	2. LAYER	-15,77	8728	Medium
	3. LAYER		34466	Rock Highlid
5_PROFILE	1. LAYER	-12,11	2528	Weak
	2. LAYER	-27,75	4746	Weak
	3. LAYER		11375	Sturdy

Elasticity modules and endurance of the grounds in the study area

Calculation of the modulus of elasticity in the direction of the seismic data obtained in the field studies and the change table are given in the above table

5.25.5.18. WTG18 Road Elasticity Modulus-E (kg/cm²)

ELASTIC MODULUS				
PROFILES	LAYERS	DEPTH	E(kg/cm²)	ENDURANCE
1_PROFILE	1. LAYER	-6,61	8722	Medium
	2.LAYER	-29,60	25400	Sturdy
	3.LAYER		95832	Rock Highlid
2_PROFILE	1. LAYER	-3,64	4666	Weak
	2. LAYER	-16,30	14938	Sturdy
	3. LAYER		73423	Rock Highlid
3_PROFILE	1. LAYER	-3,66	3288	Weak
	2. LAYER	-16,37	11484	Sturdy
	3. LAYER		47384	Rock Highlid
4_PROFILE	1. LAYER	-4,98	1262	Weak
	2. LAYER	-33,73	6113	Medium
	3. LAYER		25523	Sturdy
5_PROFILE	1. LAYER	-1,56	350	High Weak
	2. LAYER	-10,57	3445	Weak
	3. LAYER		15348	Sturdy
6_PROFILE	1. LAYER	-2,52	646	High Weak
	2. LAYER	-11,29	2374	Weak
	3. LAYER		8107	Medium
7_PROFILE	1. LAYER	-6,37	1070	Weak
	2.LAYER	-20,02	5173	Medium
	3.LAYER		17930	Sturdy
8_PROFILE	1. LAYER	-6,29	1450	Weak
	2. LAYER	-28,17	10893	Sturdy
	3. LAYER		39403	Rock Highlid
9_PROFILE	1. LAYER	-4,59	4763	Weak
	2. LAYER	-31,09	21118	Sturdy
	3. LAYER		97977	Rock Highlid
10_PROFILE	1. LAYER	-4,19	1710	Weak

	2. LAYER	-28,36	7344	Medium
	3. LAYER		29741	Sturdy
11_PROFILE	1. LAYER	-2,41	1116	Weak
	2. LAYER	-16,31	4787	Weak
	3. LAYER		26334	Sturdy

Elasticity modules and endurance of the grounds in the study area

Calculation of the modulus of elasticity in the direction of the seismic data obtained in the field studies and the change table are given in the above table

5.25.5.19. WTG19 Road Elasticity Modulus-E (kg/cm²)

ELASTIC MODULUS				
PROFILES	LAYERS	DEPTH	E(kg/cm^2)	ENDURANCE
1_PROFILE	1. LAYER	-3,22	9938	Medium
	2.LAYER	-14,43	52701	Rock Highlid
	3.LAYER		218012	Rock Highlid
2_PROFILE	1. LAYER	-3,30	1388	Weak
	2. LAYER	-22,34	6782	Medium
	3. LAYER		27795	Sturdy
3_PROFILE	1. LAYER	-4,61	1069	Weak
	2. LAYER	-20,65	1889	Weak
	3. LAYER		7691	Medium
4_PROFILE	1. LAYER	-3,04	2175	Weak
	2. LAYER	-20,57	13037	Sturdy
	3. LAYER		53101	Rock Highlid

Elasticity modules and endurance of the grounds in the study area

Calculation of the modulus of elasticity in the direction of the seismic data obtained in the field studies and the change table are given in the above table

5.25.5.20. WTG20 Road Elasticity Modulus-E (kg/cm²)

ELASTIC MODULUS				
PROFILES	LAYERS	DEPTH	E(kg/cm^2)	ENDURANCE
1_PROFILE	1. LAYER	-8,11	1450	Weak
	2.LAYER	-25,49	5522	Medium
	3.LAYER		18292	Sturdy
2_PROFILE	1. LAYER	-5,30	1461	Weak
	2. LAYER	-16,65	11577	Sturdy
	3. LAYER		35948	Rock Highlid
3_PROFILE	1. LAYER	-6,61	2784	Weak
	2. LAYER	-29,56	17120	Sturdy
	3. LAYER		61889	Rock Highlid
4_PROFILE	1. LAYER	-2,19	845	High Weak
	2. LAYER	-14,82	6614	Medium
	3. LAYER		29068	Sturdy

Elasticity modules and endurance of the grounds in the study area

Calculation of the modulus of elasticity in the direction of the seismic data obtained in the field studies and the change table are given in the above table

5.25.5.21. WTG21 Road Elasticity Modulus-E (kg/cm²)

ELASTIC MODULUS				
PROFILES	LAYERS	DEPTH	E(kg/cm²)	ENDURANCE
1_PROFILE	1. LAYER	-5,93	1045	Weak
	2.LAYER	-18,64	3994	Weak
	3.LAYER		12504	Sturdy
2_PROFILE	1. LAYER	-3,36	8986	Medium
	2. LAYER	-15,06	37140	Rock Highlid
	3. LAYER		169846	Rock Highlid
3_PROFILE	1. LAYER	-2,18	12293	Sturdy
	2. LAYER	-14,76	25096	Sturdy
	3. LAYER		109939	Rock Highlid
4_PROFILE	1. LAYER	-6,15	7402	Medium
	2. LAYER	-19,32	28373	Sturdy
	3. LAYER		95093	Rock Highlid
5_PROFILE	1. LAYER	-5,57	9988	Medium
	2. LAYER	-12,76	7637	Medium
	3. LAYER		35679	Rock Highlid
6_PROFILE	1. LAYER	-6,22	3824	Weak
	2. LAYER	-14,25	7636	Medium
	3. LAYER		27862	Sturdy

Elasticity modules and endurance of the grounds in the study area

Calculation of the modulus of elasticity in the direction of the seismic data obtained in the field studies and the change table are given in the above table

5.25.5.22. WTG22 Road Elasticity Modulus-E (kg/cm²)

ELASTIC MODULUS				
PROFILES	LAYERS	DEPTH	E(kg/cm²)	ENDURANCE
1_PROFILE	1. LAYER	-6,00	14405	Sturdy
	2.LAYER	-26,85	21452	Sturdy
	3.LAYER		73003	Rock Highlid
2_PROFILE	1. LAYER	-3,78	5770	Medium
	2. LAYER	-16,92	21552	Sturdy
	3. LAYER		76180	Rock Highlid
3_PROFILE	1. LAYER	-3,56	8362	Medium
	2. LAYER	-15,94	27580	Sturdy
	3. LAYER		123343	Rock Highlid
4_PROFILE	1. LAYER	-3,89	5606	Medium
	2. LAYER	-17,42	25937	Sturdy
	3. LAYER		122087	Rock Highlid

Elasticity modules and endurance of the grounds in the study area

Calculation of the modulus of elasticity in the direction of the seismic data obtained in the field studies and the change table are given in the above table

5.25.5.23. WTG23 Road Elasticity Modulus-E (kg/cm²)

ELASTIC MODULUS				
PROFILES	LAYERS	DEPTH	E(kg/cm²)	ENDURANCE
1_PROFILE	1. LAYER	-2,94	2322	Weak
	2.LAYER	-19,90	8103	Medium
	3.LAYER		34131	Rock Highlid
2_PROFILE	1. LAYER	-4,61	9225	Medium
	2. LAYER	-20,61	23705	Sturdy
	3. LAYER		111859	Rock Highlid
3_PROFILE	1. LAYER	-4,22	6562	Medium
	2. LAYER	-18,89	34846	Rock Highlid
	3. LAYER		140582	Rock Highlid

Elasticity modules and endurance of the grounds in the study area

Calculation of the modulus of elasticity in the direction of the seismic data obtained in the field studies and the change table are given in the above table

5.25.5.24. Substation Road Elasticity Modulus-E (kg/cm²)

ELASTIC MODULUS				
PROFILES	LAYERS	DEPTH	E(kg/cm^2)	ENDURANCE
1_PROFILE	1. LAYER	-5,90	19518	Sturdy
	2.LAYER	-26,41	44701	Rock Highlid
	3.LAYER		169699	Rock Highlid

Elasticity modules and endurance of the grounds in the study area

Calculation of the modulus of elasticity in the direction of the seismic data obtained in the field studies and the change table are given in the above table

5.25.6. Poisson's Ratio - (б)

5.25.6.1. WTG01 Road Poisson's Ratio - (б)

POISSON'S RATIO				
PROFILES	LAYERS	DEPTH	(σ)	POROSITY
1_PROFILE	1. LAYER	-3,24	0,40	High Porous
	2.LAYER	-10,20	0,34	Medium Porous
	3.LAYER		0,38	High Porous
2_PROFILE	1. LAYER	-2,45	0,36	High Porous
	2. LAYER	-10,98	0,36	High Porous
	3. LAYER		0,40	High Porous
3_PROFILE	1. LAYER	-1,74	0,43	High Porous
	2. LAYER	-7,79	0,36	High Porous
	3. LAYER		0,37	High Porous
4_PROFILE	1. LAYER	-5,92	0,37	High Porous
	2. LAYER	-26,50	0,31	Medium Porous
	3. LAYER		0,37	High Porous
5_PROFILE	1. LAYER	-3,19	0,37	High Porous
	2. LAYER	-14,28	0,31	Medium Porous
	3. LAYER		0,34	Medium Porous
6_PROFILE	1. LAYER	-2,50	0,34	Medium Porous
	2. LAYER	-11,19	0,31	Medium Porous
	3. LAYER		0,39	High Porous
7_PROFILE	1. LAYER	-5,47	0,39	High Porous
	2.LAYER	-17,21	0,36	High Porous
	3.LAYER		0,37	High Porous
8_PROFILE	1. LAYER	-2,61	0,37	High Porous
	2. LAYER	-11,68	0,32	Medium Porous
	3. LAYER		0,39	High Porous
9_PROFILE	1. LAYER	-2,76	0,34	Medium Porous
	2. LAYER	-12,34	0,31	Medium Porous
	3. LAYER		0,38	High Porous

Poisson's ratio values of the units in the study area, porosity

Poisson's Ratio;(σ)	Porosity
0,00≤σ≤0,25	Nonporous
0,26≤σ≤0,35	Medium Porous
0,36≤σ≤0,50	High Porous

Calculation of poisson's ratio values in the direction of the seismic data obtained in the field studies and the change table are given in the above table.

5.25.6.2. WTG02 Road Poisson's Ratio - (б)

POISSON'S RATIO				
PROFILES	LAYERS	DEPTH	(σ)	POROSITY
1_PROFILE	1. LAYER	-6,19	0,36	High Porous
	2.LAYER	-19,45	0,41	High Porous
	3.LAYER		0,35	High Porous
2_PROFILE	1. LAYER	-6,03	0,36	High Porous
	2. LAYER	-18,97	0,38	High Porous
	3. LAYER		0,32	Medium Porous
3_PROFILE	1. LAYER	-2,70	0,34	Medium Porous
	2. LAYER	-12,07	0,31	Medium Porous
	3. LAYER		0,38	High Porous
4_PROFILE	1. LAYER	-5,56	0,38	High Porous
	2. LAYER	-12,74	0,31	Medium Porous

	3. LAYER		0,39	High Porous
5_PROFILE	1. LAYER	-3,53	0,40	High Porous
	2. LAYER	-11,09	0,36	High Porous
	3. LAYER		0,34	Medium Porous
6_PROFILE	1. LAYER	-3,89	0,33	Medium Porous
	2. LAYER	-12,22	0,32	Medium Porous
	3. LAYER		0,38	High Porous
7_PROFILE	1. LAYER	-2,59	0,43	High Porous
	2.LAYER	-8,14	0,33	Medium Porous
	3.LAYER		0,39	High Porous

Poisson's ratio values of the units in the study area, porosity

Poisson's Ratio;(σ)	Porosity
0,00≤σ≤0,25	Nonporous
0,26≤σ≤0,35	Medium Porous
0,36≤σ≤0,50	High Porous

Calculation of poisson's ratio values in the direction of the seismic data obtained in the field studies and the change table are given in the above table.

5.25.6.3. WTG03 Road Poisson's Ratio - (б)

POISSON'S RATIO				
PROFILES	LAYERS	DEPTH	(σ)	POROSITY
1_PROFILE	1. LAYER	-3,83	0,37	High Porous
	2.LAYER	-25,93	0,34	Medium Porous
	3.LAYER		0,37	High Porous
2_PROFILE	1. LAYER	-2,13	0,39	High Porous
	2. LAYER	-9,55	0,33	Medium Porous
	3. LAYER		0,39	High Porous
3_PROFILE	1. LAYER	-3,91	0,41	High Porous
	2. LAYER	-17,48	0,32	Medium Porous
	3. LAYER		0,39	High Porous
4_PROFILE	1. LAYER	-3,55	0,39	High Porous
	2. LAYER	-15,87	0,34	Medium Porous
	3. LAYER		0,39	High Porous
5_PROFILE	1. LAYER	-5,99	0,41	High Porous
	2. LAYER	-13,73	0,34	Medium Porous
	3. LAYER		0,39	High Porous
6_PROFILE	1. LAYER	-1,87	0,39	High Porous
	2. LAYER	-5,88	0,30	Medium Porous
	3. LAYER		0,38	High Porous

Poisson's ratio values of the units in the study area, porosity

Poisson's Ratio;(σ)	Porosity
0,00≤σ≤0,25	Nonporous
0,26≤σ≤0,35	Medium Porous
0,36≤σ≤0,50	High Porous

Calculation of poisson's ratio values in the direction of the seismic data obtained in the field studies and the change table are given in the above table.

5.25.6.4. *WTG04 Road Poisson's Ratio - (б)*

POISSON'S RATIO				
PROFILES	LAYERS	DEPTH	(σ)	POROSITY
1_PROFILE	1. LAYER	-3,50	0,43	High Porous
	2.LAYER	-11,01	0,34	Medium Porous
	3.LAYER		0,40	High Porous
2_PROFILE	1. LAYER	-2,30	0,42	High Porous
	2. LAYER	-10,29	0,34	Medium Porous
	3. LAYER		0,39	High Porous
3_PROFILE	1. LAYER	-2,51	0,42	High Porous
	2. LAYER	-11,21	0,38	High Porous
	3. LAYER		0,38	High Porous
4_PROFILE	1. LAYER	-5,32	0,40	High Porous
	2. LAYER	-16,73	0,31	Medium Porous
	3. LAYER		0,38	High Porous
5_PROFILE	1. LAYER	-8,00	0,37	High Porous
	2. LAYER	-25,15	0,29	Medium Porous
	3. LAYER		0,38	High Porous
6_PROFILE	1. LAYER	-4,02	0,41	High Porous
	2. LAYER	-12,65	0,34	Medium Porous
	3. LAYER		0,32	Medium Porous
7_PROFILE	1. LAYER	-7,02	0,41	High Porous
	2.LAYER	-31,40	0,37	High Porous
	3.LAYER		0,40	High Porous
8_PROFILE	1. LAYER	-4,63	0,41	High Porous
	2. LAYER	-20,71	0,35	Medium Porous
	3. LAYER		0,40	High Porous
9_PROFILE	1. LAYER	-3,49	0,42	High Porous
	2. LAYER	-10,97	0,38	High Porous
	3. LAYER		0,38	High Porous
10_PROFILE	1. LAYER	-4,84	0,41	High Porous
	2. LAYER	-11,09	0,38	High Porous
	3. LAYER		0,39	High Porous

Poisson's ratio values of the units in the study area, porosity

Poisson's Ratio;(σ)	Porosity
0,00≤σ≤0,25	Nonporous
0,26≤σ≤0,35	Medium Porous
0,36≤σ≤0,50	High Porous

Calculation of poisson's ratio values in the direction of the seismic data obtained in the field studies and the change table are given in the above table.

5.25.6.5. *WTG05 Road Poisson's Ratio - (б)*

POISSON'S RATIO				
PROFILES	LAYERS	DEPTH	(σ)	POROSITY
1_PROFILE	1. LAYER	-3,27	0,33	Medium Porous
	2.LAYER	-10,28	0,35	Medium Porous
	3.LAYER		0,37	High Porous
2_PROFILE	1. LAYER	-3,00	0,43	High Porous
	2. LAYER	-13,44	0,34	Medium Porous
	3. LAYER		0,39	High Porous
3_PROFILE	1. LAYER	-3,04	0,39	High Porous
	2. LAYER	-13,59	0,31	Medium Porous
	3. LAYER		0,39	High Porous

4_PROFILE	1. LAYER	-4,54	0,39	High Porous
	2. LAYER	-20,31	0,32	Medium Porous
	3. LAYER		0,39	High Porous
5_PROFILE	1. LAYER	-3,85	0,36	High Porous
	2. LAYER	-8,82	0,34	Medium Porous
	3. LAYER		0,37	High Porous
6_PROFILE	1. LAYER	-3,84	0,42	High Porous
	2. LAYER	-12,08	0,34	Medium Porous
	3. LAYER		0,38	High Porous
7_PROFILE	1. LAYER	-3,44	0,44	High Porous
	2.LAYER	-15,37	0,35	High Porous
	3.LAYER		0,39	High Porous

Poisson's ratio values of the units in the study area, porosity

Poisson's Ratio;(σ)	Porosity
0,00≤σ≤0,25	Nonporous
0,26≤σ≤0,35	Medium Porous
0,36≤σ≤0,50	High Porous

Calculation of poisson's ratio values in the direction of the seismic data obtained in the field studies and the change table are given in the above table.

5.25.6.6. WTG06 Road Poisson's Ratio - (б)

POISSON'S RATIO				
PROFILES	LAYERS	DEPTH	(σ)	POROSITY
1_PROFILE	1. LAYER	-2,20	0,44	High Porous
	2.LAYER	-14,88	0,37	High Porous
	3.LAYER		0,37	High Porous
2_PROFILE	1. LAYER	-3,78	0,41	High Porous
	2. LAYER	-16,91	0,36	High Porous
	3. LAYER		0,38	High Porous
3_PROFILE	1. LAYER	-3,85	0,40	High Porous
	2. LAYER	-17,25	0,36	High Porous
	3. LAYER		0,38	High Porous
4_PROFILE	1. LAYER	-6,77	0,41	High Porous
	2. LAYER	-15,52	0,35	Medium Porous
	3. LAYER		0,41	High Porous
5_PROFILE	1. LAYER	-3,48	0,35	Medium Porous
	2. LAYER	-10,93	0,31	Medium Porous
	3. LAYER		0,39	High Porous
6_PROFILE	1. LAYER	-4,23	0,42	High Porous
	2. LAYER	-13,29	0,34	Medium Porous
	3. LAYER		0,39	High Porous
7_PROFILE	1. LAYER	-5,14	0,41	High Porous
	2.LAYER	-11,77	0,34	Medium Porous
	3.LAYER		0,40	High Porous
8_PROFILE	1. LAYER	-3,86	0,40	High Porous
	2. LAYER	-12,14	0,33	Medium Porous
	3. LAYER		0,40	High Porous
9_PROFILE	1. LAYER	-6,26	0,36	High Porous
	2. LAYER	-19,69	0,32	Medium Porous
	3. LAYER		0,40	High Porous
10_PROFILE	1. LAYER	-4,26	0,43	High Porous
	2. LAYER	-13,39	0,33	Medium Porous

	3. LAYER		0,39	High Porous
11_PROFILE	1. LAYER	-5,84	0,40	High Porous
	2. LAYER	-18,35	0,38	High Porous
	3. LAYER		0,37	High Porous

Poisson's ratio values of the units in the study area, porosity

Poisson's Ratio;(σ)	Porosity
0,00≤σ≤0,25	Nonporous
0,26≤σ≤0,35	Medium Porous
0,36≤σ≤0,50	High Porous

Calculation of poisson's ratio values in the direction of the seismic data obtained in the field studies and the change table are given in the above table.

5.25.6.7. WTG07 Road Poisson's Ratio - (б)

POISSON'S RATIO				
PROFILES	LAYERS	DEPTH	(σ)	POROSITY
1_PROFILE	1. LAYER	-5,46	0,39	High Porous
	2.LAYER	-17,16	0,33	Medium Porous
	3.LAYER		0,41	High Porous
2_PROFILE	1. LAYER	-5,57	0,41	High Porous
	2. LAYER	-17,51	0,33	Medium Porous
	3. LAYER		0,39	High Porous
3_PROFILE	1. LAYER	-5,53	0,42	High Porous
	2. LAYER	-17,38	0,37	High Porous
	3. LAYER		0,39	High Porous
4_PROFILE	1. LAYER	-2,72	0,42	High Porous
	2. LAYER	-8,55	0,32	Medium Porous
	3. LAYER		0,39	High Porous
5_PROFILE	1. LAYER	-2,67	0,41	High Porous
	2. LAYER	-8,39	0,35	High Porous
	3. LAYER		0,35	High Porous
6_PROFILE	1. LAYER	-2,29	0,42	High Porous
	2. LAYER	-10,25	0,33	Medium Porous
	3. LAYER		0,39	High Porous
7_PROFILE	1. LAYER	-2,86	0,41	High Porous
	2.LAYER	-6,55	0,34	Medium Porous
	3.LAYER		0,41	High Porous
8_PROFILE	1. LAYER	-2,52	0,42	High Porous
	2. LAYER	-11,29	0,33	Medium Porous
	3. LAYER		0,40	High Porous
9_PROFILE	1. LAYER	-2,85	0,36	High Porous
	2. LAYER	-12,76	0,32	Medium Porous
	3. LAYER		0,35	Medium Porous
10_PROFILE	1. LAYER	-2,84	0,38	High Porous
	2. LAYER	-8,91	0,30	Medium Porous
	3. LAYER		0,38	High Porous
11_PROFILE	1. LAYER	-2,53	0,39	High Porous
	2. LAYER	-11,33	0,32	Medium Porous
	3. LAYER		0,38	High Porous
12_PROFILE	1. LAYER	-3,82	0,39	High Porous
	2. LAYER	-17,11	0,37	High Porous
	3. LAYER		0,38	High Porous
13_PROFILE	1. LAYER	-2,07	0,45	High Porous
	2. LAYER	-13,99	0,36	High Porous
	3. LAYER		0,37	High Porous
14_PROFILE	1. LAYER	-3,80	0,42	High Porous
	2. LAYER	-11,96	0,37	High Porous
	3. LAYER		0,37	High Porous
15_PROFILE	1. LAYER	-4,71	0,38	High Porous
	2. LAYER	-10,80	0,31	Medium Porous

	3. LAYER		0,38	High Porous
16_PROFILE	1. LAYER	-7,20	0,39	High Porous
	2. LAYER	-16,50	0,34	Medium Porous
	3. LAYER		0,40	High Porous
17_PROFILE	1. LAYER	-5,07	0,41	High Porous
	2.LAYER	-15,93	0,37	High Porous
	3.LAYER		0,38	High Porous
18_PROFILE	1. LAYER	-4,90	0,38	High Porous
	2. LAYER	-15,40	0,36	High Porous
	3. LAYER		0,37	High Porous
19_PROFILE	1. LAYER	-2,17	0,43	High Porous
	2. LAYER	-9,73	0,35	Medium Porous
	3. LAYER		0,39	High Porous
20_PROFILE	1. LAYER	-5,73	0,38	High Porous
	2. LAYER	-13,14	0,31	Medium Porous
	3. LAYER		0,38	High Porous
21_PROFILE	1. LAYER	-7,08	0,37	High Porous
	2. LAYER	-16,23	0,31	Medium Porous
	3. LAYER		0,38	High Porous
22_PROFILE	1. LAYER	-8,64	0,39	High Porous
	2. LAYER	-19,80	0,32	Medium Porous
	3. LAYER		0,39	High Porous
23_PROFILE	1. LAYER	-7,13	0,38	High Porous
	2. LAYER	-16,34	0,31	Medium Porous
	3. LAYER		0,39	High Porous
24_PROFILE	1. LAYER	-4,08	0,39	High Porous
	2. LAYER	-12,84	0,30	Medium Porous
	3. LAYER		0,39	High Porous

Poisson's ratio values of the units in the study area, porosity

Poisson's Ratio;(σ)	Porosity
0,00≤σ≤0,25	Nonporous
0,26≤σ≤0,35	Medium Porous
0,36≤σ≤0,50	High Porous

Calculation of poisson's ratio values in the direction of the seismic data obtained in the field studies and the change table are given in the above table.

5.25.6.8. WTG08 Road Poisson's Ratio - (б)

POISSON'S RATIO				
PROFILES	LAYERS	DEPTH	(σ)	POROSITY
1_PROFILE	1. LAYER	-2,92	0,39	High Porous
	2.LAYER	-13,06	0,39	High Porous
	3.LAYER		0,38	High Porous
2_PROFILE	1. LAYER	-2,91	0,42	High Porous
	2. LAYER	-13,00	0,35	High Porous
	3. LAYER		0,40	High Porous
3_PROFILE	1. LAYER	-4,21	0,36	High Porous
	2. LAYER	-18,84	0,29	Medium Porous
	3. LAYER		0,39	High Porous
4_PROFILE	1. LAYER	-4,67	0,42	High Porous
	2. LAYER	-10,71	0,33	Medium Porous
	3. LAYER		0,38	High Porous
5_PROFILE	1. LAYER	-8,27	0,41	High Porous
	2. LAYER	-18,95	0,32	Medium Porous
	3. LAYER		0,38	High Porous
6_PROFILE	1. LAYER	-8,21	0,39	High Porous

	2. LAYER	-18,80	0,31	Medium Porous
	3. LAYER		0,39	High Porous
7_PROFILE	1. LAYER	-4,01	0,43	High Porous
	2.LAYER	-12,62	0,33	Medium Porous
	3.LAYER		0,38	High Porous
8_PROFILE	1. LAYER	-3,31	0,42	High Porous
	2. LAYER	-7,58	0,34	Medium Porous
	3. LAYER		0,39	High Porous
9_PROFILE	1. LAYER	-6,12	0,42	High Porous
	2. LAYER	-14,04	0,33	Medium Porous
	3. LAYER		0,38	High Porous
10_PROFILE	1. LAYER	-5,68	0,36	High Porous
	2. LAYER	-17,86	0,31	Medium Porous
	3. LAYER		0,40	High Porous
11_PROFILE	1. LAYER	-2,81	0,40	High Porous
	2. LAYER	-12,58	0,32	Medium Porous
	3. LAYER		0,39	High Porous
12_PROFILE	1. LAYER	-3,78	0,39	High Porous
	2. LAYER	-11,88	0,31	Medium Porous
	3. LAYER		0,38	High Porous

Poisson's ratio values of the units in the study area, porosity

Poisson's Ratio;(σ)	Porosity
0,00≤σ≤0,25	Nonporous
0,26≤σ≤0,35	Medium Porous
0,36≤σ≤0,50	High Porous

Calculation of poisson's ratio values in the direction of the seismic data obtained in the field studies and the change table are given in the above table.

5.25.6.9. WTG09 Road Poisson's Ratio - (б)

POISSON'S RATIO				
PROFILES	LAYERS	DEPTH	(σ)	POROSITY
1_PROFILE	1. LAYER	-4,73	0,40	High Porous
	2.LAYER	-14,88	0,32	Medium Porous
	3.LAYER		0,39	High Porous
2_PROFILE	1. LAYER	-2,44	0,39	High Porous
	2. LAYER	-10,90	0,37	High Porous
	3. LAYER		0,40	High Porous
3_PROFILE	1. LAYER	-3,38	0,43	High Porous
	2. LAYER	-15,14	0,36	High Porous
	3. LAYER		0,34	Medium Porous
4_PROFILE	1. LAYER	-2,56	0,42	High Porous
	2. LAYER	-11,48	0,37	High Porous
	3. LAYER		0,42	High Porous
5_PROFILE	1. LAYER	-4,36	0,42	High Porous
	2. LAYER	-19,53	0,37	High Porous
	3. LAYER		0,38	High Porous
6_PROFILE	1. LAYER	-4,45	0,34	Medium Porous
	2. LAYER	-19,93	0,31	Medium Porous
	3. LAYER		0,39	High Porous
7_PROFILE	1. LAYER	-1,96	0,36	High Porous
	2.LAYER	-8,77	0,32	Medium Porous
	3.LAYER		0,39	High Porous

Poisson's ratio values of the units in the study area, porosity

Poisson's Ratio;(σ)	Porosity
0,00≤σ≤0,25	Nonporous
0,26≤σ≤0,35	Medium Porous
0,36≤σ≤0,50	High Porous

Calculation of poisson's ratio values in the direction of the seismic data obtained in the field studies and the change table are given in the above table.

5.25.6.10. WTG10 Road Poisson's Ratio - (б)

POISSON'S RATIO				
PROFILES	LAYERS	DEPTH	(σ)	POROSITY
1_PROFILE	1. LAYER	-4,06	0,39	High Porous
	2.LAYER	-12,76	0,31	Medium Porous
	3.LAYER		0,38	High Porous
2_PROFILE	1. LAYER	-4,54	0,39	High Porous
	2. LAYER	-14,27	0,35	Medium Porous
	3. LAYER		0,40	High Porous
3_PROFILE	1. LAYER	-3,18	0,41	High Porous
	2. LAYER	-14,22	0,36	High Porous
	3. LAYER		0,38	High Porous
4_PROFILE	1. LAYER	-4,45	0,44	High Porous
	2. LAYER	-19,94	0,37	High Porous
	3. LAYER		0,40	High Porous
5_PROFILE	1. LAYER	-4,35	0,42	High Porous
	2. LAYER	-13,68	0,32	Medium Porous
	3. LAYER		0,39	High Porous
6_PROFILE	1. LAYER	-5,13	0,37	High Porous
	2. LAYER	-22,94	0,36	High Porous
	3. LAYER		0,39	High Porous
7_PROFILE	1. LAYER	-2,83	0,41	High Porous
	2.LAYER	-12,65	0,33	Medium Porous
	3.LAYER		0,31	Medium Porous

Poisson's ratio values of the units in the study area, porosity

Poisson's Ratio;(σ)	Porosity
0,00≤σ≤0,25	Nonporous
0,26≤σ≤0,35	Medium Porous
0,36≤σ≤0,50	High Porous

Calculation of poisson's ratio values in the direction of the seismic data obtained in the field studies and the change table are given in the above table.

5.25.6.11. WTG11 Road Poisson's Ratio - (б)

POISSON'S RATIO				
PROFILES	LAYERS	DEPTH	(σ)	POROSITY
1_PROFILE	1. LAYER	-2,87	0,43	High Porous
	2.LAYER	-12,85	0,37	High Porous
	3.LAYER		0,33	Medium Porous
2_PROFILE	1. LAYER	-2,54	0,44	High Porous
	2. LAYER	-7,97	0,33	Medium Porous

	3. LAYER		0,39	High Porous
3_PROFILE	1. LAYER	-2,46	0,37	High Porous
	2. LAYER	-7,73	0,36	High Porous
	3. LAYER		0,36	High Porous
4_PROFILE	1. LAYER	-2,45	0,43	High Porous
	2. LAYER	-7,71	0,36	High Porous
	3. LAYER		0,40	High Porous
5_PROFILE	1. LAYER	-4,84	0,39	High Porous
	2. LAYER	-15,21	0,37	High Porous
	3. LAYER		0,38	High Porous
6_PROFILE	1. LAYER	-3,12	0,40	High Porous
	2. LAYER	-9,80	0,31	Medium Porous
	3. LAYER		0,39	High Porous

Poisson's ratio values of the units in the study area, porosity

Poisson's Ratio;(σ)	Porosity
0,00≤σ≤0,25	Nonporous
0,26≤σ≤0,35	Medium Porous
0,36≤σ≤0,50	High Porous

Calculation of poisson's ratio values in the direction of the seismic data obtained in the field studies and the change table are given in the above table.

5.25.6.12. WTG12 Road Poisson's Ratio - (б)

POISSON'S RATIO				
PROFILES	LAYERS	DEPTH	(σ)	POROSITY
1_PROFILE	1. LAYER	-3,18	0,43	High Porous
	2.LAYER	-14,25	0,39	High Porous
	3.LAYER		0,38	High Porous
2_PROFILE	1. LAYER	-4,33	0,34	Medium Porous
	2. LAYER	-19,37	0,40	High Porous
	3. LAYER		0,37	High Porous
3_PROFILE	1. LAYER	-2,55	0,44	High Porous
	2. LAYER	-11,40	0,37	High Porous
	3. LAYER		0,35	High Porous
4_PROFILE	1. LAYER	-4,44	0,37	High Porous
	2. LAYER	-19,85	0,36	High Porous
	3. LAYER		0,38	High Porous
5_PROFILE	1. LAYER	-2,72	0,41	High Porous
	2. LAYER	-8,55	0,38	High Porous
	3. LAYER		0,38	High Porous

Poisson's ratio values of the units in the study area, porosity

Poisson's Ratio;(σ)	Porosity
0,00≤σ≤0,25	Nonporous
0,26≤σ≤0,35	Medium Porous
0,36≤σ≤0,50	High Porous

Calculation of poisson's ratio values in the direction of the seismic data obtained in the field studies and the change table are given in the above table.

5.25.6.13. WTG13 Road Poisson's Ratio - (б)

POISSON'S RATIO				
PROFILES	LAYERS	DEPTH	(σ)	POROSITY
1_PROFILE	1. LAYER	-4,20	0,40	High Porous
	2.LAYER	-13,19	0,34	Medium Porous
	3.LAYER		0,38	High Porous
2_PROFILE	1. LAYER	-6,28	0,42	High Porous
	2. LAYER	-14,40	0,34	Medium Porous
	3. LAYER		0,39	High Porous
3_PROFILE	1. LAYER	-6,66	0,41	High Porous
	2. LAYER	-20,95	0,34	Medium Porous
	3. LAYER		0,40	High Porous
4_PROFILE	1. LAYER	-3,55	0,43	High Porous
	2. LAYER	-11,16	0,39	High Porous
	3. LAYER		0,39	High Porous
5_PROFILE	1. LAYER	-1,72	0,37	High Porous
	2. LAYER	-7,69	0,32	Medium Porous
	3. LAYER		0,39	High Porous

Poisson's ratio values of the units in the study area, porosity

Poisson's Ratio;(σ)	Porosity
0,00≤σ≤0,25	Nonporous
0,26≤σ≤0,35	Medium Porous
0,36≤σ≤0,50	High Porous

Calculation of poisson's ratio values in the direction of the seismic data obtained in the field studies and the change table are given in the above table.

5.25.6.14. WTG14 Road Poisson's Ratio - (б)

POISSON'S RATIO				
PROFILES	LAYERS	DEPTH	(σ)	POROSITY
1_PROFILE	1. LAYER	-3,26	0,43	High Porous
	2.LAYER	-14,61	0,35	Medium Porous
	3.LAYER		0,39	High Porous
2_PROFILE	1. LAYER	-2,29	0,38	High Porous
	2. LAYER	-10,27	0,31	Medium Porous
	3. LAYER		0,39	High Porous
3_PROFILE	1. LAYER	-2,78	0,35	Medium Porous
	2. LAYER	-12,43	0,35	High Porous
	3. LAYER		0,37	High Porous
4_PROFILE	1. LAYER	-2,45	0,41	High Porous
	2. LAYER	-10,97	0,34	Medium Porous
	3. LAYER		0,36	High Porous
5_PROFILE	1. LAYER	-3,58	0,43	High Porous
	2. LAYER	-11,27	0,33	Medium Porous
	3. LAYER		0,39	High Porous
6_PROFILE	1. LAYER	-3,35	0,43	High Porous
	2. LAYER	-10,54	0,33	Medium Porous
	3. LAYER		0,39	High Porous
7_PROFILE	1. LAYER	-5,59	0,41	High Porous
	2.LAYER	-12,82	0,38	High Porous
	3.LAYER		0,33	Medium Porous
8_PROFILE	1. LAYER	-4,84	0,38	High Porous
	2. LAYER	-11,10	0,37	High Porous

	3. LAYER		0,39	High Porous
9_PROFILE	1. LAYER	-3,11	0,35	High Porous
	2. LAYER	-9,76	0,40	High Porous
	3. LAYER		0,35	Medium Porous
10_PROFILE	1. LAYER	-4,22	0,39	High Porous
	2. LAYER	-13,26	0,36	High Porous
	3. LAYER		0,40	High Porous
11_PROFILE	1. LAYER	-3,99	0,36	High Porous
	2. LAYER	-12,55	0,39	High Porous
	3. LAYER		0,36	High Porous

Poisson's ratio values of the units in the study area, porosity

Poisson's Ratio;(σ)	Porosity
0,00≤σ≤0,25	Nonporous
0,26≤σ≤0,35	Medium Porous
0,36≤σ≤0,50	High Porous

Calculation of poisson's ratio values in the direction of the seismic data obtained in the field studies and the change table are given in the above table.

5.25.6.15. WTG15 Road Poisson's Ratio - (б)

POISSON'S RATIO				
PROFILES	LAYERS	DEPTH	(σ)	POROSITY
1_PROFILE	1. LAYER	-4,23	0,41	High Porous
	2.LAYER	-13,30	0,36	High Porous
	3.LAYER		0,41	High Porous
2_PROFILE	1. LAYER	-3,50	0,42	High Porous
	2. LAYER	-15,65	0,38	High Porous
	3. LAYER		0,39	High Porous
3_PROFILE	1. LAYER	-2,77	0,39	High Porous
	2. LAYER	-12,40	0,38	High Porous
	3. LAYER		0,33	Medium Porous
4_PROFILE	1. LAYER	-3,56	0,42	High Porous
	2. LAYER	-11,19	0,38	High Porous
	3. LAYER		0,38	High Porous
5_PROFILE	1. LAYER	-3,34	0,42	High Porous
	2. LAYER	-10,50	0,40	High Porous
	3. LAYER		0,40	High Porous
6_PROFILE	1. LAYER	-3,10	0,39	High Porous
	2. LAYER	-9,75	0,31	Medium Porous
	3. LAYER		0,38	High Porous
7_PROFILE	1. LAYER	-2,80	0,40	High Porous
	2.LAYER	-8,81	0,36	High Porous
	3.LAYER		0,38	High Porous
8_PROFILE	1. LAYER	-3,94	0,37	High Porous
	2. LAYER	-12,40	0,35	Medium Porous
	3. LAYER		0,36	High Porous
9_PROFILE	1. LAYER	-6,66	0,42	High Porous
	2. LAYER	-15,25	0,33	Medium Porous
	3. LAYER		0,38	High Porous
10_PROFILE	1. LAYER	-8,12	0,42	High Porous
	2. LAYER	-18,61	0,33	Medium Porous
	3. LAYER		0,39	High Porous
11_PROFILE	1. LAYER	-5,54	0,41	High Porous
	2. LAYER	-17,40	0,33	Medium Porous
	3. LAYER		0,39	High Porous

12_PROFILE	1. LAYER	-3,48	0,42	High Porous
	2. LAYER	-10,94	0,38	High Porous
	3. LAYER		0,36	High Porous
13_PROFILE	1. LAYER	-3,13	0,33	Medium Porous
	2. LAYER	-9,85	0,32	Medium Porous
	3. LAYER		0,39	High Porous
14_PROFILE	1. LAYER	-3,34	0,39	High Porous
	2. LAYER	-14,94	0,34	Medium Porous
	3. LAYER		0,42	High Porous
15_PROFILE	1. LAYER	-3,48	0,40	High Porous
	2. LAYER	-15,60	0,34	Medium Porous
	3. LAYER		0,37	High Porous
16_PROFILE	1. LAYER	-2,87	0,45	High Porous
	2. LAYER	-12,85	0,36	High Porous
	3. LAYER		0,35	High Porous
17_PROFILE	1. LAYER	-5,81	0,42	High Porous
	2.LAYER	-18,27	0,37	High Porous
	3.LAYER		0,37	High Porous
18_PROFILE	1. LAYER	-4,83	0,41	High Porous
	2. LAYER	-15,19	0,35	High Porous
	3. LAYER		0,36	High Porous

Poisson's ratio values of the units in the study area, porosity

Poisson's Ratio;(σ)	Porosity
0,00≤σ≤0,25	Nonporous
0,26≤σ≤0,35	Medium Porous
0,36≤σ≤0,50	High Porous

Calculation of poisson's ratio values in the direction of the seismic data obtained in the field studies and the change table are given in the above table.

5.25.6.16. WTG16 Road Poisson's Ratio - (б)

POISSON'S RATIO				
PROFILES	LAYERS	DEPTH	(σ)	POROSITY
1_PROFILE	1. LAYER	-2,78	0,39	High Porous
	2.LAYER	-8,75	0,35	Medium Porous
	3.LAYER		0,38	High Porous
2_PROFILE	1. LAYER	-4,28	0,35	Medium Porous
	2. LAYER	-19,17	0,33	Medium Porous
	3. LAYER		0,38	High Porous
3_PROFILE	1. LAYER	-6,18	0,41	High Porous
	2. LAYER	-19,43	0,32	Medium Porous
	3. LAYER		0,38	High Porous
4_PROFILE	1. LAYER	-2,89	0,37	High Porous
	2. LAYER	-12,92	0,34	Medium Porous
	3. LAYER		0,37	High Porous
5_PROFILE	1. LAYER	-3,43	0,39	High Porous
	2. LAYER	-15,35	0,31	Medium Porous
	3. LAYER		0,39	High Porous
6_PROFILE	1. LAYER	-3,75	0,40	High Porous
	2. LAYER	-16,78	0,38	High Porous
	3. LAYER		0,40	High Porous
7_PROFILE	1. LAYER	-2,29	0,35	Medium Porous
	2.LAYER	-10,26	0,30	Medium Porous
	3.LAYER		0,39	High Porous
8_PROFILE	1. LAYER	-3,33	0,42	High Porous

	2. LAYER	-10,48	0,37	High Porous
	3. LAYER		0,38	High Porous
9_PROFILE	1. LAYER	-4,48	0,42	High Porous
	2. LAYER	-14,07	0,35	Medium Porous
	3. LAYER		0,38	High Porous
10_PROFILE	1. LAYER	-6,87	0,35	High Porous
	2. LAYER	-21,60	0,39	High Porous
	3. LAYER		0,35	High Porous
11_PROFILE	1. LAYER	-3,93	0,34	Medium Porous
	2. LAYER	-26,63	0,28	Medium Porous
	3. LAYER		0,39	High Porous
12_PROFILE	1. LAYER	-2,18	0,44	High Porous
	2. LAYER	-14,74	0,35	High Porous
	3. LAYER		0,38	High Porous
13_PROFILE	1. LAYER	-3,89	0,34	Medium Porous
	2. LAYER	-17,40	0,28	Medium Porous
	3. LAYER		0,34	Medium Porous
14_PROFILE	1. LAYER	-4,44	0,42	High Porous
	2. LAYER	-10,17	0,33	Medium Porous
	3. LAYER		0,38	High Porous
15_PROFILE	1. LAYER	-4,63	0,42	High Porous
	2. LAYER	-14,57	0,33	Medium Porous
	3. LAYER		0,39	High Porous
16_PROFILE	1. LAYER	-6,05	0,41	High Porous
	2. LAYER	-19,02	0,32	Medium Porous
	3. LAYER		0,39	High Porous
17_PROFILE	1. LAYER	-2,56	0,40	High Porous
	2.LAYER	-8,05	0,33	Medium Porous
	3.LAYER		0,39	High Porous
18_PROFILE	1. LAYER	-6,05	0,39	High Porous
	2. LAYER	-27,07	0,34	Medium Porous
	3. LAYER		0,40	High Porous
19_PROFILE	1. LAYER	-9,75	0,41	High Porous
	2. LAYER	-30,66	0,38	High Porous
	3. LAYER		0,39	High Porous

Poisson's ratio values of the units in the study area, porosity

Poisson's Ratio;(σ)	Porosity
0,00≤σ≤0,25	Nonporous
0,26≤σ≤0,35	Medium Porous
0,36≤σ≤0,50	High Porous

Calculation of poisson's ratio values in the direction of the seismic data obtained in the field studies and the change table are given in the above table.

5.25.6.17. WTG17 Road Poisson's Ratio - (б)

POISSON'S RATIO				
PROFILES	LAYERS	DEPTH	(σ)	POROSITY
1_PROFILE	1. LAYER	-7,19	0,40	High Porous
	2.LAYER	-16,48	0,34	Medium Porous
	3.LAYER		0,39	High Porous
2_PROFILE	1. LAYER	-2,18	0,41	High Porous
	2. LAYER	-9,77	0,39	High Porous
	3. LAYER		0,40	High Porous

3_PROFILE	1. LAYER	-4,10	0,42	High Porous
	2. LAYER	-18,33	0,37	High Porous
	3. LAYER		0,39	High Porous
4_PROFILE	1. LAYER	-3,52	0,35	Medium Porous
	2. LAYER	-15,77	0,31	Medium Porous
	3. LAYER		0,40	High Porous
5_PROFILE	1. LAYER	-12,11	0,38	High Porous
	2. LAYER	-27,75	0,35	High Porous
	3. LAYER		0,42	High Porous

Poisson's ratio values of the units in the study area, porosity

Poisson's Ratio;(σ)	Porosity
0,00≤σ≤0,25	Nonporous
0,26≤σ≤0,35	Medium Porous
0,36≤σ≤0,50	High Porous

Calculation of poisson's ratio values in the direction of the seismic data obtained in the field studies and the change table are given in the above table.

5.25.6.18. WTG18 Road Poisson's Ratio - (б)

POISSON'S RATIO				
PROFILES	LAYERS	DEPTH	(σ)	POROSITY
1_PROFILE	1. LAYER	-6,61	0,43	High Porous
	2.LAYER	-29,60	0,37	High Porous
	3.LAYER		0,39	High Porous
2_PROFILE	1. LAYER	-3,64	0,42	High Porous
	2. LAYER	-16,30	0,37	High Porous
	3. LAYER		0,36	High Porous
3_PROFILE	1. LAYER	-3,66	0,39	High Porous
	2. LAYER	-16,37	0,34	Medium Porous
	3. LAYER		0,39	High Porous
4_PROFILE	1. LAYER	-4,98	0,42	High Porous
	2. LAYER	-33,73	0,35	Medium Porous
	3. LAYER		0,39	High Porous
5_PROFILE	1. LAYER	-1,56	0,38	High Porous
	2. LAYER	-10,57	0,34	Medium Porous
	3. LAYER		0,39	High Porous
6_PROFILE	1. LAYER	-2,52	0,39	High Porous
	2. LAYER	-11,29	0,35	Medium Porous
	3. LAYER		0,40	High Porous
7_PROFILE	1. LAYER	-6,37	0,39	High Porous
	2.LAYER	-20,02	0,31	Medium Porous
	3.LAYER		0,39	High Porous
8_PROFILE	1. LAYER	-6,29	0,36	High Porous
	2. LAYER	-28,17	0,28	Medium Porous
	3. LAYER		0,38	High Porous
9_PROFILE	1. LAYER	-4,59	0,41	High Porous
	2. LAYER	-31,09	0,35	Medium Porous
	3. LAYER		0,38	High Porous
10_PROFILE	1. LAYER	-4,19	0,39	High Porous
	2. LAYER	-28,36	0,35	Medium Porous
	3. LAYER		0,39	High Porous
11_PROFILE	1. LAYER	-2,41	0,44	High Porous
	2. LAYER	-16,31	0,35	High Porous
	3. LAYER		0,37	High Porous

Poisson's ratio values of the units in the study area, porosity

Poisson's Ratio;(σ)	Porosity
0,00≤σ≤0,25	Nonporous
0,26≤σ≤0,35	Medium Porous
0,36≤σ≤0,50	High Porous

Calculation of poisson's ratio values in the direction of the seismic data obtained in the field studies and the change table are given in the above table.

5.25.6.19. WTG19 Road Poisson's Ratio - (б)

POISSON'S RATIO				
PROFILES	LAYERS	DEPTH	(σ)	POROSITY
1_PROFILE	1. LAYER	-3,22	0,35	Medium Porous
	2.LAYER	-14,43	0,30	Medium Porous
	3.LAYER		0,38	High Porous
2_PROFILE	1. LAYER	-3,30	0,41	High Porous
	2. LAYER	-22,34	0,37	High Porous
	3. LAYER		0,40	High Porous
3_PROFILE	1. LAYER	-4,61	0,41	High Porous
	2. LAYER	-20,65	0,36	High Porous
	3. LAYER		0,40	High Porous
4_PROFILE	1. LAYER	-3,04	0,39	High Porous
	2. LAYER	-20,57	0,35	Medium Porous
	3. LAYER		0,39	High Porous

Poisson's ratio values of the units in the study area, porosity

Poisson's Ratio;(σ)	Porosity
0,00≤σ≤0,25	Nonporous
0,26≤σ≤0,35	Medium Porous
0,36≤σ≤0,50	High Porous

Calculation of poisson's ratio values in the direction of the seismic data obtained in the field studies and the change table are given in the above table.

5.25.6.20. WTG20 Road Poisson's Ratio - (б)

POISSON'S RATIO				
PROFILES	LAYERS	DEPTH	(σ)	POROSITY
1_PROFILE	1. LAYER	-8,11	0,34	Medium Porous
	2.LAYER	-25,49	0,34	Medium Porous
	3.LAYER		0,39	High Porous
2_PROFILE	1. LAYER	-5,30	0,35	Medium Porous
	2. LAYER	-16,65	0,28	Medium Porous
	3. LAYER		0,38	High Porous
3_PROFILE	1. LAYER	-6,61	0,36	High Porous
	2. LAYER	-29,56	0,33	Medium Porous
	3. LAYER		0,39	High Porous
4_PROFILE	1. LAYER	-2,19	0,34	Medium Porous
	2. LAYER	-14,82	0,29	Medium Porous
	3. LAYER		0,40	High Porous

Poisson's ratio values of the units in the study area, porosity

Poisson's Ratio;(σ)	Porosity
0,00≤σ≤0,25	Nonporous
0,26≤σ≤0,35	Medium Porous
0,36≤σ≤0,50	High Porous

Calculation of poisson's ratio values in the direction of the seismic data obtained in the field studies and the change table are given in the above table.

5.25.6.21. WTG21 Road Poisson's Ratio - (б)

POISSON'S RATIO				
PROFILES	LAYERS	DEPTH	(σ)	POROSITY
1_PROFILE	1. LAYER	-5,93	0,40	High Porous
	2.LAYER	-18,64	0,35	High Porous
	3.LAYER		0,40	High Porous
2_PROFILE	1. LAYER	-3,36	0,41	High Porous
	2. LAYER	-15,06	0,35	Medium Porous
	3. LAYER		0,36	High Porous
3_PROFILE	1. LAYER	-2,18	0,32	Medium Porous
	2. LAYER	-14,76	0,35	Medium Porous
	3. LAYER		0,39	High Porous
4_PROFILE	1. LAYER	-6,15	0,41	High Porous
	2. LAYER	-19,32	0,36	High Porous
	3. LAYER		0,40	High Porous
5_PROFILE	1. LAYER	-5,57	0,37	High Porous
	2. LAYER	-12,76	0,39	High Porous
	3. LAYER		0,35	High Porous
6_PROFILE	1. LAYER	-6,22	0,38	High Porous
	2. LAYER	-14,25	0,37	High Porous
	3. LAYER		0,38	High Porous

Poisson's ratio values of the units in the study area, porosity

Poisson's Ratio;(σ)	Porosity
0,00≤σ≤0,25	Nonporous
0,26≤σ≤0,35	Medium Porous
0,36≤σ≤0,50	High Porous

Calculation of poisson's ratio values in the direction of the seismic data obtained in the field studies and the change table are given in the above table.

5.25.6.22. WTG22 Road Poisson's Ratio - (б)

POISSON'S RATIO				
PROFILES	LAYERS	DEPTH	(σ)	POROSITY
1_PROFILE	1. LAYER	-6,00	0,37	High Porous
	2.LAYER	-26,85	0,37	High Porous
	3.LAYER		0,41	High Porous
2_PROFILE	1. LAYER	-3,78	0,42	High Porous
	2. LAYER	-16,92	0,37	High Porous
	3. LAYER		0,41	High Porous
3_PROFILE	1. LAYER	-3,56	0,43	High Porous

	2. LAYER	-15,94	0,37	High Porous
	3. LAYER		0,38	High Porous
4_PROFILE	1. LAYER	-3,89	0,41	High Porous
	2. LAYER	-17,42	0,35	High Porous
	3. LAYER		0,37	High Porous

Poisson's ratio values of the units in the study area, porosity

Poisson's Ratio;(σ)	Porosity
0,00≤σ≤0,25	Nonporous
0,26≤σ≤0,35	Medium Porous
0,36≤σ≤0,50	High Porous

Calculation of poisson's ratio values in the direction of the seismic data obtained in the field studies and the change table are given in the above table.

5.25.6.23. WTG23 Road Poisson's Ratio - (б)

POISSON'S RATIO				
PROFILES	LAYERS	DEPTH	(σ)	POROSITY
1_PROFILE	1. LAYER	-2,94	0,41	High Porous
	2.LAYER	-19,90	0,38	High Porous
	3.LAYER		0,39	High Porous
2_PROFILE	1. LAYER	-4,61	0,43	High Porous
	2. LAYER	-20,61	0,37	High Porous
	3. LAYER		0,35	High Porous
3_PROFILE	1. LAYER	-4,22	0,37	High Porous
	2. LAYER	-18,89	0,34	Medium Porous
	3. LAYER		0,39	High Porous

Poisson's ratio values of the units in the study area, porosity

Poisson's Ratio;(σ)	Porosity
0,00≤σ≤0,25	Nonporous
0,26≤σ≤0,35	Medium Porous
0,36≤σ≤0,50	High Porous

Calculation of poisson's ratio values in the direction of the seismic data obtained in the field studies and the change table are given in the above table.

5.25.6.24. Substation Road Poisson's Ratio - (б)

POISSON'S RATIO				
PROFILES	LAYERS	DEPTH	(σ)	POROSITY
1_PROFILE	1. LAYER	-5,90	0,40	High Porous
	2.LAYER	-26,41	0,37	High Porous
	3.LAYER		0,39	High Porous

Poisson's ratio values of the units in the study area, porosity

Poisson's Ratio;(σ)	Porosity
0,00≤σ≤0,25	Nonporous
0,26≤σ≤0,35	Medium Porous
0,36≤σ≤0,50	High Porous

Calculation of poisson's ratio values in the direction of the seismic data obtained in the field studies and the change table are given in the above table.

5.25.7. Density - ρ (gr/ cm³)

5.25.7.1. WTG01 Road Density - ρ (gr/ cm³)

DENSITY				
PROFILES	LAYERS	DEPTH	ρ (gr/cm³)	DEFINITION
1_PROFILE	1. LAYER	-3,24	1,58	Medium
	2.LAYER	-10,20	1,68	Medium
	3.LAYER		2,01	High
2_PROFILE	1. LAYER	-2,45	1,56	Medium
	2. LAYER	-10,98	1,65	Medium
	3. LAYER		1,98	High
3_PROFILE	1. LAYER	-1,74	1,58	Medium
	2. LAYER	-7,79	1,74	Medium
	3. LAYER		2,13	High
4_PROFILE	1. LAYER	-5,92	1,55	Medium
	2. LAYER	-26,50	1,76	Medium
	3. LAYER		2,16	High
5_PROFILE	1. LAYER	-3,19	1,62	Medium
	2. LAYER	-14,28	1,85	Medium
	3. LAYER		2,28	High
6_PROFILE	1. LAYER	-2,50	1,37	Low
	2. LAYER	-11,19	1,67	Medium
	3. LAYER		2,05	High
7_PROFILE	1. LAYER	-5,47	1,53	Medium
	2.LAYER	-17,21	1,65	Medium
	3.LAYER		1,96	High
8_PROFILE	1. LAYER	-2,61	1,38	Low
	2. LAYER	-11,68	1,63	Medium
	3. LAYER		2,02	High
9_PROFILE	1. LAYER	-2,76	1,38	Low
	2. LAYER	-12,34	1,61	Medium
	3. LAYER		1,97	High

Density values and description of the units in the study area

Calculation of the density values of the geological units in the direction of the seismic data obtained in the field studies and the table of variation are given in the above table.

5.25.7.2. WTG02 Road Density - ρ (gr/ cm³)

DENSITY				
PROFILES	LAYERS	DEPTH	ρ (gr/cm³)	DEFINITION
1_PROFILE	1. LAYER	-6,19	1,68	Medium
	2.LAYER	-19,45	1,68	Medium
	3.LAYER		1,92	High
2_PROFILE	1. LAYER	-6,03	1,68	Medium
	2. LAYER	-18,97	1,72	Medium
	3. LAYER		2,00	High
3_PROFILE	1. LAYER	-2,70	1,34	Low
	2. LAYER	-12,07	1,61	Medium
	3. LAYER		1,96	High
4_PROFILE	1. LAYER	-5,56	1,69	Medium
	2. LAYER	-12,74	1,85	Medium
	3. LAYER		2,18	High
5_PROFILE	1. LAYER	-3,53	1,66	Medium
	2. LAYER	-11,09	1,82	Medium
	3. LAYER		2,14	High
6_PROFILE	1. LAYER	-3,89	1,58	Medium

	2. LAYER	-12,22	1,87	Medium
	3. LAYER		2,24	High
7_PROFILE	1. LAYER	-2,59	1,66	Medium
	2.LAYER	-8,14	1,82	Medium
	3.LAYER		2,20	High

Density values and description of the units in the study area

Calculation of the density values of the geological units in the direction of the seismic data obtained in the field studies and the table of variation are given in the above table.

5.25.7.3. WTG03 Road Density - ρ (gr/ cm³)

DENSITY				
PROFILES	LAYERS	DEPTH	ρ (gr/cm³)	DEFINITION
1_PROFILE	1. LAYER	-3,83	1,49	Medium
	2.LAYER	-25,93	1,78	Medium
	3.LAYER		2,16	High
2_PROFILE	1. LAYER	-2,13	1,88	Medium
	2. LAYER	-9,55	2,13	High
	3. LAYER		2,59	High
3_PROFILE	1. LAYER	-3,91	1,64	Medium
	2. LAYER	-17,48	1,87	Medium
	3. LAYER		2,32	High
4_PROFILE	1. LAYER	-3,55	1,71	Medium
	2. LAYER	-15,87	1,78	Medium
	3. LAYER		2,16	High
5_PROFILE	1. LAYER	-5,99	1,67	Medium
	2. LAYER	-13,73	1,84	Medium
	3. LAYER		2,18	High
6_PROFILE	1. LAYER	-1,87	1,47	Medium
	2. LAYER	-5,88	1,65	Medium
	3. LAYER		1,99	High

Density values and description of the units in the study area

Calculation of the density values of the geological units in the direction of the seismic data obtained in the field studies and the table of variation are given in the above table.

5.25.7.4. WTG04 Road Density - ρ (gr/ cm³)

DENSITY				
PROFILES	LAYERS	DEPTH	ρ (gr/cm³)	DEFINITION
1_PROFILE	1. LAYER	-3,50	1,75	Medium
	2.LAYER	-11,01	1,89	Medium
	3.LAYER		2,28	High
2_PROFILE	1. LAYER	-2,30	1,56	Medium
	2. LAYER	-10,29	1,69	Medium
	3. LAYER		2,06	High
3_PROFILE	1. LAYER	-2,51	1,84	Medium
	2. LAYER	-11,21	1,87	Medium
	3. LAYER		2,23	High
4_PROFILE	1. LAYER	-5,32	1,73	Medium
	2. LAYER	-16,73	1,85	Medium
	3. LAYER		2,23	High
5_PROFILE	1. LAYER	-8,00	1,59	Medium
	2. LAYER	-25,15	1,86	Medium
	3. LAYER		2,22	High
6_PROFILE	1. LAYER	-4,02	1,56	Medium
	2. LAYER	-12,65	1,80	Medium

	3. LAYER		2,11	High
7_PROFILE	1. LAYER	-7,02	2,08	High
	2.LAYER	-31,40	2,31	High
	3.LAYER		2,74	High
8_PROFILE	1. LAYER	-4,63	1,83	Medium
	2. LAYER	-20,71	1,94	High
	3. LAYER		2,33	High
9_PROFILE	1. LAYER	-3,49	1,60	Medium
	2. LAYER	-10,97	1,74	Medium
	3. LAYER		2,02	High
10_PROFILE	1. LAYER	-4,84	1,66	Medium
	2. LAYER	-11,09	1,74	Medium
	3. LAYER		2,01	High

Density values and description of the units in the study area

Calculation of the density values of the geological units in the direction of the seismic data obtained in the field studies and the table of variation are given in the above table.

5.25.7.5. WTG05 Road Density - ρ (gr/ cm³)

DENSITY				
PROFILES	LAYERS	DEPTH	ρ (gr/cm³)	DEFINITION
1_PROFILE	1. LAYER	-3,27	1,56	Medium
	2.LAYER	-10,28	1,77	Medium
	3.LAYER		2,08	High
2_PROFILE	1. LAYER	-3,00	1,82	Medium
	2. LAYER	-13,44	1,97	High
	3. LAYER		2,44	High
3_PROFILE	1. LAYER	-3,04	1,53	Medium
	2. LAYER	-13,59	1,73	Medium
	3. LAYER		2,14	High
4_PROFILE	1. LAYER	-4,54	1,51	Medium
	2. LAYER	-20,31	1,60	Medium
	3. LAYER		1,96	High
5_PROFILE	1. LAYER	-3,85	1,56	Medium
	2. LAYER	-8,82	1,80	Medium
	3. LAYER		2,13	High
6_PROFILE	1. LAYER	-3,84	1,81	Medium
	2. LAYER	-12,08	1,89	Medium
	3. LAYER		2,27	High
7_PROFILE	1. LAYER	-3,44	1,84	Medium
	2.LAYER	-15,37	1,94	High
	3.LAYER		2,39	High

Density values and description of the units in the study area

Calculation of the density values of the geological units in the direction of the seismic data obtained in the field studies and the table of variation are given in the above table.

5.25.7.6. WTG06 Road Density - ρ (gr/ cm³)

DENSITY				
PROFILES	LAYERS	DEPTH	ρ (gr/cm³)	DEFINITION
1_PROFILE	1. LAYER	-2,20	1,77	Medium
	2.LAYER	-14,88	1,92	High
	3.LAYER		2,33	High
2_PROFILE	1. LAYER	-3,78	1,77	Medium
	2. LAYER	-16,91	1,97	High
	3. LAYER		2,34	High
3_PROFILE	1. LAYER	-3,85	1,81	Medium
	2. LAYER	-17,25	1,92	High
	3. LAYER		2,31	High
4_PROFILE	1. LAYER	-6,77	1,87	Medium
	2. LAYER	-15,52	1,96	High
	3. LAYER		2,28	High
5_PROFILE	1. LAYER	-3,48	1,57	Medium
	2. LAYER	-10,93	1,87	Medium
	3. LAYER		2,25	High
6_PROFILE	1. LAYER	-4,23	1,84	Medium
	2. LAYER	-13,29	2,01	High
	3. LAYER		2,40	High
7_PROFILE	1. LAYER	-5,14	1,83	Medium
	2.LAYER	-11,77	2,02	High
	3.LAYER		2,35	High
8_PROFILE	1. LAYER	-3,86	1,77	Medium
	2. LAYER	-12,14	1,94	High
	3. LAYER		2,30	High
9_PROFILE	1. LAYER	-6,26	1,80	Medium
	2. LAYER	-19,69	2,09	High
	3. LAYER		2,46	High
10_PROFILE	1. LAYER	-4,26	1,74	Medium
	2. LAYER	-13,39	1,88	Medium
	3. LAYER		2,26	High
11_PROFILE	1. LAYER	-5,84	1,82	Medium
	2. LAYER	-18,35	1,99	High
	3. LAYER		2,32	High

Density values and description of the units in the study area

Calculation of the density values of the geological units in the direction of the seismic data obtained in the field studies and the table of variation are given in the above table.

5.25.7.7. WTG07 Road Density - ρ (gr/ cm³)

POISSON'S RATIO				
PROFILES	LAYERS	DEPTH	(σ)	POROSITY
1_PROFILE	1. LAYER	-5,46	0,39	High Porous
	2.LAYER	-17,16	0,33	Medium Porous
	3.LAYER		0,41	High Porous
2_PROFILE	1. LAYER	-5,57	0,41	High Porous
	2. LAYER	-17,51	0,33	Medium Porous
	3. LAYER		0,39	High Porous
3_PROFILE	1. LAYER	-5,53	0,42	High Porous
	2. LAYER	-17,38	0,37	High Porous
	3. LAYER		0,39	High Porous
4_PROFILE	1. LAYER	-2,72	0,42	High Porous
	2. LAYER	-8,55	0,32	Medium Porous
	3. LAYER		0,39	High Porous
5_PROFILE	1. LAYER	-2,67	0,41	High Porous
	2. LAYER	-8,39	0,35	High Porous

	3. LAYER		0,35	High Porous
6_PROFILE	1. LAYER	-2,29	0,42	High Porous
	2. LAYER	-10,25	0,33	Medium Porous
	3. LAYER		0,39	High Porous
7_PROFILE	1. LAYER	-2,86	0,41	High Porous
	2.LAYER	-6,55	0,34	Medium Porous
	3.LAYER		0,41	High Porous
8_PROFILE	1. LAYER	-2,52	0,42	High Porous
	2. LAYER	-11,29	0,33	Medium Porous
	3. LAYER		0,40	High Porous
9_PROFILE	1. LAYER	-2,85	0,36	High Porous
	2. LAYER	-12,76	0,32	Medium Porous
	3. LAYER		0,35	Medium Porous
10_PROFILE	1. LAYER	-2,84	0,38	High Porous
	2. LAYER	-8,91	0,30	Medium Porous
	3. LAYER		0,38	High Porous
11_PROFILE	1. LAYER	-2,53	0,39	High Porous
	2. LAYER	-11,33	0,32	Medium Porous
	3. LAYER		0,38	High Porous
12_PROFILE	1. LAYER	-3,82	0,39	High Porous
	2. LAYER	-17,11	0,37	High Porous
	3. LAYER		0,38	High Porous
13_PROFILE	1. LAYER	-2,07	0,45	High Porous
	2. LAYER	-13,99	0,36	High Porous
	3. LAYER		0,37	High Porous
14_PROFILE	1. LAYER	-3,80	0,42	High Porous
	2. LAYER	-11,96	0,37	High Porous
	3. LAYER		0,37	High Porous
15_PROFILE	1. LAYER	-4,71	0,38	High Porous
	2. LAYER	-10,80	0,31	Medium Porous
	3. LAYER		0,38	High Porous
16_PROFILE	1. LAYER	-7,20	0,39	High Porous
	2. LAYER	-16,50	0,34	Medium Porous
	3. LAYER		0,40	High Porous
17_PROFILE	1. LAYER	-5,07	0,41	High Porous
	2.LAYER	-15,93	0,37	High Porous
	3.LAYER		0,38	High Porous
18_PROFILE	1. LAYER	-4,90	0,38	High Porous
	2. LAYER	-15,40	0,36	High Porous
	3. LAYER		0,37	High Porous
19_PROFILE	1. LAYER	-2,17	0,43	High Porous
	2. LAYER	-9,73	0,35	Medium Porous
	3. LAYER		0,39	High Porous
20_PROFILE	1. LAYER	-5,73	0,38	High Porous
	2. LAYER	-13,14	0,31	Medium Porous
	3. LAYER		0,38	High Porous
21_PROFILE	1. LAYER	-7,08	0,37	High Porous
	2. LAYER	-16,23	0,31	Medium Porous
	3. LAYER		0,38	High Porous
22_PROFILE	1. LAYER	-8,64	0,39	High Porous
	2. LAYER	-19,80	0,32	Medium Porous
	3. LAYER		0,39	High Porous
23_PROFILE	1. LAYER	-7,13	0,38	High Porous
	2. LAYER	-16,34	0,31	Medium Porous
	3. LAYER		0,39	High Porous
24_PROFILE	1. LAYER	-4,08	0,39	High Porous
	2. LAYER	-12,84	0,30	Medium Porous
	3. LAYER		0,39	High Porous

Density values and description of the units in the study area

Calculation of the density values of the geological units in the direction of the seismic data obtained in the field studies and the table of variation are given in the above table.

5.25.7.8. WTG08 Road Density - ρ (gr/ cm³)

DENSITY				
PROFILES	LAYERS	DEPTH	ρ (gr/cm³)	DEFINITION
1_PROFILE	1. LAYER	-2,92	1,75	Medium
	2.LAYER	-13,06	1,79	Medium
	3.LAYER		2,11	High
2_PROFILE	1. LAYER	-2,91	1,76	Medium
	2. LAYER	-13,00	1,93	High
	3. LAYER		2,33	High
3_PROFILE	1. LAYER	-4,21	1,65	Medium
	2. LAYER	-18,84	1,93	High
	3. LAYER		2,41	High
4_PROFILE	1. LAYER	-4,67	1,77	Medium
	2. LAYER	-10,71	1,89	Medium
	3. LAYER		2,23	High
5_PROFILE	1. LAYER	-8,27	1,89	Medium
	2. LAYER	-18,95	2,04	High
	3. LAYER		2,40	High
6_PROFILE	1. LAYER	-8,21	1,84	Medium
	2. LAYER	-18,80	2,01	High
	3. LAYER		2,37	High
7_PROFILE	1. LAYER	-4,01	1,58	Medium
	2.LAYER	-12,62	1,67	Medium
	3.LAYER		2,00	High
8_PROFILE	1. LAYER	-3,31	1,68	Medium
	2. LAYER	-7,58	1,79	Medium
	3. LAYER		2,13	High
9_PROFILE	1. LAYER	-6,12	1,78	Medium
	2. LAYER	-14,04	1,88	Medium
	3. LAYER		2,20	High
10_PROFILE	1. LAYER	-5,68	1,54	Medium
	2. LAYER	-17,86	1,74	Medium
	3. LAYER		2,08	High
11_PROFILE	1. LAYER	-2,81	1,68	Medium
	2. LAYER	-12,58	1,92	High
	3. LAYER		2,35	High
12_PROFILE	1. LAYER	-3,78	1,66	Medium
	2. LAYER	-11,88	1,82	Medium
	3. LAYER		2,19	High

Density values and description of the units in the study area

Calculation of the density values of the geological units in the direction of the seismic data obtained in the field studies and the table of variation are given in the above table.

5.25.7.9. WTG09 Road Density - ρ (gr/ cm³)

DENSITY				
PROFILES	LAYERS	DEPTH	ρ (gr/cm³)	DEFINITION
1_PROFILE	1. LAYER	-4,73	1,79	Medium
	2.LAYER	-14,88	2,03	High
	3.LAYER		2,45	High
2_PROFILE	1. LAYER	-2,44	1,75	Medium
	2. LAYER	-10,90	1,89	Medium
	3. LAYER		2,27	High
3_PROFILE	1. LAYER	-3,38	1,74	Medium
	2. LAYER	-15,14	1,84	Medium
	3. LAYER		2,18	High
4_PROFILE	1. LAYER	-2,56	1,66	Medium
	2. LAYER	-11,48	1,80	Medium
	3. LAYER		2,14	High
5_PROFILE	1. LAYER	-4,36	1,79	Medium

	2. LAYER	-19,53	1,95	High
	3. LAYER		2,30	High
6_PROFILE	1. LAYER	-4,45	1,32	Low
	2. LAYER	-19,93	1,64	Medium
	3. LAYER		2,01	High
7_PROFILE	1. LAYER	-1,96	1,40	Low
	2.LAYER	-8,77	1,68	Medium
	3.LAYER		2,10	High

Density values and description of the units in the study area

Calculation of the density values of the geological units in the direction of the seismic data obtained in the field studies and the table of variation are given in the above table.

5.25.7.10. WTG10 Road Density - ρ (gr/ cm³)

DENSITY				
PROFILES	LAYERS	DEPTH	ρ (gr/cm³)	DEFINITION
1_PROFILE	1. LAYER	-4,06	1,48	Medium
	2.LAYER	-12,76	1,62	Medium
	3.LAYER		1,95	High
2_PROFILE	1. LAYER	-4,54	1,55	Medium
	2. LAYER	-14,27	1,65	Medium
	3. LAYER		1,95	High
3_PROFILE	1. LAYER	-3,18	1,71	Medium
	2. LAYER	-14,22	1,88	Medium
	3. LAYER		2,27	High
4_PROFILE	1. LAYER	-4,45	1,88	Medium
	2. LAYER	-19,94	2,00	High
	3. LAYER		2,36	High
5_PROFILE	1. LAYER	-4,35	1,70	Medium
	2. LAYER	-13,68	1,76	Medium
	3. LAYER		2,11	High
6_PROFILE	1. LAYER	-5,13	1,67	Medium
	2. LAYER	-22,94	1,71	Medium
	3. LAYER		2,06	High
7_PROFILE	1. LAYER	-2,83	1,71	Medium
	2.LAYER	-12,65	1,85	Medium
	3.LAYER		2,26	High

Density values and description of the units in the study area

Calculation of the density values of the geological units in the direction of the seismic data obtained in the field studies and the table of variation are given in the above table.

5.25.7.11. WTG11 Road Density - ρ (gr/ cm³)

DENSITY				
PROFILES	LAYERS	DEPTH	ρ (gr/cm³)	DEFINITION
1_PROFILE	1. LAYER	-2,87	1,63	Medium
	2.LAYER	-12,85	1,81	Medium
	3.LAYER		2,09	High
2_PROFILE	1. LAYER	-2,54	1,59	Medium
	2. LAYER	-7,97	1,68	Medium
	3. LAYER		2,05	High
3_PROFILE	1. LAYER	-2,46	1,69	Medium
	2. LAYER	-7,73	1,79	Medium
	3. LAYER		2,14	High
4_PROFILE	1. LAYER	-2,45	1,59	Medium
	2. LAYER	-7,71	1,74	Medium

	3. LAYER		2,06	High
5_PROFILE	1. LAYER	-4,84	1,59	Medium
	2. LAYER	-15,21	1,68	Medium
	3. LAYER		1,98	High
6_PROFILE	1. LAYER	-3,12	1,55	Medium
	2. LAYER	-9,80	1,76	Medium
	3. LAYER		2,13	High

Density values and description of the units in the study area

Calculation of the density values of the geological units in the direction of the seismic data obtained in the field studies and the table of variation are given in the above table.

5.25.7.12. WTG12 Road Density - ρ (gr/ cm³)

DENSITY				
PROFILES	LAYERS	DEPTH	ρ (gr/cm³)	DEFINITION
1_PROFILE	1. LAYER	-3,18	1,79	Medium
	2.LAYER	-14,25	1,86	Medium
	3.LAYER		2,15	High
2_PROFILE	1. LAYER	-4,33	1,81	Medium
	2. LAYER	-19,37	1,81	Medium
	3. LAYER		2,13	High
3_PROFILE	1. LAYER	-2,55	1,83	Medium
	2. LAYER	-11,40	1,95	High
	3. LAYER		2,28	High
4_PROFILE	1. LAYER	-4,44	1,70	Medium
	2. LAYER	-19,85	1,66	Medium
	3. LAYER		1,97	High
5_PROFILE	1. LAYER	-2,72	1,66	Medium
	2. LAYER	-8,55	1,78	Medium
	3. LAYER		2,09	High

Density values and description of the units in the study area

Calculation of the density values of the geological units in the direction of the seismic data obtained in the field studies and the table of variation are given in the above table.

5.25.7.13. WTG13 Road Density - ρ (gr/ cm³)

DENSITY				
PROFILES	LAYERS	DEPTH	ρ (gr/cm³)	DEFINITION
1_PROFILE	1. LAYER	-4,20	1,81	Medium
	2.LAYER	-13,19	1,83	Medium
	3.LAYER		2,21	High
2_PROFILE	1. LAYER	-6,28	1,80	Medium
	2. LAYER	-14,40	1,90	Medium
	3. LAYER		2,24	High
3_PROFILE	1. LAYER	-6,66	1,64	Medium
	2. LAYER	-20,95	1,81	Medium
	3. LAYER		2,15	High
4_PROFILE	1. LAYER	-3,55	1,73	Medium
	2. LAYER	-11,16	1,80	Medium
	3. LAYER		2,07	High
5_PROFILE	1. LAYER	-1,72	1,47	Medium
	2. LAYER	-7,69	1,67	Medium
	3. LAYER		2,06	High

Density values and description of the units in the study area

Calculation of the density values of the geological units in the direction of the seismic data obtained in the field studies and the table of variation are given in the above table.

5.25.7.14. WTG14 Road Density - ρ (gr/ cm³)

DENSITY				
PROFILES	LAYERS	DEPTH	ρ (gr/cm³)	DEFINITION
1_PROFILE	1. LAYER	-3,26	1,82	Medium
	2.LAYER	-14,61	1,96	High
	3.LAYER		2,40	High
2_PROFILE	1. LAYER	-2,29	1,58	Medium
	2. LAYER	-10,27	1,79	Medium
	3. LAYER		2,18	High
3_PROFILE	1. LAYER	-2,78	1,74	Medium
	2. LAYER	-12,43	1,76	Medium
	3. LAYER		2,13	High
4_PROFILE	1. LAYER	-2,45	1,69	Medium
	2. LAYER	-10,97	1,89	Medium
	3. LAYER		2,30	High
5_PROFILE	1. LAYER	-3,58	1,85	Medium
	2. LAYER	-11,27	1,98	High
	3. LAYER		2,37	High
6_PROFILE	1. LAYER	-3,35	1,79	Medium
	2. LAYER	-10,54	1,95	High
	3. LAYER		2,34	High
7_PROFILE	1. LAYER	-5,59	1,66	Medium
	2.LAYER	-12,82	1,75	Medium
	3.LAYER		2,04	High
8_PROFILE	1. LAYER	-4,84	1,69	Medium
	2. LAYER	-11,10	1,80	Medium
	3. LAYER		2,09	High
9_PROFILE	1. LAYER	-3,11	1,88	Medium
	2. LAYER	-9,76	1,94	High
	3. LAYER		2,26	High
10_PROFILE	1. LAYER	-4,22	1,68	Medium
	2. LAYER	-13,26	1,86	Medium
	3. LAYER		2,18	High
11_PROFILE	1. LAYER	-3,99	1,74	Medium
	2. LAYER	-12,55	1,72	Medium
	3. LAYER		1,99	High

Density values and description of the units in the study area

Calculation of the density values of the geological units in the direction of the seismic data obtained in the field studies and the table of variation are given in the above table.

5.25.7.15. WTG15 Road Density - ρ (gr/ cm³)

DENSITY				
PROFILES	LAYERS	DEPTH	ρ (gr/cm³)	DEFINITION
1_PROFILE	1. LAYER	-4,23	1,72	Medium
	2.LAYER	-13,30	1,83	Medium
	3.LAYER		2,16	High
2_PROFILE	1. LAYER	-3,50	1,60	Medium
	2. LAYER	-15,65	1,70	Medium
	3. LAYER		1,97	High
3_PROFILE	1. LAYER	-2,77	1,76	Medium
	2. LAYER	-12,40	1,86	Medium
	3. LAYER		2,20	High
4_PROFILE	1. LAYER	-3,56	1,77	Medium
	2. LAYER	-11,19	1,87	Medium
	3. LAYER		2,17	High
5_PROFILE	1. LAYER	-3,34	1,81	Medium

	2. LAYER	-10,50	1,85	Medium
	3. LAYER		2,11	High
6_PROFILE	1. LAYER	-3,10	1,69	Medium
	2. LAYER	-9,75	1,77	Medium
	3. LAYER		2,12	High
7_PROFILE	1. LAYER	-2,80	1,64	Medium
	2.LAYER	-8,81	1,61	Medium
	3.LAYER		1,92	High
8_PROFILE	1. LAYER	-3,94	1,68	Medium
	2. LAYER	-12,40	1,71	Medium
	3. LAYER		2,02	High
9_PROFILE	1. LAYER	-6,66	1,92	High
	2. LAYER	-15,25	2,03	High
	3. LAYER		2,40	High
10_PROFILE	1. LAYER	-8,12	1,76	Medium
	2. LAYER	-18,61	1,89	Medium
	3. LAYER		2,23	High
11_PROFILE	1. LAYER	-5,54	1,78	Medium
	2. LAYER	-17,40	1,98	High
	3. LAYER		2,39	High
12_PROFILE	1. LAYER	-3,48	1,73	Medium
	2. LAYER	-10,94	1,83	Medium
	3. LAYER		2,13	High
13_PROFILE	1. LAYER	-3,13	1,45	Medium
	2. LAYER	-9,85	1,74	Medium
	3. LAYER		2,07	High
14_PROFILE	1. LAYER	-3,34	1,49	Medium
	2. LAYER	-14,94	1,77	Medium
	3. LAYER		2,06	High
15_PROFILE	1. LAYER	-3,48	1,59	Medium
	2. LAYER	-15,60	1,78	Medium
	3. LAYER		2,10	High
16_PROFILE	1. LAYER	-2,87	1,86	Medium
	2. LAYER	-12,85	1,95	High
	3. LAYER		2,34	High
17_PROFILE	1. LAYER	-5,81	1,83	Medium
	2.LAYER	-18,27	1,96	High
	3.LAYER		2,31	High
18_PROFILE	1. LAYER	-4,83	1,69	Medium
	2. LAYER	-15,19	1,82	Medium
	3. LAYER		2,17	High

Density values and description of the units in the study area

Calculation of the density values of the geological units in the direction of the seismic data obtained in the field studies and the table of variation are given in the above table.

5.25.7.16. WTG16 Road Density - ρ (gr/ cm³)

DENSITY				
PROFILES	LAYERS	DEPTH	ρ (gr/cm³)	DEFINITION
1_PROFILE	1. LAYER	-2,78	1,46	Medium
	2.LAYER	-8,75	1,63	Medium
	3.LAYER		1,96	High
2_PROFILE	1. LAYER	-4,28	1,51	Medium
	2. LAYER	-19,17	1,70	Medium
	3. LAYER		2,07	High
3_PROFILE	1. LAYER	-6,18	1,56	Medium
	2. LAYER	-19,43	1,75	Medium
	3. LAYER		2,10	High
4_PROFILE	1. LAYER	-2,89	1,43	Medium
	2. LAYER	-12,92	1,57	Medium
	3. LAYER		1,92	High
5_PROFILE	1. LAYER	-3,43	1,39	Low

	2. LAYER	-15,35	1,61	Medium
	3. LAYER		1,99	High
6_PROFILE	1. LAYER	-3,75	1,61	Medium
	2. LAYER	-16,78	1,78	Medium
	3. LAYER		2,12	High
7_PROFILE	1. LAYER	-2,29	1,46	Medium
	2.LAYER	-10,26	1,72	Medium
	3.LAYER		2,12	High
8_PROFILE	1. LAYER	-3,33	1,68	Medium
	2. LAYER	-10,48	1,81	Medium
	3. LAYER		2,13	High
9_PROFILE	1. LAYER	-4,48	1,84	Medium
	2. LAYER	-14,07	2,03	High
	3. LAYER		2,42	High
10_PROFILE	1. LAYER	-6,87	1,92	High
	2. LAYER	-21,60	1,88	Medium
	3. LAYER		2,18	High
11_PROFILE	1. LAYER	-3,93	1,65	Medium
	2. LAYER	-26,63	1,91	High
	3. LAYER		2,38	High
12_PROFILE	1. LAYER	-2,18	1,55	Medium
	2. LAYER	-14,74	1,73	Medium
	3. LAYER		2,09	High
13_PROFILE	1. LAYER	-3,89	1,39	Low
	2. LAYER	-17,40	1,62	Medium
	3. LAYER		1,99	High
14_PROFILE	1. LAYER	-4,44	1,79	Medium
	2. LAYER	-10,17	1,91	High
	3. LAYER		2,24	High
15_PROFILE	1. LAYER	-4,63	1,69	Medium
	2. LAYER	-14,57	1,86	Medium
	3. LAYER		2,24	High
16_PROFILE	1. LAYER	-6,05	1,84	Medium
	2. LAYER	-19,02	2,03	High
	3. LAYER		2,45	High
17_PROFILE	1. LAYER	-2,56	1,59	Medium
	2.LAYER	-8,05	1,77	Medium
	3.LAYER		2,12	High
18_PROFILE	1. LAYER	-6,05	1,60	Medium
	2. LAYER	-27,07	1,83	Medium
	3. LAYER		2,17	High
19_PROFILE	1. LAYER	-9,75	1,84	Medium
	2. LAYER	-30,66	1,94	High
	3. LAYER		2,26	High

Density values and description of the units in the study area

Calculation of the density values of the geological units in the direction of the seismic data obtained in the field studies and the table of variation are given in the above table.

5.25.7.17. WTG17 Road Density - ρ (gr/ cm³)

DENSITY				
PROFILES	LAYERS	DEPTH	ρ (gr/cm³)	DEFINITION
1_PROFILE	1. LAYER	-7,19	1,64	Medium
	2.LAYER	-16,48	1,79	Medium
	3.LAYER		2,10	High
2_PROFILE	1. LAYER	-2,18	1,54	Medium
	2. LAYER	-9,77	1,54	Medium
	3. LAYER		1,74	Medium
3_PROFILE	1. LAYER	-4,10	1,63	Medium
	2. LAYER	-18,33	1,77	Medium
	3. LAYER		2,12	High

4_PROFILE	1. LAYER	-3,52	1,36	Low
	2. LAYER	-15,77	1,66	Medium
	3. LAYER		2,04	High
5_PROFILE	1. LAYER	-12,11	1,52	Medium
	2. LAYER	-27,75	1,60	Medium
	3. LAYER		1,84	Medium

Density values and description of the units in the study area

Calculation of the density values of the geological units in the direction of the seismic data obtained in the field studies and the table of variation are given in the above table.

5.25.7.18. WTG18 Road Density - ρ (gr/ cm³)

DENSITY				
PROFILES	LAYERS	DEPTH	ρ (gr/cm³)	DEFINITION
1_PROFILE	1. LAYER	-6,61	1,81	Medium
	2.LAYER	-29,60	1,94	High
	3.LAYER		2,27	High
2_PROFILE	1. LAYER	-3,64	1,67	Medium
	2. LAYER	-16,30	1,81	Medium
	3. LAYER		2,16	High
3_PROFILE	1. LAYER	-3,66	1,57	Medium
	2. LAYER	-16,37	1,73	Medium
	3. LAYER		2,10	High
4_PROFILE	1. LAYER	-4,98	1,44	Medium
	2. LAYER	-33,73	1,61	Medium
	3. LAYER		1,96	High
5_PROFILE	1. LAYER	-1,56	1,21	Low
	2. LAYER	-10,57	1,49	Medium
	3. LAYER		1,86	Medium
6_PROFILE	1. LAYER	-2,52	1,31	Low
	2. LAYER	-11,29	1,47	Medium
	3. LAYER		1,75	Medium
7_PROFILE	1. LAYER	-6,37	1,39	Low
	2.LAYER	-20,02	1,57	Medium
	3.LAYER		1,89	Medium
8_PROFILE	1. LAYER	-6,29	1,39	Low
	2. LAYER	-28,17	1,67	Medium
	3. LAYER		2,05	High
9_PROFILE	1. LAYER	-4,59	1,65	Medium
	2. LAYER	-31,09	1,84	Medium
	3. LAYER		2,26	High
10_PROFILE	1. LAYER	-4,19	1,46	Medium
	2. LAYER	-28,36	1,64	Medium
	3. LAYER		2,00	High
11_PROFILE	1. LAYER	-2,41	1,46	Medium
	2. LAYER	-16,31	1,58	Medium
	3. LAYER		1,94	High

Density values and description of the units in the study area

Calculation of the density values of the geological units in the direction of the seismic data obtained in the field studies and the table of variation are given in the above table.

5.25.7.19. WTG19 Road Density - ρ (gr/ cm³)

DENSITY				
PROFILES	LAYERS	DEPTH	ρ (gr/cm³)	DEFINITION
1_PROFILE	1. LAYER	-3,22	1,74	Medium
	2.LAYER	-14,43	2,00	High
	3.LAYER		2,47	High
2_PROFILE	1. LAYER	-3,30	1,45	Medium
	2. LAYER	-22,34	1,65	Medium
	3. LAYER		1,99	High
3_PROFILE	1. LAYER	-4,61	1,39	Low
	2. LAYER	-20,65	1,43	Medium
	3. LAYER		1,73	Medium
4_PROFILE	1. LAYER	-3,04	1,49	Medium
	2. LAYER	-20,57	1,76	Medium
	3. LAYER		2,13	High

Density values and description of the units in the study area

Calculation of the density values of the geological units in the direction of the seismic data obtained in the field studies and the table of variation are given in the above table.

5.25.7.20. WTG20 Road Density - ρ (gr/ cm³)

DENSITY				
PROFILES	LAYERS	DEPTH	ρ (gr/cm³)	DEFINITION
1_PROFILE	1. LAYER	-8,11	1,39	Low
	2.LAYER	-25,49	1,60	Medium
	3.LAYER		1,89	Medium
2_PROFILE	1. LAYER	-5,30	1,38	Low
	2. LAYER	-16,65	1,70	Medium
	3. LAYER		2,03	High
3_PROFILE	1. LAYER	-6,61	1,51	Medium
	2. LAYER	-29,56	1,80	Medium
	3. LAYER		2,17	High
4_PROFILE	1. LAYER	-2,19	1,33	Low
	2. LAYER	-14,82	1,58	Medium
	3. LAYER		2,00	High

Density values and description of the units in the study area

Calculation of the density values of the geological units in the direction of the seismic data obtained in the field studies and the table of variation are given in the above table.

5.25.7.21. WTG21 Road Density - ρ (gr/ cm³)

DENSITY				
PROFILES	LAYERS	DEPTH	ρ (gr/cm³)	DEFINITION
1_PROFILE	1. LAYER	-5,93	1,38	Low
	2.LAYER	-18,64	1,56	Medium
	3.LAYER		1,83	Medium
2_PROFILE	1. LAYER	-3,36	1,79	Medium
	2. LAYER	-15,06	1,99	High
	3. LAYER		2,38	High
3_PROFILE	1. LAYER	-2,18	1,75	Medium
	2. LAYER	-14,76	1,88	Medium
	3. LAYER		2,31	High
4_PROFILE	1. LAYER	-6,15	1,74	Medium

	2. LAYER	-19,32	1,96	High
	3. LAYER		2,29	High
5_PROFILE	1. LAYER	-5,57	1,75	Medium
	2. LAYER	-12,76	1,72	Medium
	3. LAYER		1,99	High
6_PROFILE	1. LAYER	-6,22	1,59	Medium
	2. LAYER	-14,25	1,69	Medium
	3. LAYER		1,97	High

Density values and description of the units in the study area

Calculation of the density values of the geological units in the direction of the seismic data obtained in the field studies and the table of variation are given in the above table.

5.25.7.22. WTG22 Road Density - ρ (gr/ cm³)

DENSITY				
PROFILES	LAYERS	DEPTH	ρ (gr/cm³)	DEFINITION
1_PROFILE	1. LAYER	-6,00	1,83	Medium
	2.LAYER	-26,85	1,89	Medium
	3.LAYER		2,24	High
2_PROFILE	1. LAYER	-3,78	1,72	Medium
	2. LAYER	-16,92	1,88	Medium
	3. LAYER		2,25	High
3_PROFILE	1. LAYER	-3,56	1,79	Medium
	2. LAYER	-15,94	1,93	High
	3. LAYER		2,32	High
4_PROFILE	1. LAYER	-3,89	1,69	Medium
	2. LAYER	-17,42	1,91	High
	3. LAYER		2,30	High

Density values and description of the units in the study area

Calculation of the density values of the geological units in the direction of the seismic data obtained in the field studies and the table of variation are given in the above table.

5.25.7.23. WTG23 Road Density - ρ (gr/ cm³)

DENSITY				
PROFILES	LAYERS	DEPTH	ρ (gr/cm³)	DEFINITION
1_PROFILE	1. LAYER	-2,94	1,54	Medium
	2.LAYER	-19,90	1,71	Medium
	3.LAYER		2,03	High
2_PROFILE	1. LAYER	-4,61	1,82	Medium
	2. LAYER	-20,61	1,92	High
	3. LAYER		2,26	High
3_PROFILE	1. LAYER	-4,22	1,68	Medium
	2. LAYER	-18,89	1,95	High
	3. LAYER		2,37	High

Density values and description of the units in the study area

Calculation of the density values of the geological units in the direction of the seismic data obtained in the field studies and the table of variation are given in the above table.

5.25.7.24. Substation Road Density - ρ (gr/ cm³)

DENSITY				
PROFILES	LAYERS	DEPTH	ρ (gr/cm³)	DEFINITION
1_PROFILE	1. LAYER	-5,90	1,93	High
	2.LAYER	-26,41	2,04	High
	3.LAYER		2,43	High

Density values and description of the units in the study area

Calculation of the density values of the geological units in the direction of the seismic data obtained in the field studies and the table of variation are given in the above table.

5.25.8. Modulus of Subgrade Reaction – D Y K (ton/m^3)

5.25.8.1. WTG01 Road Modulus of Subgrade Reaction – D Y K (ton/m^3)

Modulus of Subgrade Reaction			
PROFILES	LAYERS	DEPTH	D Y K (ton/m^3)
1_PROFILE	1. LAYER	-3,24	1852
	2.LAYER	-10,20	3176
	3.LAYER		6087
2_PROFILE	1. LAYER	-2,45	2083
	2. LAYER	-10,98	2667
	3. LAYER		5403
3_PROFILE	1. LAYER	-1,74	1636
	2. LAYER	-7,79	3530
	3. LAYER		8277
4_PROFILE	1. LAYER	-5,92	1911
	2. LAYER	-26,50	4276
	3. LAYER		9146
5_PROFILE	1. LAYER	-3,19	2269
	2. LAYER	-14,28	5216
	3. LAYER		12641
6_PROFILE	1. LAYER	-2,50	1239
	2. LAYER	-11,19	3313
	3. LAYER		6504
7_PROFILE	1. LAYER	-5,47	1679
	2.LAYER	-17,21	2687
	3.LAYER		5790
8_PROFILE	1. LAYER	-2,61	1179
	2. LAYER	-11,68	2904
	3. LAYER		5976
9_PROFILE	1. LAYER	-2,76	1222
	2. LAYER	-12,34	2805
	3. LAYER		5670

The above table shows the Modulus of Subgrade Reaction obtained for each layer in the direction of the data obtained after the seismic measurements made in the study area.

5.25.8.2. WTG02 Road Modulus of Subgrade Reaction – D Y K (ton/m^3)

Modulus of Subgrade Reaction			
PROFILES	LAYERS	DEPTH	D Y K (ton/m^3)
1_PROFILE	1. LAYER	-6,19	2841
	2.LAYER	-19,45	2352
	3.LAYER		5367
2_PROFILE	1. LAYER	-6,03	2913
	2. LAYER	-18,97	2897
	3. LAYER		7089
3_PROFILE	1. LAYER	-2,70	1118
	2. LAYER	-12,07	2777
	3. LAYER		5633
4_PROFILE	1. LAYER	-5,56	2725
	2. LAYER	-12,74	5168
	3. LAYER		8844
5_PROFILE	1. LAYER	-3,53	2383
	2. LAYER	-11,09	4088
	3. LAYER		9321
6_PROFILE	1. LAYER	-3,89	2303
	2. LAYER	-12,22	5371
	3. LAYER		10433
7_PROFILE	1. LAYER	-2,59	2102
	2.LAYER	-8,14	4538
	3.LAYER		9227

The above table shows the Modulus of Subgrade Reaction obtained for each layer in the direction of the data obtained after the seismic measurements made in the study area.

5.25.8.3. WTG03 Road Modulus of Subgrade Reaction – D Y K (ton/m³)

Modulus of Subgrade Reaction			
PROFILES	LAYERS	DEPTH	D Y K (ton/m³)
1_PROFILE	1. LAYER	-3,83	1621
	2.LAYER	-25,93	4117
	3.LAYER		8994
2_PROFILE	1. LAYER	-2,13	4203
	2. LAYER	-9,55	9551
	3. LAYER		22189
3_PROFILE	1. LAYER	-3,91	2143
	2. LAYER	-17,48	5323
	3. LAYER		11938
4_PROFILE	1. LAYER	-3,55	2779
	2. LAYER	-15,87	3966
	3. LAYER		8588
5_PROFILE	1. LAYER	-5,99	2277
	2. LAYER	-13,73	4685
	3. LAYER		8725
6_PROFILE	1. LAYER	-1,87	1449
	2. LAYER	-5,88	3133
	3. LAYER		5886

The above table shows the Modulus of Subgrade Reaction obtained for each layer in the direction of the data obtained after the seismic measurements made in the study area.

5.25.8.4. WTG04 Road Modulus of Subgrade Reaction – D Y K (ton/m³)

Modulus of Subgrade Reaction			
PROFILES	LAYERS	DEPTH	D Y K (ton/m³)
1_PROFILE	1. LAYER	-3,50	2697
	2.LAYER	-11,01	5331
	3.LAYER		11009
2_PROFILE	1. LAYER	-2,30	1668
	2. LAYER	-10,29	3278
	3. LAYER		6645
3_PROFILE	1. LAYER	-2,51	3584
	2. LAYER	-11,21	4295
	3. LAYER		10078
4_PROFILE	1. LAYER	-5,32	2801
	2. LAYER	-16,73	5132
	3. LAYER		10208
5_PROFILE	1. LAYER	-8,00	2175
	2. LAYER	-25,15	5427
	3. LAYER		10306
6_PROFILE	1. LAYER	-4,02	1759
	2. LAYER	-12,65	4185
	3. LAYER		9192
7_PROFILE	1. LAYER	-7,02	6294
	2.LAYER	-31,40	12979
	3.LAYER		28214
8_PROFILE	1. LAYER	-4,63	3425
	2. LAYER	-20,71	5810
	3. LAYER		11699
9_PROFILE	1. LAYER	-3,49	1838

	2. LAYER	-10,97	3179
	3. LAYER		6457
10_PROFILE	1. LAYER	-4,84	2234
	2. LAYER	-11,09	3234
	3. LAYER		5850

The above table shows the Modulus of Subgrade Reaction obtained for each layer in the direction of the data obtained after the seismic measurements made in the study area.

5.25.8.5. WTG05 Road Modulus of Subgrade Reaction – D Y K (ton/m³)

Modulus of Subgrade Reaction			
PROFILES	LAYERS	DEPTH	D Y K (ton/m³)
1_PROFILE	1. LAYER	-3,27	2208
	2.LAYER	-10,28	3757
	3.LAYER		7554
2_PROFILE	1. LAYER	-3,00	3033
	2. LAYER	-13,44	6663
	3. LAYER		15521
3_PROFILE	1. LAYER	-3,04	1672
	2. LAYER	-13,59	3900
	3. LAYER		8140
4_PROFILE	1. LAYER	-4,54	1582
	2. LAYER	-20,31	2684
	3. LAYER		5238
5_PROFILE	1. LAYER	-3,85	2040
	2. LAYER	-8,82	4298
	3. LAYER		8452
6_PROFILE	1. LAYER	-3,84	3156
	2. LAYER	-12,08	5327
	3. LAYER		11324
7_PROFILE	1. LAYER	-3,44	3129
	2.LAYER	-15,37	5861
	3.LAYER		13955

The above table shows the Modulus of Subgrade Reaction obtained for each layer in the direction of the data obtained after the seismic measurements made in the study area.

5.25.8.6. WTG06 Road Modulus of Subgrade Reaction – D Y K (ton/m³)

Modulus of Subgrade Reaction			
PROFILES	LAYERS	DEPTH	D Y K (ton/m³)
1_PROFILE	1. LAYER	-2,20	2607
	2.LAYER	-14,88	5301
	3.LAYER		13334
2_PROFILE	1. LAYER	-3,78	2989
	2. LAYER	-16,91	5911
	3. LAYER		13283
3_PROFILE	1. LAYER	-3,85	3554
	2. LAYER	-17,25	5319
	3. LAYER		12181
4_PROFILE	1. LAYER	-6,77	3828
	2. LAYER	-15,52	6148
	3. LAYER		10183
5_PROFILE	1. LAYER	-3,48	2162
	2. LAYER	-10,93	5242
	3. LAYER		10259
6_PROFILE	1. LAYER	-4,23	3339
	2. LAYER	-13,29	7107
	3. LAYER		14372
7_PROFILE	1. LAYER	-5,14	3440
	2.LAYER	-11,77	7213

	3.LAYER		12549
8_PROFILE	1. LAYER	-3,86	3115
	2. LAYER	-12,14	6027
	3. LAYER		11218
9_PROFILE	1. LAYER	-6,26	3809
	2. LAYER	-19,69	8616
	3. LAYER		16108
10_PROFILE	1. LAYER	-4,26	2585
	2. LAYER	-13,39	5240
	3. LAYER		10549
11_PROFILE	1. LAYER	-5,84	3483
	2. LAYER	-18,35	5780
	3. LAYER		12728

The above table shows the Modulus of Subgrade Reaction obtained for each layer in the direction of the data obtained after the seismic measurements made in the study area.

5.25.8.7. WTG07 Road Modulus of Subgrade Reaction – D Y K (ton/m^3)

Modulus of Subgrade Reaction			
PROFILES	LAYERS	DEPTH	D Y K (ton/m^3)
1_PROFILE	1. LAYER	-5,46	2205
	2.LAYER	-17,16	3458
	3.LAYER		5906
2_PROFILE	1. LAYER	-5,57	2448
	2. LAYER	-17,51	5920
	3. LAYER		12304
3_PROFILE	1. LAYER	-5,53	2126
	2. LAYER	-17,38	3329
	3. LAYER		6593
4_PROFILE	1. LAYER	-2,72	2516
	2. LAYER	-8,55	4681
	3. LAYER		9871
5_PROFILE	1. LAYER	-2,67	2558
	2. LAYER	-8,39	4909
	3. LAYER		11462
6_PROFILE	1. LAYER	-2,29	2376
	2. LAYER	-10,25	5387
	3. LAYER		11453
7_PROFILE	1. LAYER	-2,86	2612
	2.LAYER	-6,55	4652
	3.LAYER		7679
8_PROFILE	1. LAYER	-2,52	2437
	2. LAYER	-11,29	5803
	3. LAYER		11635
9_PROFILE	1. LAYER	-2,85	4531
	2. LAYER	-12,76	11162
	3. LAYER		29182
10_PROFILE	1. LAYER	-2,84	2840
	2. LAYER	-8,91	5870
	3. LAYER		12094
11_PROFILE	1. LAYER	-2,53	2710
	2. LAYER	-11,33	6058
	3. LAYER		13284
12_PROFILE	1. LAYER	-3,82	4219
	2. LAYER	-17,11	5048
	3. LAYER		12004
13_PROFILE	1. LAYER	-2,07	3286
	2. LAYER	-13,99	7341
	3. LAYER		18590
14_PROFILE	1. LAYER	-3,80	3719
	2. LAYER	-11,96	7040
	3. LAYER		15904

15_PROFILE	1. LAYER	-4,71	2743
	2. LAYER	-10,80	5001
	3. LAYER		8632
16_PROFILE	1. LAYER	-7,20	2244
	2. LAYER	-16,50	4008
	3. LAYER		6983
17_PROFILE	1. LAYER	-5,07	2209
	2.LAYER	-15,93	3214
	3.LAYER		6516
18_PROFILE	1. LAYER	-4,90	2247
	2. LAYER	-15,40	3484
	3. LAYER		7346
19_PROFILE	1. LAYER	-2,17	2961
	2. LAYER	-9,73	5825
	3. LAYER		13293
20_PROFILE	1. LAYER	-5,73	3611
	2. LAYER	-13,14	6008
	3. LAYER		10852
21_PROFILE	1. LAYER	-7,08	1377
	2. LAYER	-16,23	3283
	3. LAYER		5434
22_PROFILE	1. LAYER	-8,64	2100
	2. LAYER	-19,80	4621
	3. LAYER		8253
23_PROFILE	1. LAYER	-7,13	2203
	2. LAYER	-16,34	4519
	3. LAYER		7838
24_PROFILE	1. LAYER	-4,08	2519
	2. LAYER	-12,84	4448
	3. LAYER		8616

The above table shows the Modulus of Subgrade Reaction obtained for each layer in the direction of the data obtained after the seismic measurements made in the study area.

5.25.8.8. WTG08 Road Modulus of Subgrade Reaction – D Y K (ton/m³)

Modulus of Subgrade Reaction			
PROFILES	LAYERS	DEPTH	D Y K (ton/m³)
1_PROFILE	1. LAYER	-2,92	3209
	2.LAYER	-13,06	3489
	3.LAYER		7850
2_PROFILE	1. LAYER	-2,91	2841
	2. LAYER	-13,00	5736
	3. LAYER		11983
3_PROFILE	1. LAYER	-4,21	2547
	2. LAYER	-18,84	6548
	3. LAYER		14658
4_PROFILE	1. LAYER	-4,67	2932
	2. LAYER	-10,71	5446
	3. LAYER		10193
5_PROFILE	1. LAYER	-8,27	4168
	2. LAYER	-18,95	7867
	3. LAYER		14933
6_PROFILE	1. LAYER	-8,21	3803
	2. LAYER	-18,80	7431
	3. LAYER		13672
7_PROFILE	1. LAYER	-4,01	1641
	2.LAYER	-12,62	3068
	3.LAYER		5926
8_PROFILE	1. LAYER	-3,31	2250
	2. LAYER	-7,58	4208
	3. LAYER		7887
9_PROFILE	1. LAYER	-6,12	3021

	2. LAYER	-14,04	5285
	3. LAYER		9627
10_PROFILE	1. LAYER	-5,68	1874
	2. LAYER	-17,86	3814
	3. LAYER		6779
11_PROFILE	1. LAYER	-2,81	2449
	2. LAYER	-12,58	6052
	3. LAYER		12827
12_PROFILE	1. LAYER	-3,78	2401
	2. LAYER	-11,88	4714
	3. LAYER		9481

The above table shows the Modulus of Subgrade Reaction obtained for each layer in the direction of the data obtained after the seismic measurements made in the study area.

5.25.8.9. WTG09 Road Modulus of Subgrade Reaction – D Y K (ton/m³)

Modulus of Subgrade Reaction			
PROFILES	LAYERS	DEPTH	D Y K (ton/m³)
1_PROFILE	1. LAYER	-4,73	3285
	2.LAYER	-14,88	7784
	3.LAYER		15950
2_PROFILE	1. LAYER	-2,44	3085
	2. LAYER	-10,90	5013
	3. LAYER		10483
3_PROFILE	1. LAYER	-3,38	2421
	2. LAYER	-15,14	4270
	3. LAYER		10317
4_PROFILE	1. LAYER	-2,56	2199
	2. LAYER	-11,48	3866
	3. LAYER		7229
5_PROFILE	1. LAYER	-4,36	2924
	2. LAYER	-19,53	5464
	3. LAYER		11977
6_PROFILE	1. LAYER	-4,45	1095
	2. LAYER	-19,93	3075
	3. LAYER		5932
7_PROFILE	1. LAYER	-1,96	1302
	2.LAYER	-8,77	3382
	3.LAYER		7280

The above table shows the Modulus of Subgrade Reaction obtained for each layer in the direction of the data obtained after the seismic measurements made in the study area.

5.25.8.10. WTG10 Road Modulus of Subgrade Reaction – D Y K (ton/m³)

Modulus of Subgrade Reaction			
PROFILES	LAYERS	DEPTH	D Y K (ton/m³)
1_PROFILE	1. LAYER	-4,06	1464
	2.LAYER	-12,76	2886
	3.LAYER		5292
2_PROFILE	1. LAYER	-4,54	1795
	2. LAYER	-14,27	2733
	3. LAYER		5030
3_PROFILE	1. LAYER	-3,18	2651
	2. LAYER	-14,22	4944
	3. LAYER		11138
4_PROFILE	1. LAYER	-4,45	3351
	2. LAYER	-19,94	6266
	3. LAYER		12724
5_PROFILE	1. LAYER	-4,35	2328

	2. LAYER	-13,68	3957
	3. LAYER		7581
6_PROFILE	1. LAYER	-5,13	2742
	2. LAYER	-22,94	3147
	3. LAYER		6801
7_PROFILE	1. LAYER	-2,83	2448
	2.LAYER	-12,65	4911
	3.LAYER		12983

The above table shows the Modulus of Subgrade Reaction obtained for each layer in the direction of the data obtained after the seismic measurements made in the study area.

5.25.8.11. WTG11 Road Modulus of Subgrade Reaction – D Y K (ton/m³)

Modulus of Subgrade Reaction			
PROFILES	LAYERS	DEPTH	D Y K (ton/m³)
1_PROFILE	1. LAYER	-2,87	1840
	2.LAYER	-12,85	3760
	3.LAYER		8536
2_PROFILE	1. LAYER	-2,54	1647
	2. LAYER	-7,97	3245
	3. LAYER		6540
3_PROFILE	1. LAYER	-2,46	2891
	2. LAYER	-7,73	3802
	3. LAYER		8748
4_PROFILE	1. LAYER	-2,45	1739
	2. LAYER	-7,71	3438
	3. LAYER		6428
5_PROFILE	1. LAYER	-4,84	1979
	2. LAYER	-15,21	2804
	3. LAYER		5716
6_PROFILE	1. LAYER	-3,12	1810
	2. LAYER	-9,80	4140
	3. LAYER		7870

The above table shows the Modulus of Subgrade Reaction obtained for each layer in the direction of the data obtained after the seismic measurements made in the study area.

5.25.8.12. WTG12 Road Modulus of Subgrade Reaction – D Y K (ton/m³)

Modulus of Subgrade Reaction			
PROFILES	LAYERS	DEPTH	D Y K (ton/m³)
1_PROFILE	1. LAYER	-3,18	2948
	2.LAYER	-14,25	4032
	3.LAYER		8526
2_PROFILE	1. LAYER	-4,33	4203
	2. LAYER	-19,37	3455
	3. LAYER		8553
3_PROFILE	1. LAYER	-2,55	2960
	2. LAYER	-11,40	5404
	3. LAYER		12414
4_PROFILE	1. LAYER	-4,44	2886
	2. LAYER	-19,85	2556
	3. LAYER		5787
5_PROFILE	1. LAYER	-2,72	2231
	2. LAYER	-8,55	3562
	3. LAYER		7584

The above table shows the Modulus of Subgrade Reaction obtained for each layer in the direction of the data obtained after the seismic measurements made in the study area.

5.25.8.13. WTG13 Road Modulus of Subgrade Reaction – D Y K (ton/m³)

Modulus of Subgrade Reaction			
PROFILES	LAYERS	DEPTH	D Y K (ton/m³)
1_PROFILE	1. LAYER	-4,20	3473
	2.LAYER	-13,19	4670
	3.LAYER		9873
2_PROFILE	1. LAYER	-6,28	3196
	2. LAYER	-14,40	5342
	3. LAYER		10121
3_PROFILE	1. LAYER	-6,66	2203
	2. LAYER	-20,95	4257
	3. LAYER		7953
4_PROFILE	1. LAYER	-3,55	2524
	2. LAYER	-11,16	3482
	3. LAYER		6889
5_PROFILE	1. LAYER	-1,72	1464
	2. LAYER	-7,69	3251
	3. LAYER		6819

The above table shows the Modulus of Subgrade Reaction obtained for each layer in the direction of the data obtained after the seismic measurements made in the study area.

5.25.8.14. WTG14 Road Modulus of Subgrade Reaction – D Y K (ton/m³)

Modulus of Subgrade Reaction			
PROFILES	LAYERS	DEPTH	D Y K (ton/m³)
1_PROFILE	1. LAYER	-3,26	3145
	2.LAYER	-14,61	6167
	3.LAYER		14375
2_PROFILE	1. LAYER	-2,29	1967
	2. LAYER	-10,27	4432
	3. LAYER		8923
3_PROFILE	1. LAYER	-2,78	3411
	2. LAYER	-12,43	3598
	3. LAYER		8383
4_PROFILE	1. LAYER	-2,45	2440
	2. LAYER	-10,97	5351
	3. LAYER		12837
5_PROFILE	1. LAYER	-3,58	3353
	2. LAYER	-11,27	6765
	3. LAYER		13429
6_PROFILE	1. LAYER	-3,35	2887
	2. LAYER	-10,54	6269
	3. LAYER		12598
7_PROFILE	1. LAYER	-5,59	2283
	2.LAYER	-12,82	3324
	3.LAYER		7522
8_PROFILE	1. LAYER	-4,84	2670
	2. LAYER	-11,10	3885
	3. LAYER		7371
9_PROFILE	1. LAYER	-3,11	4904
	2. LAYER	-9,76	4752
	3. LAYER		12092
10_PROFILE	1. LAYER	-4,22	2586

	2. LAYER	-13,26	4530
	3. LAYER		8419
11_PROFILE	1. LAYER	-3,99	3388
	2. LAYER	-12,55	2735
	3. LAYER		6301

The above table shows the Modulus of Subgrade Reaction obtained for each layer in the direction of the data obtained after the seismic measurements made in the study area.

5.25.8.15. WTG15 Road Modulus of Subgrade Reaction – D Y K (ton/m³)

Modulus of Subgrade Reaction			
PROFILES	LAYERS	DEPTH	D Y K (ton/m³)
1_PROFILE	1. LAYER	-4,23	2703
	2.LAYER	-13,30	4325
	3.LAYER		7645
2_PROFILE	1. LAYER	-3,50	1832
	2. LAYER	-15,65	2888
	3. LAYER		5543
3_PROFILE	1. LAYER	-2,77	3198
	2. LAYER	-12,40	4239
	3. LAYER		10926
4_PROFILE	1. LAYER	-3,56	2955
	2. LAYER	-11,19	4381
	3. LAYER		9121
5_PROFILE	1. LAYER	-3,34	3243
	2. LAYER	-10,50	3713
	3. LAYER		7151
6_PROFILE	1. LAYER	-3,10	2572
	2. LAYER	-9,75	4234
	3. LAYER		8024
7_PROFILE	1. LAYER	-2,80	2187
	2.LAYER	-8,81	2350
	3.LAYER		5012
8_PROFILE	1. LAYER	-3,94	2755
	2. LAYER	-12,40	3083
	3. LAYER		6752
9_PROFILE	1. LAYER	-6,66	4244
	2. LAYER	-15,25	7511
	3. LAYER		14672
10_PROFILE	1. LAYER	-8,12	2802
	2. LAYER	-18,61	5442
	3. LAYER		10120
11_PROFILE	1. LAYER	-5,54	2933
	2. LAYER	-17,40	6796
	3. LAYER		13891
12_PROFILE	1. LAYER	-3,48	2567
	2. LAYER	-10,94	3967
	3. LAYER		8852
13_PROFILE	1. LAYER	-3,13	1557
	2. LAYER	-9,85	3783
	3. LAYER		6703
14_PROFILE	1. LAYER	-3,34	1561
	2. LAYER	-14,94	3817
	3. LAYER		5713
15_PROFILE	1. LAYER	-3,48	1820
	2. LAYER	-15,60	3892
	3. LAYER		8096

16_PROFILE	1. LAYER	-2,87	2891
	2. LAYER	-12,85	5763
	3. LAYER		14209
17_PROFILE	1. LAYER	-5,81	3149
	2.LAYER	-18,27	5813
	3.LAYER		12825
18_PROFILE	1. LAYER	-4,83	2518
	2. LAYER	-15,19	4266
	3. LAYER		9389

The above table shows the Modulus of Subgrade Reaction obtained for each layer in the direction of the data obtained after the seismic measurements made in the study area.

5.25.8.16. WTG16 Road Modulus of Subgrade Reaction – D Y K (ton/m³)

Modulus of Subgrade Reaction			
PROFILES	LAYERS	DEPTH	D Y K (ton/m³)
1_PROFILE	1. LAYER	-2,78	1404
	2.LAYER	-8,75	2667
	3.LAYER		5476
2_PROFILE	1. LAYER	-4,28	1785
	2. LAYER	-19,17	3340
	3. LAYER		7062
3_PROFILE	1. LAYER	-6,18	1779
	2. LAYER	-19,43	3880
	3. LAYER		7752
4_PROFILE	1. LAYER	-2,89	1396
	2. LAYER	-12,92	2306
	3. LAYER		5079
5_PROFILE	1. LAYER	-3,43	1130
	2. LAYER	-15,35	2769
	3. LAYER		5635
6_PROFILE	1. LAYER	-3,75	2081
	2. LAYER	-16,78	3648
	3. LAYER		7210
7_PROFILE	1. LAYER	-2,29	1532
	2.LAYER	-10,26	3779
	3.LAYER		7756
8_PROFILE	1. LAYER	-3,33	2219
	2. LAYER	-10,48	3959
	3. LAYER		8121
9_PROFILE	1. LAYER	-4,48	3406
	2. LAYER	-14,07	7337
	3. LAYER		15913
10_PROFILE	1. LAYER	-6,87	5295
	2. LAYER	-21,60	4002
	3. LAYER		9881
11_PROFILE	1. LAYER	-3,93	2579
	2. LAYER	-26,63	6471
	3. LAYER		14036
12_PROFILE	1. LAYER	-2,18	1441
	2. LAYER	-14,74	3402
	3. LAYER		7636
13_PROFILE	1. LAYER	-3,89	1294
	2. LAYER	-17,40	3065
	3. LAYER		6621
14_PROFILE	1. LAYER	-4,44	3069
	2. LAYER	-10,17	5627

	3. LAYER		10414
15_PROFILE	1. LAYER	-4,63	2362
	2. LAYER	-14,57	5064
	3. LAYER		10184
16_PROFILE	1. LAYER	-6,05	3566
	2. LAYER	-19,02	7819
	3. LAYER		16278
17_PROFILE	1. LAYER	-2,56	1940
	2.LAYER	-8,05	3950
	3.LAYER		7697
18_PROFILE	1. LAYER	-6,05	2140
	2. LAYER	-27,07	4442
	3. LAYER		8557
19_PROFILE	1. LAYER	-9,75	3724
	2. LAYER	-30,66	5283
	3. LAYER		10552

The above table shows the Modulus of Subgrade Reaction obtained for each layer in the direction of the data obtained after the seismic measurements made in the study area.

5.25.8.17. WTG17 Road Modulus of Subgrade Reaction – D Y K (ton/m^3)

Modulus of Subgrade Reaction			
PROFILES	LAYERS	DEPTH	D Y K (ton/m^3)
1_PROFILE	1. LAYER	-7,19	2183
	2.LAYER	-16,48	4138
	3.LAYER		7344
2_PROFILE	1. LAYER	-2,18	1607
	2. LAYER	-9,77	1768
	3. LAYER		2966
3_PROFILE	1. LAYER	-4,10	1973
	2. LAYER	-18,33	3698
	3. LAYER		7678
4_PROFILE	1. LAYER	-3,52	1193
	2. LAYER	-15,77	3153
	3. LAYER		6283
5_PROFILE	1. LAYER	-12,11	1674
	2. LAYER	-27,75	2358
	3. LAYER		3532

The above table shows the Modulus of Subgrade Reaction obtained for each layer in the direction of the data obtained after the seismic measurements made in the study area.

5.25.8.18. WTG18 Road Modulus of Subgrade Reaction – D Y K (ton/m^3)

Modulus of Subgrade Reaction			
PROFILES	LAYERS	DEPTH	D Y K (ton/m^3)
1_PROFILE	1. LAYER	-6,61	3066
	2.LAYER	-29,60	5376
	3.LAYER		10974
2_PROFILE	1. LAYER	-3,64	2248
	2. LAYER	-16,30	4014
	3. LAYER		9485
3_PROFILE	1. LAYER	-3,66	1881
	2. LAYER	-16,37	3580
	3. LAYER		7453
4_PROFILE	1. LAYER	-4,98	1208
	2. LAYER	-33,73	2568
	3. LAYER		5374

5_PROFILE	1. LAYER	-1,56	683
	2. LAYER	-10,57	1924
	3. LAYER		4138
6_PROFILE	1. LAYER	-2,52	878
	2. LAYER	-11,29	1682
	3. LAYER		2996
7_PROFILE	1. LAYER	-6,37	1136
	2.LAYER	-20,02	2459
	3.LAYER		4485
8_PROFILE	1. LAYER	-6,29	1268
	2. LAYER	-28,17	3492
	3. LAYER		6760
9_PROFILE	1. LAYER	-4,59	2294
	2. LAYER	-31,09	4701
	3. LAYER		11108
10_PROFILE	1. LAYER	-4,19	1424
	2. LAYER	-28,36	2795
	3. LAYER		5816
11_PROFILE	1. LAYER	-2,41	1127
	2. LAYER	-16,31	2286
	3. LAYER		5497

The above table shows the Modulus of Subgrade Reaction obtained for each layer in the direction of the data obtained after the seismic measurements made in the study area.

5.25.8.19. WTG19 Road Modulus of Subgrade Reaction – D Y K (ton/m³)

Modulus of Subgrade Reaction			
P ROFILES	LAYERS	DEPTH	D Y K (ton/m³)
1_PROFILE	1. LAYER	-3,22	3338
	2.LAYER	-14,43	7761
	3.LAYER		17619
2_PROFILE	1. LAYER	-3,30	1276
	2. LAYER	-22,34	2724
	3. LAYER		5610
3_PROFILE	1. LAYER	-4,61	1092
	2. LAYER	-20,65	1487
	3. LAYER		2928
4_PROFILE	1. LAYER	-3,04	1559
	2. LAYER	-20,57	3792
	3. LAYER		7923

The above table shows the Modulus of Subgrade Reaction obtained for each layer in the direction of the data obtained after the seismic measurements made in the study area.

5.25.8.20. WTG20 Road Modulus of Subgrade Reaction – D Y K (ton/m³)

Modulus of Subgrade Reaction			
PROFILES	LAYERS	DEPTH	D Y K (ton/m³)
1_PROFILE	1. LAYER	-8,11	1310
	2.LAYER	-25,49	2510
	3.LAYER		4530
2_PROFILE	1. LAYER	-5,30	1305
	2. LAYER	-16,65	3671
	3. LAYER		6441
3_PROFILE	1. LAYER	-6,61	1753
	2. LAYER	-29,56	4351

	3. LAYER		8611
4_PROFILE	1. LAYER	-2,19	1023
	2. LAYER	-14,82	2692
	3. LAYER		5745

The above table shows the Modulus of Subgrade Reaction obtained for each layer in the direction of the data obtained after the seismic measurements made in the study area.

5.25.8.21. WTG21 Road Modulus of Subgrade Reaction – D Y K (ton/m³)

Modulus of Subgrade Reaction			
PROFILES	LAYERS	DEPTH	D Y K (ton/m³)
1_PROFILE	1. LAYER	-5,93	1092
	2.LAYER	-18,64	2159
	3.LAYER		3721
2_PROFILE	1. LAYER	-3,36	3063
	2. LAYER	-15,06	6439
	3. LAYER		15194
3_PROFILE	1. LAYER	-2,18	3801
	2. LAYER	-14,76	5069
	3. LAYER		11860
4_PROFILE	1. LAYER	-6,15	2801
	2. LAYER	-19,32	5711
	3. LAYER		10936
5_PROFILE	1. LAYER	-5,57	3341
	2. LAYER	-12,76	2750
	3. LAYER		6462
6_PROFILE	1. LAYER	-6,22	2063
	2. LAYER	-14,25	2935
	3. LAYER		5638

The above table shows the Modulus of Subgrade Reaction obtained for each layer in the direction of the data obtained after the seismic measurements made in the study area.

5.25.8.22. WTG22 Road Modulus of Subgrade Reaction – D Y K (ton/m³)

Modulus of Subgrade Reaction			
PROFILES	LAYERS	DEPTH	D Y K (ton/m³)
1_PROFILE	1. LAYER	-6,00	4001
	2.LAYER	-26,85	4808
	3.LAYER		9439
2_PROFILE	1. LAYER	-3,78	2492
	2. LAYER	-16,92	4827
	3. LAYER		9664
3_PROFILE	1. LAYER	-3,56	3008
	2. LAYER	-15,94	5464
	3. LAYER		12651
4_PROFILE	1. LAYER	-3,89	2418
	2. LAYER	-17,42	5328
	3. LAYER		12577

The above table shows the Modulus of Subgrade Reaction obtained for each layer in the direction of the data obtained after the seismic measurements made in the study area.

5.25.8.23. WTG23 Road Modulus of Subgrade Reaction – D Y K (ton/m³)

Modulus of Subgrade Reaction			
PROFILES	LAYERS	DEPTH	D Y K (ton/m³)
1_PROFILE	1. LAYER	-2,94	2002
	2.LAYER	-19,90	3638
	3.LAYER		7525
2_PROFILE	1. LAYER	-4,61	3834
	2. LAYER	-20,61	6171
	3. LAYER		14188
3_PROFILE	1. LAYER	-4,22	3273
	2. LAYER	-18,89	7573
	3. LAYER		16041

The above table shows the Modulus of Subgrade Reaction obtained for each layer in the direction of the data obtained after the seismic measurements made in the study area.

5.25.8.24. Substation Road Modulus of Subgrade Reaction – D Y K (ton/m³)

Modulus of Subgrade Reaction			
PROFILES	LAYERS	DEPTH	D Y K (ton/m³)
1_PROFILE	1. LAYER	-5,90	4656
	2.LAYER	-26,41	7022
	3.LAYER		15252

The above table shows the Modulus of Subgrade Reaction obtained for each layer in the direction of the data obtained after the seismic measurements made in the study area.

5.25.9. Bearing Capacity qu (kg/cm^2) / Allowable Bearing Capacity qa (kg/cm^2)

5.25.9.1. WTG01 Road Bearing Capacity qu (kg/cm2) Allowable Bearing Capacity qa (kg/cm2)

PROFILES	LAYERS	DEPTH	BEARING CAPACITY (qu,kg/cm^2)	ALLOWABLE BEARING CAPACITY (qa,kg/cm^2)
1_PROFILE	1. LAYER	-3,24	4,63	1,54
	2.LAYER	-10,20	7,94	2,65
	3.LAYER	-39,80	15,22	5,07
2_PROFILE	1. LAYER	-2,45	5,21	1,74
	2. LAYER	-10,98	6,67	2,22
	3. LAYER	-39,02	13,51	4,50
3_PROFILE	1. LAYER	-1,74	4,09	1,36
	2. LAYER	-7,79	8,82	2,94
	3. LAYER	-42,21	20,69	6,90
4_PROFILE	1. LAYER	-5,92	4,78	1,59
	2. LAYER	-26,50	10,69	3,56
	3. LAYER	-23,50	22,86	7,62
5_PROFILE	1. LAYER	-3,19	5,67	1,89
	2. LAYER	-14,28	13,04	4,35
	3. LAYER	-35,72	31,60	10,53
6_PROFILE	1. LAYER	-2,50	3,10	1,03
	2. LAYER	-11,19	8,28	2,76
	3. LAYER	-38,81	16,26	5,42
7_PROFILE	1. LAYER	-5,47	4,20	1,40
	2.LAYER	-17,21	6,72	2,24
	3.LAYER	-32,79	14,48	4,83
8_PROFILE	1. LAYER	-2,61	2,95	0,98
	2. LAYER	-11,68	7,26	2,42
	3. LAYER	-38,32	14,94	4,98
9_PROFILE	1. LAYER	-2,76	3,05	1,02
	2. LAYER	-12,34	7,01	2,34
	3. LAYER	-37,66	14,18	4,73

5.25.9.2. WTG02 Road Bearing Capacity qu (kg/cm2) Allowable Bearing Capacity qa (kg/cm2)

PROFILES	LAYERS	DEPTH	BEARING CAPACITY (qu,kg/cm^2)	ALLOWABLE BEARING CAPACITY (qa,kg/cm^2)
1_PROFILE	1. LAYER	-6,19	7,10	2,37
	2.LAYER	-19,45	5,88	1,96
	3.LAYER	-30,55	13,42	4,47
2_PROFILE	1. LAYER	-6,03	7,28	2,43
	2. LAYER	-18,97	7,24	2,41
	3. LAYER	-31,03	17,72	5,91
3_PROFILE	1. LAYER	-2,70	2,80	0,93
	2. LAYER	-12,07	6,94	2,31
	3. LAYER	-37,93	14,08	4,69
4_PROFILE	1. LAYER	-5,56	6,81	2,27
	2. LAYER	-12,74	12,92	4,31
	3. LAYER	-37,26	22,11	7,37
5_PROFILE	1. LAYER	-3,53	5,96	1,99
	2. LAYER	-11,09	10,22	3,41
	3. LAYER	-38,91	23,30	7,77
6_PROFILE	1. LAYER	-3,89	5,76	1,92
	2. LAYER	-12,22	13,43	4,48

	3. LAYER	-37,78	26,08	8,69
7_PROFILE	1. LAYER	-2,59	5,26	1,75
	2.LAYER	-8,14	11,35	3,78
	3.LAYER	-41,86	23,07	7,69

5.25.9.3. WTG03 Road Bearing Capacity qu (kg/cm2) Allowable Bearing Capacity qa (kg/cm2)

PROFILES	LAYERS	DEPTH	BEARING CAPACITY (qu,kg/cm^2)	ALLOWABLE BEARING CAPACITY (qa,kg/cm^2)
1_PROFILE	1. LAYER	-3,83	4,05	1,35
	2.LAYER	-25,93	10,29	3,43
	3.LAYER	-24,07	22,48	7,49
2_PROFILE	1. LAYER	-2,13	10,51	3,50
	2. LAYER	-9,55	23,88	7,96
	3. LAYER	-40,45	55,47	18,49
3_PROFILE	1. LAYER	-3,91	5,36	1,79
	2. LAYER	-17,48	13,31	4,44
	3. LAYER	-32,52	29,84	9,95
4_PROFILE	1. LAYER	-3,55	6,95	2,32
	2. LAYER	-15,87	9,91	3,30
	3. LAYER	-34,13	21,47	7,16
5_PROFILE	1. LAYER	-5,99	5,69	1,90
	2. LAYER	-13,73	11,71	3,90
	3. LAYER	-36,27	21,81	7,27
6_PROFILE	1. LAYER	-1,87	3,62	1,21
	2. LAYER	-5,88	7,83	2,61
	3. LAYER	-44,12	14,71	4,90

5.25.9.4. WTG04 Road Bearing Capacity qu (kg/cm2) Allowable Bearing Capacity qa (kg/cm2)

PROFILES	LAYERS	DEPTH	BEARING CAPACITY (qu,kg/cm^2)	ALLOWABLE BEARING CAPACITY (qa,kg/cm^2)
1_PROFILE	1. LAYER	-3,50	6,74	2,25
	2.LAYER	-11,01	13,33	4,44
	3.LAYER	-38,99	27,52	9,17
2_PROFILE	1. LAYER	-2,30	4,17	1,39
	2. LAYER	-10,29	8,20	2,73
	3. LAYER	-39,71	16,61	5,54
3_PROFILE	1. LAYER	-2,51	8,96	2,99
	2. LAYER	-11,21	10,74	3,58
	3. LAYER	-38,79	25,19	8,40
4_PROFILE	1. LAYER	-5,32	7,00	2,33
	2. LAYER	-16,73	12,83	4,28
	3. LAYER	-33,27	25,52	8,51
5_PROFILE	1. LAYER	-8,00	5,44	1,81
	2. LAYER	-25,15	13,57	4,52
	3. LAYER	-24,85	25,77	8,59
6_PROFILE	1. LAYER	-4,02	4,40	1,47
	2. LAYER	-12,65	10,46	3,49
	3. LAYER	-37,35	22,98	7,66
7_PROFILE	1. LAYER	-7,02	15,74	5,25
	2.LAYER	-31,40	32,45	10,82
	3.LAYER	-18,60	70,53	23,51
8_PROFILE	1. LAYER	-4,63	8,56	2,85

	2. LAYER	-20,71	14,53	4,84
	3. LAYER	-29,29	29,25	9,75
9_PROFILE	1. LAYER	-3,49	4,59	1,53
	2. LAYER	-10,97	7,95	2,65
	3. LAYER	-39,03	16,14	5,38
10_PROFILE	1. LAYER	-4,84	5,59	1,86
	2. LAYER	-11,09	8,08	2,69
	3. LAYER	-38,91	14,63	4,88

5.25.9.5. WTG05 Road Bearing Capacity qu (kg/cm2) Allowable Bearing Capacity qa (kg/cm2)

PROFILES	LAYERS	DEPTH	BEARING CAPACITY (qu,kg/cm^2)	ALLOWABLE BEARING CAPACITY (qa,kg/cm^2)
1_PROFILE	1. LAYER	-3,27	5,52	1,84
	2.LAYER	-10,28	9,39	3,13
	3.LAYER	-39,72	18,89	6,30
2_PROFILE	1. LAYER	-3,00	7,58	2,53
	2. LAYER	-13,44	16,66	5,55
	3. LAYER	-36,56	38,80	12,93
3_PROFILE	1. LAYER	-3,04	4,18	1,39
	2. LAYER	-13,59	9,75	3,25
	3. LAYER	-36,41	20,35	6,78
4_PROFILE	1. LAYER	-4,54	3,95	1,32
	2. LAYER	-20,31	6,71	2,24
	3. LAYER	-29,69	13,09	4,36
5_PROFILE	1. LAYER	-3,85	5,10	1,70
	2. LAYER	-8,82	10,75	3,58
	3. LAYER	-41,18	21,13	7,04
6_PROFILE	1. LAYER	-3,84	7,89	2,63
	2. LAYER	-12,08	13,32	4,44
	3. LAYER	-37,92	28,31	9,44
7_PROFILE	1. LAYER	-3,44	7,82	2,61
	2.LAYER	-15,37	14,65	4,88
	3.LAYER	-34,63	34,89	11,63

5.25.9.6. WTG06 Road Bearing Capacity qu (kg/cm2) Allowable Bearing Capacity qa (kg/cm2)

PROFILES	LAYERS	DEPTH	BEARING CAPACITY (qu,kg/cm^2)	ALLOWABLE BEARING CAPACITY (qa,kg/cm^2)
1_PROFILE	1. LAYER	-2,20	6,52	2,17
	2.LAYER	-14,88	13,25	4,42
	3.LAYER	-35,12	33,34	11,11
2_PROFILE	1. LAYER	-3,78	7,47	2,49
	2. LAYER	-16,91	14,78	4,93
	3. LAYER	-33,09	33,21	11,07
3_PROFILE	1. LAYER	-3,85	8,89	2,96
	2. LAYER	-17,25	13,30	4,43
	3. LAYER	-32,75	30,45	10,15
4_PROFILE	1. LAYER	-6,77	9,57	3,19
	2. LAYER	-15,52	15,37	5,12
	3. LAYER	-34,48	25,46	8,49
5_PROFILE	1. LAYER	-3,48	5,40	1,80
	2. LAYER	-10,93	13,10	4,37
	3. LAYER	-39,07	25,65	8,55

6_PROFILE	1. LAYER	-4,23	8,35	2,78
	2. LAYER	-13,29	17,77	5,92
	3. LAYER	-36,71	35,93	11,98
7_PROFILE	1. LAYER	-5,14	8,60	2,87
	2.LAYER	-11,77	18,03	6,01
	3.LAYER	-38,23	31,37	10,46
8_PROFILE	1. LAYER	-3,86	7,79	2,60
	2. LAYER	-12,14	15,07	5,02
	3. LAYER	-37,86	28,05	9,35
9_PROFILE	1. LAYER	-6,26	9,52	3,17
	2. LAYER	-19,69	21,54	7,18
	3. LAYER	-30,31	40,27	13,42
10_PROFILE	1. LAYER	-4,26	6,46	2,15
	2. LAYER	-13,39	13,10	4,37
	3. LAYER	-36,61	26,37	8,79
11_PROFILE	1. LAYER	-5,84	8,71	2,90
	2. LAYER	-18,35	14,45	4,82
	3. LAYER	-31,65	31,82	10,61

5.25.9.7. WTG07 Road Bearing Capacity qu (kg/cm2) Allowable Bearing Capacity qa (kg/cm2)

PROFILES	LAYERS	DEPTH	BEARING CAPACITY (qu,kg/cm^2)	ALLOWABLE BEARING CAPACITY (qa,kg/cm^2)
1_PROFILE	1. LAYER	-5,46	5,51	1,84
	2.LAYER	-17,16	8,65	2,88
	3.LAYER	-32,84	14,77	4,92
2_PROFILE	1. LAYER	-5,57	6,12	2,04
	2. LAYER	-17,51	14,80	4,93
	3. LAYER	-32,49	30,76	10,25
3_PROFILE	1. LAYER	-5,53	5,32	1,77
	2. LAYER	-17,38	8,32	2,77
	3. LAYER	-32,62	16,48	5,49
4_PROFILE	1. LAYER	-2,72	6,29	2,10
	2. LAYER	-8,55	11,70	3,90
	3. LAYER	-41,45	24,68	8,23
5_PROFILE	1. LAYER	-2,67	6,39	2,13
	2. LAYER	-8,39	12,27	4,09
	3. LAYER	-41,61	28,65	9,55
6_PROFILE	1. LAYER	-2,29	5,94	1,98
	2. LAYER	-10,25	13,47	4,49
	3. LAYER	-39,75	28,63	9,54
7_PROFILE	1. LAYER	-2,86	6,53	2,18
	2.LAYER	-6,55	11,63	3,88
	3.LAYER	-43,45	19,20	6,40
8_PROFILE	1. LAYER	-2,52	6,09	2,03
	2. LAYER	-11,29	14,51	4,84
	3. LAYER	-38,71	29,09	9,70
9_PROFILE	1. LAYER	-2,85	11,33	3,78
	2. LAYER	-12,76	27,90	9,30
	3. LAYER	-37,24	72,96	24,32
10_PROFILE	1. LAYER	-2,84	7,10	2,37
	2. LAYER	-8,91	14,68	4,89
	3. LAYER	-41,09	30,23	10,08
11_PROFILE	1. LAYER	-2,53	6,77	2,26
	2. LAYER	-11,33	15,14	5,05
	3. LAYER	-38,67	33,21	11,07
12_PROFILE	1. LAYER	-3,82	10,55	3,52

	2. LAYER	-17,11	12,62	4,21
	3. LAYER	-32,89	30,01	10,00
13_PROFILE	1. LAYER	-2,07	8,21	2,74
	2. LAYER	-13,99	18,35	6,12
	3. LAYER	-36,01	46,48	15,49
14_PROFILE	1. LAYER	-3,80	9,30	3,10
	2. LAYER	-11,96	17,60	5,87
	3. LAYER	-38,04	39,76	13,25
15_PROFILE	1. LAYER	-4,71	6,86	2,29
	2. LAYER	-10,80	12,50	4,17
	3. LAYER	-39,20	21,58	7,19
16_PROFILE	1. LAYER	-7,20	5,61	1,87
	2. LAYER	-16,50	10,02	3,34
	3. LAYER	-33,50	17,46	5,82
17_PROFILE	1. LAYER	-5,07	5,52	1,84
	2.LAYER	-15,93	8,04	2,68
	3.LAYER	-34,07	16,29	5,43
18_PROFILE	1. LAYER	-4,90	5,62	1,87
	2. LAYER	-15,40	8,71	2,90
	3. LAYER	-34,60	18,36	6,12
19_PROFILE	1. LAYER	-2,17	7,40	2,47
	2. LAYER	-9,73	14,56	4,85
	3. LAYER	-40,27	33,23	11,08
20_PROFILE	1. LAYER	-5,73	9,03	3,01
	2. LAYER	-13,14	15,02	5,01
	3. LAYER	-36,86	27,13	9,04
21_PROFILE	1. LAYER	-7,08	3,44	1,15
	2. LAYER	-16,23	8,21	2,74
	3. LAYER	-33,77	13,58	4,53
22_PROFILE	1. LAYER	-8,64	5,25	1,75
	2. LAYER	-19,80	11,55	3,85
	3. LAYER	-30,20	20,63	6,88
23_PROFILE	1. LAYER	-7,13	5,51	1,84
	2. LAYER	-16,34	11,30	3,77
	3. LAYER	-33,66	19,60	6,53
24_PROFILE	1. LAYER	-4,08	6,30	2,10
	2. LAYER	-12,84	11,12	3,71
	3. LAYER	-37,16	21,54	7,18

5.25.9.8. WTG08 Road Bearing Capacity qu (kg/cm2) Allowable Bearing Capacity qa (kg/cm2)

PROFILES	LAYERS	DEPTH	BEARING CAPACITY (qu,kg/cm^2)	ALLOWABLE BEARING CAPACITY (qa,kg/cm^2)
1_PROFILE	1. LAYER	-2,92	8,02	2,67
	2.LAYER	-13,06	8,72	2,91
	3.LAYER	-36,94	19,62	6,54
2_PROFILE	1. LAYER	-2,91	7,10	2,37
	2. LAYER	-13,00	14,34	4,78
	3. LAYER	-37,00	29,96	9,99
3_PROFILE	1. LAYER	-4,21	6,37	2,12
	2. LAYER	-18,84	16,37	5,46
	3. LAYER	-31,16	36,64	12,21
4_PROFILE	1. LAYER	-4,67	7,33	2,44
	2. LAYER	-10,71	13,62	4,54
	3. LAYER	-39,29	25,48	8,49

5_PROFILE	1. LAYER	-8,27	10,42	3,47
	2. LAYER	-18,95	19,67	6,56
	3. LAYER	-31,05	37,33	12,44
6_PROFILE	1. LAYER	-8,21	9,51	3,17
	2. LAYER	-18,80	18,58	6,19
	3. LAYER	-31,20	34,18	11,39
7_PROFILE	1. LAYER	-4,01	4,10	1,37
	2.LAYER	-12,62	7,67	2,56
	3.LAYER	-37,38	14,82	4,94
8_PROFILE	1. LAYER	-3,31	5,62	1,87
	2. LAYER	-7,58	10,52	3,51
	3. LAYER	-42,42	19,72	6,57
9_PROFILE	1. LAYER	-6,12	7,55	2,52
	2. LAYER	-14,04	13,21	4,40
	3. LAYER	-35,96	24,07	8,02
10_PROFILE	1. LAYER	-5,68	4,69	1,56
	2. LAYER	-17,86	9,54	3,18
	3. LAYER	-32,14	16,95	5,65
11_PROFILE	1. LAYER	-2,81	6,12	2,04
	2. LAYER	-12,58	15,13	5,04
	3. LAYER	-37,42	32,07	10,69
12_PROFILE	1. LAYER	-3,78	6,00	2,00
	2. LAYER	-11,88	11,78	3,93
	3. LAYER	-38,12	23,70	7,90

5.25.9.9. WTG09 Road Bearing Capacity qu (kg/cm2) Allowable Bearing Capacity qa (kg/cm2)

PROFILES	LAYERS	DEPTH	BEARING CAPACITY (qu,kg/cm^2)	ALLOWABLE BEARING CAPACITY (qa,kg/cm^2)
1_PROFILE	1. LAYER	-4,73	8,21	2,74
	2.LAYER	-14,88	19,46	6,49
	3.LAYER	-35,12	39,87	13,29
2_PROFILE	1. LAYER	-2,44	7,71	2,57
	2. LAYER	-10,90	12,53	4,18
	3. LAYER	-39,10	26,21	8,74
3_PROFILE	1. LAYER	-3,38	6,05	2,02
	2. LAYER	-15,14	10,67	3,56
	3. LAYER	-34,86	25,79	8,60
4_PROFILE	1. LAYER	-2,56	5,50	1,83
	2. LAYER	-11,48	9,67	3,22
	3. LAYER	-38,52	18,07	6,02
5_PROFILE	1. LAYER	-4,36	7,31	2,44
	2. LAYER	-19,53	13,66	4,55
	3. LAYER	-30,47	29,94	9,98
6_PROFILE	1. LAYER	-4,45	2,74	0,91
	2. LAYER	-19,93	7,69	2,56
	3. LAYER	-30,07	14,83	4,94
7_PROFILE	1. LAYER	-1,96	3,26	1,09
	2.LAYER	-8,77	8,45	2,82
	3.LAYER	-41,23	18,20	6,07

5.25.9.10. WTG10 Road Bearing Capacity qu (kg/cm2) Allowable Bearing Capacity qa (kg/cm2)

PROFILES	LAYERS	DEPTH	BEARING CAPACITY (qu,kg/cm^2)	ALLOWABLE BEARING CAPACITY (qa,kg/cm^2)
1_PROFILE	1. LAYER	-4,06	3,66	1,22
	2.LAYER	-12,76	7,21	2,40
	3.LAYER	-37,24	13,23	4,41
2_PROFILE	1. LAYER	-4,54	4,49	1,50
	2. LAYER	-14,27	6,83	2,28
	3. LAYER	-35,73	12,58	4,19
3_PROFILE	1. LAYER	-3,18	6,63	2,21
	2. LAYER	-14,22	12,36	4,12
	3. LAYER	-35,78	27,85	9,28
4_PROFILE	1. LAYER	-4,45	8,38	2,79
	2. LAYER	-19,94	15,67	5,22
	3. LAYER	-30,06	31,81	10,60
5_PROFILE	1. LAYER	-4,35	5,82	1,94
	2. LAYER	-13,68	9,89	3,30
	3. LAYER	-36,32	18,95	6,32
6_PROFILE	1. LAYER	-5,13	6,85	2,28
	2. LAYER	-22,94	7,87	2,62
	3. LAYER	-27,06	17,00	5,67
7_PROFILE	1. LAYER	-2,83	6,12	2,04
	2.LAYER	-12,65	12,28	4,09
	3.LAYER	-37,35	32,46	10,82

5.25.9.11. WTG11 Road Bearing Capacity qu (kg/cm2) Allowable Bearing Capacity qa (kg/cm2)

PROFILES	LAYERS	DEPTH	BEARING CAPACITY (qu,kg/cm^2)	ALLOWABLE BEARING CAPACITY (qa,kg/cm^2)
1_PROFILE	1. LAYER	-2,87	4,60	1,53
	2.LAYER	-12,85	9,40	3,13
	3.LAYER	-37,15	21,34	7,11
2_PROFILE	1. LAYER	-2,54	4,12	1,37
	2. LAYER	-7,97	8,11	2,70
	3. LAYER	-42,03	16,35	5,45
3_PROFILE	1. LAYER	-2,46	7,23	2,41
	2. LAYER	-7,73	9,51	3,17
	3. LAYER	-42,27	21,87	7,29
4_PROFILE	1. LAYER	-2,45	4,35	1,45
	2. LAYER	-7,71	8,59	2,86
	3. LAYER	-42,29	16,07	5,36
5_PROFILE	1. LAYER	-4,84	4,95	1,65
	2. LAYER	-15,21	7,01	2,34
	3. LAYER	-34,79	14,29	4,76
6_PROFILE	1. LAYER	-3,12	4,53	1,51
	2. LAYER	-9,80	10,35	3,45
	3. LAYER	-40,20	19,68	6,56

5.25.9.12. WTG12 Road Bearing Capacity qu (kg/cm2) Allowable Bearing Capacity qa (kg/cm2)

PROFILES	LAYERS	DEPTH	BEARING CAPACITY (qu,kg/cm^2)	ALLOWABLE BEARING CAPACITY (qa,kg/cm^2)
1_PROFILE	1. LAYER	-3,18	7,37	2,46
	2.LAYER	-14,25	10,08	3,36
	3.LAYER	-35,75	21,31	7,10
2_PROFILE	1. LAYER	-4,33	10,51	3,50
	2. LAYER	-19,37	8,64	2,88
	3. LAYER	-30,63	21,38	7,13
3_PROFILE	1. LAYER	-2,55	7,40	2,47
	2. LAYER	-11,40	13,51	4,50
	3. LAYER	-38,60	31,03	10,34
4_PROFILE	1. LAYER	-4,44	7,21	2,40
	2. LAYER	-19,85	6,39	2,13
	3. LAYER	-30,15	14,47	4,82
5_PROFILE	1. LAYER	-2,72	5,58	1,86
	2. LAYER	-8,55	8,90	2,97
	3. LAYER	-41,45	18,96	6,32

5.25.9.13. WTG13 Road Bearing Capacity qu (kg/cm2) Allowable Bearing Capacity qa (kg/cm2)

PROFILES	LAYERS	DEPTH	BEARING CAPACITY (qu,kg/cm^2)	ALLOWABLE BEARING CAPACITY (qa,kg/cm^2)
1_PROFILE	1. LAYER	-4,20	8,68	2,89
	2.LAYER	-13,19	11,68	3,89
	3.LAYER	-36,81	24,68	8,23
2_PROFILE	1. LAYER	-6,28	7,99	2,66
	2. LAYER	-14,40	13,35	4,45
	3. LAYER	-35,60	25,30	8,43
3_PROFILE	1. LAYER	-6,66	5,51	1,84
	2. LAYER	-20,95	10,64	3,55
	3. LAYER	-29,05	19,88	6,63
4_PROFILE	1. LAYER	-3,55	6,31	2,10
	2. LAYER	-11,16	8,71	2,90
	3. LAYER	-38,84	17,22	5,74
5_PROFILE	1. LAYER	-1,72	3,66	1,22
	2. LAYER	-7,69	8,13	2,71
	3. LAYER	-42,31	17,05	5,68

5.25.9.14. WTG14 Road Bearing Capacity qu (kg/cm2) Allowable Bearing Capacity qa (kg/cm2)

PROFILES	LAYERS	DEPTH	BEARING CAPACITY (qu,kg/cm^2)	ALLOWABLE BEARING CAPACITY (qa,kg/cm^2)
1_PROFILE	1. LAYER	-3,26	7,86	2,62
	2.LAYER	-14,61	15,42	5,14
	3.LAYER	-35,39	35,94	11,98
2_PROFILE	1. LAYER	-2,29	4,92	1,64
	2. LAYER	-10,27	11,08	3,69
	3. LAYER	-39,73	22,31	7,44
3_PROFILE	1. LAYER	-2,78	8,53	2,84
	2. LAYER	-12,43	8,99	3,00
	3. LAYER	-37,57	20,96	6,99
4_PROFILE	1. LAYER	-2,45	6,10	2,03
	2. LAYER	-10,97	13,38	4,46
	3. LAYER	-39,03	32,09	10,70
5_PROFILE	1. LAYER	-3,58	8,38	2,79
	2. LAYER	-11,27	16,91	5,64
	3. LAYER	-38,73	33,57	11,19
6_PROFILE	1. LAYER	-3,35	7,22	2,41
	2. LAYER	-10,54	15,67	5,22
	3. LAYER	-39,46	31,50	10,50
7_PROFILE	1. LAYER	-5,59	5,71	1,90
	2.LAYER	-12,82	8,31	2,77
	3.LAYER	-37,18	18,80	6,27
8_PROFILE	1. LAYER	-4,84	6,68	2,23
	2. LAYER	-11,10	9,71	3,24
	3. LAYER	-38,90	18,43	6,14
9_PROFILE	1. LAYER	-3,11	12,26	4,09
	2. LAYER	-9,76	11,88	3,96
	3. LAYER	-40,24	30,23	10,08
10_PROFILE	1. LAYER	-4,22	6,47	2,16
	2. LAYER	-13,26	11,33	3,78
	3. LAYER	-36,74	21,05	7,02
11_PROFILE	1. LAYER	-3,99	8,47	2,82
	2. LAYER	-12,55	6,84	2,28
	3. LAYER	-37,45	15,75	5,25

5.25.9.15. WTG15 Road Bearing Capacity qu (kg/cm2) Allowable Bearing Capacity qa (kg/cm2)

PROFILES	LAYERS	DEPTH	BEARING CAPACITY (qu,kg/cm^2)	ALLOWABLE BEARING CAPACITY (qa,kg/cm^2)
1_PROFILE	1. LAYER	-4,23	6,76	2,25
	2.LAYER	-13,30	10,81	3,60
	3.LAYER	-36,70	19,11	6,37
2_PROFILE	1. LAYER	-3,50	4,58	1,53
	2. LAYER	-15,65	7,22	2,41
	3. LAYER	-34,35	13,86	4,62
3_PROFILE	1. LAYER	-2,77	7,99	2,66
	2. LAYER	-12,40	10,60	3,53
	3. LAYER	-37,60	27,32	9,11
4_PROFILE	1. LAYER	-3,56	7,39	2,46
	2. LAYER	-11,19	10,95	3,65
	3. LAYER	-38,81	22,80	7,60
5_PROFILE	1. LAYER	-3,34	8,11	2,70

	2. LAYER	-10,50	9,28	3,09
	3. LAYER	-39,50	17,88	5,96
6_PROFILE	1. LAYER	-3,10	6,43	2,14
	2. LAYER	-9,75	10,59	3,53
	3. LAYER	-40,25	20,06	6,69
7_PROFILE	1. LAYER	-2,80	5,47	1,82
	2.LAYER	-8,81	5,87	1,96
	3.LAYER	-41,19	12,53	4,18
8_PROFILE	1. LAYER	-3,94	6,89	2,30
	2. LAYER	-12,40	7,71	2,57
	3. LAYER	-37,60	16,88	5,63
9_PROFILE	1. LAYER	-6,66	10,61	3,54
	2. LAYER	-15,25	18,78	6,26
	3. LAYER	-34,75	36,68	12,23
10_PROFILE	1. LAYER	-8,12	7,01	2,34
	2. LAYER	-18,61	13,61	4,54
	3. LAYER	-31,39	25,30	8,43
11_PROFILE	1. LAYER	-5,54	7,33	2,44
	2. LAYER	-17,40	16,99	5,66
	3. LAYER	-32,60	34,73	11,58
12_PROFILE	1. LAYER	-3,48	6,42	2,14
	2. LAYER	-10,94	9,92	3,31
	3. LAYER	-39,06	22,13	7,38
13_PROFILE	1. LAYER	-3,13	3,89	1,30
	2. LAYER	-9,85	9,46	3,15
	3. LAYER	-40,15	16,76	5,59
14_PROFILE	1. LAYER	-3,34	3,90	1,30
	2. LAYER	-14,94	9,54	3,18
	3. LAYER	-35,06	14,28	4,76
15_PROFILE	1. LAYER	-3,48	4,55	1,52
	2. LAYER	-15,60	9,73	3,24
	3. LAYER	-34,40	20,24	6,75
16_PROFILE	1. LAYER	-2,87	7,23	2,41
	2. LAYER	-12,85	14,41	4,80
	3. LAYER	-37,15	35,52	11,84
17_PROFILE	1. LAYER	-5,81	7,87	2,62
	2.LAYER	-18,27	14,53	4,84
	3.LAYER	-31,73	32,06	10,69
18_PROFILE	1. LAYER	-4,83	6,29	2,10
	2. LAYER	-15,19	10,67	3,56
	3. LAYER	-34,81	23,47	7,82

5.25.9.16. WTG16 Road Bearing Capacity qu (kg/cm^2) Allowable Bearing Capacity qa (kg/cm^2)

PROFILES	LAYERS	DEPTH	BEARING CAPACITY (qu,kg/cm2)	ALLOWABLE BEARING CAPACITY (qa,kg/cm2)
1_PROFILE	1. LAYER	-2,78	3,51	1,17
	2.LAYER	-8,75	6,67	2,22
	3.LAYER		13,69	4,56
2_PROFILE	1. LAYER	-4,28	4,46	1,49
	2. LAYER	-19,17	8,35	2,78
	3. LAYER		17,66	5,89
3_PROFILE	1. LAYER	-6,18	4,45	1,48
	2. LAYER	-19,43	9,70	3,23
	3. LAYER		19,38	6,46
4_PROFILE	1. LAYER	-2,89	3,49	1,16
	2. LAYER	-12,92	5,77	1,92

	3. LAYER		12,70	4,23
5_PROFILE	1. LAYER	-3,43	2,83	0,94
	2. LAYER	-15,35	6,92	2,31
	3. LAYER		14,09	4,70
6_PROFILE	1. LAYER	-3,75	5,20	1,73
	2. LAYER	-16,78	9,12	3,04
	3. LAYER		18,03	6,01
7_PROFILE	1. LAYER	-2,29	3,83	1,28
	2.LAYER	-10,26	9,45	3,15
	3.LAYER		19,39	6,46
8_PROFILE	1. LAYER	-3,33	5,55	1,85
	2. LAYER	-10,48	9,90	3,30
	3. LAYER		20,30	6,77
9_PROFILE	1. LAYER	-4,48	8,52	2,84
	2. LAYER	-14,07	18,34	6,11
	3. LAYER		39,78	13,26
10_PROFILE	1. LAYER	-6,87	13,24	4,41
	2. LAYER	-21,60	10,01	3,34
	3. LAYER		24,70	8,23
11_PROFILE	1. LAYER	-3,93	6,45	2,15
	2. LAYER	-26,63	16,18	5,39
	3. LAYER		35,09	11,70
12_PROFILE	1. LAYER	-2,18	3,60	1,20
	2. LAYER	-14,74	8,50	2,83
	3. LAYER		19,09	6,36
13_PROFILE	1. LAYER	-3,89	3,24	1,08
	2. LAYER	-17,40	7,66	2,55
	3. LAYER		16,55	5,52
14_PROFILE	1. LAYER	-4,44	7,67	2,56
	2. LAYER	-10,17	14,07	4,69
	3. LAYER		26,03	8,68
15_PROFILE	1. LAYER	-4,63	5,90	1,97
	2. LAYER	-14,57	12,66	4,22
	3. LAYER		25,46	8,49
16_PROFILE	1. LAYER	-6,05	8,92	2,97
	2. LAYER	-19,02	19,55	6,52
	3. LAYER		40,69	13,56
17_PROFILE	1. LAYER	-2,56	4,85	1,62
	2.LAYER	-8,05	9,87	3,29
	3.LAYER		19,24	6,41
18_PROFILE	1. LAYER	-6,05	5,35	1,78
	2. LAYER	-27,07	11,10	3,70
	3. LAYER		21,39	7,13
19_PROFILE	1. LAYER	-9,75	9,31	3,10
	2. LAYER	-30,66	13,21	4,40
	3. LAYER		26,38	8,79

5.25.9.17. WTG17 Road Bearing Capacity qu (kg/cm2) Allowable Bearing Capacity qa (kg/cm2)

PROFILES	LAYERS	DEPTH	BEARING CAPACITY (qu,kg/cm^2)	ALLOWABLE BEARING CAPACITY (qa,kg/cm^2)
1_PROFILE	1. LAYER	-7,19	5,46	1,82
	2.LAYER	-16,48	10,35	3,45
	3.LAYER	-33,52	18,36	6,12
2_PROFILE	1. LAYER	-2,18	4,02	1,34
	2. LAYER	-9,77	4,42	1,47
	3. LAYER	-40,23	7,41	2,47

3_PROFILE	1. LAYER	-4,10	4,93	1,64
	2. LAYER	-18,33	9,25	3,08
	3. LAYER	-31,67	19,20	6,40
4_PROFILE	1. LAYER	-3,52	2,98	0,99
	2. LAYER	-15,77	7,88	2,63
	3. LAYER	-34,23	15,71	5,24
5_PROFILE	1. LAYER	-12,11	4,18	1,39
	2. LAYER	-27,75	5,89	1,96
	3. LAYER	-22,25	8,83	2,94

5.25.9.18. WTG18 Road Bearing Capacity qu (kg/cm2) Allowable Bearing Capacity qa (kg/cm2)

PROFILES	LAYERS	DEPTH	BEARING CAPACITY (qu,kg/cm^2)	ALLOWABLE BEARING CAPACITY (qa,kg/cm^2)
1_PROFILE	1. LAYER	-6,61	7,67	2,56
	2.LAYER	-29,60	13,44	4,48
	3.LAYER	-20,40	27,43	9,14
2_PROFILE	1. LAYER	-3,64	5,62	1,87
	2. LAYER	-16,30	10,03	3,34
	3. LAYER	-33,70	23,71	7,90
3_PROFILE	1. LAYER	-3,66	4,70	1,57
	2. LAYER	-16,37	8,95	2,98
	3. LAYER	-33,63	18,63	6,21
4_PROFILE	1. LAYER	-4,98	3,02	1,01
	2. LAYER	-33,73	6,42	2,14
	3. LAYER	-16,27	13,43	4,48
5_PROFILE	1. LAYER	-1,56	1,71	0,57
	2. LAYER	-10,57	4,81	1,60
	3. LAYER	-39,43	10,35	3,45
6_PROFILE	1. LAYER	-2,52	2,19	0,73
	2. LAYER	-11,29	4,21	1,40
	3. LAYER	-38,71	7,49	2,50
7_PROFILE	1. LAYER	-6,37	2,84	0,95
	2.LAYER	-20,02	6,15	2,05
	3.LAYER	-29,98	11,21	3,74
8_PROFILE	1. LAYER	-6,29	3,17	1,06
	2. LAYER	-28,17	8,73	2,91
	3. LAYER	-21,83	16,90	5,63
9_PROFILE	1. LAYER	-4,59	5,73	1,91
	2. LAYER	-31,09	11,75	3,92
	3. LAYER	-18,91	27,77	9,26
10_PROFILE	1. LAYER	-4,19	3,56	1,19
	2. LAYER	-28,36	6,99	2,33
	3. LAYER	-21,64	14,54	4,85
11_PROFILE	1. LAYER	-2,41	2,82	0,94
	2. LAYER	-16,31	5,71	1,90
	3. LAYER	-33,69	13,74	4,58

5.25.9.19. WTG19 Road Bearing Capacity qu (kg/cm2) Allowable Bearing Capacity qa (kg/cm2)

PROFILES	LAYERS	DEPTH	BEARING CAPACITY (qu,kg/cm^2)	ALLOWABLE BEARING CAPACITY (qa,kg/cm^2)
1_PROFILE	1. LAYER	-3,22	8,34	2,78
	2.LAYER	-14,43	19,40	6,47
	3.LAYER	-35,57	44,05	14,68
2_PROFILE	1. LAYER	-3,30	3,19	1,06
	2. LAYER	-22,34	6,81	2,27

	3. LAYER	-27,66	14,02	4,67
3_PROFILE	1. LAYER	-4,61	2,73	0,91
	2. LAYER	-20,65	3,72	1,24
	3. LAYER	-29,35	7,32	2,44
4_PROFILE	1. LAYER	-3,04	3,90	1,30
	2. LAYER	-20,57	9,48	3,16
	3. LAYER	-29,43	19,81	6,60

5.25.9.20. WTG20 Road Bearing Capacity qu (kg/cm2) Allowable Bearing Capacity qa (kg/cm2)

PROFILES	LAYERS	DEPTH	BEARING CAPACITY (qu,kg/cm^2)	ALLOWABLE BEARING CAPACITY (qa,kg/cm^2)
1_PROFILE	1. LAYER	-8,11	3,28	1,09
	2.LAYER	-25,49	6,28	2,09
	3.LAYER	-24,51	11,32	3,77
2_PROFILE	1. LAYER	-5,30	3,26	1,09
	2. LAYER	-16,65	9,18	3,06
	3. LAYER	-33,35	16,10	5,37
3_PROFILE	1. LAYER	-6,61	4,38	1,46
	2. LAYER	-29,56	10,88	3,63
	3. LAYER	-20,44	21,53	7,18
4_PROFILE	1. LAYER	-2,19	2,56	0,85
	2. LAYER	-14,82	6,73	2,24
	3. LAYER	-35,18	14,36	4,79

5.25.9.21. WTG21 Road Bearing Capacity qu (kg/cm2) Allowable Bearing Capacity qa (kg/cm2)

PROFILES	LAYERS	DEPTH	BEARING CAPACITY (qu,kg/cm^2)	ALLOWABLE BEARING CAPACITY (qa,kg/cm^2)
1_PROFILE	1. LAYER	-5,93	2,73	0,91
	2.LAYER	-18,64	5,40	1,80
	3.LAYER	-31,36	9,30	3,10
2_PROFILE	1. LAYER	-3,36	7,66	2,55
	2. LAYER	-15,06	16,10	5,37
	3. LAYER	-34,94	37,98	12,66
3_PROFILE	1. LAYER	-2,18	9,50	3,17
	2. LAYER	-14,76	12,67	4,22
	3. LAYER	-35,24	29,65	9,88
4_PROFILE	1. LAYER	-6,15	7,00	2,33
	2. LAYER	-19,32	14,28	4,76
	3. LAYER	-30,68	27,34	9,11
5_PROFILE	1. LAYER	-5,57	8,35	2,78
	2. LAYER	-12,76	6,87	2,29
	3. LAYER	-37,24	16,15	5,38
6_PROFILE	1. LAYER	-6,22	5,16	1,72
	2. LAYER	-14,25	7,34	2,45
	3. LAYER	-35,75	14,10	4,70

5.25.9.22. WTG22 Road Bearing Capacity qu (kg/cm2) Allowable Bearing Capacity qa (kg/cm2)

PROFILES	LAYERS	DEPTH	BEARING CAPACITY (qu,kg/cm^2)	ALLOWABLE BEARING CAPACITY (qa,kg/cm^2)
1_PROFILE	1. LAYER	-6,00	10,00	3,33
	2.LAYER	-26,85	12,02	4,01
	3.LAYER	-23,15	23,60	7,87
2_PROFILE	1. LAYER	-3,78	6,23	2,08
	2. LAYER	-16,92	12,07	4,02
	3. LAYER	-33,08	24,16	8,05
3_PROFILE	1. LAYER	-3,56	7,52	2,51
	2. LAYER	-15,94	13,66	4,55
	3. LAYER	-34,06	31,63	10,54
4_PROFILE	1. LAYER	-3,89	6,05	2,02
	2. LAYER	-17,42	13,32	4,44
	3. LAYER	-32,58	31,44	10,48

5.25.9.23. WTG23 Road Bearing Capacity qu (kg/cm2) Allowable Bearing Capacity qa (kg/cm2)

PROFILES	LAYERS	DEPTH	BEARING CAPACITY (qu,kg/cm^2)	ALLOWABLE BEARING CAPACITY (qa,kg/cm^2)
1_PROFILE	1. LAYER	-2,94	5,00	1,67
	2.LAYER	-19,90	9,10	3,03
	3.LAYER	-30,10	18,81	6,27
2_PROFILE	1. LAYER	-4,61	9,58	3,19
	2. LAYER	-20,61	15,43	5,14
	3. LAYER	-29,39	35,47	11,82
3_PROFILE	1. LAYER	-4,22	8,18	2,73
	2. LAYER	-18,89	18,93	6,31
	3. LAYER	-31,11	40,10	13,37

5.25.9.24. Substaton Road Bearing Capacity qu (kg/cm2) Allowable Bearing Capacity qa (kg/cm2)

PROFILES	LAYERS	DEPTH	BEARING CAPACITY (qu,kg/cm^2)	ALLOWABLE BEARING CAPACITY (qa,kg/cm^2)
1_PROFILE	1. LAYER	-5,90	11,64	3,88
	2.LAYER	-26,41	17,55	5,85
	3.LAYER	-23,59	38,13	12,71

5.25.10 Vibration Period - T_0 (sec) / Ground Amplification (Ak)

5.25.10.1. WTG01 Road Vibration Period - T_0 (sec) / Ground Amplification (Ak)

PROFILES	To (sec)	Ta (sec)	Tb (sec)	Ak (Amplification)
1.PROFILE	0,33	0,22	0,49	1,76
2.PROFILE	0,36	0,24	0,54	1,85
3.PROFILE	0,25	0,17	0,38	1,55
4.PROFILE	0,33	0,22	0,50	1,61
5.PROFILE	0,21	0,14	0,32	1,35
6.PROFILE	0,33	0,22	0,49	1,76
7.PROFILE	0,40	0,27	0,61	1,91
8.PROFILE	0,36	0,24	0,54	1,87
9.PROFILE	0,38	0,25	0,57	1,92

The Vibration Period and Ground Amplification calculated in the direction of the parameters obtained during the seismic studies made during the field survey are presented in the table above.

5.25.10.2. WTG02 Road Vibration Period - T_0 (sec) / Ground Amplification (Ak)

PROFILES	To (sec)	Ta (sec)	Tb (sec)	Ak (Amplification)
1.PROFILE	0,41	0,28	0,62	1,87
2.PROFILE	0,34	0,22	0,51	1,68
3.PROFILE	0,38	0,25	0,57	1,91
4.PROFILE	0,25	0,17	0,38	1,47
5.PROFILE	0,24	0,16	0,36	1,47
6.PROFILE	0,23	0,15	0,34	1,41
7.PROFILE	0,23	0,15	0,34	1,46

The Vibration Period and Ground Amplification calculated in the direction of the parameters obtained during the seismic studies made during the field survey are presented in the table above.

5.25.10.3. WTG03 Road Vibration Period - T_0 (sec) / Ground Amplification (Ak)

PROFILES	To (sec)	Ta (sec)	Tb (sec)	Ak (Amplification)
1.PROFILE	0,32	0,21	0,48	1,56
2.PROFILE	0,12	0,08	0,18	0,98
3.PROFILE	0,23	0,16	0,35	1,37
4.PROFILE	0,27	0,18	0,41	1,50
5.PROFILE	0,27	0,18	0,40	1,53
6.PROFILE	0,31	0,21	0,47	1,80

The Vibration Period and Ground Amplification calculated in the direction of the parameters obtained during the seismic studies made during the field survey are presented in the table above.

5.25.10.4. WTG04 Road Vibration Period - T_0 (sec) / Ground Amplification (Ak)

PROFILES	To (sec)	Ta (sec)	Tb (sec)	Ak (Amplification)
1.PROFILE	0,21	0,14	0,31	1,35
2.PROFILE	0,31	0,21	0,46	1,71
3.PROFILE	0,22	0,15	0,33	1,37
4.PROFILE	0,24	0,16	0,36	1,40
5.PROFILE	0,29	0,19	0,43	1,48
6.PROFILE	0,26	0,18	0,40	1,54
7.PROFILE	0,14	0,09	0,20	0,87
8.PROFILE	0,22	0,15	0,34	1,28
9.PROFILE	0,32	0,21	0,48	1,73
10.PROFILE	0,33	0,22	0,50	1,76

The Vibration Period and Ground Amplification calculated in the direction of the parameters obtained during the seismic studies made during the field survey are presented in the table above.

5.25.10.5. WTG05 Road Vibration Period - T_0 (sec) / Ground Amplification (Ak)

PROFILES	To (sec)	Ta (sec)	Tb (sec)	Ak (Amplification)
1.PROFILE	0,28	0,18	0,42	1,60
2.PROFILE	0,17	0,11	0,26	1,17
3.PROFILE	0,29	0,19	0,43	1,59
4.PROFILE	0,45	0,30	0,67	1,97
5.PROFILE	0,26	0,17	0,39	1,56
6.PROFILE	0,21	0,14	0,31	1,32
7.PROFILE	0,19	0,13	0,29	1,24

The Vibration Period and Ground Amplification calculated in the direction of the parameters obtained during the seismic studies made during the field survey are presented in the table above.

5.25.10.6 WTG06 Road Vibration Period - T_0 (sec) / Ground Amplification (Ak)

PROFILES	To (sec)	Ta (sec)	Tb (sec)	Ak (Amplification)
1.PROFILE	0,20	0,13	0,29	1,26
2.PROFILE	0,20	0,13	0,30	1,25
3.PROFILE	0,21	0,14	0,31	1,27
4.PROFILE	0,22	0,15	0,33	1,32
5.PROFILE	0,23	0,15	0,34	1,43
6.PROFILE	0,18	0,12	0,27	1,19
7.PROFILE	0,19	0,13	0,28	1,25
8.PROFILE	0,20	0,14	0,31	1,30
9.PROFILE	0,18	0,12	0,27	1,14
10.PROFILE	0,23	0,15	0,34	1,38
11.PROFILE	0,21	0,14	0,32	1,27

The Vibration Period and Ground Amplification calculated in the direction of the parameters obtained during the seismic studies made during the field survey are presented in the table above.

5.25.10.7 WTG07 Road Vibration Period - T_0 (sec) / Ground Amplification (Ak)

PROFILES	To (sec)	Ta (sec)	Tb (sec)	Ak (Amplification)
1.PROFILE	0,36	0,24	0,55	1,75
2.PROFILE	0,23	0,15	0,34	1,36
3.PROFILE	0,34	0,23	0,51	1,69
4.PROFILE	0,22	0,15	0,33	1,41
5.PROFILE	0,20	0,13	0,29	1,33
6.PROFILE	0,20	0,13	0,30	1,32
7.PROFILE	0,25	0,17	0,37	1,55
8.PROFILE	0,20	0,13	0,30	1,30
9.PROFILE	0,11	0,07	0,16	0,91
10.PROFILE	0,19	0,13	0,28	1,29
11.PROFILE	0,18	0,12	0,28	1,24
12.PROFILE	0,21	0,14	0,31	1,27
13.PROFILE	0,15	0,10	0,22	1,08
14.PROFILE	0,16	0,11	0,24	1,14
15.PROFILE	0,25	0,16	0,37	1,48
16.PROFILE	0,33	0,22	0,49	1,66
17.PROFILE	0,34	0,22	0,50	1,70
18.PROFILE	0,31	0,21	0,47	1,66
19.PROFILE	0,18	0,12	0,27	1,23

20.PROFILE	0,21	0,14	0,32	1,33
21.PROFILE	0,42	0,28	0,63	1,97
22.PROFILE	0,31	0,21	0,47	1,59
23.PROFILE	0,30	0,20	0,45	1,60
24.PROFILE	0,26	0,17	0,39	1,50

The Vibration Period and Ground Amplification calculated in the direction of the parameters obtained during the seismic studies made during the field survey are presented in the table above.

5.25.10.8. WTG08 Road Vibration Period - T_0 (sec) / Ground Amplification (Ak)

PROFILES	To (sec)	Ta (sec)	Tb (sec)	Ak (Amplification)
1.PROFILE	0,27	0,18	0,40	1,53
2.PROFILE	0,20	0,13	0,30	1,28
3.PROFILE	0,21	0,14	0,31	1,26
4.PROFILE	0,22	0,15	0,33	1,38
5.PROFILE	0,19	0,12	0,28	1,17
6.PROFILE	0,20	0,13	0,30	1,22
7.PROFILE	0,36	0,24	0,53	1,82
8.PROFILE	0,25	0,17	0,38	1,56
9.PROFILE	0,24	0,16	0,36	1,41
10.PROFILE	0,34	0,23	0,51	1,70
11.PROFILE	0,20	0,13	0,29	1,28
12.PROFILE	0,24	0,16	0,36	1,44

The Vibration Period and Ground Amplification calculated in the direction of the parameters obtained during the seismic studies made during the field survey are presented in the table above.

5.25.10.9. WTG09 Road Vibration Period - T_0 (sec) / Ground Amplification (Ak)

PROFILES	To (sec)	Ta (sec)	Tb (sec)	Ak (Amplification)
1.PROFILE	0,17	0,11	0,26	1,16
2.PROFILE	0,21	0,14	0,31	1,34
3.PROFILE	0,24	0,16	0,37	1,44
4.PROFILE	0,28	0,19	0,42	1,59
5.PROFILE	0,22	0,15	0,34	1,31
6.PROFILE	0,42	0,28	0,63	1,90
7.PROFILE	0,29	0,19	0,43	1,67

The Vibration Period and Ground Amplification calculated in the direction of the parameters obtained during the seismic studies made during the field survey are presented in the table above.

5.25.10.10. WTG10 Road Vibration Period - T_0 (sec) / Ground Amplification (Ak)

PROFILES	To (sec)	Ta (sec)	Tb (sec)	Ak (Amplification)
1.PROFILE	0,39	0,26	0,58	1,92
2.PROFILE	0,41	0,27	0,62	1,95
3.PROFILE	0,22	0,15	0,33	1,34
4.PROFILE	0,21	0,14	0,31	1,24
5.PROFILE	0,29	0,19	0,43	1,59
6.PROFILE	0,36	0,24	0,54	1,69
7.PROFILE	0,20	0,13	0,30	1,31

The Vibration Period and Ground Amplification calculated in the direction of the parameters obtained during the seismic studies made during the field survey are presented in the table above.

5.25.10.11. WTG11 Road Vibration Period - T_0 (sec) / Ground Amplification (Ak)

PROFILES	To (sec)	Ta (sec)	Tb (sec)	Ak (Amplification)
1.PROFILE	0,28	0,19	0,42	1,58
2.PROFILE	0,30	0,20	0,46	1,73
3.PROFILE	0,23	0,15	0,35	1,47
4.PROFILE	0,30	0,20	0,45	1,72
5.PROFILE	0,38	0,25	0,56	1,84
6.PROFILE	0,27	0,18	0,40	1,58

The Vibration Period and Ground Amplification calculated in the direction of the parameters obtained during the seismic studies made during the field survey are presented in the table above.

5.25.10.12. WTG12 Road Vibration Period - T_0 (sec) / Ground Amplification (Ak)

PROFILES	To (sec)	Ta (sec)	Tb (sec)	Ak (Amplification)
1.PROFILE	0,26	0,17	0,39	1,47
2.PROFILE	0,29	0,19	0,43	1,51
3.PROFILE	0,19	0,13	0,29	1,27
4.PROFILE	0,40	0,27	0,60	1,84
5.PROFILE	0,27	0,18	0,40	1,58

The Vibration Period and Ground Amplification calculated in the direction of the parameters obtained during the seismic studies made during the field survey are presented in the table above.

5.25.10.13. WTG13 Road Vibration Period - T_0 (sec) / Ground Amplification (Ak)

PROFILES	To (sec)	Ta (sec)	Tb (sec)	Ak (Amplification)
1.PROFILE	0,23	0,15	0,35	1,39
2.PROFILE	0,23	0,15	0,35	1,38
3.PROFILE	0,31	0,21	0,47	1,56
4.PROFILE	0,29	0,20	0,44	1,64
5.PROFILE	0,29	0,19	0,44	1,69

The Vibration Period and Ground Amplification calculated in the direction of the parameters obtained during the seismic studies made during the field survey are presented in the table above.

5.25.10.14. WTG14 Road Vibration Period - T_0 (sec) / Ground Amplification (Ak)

PROFILES	To (sec)	Ta (sec)	Tb (sec)	Ak (Amplification)
1.PROFILE	0,18	0,12	0,28	1,21
2.PROFILE	0,24	0,16	0,36	1,48
3.PROFILE	0,26	0,17	0,39	1,52
4.PROFILE	0,19	0,13	0,28	1,28
5.PROFILE	0,18	0,12	0,27	1,21
6.PROFILE	0,19	0,12	0,28	1,26
7.PROFILE	0,29	0,20	0,44	1,63
8.PROFILE	0,28	0,19	0,42	1,59
9.PROFILE	0,18	0,12	0,28	1,26
10.PROFILE	0,26	0,17	0,39	1,50
11.PROFILE	0,32	0,21	0,48	1,71

The Vibration Period and Ground Amplification calculated in the direction of the parameters obtained during the seismic studies made during the field survey are presented in the table above.

5.25.10.15. WTG15 Road Vibration Period - T_0 (sec) / Ground Amplification (Ak)

PROFILES	To (sec)	Ta (sec)	Tb (sec)	Ak (Amplification)
1.PROFILE	0,27	0,18	0,41	1,52
2.PROFILE	0,38	0,25	0,57	1,83
3.PROFILE	0,22	0,14	0,32	1,36
4.PROFILE	0,24	0,16	0,35	1,44
5.PROFILE	0,28	0,19	0,42	1,60
6.PROFILE	0,26	0,17	0,39	1,53
7.PROFILE	0,37	0,25	0,56	1,94
8.PROFILE	0,31	0,21	0,46	1,68
9.PROFILE	0,18	0,12	0,27	1,17
10.PROFILE	0,26	0,17	0,38	1,43
11.PROFILE	0,20	0,13	0,30	1,25
12.PROFILE	0,25	0,16	0,37	1,49
13.PROFILE	0,31	0,21	0,47	1,73
14.PROFILE	0,36	0,24	0,53	1,76
15.PROFILE	0,30	0,20	0,44	1,60
16.PROFILE	0,18	0,12	0,28	1,23
17.PROFILE	0,21	0,14	0,32	1,30
18.PROFILE	0,26	0,17	0,38	1,47

The Vibration Period and Ground Amplification calculated in the direction of the parameters obtained during the seismic studies made during the field survey are presented in the table above.

5.25.10.16. WTG16 Road Vibration Period - T_0 (sec) / Ground Amplification (Ak)

PROFILES	To (sec)	Ta (sec)	Tb (sec)	Ak (Amplification)
1.PROFILE	0,36	0,24	0,54	1,91
2.PROFILE	0,36	0,24	0,54	1,75
3.PROFILE	0,33	0,22	0,49	1,66
4.PROFILE	0,41	0,27	0,62	1,99
5.PROFILE	0,41	0,27	0,61	1,94
6.PROFILE	0,31	0,21	0,47	1,61
7.PROFILE	0,28	0,19	0,42	1,63
8.PROFILE	0,26	0,17	0,39	1,54
9.PROFILE	0,17	0,11	0,25	1,16
10.PROFILE	0,26	0,18	0,40	1,41
11.PROFILE	0,23	0,15	0,34	1,26
12.PROFILE	0,30	0,20	0,45	1,63
13.PROFILE	0,39	0,26	0,59	1,89
14.PROFILE	0,21	0,14	0,32	1,36
15.PROFILE	0,24	0,16	0,36	1,42
16.PROFILE	0,18	0,12	0,27	1,16
17.PROFILE	0,26	0,18	0,40	1,59
18.PROFILE	0,32	0,21	0,48	1,52
19.PROFILE	0,27	0,18	0,40	1,30

The Vibration Period and Ground Amplification calculated in the direction of the parameters obtained during the seismic studies made during the field survey are presented in the table above.

5.25.10.17. WTG17 Road Vibration Period - T_0 (sec) / Ground Amplification (Ak)

PROFILES	To (sec)	Ta (sec)	Tb (sec)	Ak (Amplification)
1.PROFILE	0,32	0,21	0,48	1,65
2.PROFILE	0,58	0,39	0,87	2,49
3.PROFILE	0,31	0,21	0,47	1,59
4.PROFILE	0,38	0,25	0,56	1,85
5.PROFILE	0,61	0,41	0,92	2,13

The Vibration Period and Ground Amplification calculated in the direction of the parameters obtained during the seismic studies made during the field survey are presented in the table above.

5.25.10.18. WTG18 Road Vibration Period - T_0 (sec) / Ground Amplification (Ak)

PROFILES	To (sec)	Ta (sec)	Tb (sec)	Ak (Amplification)
1.PROFILE	0,27	0,18	0,40	1,32
2.PROFILE	0,26	0,17	0,39	1,48
3.PROFILE	0,32	0,21	0,47	1,65
4.PROFILE	0,53	0,35	0,79	1,98
5.PROFILE	0,48	0,32	0,73	2,24
6.PROFILE	0,61	0,41	0,92	2,55
7.PROFILE	0,52	0,35	0,78	2,16
8.PROFILE	0,44	0,30	0,67	1,90
9.PROFILE	0,29	0,19	0,44	1,43
10.PROFILE	0,45	0,30	0,68	1,85
11.PROFILE	0,42	0,28	0,64	1,98

The Vibration Period and Ground Amplification calculated in the direction of the parameters obtained during the seismic studies made during the field survey are presented in the table above.

5.25.10.19. WTG19 Road Vibration Period - T_0 (sec) / Ground Amplification (Ak)

PROFILES	To (sec)	Ta (sec)	Tb (sec)	Vs30 (m/sec)	Ak (Amplification)
1.PROFILE	0,16	0,11	0,24	955	1,11
2.PROFILE	0,43	0,28	0,64	402	1,86
3.PROFILE	0,72	0,48	1,08	234	2,58
4.PROFILE	0,32	0,21	0,47	523	1,59

The Vibration Period and Ground Amplification calculated in the direction of the parameters obtained during the seismic studies made during the field survey are presented in the table above.

5.25.10.20. WTG20 Road Vibration Period - T_0 (sec) / Ground Amplification (Ak)

PROFILES	To (sec)	Ta (sec)	Tb (sec)	Ak (Amplification)
1.PROFILE	0,56	0,37	0,84	2,18
2.PROFILE	0,37	0,25	0,55	1,81
3.PROFILE	0,35	0,24	0,53	1,62
4.PROFILE	0,40	0,27	0,60	1,93

The Vibration Period and Ground Amplification calculated in the direction of the parameters obtained during the seismic studies made during the field survey are presented in the table above.

5.25.10.21. WTG21 Road Vibration Period - T_0 (sec) / Ground Amplification (Ak)

PROFILES	To (sec)	Ta (sec)	Tb (sec)	Ak (Amplification)
1.PROFILE	0,57	0,38	0,86	2,28
2.PROFILE	0,18	0,12	0,27	1,19
3.PROFILE	0,20	0,14	0,31	1,28
4.PROFILE	0,24	0,16	0,36	1,35
5.PROFILE	0,32	0,21	0,48	1,71
6.PROFILE	0,37	0,25	0,56	1,84

The Vibration Period and Ground Amplification calculated in the direction of the parameters obtained during the seismic studies made during the field survey are presented in the table above.

5.25.10.22 WTG22 Road Vibration Period - T_0 (sec) / Ground Amplification (Ak)

PROFILES	To (sec)	Ta (sec)	Tb (sec)	Ak (Amplification)
1.PROFILE	0,27	0,18	0,41	1,34
2.PROFILE	0,25	0,17	0,37	1,40
3.PROFILE	0,20	0,14	0,31	1,27
4.PROFILE	0,22	0,15	0,33	1,33

The Vibration Period and Ground Amplification calculated in the direction of the parameters obtained during the seismic studies made during the field survey are presented in the table above.

5.25.10.23. WTG23 Road Vibration Period - T_0 (sec) / Ground Amplification (Ak)

PROFILES	To (sec)	Ta (sec)	Tb (sec)	Ak (Amplification)
1.PROFILE	0,37	0,25	0,56	1,75
2.PROFILE	0,23	0,15	0,34	1,32
3.PROFILE	0,21	0,14	0,31	1,26

The Vibration Period and Ground Amplification calculated in the direction of the parameters obtained during the seismic studies made during the field survey are presented in the table above.

5.25.10.24. Substation Road Vibration Period - T_0 (sec) / Ground Amplification (Ak)

PROFILES	To (sec)	Ta (sec)	Tb (sec)	Ak (Amplification)
1.PROFILE	0,19	0,13	0,29	1,12

The Vibration Period and Ground Amplification calculated in the direction of the parameters obtained during the seismic studies made during the field survey are presented in the table above.

6. SEISMICITY OF THE STUDY AREA AND LEBANON AT LARGE

Table 1 shows the instrumentally recorded earthquakes of magnitude 4.5 or more that have occurred in Lebanon in the twentieth century. The earthquakes 3, 9, and 20 (events) are the main events of years 1907, 1956 and 1997, respectively, and all other events occurring in these years were either foreshocks or aftershocks. Therefore, in the following discussion, only the main events (3, 9, and 20) will be considered for these years. Various sources and references review different coordinates of the location of earthquake epicenters as well as other parameters. The uncertainty in the location of epicenters might exceed 20 km for most of the events. Nevertheless, Table 1 and Figure I show that the epicenters of the strongest three seismic events in this century (1907, 1956, and 1997) are located in the Roum fault zone including the Chouf region and its offshore area (Figure 1). Moreover, information issued by the Lebanese Geophysical Center through its seismological station at Bhannes (the only recording station in Lebanon) indicated that the distance from the epicenter of the main 1997 event (20) to the station is only 33 km. This implies that the epicenter of this event could be relocated northward to become closer to the epicenters of its own aftershock (21) and of the 1907 and 1956 events. Hence the Chouf area with its -complicated structural setting, probably, constitutes a locked (northern) segment of the Roum fault zone, which probably terminates near Damour river.

The earthquakes of 1907, 1956, and 1997 occumng in the study area had a recurrence interval of 40 to 50 years. Searching in the available journals of the period between 1865 and 1875, I could not find any hints about seismic events of comparable, magnitude in that period. However, no major seismic events are known in Lebanon atter the destructive 1837 earthquake, which has affected northern Palestine and southern Lebanon. The epicenter of thi's earthquake has been located by many investigators near Salad in the Huleh depression [e.g. Ben-Menahem, 1981; Amiran et al., 1994], where the Dead Sea Fault bifurcates into its Lebanese fault branches. However, in a recent study, Ambraseys [199.7] upgraded the magnitude of this earthquake from 6.2-6.4 to more than 7.0 and indicated that this earthquake could have originated along the Roum or the Yammouneh faults.

There have been many destructive earthquakes inLebanese history, the strongest ofwhich in the past two millennia occurred m 551, 1202, and 1759 [e.g., Plassard and Kogoj, 1981; Beydoun, 1997; Griffiths et al., 2000; Khair et al., 2000]. The last two events were thoroughly studied by Ambraseys andMel•lie [1988], and Ambraseys and Barazangi [1989], respectively. The epicenters of these earthquakes have been located along the Yammouneh fault, whereas their respective magnitudes were estimated to be 7.6 and 7.4. This long recurrence period (~600 years) indicates that the past 100 years of insmunental record and the observation of microseismicity over shorter periods cannot represent of the long-term seismicity of the DSTF.

Griffiths et al. [2000] compiled anew seismicity catalogue for the area of Lebanon (32ø-35øN, 34ø-37øE) with 1725 events including both historical earthquakes and msmnnentally recorded tremors. They concluded that changing (decreasing northward) seismicity characteristics along the Roum fault zone suggest a change in faulting mechanism. The low b' value for SW Lebanon (0.75 + 0.07) compared to that of a "simple" section of the DSTF (0.88 + 0.09) reflects a slighfiy higher earthquake hazard for SW Lebanon [Griffiths et al., 2000]. On the other hand,. b' value of 0.86 has been estimated for the whole Dead Sea Transform

fault zone [Ben-Menahem and Aboodi, 1981; Ben-Menahem, 1991]. However, the lack and irregular distribution of seismological stations, especially in the northern segment of the DSTF, leave many events unrecorded or wrongly pinpointed, which severely limits the accuracy of calculated b'values.

The seismicity in the southern segment of the DSTF (IsraelJordan) tends to cluster in areas with tensional phenomena such as left steps on the left-lateral strike-slip faults [van Eck and Hofi'tetter, 1990]. They also concluded that the seismicit)' and focal mechanism solutions near the branching of the Cannel-Faraa, which is similar to Roum fault, and the DSTF suggest a complicated tectonic breakup. HoJbtetter et al. [1996] concluded that seismic characteristics such as b' value, seismic moment estimates Mo, and Brune stress drop estimates Ac• along the Carmel-Tirtza fault system are comparable to those for events occumng along the main Dead Sea Transform fault.

Table 1. Lebanese Earthquakes With Magnitudes 4.5 or More of the Twentieth Century [a]

Event	Year	Date	Time, UT	Coordinates		Mag	Source
				Lat	Lon		
1	1907	June 10	12 20	33.7	35.4	4.7	*Griffiths et al.* [2000]
2	1907	June 22	15 32	33.7	35.4	5.0	*Ben-Menahem and Aboodi* [1981]
3	1907	June 22	17 40	33.6	35.3	5.7	*Griffiths et al.* [2000]
4	1907	July 22	17 40	33.7	35.4	5.2	*Griffiths et al.* [2000]
5	1910	July 10	19 24:42	33.9	36.2	5.0	*Ben-Menahem and Aboodi* [1981]
6	1930	Sept. 14	02 24	34.6	36.6	4.5	*Griffiths et al.* [2000]
7	1930	Nov. 18	13 12	34.4	36.6	4.5	*Griffiths et al.* [2000]
8	1951	Aug. 5	15 12:09	34.2	36.1	5.0	*Ben-Menahem and Aboodi* [1981]
9	1956	March 16	19 32:40	33.6	35.5	6.0	*Khair et al.* [2000]
10	1956	March 16	19 43:28	33.6	35.5	5.7	*Khair et al.* [2000]
11	1964	Sept. 23	01 40	33.2	35.7	4.7	*Griffiths et al.* [2000]
12	1965	May 2	11 52	33.3	35.3	4.5	*Griffiths et al.* [2000]
13	1968	March 26	19 37:34	34.1	35.5	4.8	*Griffiths et al.* [2000]
14	1970	July 30	05 00:47	34.4	35.5	5	*Griffiths et al.* [2000]
15	1971	April 16	21 27:42	33.6	35.4	4.6	*Griffiths et al.* [2000]
16	1981	Nov. 9	01 11:21	34.4	35.9	4.6	*Griffiths et al.* [2000]
17	1983	June 3	02 04:39	33.8	35.7	4.9	*Griffiths et al.* [2000]
18	1991	Oct. 18	16 48:54	33.6	36.5	4.6	*Griffiths et al.* [2000]
19	1992	March 9	19 54:26	34.5	35.9	5.2	*Griffiths et al.* [2000]
20	1997	March 26	04 22:51	33.4	35.5	5.6	*Khair et al.* [2000]
21	1997	March 26	13 20:21	33.7	35.5	5.0	*Khair et al.* [2000]

[a] The Mag (magnitudes) refer to M_L, except for events 9, 10, 20 and 21, which refer to M_S.

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8. ATTACHMENTS

- **MEASUREMENT POINTS COORDINATES**

PROFİLE	X	Y
WTG1-1	250329	3822919
WTG1-2	250371	3822942
WTG1-3	250364	3822978
WTG1-4	250341	3822951
WTG1-5	250334	3822981
WTG1-6	250366	3823000
WTG1-7	250305	3822973
WTG1-8	250306	3822951
WTG1-9	250295	3822917
WTG1-way1	250156	3822789
WTG1-way2	250183	3822713
WTG1-way3	250216	3822640
WTG1-way4	250231	3822592
WTG1-way5	250244	3822554
WTG1-way6	250261	3822517
WTG1-way7	250275	3822490
WTG1-way8	250306	3822460
WTG1-way9	250342	3822444
WTG2-1	249891	3822556
WTG2-2	249900	3822555
WTG2-3	249926	3822554
WTG2-4	249937	3822556
WTG2-5	249942	3822535
WTG2-6	249930	3822527
WTG2-7	249943	3822518
WTG2-8	249931	3822502
WTG2-9	249905	3822531
WTG2-10	249881	3822506
WTG2-11	249878	3822532
WTG2-way1	249905	3822604
WTG2-way2	249935	3822657
WTG2-way3	249958	3822702
WTG2-way4	250020	3822783
WTG2-way5	250128	3822855
WTG2-way6	250186	3822867
WTG2-way7	250248	3822876
WTG3-1	249652	3822102
WTG3-2	249666	3822101
WTG3-3	249682	3822107
WTG3-4	249698	3822111
WTG3-5	249697	3822080
WTG3-6	249678	3822077
WTG3-7	249662	3822072
WTG3-8	249669	3822151
WTG3-9	249694	3822151
WTG3-10	249649	3822143
WTG3-way1	249651	3822213
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WTG3-way3	249686	3822313
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WTG3-way5	249817	3822304
WTG3-way6	249837	3822430
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WTG4-way10	249493	3821889
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WTG14-way5	248232	3818142
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WTG14-way8	248204	3818345
WTG14-way9	248333	3818433
WTG14-way10	248406	3818574
WTG14-way11	248219	3818296
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WTG15-2	248195	3817417
WTG15-3	248219	3817399
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WTG15-7	248274	3817475
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WTG15-11	248189	3817484

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WTG15-way2	248173	3817376
WTG15-way3	248247	3817390
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WTG15-way13	247810	3817551
WTG15-way14	247836	3817584
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WTG16-11	247475	3816956
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WTG16-way4	247258	3816724
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WTG17-11	246974	3816561
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WTG19-4	246454	3815693

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WTG19-9	246521	3815712
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WTG19-way2	246391	3815859
WTG19-way3	246451	3815964
WTG19-way4	246557	3816077
WTG20-1	246610	3815376
WTG20-2	246595	3815365
WTG20-3	246584	3815385
WTG20-4	246566	3815380
WTG20-5	246528	3815395
WTG20-6	246520	3815379
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WTG20-8	246521	3815439
WTG20-9	246523	3815455
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WTG20-11	246534	3815521
WTG20-12	246509	3815536
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WTG20-way2	246504	3815554
WTG20-way3	246424	3815612
WTG20-way4	246387	3815674
WTG21-1	246733	3815052
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WTG21-3	246701	3815015
WTG21-4	246687	3814992
WTG21-5	246663	3815027
WTG21-6	246649	3815044
WTG21-7	246679	3815050
WTG21-8	246710	3815049
WTG21-9	246696	3815073
WTG21-way1	246737	3815089
WTG21-way2	246705	3815125
WTG21-way3	246668	3815155
WTG21-way4	246632	3815185
WTG21-way5	246628	3815231
WTG21-way6	246618	3815324
WTG22-1	246607	3814663
WTG22-2	246600	3814692
WTG22-3	246591	3814659
WTG22-4	246585	3814666
WTG22-5	246566	3814653
WTG22-6	246563	3814684

WTG22-7	246585	3814726
WTG22-8	246603	3814738
WTG22-way1	246648	3814752
WTG22-way2	246664	3814791
WTG22-way3	246684	3814878
WTG22-way4	246736	3814925
WTG23-1	246634	3814353
WTG23-2	246639	3814347
WTG23-3	246652	3814345
WTG23-4	246644	3814361
WTG23-5	246603	3814348
WTG23-6	246611	3814348
WTG23-7	246608	3814368
WTG23-8	246590	3814380
WTG23-9	246593	3814341
WTG23-10	246629	3814318
WTG23-11	246667	3814330
WTG23-way1	246625	3814431
WTG23-way2	246646	3814499
WTG23-way3	246640	3814583
WTG Sub-1	248834	3819595
WTG Sub-2	248851	3819580
WTG Sub-3	248870	3819569
WTG Sub-4	248885	3819553
WTG Sub-5	248897	3819539
WTG Sub-6	248870	3819510
WTG Sub-7	248843	3819535
WTG Sub-8	248825	3819556
WTG Sub-9	248810	3819569
WTG Sub-10	248841	3819489
WTG Sub-11	248825	3819500
WTG Sub-12	248809	3819513
WTG Sub-13	248793	3819526
WTG Sub-14	248777	3819540
WTG Sub-way1	248899	3819598

APPENDIX K
TRANSPORT AND TRAFFIC STUDIES

SUSTAINABLE AKKAR 82.5MW & LWP 60MW

WIND POWER PLANTS - ROUTE SURVEY REPORT

one kilo up to one thousand tons

MASSIVE PROJECTS NEED MASSIVE EXPERIENCE

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SURVEY DATE: 02.04.2018 -05.04.2018

REPORT DATE: 30.04.2018

one kilo up to one thousand tons
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Magdenli was assigned to conduct a route survey in order to assess the conditions for the practical and safe transport of wind turbine components for the two wind power plant project planned in the Akkar region, Lebanon. Considered to be jointly implemented, the first project of 82,5MW is under SUSTAINABLE AKKAR SAL with an estimated number of 21 turbines, and the second is under LEBANON WIND POWER with a total installed power of 60 MW, and an estimated number of 15 turbines.

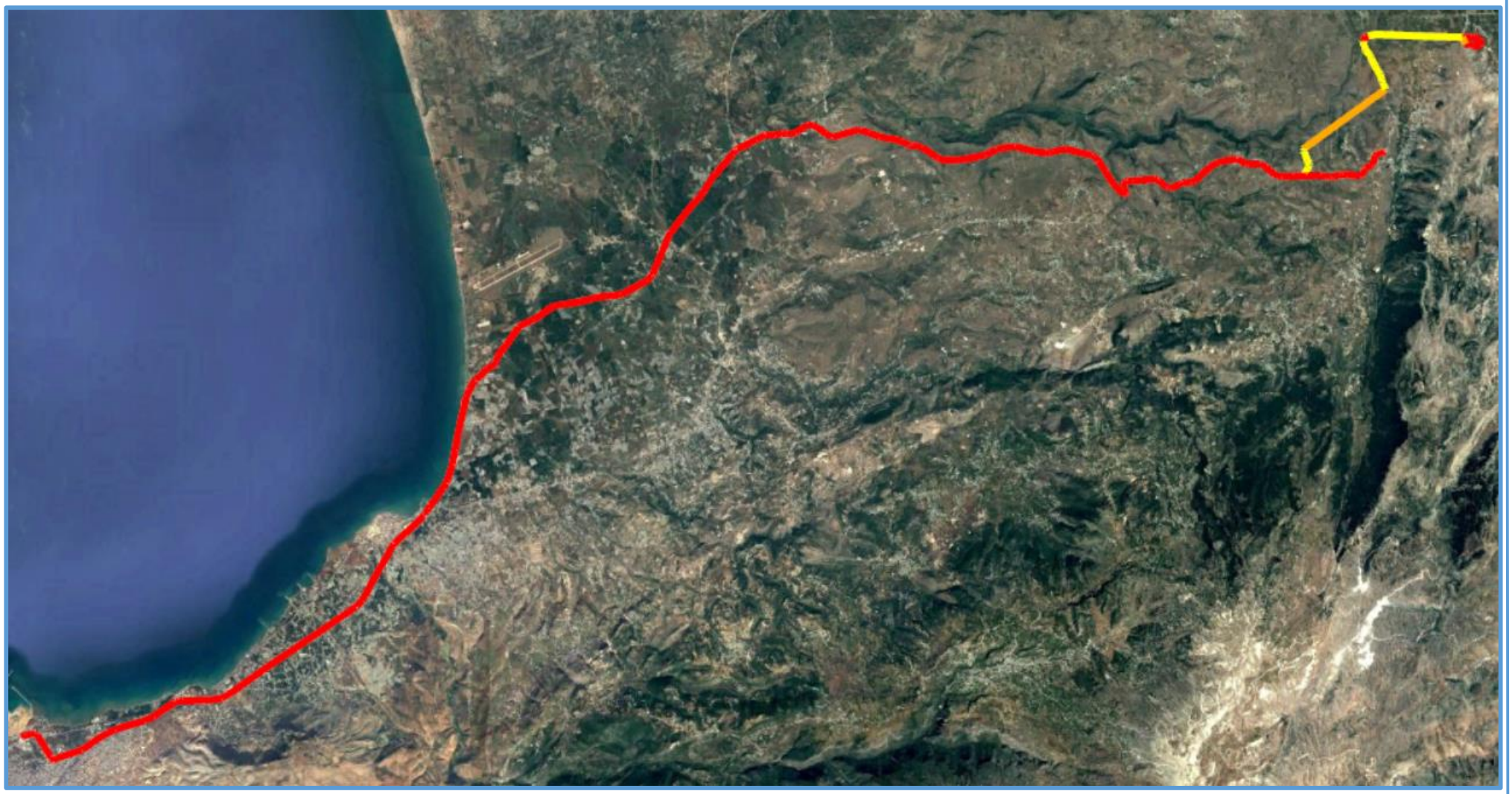
This report has been prepared in order to demonstrate the observed conditions, determine the necessity of civil works and precautions to be taken, starting from Tripoli Port to the Project Site entrance. The final route is estimated to be 65-70 km. For the purpose of this study, turbines with 140m rotor diameter were considered from among the wind turbine models indicated by the client.

The study was initialized by taking a basic map from the Google Maps and Google Earth applications, defining the project area and also marking the previously advised route for transportation by the client. The route advised by the client was based on their initial studies to optimize potential transport route alternatives.

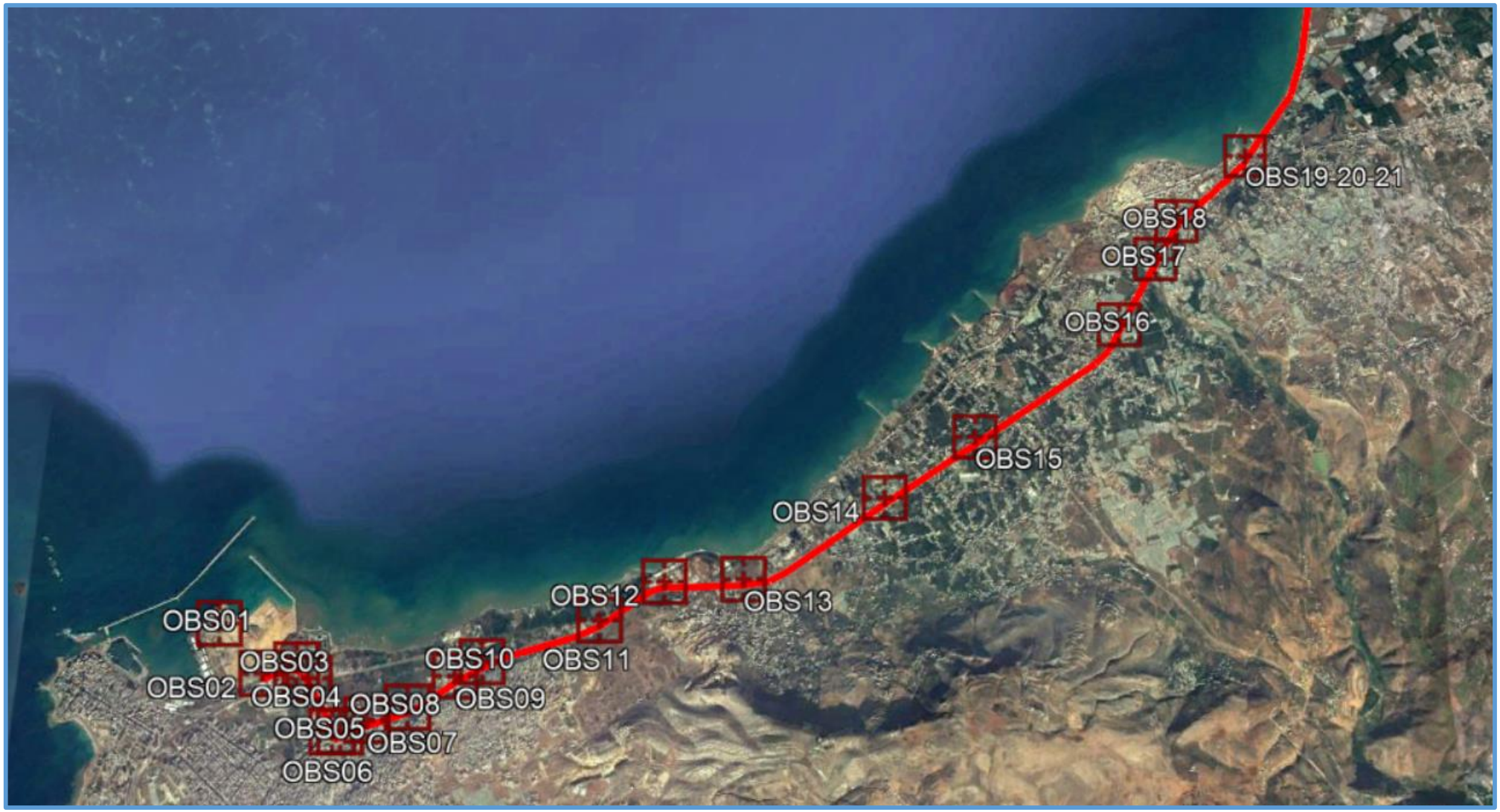
Having this information, the site was visited and the route was evaluated from the transportation point of view. The potential obstacles on the route were checked and defined, mitigation measures noted. Therefore, some critical turning points, bridges, motorway bridges and pedestrian overpasses are also visually documented and defined. The orange line at the end of the route shows the necessary alternative route segment to be constructed in order to reach the Project Site entrance.

North Lebanon is considered as a security sensitive area, in particular the areas of Tripoli and Akkar. Therefore, since the survey has been conducted without necessary official permits, several military check-points along the route could not be adequately documented by photos. Nevertheless observations have been noted with possible revision suggestions.

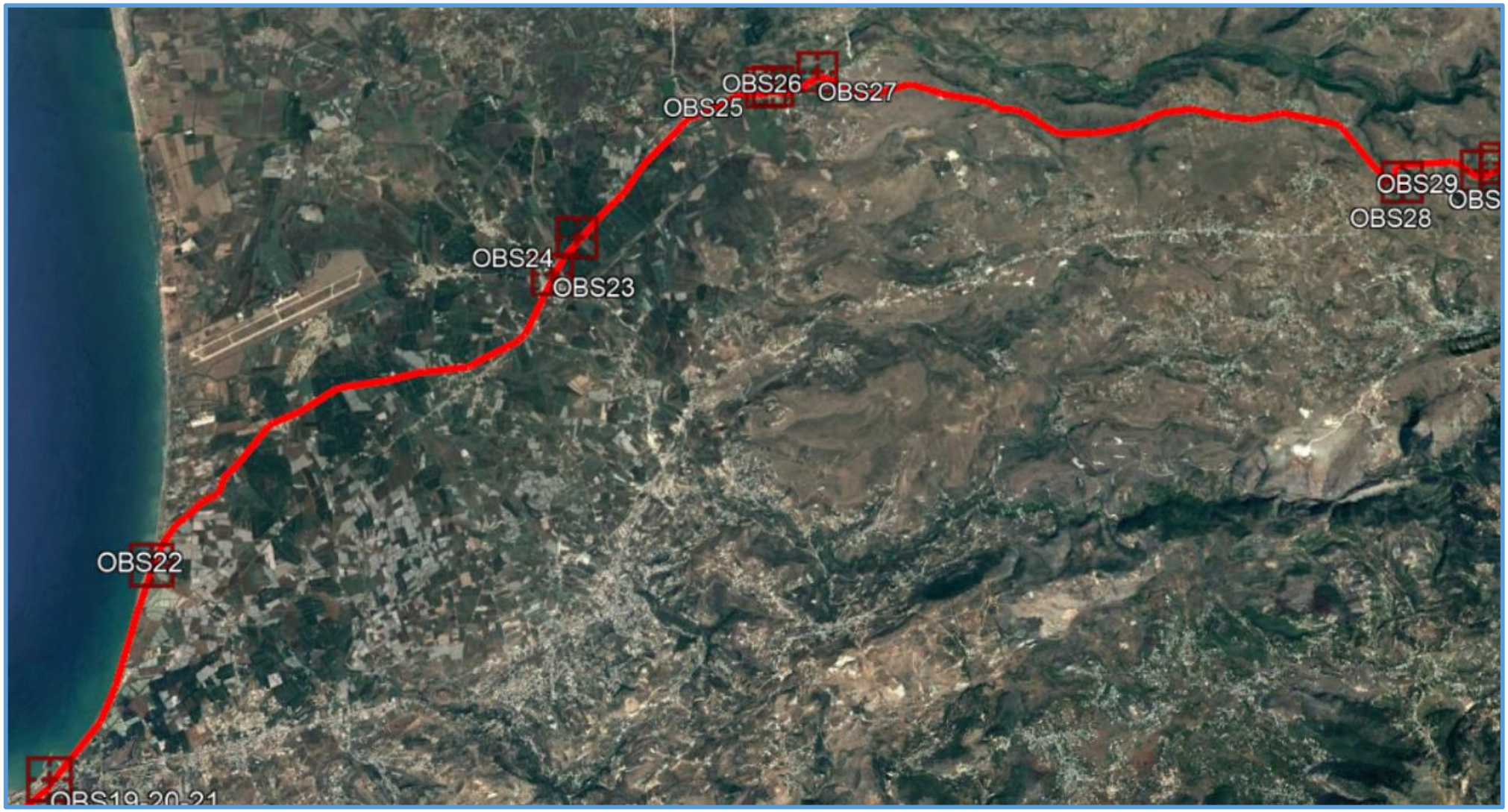
The ground clearances of a number of electric wires hanging over the road along route may not be meeting the transport requirements of turbine suppliers and could pose a certain risk during transportation. Due to the complexity of the wires, another survey may be required with the presence of a qualified professional to determine which wires are controlled by EDL and which belong to private generator operators or individuals. Further assessment of this matter, and any method and apparatus which may be utilized to safely pass under the hanging wires will be discussed once the wind turbine model is selected and relevant transport dimensions are finalized.



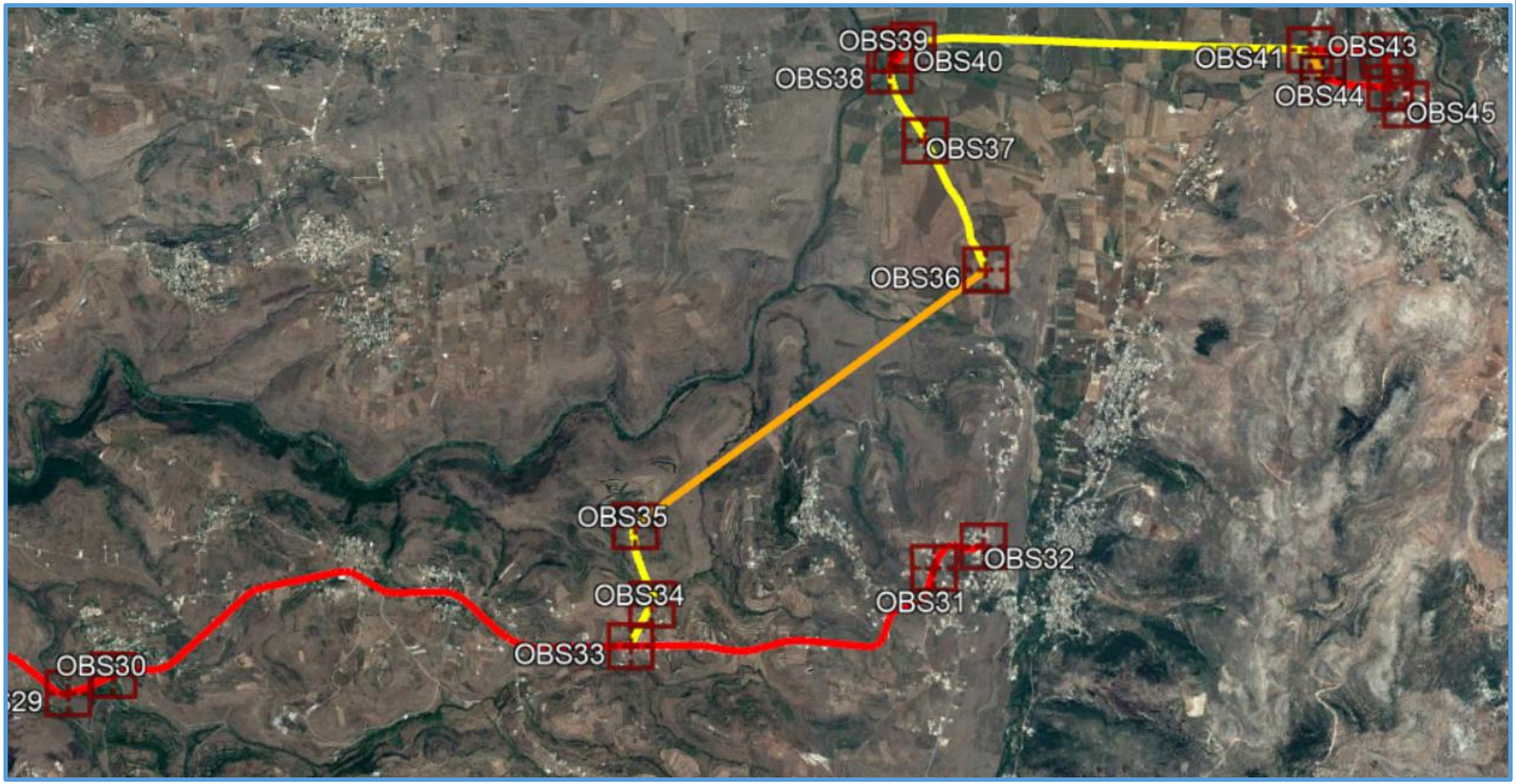
General View of the Route



General View of Observation Points -1



General View of Observation Points - 2



General View of Observation Points - 3

Definition	: Storage area in Tripoli Port
Comment	: It was informed that the required storage area 10.000 m² could be provided.

Observation : 01
N 34°27’29’’
E 35°49’45’’

Definition : Cranes in Tripoli Port

Quantity : 2

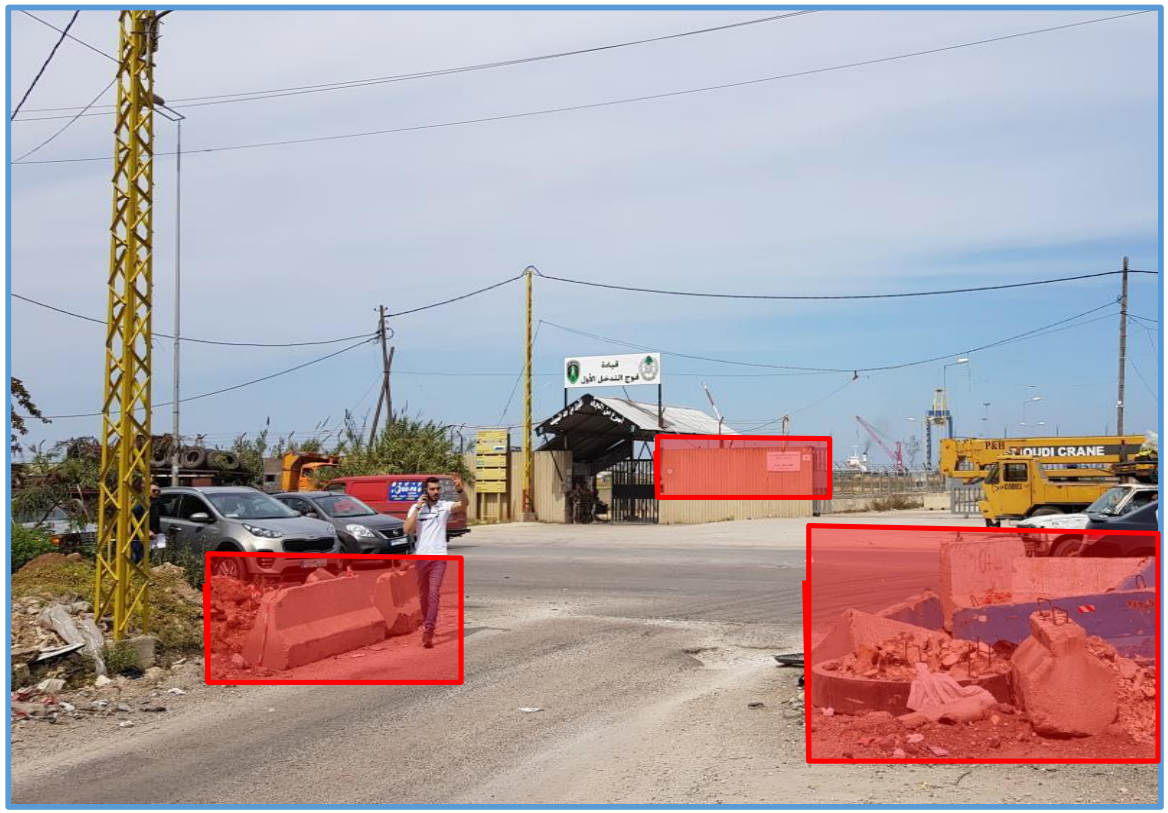
Capacity : 150 ton

Observation : 01
N 34°27’29’’
E 35°49’45’’

Definition : Exit road in Tripoli Port

Comment : It is suitable for transportation

Observation : 01
N 34°27’29’’
E 35°49’45’’



Definition : Port exit

Comment : Red hatched obstacles should be removed.

Observation : 02
N 34°27’08’’
E 35°50’09’’
Km : 0+000

Definition : Port exit

Comment : Red hatched obstacles should be removed.

Observation : 02
N 34°27’08’’
E 35°50’09’’
Km : 0+000

Definition : Public road in Tripoli

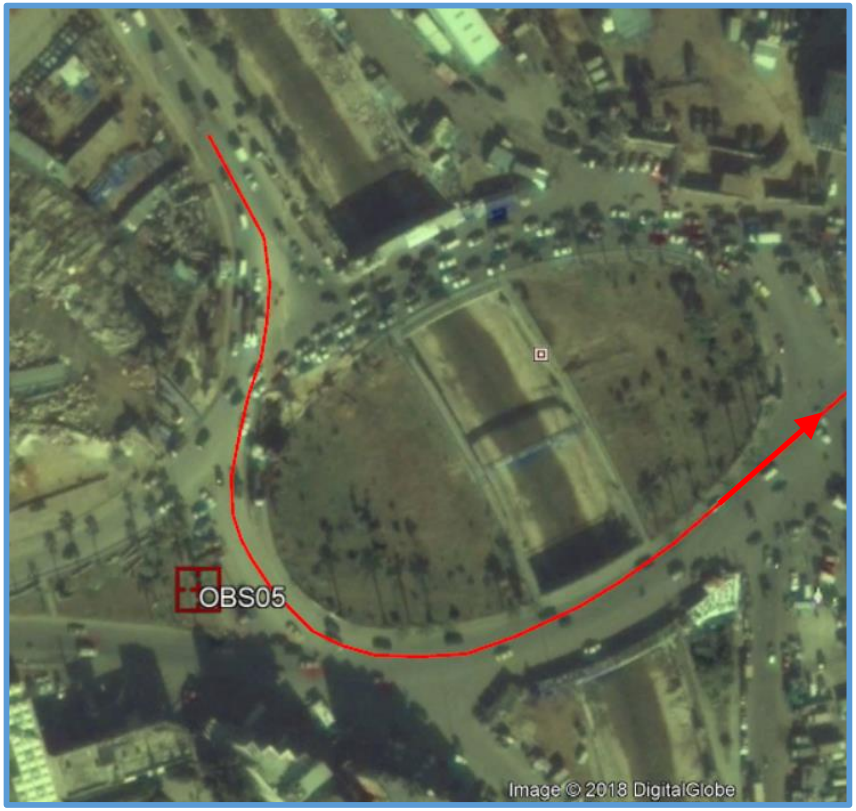
Comment : Second-row car park should not be allowed during the transportation

Observation : 03
N 34°27’11’’
E 35°50’26’’
Km : 1+200

Definition : Bridge Construction in Tripoli

Comment : Bridge height is over 6m. It is suitable for passing

Observation : 04
N 34°27’06’’
E 35°50’33’’
Km : 1+450



Definition : Roundabout in Tripoli

Comment : Car park should not be allowed during the transportation

Observation : 05
N 34°26’44’’
E 35°50’47’’
Km : 2+400

Definition	: On-site cast bridge in Tripoli
No of Span	: 1 / Distance of Span : 30m.
Comment	: It is suitable for passing

Observation : 06
N 34°26’44’’
E 35°50’51’’
Km : 2+500

Definition : Pedestrian overpass in Tripoli

Comment : Height is over 5,77m. It is suitable for passing

Observation : 07
N 34°26’48’’
E 35°51’04’’
Km : 2+900

Definition : Highway overpass in Tripoli

Comment : Vertical curve should be checked during test drive.

Observation : 08
N 34°26’54’’
E 35°51’24’’
Km : 3+200

Definition : Highway overpass in Tripoli

No of Span : 6 / Distance of Span : 24m.

Comment : It is suitable for passing

Observation : 08
N 34°26’54’’
E 35°51’24’’
Km : 3+200

Definition : Pedestrian overpass in Tripoli

Comment : Height is over 5,70 m. It is suitable for passing

Observation : 09
N 34°27’07’’
E 35°51’46’’
Km : 4+100

Definition : Pedestrian overpass in Tripoli

Comment : Height is over 5,00 m. It should be checked after WTG selection.

Observation : 10
N 34°27’13’’
E 35°51’60’’
Km : 4+500

Definition : Overhead board in Tripoli

Comment : Height is over 5,50 m. It is suitable for passing

Observation : 11
N 34°27’30’’
E 35°52’58’’
Km : 6+300

Photography was not allowed by the Authority.

Definition	: Deir Amar Army Control Point
Comment	: Concrete and steel barriers should be removed during the transportation

Observation : 12
N 34°27’47’’
E 35°53’31’’
Km : 7+200

Definition : Pedestrian overpass

Comment : Height is over 5,60 m. It is suitable for passing

Observation : 13
N 34°27’48’’
E 35°54’12’’
Km : 8+100

Definition : Pedestrian overpass

Comment : Height is over 5,15 m. It should be checked after WTG selection.

Observation : 14
N 34°28’24’’
E 35°55’24’’
Km : 10+300

Definition : Pedestrian overpass

Comment : Height is over 5,25 m. It should be checked after WTG selection.

Observation : 15
N 34°28’50’’
E 35°56’11’’
Km : 11+800

Definition : Pedestrian overpass

Comment : Height is over 5,19 m. It should be checked after WTG selection.

Observation : 16
N 34°29’42’’
E 35°57’28’’
Km : 14+300

Definition : Overhead board

Comment : Height is over 5,60 m. It is suitable for passing

Observation : 17
N 34°30’13’’
E 35°57’49’’
Km : 15+300

Definition : Pedestrian overpass

Comment : Height is over 5,40 m. It is suitable for passing

Observation : 18
N 34°30’31’’
E 35°58’01’’
Km : 16+100

Definition : Roundabout (Alternative 1)

Comment : Red hatched area should be removed during the transportation period.

Observation : 19
N 34°31’03’’
E 35°58’40’’
Km : 17+500

Definition : Roundabout (Alternative 2)

Comment : Red hatched area should be removed during the transportation period.

Observation : 20
N 34°31’03’’
E 35°58’40’’
Km : 17+500

Definition	: Roundabout (Alternative 2)
Comment	: Poles and signboard should be removed during the transportation period.

Observation : 21
N 34°31’03’’
E 35°58’40’’
Km : 17+500

Definition : On-site cast bridge

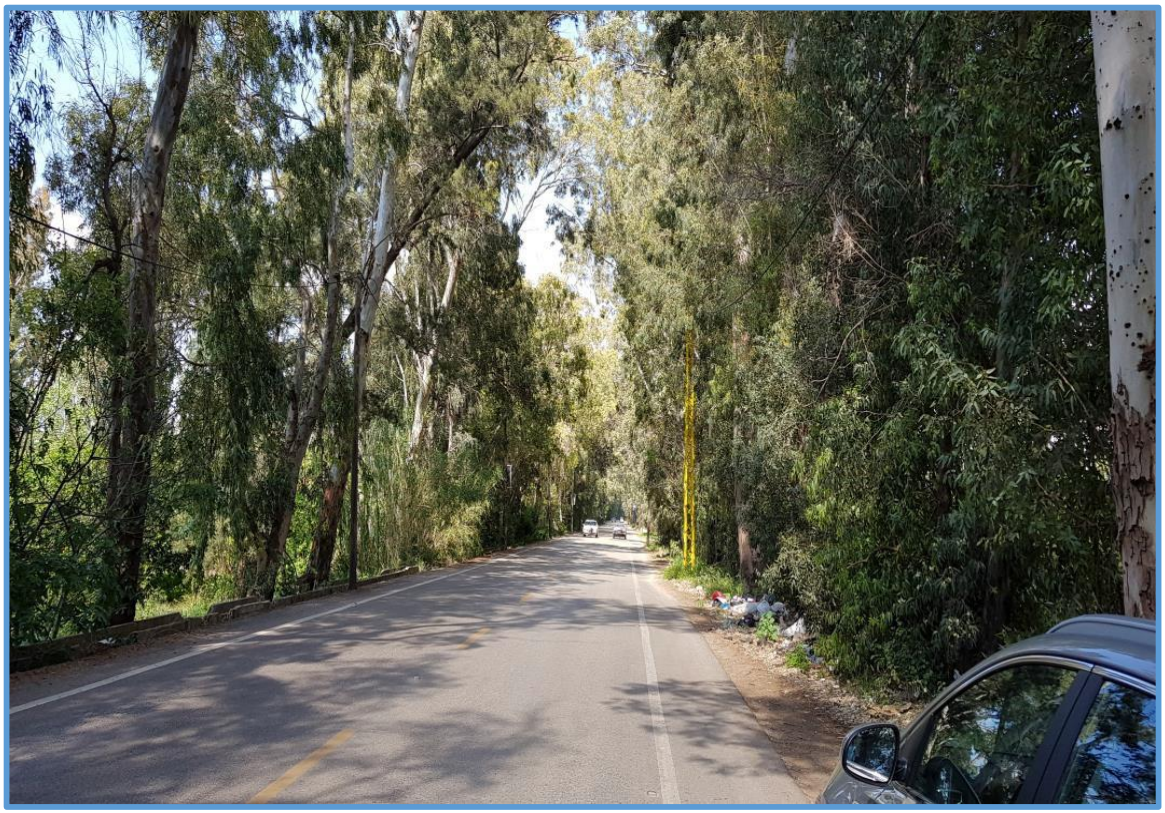
No of Span : 3 / Distance of Span : 5-7m.

Comment : It is suitable for passing

Observation : 22
N 34°32’58’’
E 35°59’31’’
Km : 21+400

Definition	: On-site cast bridge
No of Span	: 7 / Distance of Span : 5-6m.
Comment	: It is suitable for passing

Observation : 23
N 34°35’46’’
E 36°03’46’’
Km : 30+400



Definition : Trees

Comment : Trees should be pruned prior to transportation.

Observation : 24
N 34°36’09’’
E 36°04’02’’
Km : 31+000

Definition : Car/Truck park

Comment : Car/Truck park should not be allowed during the transportation period

Observation : 25
N 34°37’43’’
E 36°06’11’’
Km : 35+800

Definition : Old Customs Building (Alternative 1)

Comment : Red hatched section of the building should be removed.

Observation : 26
N 34°37’44’’
E 36°06’16’’
Km : 35+900

Definition : Old Customs Building (Alternative 2)

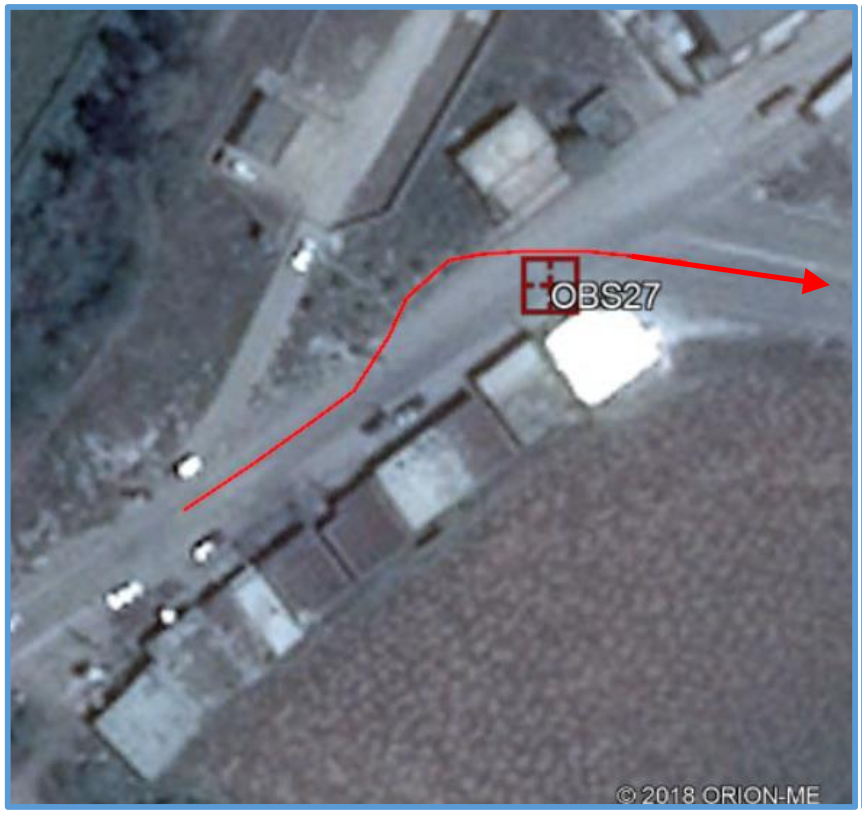
Comment : Red hatched area should be removed and yellow hatched pole should be displaced

Observation : 26
N 34°37’44’’
E 36°06’16’’
Km : 35+900

Definition : Old Customs Building (Alternative 2)

Comment : Red hatched area should be filled and compacted (L:20m / W: 3-4m.)
Yellow hatched pole should be removed during the transportation

Observation : 26
N 34°37’44’’
E 36°06’16’’
Km : 35+900



Definition : Sharp Right Turning

Comment : Red hatched area should be filled/compacted and yellow hatched pole should be removed during the transportation period

Observation : 27
N 34°37’53’’
E 36°06’47’’
Km : 36+800

Definition	: On-site cast bridge
No of Span	: 2 / Distance of Span : 12-15m.
Comment	: It is suitable for passing. Side slopes to be checked during test drive

Observation : 28
N 34°36’39’’
E 36°13’32’’
Km : 48+400

Definition : On-site cast bridge

No of Span : 1 / Distance of Span : 12-15m.

Comment : It is suitable for passing

Observation : 29
N 34°36’46’’
E 36°14’27’’
Km : 50+300

Photography was not allowed by the Authority.

Definition : Army Control Point

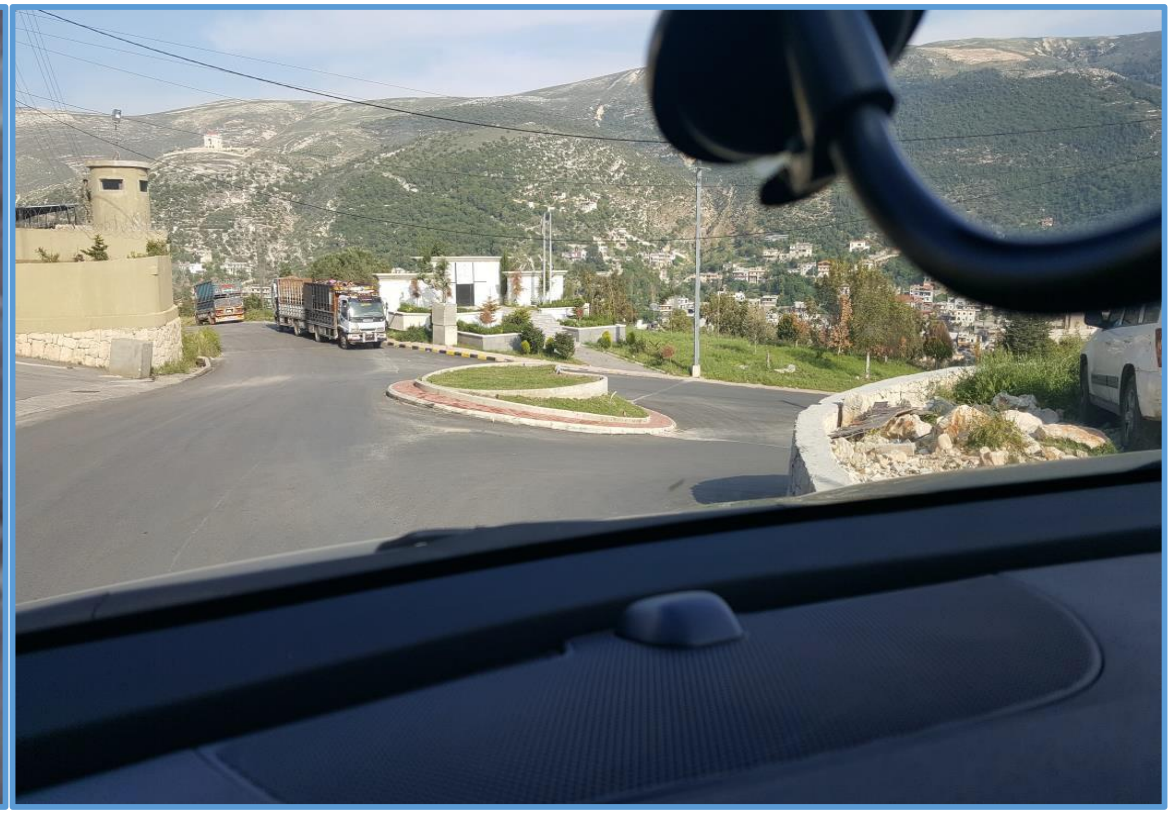
Comment : Barrels and hut should be removed during the transportation

Observation : 30
N 34°36’50’’
E 36°14’41’’
Km : 50+800

Photography was not allowed by the Authority.

Definition	: Chadra Army Control Point
Comment	: All concrete blocks and huts should be removed during the transportation

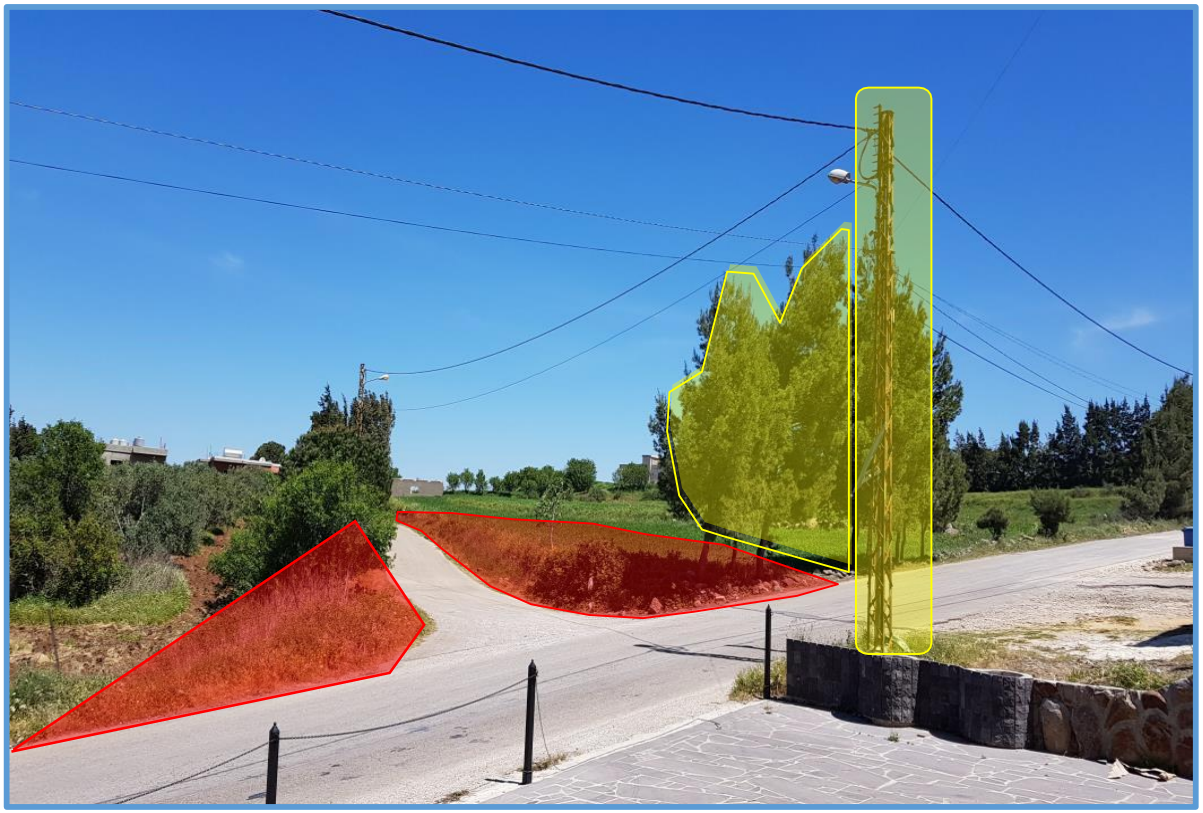
Observation : 31
N 34°37’17’’
E 36°18’45’’
Km : 57+800



Definition : End point

Comment : The defined route is not convenient for transport after this point.

Observation : 32
N 34°37’22’’
E 36°19’00’’
Km : 58+200



Definition : Start point of alternative route.

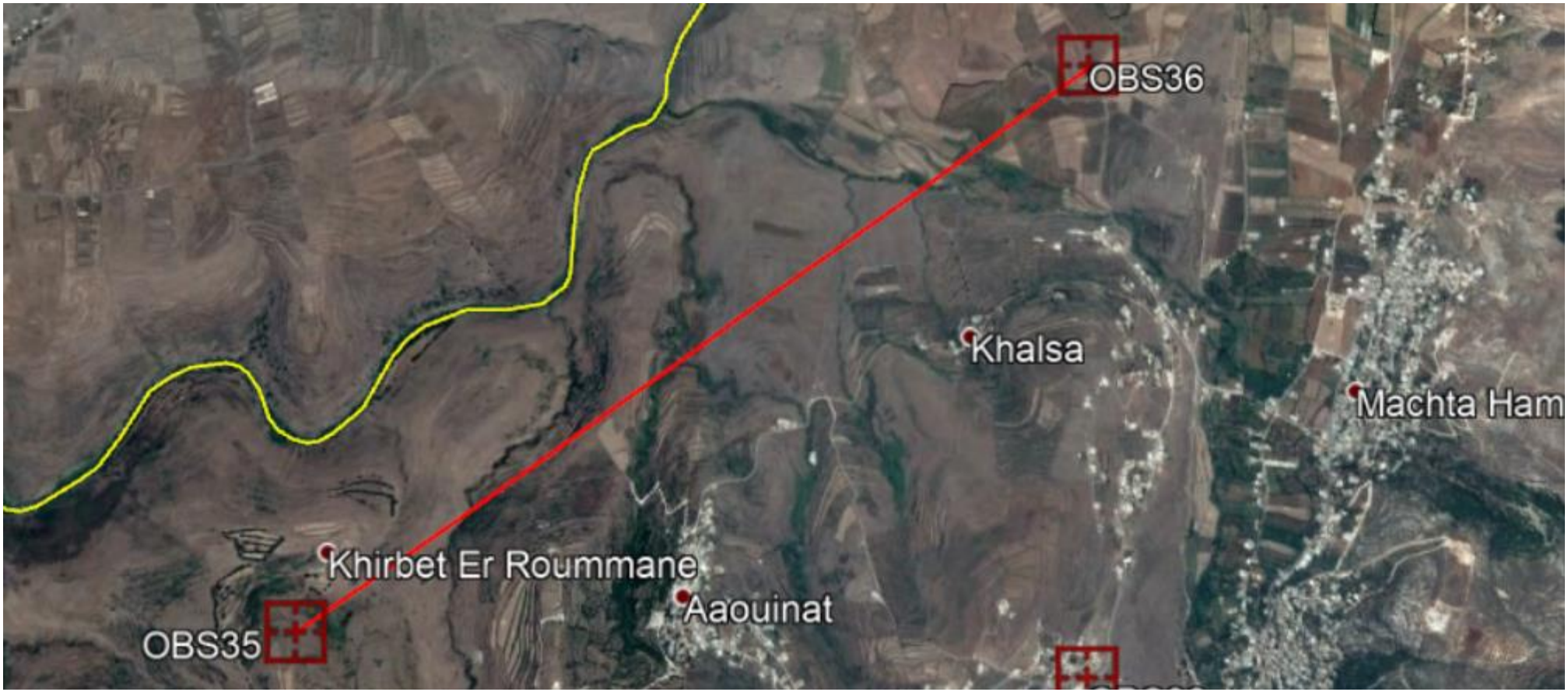
Comment : Red hatched area should be filled / compacted until road level.
(L: 30m. W: 8-10m.)
Yellow hatched pole and trees should be displaced/removed.

Observation : 33
N 34°36’58’’
E 36°17’16’’
Km : 55+500

Definition : Unpaved road

Comment : Road surface should be improved. Min road width should be 5 m.

Observation : 34
N 34°37’08’’
E 36°17’22’’
Km : 56+000



Definition : New road between Observation 35 and 36	Observation : 35 (Km: 56+500) N 34°37’27’’ / E 36°17’17’’
Comment : New road should be constructed from Obs. 35 and 36. Min. road width should be 5 m and dimensioning according to turbine transport guidelines.	Observation : 36 (Km: 61+500) N 34°38’30’’ / E 36°19’02’’

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Definition : Unpaved road

Comment : Road surface should be improved. Min road width should be 5 m. Temporary or permanent relocation of electric poles and other obstacles must be studied separately

Observation : 37
N 34°39’02’’
E 36°18’44’’
Km : 62+750

Definition : Right turn

Comment : Red hatched soil should be removed.

Observation : 38
N 34°39’19’’
E 36°18’33’’
Km : 63+500

Definition : Sharp Right Turn

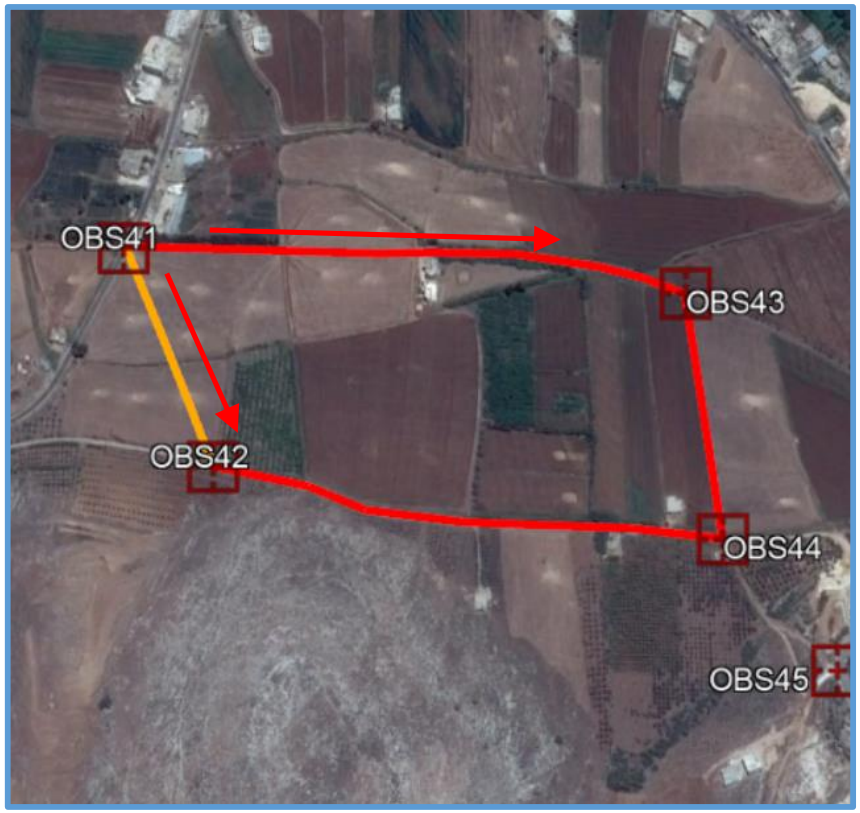
Comment : Either of the alternative by-pass roads should be constructed.

Observation : 39
N 34°39’24’’
E 36°18’35’’
Km : 63+700

Definition : Unpaved road

Comment : The road should be improved from this point to OBS 41 about 3 km. There are unused railway tracks under the surface. Needs to be checked with railway authority for any revision.

Observation : 40
N 34°39’25’’
E 36°18’39’’
Km : 63+750



Definition : Start point of 2 alternative roads

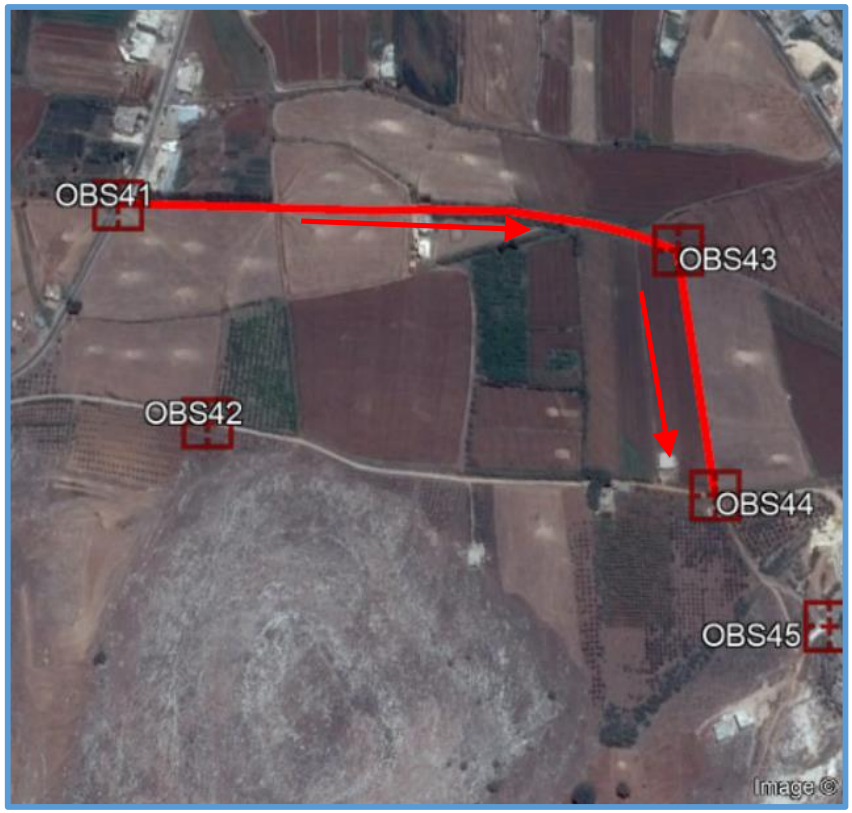
Comment : Alternative 1 : OBS41 – OBS 42 –OBS44
Alternative 2 : OBS41 – OBS 43 –OBS44

Observation : 41
N 34°39’24’’
E 36°20’39’’
Km : 67+000

Definition : Alternative 1 : OBS41 – OBS 42 –OBS44

Comment : New by-pass road of about 300 m., passing through the fields at each turn, should be constructed from OBS41 to OBS42.

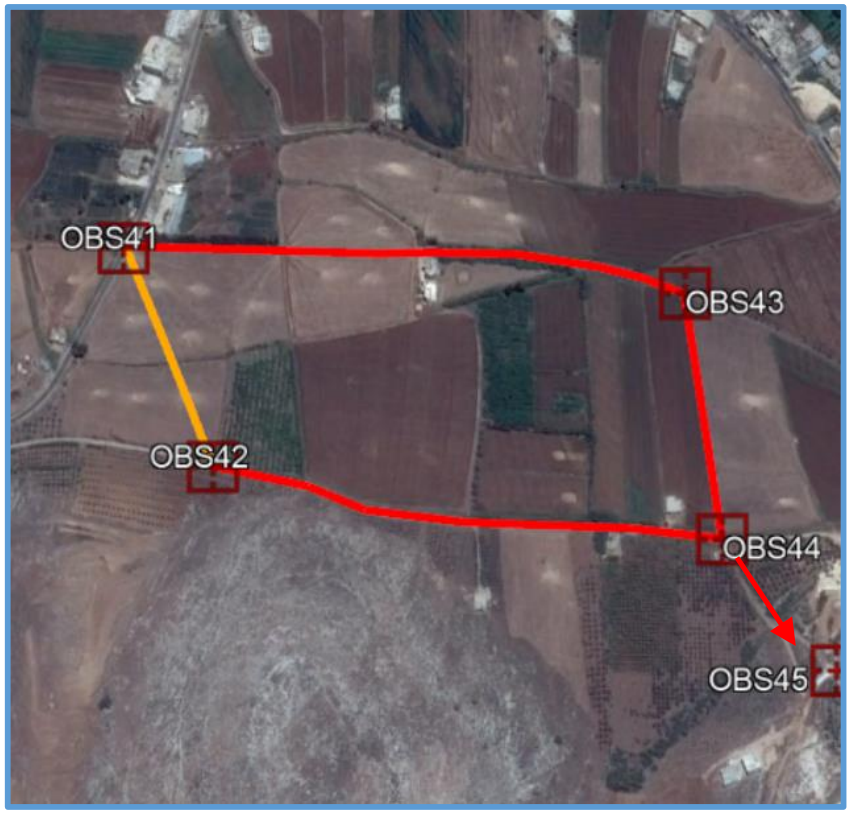
Observation : 42
N 34°39’16’’
E 36°20’47’’
Km : 67+300



Definition : Alternative 2 : OBS41 – OBS 43 –OBS44

Comment : Yellow hatched area should be filled / compacted until road level. (L: 40m. W: 15-20m.) Single field-crossing.

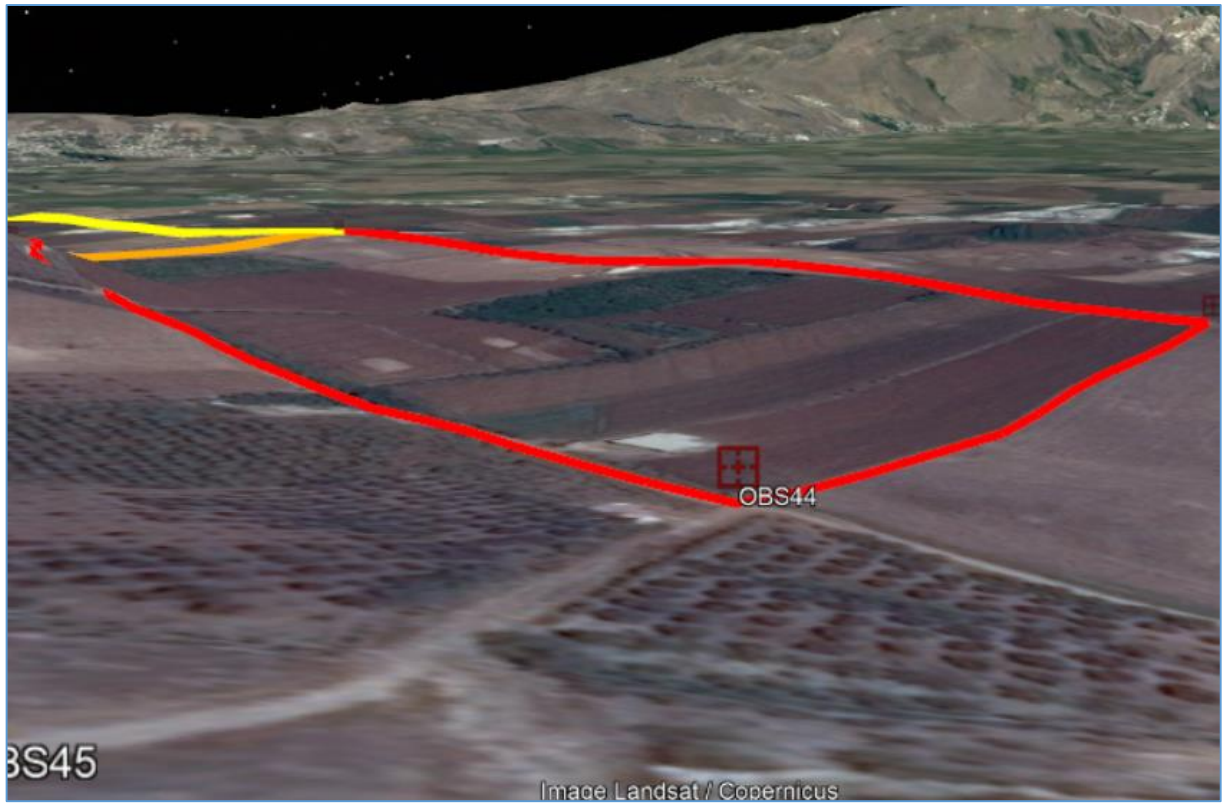
Observation : 43
N 34°39’22’’
E 36°21’02’’
Km : 67+600



Definition : Same end point of 2 alternatives roads

Note: Alternative 1 has three sharp turns to reach PSEP (OBS45)
Alternative 2 seems to be a better option. It has a single right turn and reaches straight towards the Project Site entrance point (PSEP).

Observation : 44
N 34°39’14’’
E 36°21’04’’
Km : 68+000



Definition : Project Site entrance point OBS 45.

Observation : 45
N 34°39’10’’
E 36°21’08’’
Km : 68+200

CONCLUSION

The transport survey starts from Tripoli Port and ends at the Project Site entrance point. This report aims to demonstrate the major concerns along the route, and several critical sections are indicated herein.

Nevertheless, any remaining obstacles or minor conditions which may potentially restrain transport activities shall be identified during a test drive, which is to be scheduled following the selection of the final turbine model, and its transport dimensions.

The most significant concern during the route survey was the need for the construction of a new connection road between OBS35 and OBS36. This segment is to be studied and designed separately.

Also;

- All electric and phone cables over the road must have a clearance of 6m above ground.
- The access and site road longitudinal gradient must be a maximum of 8° (14%).
- Additional pulling units are required during transportation for gradient above 14%.
- Minimum transverse inclination of road is to be 2 % to one or both sides in within the project site.
- The load bearing capacity of all site roads must have a compaction of min. 95%.

We hope our report meets your expectations and remain at your disposal for any clarification which you may require.

Yours Sincerely,

Magdenli Transport and Trade Co.

H. Emre VENEDIK - Civil Engineer

Ghorayeb International Freight Forwarding Co. (GIFCO) S.A.L.
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TECHNICAL DOCUMENTATION FRONT SHEET

Initial Route Survey Report

Transportation Delivery Route for Wind Turbine Generators
Exact total quantities and types to be advised
Example WTG used for this survey
Siemens SWTDD-130

From Tripoli Container Port, Tripoli, Lebanon

To Sustainable Akkar Wind Farms in the Akkar Region of Lebanon.

Rev	Date	Reason for Issue	Prepared	Reviewed	Approved	Reviewed	Reviewed	Approved
D1	14/06/2018	Internal Use	MP					
			Originator	Lead	Manager	Project Lead		SPA

Notes:

Category	Code	Description
Location Code		
Document Type	RSR	WTG delivery
System Number		
		Original Document Number

Company	Location Code	Disc	Doc. Type	Seq No.	Sheet No.	Rev
	LEB	LOG	RSR	0002	1	A2

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Revision History and Hold Record

Revision History

Date	Rev. No.	Detailed Description of Change	Ref. Section

Hold Record

Hold Ref.	Description / Reason for Hold	Ref. Section

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Comment Record Sheet

Item	Section/ Reference	Comments
1		
2		
3		
4		
5		
6		
7		

Action Title	Action Description	Actionee	Doc. Rev. generated

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1. General

1.1 Purpose

This document shall outline to Sustainable Akkar the results and recommendations of the initial route survey carried out by Gifco's Project team for the delivery of Wind Turbine Generators from free on trailer (FoT) Tripoli Port to FoT at the designated Wind Farms in the Akkar region of Lebanon. Gifco are fully aware of the national importance to Lebanon and Sustainable Akkar of this project. As are the needs to minimise any disruptive effect the delivery of the WTG's to site may have on the local populous and environments they pass. Safety and timely implementation of the operation are paramount.

Therefore this initial route survey shall advise Sustainable Akkar of the most viable route Gifco have discovered and outline Gifco's recommendations for the proposed WTG delivery. This survey is submitted to Sustainable Akkar, in order to demonstrate the safe, professional, and efficient methods Gifco have approached the pre- appraisal of the Logistics required and used to fulfil Sustainable Akkar's RFQ.

1.2 Confidentiality:

The information contained within this document has relevance to Gifco's future commercial proposals as do their suggested amendments /solutions to the identified route issues. Therefore, this is a restricted document for Sustainable Akkar's information and use within their Wind Farm Project Team only.

All the surveys content, format, and intellectual rights are protected by "copy write".

As such the document and or contents, in part or full, shall not be shared with Gifco competitors, competitor's agents, or others outside Sustainable Akkars Project team organisation without the written consent of Gifco.

1.3 Overview:

This is an initial survey, to identify the most suitable route available for delivery by road of all the major Out of Gauge (OOG) components of the Wind Turbine Generators (WTG). It is not a full topographical survey of the pre-advised routes available, nor of the alternatives Gifco have found or suggest.

Post Contract award, Gifco advise that a full, OOG transport orientated topographic survey be undertaken to detail the proposed route amendments required. Gifco have access to latest "state of the art" vehicle mounted route survey equipment that can electronically gather the required data to assist in determining the precise remedial actions required to give free passage to the proposed transport configurations. In conjunction with the transport company, roads civil contractors, utility companies and client this data will exact and viable remedial actions needed allowing formulation of a schedule of works at a reasonable and reliable cost.

Due to lack of exact and specific WTG details, including drawings, CoG and support frame design, at the time of the survey, general industry indicative WTG transport configurations and vehicle types have be utilised in determining the route viability, post remedial works where necessary, along with manoeuvrability and clearances requirements of the indicative transport configurations

The survey, at this stage, will identify only general outline remedial works required to overcome highlighted issues. Once the specific WTG drawings from the supplier are received for review by the transport company a full topographical survey is highly advised.

Note: All proposed and or alternative transport configurations and support methods shall be in consultation with and agreed by the WTG manufacturer in order to ensure compliance with their specific product safe carriage and Safe systems of work.

Where major issues on the route are encountered or identified, Gifco shall endeavour to suggest alternatives routes that probably could be utilised for the delivery of the WTG major components. These suggestions may necessitate extensive modifications to the current infrastructure and or construction of permanent or temporary access roads on private or public land. Verification of their viability and budget cost will be clarified post client agreement to engage Gifco for this work scope and completion of topographic survey in consultation with road civils engineering contractor.

Removal and reinstatement of street furniture, utilities and works, design and construction of roads will be outside Gifco scope, unless agreed in advance. Compliance with WTG recommended criteria of clearances, geometry and load bearing requirements should be considered in all infrastructure development, remedial works and actions.

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1.4 References

Document Number	Document Title

1.5 Abbreviations and Definitions

1.5.1 Abbreviations

Abbreviation/ Acronym	Description
KTT	Kocaman Transport-Turkey
HSSE	Health, Safety, Security and Environment
OOG	Out of Gauge
SoW	Scope of Work
MoC	Management of Change
MoR	Ministry of Roads
SA	Security Authorities of Lebanon i.e. General Security, Military, Police
RA	Risk Assessment register
KoM	Kick off Meeting
ESIA	Environmental and Social Impact Assessment

1.5.2 Definitions

Term	Meaning
GIFCO	Contractor legal entity as registered in Lebanon
CONTRACT	Formal written instruction and promise to pay Contractor from Client to proceed with the SoW as defined in the signed Contractor / Client agreement.
CONTRACTOR	Out sourced resources
Sub-Contractor (s)	Outsourced third party contracted to carry out the work scope as directed by and on behalf of the Contractor
SECURITY AUTHORITIES	Those responsible for private, military or public order and protection in Lebanon
UTILITY COMPANY	Companies having responsibility for Energy, Telephone, Gas, Water or other conduit services in the local area.
Ministry of Roads (MoR)	Government body responsible for the development, implementation and maintenance of public access roads in Lebanon
Management of Change (MoC)	Defined procedure in which changes to the agree equipment or process which could affect the safety or integrity of the activity are identified, managed risk assessed and recorded prior to recommencement of the activity.

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2. Scope of Work

2.1 Outline

Client's requirement is for Gifco to supply route recommendations for transportation of the OOG components of advised Wind Turbine Generators from Tripoli container Port Tripoli Lebanon to designated map coordinates in the Akkar region of Lebanon.
The results of the route survey will determine the most efficient and least invasive transport configurations to fulfil the WTG delivery segment of this Project.
Where current public roads infrastructure, structures, utilities or environment encroach or are inadequate to allow free passage of the pre-advised indicative transport configurations. Gifco shall endeavour to path find alternative routes. From this Gifco shall recommend or suggest alternatives that may overcome or minimise remedial works in order to reach the desired delivery destination.

2.2 Survey Terms of Reference

- Road Delivery of 17 Wind Turbine Generators (WTG)
- Advised Point of entry into Lebanon
- Tripoli Port Grid ref **34°27'34.86"N 35°49'42.63"E**
- Advised wind farm locations cover a vast area in this region therefore exact site entrances will be subject to a viable route being identified.
- Site Access roads, turning and WTG laydown area will be constructed in accordance with WTG manufacturer's standard advised criteria by others.
- All WTG locations, site roads and turning areas to be completed prior to commencement of WTG major component delivery.
- OOG WTG components per WTG used as guide for the survey are as per slide 5.
- Each WTG consisting of up to 10 individual OOG loads.
- Clients projected delivery schedule is 2 WTGs per week over a 2 month period
- Delivery date TBA but early estimates are spring 2019 / 20
- Convoy size & delivery period and schedule to be agreed with Client, Erection team, Local security authorities & permitting authorities.

Component Specifications *** note dimensions are only indicative**

Component		LENGTH [m]	WIDTH [m] Large dia	HEIGHT [m] Small dia	WEIGHT (t)
B63 Blade (per blade)		63.45	4.10	2.63	17.200*
Hub		5.25	4.81	4.20	45.914
Nacelle		6.08	4.14	4.18	33.000
Generator		2.6	4.18	4.18	70.300
D3-T85.0-4753	Tower top Section	36.0	4.22	2.96	76.879
	Tower Mid-Section (1)	31.64	4.30	4.22	69.022
	Tower Base Section	14.98	4.50	4.30	63.715

* Weights with bolts
**As used for the route survey TOR

2.3 Route Survey Transport & Delivery Synopsis

2.1 All WTG oversized components will arrive into Lebanon at Tripoli Sea Port Container Terminal by Cargo Vessel

2.2 At this time, Gifco have been informed that the ships discharge and movement, to a suitable laydown areas within the port are the responsibly of others.

2.3 Gifco's responsibility, at this time, is only for the onward Transport from FOT (Free on trailer) at the designated Port laydown area. To FOT at each individual WTG foundation & laydown area. Discharge from the transport at the destination will be by others. Transport company personnel will assist where required at point of loading and discharge by lashing & freeing lashings. Plus operating their transport equipment as required.

2.4 Transport Configuration: As a guide to the survey, the transport engineer has used the Siemens SWTDD-130 major component indicative weights, measurements and transport configurations as detailed in slide # 5. However, these may not be the most usable transport configurations for this particular wind farm topography and infrastructure. Gifco may suggest alternative transport configurations which may overcome some of the identified route issues found during the initial survey. These transport changes, if any, are to be discussed and agreed with Sustainable Akkar and manufacture as the project delivery synopsis is developed.

2.5 Delivery and schedule will be subject to local authority permit approval TBA. However, Client has indicated a delivery schedule of 2 WTGs per Week, over a 2 Month continual period for 17 WTG units.

2.6 Movement from the Port laydown area will be subject to prevailing local conditions at the time. Namely weather, Military, Police, Public and Utility Authority permits or restrictions imposed by them due to traffic volume or holiday periods or security issues. All TBA nearer the delivery date.

2.7 Subject to routing and outside controls, staged route segment delivery may be required to ensure minimum disruption to local community activities and working / commuting periods. Again this synopsis can be clarified as the project delivery details are developed.

3. Assumptions

Gifco assumes, and shall plan according, that others have already reviewed the siting of these Wind farms and that alternative suggestions have been voiced on the solutions to overcome the route issues identified in previous surveys.

4. Execution

Using a suitable vehicle for the intended terrain, Gifco, over a two day period in the region, travelled the public highway from Tripoli Port to the region of the intended wind farms. During this journey overhead and under road major structures shall be identified and initial measurements taken where required. Where routes are found impassable, by the indicative transport configurations, outline suggestions for remedial actions to enable passage shall be noted.
Where allowed Video and photographs shall be taken. These shall, where possible, be geo tagged to enable location identification labelling.

5. Journey Management

The journey shall start at the Tripoli Container Port and end at the advised Wind farm destination entry points.
Where issues are encountered that are insurmountable, Team shall endeavour to locate alternative routes. Log their location, local environmental, current status and general works required for any upgrade / civil works.

6. Health, Safety, Security, Environment - HSSE

Gifco team shall at all times be aware of the surrounding hazards and potential risks to life these hazards may inflict. Suitable precautions shall be implemented at all times. Local knowledge and recommendations from Local advisor shall be adhered to at all times.

7. Report Findings

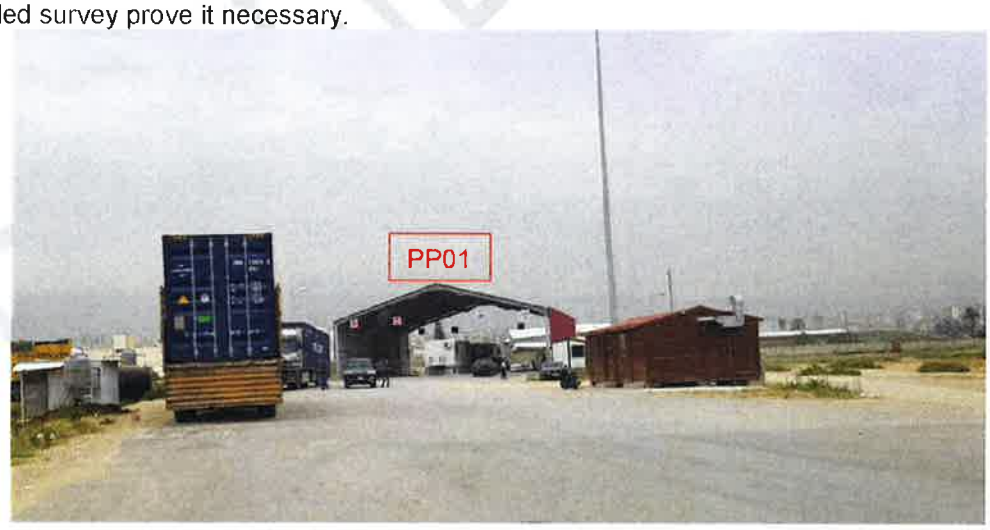
The initial route was suggested by Sustainable Akkar and supplemented by information gathered from Google Earth Pro / Maps and electronic navigational aids
The route survey Team shall use this route as the basis of the survey and highlight any pinch points (PP) that may cause restrictions & or obstacles for the indicative transport configurations.
Where architectural or geographical obstacles are encountered that are insurmountable, Survey Team shall attempt to route find other solutions and or suggest other solutions, transport configurations, or approaches that may overcome the issue.

7.1 Start of route: Tripoli Port Container Terminal

Receiving the cargo, transfer to Laydown, support and reloading to transport, at this time, is outside this survey scope and will be to the responsibility of others.
However, it was noted that the ports current handling equipment for this project, includes two Gottwald Harbour mobile port cranes. Year of manufacture 2003 & 2006 respectively with 100 ton capacity which are currently using 5 year test criteria, in test and several 40 tonne container

handling Telehandler and Front lift handlers. Several 70 tonne capacity port container trailers were noted but no low heavy Mafi trailers. All the handling equipment looked to be well maintained and serviceable.

PP01 Within the port and on the exit route there is a customs hall that all vehicles transit. Measurements of the facility, at the time of survey, were not possible due to the short notice survey request and permit requirements. Currently there is no bypass road of this facility. However, there was vacant land suitable for one to the immediate side of the hall, should a detailed survey prove it necessary.



PP02: The port internal access road by the exit gate is circa 19 m wide, reducing to circa 16 m nearer the exit gate. Each side bordered by concrete bund walls surmounted by steel poles and wire mesh infills. These look to be movable, with agreement of the Port and Lebanese's General Security, should it be necessary to increase the clear oversail & overhang sweep area to allow the WTG blades to exit the port un-hindered.

PP03: Exit from the Port is by a commercial gate which is circa 13 meters wide. There are concrete bund walls circa 3 m high to each side circa 6 meters long. In an addition another smaller security / personnel / car access gated building to the left (looking at the port from outside).

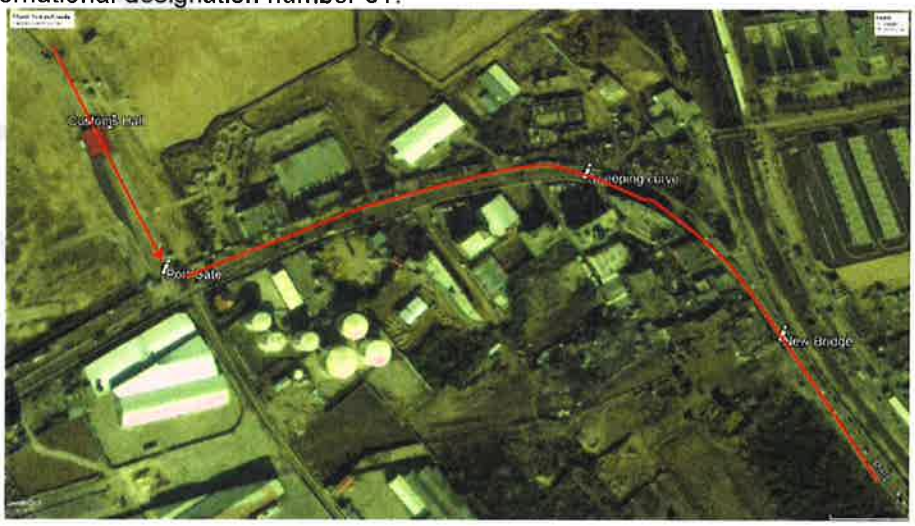
A detailed topographic survey of the port internal and external area will be require to determine the exact remedial works required once the transport configurations have been clarified. However, this visual assessment suggests that a section of external wall and internal bund wall / fence will need to be temporally removed.

The external area of the port exit is a dual carriage way public road with a 13 m wide supplementary area used for parking and layover of commercial vehicles.
From the gate to the opposite side of the road is a total of circa 33 m whilst the gate is only circa 13 m wide.
Initially, In order to exit the port with a 63/4 meter long WTG blade on a "wing trailer", alterations will be required to supply sufficient oversail and overhang swing clearance. This visual assessment identified that the following amendments will be required Topographic survey will clarify the exact details.

PP04 In addition to this various items of concrete blocks will require removing, and the ground / roadway making good for the vehicles to utilise all the available area.
PP05 Subject to Topographic report, Overhead cables and or their supporting pylons may need to be temporary repositioned removed or permanently relocated.
A topographic survey will determine exact remedial works required allowing detailed consultations and agreements with the local utility owners, Ministries & Authorities for their costs and implementation schedules to be submitted.
NOTE: For sake of good order, and not to continually be repeated, the aforementioned sequence for route amendments will be the protocol for all identified pinch points along the route, unless mentioned in this report otherwise.

7.2 Tripoli Port Road Highway 51

On exiting the Port the vehicles will turn 90 deg left along the main Lebanese South/North highway with international designation number 51.



PP06: 1.5km Grid ref N 34.451849° E 35.842352°
A new road is being constructed with a concrete beamed bridge passing over the main port road.
Measured minimum heights left 6.7 m, right 6.7m.

The surveyors have been advised, post carrying out the survey, that road, of which this bridge is part off, may be completed by the time of the WTG delivery and may therefore give an alternative route out of the city of Tripoli. This would be subject to usability of the access ramp location & geometry, also the egress location and geometry onto the current highway 51 infrastructure.
A detailed profile and geometry of the access egress junctions have been requested from the information source so that it can be evaluated and either integrated into the proposed route or eliminated.

PP07: N34.453341° E35.840381°: Between the port gate and the over bridge there is a sweeping curve to the right. This area is lined on the left with commercial properties and young trees on the central reserve. Surveyor recommends that this area is cleared of all parked vehicles and traffic flow before and whilst transports pass.

PP08: 2.2km
Abou Ali Roundabout is an oval Roundabout of circa 140 m on the long axis & 84 m on the short axis.
The roundabout road fluctuates between 13 & 18 m wide.

Grid N34.446514° E35.846558°

Entry into the roundabout is from a circa 15m wide road. This is split by a divider reducing the road down to circa 10 m.

PP09: At grid 34.446588° 35.846541° on the left of the road set back circa 22m from the divider apex there is a lamp post which may need to be removed to allow entry into the roundabout.

PP10:

PP11: 2.4km the roundabout is intersected by a river though it's short axis and passed over by a single span concrete bridge of circa 30 m which is full width of the surrounding road.
It was not possible to see under the bridge to assess the condition and type of construction. Further investigation with the ministry of roads will be required to exact its current capacity capabilities in regard to load support and permissible axle loads. However, as this is a major access road to the port & city, it is estimated that the bridge is of structural soundness and be of a minimum of 50B rating.
This is a busy road and all parked vehicles and traffic should be removed during transit of the OOGs

Roundabout Entry Roundabout 1st Quadrant

Roundabout 2nd Quadrant

Roundabout 2nd Quadrant looking back

Roundabout River bridge 3rd Quadrant

Roundabout 3rd Quadrant & Exit

Fouad Cheheb Tripoli Minieh Highway 51

PP12: 2.78km Footbridge Steel & concrete construction. Rising from the right to left. Minimum 5.7 m clearance.

Note: All along Fouad Cheheb there are myriad of overhead cables. Due to the abundance of them they were not measured. However, as this is a major highway trucks pass along, the minimum height is estimated at 5 m. Should the overall traveling height of any of the OOG vehicles be over this then the cables shall need specific survey to determine the actions required. i.e. temporary lifting or permanent raising prior to transit.
As this and the other road identified are extremely busy, should any of the cables require lifting, then the surveyor recommends that these are permanently raised prior to commencement of the first OOG movement. Not to do this, would severely hinder and slow down the transit of any convoy and have a serious impact on the safety of the transit operation and the public in general. Due to the abundance of transports, permanently raising identified low cables is recommended for all of the subsequent routes chosen.

Fouad Cheheb Tripoli Minieh Highway Fly over bridge ramp @ 2.3 km

PP13: 3.1km A Fly over ramp with an angle of circa 3.5 deg over a longitudinal length of circa 95 m with the apex at circa 5.45 m high, it then gradually descends back to 0 ground level after circa 600 meters. More information from Ministry of Roads (MoR) is required to clarify structural integrity and is suitable for the proposed load configurations. Should the MoR not have these on record, or detailed drawings a full topographic survey to determine exact longitudinal concave and convex profile will be required.

PP14: 4.0 km Concrete build Footbridge
Grid N 34.451930°, E 35.863013°
Measured height left 5.1 m lowering to 4.49 m right. Calculated max height of cylindrical load centre 4.88 m.
This is the lowest structural height restriction so far on the route. Therefore the limiting factor on overall traveling height of all loads out of Tripoli city on the current identified route.

Note: Should the new relief road which is still under construction be suitable and sufficient for the transports at the time, then this alternative route could by pass this height restriction.

PP15: Footbridge 5.5 km
Grid N 34.27123 E 35.151.5830
Sign over road measured height 5.75 m lowering to 5.7 m on the left 12 m wide road way.

PP16; @ Circa 7.0 Km along the route there is a Military check point consisting of concrete blocks and sentry stations. Grid N 34.463103° E 35.892431°

No photographs were allowed and measurements for clearances were not taken.
Lebanon General Security and Ministry of Defence authorisation and permits will be required before any Topographic survey can be undertaken to determine any possible temporary amendments to the facility during transit period of the WTG OOG components.

PP17: Sign Over road
Grid N 34.463330°, E 35.903116°
Height 5.7m left 5.75 m right

PP18 Grid N 34.463815° E 35.906872°

At 8.37km past the sign

PP17 Under pass tunnel. To the right there is a slip road off and back onto the main highway. This bypass road has no overhead restrictions and is suitable for all WTG OOG components to pass.

PP19 Footbridge
Grid N 34.473213° E 35.923225°
Measured height 5.52 left 5.63 right
Road width circa 11 m

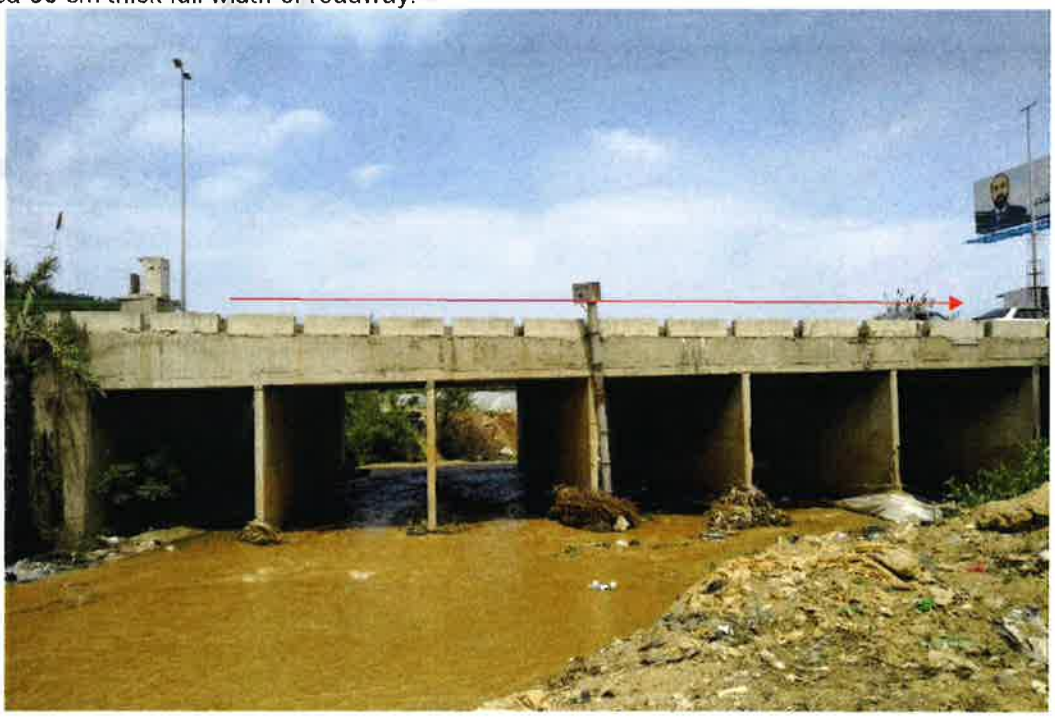
PP20: @ 9.6 km Cast Footbridge
Grid N 34.480712° E 35.936339°
Measured @ 5.1 left & 5.13 right

PP21: @ 11.1 km Cast Footbridge
Grid N 34.494877° E 35.957846°
Measured @ 5.1m left & 5.33m right side

PP22. Underpass Tunnel
Grid N 34.49882, E 35.960169
To the right there is a slip road off and back onto the main highway. This bypass road has no overhead restrictions and is suitable for all WTG OOG components to pass.

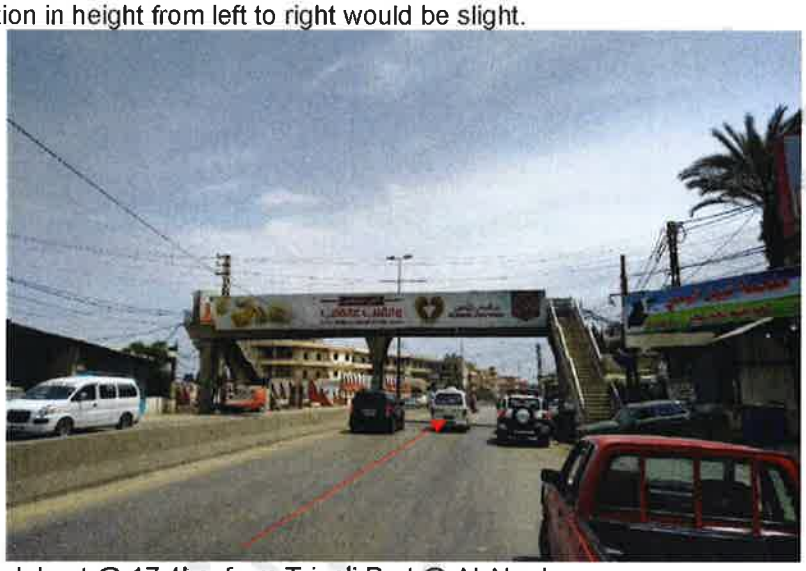
PP23 @ 14.7 km Over sign
Grid
Measured @ 5.6 m right side. Traffic was too heavy and too dangerous to get the left side measurement.

PP24: Al Mahrma : Cast in Situ 7 span concrete bridge
Grid N 34.503154°E 35.963379°
Measured overall span of 36 meters bearing to bearing. Each span is circa 5 m resting on supports of circa 30 cm thick full width of roadway.



Details of the bridges original capacity and current structural status should be obtained from MoR. However, this being a major highway it is expected to be suitable for all expected imposed WTG OOG vehicle axle loads.
Should the MoR not have the information available, a structural bridge assessment may be required to ascertain the current structural integrity and capacity.

PP25: Cast Footbridge @16 km
Grid N 34.508707° E 35.966972°
Measured @ 5.5m right side
The traffic at the time was too substantial and dangerous to enable measuring the Left side as there was no safe haven for the surveyor. However, the survey team's visual review noted that any fluctuation in height from left to right would be slight.



PP26: Roundabout @ 17.4km from Tripoli Port @ Al Abade.
This is a major intersection of the highways. The 1st exit to the right leads to Halba.
Whilst the 2nd exit leads to Aarida along the coast and the border crossing into Syria.
For the Wind Farm Project the 2nd exit will be taken and the route continued towards Aarida.

Due to the numerous items of street furniture, lamps and fencing etc, plus the substantial traffic volumes, a full topographic survey is recommended to determine the exact path the WTG OOG cargo could take, especially the Blades and the top tower section, this will detail the exact remedial actions required to give a free transit corridor.

One suggested option could be to; temporary remove the roundabout island features down to street level and place temporary barriers there to guide general traffic in the period between transport convoys, thus giving free passage of the vehicles through the island area. Reinstating such post-delivery of all OOG items.

An alternative path may be, to pass contraflow to the left of the roundabout island. This would entail removal of a section of the central North /South concrete divide, and possibly a street lamp post on the approach to the roundabout. As well as a section of the roundabout island perimeter fencing and signage. Exit from the roundabout would be also contraflow on the south bound carriageway. Therefore, also requiring removal of a section of the North / South concrete central divide to allow the vehicles to pass back onto the north bound carriageway. A topographical survey would determine exactly the optimal corridor with the least amount of adjustments.

Shaded area to be removed to allow contra flow

PP27: 3 span concrete on site concrete cast bridge
Grid N 34.54968, 35.99218 N
Overall Span circa 17 m bearing to bearing
Support columns circa 40 cm thick.

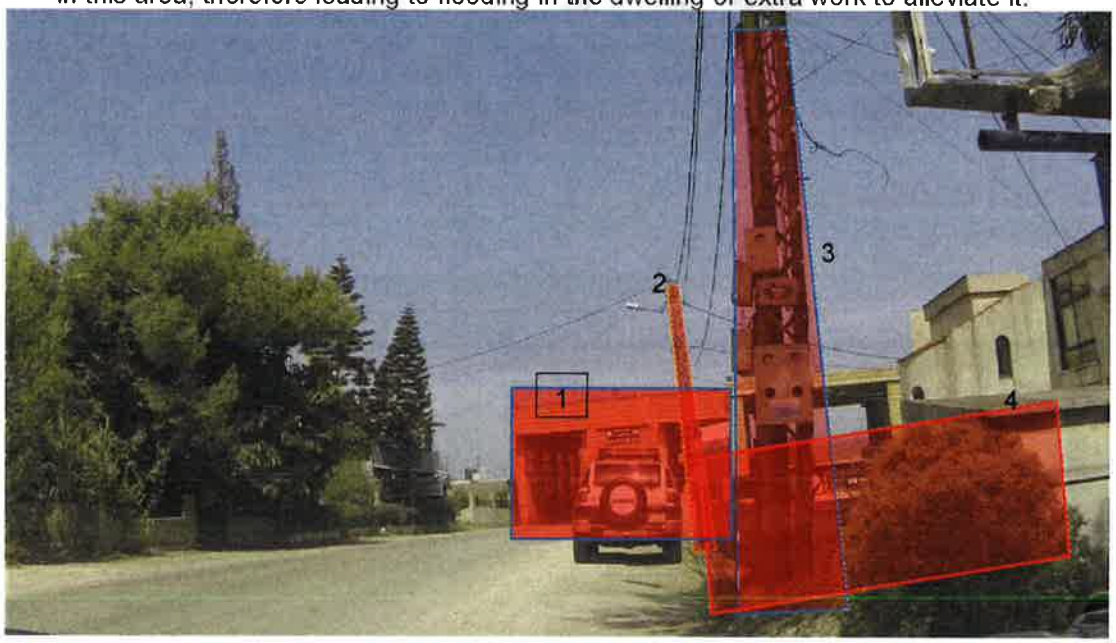
Details of bridge capacity and current structural status should be obtained from MoR. However, this being a major highway it is expected to be suitable for all expected imposed WTG OOG vehicle axle loads.
Should the information from the MoR not be available, a structural bridge assessment may be required to ascertain the current structural integrity and capacity.

PP28: Offset Roundabout
Grid N 34.553346° E 35.993084

At this roundabout the highway splits. The left fork continues along the coast towards Aarida and the Syrian border crossing. The right fork leads towards Aabboudiye. This is the direction the transports will continue along to the prospective Wind Farm locations.

PP29: Old Customs Hall

This facility is made up of three halls, two narrow halls joined in the centre with offices and inspection kiosks / tables. With a separate wider and higher, clear of obstacles, hall to the right. However, accessing this wider hall would entail removing a private dwelling boundary wall plus relocating major overhead power cables & lamp towers plus raising the yard level in front of the private dwelling. This raising could have negative consequences on the surface water drainage in this area, therefore leading to flooding in the dwelling or extra work to alleviate it.



A further study would be required to ensure that the work would not cause problems to the owner. Marked 2, 3 & 4
An alternative could be to remove the central office and inspection counter from the two adjoined halls or remove the Halls completely. This option would negate any other work with the power cables, towers, walls or private dwelling. Should the authorities require reinstatement of the hall, this could be achieved with a cost effective modern prefabricated building.
Gifco Survey Team recommendation would be the removal of the Customs Hall marked 1.

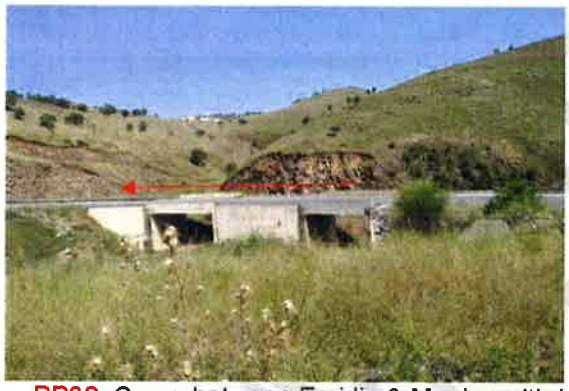
PP30: Turn right @ Aabboudiye circa 36.6 km from Tripoli Port
Grid: N 34.631685° E 36.113019°

The right turn towards Kouachra is from a circa 14 m wide road flanked on each side by commercial properties and an area with small trees onto a 25 m dual carriageway with low a concrete divider.

To allow the OOG vehicles to pass freely the central divider, area of trees and power pylon should be cleared.

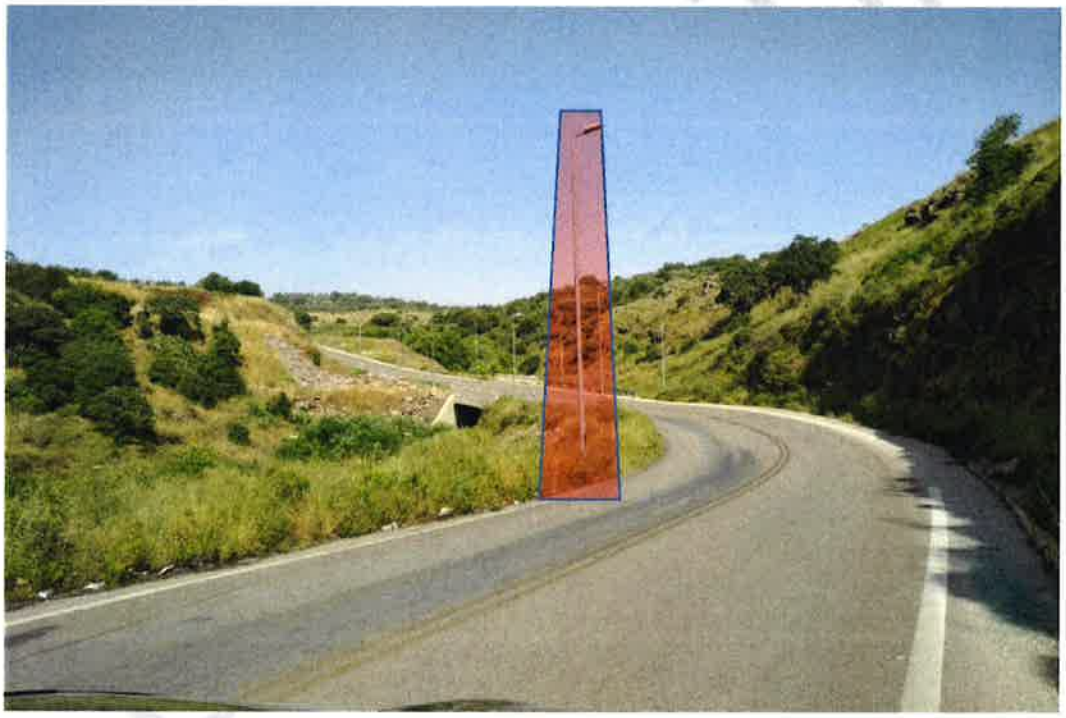
PP31: U bend in a Valley @ 46 Km.
Grid N 34.610594° E 36.225503°

Between Dabbabiye & Fraidis there is a U bend in a valley with two separate single span cast in situ concrete bridges. These single span bridges are circa 13 m span each
The road inner radius = circa 50 m with outer radius of circa 60 m.
Due to gradient changes between the approach road and the egress road the angles and gradients will require plotting to ensure they are within the wing trailers manoeuvring capabilities. Also the rock face near the apex of the bend requires review to ensure blade overhang clearance.



PP32: Curve between Fraidis & Menjez with lamp standards on the inner radius.
Grid: N 34.612789° E 36.240019°
Radii of curves to be surveyed to ensure Blade oversail and overhang are not encroached.
If required temporary remove lamps as marked or reposition outside over sail /overhang swing area.

2 x Single span cast on site bridges with circa 13 m span each. These are fairly new constructions and visually, in good structural condition.



PP33: Security Checkpoint with no Photos allowed.
Grid N 34.610594° E 36.225503°

Security Checkpoint with concrete blocks and sentry posts. This was unmanned during the survey, however the traffic calming obstacles in the roadway should be removed or repositioned for free passage of the WTG OOG transport period.

The Gifco surveying team continued along the highway until Chadra. Here the route became impassable for long OOG vehicles due to urbanisation and infrastructure restrictions by acute turns and junctions surrounded by immovable obstacles. i.e. houses and private structures

Therefore is was decided to ended the survey of the known highway route at this point.
The surveying team was made aware of previously identified, by others, alternative roads which was basically a very narrow farmer's field access track. This was extremely narrow and rugged only accessible by a specialised rugged terrain 4x4 vehicle. This track would require major re construction, as much as the suggested link road at its end point. The previous survey suggestion, to build a new link across contoured agricultural land of some 3 km, as the crow flies, to meet up with a current road / farm tracks that also need upgrades.
Surveyor decided that, as this alternative had already been explored by others and recommendations submitted to Sustainable Akkar for their digest, and as the Gifco surveying team only had limited time in the area, it would be more productively spent exploring the surrounding areas to try and discover any other probable alternatives.
Following this mandate, the team explored several roads and routes that linked to the existing highways and major road systems.
The objective of this part of the survey was to explore roads and tracks in the area which could open up other delivery routes and possibly, alternative methods of transport configurations that may minimise other civil works.

8. Path finding

After several hours driving many local roads, and consulting with navigational aids, two or three probable alternative roads were identified. These roads all lead in the general direction of the intended Wind Farm sites. None of the locally located roads found by the team were suitable & sufficient to ensure free passage of the super long transport configurations, without major civil works and or removal of buildings, consisting of both commercial and private dwellings. In some cases, the roads discovered reduced in width and geometry significantly enough to make them only passable by small commercial vehicles and private cars.

The Gifco surveying team however, did locate some probable alternatives which, after upgrade work could possibly be more direct to the site, but not to the previously

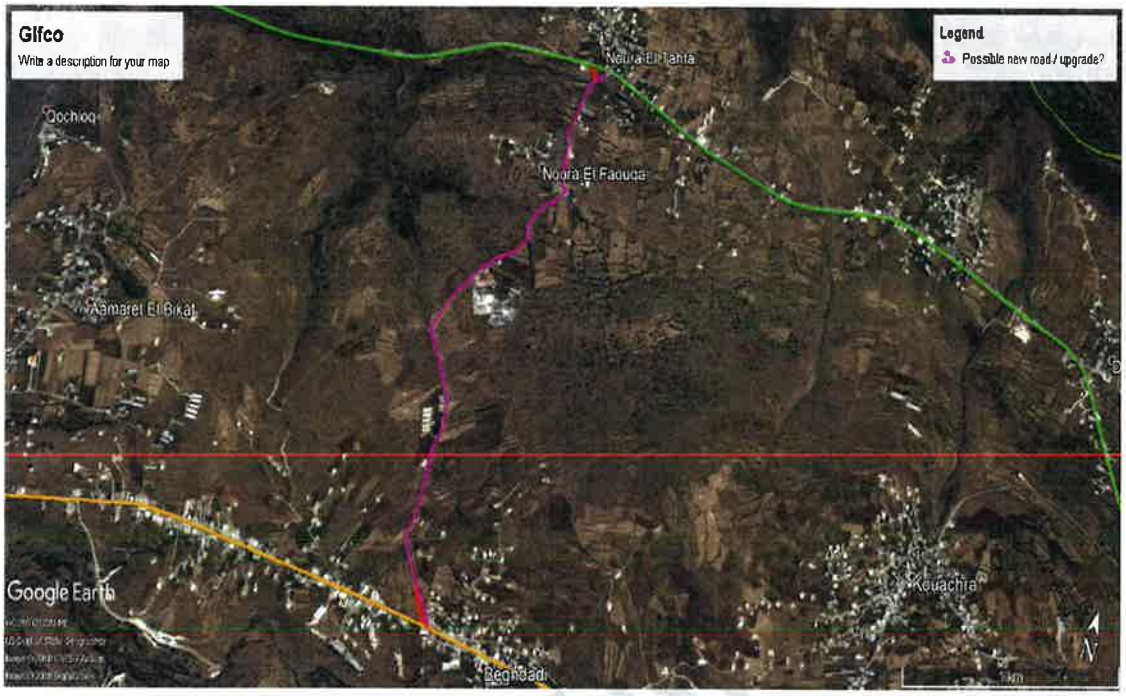
identified entrance locations and only with more manoeuvrable transport configurations.

Topographic survey and further enquiries with local community and authorities are highly recommended for all routes located. This will ensure verification that they can be utilised and that any amendments to alignment or configuration required can be implemented.

The following screen shots show some of their locations.

Note: Some routes investigated have been removed in order to give clarity to the image.

8.1 Gifco Alternative route 1



This route is along a current road servicing villages, farms and residential properties. The surfaced road links the Aabboudiye / Chadra highway to the Halba / Qoubaiyat highway. It is recommended that a full topographic survey is carried out to identify and determine the exact needs for upgrades to allow free passage of the super long WTG OOG transports.
This probable route would link the two major highways in the area bypassing the Pinch point at Halba.

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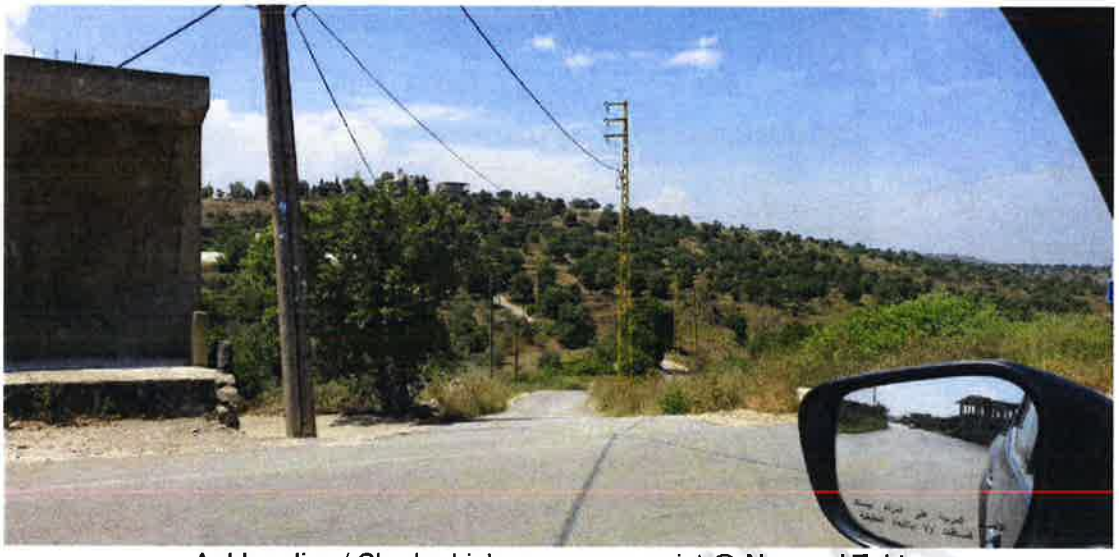
Show list

Link road route 1
Between Noura El Tahta & Baghdadi



Aabboudiye / Chadra highway access point @ Noura el Tahta

Halba / Qoubaiyat highway egress point @ Bagdadi

8.2 Gifco alternative link Route 2

This link road would connect the Aabboudiye / Chadra highway with the main road that connects Chadra & Aandqet.

Looking down the link road gradient towards the intersection with the Aabboudiye / Chadra highway.

Link Road looking up the Gradient

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From here it is possible to connect to the current road past the Country club and up into the mountains by the Wind farm sites.

It's common knowledge that this road up to the wind farm sites is unsuitable for the super long transport configurations. However, Gifco team believe that by utilising different transport configurations they can negotiate the majority of these curves and bends, with minimum alterations, to gain access to the suitable Wind Farm site locations.

9. Highway 51 Survey Conclusion

After two days traveling the main route, as previously outlined by Sustainable Akkar's representative, Gifco's survey team concluded the following:

a) The main highway route is only suitable, with remedial actions at selected pinch points, for transport configurations with a ridged length of circa 64 meters and a nominal running height of 4.88 meters and below.
This restriction is due to the lowest road overpass bridge at PP14 as measured at 5.1 meters left side and 4.49 meters right side over a 12 m span. Thus giving a centre of the load calculated maximum height under the footbridge of 4.88 m. Assuming free air safety gap above the load of circa 10 cm on a longitudinal and lateral level road profile. With a similar air gap to the side of the load to the left side support pillar.
However, subject to usability at the time of movement there may be a bypass route that may detour around this low restriction.

b) There are a myriad of overhead cables cross highway 51 along the entire route, mainly concentrated within the urbanisations. Due to the immense number of these they were not measured, however the visual inspection concluded that the majority were above 5 meters high.

c) The main highway route from Tripoli Port is extremely busy at certain times of the day. Therefore timing of transits through this area will require close coordination with the local authorities to ensure safety of the cargo, transport operatives and general public.

d) All major intersections along the route would require some manner of remedial works to ensure free passage of the super long transport configurations.

e) There is a possibility of an alternative route out of Tripoli Port to connect to highway 51. This would in effect bypass the low footbridge as detailed previously. However, this road is still under construction! Gifco's survey team were advised, post the completion of this initial survey, that the new road is expected to be completed prior to commencement of movement of the OOG WTG components. Therefore subject to further enquiries.

9.1 Highway 51 Conclusion Recommendations

a) The restricted overhead height of the footbridge @ PP14 limits the overall traveling height of the OOG vehicles, consequently omitting the use of shorter but higher transport configurations. However, to pass some of the ground fixed infrastructures, the surveyor recommends that detailed topographic surveys are undertaken to verify the suggested visual alterations are suitable and sufficient to enable unhindered transit of the super long OOG vehicles.

b) Timing of the transits will be subject of critical planning and coordination due to the extreme volumes of traffic and the lack of patience of other road users.

c) It is also recommended that all verified remedial actions along this highway be completed in advance of commencement of any OOG transports. The transport contractor should verify the sufficiency of this work, either by test run or physical measurements, prior to mobilisation of their equipment into Lebanon.

d) Surveyor recommends; that all overhead cables are detailed and measured to establish the work scope required to permanently raise any low cables prior to transit of the OOG WTG components. During this detailed survey the condition of the cables insulation status should be reviewed to establish the projected air gap between load and cable. This air gap should be a minimum of 30 cm for insulated low voltage cables, raising up to 7 meters for non-insulated high tension power

lines as per international guidelines on safe passage under power lines. The last thing anybody wants, is damage to the cargo, operators or outages due to arcing from the cables during transit.

e) Due to extreme volumes of traffic on this highway, especially at junctions and intersections through urbanised areas, the surveyor recommends that pre planning with the local authorities is undertaken at the earliest opportunity to establish possible time periods, schedules, controls and barriers to ensure unhindered safe transit of the OOG WTG major components.

f) Convoy layover facilities should be identified and established along the route to ensure that; should any unrelated incident or situation occur, outside the transport companies or escorts control, then a safe haven is available for all the vehicle within the convoy. These are safety contingency facilities but an essential requirement whilst a situation is dealt with and the route cleared, or the escorting personnel return for continuation of the transit.

g) As stated in the beginning of this report; It is recommended that a topographic survey on all identified intersections along the highway are undertaken to confirm all suggested amendments in this initial survey are suitable and sufficient to establish clear over sail and overhang swing for all transport configurations.

For this purpose Gifco have access to the latest award winning vehicle mounted electronic and image survey equipment to carry out this type of route survey. The collected data is analysed with sophisticated software to measure the routes road and periphery objects and map their locations in relation to the transit route. Enabling the selection of the most suitable transport configuration and minimising unnecessary route upgrades, utility amendments and peripheral street furniture.

h) Gifco recommend that further information is gathered from the contractors and Ministry of Roads at the earliest of time, to establish whether the new road in Tripoli will be available. Also the suitability and sufficiency for using this new road section to exit Tripoli.

10. Local roads to site route Conclusion

a) The road infrastructure in the region of the Wind Power sites and their project entrances was found to be of a lower class than the Highway. From entering Chadra on the highway it was clearly evident that Sustainable Akkar's original proposed delivery route was unsuitable and insufficient for any of the proposed super long OOG WTG vehicles. It was noted that some standard construction and general delivery vehicles also found difficulties at times to negotiate some of the gradients, junctions and hairpin bends as the route progressed up the mountain route.

b) Where hairpins and turns were encountered some of the road surfaces were polished and or rutted. This would have significant effect on the traction of any OOG vehicles. These would require addressing prior to movements should this route be the agreed solution.

c) Overall none of the roads surveyed were passable by long, wide & heavy loads of the ones originally intended for the WTG's.

d) The Gifco team identified some probable alternative roads that could bypass some of the inanimate obstacles, however they too were not suitable or sufficient for the super long transport configurations. However, it is believed that they could be made suitable either on a permanent or temporary basis, subject to authorisation and adjacent land owners consent.

e) These alternative roads however do not extend all the way to the original advised site entrance. However, other probable routes were found that, subject to some reconstruction and or construction of short sections of new roads, could be made passable for shorter but higher transport configurations.

f) Some of these roads could be linked to the current roads infrastructure so as to enable

reconfigured transports to deliver the OOG components via current routes available to site subject to further consultation and enquiries with all parties.

g) Alternative non land based options for the final delivery to site were investigated, mainly helicopter and an aerial ropeway. Gifco have located a suitable commercially available helicopter in the Mediterranean region that may be suitable. However its operational carrying capacity is limited to circa 21 tonne, and then it would be subject to an intensive review of the operating terrain, load support system and flight permits for Lebanon. Gifco is still investigating and awaiting responses, on the viability of an aerial rope way with a manufacturer to ascertain its full potential and load capabilities.

11. Local roads to site route Recommendations

a) In order to overcome both the height limitations of the main highway route 51 from Tripoli to Chadra, Gifco surveyor recommends at this time, and is subject to further consultations, enquiries and results of topographical survey, the utilisation of a different transport configurations as per the indicatives ones advised by Sustainable Akkar for this initial survey.

b) For example; for the tower sections the use of Snabell type configurations from Tripoli towards Chadra, as per the Siemens indicative transport illustrations. Then at a suitable location in the vicinity of the Wind Farm locations, changing the transport vehicles to shorter but overall higher configurations for the final segment up to the WTG sites.
Although this will entail transhipments it may negate a significant amount of road amendments and new build in the final segment to the wind farm entrances. These shorter and more manoeuvrable modular axles, for the heavy and long tower sections and nacelles could eliminate the majority of tree removal and reduce it to raising the tree crowns.

c) With regard to the Blades delivery, again the major issue is the final segment of road to the site entrances. From either Chadra, Aandqet or Qoubaiyat, blade lifters would be highly recommended for this final leg of the route to site in order to overcome many of the obstacles, tight curves, hairpin bends and trees. Utilising these items of highly manoeuvrable equipment would in itself open up opportunities on the routes, otherwise closed to the Wing Type Trailer configurations. Initially the Surveyors thoughts were to tranship the blades as per the towers above, however Gifco's Transport Contractor has possibly an alternative, subject to review of the blade details, plus client, WTG suppliers and Lebanon's authorities' approval. These pieces of equipment would allow suitable road speed on the highway to deliver the blades direct from Tripoli Port to the site without this transhipment. This equipment would also minimise route amendments on highway 51 too.

12. Gifco Outline WTG OOG Transport Synopsis

Gifco's outline transport synopsis for the WTG OOG components is as follows:

a) Undertake full vehicle mounted electronic Topographic survey followed by analysis and report.

b) Based on the Topographic report and the routes identified as most viable, select the most suitable transport configurations for the given WTG OOG components.

c) In addition to identifying incident safe havens along the route, locate and prepare a suitable consolidation / transhipment area within the Chadra, Aandqet or Qoubaiyat region. Gifco have already earmarked a couple of areas that would fulfil this requirement. However, these may change subject to the Topographic report and the final route chosen. Here the WTG major components requiring transhipment will be consolidated for onward delivery.
Where component transhipment is undertaken Gifco intend to utilise two different sets of transport equipment. One set to work between Tripoli port and the consolidation site. The other to work independently, but continually, between the consolidation site and the WTG erection

locations. In this manner the delivery schedule will be controlled. It is envisaged at this time that the highway 51 segment from Tripoli port will have restrictions imposed with regard to time of day movements. It is also possible due to the local commercial traffic from the quarries and businesses in the area that similar restrictions may apply to the final delivery segment too.

All these issues Gifco will be investigation further and developed as will the delivery strategy, in consultation with Sustainable Akkar, Authorities, Businesses and local Community leaders once Gifco have been awarded the transport delivery contract.

d) Post topographic survey Gifco will agree with client on any necessary road improvements in quality of surface, and or infrastructure geometry.

e) Post any road improvements shall to be inspected by Gifco's Transport contractor prior to commencement of the first WTG OOG delivery.

f) With regard to the alternative, non-land based options, for the final delivery to site of the WTG OOG components. The helicopter option would only be available for items below 21 tonnes, and as such an alternative for not all of the major WTG components. The aerial ropeway, at this time, also has a limited capacity in the region of circa 40 tonne and therefore again not a solution to all the WTG components. Additionally one has to consider the need to have handling equipment and transport at the head of an aerial ropeway to move the items to the WTG foundations. Gifco believe that these alternatives would not fulfil Sustainable Akkar's scope in full and at timely and cost efficient manner at this time.

13. Closing Statement

In closing this report, Gifco would like to assure Sustainable Akkar that this report was carried out by persons who are highly skilled, knowledgeable and experience in the movement of Energy, Oil & Gas major assets around the world.

The lead surveyor himself has over 40 years in the Oil & Gas Energy sector specialising in Heavy transports using Road, Air, Sea and Rail.
The chosen specialist transport contractor's principal has in excess of 50 years owning, developing and operating the types of vehicles required to move these WTG components.
The two together, working for Gifco, successfully planned, managed and executed the most recent delivery of oversized and heavy none devisable loads in Lebanon of 10 X 340 tonne Engines to the Zouk Power station. The project was completed safely, on time and within budget to the end Clients satisfaction.

Gifco is the Main Contractor and Lebanese Legal Entity fully capable to undertake this work scope with their contractors above. Gifco has been involved in freight movements, third party supply chain management solutions, project cargo services for Government and Non-government entities and is duly registered and licenced in Lebanon since 1971. Employing to date over 214 Local staff, with warehouses and offices across Lebanon including office in its main port and airport. Along with its head office in Lebanon, GIFCO operates several branches across the Middle East and Africa.

The recommendations, viability and suggestions contained within this report are the surveying team's confidant belief that they can deliver the WTG OOG components to the required sites along the routes identified within Sustainable Akkar's imposed environmental and financial parameters.

This initial survey along with the teams overall view, conclusions, suggestions and recommendations for the route and delivery synopsis, are the basis of the Gifco delivery strategy and basis of our commercial bid.

Although this initial report does not categorically state that the current routes identified are suitable and sufficient for the intended OOG vehicles, it is the Gifco's team opinion that with some intervention works on the infrastructure and with good cooperation and coordination between Sustainable Akkar's, civils engineers and WTG supplier, a suitable route solution can be established with minimal environmental disruption.

Gifco recommends establishment of a working group with Sustainable Akkar to further develop the delivery route and transport synopsis. The working group should consist of decision making technically competent persons of all the required disciplines with direct responsibility to the delivery program.

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Traffic Impact Study

Akkar Wind Farms (SA & LWP) Construction

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October 2018

TRAFFIC IMPACT STUDY

AKKAR WIND FARMS (SA & LWP)

AKROUM – NORTH Lebanon

October 2018

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Introduction

Context

Sustainable Environmental Solutions (SES) on behalf of their clients Sustainable Akkar (SA) and Lebanon Wind Power (LWP) has engaged the services of Dima Jawad to carry out Traffic Impact Study (TIS) for Akkar Wind Farms Project. Three wind farms will be built in the northern eastern region of Akkar in Lebanon. These farms will be built and operated by SA, LWP, and Hawa Akkar (HA) as licensed by the Lebanese government in July 2018 according to the Lebanese public private partnership (PPP) law. Combined the three wind farms is expected to have a total generation capacity of 180 megawatts.

The Akkar Wind Farm project entails construction activities for the access, erection and installation of WTGs and other transformer facilities and storage facilities. The 60+ wind turbine generators (WTG) equipment and blades will be imported from outside Lebanon and will be shipped to Tripoli Port.

Scope

The scope of work of the study is to determine the traffic-related impacts associated with pre-operation phases of SA and LWP Akkar Wind Farms (ie, HA wind farm is not covered by this study). These impacts are anticipated in the pre-operation phase due to the transport of the WTGs from Tripoli Port to the wind farm site, in addition to the impacts resulting from traffic generated by construction activities. The report evaluates the following traffic conditions:

- Trips generation and distribution as a result of the project;
- Existing (2018) traffic conditions and capacity analysis;
- Cumulative (2020) traffic conditions during the critical peak hours of project phases without and with the proposed project;

TIS Guidelines

The TIS will be conducted as per Institute of Transportation Engineers (ITE) published guidelines. The ITE TIS guidelines defines its main objective as to determine the impact of the generated traffic by the proposed project on the surrounding road network and identify the extent of required improvements, if any, to adequately and safely accommodate the additional generated traffic.

Assessment Methodology

To identify the road impacts of the project and associated mitigation measures, the following tasks were undertaken:

- Review of previous studies and documents as provided by client
- Inspection of the roads network from port of Tripoli to the site in addition to the surroundings of the proposed site
- Identification of the spatial extents over which traffic associated with the project has the potential to "significantly" increase traffic volumes to delineate the study area
- Review of road network planning undertaken for the surrounding road network
- Conducting 3-day automatic traffic counts at key road links and manual counts at peak hours at critical junctions
- Survey of existing peak hour traffic volumes at key study links and junctions
- Review of historical traffic growth patterns to inform estimation of the likely traffic volume growth across the road network, excluding traffic generated by the project

- Estimation of the traffic demands likely to be generated by the activities associated with project
- Estimation of the future traffic volumes during the project phases including and excluding the project
- Assessment of the future operation of junctions and links identified as potentially being significantly impacted by traffic associated with the project
- Development of strategies to minimize and mitigate any significant road network performance impacts associated with traffic generated by the project.

Provided Documents and Information

Previous engineering studies were conducted to determine the best route for transporting WTGs from the port of Tripoli to the site in Akroum. These studies were conducted by consultants: Madgelni, Dako and Gifco.

The following documents and information were reviewed in preparation of this report:

- Dako Middle East: Preliminary road review Port of Tripoli to Akkar Sustainable Site 1- Date ~ December 2017
- Dako Middle East: Preliminary road review Port of Tripoli to Akkar Sustainable Site 2- Date ~ December 2017
- GIFCO: Initial Route Survey Report
- Madgelni: Sustainable Akkar 82.5mw & Lwp 60mw Wind Power Plants - Route Survey Report – Date April 30, 2018
- Mission Report: Road Survey's for Lebanon Wind Power and Sustainable Akkar Sites – Date September 2018
- Google earth-based features of the site and the proposed access routes

The studies assessed the potential routes for the WTGs transport according to requirements, the existing geometric clearances with swept path analysis of potential routes, and identified the needed modifications and upgrades along the route so it can be suitable for transporting the WTGs. These studies concluded with the need to construct new roads in specific around the villages of Chadra, Mashta Hammoud and Sahle.

Proposed Project Description and Location

The project entails the construction and erection of two wind farms, SA farm and LWP farm in the northern eastern region of Akkar north Lebanon at the mountain top of Akroum in an area known as Bab el-Hawa (ie, Doors to the Wind) indicating the suitability of this area for harnessing the wind power.

Figure 1 shows SA and LWP sites location within Akkar. As per the current configuration SA is located in the north, LWP in the south.

SA site is bounded to the north by the village of Sahle and further Chadra, Mashta Hassan and Mashta Hammoud, and villages of Andaqt and further the city of Qoubaiyat to west. To the the east, there are Mrah el-Khoukh and Kfartoun villages. LWP is bounded by Qtalbe from the north and Akkar El-Attiaka to the west and further by Fnaidek and Qammoua. The nearest village at the west is Jawz.

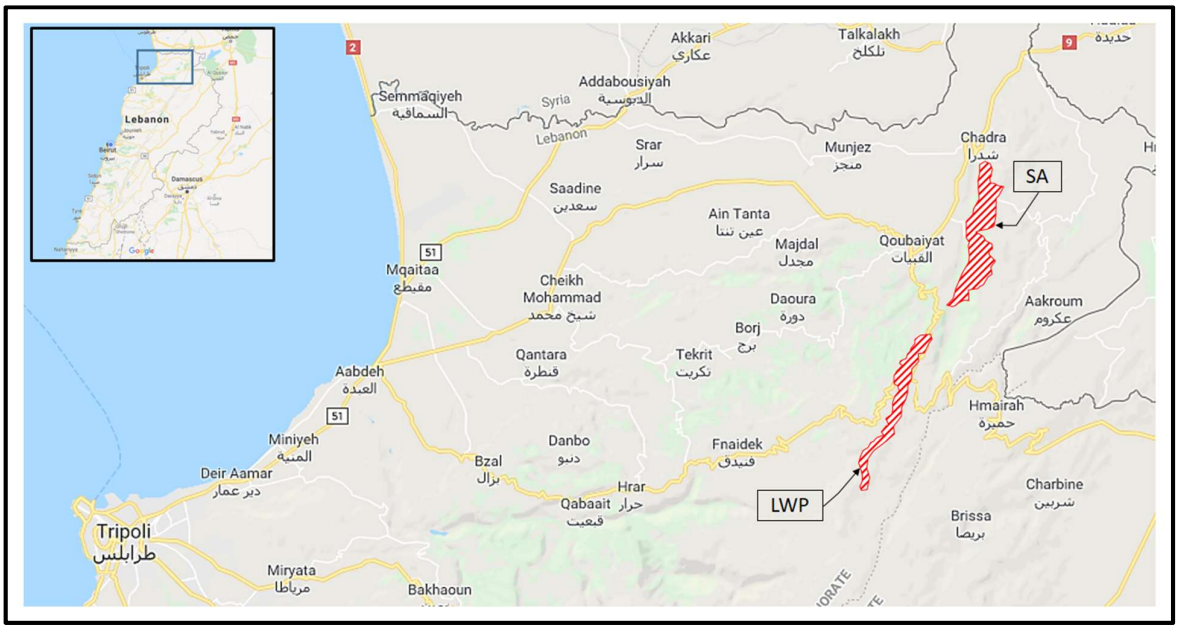


Figure 1: Project Site Location

The approximate area of the SA site is 8.7 km^2 whereas the area of LWP is around 4.8 km^2. The suggested sites is at the peak of a series of mountains in the region as shown in Figure 2.

Figure 2: SA Site Location at the Peak of the Mountains

Each site will house the WTGs, transformer, substation, storage, control, management and operation facilities. The number of WTGs at SA farm is between 17 WTGs (GE 5,3 MW) and 24 WTGs (GE 3,8 MW). As for LWP farm 13 WTGs (GE 5,3 MW) and 18 WTGs (GE 3,8 MW) making the maximum number of WTGs for the two sites at 42 WTGs. The exact sites layouts, the number and type of WTGs is not finalized yet at the time of preparing this study. Accordingly, and as a conservative measure, the study assumes the most critcal conditions. The dimensions of the WTG components were taken similar to a potential product Nordex N149-4.5MW. Its dimension is listed in Table 1.

Table 1:Nordex N149-4,5MW Turbine Transport Dimensions

Description	Length	Width	Height	Weight
Blade (x3)	72,4 m.	4,5 m.	3,2 m.	19,9 t
Nacelle (x1)	12,8 m.	4,0 m.	4,3 m.	69,6 t
Drivetrain (x1)	6,6 m.	3,2 m.	3,2 m.	75,4 t
Hub (x1)	5,3 m.	4,6 m.	4,0 m.	62,0 t
Tower Bottom Section (x1)	14,5 m.	4,4 m.	4,4 m.	79,4 t
Tower MID1 Section (x1)	22,1 m.	4,3 m.	4,3 m.	76,5 t
Tower MID2 Section (x1)	29,9 m.	4,3 m.	4,3 m.	75,3 t
Tower TOP Section (x1)	35,0 m.	4,3 m.	4,3 m.	60,6 t

The construction and delivery of the wind farms is scheduled to begin in April 2019, with the wind farms planned to begin operations by the end of 2020. The project includes the following key work phases and indicative tasks:

- Transport Route – includes the preparation of the WTGs transport route from Port of Tripoli to the site. This includes the rehabilitation and upgrading of existing routes and the construction of new roads from Chadra entrance to the sites.
- Site Establishment – Includes establishment of the on-site quarry and temporary concrete batching plant, delivery of key plant and construction equipment, the construction of initial internal access roads required for the delivery of WTGs and construction materials.
- Civil Construction Works – Includes the construction of The WTG site hardstand areas, WTG footings, other facilities, and internal power infrastructure.
- WTGs Component Delivery
- WTGs Erection.

It is expected to have significant overlap between each work phase, with site preparation, WTG component delivery and erection to be executed on a rolling basis.

Haulage Route

External Roads

As mention earlier, previous engineering studies were conducted to determine the most suitable route for transporting the WTGs from the port of Tripoli to the site in Akruom. The identified route was identified by the client as shown in purple in Figure 3.

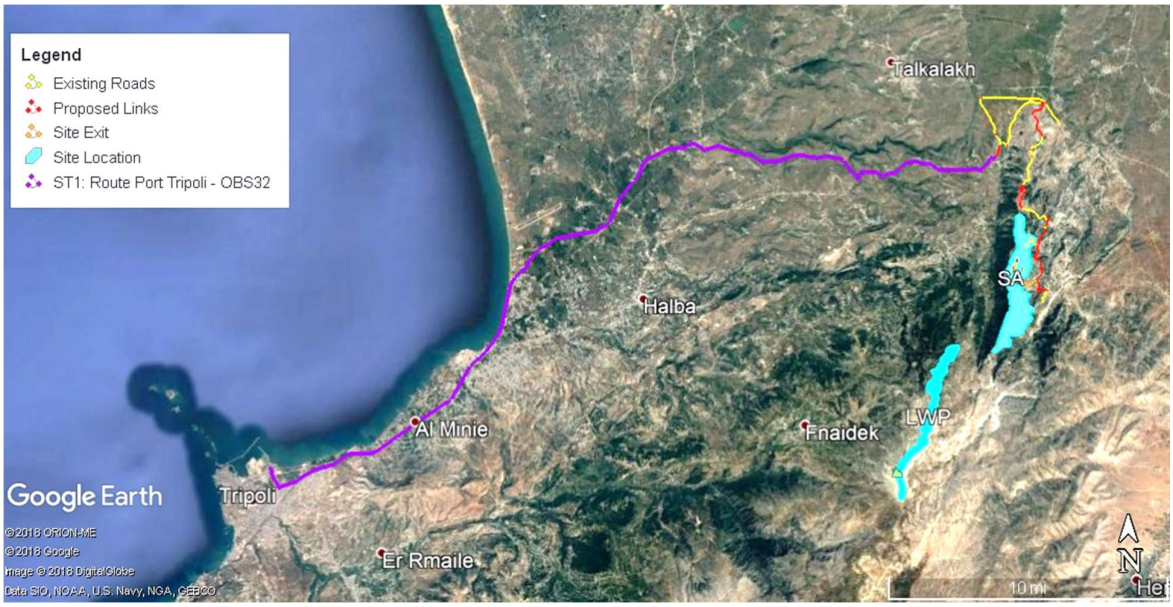


Figure 3: WTG Transport Route from Port of Tripoli to Site

As per Magdelni report, the route must fulfil these requirement:

- All electric and phone cables over the road must have a clearance of 6m above ground.
- The access and site road longitudinal gradient must be a maximum of 8° (14%).
- Additional pulling units are required during transportation for gradient above 14%.
- Minimum transverse inclination of road is to be 2 % to one or both sides in within the project site.
- The load bearing capacity of all site roads must have a compaction of minimum 95%.
- In addition to the space required for the turning swept path of the 75m-long blades.

Based on the assessment results, the transportation of the turbines will be initiated from Tripoli port and will be maneuvered along the coast through several Lebanese cities. The list of all the areas/cities the trucks will be passing through: Abou Ali Roundabout, Al Beddaoui, Deir Ammar, Al Minie, Al Nabi Kzaiber, Bhannine, Al Mahmra, Al Abde, Khane, Haret Al Jdideh, Ballaneh Al Hissa, Hissa, Tall Hmaire, Abboudiye, Nour El tahta, Dabbabiye, Fraidis, Menjez, Rmah En Nahriye, Chikhlar, Machta Hammoud and Mqabile.

The length of the route up to site entrance is approximately 67 km with an additional 16 km inside the site (not shown in Figure). The transport route is divided in three steps.

<u>Step 1: starts at Port of Tripoli until Chadra entrance (OBS32)</u>

This step entails preparation of existing roads:

- Modification at turns to accommodate the 75- meter blades along with few new links that will be constructed to reach the project site.
- The removal of concrete blocks, steel barriers, poles and signboard.
- Second row car parks should not be allowed during transportation.
- Trees should be pruned before transportation.
- Bridges under 5.50-meter height should be checked after WTG selection
- The turbines shall be transported at night to miss traffic jams and peak hours.

Step 2: starts at Chadra entrance (OBS32) to the water tank

This step involve the use of some of the existing roads that were found to be compliant to requirements and the construction of few new roads and links in the area where the use of existing road was found not feasible. The final route and the layout of the new roads is not finalized yet where few options are being considered. Figure 4 shows the options considered for this step. It has to be noted that this area has generally very light traffic.

Step 3: starts at water tank to the Sahle military check point.

Similar to Step 2, use of existing road will be employed where feasible; otherwise, new roads or links will be constructed. Figure 4 shows the proposed alignment of this section. In Figure 4, all yellow Lines refers to existing roads with minimum obstacles as for the red lines they refer to new road construction. It has to be noted that all new roads constructed along the cities as part of this project will be permanent and for the use of the public. It is estimated that the length of the internal roads is approximately 15 km.

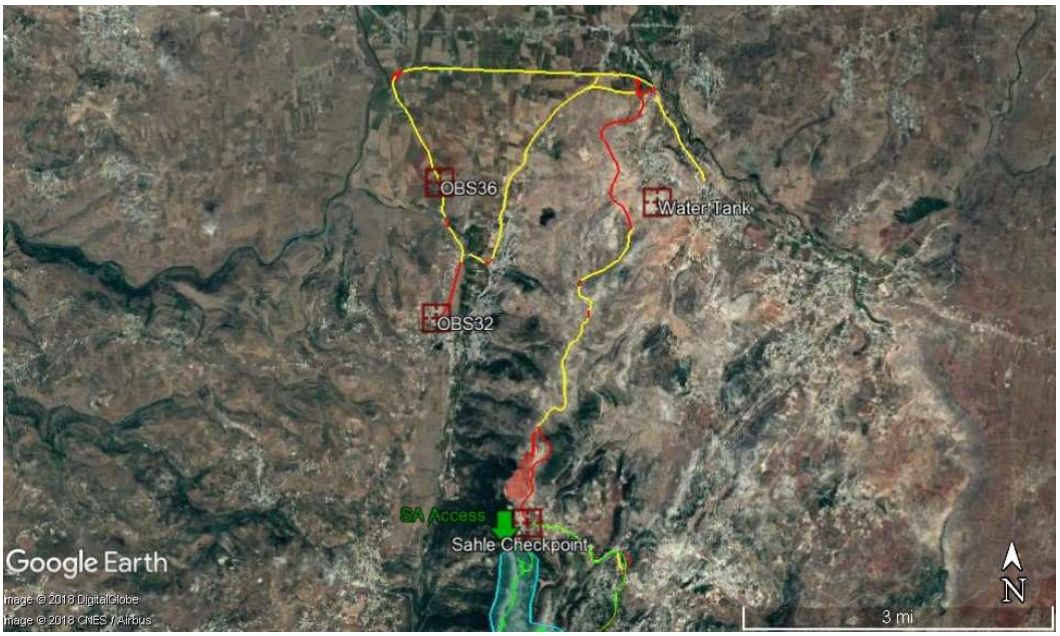


Figure 4: WTG Transport Routes - Step 2 and Step 3

Internal Roads

In addition to external roads, internal roads (within the sites will be constructed) to facilitate haulage and transport inside the site during the construction and operation phase. These roads will be permanent for the use during operation. Also note that these roads will be used for transport activity of both farms. It is estimated that the length of the internal roads is approximately 50 km.

These internal roads will be constructed according to geometric and structural requirements for WTG transport. Figure 5 and Figure 6 show the alignment of the internal roads (in green) in site SA and LWP respectively.

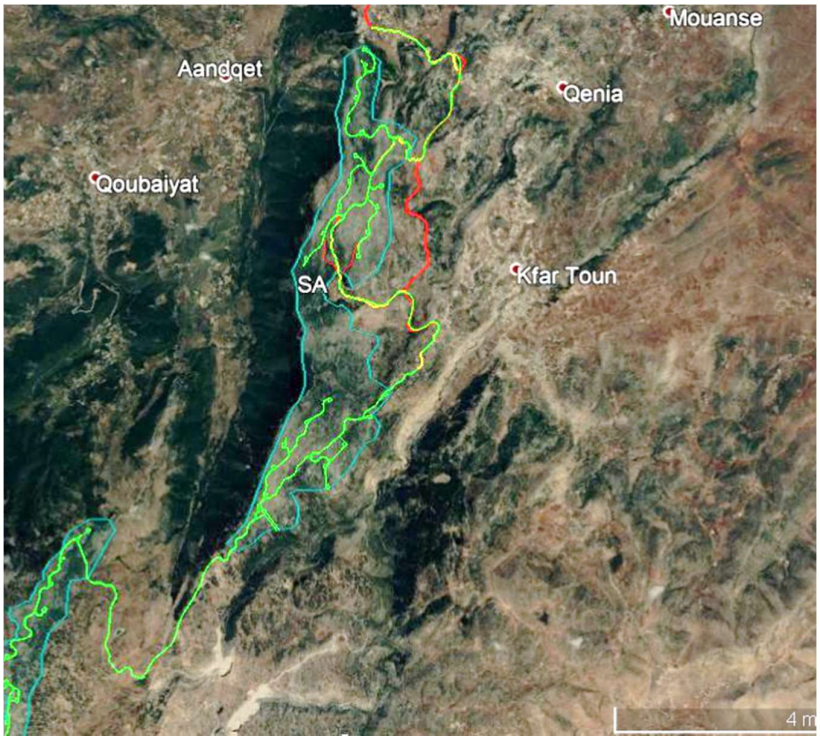


Figure 5: Internal Roads in SA Site (green alignment)

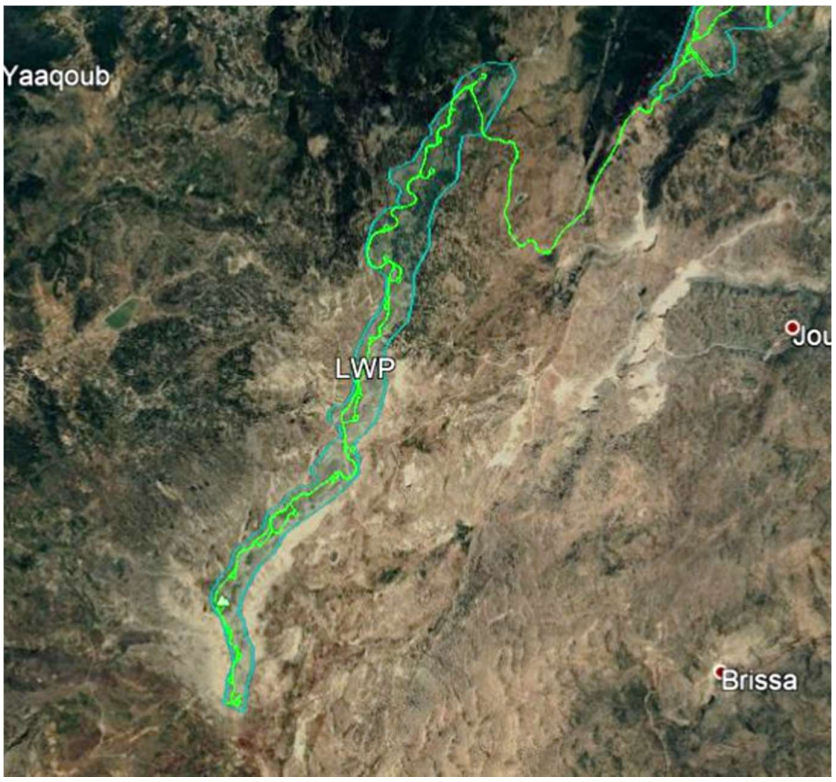


Figure 6: Internal Roads in LWP Site (green alignment)

Study Area

Considering the size, type and the required activities of the proposed project. Two study areas are delineated based on the type of trips generated, the origin and destination of trips, and the time of these trip.

The first study area is the area that is expected to be impacted due to the WTG transport from Port of Tripoli to the site. This study area includes the roads and links along the chosen haulage route.

The second study area is delineated based on the expected impact of the new roads and site construction activity. This area considers the access points to the sites and the trip generation levels. The extent of the study area is a rectangle of 14,000 x 8,000 m dimensions around the sites location. Figure 7 allocates the boundaries of the selected study areas to be covered by this Traffic Impact Study. The impacts in each study area will be assessed based on its operation time and peak hour. The green study area will be assessed during the time of WTG transport (10:00 pm – 5:00 am), while the second study area will be assessed during the site construction activity timing and the peak traffic hours along the impacted roads and junctions.

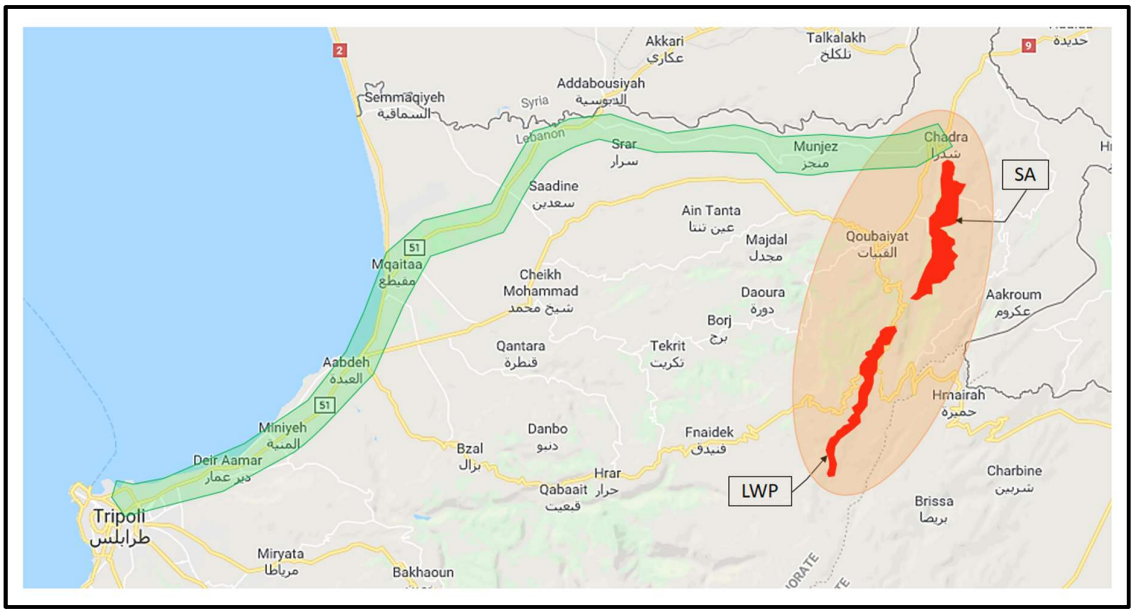


Figure 7: Study Areas

Within the green study area, six roads segments with different characteristics and traffic levels were identified. Within the second study area, three roads and three junctions were identified as key elements for assessment as part of the traffic impact study on the surrounding road network. The location of these road elements are displayed in Figure 8, whereas the location of junctions are shown in Figure 9.

Detailed description of these elements is presented in existing conditions section.

Landuse

The land use with the study area around the site is considered mainly as a rural with few villages housing rural communities. One city, Qobayat, which is considered as the largest city in Akkar is within 4 km range from the site. Besides the villages, the landuse is either agricultural land, pastoral or limited residential landuse with few recreational and touristic facilities. The area includes also several quarries. The landuse of the site itself is shrub rangeland.

Existing Road Network

In order to assess and evaluate the existing and future traffic conditions of the study area, relevant data were obtained from concerned authorities and developer. Inspection of the roads was done through review of available maps (google maps and open street maps) and aerial imagery (google earth). Site investigation of the two study areas was done. Figure 10 shows images of the various road segments that was inspected.

Roads

Based on the collected information. Eight key road segment were identified. Six of these segments are along the transport route while three of them are within the site study area as shown in Figure 8 while Table 2 summarizes the characteristics of each selected road.

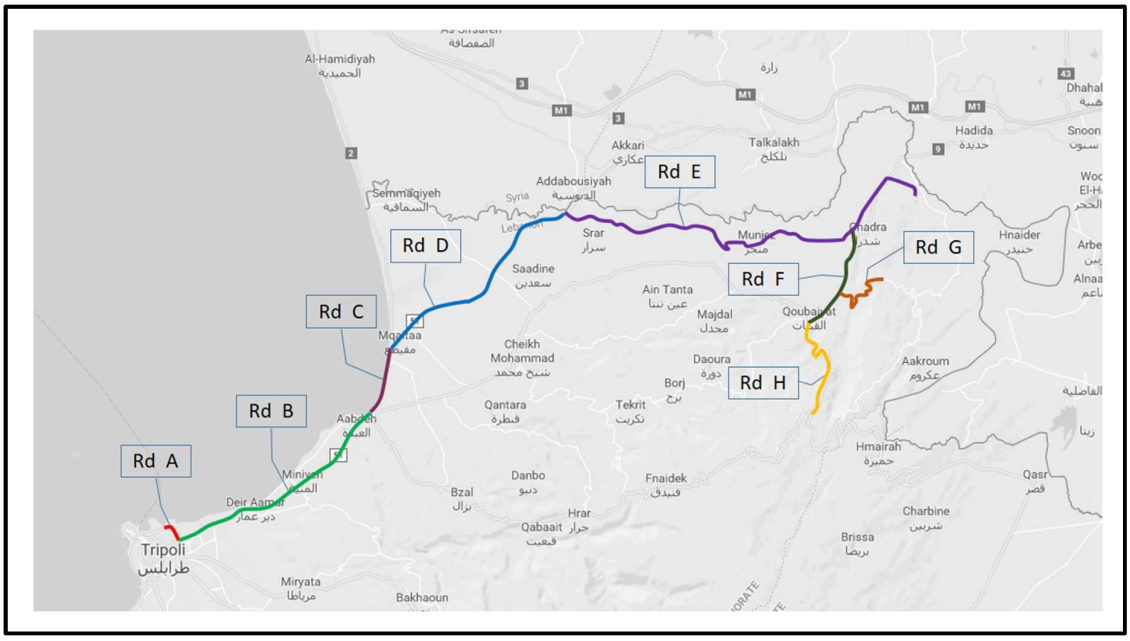


Figure 8: Selected Roads

- Tripoli Port - Abu Ali Roundabout (Rd A) is an urban major distributor, bidirectional and divided. Currently this road is in the vicinity of the construction site of the new Tripoli freeway. This road is shown on image 1 of Figure 9.

- Abu Ali Roundabout – Biddawi (Rd B) is an urban arterial, bidirectional, divided six lanes with a parallel parking on each side. The majority of junctions along this road are grade-separated while other junctions still exists that are uncontrolled junctions. This road is shown in image 2 of Figure 10.
- Biddawi – Abdeh (Rd C) is an urban minor arterial, bidirectional and divided with raised median all with concrete blocks. Different sections of this road are shown on images 3, 4 and 5 of Figure 9. Few junctions along this road are grade-separated while other junctions still exists that are uncontrolled junctions or roundabouts (ie, junction with Halba road).
- Abdeh – Mqaitea (Rd D) is an urban minor arterial, bidirectional, divided with concrete blocks. This road is shown in image 6 of Figure 9.
- Mqaitea – Abboudieh (Rd E) is a rural arterial connecting to the Syrian border. It is bidirectional and undivided two lane road. This road is shown in images 7 and 8 of Figure 9.
- Menjez – Chadra (Rd F) is rural distributor, bidirectional and undivided road. This road connects all the way to Chadra. This road is rolling/mountainous road with its grade varying up to 9%. Different sections of this road are shown on images 9, 10, 11 and 12 of Figure 9.
- Andeqt – Qobayat (Rd G) is rural distributor, Bidirectional, undivided connecting Andeqt to Qobayat. This road is shown in image 13 of Figure 9.
- Qobayat - Qtalbe (Rd H) beyond Qobayat area is rural distributor, bidirectional, undivided. This road is characterized as rolling as shown in image 16 of Figure 9.

Table 2: Selected Roads Charateristics

ID	Road	Description	# of Lanes	Median Type	Width
A	Tripoli Port - Abu Ali Roundabout	Urban major distributor, Bidirectional, divided (construction site)	4	Concrete Jersey Blocks	15 m
B	Abu Ali Roundabout – Biddawi	Urban arterial, Bidirectional, divided	6	Raised Median varied width 1-	30 m
C	Biddawi - Abdeh	Urban arterial, Bidirectional, divided	4	Concrete Jersey Blocks	18 m
D	Abdeh - Mqaitea	Urban arterial, Bidirectional, divided	4	Concrete Jersey Blocks	16 m
E	Mqaitea - Abboudieh	Rural arterial, Bidirectional, undivided	2	Painted	10 m
F	Menjez - Chadra	Rural distributor, Bidirectional, undivided	2	Painted	9-10 m
G	Andeqt - Qobayat	Rural distributor, Bidirectional, undivided	2	Painted	9 m
H	Qobayat - Qtalbe (beyond Qobayat)	Rural distributor, Bidirectional, undivided	2	Painted	8 m

Figure 9: Images of Selected Roads

Junctions

Within the study area of site, three key junctions are identified as might be impacted the construction-related activities. Table 3 summarizes these junctions along with their characteristics.

Table 3: Key Selected Junctions

No	Junction	Description	Number of Directions
1	Chadra Entrance – Mashta Hammoud	Mini Roundabout	3
2	Andaqt - Akkroum	T-Junctions	3
3	Qobaiat Roundabout	Mini Roundabout	4

Figure 10 shows the location of these junction within the study area.

Junctions along the transport study area are not included for analysis as long-haul transport along these junctions will goes travel delay to increase reaching a range between 100 – 300 seconds and ultimately their levels of service will be F.

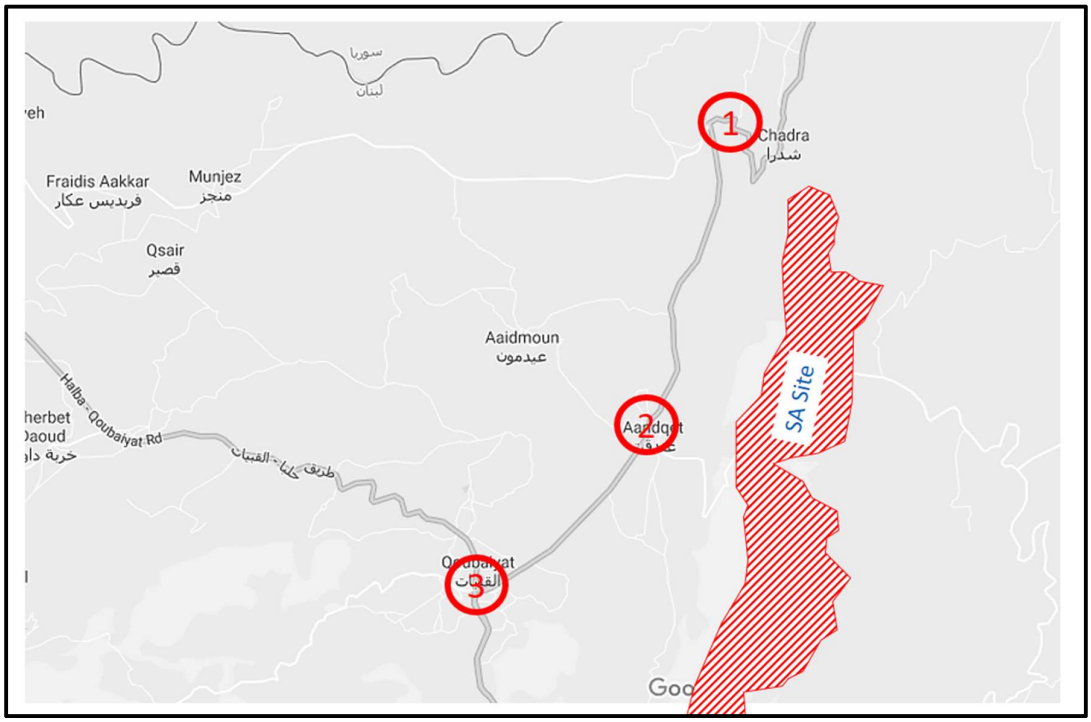


Figure 10: Location of Key Junctions

Existing Traffic Conditions

A 24-hr automatic traffic counts were conducted on different location along the selected road links for a period of three days between September 15, 2018 and September 30, 2018 inclusive. This period was chosen to ensure normal traffic operation without the special events related traffic. In addition, manual traffic counts were conducted at key junctions and links during the peak hours to determine turning movement counts.

Figures 11 shows pneumatic tubes installed for automatic traffic counts while Table 4 summarizes the classified average daily traffic volumes along the key selected roads. On the other hand, Figure 12 illustrates a chart representing the collected hourly traffic volumes at Abu Ali roundabout – Badawi to better characterize traffic peak hours occurring on these roads.

Examining traffic counts and turning movement results along with the project activities and hours of operation, it is recommended to conduct detailed capacity analysis during the project's peak hour trip generator which occur from 3:00 pm – 4:00 pm (PM peak hour) for construction activities related trips and between 10:00 pm and 11:00 pm for WTG transport trips. In addition, it is recommended to exclude traffic counts results of Sunday from calculations of project's operation which will be halted on Sundays.

Figure 11: Images of Automatic Traffic Counts

Table 4: Classified Average Daily Traffic along Selected Roads

ID	Road Designation	ADT (PC)	ADT (HV)	ADT (Total)
A	Tripoli Port - Abu Ali Roundabout	12,740	1771	14,511
B	Abu Ali Roundabout – Biddawi	33,173	3,219	36,392
C	Biddawi - Abdeh	19,230	1350	20,580
D	Abdeh - Mqaitea	14,927	1080	16,007
E	Mqaitea - Abboudieh	11,350	720	12,070
F	Menjez - Chadra	2,265	28	2,293
G	Andeqt - Qobaiat	2,279	1,291	4,470
H	Qobayat - Qtalbe (beyond Qobayat)	670	110	780

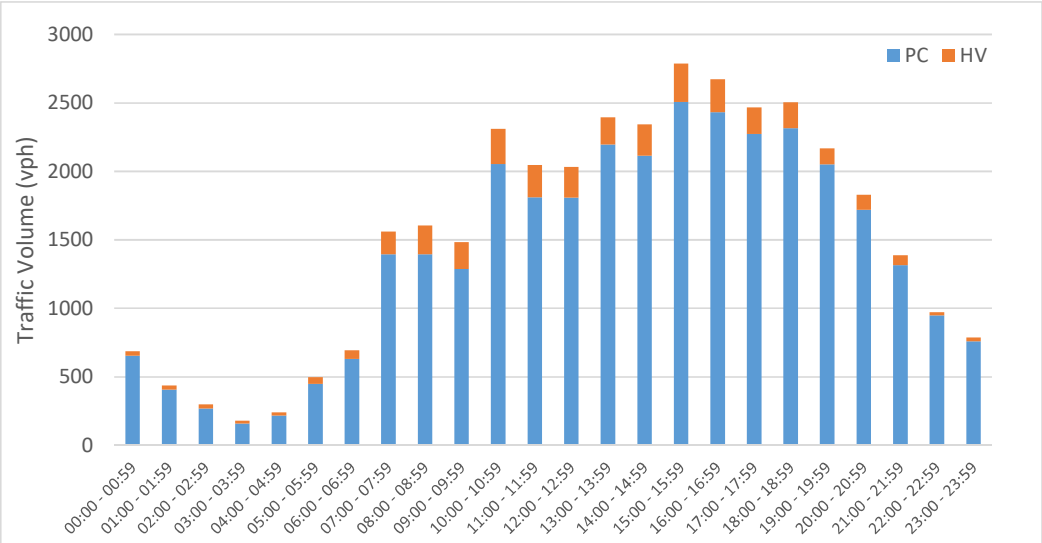


Figure 12: Classified Average Hourly Volume along Abu-Ali Badawi Road

Trips Generation

The trips generated by the Wind Farm project are the results of two activities: 1) WTGs components transport from the port of Tripoli to the project site and 2) the construction activities at the site as well as the access roads. At this time and since many of the parameters are not yet finalized (ie, type of WTGs, construction material quantities, construction work schedule, etc), several assumptions are made. These assumptions are made based on most conservative value in terms of impacts on traffic conditions in order to provide guidance if found necessary when settling on possible options.

<u>Assumptions:</u>

With regards to WTG Transport:

- Each WTG consists of 10-11 overweight / oversized components, each to be transported on a separate truck.
- A full set of WTG components are to be transported in one night.

With regards to construction material:

- Rock excavation: 800.000-1.000.000 m^3
- Backfilling (from excavation): 400.000-600.000 m^3
- Surplus from excavation to be managed: 200.000-600.000 m^3
- Ready-mixed concrete: 25.000-30.000 m^3
- Construction steel: 2.500-3.500 tonnes

With regards to construction activities:

- A maximum of 200 staff will be working in construction at one day
- Around 800 construction equipment to be transported to site

Table 5: Trips Generated by the Wind Farms Project

Description	Estimated Quantity	Unit	Vehicle Type	Estimated Trips Two-way Trips	
				Total Trips	Maximum Daily Trips
Construction Material					
Concrete Material	cubic meters	30000	Semi- trailers	7500	24
Reinforcing Steel	Tonnes	3500	Semi- trailers	350	2
Road Base	Tonnes	184,000	Semi- trailers	18400	71
Excavation	cubic meters	600,000	Semi- trailers	84000	269
Miscellaneous Equipment & Material	-	Nominal	Semi- trailers		
Wind Turbine Components					
Tower Sections	5 section/tower	210	Over size	420	10
Nacelles	2 section/nacelle	84	Over size	168	4
Hub	1 hub/turbine	42	Over size	84	2
Blades	3 blades/turbine	126	Over size	252	6
Substation					
Substation Transformer	-	2	Over size	4	2
Switch Gear & other	-	Nominal	Semi- trailers		
Site Work Activities					
Employees	Persons	100-200	Cars/ 4WD	58933	133
Construction Equipment, Plant & Components	unit	800	Various	1600	6
Total trips- Traffic Movements					
			Total Oversize	928	24
			Trucks	111850	372
			Passenger Cars	58933	133
			Total	171711	535

With regards to project timeframes:

- Preparation of WTGs transport route — Weeks 1 – 28
- Site Establishment — Weeks 1 – 10
- Civil Construction Works — Weeks 4 – 80
- WTGs Component Delivery — Weeks 52 – 75
- WTGs Erection — Weeks 56 - 116

Work phases will overlap and will be taken in tandem, with the WTGs component delivery to commence reasonably after the completion of the preparation of the transport roads and initial site works.

Based on these assumptions, the total trips that will be generated are summarized in Table 5 along with the type of vehicles that will be used. The total trips are used to estimate the maximum number of daily trips according to the proposed work schedule.

The results indicate that a total of 171,711 trips will be generated by the project divided as 928 trips using oversize vehicles, 111,850 trips using trucks and 58,933 trips using passenger cars.

Trips Distribution & Assignment

Trip distribution and assignment step is done for two separate cases based on the type of activity and the schedule since each one would entail different distribution and assignment.

- For WTGs Transport:

The origin and destination are set at port of Tripoli and the site access point around Sahle check point. The route is assigned based on oversize haulage criteria as discussed in Haulage Route sections.

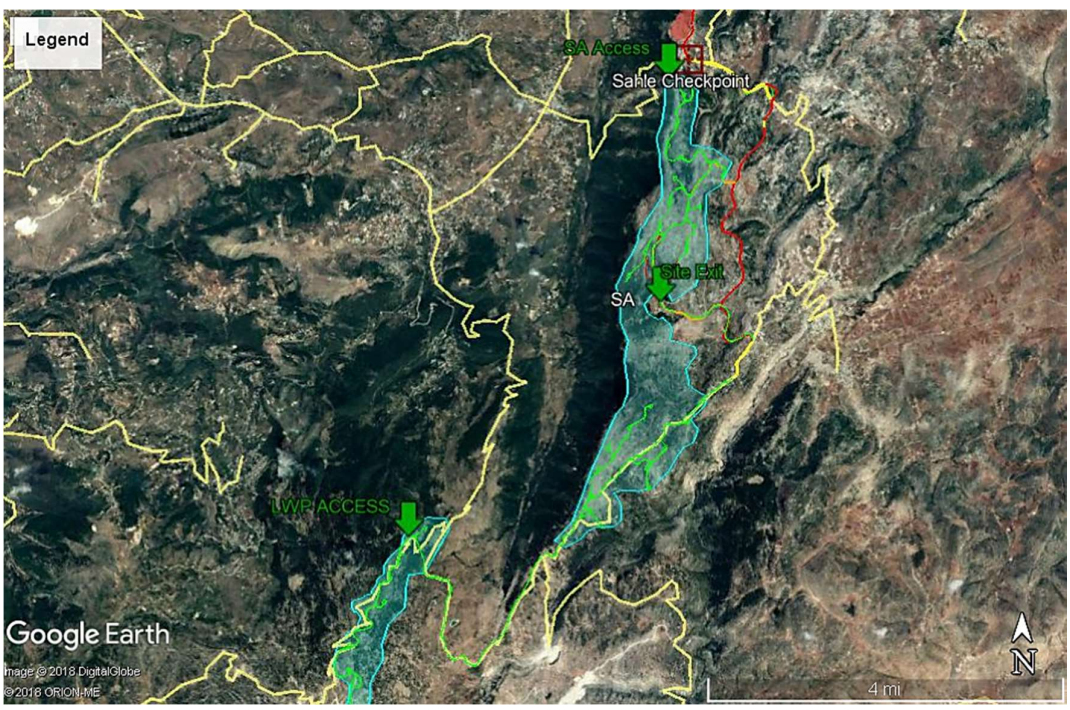


Figure 13: SA and LWP Sites Access Points

- For construction activities:

Construction activities would generate two types of trips: construction material and workforce. It is expected that construction material (concrete, steel, aggregates, etc) will be procured from sources in Akkar region. Destination of excess earth material will also be Akkar region. Based on the location of the site access point, the closest city and villages are Qobayat, Andeqt, Chadra and Fnaidek are the destination points. Similarly, workforce will be coming from Akkar northern eastern region including Wadi Khaled.

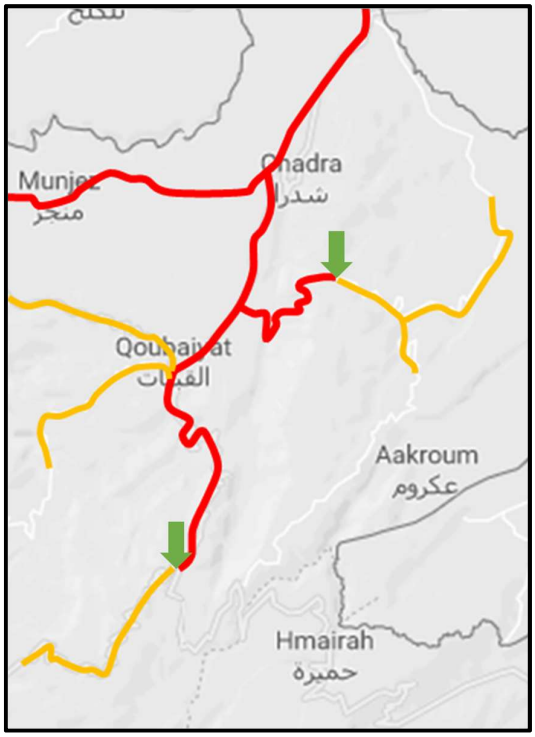


Figure 14: Results of Trip Assignment

Project trips were distributed and assigned based on locations of construction related commercial entities, quarries and population density in the region. Figure 14 shows the trips assignment where roads designated with red will carry the majority of trips generated and the roads designated with the roads designated as yellow to a lesser extent. The trip distribution and assignment also took into account the type of vehicles (PC, trucks).

Figure 15 shows the distribution and assignment results along the background traffic in the year 2020 at three key junctions.

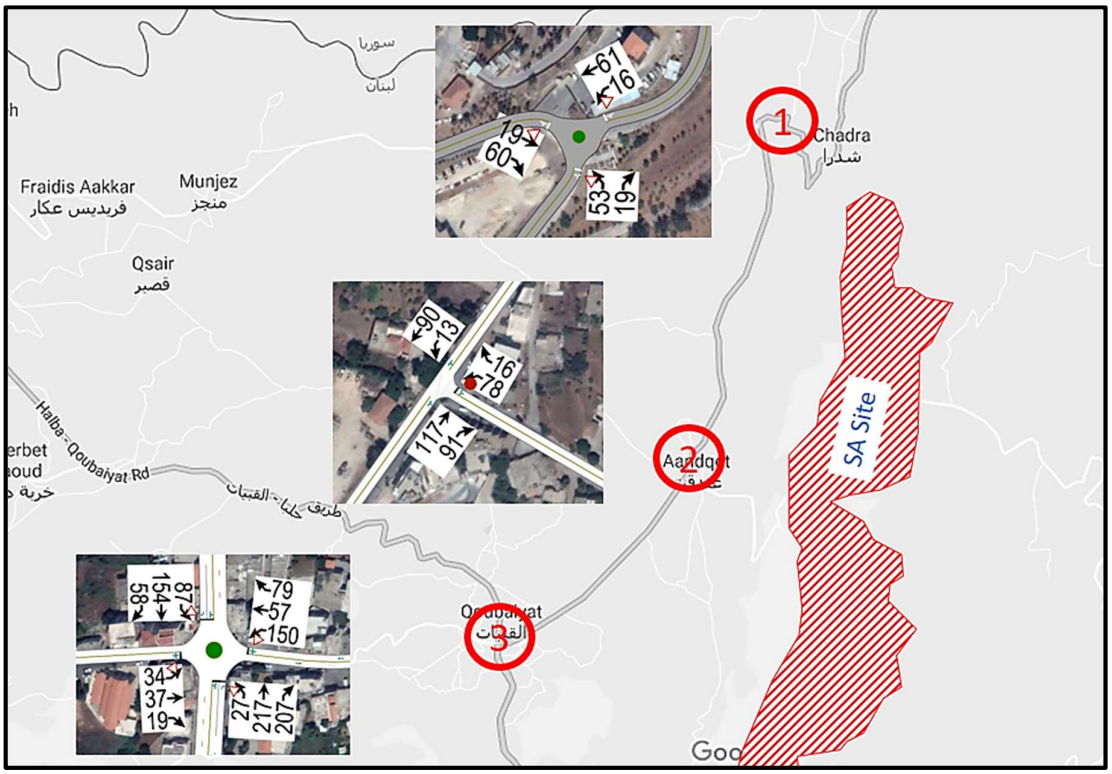


Figure 15: Assignment Results at Key Junctions (year 2020)

Impacts

Assessing the impacts of the project on the traffic conditions is done through doing the capacity analysis of the identified road links and junctions at three scenarios:

- The existing traffic conditions (year 2018)
  This step is done using the existing traffic volume collected through automatic and manual counts
- The background traffic conditions (year 2020) without the project
  This step is done using the projected traffic volumes. A geometric projection is applied using a conservative growth rate of 3%
- The future traffic conditions (year 2020) with the project
  The step is done after assigning the project's generated trips to the road links and junction in combination with the background traffic of year 2020

Capacity analysis is done by utilizing two traffic analysis program that were developed based on the US Highway Capacity Manual (HCM). For capacity analysis of road segments, the HCS+ is utilized while for junctions' analysis, Synchro 10 is used.

The impacts of Akkar Wind Farms project were estimated in two cases:

- Impacts resulting from the haulage of WTGS from port of Tripoli to site.
- Impacts resulting from the construction activities of the Wind Farms.

Impacts due to haulage of WTGS

The haulage process is planned to start at 10:00 pm from the port of Tripoli according to the route discussed in the haulage route section. The longest trip (ie, transporting blades) is expected to take between 6 and 8 hours due to maneuvering needed at curves and junctions. The length of trip is expected to get shorter after several times. Considering the schedule of transport process and looking the traffic volumes hourly distribution along the identified roads, it is concluded that these impacts should be studies at the most critical hour. As such, the impacts are assessed using the background traffic at the peak hour of 10:00 pm – 11:00 pm.

The impacts are studied for the identified road segments (Rd A, Rd B, Rd C, Rd D, Rd E and Rd F) which constitute Step 1: the route from port of Tripoli to Chadra Entrance. Beyond this point, most of the route will use newly constructed links for the transport process.

For roads (Rd A, Rd B, Rd C and Rd E) which are divided roads (with median) and since traffic management plan is not yet in place, a conservative approach is followed which assumes that the traffic management plan will dedicate one whole direction (Northbound direction) for the WTGs transport, and divert all other background traffic to the other direction making a two-lane road.

For roads (Rd E and Rd F), since these roads are two-lane roads, the WTGs transport vehicle will have to utilize these roads along with the background traffic. A special traffic management plan will be put in place where one lane will be dedicated for WTGs transport and the background traffic will use the other direction alternately. The length of the period for alternation will be decided based on the road characteristics, the location of junctions and the access points' density.

Table 6: Capacity Analysis Results of Roads Due to WTGs Transport

Road		Year 2018 Existing Traffic		Year 2020 Traffic without Project		Year 2020 Traffic WITH Project	
No.	Description	V/C* or D (pc/km/ln)	LOS	V/C* or D (pc/km/ln)	LOS	V/C* or D (pc/km/ln)	LOS
A	Tripoli - Port Abu Ali Roundabout	1.5	A	1.6	A	0.18*	B
B	Abu Ali Roundabout - Biddawi	2.3	A	2.5	A	0.36*	C
C	Biddawi - Abdeh	2.0	A	2.1	A	0.23*	B
D	Abdeh - Mqaitea	1.6	A	1.7	A	0.17*	A
E	Mqaitea - Abboudie	0.16*	A	0.17* (36%)	A	0.18*	C (59% FOLLO WING)
F	Menjez - Chadra	0.04*	A	0.04* (10%)	A	0.03*	A (30%)

The results of the capacity analysis of road segments due to WTGs transport are summarized in Table 6 for the three scenarios. Different performance indicators are used for different analysis as types of these roads vary, volume to capacity ratio, density, percent time spent following. The analysis detailed report is included in the appendix.

All roads have a configuration that is more than adequate to carry current and future background traffic at 10:00 pm. As a result of WTGs transport, the level of service of Rd(A) will be reduced from A to B, from A to C for Rd(B), and from A to B for Rd(D).

As for junctions, the capacity analysis for junctions uses the average delay time as an indicator for the level of service. Transporting WTGs through junctions entails halting traffic at all directions until the WTG vehicle clear the junctions. This standstill will cause a delay time to be between 100-300 seconds (LOS F).

Along this route, several grade-separated junction exist. Transporting WTGs through these junctions will be done through the on-grade junction due to vertical clearance restrictions.

Impacts due to Wind Farms Construction Activities

Studying the expected construction activities at the wind farms based on type of works and the construction material needed along the exiting hourly traffic volume distribution, it is decided that the most critical hour is the PM peak hour between 3:00pm and 4:00pm. Accordingly, capacity analysis of roads and junctions is done for this hour.

The impacted roads due to construction activities as shown in project's trips assignment are Rd(F), Rd(G) and Rd(H).

Table 7 summarizes the capacity analysis for the three scenarios while the detailed results output are included in the Appendix.

The level of service of the three roads will remain the same for all three roads. The highest impact is noticed for Rd(G) where the volume to capacity ratio increases from 0.20 to 0.25 while maintaining the same level of service of B.

Table 7: Capacity Analysis Results of Roads Due to Wind Farms Construction Activities

Road		Year 2018 Existing Traffic		Year 2020 Traffic without Project		Year 2020 Traffic WITH Project	
ID	Description	V/C	LOS	V/C	LOS	V/C	LOS
F	Menjez – Chadra	0.06	A	0.07	A	0.1	A
G	Andeqt to Qobaiat	0.20	B	0.22	B	0.25	B
H	Qobaiat to Qtalbe (beyond Qobaiat)	0.06	A	0.06	A	0.07	A

Capacity analysis of junctions was done using Synchro software. A summary of the results for the three scenarios is illustrated in Table 8.

The level of service is expected to remain the same for all three junctions where the highest impact is expected at Andaqt-Akkroum junction where the average delay is expected to be increased from 1.8 seconds to 3.0 seconds. At Qobayat roundabout, the westbound direction will witness an average delay of 11.5 seconds with a level of service of B as shown in the detailed analysis output.

Table 8: Capacity Analysis Results of Junctions Due to Construction Activities of the Wind Farms

Junction		Year 2018 Existing Traffic		Year 2020 Traffic without Project		Year 2020 Traffic WITH Project	
No.	Description	Average Delay (s)	LOS	Average Delay (s)	LOS	Average Delay (s)	LOS
1	Chadra Entrance Roundabout	4.2	A	4.2	A	4.5	A
2	Andaqt - Akkroum	1.8	A	1.8	A	3.0	A
3	Qobaiat Roundabout	7.9	A	8.3	A	9.0	A

Proposed Mitigation Measures

The impacts of the traffic due to Akkar Wind Farm project construction activities are found to be marginal and can be managed with proper planning and control. The level of service of all road segments and junction will continue to operate an adequate level of service (LOS C or better). The impacts of the WTGs transport will be heavily noticed at junctions along the transport route. Also, impacts on Rd(E) and Rd(F) are expected; however, due to the low traffic volume at the time of transport, capacity analysis results in an acceptable LOS on the average.

Based on analyzing the impacts, certain measures are recommended in this section to mitigate the project impacts on traffic:

With respect to WTGs transport traffic:

- Provision of traffic control personnel, pilots and police escorts with specific control arrangements where abnormal vehicles (WTG transport) as per a Special Traffic Management Plan (TMP) that must be developed at the time
- To develop the TMP, several test drives must be done ahead of time to control incidents or restrictions which can be discerned ahead of time
- Restrictions on the timing of WTGs transport by starting at transport from Port of Tripoli at 11:00 pm instead of 10:00 pm can mitigate the impacts resulting from higher volume of traffic
- The implementation of a community information and awareness program will assist in managing the traffic impacts. Ensuring a proper dissemination of information to the public regarding the traffic control measures through a timely communication plan

With respect to construction activities:

- Limiting the movement of construction material vehicles (ie, trucks and heavy equipment) to off-peak hours. It is recommended to avoid 7:30 am – 8:30 am and 3:30 pm to 4:30 pm.
- Proper training on safety issues in truck driving must be continuously provided for truck drivers. In addition, strict control and enforcement of safety regulations of truck driving must be adopted by the project.
- Installation of general signposting of the vehicular access roads with appropriate heavy vehicle and construction warning signs
- Access management with adequate warning system and control must be followed.
- Controlling the truck loads to adequate limits and employing heavy vehicles that have low truck factor to limit unnecessary pavement deterioration.
- Establishment of an inspection and maintenance program for the local road access network to ensure conditions of roads are maintained in safe state.

Conclusions

A traffic impact assessment was undertaken to determine the impact of Sustainable Akkar and Lebanon Wind Power Akkar wind farms projects generated traffic demands on the performance and safety of the road network. The intent of the assessment was to identify the locations at which traffic associated with the project has the potential to "significantly' increase traffic demands to identify locations warranting detailed assessment and mitigation.

The study indicated that impacts will be resulted from two activities: the WTGs and project construction activities. The study undertook the impact analysis of the two cases. The total trips generated by the project were found to be around 171,000 trips between passenger cars, trucks or heavy vehicles and over size (abnormal) vehicles. These trips will be conducted over a span of 24 months during years 2019 and 2020 with the maximum daily trips occurring in year 2020. In the report, capacity analysis and determining the level of service were done for three scenarios: existing traffic, background future traffic and future traffic with project.

Based on the study, trips generated by Akkar wind farms will cause minor impacts on the performance of the road network in the affected area. Most noticeable impact would be due to the WTGs transport. These impacts will be observed at junctions along the haulage route.

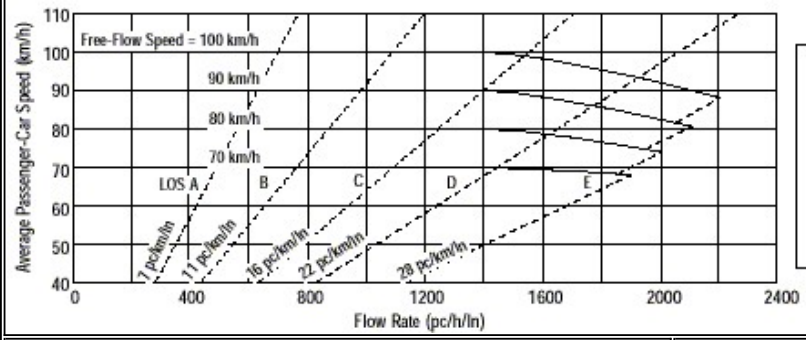
Proper traffic management plan and control during the WTGs that is communicated well-ahead of time to the public will lessen these impacts and ensure safe and efficient transport of the WTGs.

Appendix

Capacity Analysis

Existing Traffic (Year 2018)

MULTILANE HIGHWAYS WORKSHEET(Direction 1)



Application	Input	Output
Oper. (LOS)	FFS, N, v_p	LOS, S, D
Des. (N)	FFS, LOS, v_p	N, S, D
Des. (v_p)	FFS, LOS, N	v_p, S, D
Plan. (LOS)	FFS, N, AADT	LOS, S, D
Plan. (N)	FFS, LOS, AADT	N, S, D
Plan. (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	DJ
Agency or Company	Dima Jawad
Date Performed	10/1/2018
Analysis Time Period	10 - 11 PM

Site Information

Highway/Direction to Travel	Tripoli Port
From/To	Port to Abu Ali
Jurisdiction	North
Analysis Year	2018

Project Description Akkar Wind Farms - Without Project

☑ Oper.(LOS) ☐ Des. (N) ☐ Plan. (vp)

Flow Inputs

Volume, V (veh/h)	245	Peak-Hour Factor, PHF	0.90
AADT(veh/h)		%Trucks and Buses, P_T	11
Peak-Hour Prop of AADT (veh/d)		%RVs, P_R	0
Peak-Hour Direction Prop, D		General Terrain:	Level
DDHV (veh/h)		Grade Length (km)	0.00
Driver Type Adjustment	1.00	Up/Down %	0.00
		Number of Lanes	2

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	f_{HV}	0.948

Speed Inputs

Lane Width, LW (m)	3.6
Total Lateral Clearance, LC (m)	2.0
Access Points, A (A/km)	5
Median Type, M	Divided
FFS (measured)	
Base Free-Flow Speed, BFFS	100.0

Calc Speed Adj and FFS

f_{LW} (km/h)	0.0
f_{LC} (km/h)	1.9
f_A (km/h)	3.3
f_M (km/h)	0.0
FFS (km/h)	94.8

Operations

Operational (LOS)

Flow Rate, v_p (pc/h/ln)	143
Speed, S (km/h)	94.8
D (pc/km/ln)	1.5
LOS	A

Design

Design (N)

Required Number of Lanes, N	
Flow Rate, v_p (pc/h)	
Max Service Flow Rate (pc/h/ln)	
Design LOS	

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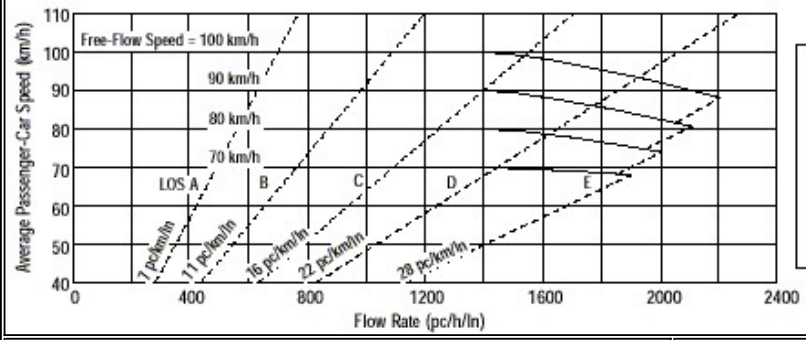
MULTILANE HIGHWAYS WORKSHEET(Direction 2)



Application	Input	Output
Oper. (LOS)	FFS, N, v_p	LOS, S, D
Des. (N)	FFS, LOS, v_p	N, S, D
Des. (v_p)	FFS, LOS, N	v_p, S, D
Plan. (LOS)	FFS, N, AADT	LOS, S, D
Plan. (N)	FFS, LOS, AADT	N, S, D
Plan. (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	DJ
Agency or Company	Dima Jawad
Date Performed	10/1/2018
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From/To	Port to Abu Ali
Jurisdiction	North
Analysis Year	2018

Project Description Akkar Wind Farms - Without Project

☑ Oper.(LOS) ☐ Des. (N) ☐ Plan. (vp)

Flow Inputs

Volume, V (veh/h)	245	Peak-Hour Factor, PHF	0.90
AADT(veh/h)		%Trucks and Buses, P_T	4
Peak-Hour Prop of AADT (veh/d)		%RVs, P_R	0
Peak-Hour Direction Prop, D		General Terrain:	Level
DDHV (veh/h)		Grade Length (km)	0.00
Driver Type Adjustment	1.00	Up/Down %	0.00
		Number of Lanes	2

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	f_{HV}	0.980

Speed Inputs

Lane Width, LW (m)	3.6
Total Lateral Clearance, LC (m)	2.0
Access Points, A (A/km)	5
Median Type, M	Divided
FFS (measured)	
Base Free-Flow Speed, BFFS	100.0

Calc Speed Adj and FFS

f_{LW} (km/h)	0.0
f_{LC} (km/h)	1.9
f_A (km/h)	3.3
f_M (km/h)	0.0
FFS (km/h)	94.8

Operations

Operational (LOS)

Flow Rate, v_p (pc/h/ln)	138
Speed, S (km/h)	94.8
D (pc/km/ln)	1.5
LOS	A

Design

Design (N)

Required Number of Lanes, N	
Flow Rate, v_p (pc/h)	
Max Service Flow Rate (pc/h/ln)	
Design LOS	

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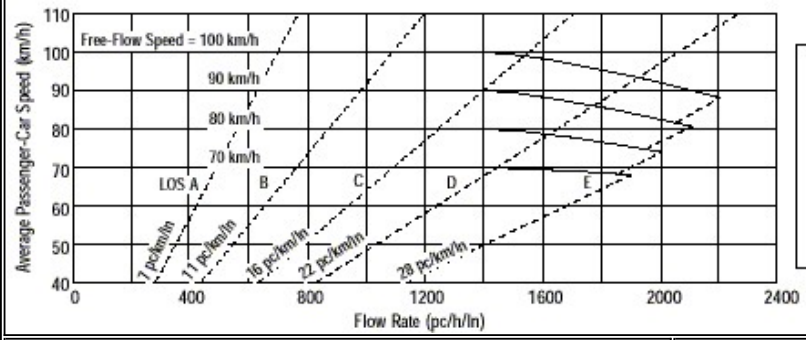
MULTILANE HIGHWAYS WORKSHEET(Direction 1)



Application	Input	Output
Oper. (LOS)	FFS, N, v_p	LOS, S, D
Des. (N)	FFS, LOS, v_p	N, S, D
Des. (v_p)	FFS, LOS, N	v_p, S, D
Plan. (LOS)	FFS, N, AADT	LOS, S, D
Plan. (N)	FFS, LOS, AADT	N, S, D
Plan. (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	DJ
Agency or Company	Dima Jawad
Date Performed	10/1/2018
Analysis Time Period	10 - 11 PM

Site Information

Highway/Direction to Travel	Tripoli - Syria
From/To	Abu Ali Roundabout - Biddawi
Jurisdiction	North
Analysis Year	2018

Project Description Akkar Wind Farms - Without Project

☑ Oper.(LOS) ☐ Des. (N) ☐ Plan. (vp)

Flow Inputs

Volume, V (veh/h)	563	Peak-Hour Factor, PHF	0.90
AADT(veh/h)		%Trucks and Buses, P_T	7
Peak-Hour Prop of AADT (veh/d)		%RVs, P_R	0
Peak-Hour Direction Prop, D		General Terrain:	Level
DDHV (veh/h)		Grade Length (km)	0.00
Driver Type Adjustment	1.00	Up/Down %	0.00
		Number of Lanes	3

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	f_{HV}	0.966

Speed Inputs

Lane Width, LW (m)	3.6
Total Lateral Clearance, LC (m)	2.8
Access Points, A (A/km)	10
Median Type, M	Divided
FFS (measured)	
Base Free-Flow Speed, BFFS	100.0

Calc Speed Adj and FFS

f_{LW} (km/h)	0.0
f_{LC} (km/h)	0.9
f_A (km/h)	6.7
f_M (km/h)	0.0
FFS (km/h)	92.4

Operations

Operational (LOS)

Flow Rate, v_p (pc/h/ln)	215
Speed, S (km/h)	92.4
D (pc/km/ln)	2.3
LOS	A

Design

Design (N)

Required Number of Lanes, N	
Flow Rate, v_p (pc/h)	
Max Service Flow Rate (pc/h/ln)	
Design LOS	

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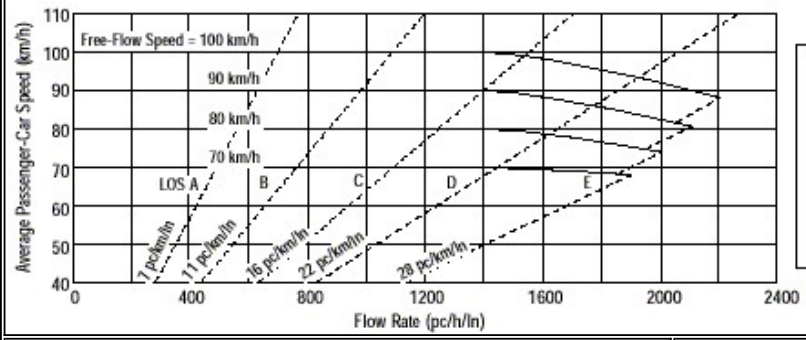
MULTILANE HIGHWAYS WORKSHEET(Direction 2)



Application	Input	Output
Oper. (LOS)	FFS, N, v_p	LOS, S, D
Des. (N)	FFS, LOS, v_p	N, S, D
Des. (v_p)	FFS, LOS, N	v_p, S, D
Plan. (LOS)	FFS, N, AADT	LOS, S, D
Plan. (N)	FFS, LOS, AADT	N, S, D
Plan. (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	DJ
Agency or Company	Dima Jawad
Date Performed	10/1/2018
Analysis Time Period	10 - 11 PM

Site Information

Highway/Direction to Travel	Tripoli - Syria
From/To	Abu Ali Roundabout - Biddawi
Jurisdiction	North
Analysis Year	2018

Project Description Akkar Wind Farms - Without Project

☑ Oper.(LOS) ☐ Des. (N) ☐ Plan. (vp)

Flow Inputs

Volume, V (veh/h)	410	Peak-Hour Factor, PHF	0.90
AADT(veh/h)		%Trucks and Buses, P_T	6
Peak-Hour Prop of AADT (veh/d)		%RVs, P_R	0
Peak-Hour Direction Prop, D		General Terrain:	Level
DDHV (veh/h)		Grade Length (km)	0.00
Driver Type Adjustment	1.00	Up/Down %	0.00
		Number of Lanes	3

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	f_{HV}	0.971

Speed Inputs

Lane Width, LW (m)	3.6
Total Lateral Clearance, LC (m)	2.8
Access Points, A (A/km)	10
Median Type, M	Divided
FFS (measured)	
Base Free-Flow Speed, BFFS	100.0

Calc Speed Adj and FFS

f_{LW} (km/h)	0.0
f_{LC} (km/h)	0.9
f_A (km/h)	6.7
f_M (km/h)	0.0
FFS (km/h)	92.4

Operations

Operational (LOS)

Flow Rate, v_p (pc/h/ln)	156
Speed, S (km/h)	92.4
D (pc/km/ln)	1.7
LOS	A

Design

Design (N)

Required Number of Lanes, N	
Flow Rate, v_p (pc/h)	
Max Service Flow Rate (pc/h/ln)	
Design LOS	

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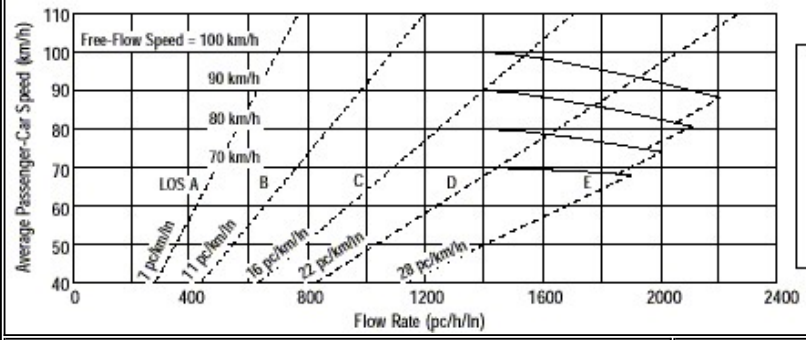
MULTILANE HIGHWAYS WORKSHEET(Direction 1)



Application	Input	Output
Oper. (LOS)	FFS, N, v_p	LOS, S, D
Des. (N)	FFS, LOS, v_p	N, S, D
Des. (v_p)	FFS, LOS, N	v_p, S, D
Plan. (LOS)	FFS, N, AADT	LOS, S, D
Plan. (N)	FFS, LOS, AADT	N, S, D
Plan. (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	DJ
Agency or Company	Dima Jawad
Date Performed	10/1/2018
Analysis Time Period	10 - 11 PM

Site Information

Highway/Direction to Travel	Tripoli - Syria
From/To	Biddawi - Abdeh
Jurisdiction	North
Analysis Year	2018

Project Description Akkar Wind Farms - Without Project

☑ Oper.(LOS) ☐ Des. (N) ☐ Plan. (vp)

Flow Inputs

Volume, V (veh/h)	313	Peak-Hour Factor, PHF	0.90
AADT(veh/h)		%Trucks and Buses, P_T	7
Peak-Hour Prop of AADT (veh/d)		%RVs, P_R	0
Peak-Hour Direction Prop, D		General Terrain:	Level
DDHV (veh/h)		Grade Length (km)	0.00
Driver Type Adjustment	1.00	Up/Down %	0.00
		Number of Lanes	2

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	f_{HV}	0.966

Speed Inputs

Lane Width, LW (m)	3.6
Total Lateral Clearance, LC (m)	2.0
Access Points, A (A/km)	10
Median Type, M	Divided
FFS (measured)	
Base Free-Flow Speed, BFFS	100.0

Calc Speed Adj and FFS

f_{LW} (km/h)	0.0
f_{LC} (km/h)	1.9
f_A (km/h)	6.7
f_M (km/h)	0.0
FFS (km/h)	91.4

Operations

Operational (LOS)

Flow Rate, v_p (pc/h/ln)	179
Speed, S (km/h)	91.4
D (pc/km/ln)	2.0
LOS	A

Design

Design (N)

Required Number of Lanes, N	
Flow Rate, v_p (pc/h)	
Max Service Flow Rate (pc/h/ln)	
Design LOS	

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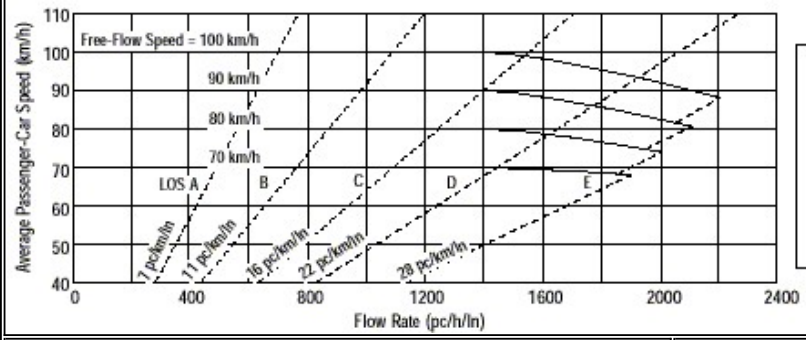
MULTILANE HIGHWAYS WORKSHEET(Direction 2)



Application	Input	Output
Oper. (LOS)	FFS, N, v_p	LOS, S, D
Des. (N)	FFS, LOS, v_p	N, S, D
Des. (v_p)	FFS, LOS, N	v_p, S, D
Plan. (LOS)	FFS, N, AADT	LOS, S, D
Plan. (N)	FFS, LOS, AADT	N, S, D
Plan. (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	DJ
Agency or Company	Dima Jawad
Date Performed	10/1/2018
Analysis Time Period	10 - 11 PM

Site Information

Highway/Direction to Travel	Tripoli - Syria
From/To	Biddawi - Abdeh
Jurisdiction	North
Analysis Year	2018

Project Description Akkar Wind Farms - Without Project

☑ Oper.(LOS) ☐ Des. (N) ☐ Plan. (vp)

Flow Inputs

Volume, V (veh/h)	304	Peak-Hour Factor, PHF	0.90
AADT(veh/h)		%Trucks and Buses, P_T	6
Peak-Hour Prop of AADT (veh/d)		%RVs, P_R	0
Peak-Hour Direction Prop, D		General Terrain:	Level
DDHV (veh/h)		Grade Length (km)	0.00
Driver Type Adjustment	1.00	Up/Down %	0.00
		Number of Lanes	2

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	f_{HV}	0.971

Speed Inputs

Lane Width, LW (m)	3.6
Total Lateral Clearance, LC (m)	2.0
Access Points, A (A/km)	10
Median Type, M	Divided
FFS (measured)	
Base Free-Flow Speed, BFFS	100.0

Calc Speed Adj and FFS

f_{LW} (km/h)	0.0
f_{LC} (km/h)	1.9
f_A (km/h)	6.7
f_M (km/h)	0.0
FFS (km/h)	91.4

Operations

Operational (LOS)

Flow Rate, v_p (pc/h/ln)	173
Speed, S (km/h)	91.4
D (pc/km/ln)	1.9
LOS	A

Design

Design (N)

Required Number of Lanes, N

Flow Rate, v_p (pc/h)

Max Service Flow Rate (pc/h/ln)

Design LOS

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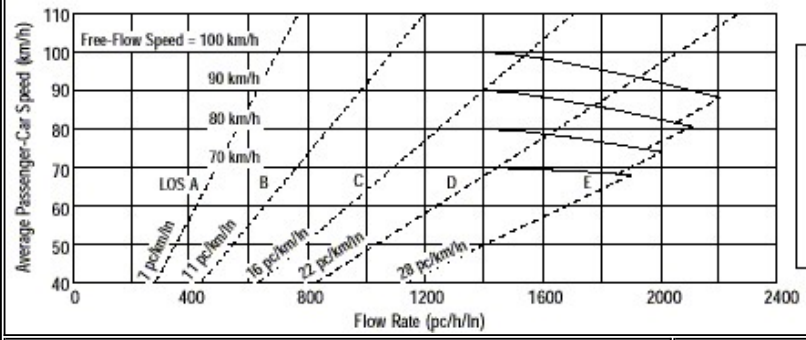
MULTILANE HIGHWAYS WORKSHEET(Direction 1)



Application	Input	Output
Oper. (LOS)	FFS, N, v_p	LOS, S, D
Des. (N)	FFS, LOS, v_p	N, S, D
Des. (v_p)	FFS, LOS, N	v_p, S, D
Plan. (LOS)	FFS, N, AADT	LOS, S, D
Plan. (N)	FFS, LOS, AADT	N, S, D
Plan. (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	DJ
Agency or Company	Dima Jawad
Date Performed	10/1/2018
Analysis Time Period	10 - 11 PM

Site Information

Highway/Direction to Travel	Tripoli - Syria
From/To	Abdeh - Mqaitea
Jurisdiction	North
Analysis Year	2018

Project Description Akkar Wind Farms - Without Project

☑ Oper.(LOS) ☐ Des. (N) ☐ Plan. (vp)

Flow Inputs

Volume, V (veh/h)	250	Peak-Hour Factor, PHF	0.90
AADT(veh/h)		%Trucks and Buses, P_T	8
Peak-Hour Prop of AADT (veh/d)		%RVs, P_R	0
Peak-Hour Direction Prop, D		General Terrain:	Level
DDHV (veh/h)		Grade Length (km)	0.00
Driver Type Adjustment	1.00	Up/Down %	0.00
		Number of Lanes	2

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	f_{HV}	0.962

Speed Inputs

Lane Width, LW (m)	3.6
Total Lateral Clearance, LC (m)	1.8
Access Points, A (A/km)	10
Median Type, M	Divided
FFS (measured)	
Base Free-Flow Speed, BFFS	100.0

Calc Speed Adj and FFS

f_{LW} (km/h)	0.0
f_{LC} (km/h)	2.1
f_A (km/h)	6.7
f_M (km/h)	0.0
FFS (km/h)	91.2

Operations

Operational (LOS)

Flow Rate, v_p (pc/h/ln)	144
Speed, S (km/h)	91.2
D (pc/km/ln)	1.6
LOS	A

Design

Design (N)

Required Number of Lanes, N	
Flow Rate, v_p (pc/h)	
Max Service Flow Rate (pc/h/ln)	
Design LOS	

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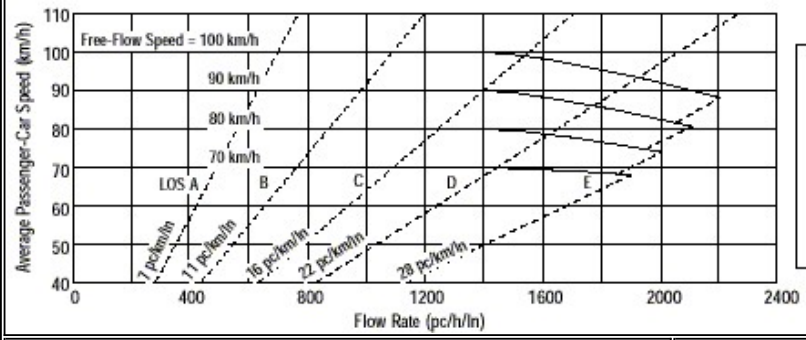
MULTILANE HIGHWAYS WORKSHEET(Direction 2)



Application	Input	Output
Oper. (LOS)	FFS, N, v_p	LOS, S, D
Des. (N)	FFS, LOS, v_p	N, S, D
Des. (v_p)	FFS, LOS, N	v_p, S, D
Plan. (LOS)	FFS, N, AADT	LOS, S, D
Plan. (N)	FFS, LOS, AADT	N, S, D
Plan. (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	DJ
Agency or Company	Dima Jawad
Date Performed	10/1/2018
Analysis Time Period	10 - 11 PM

Site Information

Highway/Direction to Travel	Tripoli - Syria
From/To	Abdeh - Mqaitea
Jurisdiction	North
Analysis Year	2018

Project Description Akkar Wind Farms - Without Project

☑ Oper.(LOS) ☐ Des. (N) ☐ Plan. (vp)

Flow Inputs

Volume, V (veh/h)	198	Peak-Hour Factor, PHF	0.90
AADT(veh/h)		%Trucks and Buses, P_T	6
Peak-Hour Prop of AADT (veh/d)		%RVs, P_R	0
Peak-Hour Direction Prop, D		General Terrain:	Level
DDHV (veh/h)		Grade Length (km)	0.00
Driver Type Adjustment	1.00	Up/Down %	0.00
		Number of Lanes	2

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	f_{HV}	0.971

Speed Inputs

Lane Width, LW (m)	3.6
Total Lateral Clearance, LC (m)	1.8
Access Points, A (A/km)	10
Median Type, M	Divided
FFS (measured)	
Base Free-Flow Speed, BFFS	100.0

Calc Speed Adj and FFS

f_{LW} (km/h)	0.0
f_{LC} (km/h)	2.1
f_A (km/h)	6.7
f_M (km/h)	0.0
FFS (km/h)	91.2

Operations

Operational (LOS)

Flow Rate, v_p (pc/h/ln)	113
Speed, S (km/h)	91.2
D (pc/km/ln)	1.2
LOS	A

Design

Design (N)

Required Number of Lanes, N	
Flow Rate, v_p (pc/h)	
Max Service Flow Rate (pc/h/ln)	
Design LOS	

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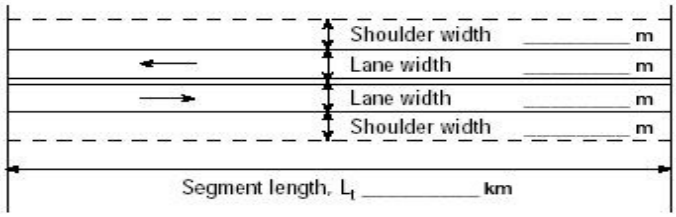
TWO-WAY TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		Site Information	
Analyst	*DJ*	Highway	*Abboudieh Rd*
Agency or Company	*Dima Jawad*	From/To	*Mqaitea - Abboudieh*
Date Performed	*10/8/2018*	Jurisdiction	*North*
Analysis Time Period	*10 -11 pm*	Analysis Year	*2018*

Project Description: *Akkar Wind Farms*

Input Data



☐ Class I highway ☑ Class II highway

Terrain ☑ Level ☐ Rolling

Two-way hourly volume	*434* veh/h
Directional split	*55 / 45*
Peak-hour factor, PHF	*0.90*
No-passing zone	*0*
% Trucks and Buses , P_T	*10 %*
% Recreational vehicles, P_R	*0%*
Access points/ *km*	*10*

Average Travel Speed

Grade adjustment factor, f_G (Exhibit 20-7)	*1.00*
Passenger-car equivalents for trucks, E_T (Exhibit 20-9)	*1.7*
Passenger-car equivalents for RVs, E_R (Exhibit 20-9)	*1.0*
Heavy-vehicle adjustment factor, f_{HV}=1/ (1+ $P_T(E_T-1)+P_R(E_R-1)$)	*0.935*
Two-way flow rate[1], v_p (pc/h)=V/ (PHF * f_G * f_{HV})	*516*
v_p * highest directional split proportion[2] (pc/h)	*284*

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Field Measured speed, S_{FM}	*km/h*	Base free-flow speed, $BFFS_{FM}$	*80.0 km/h*
Observed volume, V_f	*veh/h*	Adj. for lane width and shoulder width[3], f_{LS} (Exhibit 20-5)	*7.5 km/h*
Free-flow speed, FFS FFS=S_{FM}+0.00776(V_f/ f_{HV})	*km/h*	Adj. for access points, f_A (Exhibit 20-6)	*6.7 km/h*
		Free-flow speed, FFS (FSS=BFFS-f_{LS}-f_A)	*65.8 km/h*

Adj. for no-passing zones, f_{np} (*km/h*) (Exhibit 20-11)	*0.0*
Average travel speed, ATS (*km/h*) ATS=FFS-0.00776v_p-f_{np}	*59.4*

Percent Time-Spent-Following

Grade Adjustment factor, f_G (Exhibit 20-8)	*1.00*
Passenger-car equivalents for trucks, E_T (Exhibit 20-10)	*1.1*
Passenger-car equivalents for RVs, E_R (Exhibit 20-10)	*1.0*
Heavy-vehicle adjustment factor, f_{HV}=1/ (1+ $P_T(E_T-1)+P_R(E_R-1)$)	*0.990*
Two-way flow rate[1], v_p (pc/h)=V/ (PHF * f_G * f_{HV})	*487*
v_p * highest directional split proportion[2] (pc/h)	*268*
Base percent time-spent-following, BPTSF(%)=100(1-$e^{-0.000879v_p}$)	*34.8*
Adj. for directional distribution and no-passing zone, $f_{d/hp}$(%)(Exh. 20-12)	*0.1*
Percent time-spent-following, PTSF(%)=BPTSF+$f_{d/np}$	*35.0*

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 20-3 for Class I or 20-4 for Class II)	*A*
Volume to capacity ratio, v/c=V_p/ 3,200	*0.16*
Peak 15-min veh-miles of travel, VMT_{15} (veh- *km*)= 0.25L_t(V/PHF)	*1206*

Peak-hour vehicle-miles of travel, VMT_{60}(veh- *km*)=V*L_t	*4340*
Peak 15-min total travel time, TT_{15}(veh-h)= VMT_{15}/ATS	*20.3*
Notes	
1. If Vp >= 3,200 pc/h, terminate analysis-the LOS is F. 2. If highest directional split Vp>= 1,700 pc/h, terminated anlysis-the LOS is F.	

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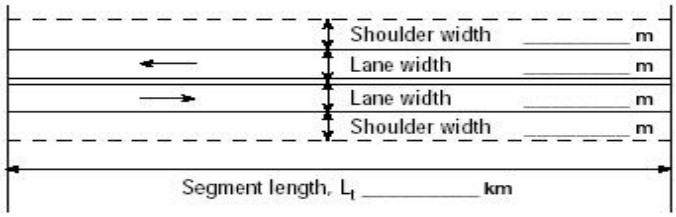
TWO-WAY TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		Site Information	
Analyst	*DJ*	Highway	*Chadra Rd (6)*
Agency or Company	*Dima Jawad*	From/To	*Menjez - Chadra*
Date Performed	*10/8/2018*	Jurisdiction	*North*
Analysis Time Period	*3:00-4:00 pm*	Analysis Year	*2018*

Project Description: *Akkar Wind Farms*

Input Data



☐ Class I highway ☑ Class II highway

Terrain ☐ Level ☑ Rolling

Two-way hourly volume	*110* veh/h
Directional split	*55 / 45*
Peak-hour factor, PHF	*0.90*
No-passing zone	*0*
% Trucks and Buses , P_T	*10 %*
% Recreational vehicles, P_R	*0%*
Access points/ *km*	*10*

Average Travel Speed

Grade adjustment factor, f_G (Exhibit 20-7)	*0.71*
Passenger-car equivalents for trucks, E_T (Exhibit 20-9)	*2.5*
Passenger-car equivalents for RVs, E_R (Exhibit 20-9)	*1.1*
Heavy-vehicle adjustment factor, f_{HV}=1/ (1+ $P_T(E_T-1)+P_R(E_R-1)$)	*0.870*
Two-way flow rate[1], v_p (pc/h)=V/ (PHF * f_G * f_{HV})	*198*
v_p * highest directional split proportion[2] (pc/h)	*109*

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Field Measured speed, S_{FM}	*km/h*	Base free-flow speed, $BFFS_{FM}$	*80.0 km/h*
Observed volume, V_f	*veh/h*	Adj. for lane width and shoulder width[3], f_{LS} (Exhibit 20-5)	*7.5 km/h*
Free-flow speed, FFS FFS=S_{FM}+0.00776(V_f/ f_{HV})	*km/h*	Adj. for access points, f_A (Exhibit 20-6)	*6.7 km/h*
		Free-flow speed, FFS (FSS=BFFS-f_{LS}-f_A)	*65.8 km/h*

Adj. for no-passing zones, f_{np} (*km/h*) (Exhibit 20-11)	*0.0*
Average travel speed, ATS (*km/h*) ATS=FFS-0.00776v_p-f_{np}	*63.4*

Percent Time-Spent-Following

Grade Adjustment factor, f_G (Exhibit 20-8)	*0.77*
Passenger-car equivalents for trucks, E_T (Exhibit 20-10)	*1.8*
Passenger-car equivalents for RVs, E_R (Exhibit 20-10)	*1.0*
Heavy-vehicle adjustment factor, f_{HV}=1/ (1+ $P_T(E_T-1)+P_R(E_R-1)$)	*0.926*
Two-way flow rate[1], v_p (pc/h)=V/ (PHF * f_G * f_{HV})	*171*
v_p * highest directional split proportion[2] (pc/h)	*94*
Base percent time-spent-following, BPTSF(%)=100(1-$e^{-0.000879v_p}$)	*14.0*
Adj. for directional distribution and no-passing zone, $f_{d/hp}$(%)(Exh. 20-12)	*0.9*
Percent time-spent-following, PTSF(%)=BPTSF+$f_{d/np}$	*14.8*

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 20-3 for Class I or 20-4 for Class II)	*A*
Volume to capacity ratio, v/c=V_p/ 3,200	*0.06*
Peak 15-min veh-miles of travel, VMT_{15} (veh- *km*)= 0.25L_t(V/PHF)	*306*

Peak-hour vehicle-miles of travel, VMT_{60}(veh- *km*)=V*L_t	*1100*
Peak 15-min total travel time, TT_{15}(veh-h)= VMT_{15}/ATS	*4.8*
Notes	
1. If Vp >= 3,200 pc/h, terminate analysis-the LOS is F. 2. If highest directional split Vp>= 1,700 pc/h, terminated anlysis-the LOS is F.	

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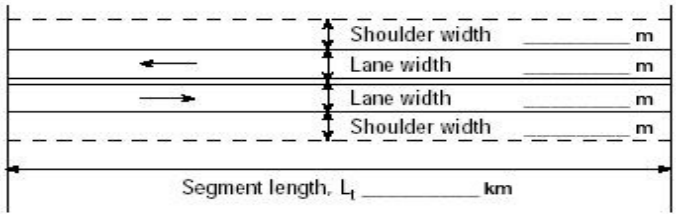
TWO-WAY TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		Site Information	
Analyst	*DJ*	Highway	*Chadra Rd*
Agency or Company	*Dima Jawad*	From/To	*Menjez - Chadra*
Date Performed	*10/8/2018*	Jurisdiction	*North*
Analysis Time Period	*10 -11 pm*	Analysis Year	*2018*

Project Description: *Akkar Wind Farms*

Input Data



☐ Class I highway ☑ Class II highway

Terrain ☐ Level ☑ Rolling

Two-way hourly volume	*68* veh/h
Directional split	*55 / 45*
Peak-hour factor, PHF	*0.90*
No-passing zone	*0*
% Trucks and Buses , P_T	*10 %*
% Recreational vehicles, P_R	*0%*
Access points/ *km*	*10*

Average Travel Speed

Grade adjustment factor, f_G (Exhibit 20-7)	*0.71*
Passenger-car equivalents for trucks, E_T (Exhibit 20-9)	*2.5*
Passenger-car equivalents for RVs, E_R (Exhibit 20-9)	*1.1*
Heavy-vehicle adjustment factor, f_{HV}=1/ (1+ $P_T(E_T-1)+P_R(E_R-1)$)	*0.870*
Two-way flow rate[1], v_p (pc/h)=V/ (PHF * f_G * f_{HV})	*122*
v_p * highest directional split proportion[2] (pc/h)	*67*

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Field Measured speed, S_{FM}	*km/h*	Base free-flow speed, $BFFS_{FM}$	*80.0 km/h*
Observed volume, V_f	*veh/h*	Adj. for lane width and shoulder width[3], f_{LS} (Exhibit 20-5)	*7.5 km/h*
Free-flow speed, FFS FFS=S_{FM}+0.00776(V_f/ f_{HV})	*km/h*	Adj. for access points, f_A (Exhibit 20-6)	*6.7 km/h*
		Free-flow speed, FFS (FSS=BFFS-f_{LS}-f_A)	*65.8 km/h*

Adj. for no-passing zones, f_{np} (*km/h*) (Exhibit 20-11)	*0.0*
Average travel speed, ATS (*km/h*) ATS=FFS-0.00776v_p-f_{np}	*64.3*

Percent Time-Spent-Following

Grade Adjustment factor, f_G (Exhibit 20-8)	*0.77*
Passenger-car equivalents for trucks, E_T (Exhibit 20-10)	*1.8*
Passenger-car equivalents for RVs, E_R (Exhibit 20-10)	*1.0*
Heavy-vehicle adjustment factor, f_{HV}=1/ (1+ $P_T(E_T-1)+P_R(E_R-1)$)	*0.926*
Two-way flow rate[1], v_p (pc/h)=V/ (PHF * f_G * f_{HV})	*106*
v_p * highest directional split proportion[2] (pc/h)	*58*
Base percent time-spent-following, BPTSF(%)=100(1-$e^{-0.000879v_p}$)	*8.9*
Adj. for directional distribution and no-passing zone, $f_{d/hp}$(%)(Exh. 20-12)	*1.1*
Percent time-spent-following, PTSF(%)=BPTSF+$f_{d/np}$	*10.0*

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 20-3 for Class I or 20-4 for Class II)	*A*
Volume to capacity ratio, v/c=V_p/ 3,200	*0.04*
Peak 15-min veh-miles of travel, VMT_{15} (veh- *km*)= 0.25L_t(V/PHF)	*189*

Peak-hour vehicle-miles of travel, VMT_{60}(veh- *km*)=V*L_t	*680*
Peak 15-min total travel time, TT_{15}(veh-h)= VMT_{15}/ATS	*2.9*
Notes	
1. If Vp >= 3,200 pc/h, terminate analysis-the LOS is F. 2. If highest directional split Vp>= 1,700 pc/h, terminated anlysis-the LOS is F.	

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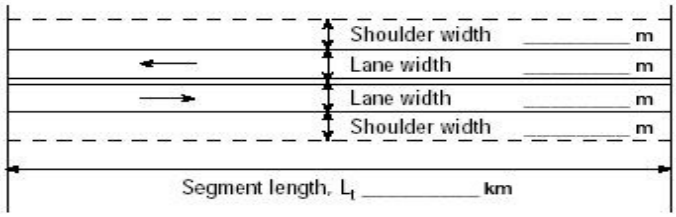
TWO-WAY TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		Site Information	
Analyst	*DJ*	Highway	*Andeqt Rd (7)*
Agency or Company	*Dima Jawad*	From/To	*Andeqt - Qobaiat*
Date Performed	*10/8/2018*	Jurisdiction	*North*
Analysis Time Period	*3:00-4:00 pm*	Analysis Year	*2018*

Project Description: *Akkar Wind Farms*

Input Data



☐ Class I highway ☑ Class II highway

Terrain ☐ Level ☑ Rolling

Two-way hourly volume	*431* veh/h
Directional split	*50 / 50*
Peak-hour factor, PHF	*0.90*
No-passing zone	*0*
% Trucks and Buses , P_T	*30 %*
% Recreational vehicles, P_R	*0%*
Access points/ *km*	*10*

Average Travel Speed

Grade adjustment factor, f_G (Exhibit 20-7)	*0.93*
Passenger-car equivalents for trucks, E_T (Exhibit 20-9)	*1.9*
Passenger-car equivalents for RVs, E_R (Exhibit 20-9)	*1.1*
Heavy-vehicle adjustment factor, f_{HV}=1/ (1+ $P_T(E_T-1)+P_R(E_R-1)$)	*0.787*
Two-way flow rate[1], v_p (pc/h)=V/ (PHF * f_G * f_{HV})	*654*
v_p * highest directional split proportion[2] (pc/h)	*327*

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Field Measured speed, S_{FM}	*km/h*	Base free-flow speed, $BFFS_{FM}$	*80.0 km/h*
Observed volume, V_f	*veh/h*	Adj. for lane width and shoulder width[3], f_{LS} (Exhibit 20-5)	*4.9 km/h*
Free-flow speed, FFS FFS=S_{FM}+0.00776(V_f/ f_{HV})	*km/h*	Adj. for access points, f_A (Exhibit 20-6)	*6.7 km/h*
		Free-flow speed, FFS (FSS=BFFS-f_{LS}-f_A)	*68.4 km/h*

Adj. for no-passing zones, f_{np} (*km/h*) (Exhibit 20-11)	*0.0*
Average travel speed, ATS (*km/h*) ATS=FFS-0.00776v_p-f_{np}	*60.3*

Percent Time-Spent-Following

Grade Adjustment factor, f_G (Exhibit 20-8)	*0.94*
Passenger-car equivalents for trucks, E_T (Exhibit 20-10)	*1.5*
Passenger-car equivalents for RVs, E_R (Exhibit 20-10)	*1.0*
Heavy-vehicle adjustment factor, f_{HV}=1/ (1+ $P_T(E_T-1)+P_R(E_R-1)$)	*0.870*
Two-way flow rate[1], v_p (pc/h)=V/ (PHF * f_G * f_{HV})	*586*
v_p * highest directional split proportion[2] (pc/h)	*293*
Base percent time-spent-following, BPTSF(%)=100(1-$e^{-0.000879v_p}$)	*40.3*
Adj. for directional distribution and no-passing zone, $f_{d/hp}$(%)(Exh. 20-12)	*0.0*
Percent time-spent-following, PTSF(%)=BPTSF+$f_{d/np}$	*40.3*

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 20-3 for Class I or 20-4 for Class II)	*B*
Volume to capacity ratio, v/c=V_p/ 3,200	*0.20*
Peak 15-min veh-miles of travel, VMT_{15} (veh- *km*)= 0.25L_t(V/PHF)	*1197*

Peak-hour vehicle-miles of travel, VMT_{60}(veh- *km*)=V*L_t	*4310*
Peak 15-min total travel time, TT_{15}(veh-h)= VMT_{15}/ATS	*19.9*
Notes	
1. If Vp >= 3,200 pc/h, terminate analysis-the LOS is F. 2. If highest directional split Vp>= 1,700 pc/h, terminated anlysis-the LOS is F.	

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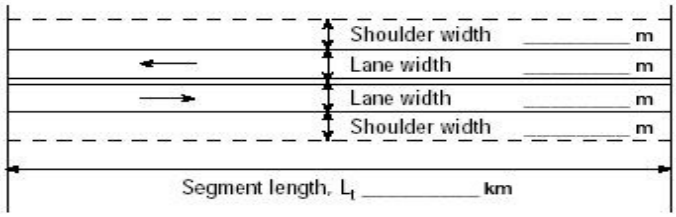
TWO-WAY TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		Site Information	
Analyst	*DJ*	Highway	*Qtalbe Rd (8)*
Agency or Company	*Dima Jawad*	From/To	*Qobaiat - Qtalbe*
Date Performed	*10/8/2018*	Jurisdiction	*North*
Analysis Time Period	*3:00-4:00 pm*	Analysis Year	*2018*

Project Description: *Akkar Wind Farms*

Input Data



☐ Class I highway ☑ Class II highway

Terrain ☐ Level ☑ Rolling

Two-way hourly volume	*78* veh/h
Directional split	*60 / 40*
Peak-hour factor, PHF	*0.90*
No-passing zone	*0*
% Trucks and Buses , P_T	*30 %*
% Recreational vehicles, P_R	*0%*
Access points/ *km*	*10*

Average Travel Speed

Grade adjustment factor, f_G (Exhibit 20-7)	*0.71*
Passenger-car equivalents for trucks, E_T (Exhibit 20-9)	*2.5*
Passenger-car equivalents for RVs, E_R (Exhibit 20-9)	*1.1*
Heavy-vehicle adjustment factor, f_{HV}=1/ (1+ $P_T(E_T-1)+P_R(E_R-1)$)	*0.690*
Two-way flow rate[1], v_p (pc/h)=V/ (PHF * f_G * f_{HV})	*177*
v_p * highest directional split proportion[2] (pc/h)	*106*

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Field Measured speed, S_{FM}	*km/h*	Base free-flow speed, $BFFS_{FM}$	*80.0 km/h*
Observed volume, V_f	*veh/h*	Adj. for lane width and shoulder width[3], f_{LS} (Exhibit 20-5)	*7.5 km/h*
Free-flow speed, FFS FFS=S_{FM}+0.00776(V_f/ f_{HV})	*km/h*	Adj. for access points, f_A (Exhibit 20-6)	*6.7 km/h*
		Free-flow speed, FFS (FSS=BFFS-f_{LS}-f_A)	*65.8 km/h*

Adj. for no-passing zones, f_{np} (*km/h*) (Exhibit 20-11)	*0.0*
Average travel speed, ATS (*km/h*) ATS=FFS-0.00776v_p-f_{np}	*63.6*

Percent Time-Spent-Following

Grade Adjustment factor, f_G (Exhibit 20-8)	*0.77*
Passenger-car equivalents for trucks, E_T (Exhibit 20-10)	*1.8*
Passenger-car equivalents for RVs, E_R (Exhibit 20-10)	*1.0*
Heavy-vehicle adjustment factor, f_{HV}=1/ (1+ $P_T(E_T-1)+P_R(E_R-1)$)	*0.806*
Two-way flow rate[1], v_p (pc/h)=V/ (PHF * f_G * f_{HV})	*140*
v_p * highest directional split proportion[2] (pc/h)	*84*
Base percent time-spent-following, BPTSF(%)=100(1-$e^{-0.000879v_p}$)	*11.6*
Adj. for directional distribution and no-passing zone, $f_{d/hp}$(%)(Exh. 20-12)	*1.9*
Percent time-spent-following, PTSF(%)=BPTSF+$f_{d/np}$	*13.5*

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 20-3 for Class I or 20-4 for Class II)	*A*
Volume to capacity ratio, v/c=V_p/ 3,200	*0.06*
Peak 15-min veh-miles of travel, VMT_{15} (veh- *km*)= 0.25L_t(V/PHF)	*217*

Peak-hour vehicle-miles of travel, VMT_{60}(veh- *km*)=V*L_t	*780*
Peak 15-min total travel time, TT_{15}(veh-h)= VMT_{15}/ATS	*3.4*
Notes	
1. If Vp >= 3,200 pc/h, terminate analysis-the LOS is F. 2. If highest directional split Vp>= 1,700 pc/h, terminated anlysis-the LOS is F.	

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Intersection	
Intersection Delay, s/veh	4.2
Intersection LOS	A

Approach	EB	WB	NB
Entry Lanes	1	1	1
Conflicting Circle Lanes	2	2	2
Adj Approach Flow, veh/h	82	38	74
Demand Flow Rate, veh/h	90	42	81
Vehicles Circulating, veh/h	18	59	22
Vehicles Exiting, veh/h	83	44	86
Follow-Up Headway, s	3.186	3.186	3.186
Ped Vol Crossing Leg, #/h	0	0	0
Ped Cap Adj	1.000	1.000	1.000
Approach Delay, s/veh	4.3	4.0	4.2
Approach LOS	A	A	A

Lane	Left	Left	Left
Designated Moves	TR	LT	LR
Assumed Moves	TR	LT	LR
RT Channelized			
Lane Util	1.000	1.000	1.000
Critical Headway, s	4.113	4.113	4.113
Entry Flow, veh/h	90	42	81
Cap Entry Lane, veh/h	1116	1084	1113
Entry HV Adj Factor	0.911	0.900	0.914
Flow Entry, veh/h	82	38	74
Cap Entry, veh/h	1017	976	1017
V/C Ratio	0.081	0.039	0.073
Control Delay, s/veh	4.3	4.0	4.2
LOS	A	A	A
95th %tile Queue, veh	0	0	0

Intersection	
Int Delay, s/veh	1.8

Movement	WBL	WBR	NET	NER	SWL	SWT
Lane Configurations						
Traffic Vol, veh/h	30	15	110	76	12	85
Future Vol, veh/h	30	15	110	76	12	85
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	40	10	10	40	10	10
Mvmt Flow	33	16	120	83	13	92

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	280	162	0	0	203	0
Stage 1	162	-	-	-	-	-
Stage 2	118	-	-	-	-	-
Critical Hdwy	6.8	6.3	-	-	4.2	-
Critical Hdwy Stg 1	5.8	-	-	-	-	-
Critical Hdwy Stg 2	5.8	-	-	-	-	-
Follow-up Hdwy	3.86	3.39	-	-	2.29	-
Pot Cap-1 Maneuver	636	862	-	-	1322	-
Stage 1	783	-	-	-	-	-
Stage 2	821	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	630	862	-	-	1322	-
Mov Cap-2 Maneuver	630	-	-	-	-	-
Stage 1	775	-	-	-	-	-
Stage 2	821	-	-	-	-	-

Approach	WB	NE	SW
HCM Control Delay, s	10.6	0	1
HCM LOS	B		

Minor Lane/Major Mvmt	NET	NER	WBLn1	SWL	SWT
Capacity (veh/h)	-	-	692	1322	-
HCM Lane V/C Ratio	-	-	0.071	0.01	-
HCM Control Delay (s)	-	-	10.6	7.8	0
HCM Lane LOS	-	-	B	A	A
HCM 95th %tile Q(veh)	-	-	0.2	0	-

Intersection	
Intersection Delay, s/veh	7.9
Intersection LOS	A

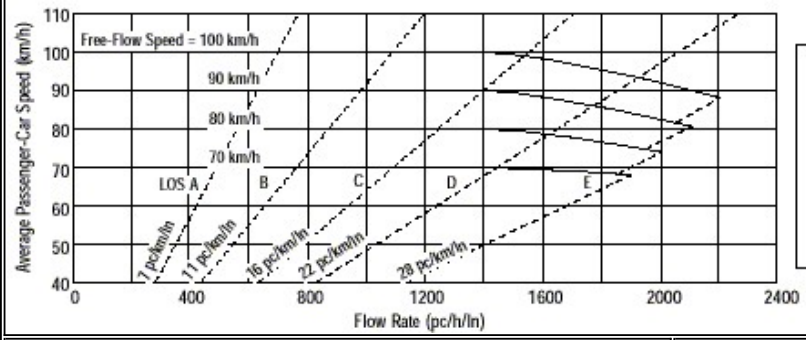
Approach	EB	WB	NB	SB
Entry Lanes	1	1	2	2
Conflicting Circle Lanes	1	1	1	1
Adj Approach Flow, veh/h	95	254	462	313
Demand Flow Rate, veh/h	98	287	556	329
Vehicles Circulating, veh/h	441	305	173	255
Vehicles Exiting, veh/h	143	424	366	337
Follow-Up Headway, s	3.186	3.186	3.186	3.186
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	6.6	9.2	7.9	7.2
Approach LOS	A	A	A	A

Lane	Left	Left	Left	Right	Left	Right
Designated Moves	LTR	LTR	LT	R	LT	R
Assumed Moves	LTR	LTR	LT	R	LT	R
RT Channelized						
Lane Util	1.000	1.000	0.482	0.518	0.805	0.195
Critical Headway, s	5.193	5.193	5.193	5.193	5.193	5.193
Entry Flow, veh/h	98	287	268	288	265	64
Cap Entry Lane, veh/h	727	833	950	950	876	876
Entry HV Adj Factor	0.972	0.885	0.954	0.715	0.951	0.953
Flow Entry, veh/h	95	254	256	206	252	61
Cap Entry, veh/h	706	737	907	680	832	835
V/C Ratio	0.135	0.345	0.282	0.303	0.303	0.073
Control Delay, s/veh	6.6	9.2	6.9	9.1	7.7	5.0
LOS	A	A	A	A	A	A
95th %tile Queue, veh	0	2	1	1	1	0

Capacity Analysis

Future Background Traffic (Year 2020)

MULTILANE HIGHWAYS WORKSHEET(Direction 1)



Application	Input	Output
Oper. (LOS)	FFS, N, v_p	LOS, S, D
Des. (N)	FFS, LOS, v_p	N, S, D
Des. (v_p)	FFS, LOS, N	v_p, S, D
Plan. (LOS)	FFS, N, AADT	LOS, S, D
Plan. (N)	FFS, LOS, AADT	N, S, D
Plan. (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	DJ
Agency or Company	Dima Jawad
Date Performed	10/1/2018
Analysis Time Period	10 - 11 PM

Site Information

Highway/Direction to Travel	Tripoli Port
From/To	Port to Abu Ali
Jurisdiction	North
Analysis Year	2020

Project Description Akkar Wind Farms - Without Project

☑ Oper.(LOS) ☐ Des. (N) ☐ Plan. (vp)

Flow Inputs

Volume, V (veh/h)	260	Peak-Hour Factor, PHF	0.90
AADT(veh/h)		%Trucks and Buses, P_T	11
Peak-Hour Prop of AADT (veh/d)		%RVs, P_R	0
Peak-Hour Direction Prop, D		General Terrain:	Level
DDHV (veh/h)		Grade Length (km)	0.00
Driver Type Adjustment	1.00	Up/Down %	0.00
		Number of Lanes	2

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	f_{HV}	0.948

Speed Inputs

Lane Width, LW (m)	3.6
Total Lateral Clearance, LC (m)	2.0
Access Points, A (A/km)	5
Median Type, M	Divided
FFS (measured)	
Base Free-Flow Speed, BFFS	100.0

Calc Speed Adj and FFS

f_{LW} (km/h)	0.0
f_{LC} (km/h)	1.9
f_A (km/h)	3.3
f_M (km/h)	0.0
FFS (km/h)	94.8

Operations

Operational (LOS)

Flow Rate, v_p (pc/h/ln)	152
Speed, S (km/h)	94.8
D (pc/km/ln)	1.6
LOS	A

Design

Design (N)

Required Number of Lanes, N	
Flow Rate, v_p (pc/h)	
Max Service Flow Rate (pc/h/ln)	
Design LOS	

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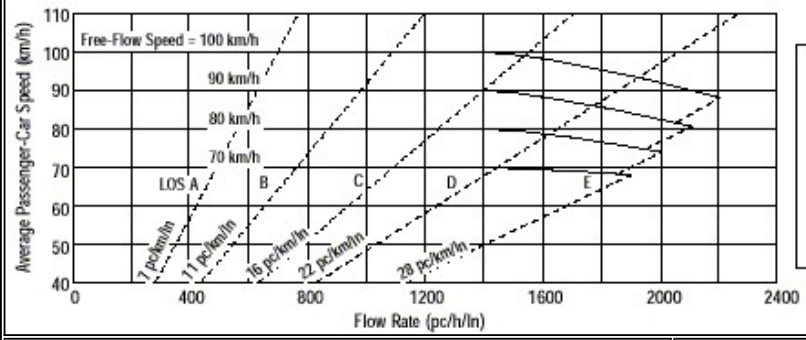
MULTILANE HIGHWAYS WORKSHEET(Direction 2)



Application	Input	Output
Oper. (LOS)	FFS, N, v_p	LOS, S, D
Des. (N)	FFS, LOS, v_p	N, S, D
Des. (v_p)	FFS, LOS, N	v_p, S, D
Plan. (LOS)	FFS, N, AADT	LOS, S, D
Plan. (N)	FFS, LOS, AADT	N, S, D
Plan. (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	DJ
Agency or Company	Dima Jawad
Date Performed	10/1/2018
Analysis Time Period	10 - 11 PM

Site Information

Highway/Direction to Travel	Tripoli Port
From/To	Port to Abu Ali
Jurisdiction	North
Analysis Year	2020

Project Description Akkar Wind Farms - Without Project

☑ Oper.(LOS) ☐ Des. (N) ☐ Plan. (vp)

Flow Inputs

Volume, V (veh/h)	261	Peak-Hour Factor, PHF	0.90
AADT(veh/h)		%Trucks and Buses, P_T	4
Peak-Hour Prop of AADT (veh/d)		%RVs, P_R	0
Peak-Hour Direction Prop, D		General Terrain:	Level
DDHV (veh/h)		Grade Length (km)	0.00
Driver Type Adjustment	1.00	Up/Down %	0.00
		Number of Lanes	2

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	f_{HV}	0.980

Speed Inputs

Lane Width, LW (m)	3.6
Total Lateral Clearance, LC (m)	2.0
Access Points, A (A/km)	5
Median Type, M	Divided
FFS (measured)	
Base Free-Flow Speed, BFFS	100.0

Calc Speed Adj and FFS

f_{LW} (km/h)	0.0
f_{LC} (km/h)	1.9
f_A (km/h)	3.3
f_M (km/h)	0.0
FFS (km/h)	94.8

Operations

Operational (LOS)

Flow Rate, v_p (pc/h/ln)	147
Speed, S (km/h)	94.8
D (pc/km/ln)	1.6
LOS	A

Design

Design (N)

Required Number of Lanes, N	
Flow Rate, v_p (pc/h)	
Max Service Flow Rate (pc/h/ln)	
Design LOS	

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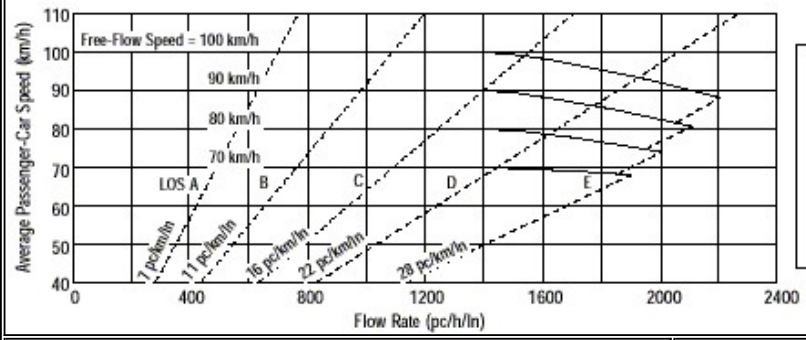
MULTILANE HIGHWAYS WORKSHEET(Direction 1)



Application	Input	Output
Oper. (LOS)	FFS, N, v_p	LOS, S, D
Des. (N)	FFS, LOS, v_p	N, S, D
Des. (v_p)	FFS, LOS, N	v_p, S, D
Plan. (LOS)	FFS, N, AADT	LOS, S, D
Plan. (N)	FFS, LOS, AADT	N, S, D
Plan. (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	DJ
Agency or Company	Dima Jawad
Date Performed	10/1/2018
Analysis Time Period	10 - 11 PM

Site Information

Highway/Direction to Travel	Tripoli - Syria
From/To	Abu Ali Roundabout - Biddawi
Jurisdiction	North
Analysis Year	2020

Project Description Akkar Wind Farms - Without Project

☑ Oper.(LOS) ☐ Des. (N) ☐ Plan. (vp)

Flow Inputs

Volume, V (veh/h)	597	Peak-Hour Factor, PHF	0.90
AADT(veh/h)		%Trucks and Buses, P_T	7
Peak-Hour Prop of AADT (veh/d)		%RVs, P_R	0
Peak-Hour Direction Prop, D		General Terrain:	Level
DDHV (veh/h)		Grade Length (km)	0.00
Driver Type Adjustment	1.00	Up/Down %	0.00
		Number of Lanes	3

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	f_{HV}	0.966

Speed Inputs

Lane Width, LW (m)	3.6
Total Lateral Clearance, LC (m)	2.8
Access Points, A (A/km)	10
Median Type, M	Divided
FFS (measured)	
Base Free-Flow Speed, BFFS	100.0

Calc Speed Adj and FFS

f_{LW} (km/h)	0.0
f_{LC} (km/h)	0.9
f_A (km/h)	6.7
f_M (km/h)	0.0
FFS (km/h)	92.4

Operations

Operational (LOS)

Flow Rate, v_p (pc/h/ln)	228
Speed, S (km/h)	92.4
D (pc/km/ln)	2.5
LOS	A

Design

Design (N)

Required Number of Lanes, N	
Flow Rate, v_p (pc/h)	
Max Service Flow Rate (pc/h/ln)	
Design LOS	

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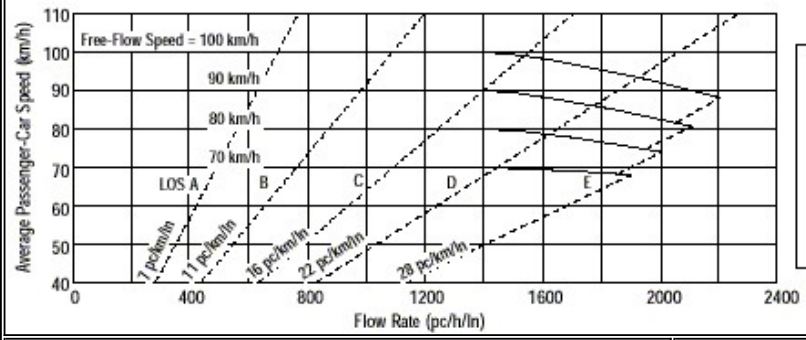
MULTILANE HIGHWAYS WORKSHEET(Direction 2)



Application	Input	Output
Oper. (LOS)	FFS, N, v_p	LOS, S, D
Des. (N)	FFS, LOS, v_p	N, S, D
Des. (v_p)	FFS, LOS, N	v_p, S, D
Plan. (LOS)	FFS, N, AADT	LOS, S, D
Plan. (N)	FFS, LOS, AADT	N, S, D
Plan. (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	DJ
Agency or Company	Dima Jawad
Date Performed	10/1/2018
Analysis Time Period	10 - 11 PM

Site Information

Highway/Direction to Travel	Tripoli - Syria
From/To	Abu Ali Roundabout - Biddawi
Jurisdiction	North
Analysis Year	2020

Project Description Akkar Wind Farms - Without Project

☑ Oper.(LOS) ☐ Des. (N) ☐ Plan. (vp)

Flow Inputs

Volume, V (veh/h)	435	Peak-Hour Factor, PHF	0.90
AADT(veh/h)		%Trucks and Buses, P_T	6
Peak-Hour Prop of AADT (veh/d)		%RVs, P_R	0
Peak-Hour Direction Prop, D		General Terrain:	Level
DDHV (veh/h)		Grade Length (km)	0.00
Driver Type Adjustment	1.00	Up/Down %	0.00
		Number of Lanes	3

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	f_{HV}	0.971

Speed Inputs

Lane Width, LW (m)	3.6
Total Lateral Clearance, LC (m)	2.8
Access Points, A (A/km)	10
Median Type, M	Divided
FFS (measured)	
Base Free-Flow Speed, BFFS	100.0

Calc Speed Adj and FFS

f_{LW} (km/h)	0.0
f_{LC} (km/h)	0.9
f_A (km/h)	6.7
f_M (km/h)	0.0
FFS (km/h)	92.4

Operations

Operational (LOS)

Flow Rate, v_p (pc/h/ln)	165
Speed, S (km/h)	92.4
D (pc/km/ln)	1.8
LOS	A

Design

Design (N)

Required Number of Lanes, N	
Flow Rate, v_p (pc/h)	
Max Service Flow Rate (pc/h/ln)	
Design LOS	

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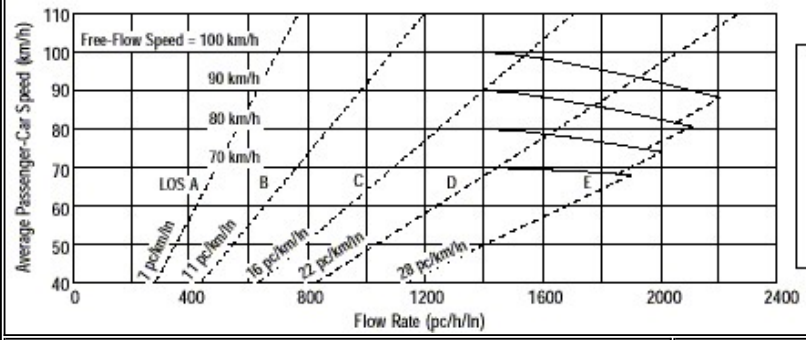
MULTILANE HIGHWAYS WORKSHEET(Direction 1)



Application	Input	Output
Oper. (LOS)	FFS, N, v_p	LOS, S, D
Des. (N)	FFS, LOS, v_p	N, S, D
Des. (v_p)	FFS, LOS, N	v_p, S, D
Plan. (LOS)	FFS, N, AADT	LOS, S, D
Plan. (N)	FFS, LOS, AADT	N, S, D
Plan. (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	DJ
Agency or Company	Dima Jawad
Date Performed	10/1/2018
Analysis Time Period	10 - 11 PM

Site Information

Highway/Direction to Travel	Tripoli - Syria
From/To	Biddawi - Abdeh
Jurisdiction	North
Analysis Year	2020

Project Description Akkar Wind Farms - Without Project

☑ Oper.(LOS) ☐ Des. (N) ☐ Plan. (vp)

Flow Inputs

Volume, V (veh/h)	332	Peak-Hour Factor, PHF	0.90
AADT(veh/h)		%Trucks and Buses, P_T	7
Peak-Hour Prop of AADT (veh/d)		%RVs, P_R	0
Peak-Hour Direction Prop, D		General Terrain:	Level
DDHV (veh/h)		Grade Length (km)	0.00
Driver Type Adjustment	1.00	Up/Down %	0.00
		Number of Lanes	2

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	f_{HV}	0.966

Speed Inputs

Lane Width, LW (m)	3.6
Total Lateral Clearance, LC (m)	2.0
Access Points, A (A/km)	10
Median Type, M	Divided
FFS (measured)	
Base Free-Flow Speed, BFFS	100.0

Calc Speed Adj and FFS

f_{LW} (km/h)	0.0
f_{LC} (km/h)	1.9
f_A (km/h)	6.7
f_M (km/h)	0.0
FFS (km/h)	91.4

Operations

Operational (LOS)

Flow Rate, v_p (pc/h/ln)	190
Speed, S (km/h)	91.4
D (pc/km/ln)	2.1
LOS	A

Design

Design (N)

Required Number of Lanes, N	
Flow Rate, v_p (pc/h)	
Max Service Flow Rate (pc/h/ln)	
Design LOS	

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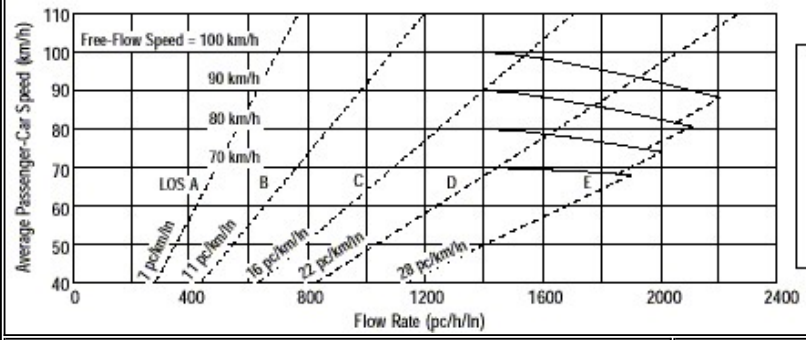
MULTILANE HIGHWAYS WORKSHEET(Direction 2)



Application	Input	Output
Oper. (LOS)	FFS, N, v_p	LOS, S, D
Des. (N)	FFS, LOS, v_p	N, S, D
Des. (v_p)	FFS, LOS, N	v_p, S, D
Plan. (LOS)	FFS, N, AADT	LOS, S, D
Plan. (N)	FFS, LOS, AADT	N, S, D
Plan. (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	DJ
Agency or Company	Dima Jawad
Date Performed	10/1/2018
Analysis Time Period	10 - 11 PM

Site Information

Highway/Direction to Travel	Tripoli - Syria
From/To	Biddawi - Abdeh
Jurisdiction	North
Analysis Year	2020

Project Description Akkar Wind Farms - Without Project

☑ Oper.(LOS) ☐ Des. (N) ☐ Plan. (vp)

Flow Inputs

Volume, V (veh/h)	322	Peak-Hour Factor, PHF	0.90
AADT(veh/h)		%Trucks and Buses, P_T	6
Peak-Hour Prop of AADT (veh/d)		%RVs, P_R	0
Peak-Hour Direction Prop, D		General Terrain:	Level
DDHV (veh/h)		Grade Length (km)	0.00
Driver Type Adjustment	1.00	Up/Down %	0.00
		Number of Lanes	2

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	f_{HV}	0.971

Speed Inputs

Lane Width, LW (m)	3.6
Total Lateral Clearance, LC (m)	2.0
Access Points, A (A/km)	10
Median Type, M	Divided
FFS (measured)	
Base Free-Flow Speed, BFFS	100.0

Calc Speed Adj and FFS

f_{LW} (km/h)	0.0
f_{LC} (km/h)	1.9
f_A (km/h)	6.7
f_M (km/h)	0.0
FFS (km/h)	91.4

Operations

Operational (LOS)

Flow Rate, v_p (pc/h/ln)	184
Speed, S (km/h)	91.4
D (pc/km/ln)	2.0
LOS	A

Design

Design (N)

Required Number of Lanes, N	
Flow Rate, v_p (pc/h)	
Max Service Flow Rate (pc/h/ln)	
Design LOS	

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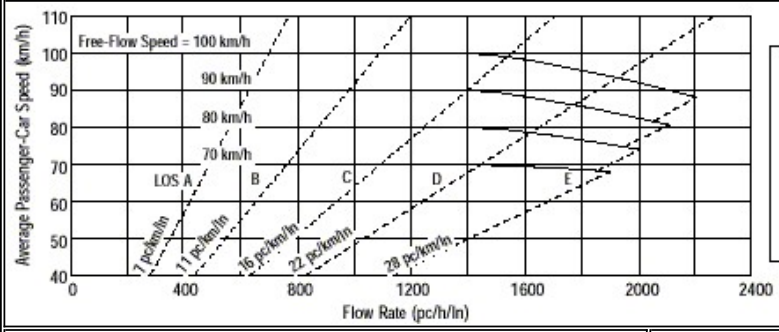
MULTILANE HIGHWAYS WORKSHEET(Direction 1)



Application	Input	Output
Oper. (LOS)	FFS, N, v_p	LOS, S, D
Des. (N)	FFS, LOS, v_p	N, S, D
Des. (v_p)	FFS, LOS, N	v_p, S, D
Plan. (LOS)	FFS, N, AADT	LOS, S, D
Plan. (N)	FFS, LOS, AADT	N, S, D
Plan. (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	DJ
Agency or Company	Dima Jawad
Date Performed	10/1/2018
Analysis Time Period	10 - 11 PM

Site Information

Highway/Direction to Travel	Tripoli - Syria
From/To	Abdeh - Mqaitea
Jurisdiction	North
Analysis Year	2020

Project Description Akkar Wind Farms - Without Project

☑ Oper.(LOS) ☐ Des. (N) ☐ Plan. (vp)

Flow Inputs

Volume, V (veh/h)	265	Peak-Hour Factor, PHF	0.90
AADT(veh/h)		%Trucks and Buses, P_T	8
Peak-Hour Prop of AADT (veh/d)		%RVs, P_R	0
Peak-Hour Direction Prop, D		General Terrain:	Level
DDHV (veh/h)		Grade Length (km)	0.00
Driver Type Adjustment	1.00	Up/Down %	0.00
		Number of Lanes	2

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	f_{HV}	0.962

Speed Inputs

Lane Width, LW (m)	3.6
Total Lateral Clearance, LC (m)	1.8
Access Points, A (A/km)	10
Median Type, M	Divided
FFS (measured)	
Base Free-Flow Speed, BFFS	100.0

Calc Speed Adj and FFS

f_{LW} (km/h)	0.0
f_{LC} (km/h)	2.1
f_A (km/h)	6.7
f_M (km/h)	0.0
FFS (km/h)	91.2

Operations

Operational (LOS)

Flow Rate, v_p (pc/h/ln)	153
Speed, S (km/h)	91.2
D (pc/km/ln)	1.7
LOS	A

Design

Design (N)

Required Number of Lanes, N	
Flow Rate, v_p (pc/h)	
Max Service Flow Rate (pc/h/ln)	
Design LOS	

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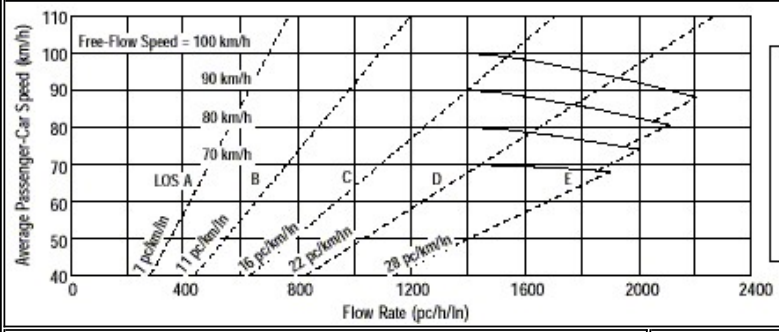
MULTILANE HIGHWAYS WORKSHEET(Direction 2)



Application	Input	Output
Oper. (LOS)	FFS, N, v_p	LOS, S, D
Des. (N)	FFS, LOS, v_p	N, S, D
Des. (v_p)	FFS, LOS, N	v_p, S, D
Plan. (LOS)	FFS, N, AADT	LOS, S, D
Plan. (N)	FFS, LOS, AADT	N, S, D
Plan. (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	DJ
Agency or Company	Dima Jawad
Date Performed	10/1/2018
Analysis Time Period	10 - 11 PM

Site Information

Highway/Direction to Travel	Tripoli - Syria
From/To	Abdeh - Mqaitea
Jurisdiction	North
Analysis Year	2020

Project Description Akkar Wind Farms - Without Project

☑ Oper.(LOS) ☐ Des. (N) ☐ Plan. (vp)

Flow Inputs

Volume, V (veh/h)	210	Peak-Hour Factor, PHF	0.90
AADT(veh/h)		%Trucks and Buses, P_T	6
Peak-Hour Prop of AADT (veh/d)		%RVs, P_R	0
Peak-Hour Direction Prop, D		General Terrain:	Level
DDHV (veh/h)		Grade Length (km)	0.00
Driver Type Adjustment	1.00	Up/Down %	0.00
		Number of Lanes	2

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	f_{HV}	0.971

Speed Inputs

Lane Width, LW (m)	3.6
Total Lateral Clearance, LC (m)	1.8
Access Points, A (A/km)	10
Median Type, M	Divided
FFS (measured)	
Base Free-Flow Speed, BFFS	100.0

Calc Speed Adj and FFS

f_{LW} (km/h)	0.0
f_{LC} (km/h)	2.1
f_A (km/h)	6.7
f_M (km/h)	0.0
FFS (km/h)	91.2

Operations

Operational (LOS)

Flow Rate, v_p (pc/h/ln)	120
Speed, S (km/h)	91.2
D (pc/km/ln)	1.3
LOS	A

Design

Design (N)

Required Number of Lanes, N	
Flow Rate, v_p (pc/h)	
Max Service Flow Rate (pc/h/ln)	
Design LOS	

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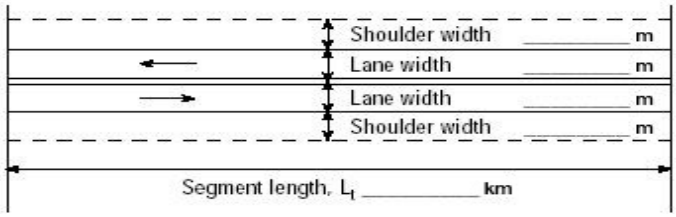
TWO-WAY TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		***Site Information***	
Analyst	*DJ*	Highway	*Abboudieh Rd*
Agency or Company	*Dima Jawad*	From/To	*Mqaitea - Abboudieh (Rd E)*
Date Performed	*10/8/2018*	Jurisdiction	*North*
Analysis Time Period	*10 -11 pm*	Analysis Year	*2020*

Project Description: *Akkar Wind Farms*

Input Data



☐ Class I highway ☑ Class II highway

Terrain ☑ Level ☐ Rolling

Two-way hourly volume	*460* veh/h
Directional split	*55 / 45*
Peak-hour factor, PHF	*0.90*
No-passing zone	*0*
% Trucks and Buses , P_T	*10* %
% Recreational vehicles, P_R	*0%*
Access points/ *km*	*10*

Average Travel Speed

Grade adjustment factor, f_G (Exhibit 20-7)	*1.00*
Passenger-car equivalents for trucks, E_T (Exhibit 20-9)	*1.7*
Passenger-car equivalents for RVs, E_R (Exhibit 20-9)	*1.0*
Heavy-vehicle adjustment factor, f_{HV}=1/ (1+ $P_T(E_T-1)+P_R(E_R-1)$)	*0.935*
Two-way flow rate[1], v_p (pc/h)=V/ (PHF * f_G * f_{HV})	*547*
v_p * highest directional split proportion[2] (pc/h)	*301*

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Field Measured speed, S_{FM}	*km/h*	Base free-flow speed, $BFFS_{FM}$	*80.0 km/h*
Observed volume, V_f	*veh/h*	Adj. for lane width and shoulder width[3], f_{LS} (Exhibit 20-5)	*7.5 km/h*
Free-flow speed, FFS FFS=S_{FM}+0.00776(V_f/ f_{HV})	*km/h*	Adj. for access points, f_A (Exhibit 20-6)	*6.7 km/h*
		Free-flow speed, FFS (FSS=BFFS-f_{LS}-f_A)	*65.8 km/h*

Adj. for no-passing zones, f_{np} (*km/h*) (Exhibit 20-11)	*0.0*
Average travel speed, ATS (*km/h*) ATS=FFS-0.00776v_p-f_{np}	*59.0*

Percent Time-Spent-Following

Grade Adjustment factor, f_G (Exhibit 20-8)	*1.00*
Passenger-car equivalents for trucks, E_T (Exhibit 20-10)	*1.1*
Passenger-car equivalents for RVs, E_R (Exhibit 20-10)	*1.0*
Heavy-vehicle adjustment factor, f_{HV}=1/ (1+ $P_T(E_T-1)+P_R(E_R-1)$)	*0.990*
Two-way flow rate[1], v_p (pc/h)=V/ (PHF * f_G * f_{HV})	*516*
v_p * highest directional split proportion[2] (pc/h)	*284*
Base percent time-spent-following, BPTSF(%)=100(1-$e^{-0.000879v_p}$)	*36.5*
Adj. for directional distribution and no-passing zone, $f_{d/np}$(%)(Exh. 20-12)	*0.1*
Percent time-spent-following, PTSF(%)=BPTSF+$f_{d/np}$	*36.6*

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 20-3 for Class I or 20-4 for Class II)	*A*
Volume to capacity ratio, v/c=V_p/ 3,200	*0.17*
Peak 15-min veh-miles of travel, VMT_{15} (veh- *km*)= 0.25L_t(V/PHF)	*1278*
Peak-hour vehicle-miles of travel, VMT_{60}(veh- *km*)=V*L_t	*4600*
Peak 15-min total travel time, TT_{15}(veh-h)= VMT_{15}/ATS	*21.7*

Notes
1. If Vp >= 3,200 pc/h, terminate analysis-the LOS is F. 2. If highest directional split Vp>= 1,700 pc/h, terminated anlysis-the LOS is F.

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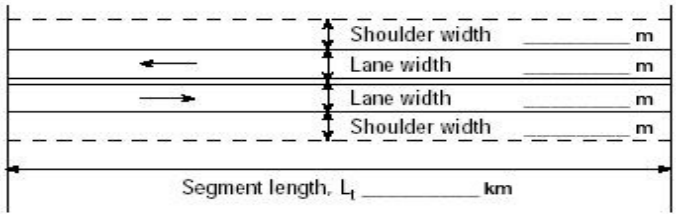
TWO-WAY TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		Site Information	
Analyst	*DJ*	Highway	*Abboudieh Rd*
Agency or Company	*Dima Jawad*	From/To	*Mqaitea - Abboudieh (Rd E)*
Date Performed	*10/8/2018*	Jurisdiction	*North*
Analysis Time Period	*10 -11 pm*	Analysis Year	*2020*

Project Description: *Akkar Wind Farms*

Input Data



☐ Class I highway ☑ Class II highway

Terrain ☑ Level ☐ Rolling

Two-way hourly volume	*460* veh/h
Directional split	*55 / 45*
Peak-hour factor, PHF	*0.90*
No-passing zone	*0*
% Trucks and Buses , P_T	*10 %*
% Recreational vehicles, P_R	*0%*
Access points/ *km*	*10*

Average Travel Speed

Grade adjustment factor, f_G (Exhibit 20-7)	*1.00*
Passenger-car equivalents for trucks, E_T (Exhibit 20-9)	*1.7*
Passenger-car equivalents for RVs, E_R (Exhibit 20-9)	*1.0*
Heavy-vehicle adjustment factor, f_{HV}=1/ (1+ $P_T(E_T-1)+P_R(E_R-1)$)	*0.935*
Two-way flow rate[1], v_p (pc/h)=V/ (PHF * f_G * f_{HV})	*547*
v_p * highest directional split proportion[2] (pc/h)	*301*

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Field Measured speed, S_{FM}	*km/h*	Base free-flow speed, $BFFS_{FM}$	*80.0 km/h*
Observed volume, V_f	*veh/h*	Adj. for lane width and shoulder width[3], f_{LS} (Exhibit 20-5)	*7.5 km/h*
Free-flow speed, FFS FFS=S_{FM}+0.00776(V_f/ f_{HV})	*km/h*	Adj. for access points, f_A (Exhibit 20-6)	*6.7 km/h*
		Free-flow speed, FFS (FSS=BFFS-f_{LS}-f_A)	*65.8 km/h*

Adj. for no-passing zones, f_{np} (*km/h*) (Exhibit 20-11)	*0.0*
Average travel speed, ATS (*km/h*) ATS=FFS-0.00776v_p-f_{np}	*59.0*

Percent Time-Spent-Following

Grade Adjustment factor, f_G (Exhibit 20-8)	*1.00*
Passenger-car equivalents for trucks, E_T (Exhibit 20-10)	*1.1*
Passenger-car equivalents for RVs, E_R (Exhibit 20-10)	*1.0*
Heavy-vehicle adjustment factor, f_{HV}=1/ (1+ $P_T(E_T-1)+P_R(E_R-1)$)	*0.990*
Two-way flow rate[1], v_p (pc/h)=V/ (PHF * f_G * f_{HV})	*516*
v_p * highest directional split proportion[2] (pc/h)	*284*
Base percent time-spent-following, BPTSF(%)=100(1-$e^{-0.000879v_p}$)	*36.5*
Adj. for directional distribution and no-passing zone, $f_{d/hp}$(%)(Exh. 20-12)	*0.1*
Percent time-spent-following, PTSF(%)=BPTSF+$f_{d/np}$	*36.6*

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 20-3 for Class I or 20-4 for Class II)	*A*
Volume to capacity ratio, v/c=V_p/ 3,200	*0.17*
Peak 15-min veh-miles of travel, VMT_{15} (veh- *km*)= 0.25L_t(V/PHF)	*1278*

Peak-hour vehicle-miles of travel, VMT_{60}(veh- *km*)=V*L_t	*4600*
Peak 15-min total travel time, TT_{15}(veh-h)= VMT_{15}/ATS	*21.7*
Notes	
1. If Vp >= 3,200 pc/h, terminate analysis-the LOS is F. 2. If highest directional split Vp>= 1,700 pc/h, terminated anlysis-the LOS is F.	

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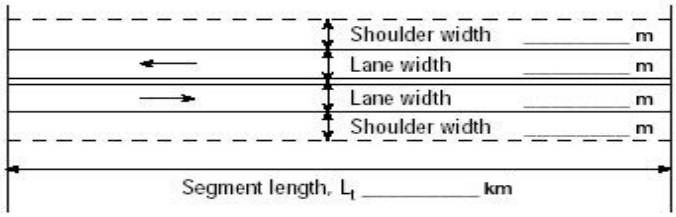
TWO-WAY TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		Site Information	
Analyst	*DJ*	Highway	*Chadra Rd (6)*
Agency or Company	*Dima Jawad*	From/To	*Menjez - Chadra*
Date Performed	*10/8/2018*	Jurisdiction	*North*
Analysis Time Period	*3:00-4:00 pm*	Analysis Year	*2020*

Project Description: *Akkar Wind Farms*

Input Data



☐ Class I highway ☑ Class II highway

Terrain ☐ Level ☑ Rolling

Two-way hourly volume	*117* veh/h
Directional split	*55 / 45*
Peak-hour factor, PHF	*0.90*
No-passing zone	*0*
% Trucks and Buses , P_T	*10 %*
% Recreational vehicles, P_R	*0%*
Access points/ *km*	*10*

Average Travel Speed

Grade adjustment factor, f_G (Exhibit 20-7)	*0.71*
Passenger-car equivalents for trucks, E_T (Exhibit 20-9)	*2.5*
Passenger-car equivalents for RVs, E_R (Exhibit 20-9)	*1.1*
Heavy-vehicle adjustment factor, f_{HV}=1/ (1+ $P_T(E_T-1)+P_R(E_R-1)$)	*0.870*
Two-way flow rate[1], v_p (pc/h)=V/ (PHF * f_G * f_{HV})	*211*
v_p * highest directional split proportion[2] (pc/h)	*116*

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Field Measured speed, S_{FM}	*km/h*	Base free-flow speed, $BFFS_{FM}$	*80.0 km/h*
Observed volume, V_f	*veh/h*	Adj. for lane width and shoulder width[3], f_{LS} (Exhibit 20-5)	*7.5 km/h*
Free-flow speed, FFS FFS=S_{FM}+0.00776(V_f/ f_{HV})	*km/h*	Adj. for access points, f_A (Exhibit 20-6)	*6.7 km/h*
		Free-flow speed, FFS (FSS=BFFS-f_{LS}-f_A)	*65.8 km/h*

Adj. for no-passing zones, f_{np} (*km/h*) (Exhibit 20-11)	*0.0*
Average travel speed, ATS (*km/h*) ATS=FFS-0.00776v_p-f_{np}	*63.2*

Percent Time-Spent-Following

Grade Adjustment factor, f_G (Exhibit 20-8)	*0.77*
Passenger-car equivalents for trucks, E_T (Exhibit 20-10)	*1.8*
Passenger-car equivalents for RVs, E_R (Exhibit 20-10)	*1.0*
Heavy-vehicle adjustment factor, f_{HV}=1/ (1+ $P_T(E_T-1)+P_R(E_R-1)$)	*0.926*
Two-way flow rate[1], v_p (pc/h)=V/ (PHF * f_G * f_{HV})	*182*
v_p * highest directional split proportion[2] (pc/h)	*100*
Base percent time-spent-following, BPTSF(%)=100(1-$e^{-0.000879v_p}$)	*14.8*
Adj. for directional distribution and no-passing zone, $f_{d/hp}$(%)(Exh. 20-12)	*0.8*
Percent time-spent-following, PTSF(%)=BPTSF+$f_{d/np}$	*15.6*

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 20-3 for Class I or 20-4 for Class II)	*A*
Volume to capacity ratio, v/c=V_p/ 3,200	*0.07*
Peak 15-min veh-miles of travel, VMT_{15} (veh- *km*)= 0.25L_t(V/PHF)	*325*

Peak-hour vehicle-miles of travel, VMT_{60}(veh- *km*)=V*L_t	*1170*
Peak 15-min total travel time, TT_{15}(veh-h)= VMT_{15}/ATS	*5.1*
Notes	
1. If Vp >= 3,200 pc/h, terminate analysis-the LOS is F. 2. If highest directional split Vp>= 1,700 pc/h, terminated anlysis-the LOS is F.	

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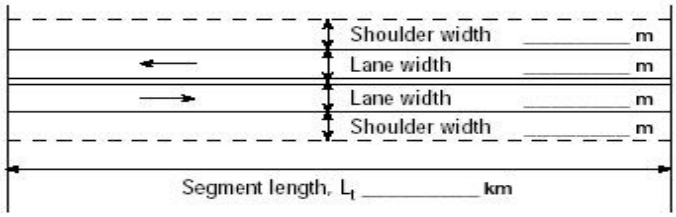
TWO-WAY TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		Site Information	
Analyst	*DJ*	Highway	*Andeqt Rd (7)*
Agency or Company	*Dima Jawad*	From/To	*Andeqt - Qobaiat*
Date Performed	*10/8/2018*	Jurisdiction	*North*
Analysis Time Period	*3:00-4:00 pm*	Analysis Year	*2020*

Project Description: *Akkar Wind Farms*

Input Data



☐ Class I highway ☑ Class II highway

Terrain ☐ Level ☑ Rolling

Two-way hourly volume	*457* veh/h
Directional split	*50 / 50*
Peak-hour factor, PHF	*0.90*
No-passing zone	*0*
% Trucks and Buses , P_T	*30 %*
% Recreational vehicles, P_R	*0%*
Access points/ *km*	*10*

Average Travel Speed

Grade adjustment factor, f_G (Exhibit 20-7)	*0.93*
Passenger-car equivalents for trucks, E_T (Exhibit 20-9)	*1.9*
Passenger-car equivalents for RVs, E_R (Exhibit 20-9)	*1.1*
Heavy-vehicle adjustment factor, f_{HV}=1/ (1+ $P_T(E_T-1)+P_R(E_R-1)$)	*0.787*
Two-way flow rate[1], v_p (pc/h)=V/ (PHF * f_G * f_{HV})	*693*
v_p * highest directional split proportion[2] (pc/h)	*347*

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Field Measured speed, S_{FM}	*km/h*	Base free-flow speed, $BFFS_{FM}$	*80.0 km/h*
Observed volume, V_f	*veh/h*	Adj. for lane width and shoulder width[3], f_{LS} (Exhibit 20-5)	*4.9 km/h*
Free-flow speed, FFS FFS=S_{FM}+0.00776(V_f/ f_{HV})	*km/h*	Adj. for access points, f_A (Exhibit 20-6)	*6.7 km/h*
		Free-flow speed, FFS (FSS=BFFS-f_{LS}-f_A)	*68.4 km/h*

Adj. for no-passing zones, f_{np} (*km/h*) (Exhibit 20-11)	*0.0*
Average travel speed, ATS (*km/h*) ATS=FFS-0.00776v_p-f_{np}	*59.8*

Percent Time-Spent-Following

Grade Adjustment factor, f_G (Exhibit 20-8)	*0.94*
Passenger-car equivalents for trucks, E_T (Exhibit 20-10)	*1.5*
Passenger-car equivalents for RVs, E_R (Exhibit 20-10)	*1.0*
Heavy-vehicle adjustment factor, f_{HV}=1/ (1+ $P_T(E_T-1)+P_R(E_R-1)$)	*0.870*
Two-way flow rate[1], v_p (pc/h)=V/ (PHF * f_G * f_{HV})	*621*
v_p * highest directional split proportion[2] (pc/h)	*311*
Base percent time-spent-following, BPTSF(%)=100(1-$e^{-0.000879v_p}$)	*42.1*
Adj. for directional distribution and no-passing zone, $f_{d/np}$(%)(Exh. 20-12)	*0.0*
Percent time-spent-following, PTSF(%)=BPTSF+$f_{d/np}$	*42.1*

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 20-3 for Class I or 20-4 for Class II)	*B*
Volume to capacity ratio, v/c=V_p/ 3,200	*0.22*
Peak 15-min veh-miles of travel, VMT_{15} (veh- *km*)= 0.25L_t(V/PHF)	*1269*

Peak-hour vehicle-miles of travel, VMT_{60}(veh- *km*)=V*L_t	*4570*
Peak 15-min total travel time, TT_{15}(veh-h)= VMT_{15}/ATS	*21.2*
Notes	
1. If Vp >= 3,200 pc/h, terminate analysis-the LOS is F. 2. If highest directional split Vp>= 1,700 pc/h, terminated anlysis-the LOS is F.	

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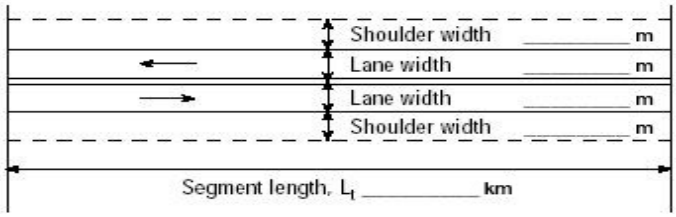
TWO-WAY TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		Site Information	
Analyst	*DJ*	Highway	*Qtalbe Rd (8)*
Agency or Company	*Dima Jawad*	From/To	*Qobaiat - Qtalbe*
Date Performed	*10/8/2018*	Jurisdiction	*North*
Analysis Time Period	*3:00-4:00 pm*	Analysis Year	*2020*

Project Description: *Akkar Wind Farms*

Input Data



☐ Class I highway ☑ Class II highway

Terrain ☐ Level ☑ Rolling

Two-way hourly volume	*84* veh/h
Directional split	*60 / 40*
Peak-hour factor, PHF	*0.90*
No-passing zone	*0*
% Trucks and Buses , P_T	*30 %*
% Recreational vehicles, P_R	*0%*
Access points/ *km*	*10*

Average Travel Speed

Grade adjustment factor, f_G (Exhibit 20-7)	*0.71*
Passenger-car equivalents for trucks, E_T (Exhibit 20-9)	*2.5*
Passenger-car equivalents for RVs, E_R (Exhibit 20-9)	*1.1*
Heavy-vehicle adjustment factor, f_{HV}=1/ (1+ $P_T(E_T-1)+P_R(E_R-1)$)	*0.690*
Two-way flow rate[1], v_p (pc/h)=V/ (PHF * f_G * f_{HV})	*191*
v_p * highest directional split proportion[2] (pc/h)	*115*

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Field Measured speed, S_{FM}	*km/h*	Base free-flow speed, $BFFS_{FM}$	*80.0 km/h*
Observed volume, V_f	*veh/h*	Adj. for lane width and shoulder width[3], f_{LS} (Exhibit 20-5)	*7.5 km/h*
Free-flow speed, FFS FFS=S_{FM}+0.00776(V_f/ f_{HV})	*km/h*	Adj. for access points, f_A (Exhibit 20-6)	*6.7 km/h*
		Free-flow speed, FFS (FSS=BFFS-f_{LS}-f_A)	*65.8 km/h*

Adj. for no-passing zones, f_{np} (*km/h*) (Exhibit 20-11)	*0.0*
Average travel speed, ATS (*km/h*) ATS=FFS-0.00776v_p-f_{np}	*63.4*

Percent Time-Spent-Following

Grade Adjustment factor, f_G (Exhibit 20-8)	*0.77*
Passenger-car equivalents for trucks, E_T (Exhibit 20-10)	*1.8*
Passenger-car equivalents for RVs, E_R (Exhibit 20-10)	*1.0*
Heavy-vehicle adjustment factor, f_{HV}=1/ (1+ $P_T(E_T-1)+P_R(E_R-1)$)	*0.806*
Two-way flow rate[1], v_p (pc/h)=V/ (PHF * f_G * f_{HV})	*150*
v_p * highest directional split proportion[2] (pc/h)	*90*
Base percent time-spent-following, BPTSF(%)=100(1-$e^{-0.000879v_p}$)	*12.4*
Adj. for directional distribution and no-passing zone, $f_{d/hp}$(%)(Exh. 20-12)	*1.9*
Percent time-spent-following, PTSF(%)=BPTSF+$f_{d/np}$	*14.2*

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 20-3 for Class I or 20-4 for Class II)	*A*
Volume to capacity ratio, v/c=V_p/ 3,200	*0.06*
Peak 15-min veh-miles of travel, VMT_{15} (veh- *km*)= 0.25L_t(V/PHF)	*233*

Peak-hour vehicle-miles of travel, VMT_{60}(veh- *km*)=V*L_t	*840*
Peak 15-min total travel time, TT_{15}(veh-h)= VMT_{15}/ATS	*3.7*
Notes	
1. If Vp >= 3,200 pc/h, terminate analysis-the LOS is F. 2. If highest directional split Vp>= 1,700 pc/h, terminated anlysis-the LOS is F.	

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Intersection	
Intersection Delay, s/veh	4.2
Intersection LOS	A

Approach	EB	WB	NB
Entry Lanes	1	1	1
Conflicting Circle Lanes	2	2	2
Adj Approach Flow, veh/h	86	40	79
Demand Flow Rate, veh/h	95	44	87
Vehicles Circulating, veh/h	19	64	23
Vehicles Exiting, veh/h	89	46	90
Follow-Up Headway, s	3.186	3.186	3.186
Ped Vol Crossing Leg, #/h	0	0	0
Ped Cap Adj	1.000	1.000	1.000
Approach Delay, s/veh	4.3	4.1	4.3
Approach LOS	A	A	A

Lane	Left	Left	Left
Designated Moves	TR	LT	LR
Assumed Moves	TR	LT	LR
RT Channelized			
Lane Util	1.000	1.000	1.000
Critical Headway, s	4.113	4.113	4.113
Entry Flow, veh/h	95	44	87
Cap Entry Lane, veh/h	1115	1080	1112
Entry HV Adj Factor	0.904	0.903	0.908
Flow Entry, veh/h	86	40	79
Cap Entry, veh/h	1008	976	1010
V/C Ratio	0.085	0.041	0.078
Control Delay, s/veh	4.3	4.1	4.3
LOS	A	A	A
95th %tile Queue, veh	0	0	0

Intersection	
Int Delay, s/veh	1.8

Movement	WBL	WBR	NET	NER	SWL	SWT
Lane Configurations						
Traffic Vol, veh/h	32	16	117	81	13	90
Future Vol, veh/h	32	16	117	81	13	90
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	40	10	10	40	10	10
Mvmt Flow	36	18	130	90	14	100

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	303	175	0	0	220	0
Stage 1	175	-	-	-	-	-
Stage 2	128	-	-	-	-	-
Critical Hdwy	6.8	6.3	-	-	4.2	-
Critical Hdwy Stg 1	5.8	-	-	-	-	-
Critical Hdwy Stg 2	5.8	-	-	-	-	-
Follow-up Hdwy	3.86	3.39	-	-	2.29	-
Pot Cap-1 Maneuver	616	848	-	-	1303	-
Stage 1	772	-	-	-	-	-
Stage 2	812	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	609	848	-	-	1303	-
Mov Cap-2 Maneuver	609	-	-	-	-	-
Stage 1	764	-	-	-	-	-
Stage 2	812	-	-	-	-	-

Approach	WB	NE	SW
HCM Control Delay, s	10.8	0	1
HCM LOS	B		

Minor Lane/Major Mvmt	NET	NER	WBLn1	SWL	SWT
Capacity (veh/h)	-	-	672	1303	-
HCM Lane V/C Ratio	-	-	0.079	0.011	-
HCM Control Delay (s)	-	-	10.8	7.8	0
HCM Lane LOS	-	-	B	A	A
HCM 95th %tile Q(veh)	-	-	0.3	0	-

Intersection	
Intersection Delay, s/veh	8.3
Intersection LOS	A

Approach	EB	WB	NB	SB
Entry Lanes	1	1	2	2
Conflicting Circle Lanes	1	1	1	1
Adj Approach Flow, veh/h	100	269	489	332
Demand Flow Rate, veh/h	103	304	589	349
Vehicles Circulating, veh/h	469	323	183	271
Vehicles Exiting, veh/h	151	449	389	356
Follow-Up Headway, s	3.186	3.186	3.186	3.186
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	6.9	9.7	8.3	7.6
Approach LOS	A	A	A	A

Lane	Left	Left	Left	Right	Left	Right
Designated Moves	LTR	LTR	LT	R	LT	R
Assumed Moves	LTR	LTR	LT	R	LT	R
RT Channelized						
Lane Util	1.000	1.000	0.482	0.518	0.808	0.192
Critical Headway, s	5.193	5.193	5.193	5.193	5.193	5.193
Entry Flow, veh/h	103	304	284	305	282	67
Cap Entry Lane, veh/h	707	818	941	941	862	862
Entry HV Adj Factor	0.973	0.885	0.954	0.715	0.952	0.955
Flow Entry, veh/h	100	269	271	218	268	64
Cap Entry, veh/h	688	724	898	673	820	823
V/C Ratio	0.146	0.372	0.302	0.324	0.327	0.078
Control Delay, s/veh	6.9	9.7	7.2	9.5	8.1	5.1
LOS	A	A	A	A	A	A
95th %tile Queue, veh	1	2	1	1	1	0

Capacity Analysis

Future Traffic with Project (Year 2020)

Intersection	
Intersection Delay, s/veh	4.5
Intersection LOS	A

Approach	EB	WB	NB
Entry Lanes	1	1	1
Conflicting Circle Lanes	2	2	2
Adj Approach Flow, veh/h	86	83	79
Demand Flow Rate, veh/h	95	98	87
Vehicles Circulating, veh/h	19	64	23
Vehicles Exiting, veh/h	143	46	90
Follow-Up Headway, s	3.186	3.186	3.186
Ped Vol Crossing Leg, #/h	0	0	0
Ped Cap Adj	1.000	1.000	1.000
Approach Delay, s/veh	4.3	4.8	4.3
Approach LOS	A	A	A

Lane	Left	Left	Left
Designated Moves	TR	LT	LR
Assumed Moves	TR	LT	LR
RT Channelized			
Lane Util	1.000	1.000	1.000
Critical Headway, s	4.113	4.113	4.113
Entry Flow, veh/h	95	98	87
Cap Entry Lane, veh/h	1115	1080	1112
Entry HV Adj Factor	0.904	0.845	0.908
Flow Entry, veh/h	86	83	79
Cap Entry, veh/h	1008	913	1010
V/C Ratio	0.085	0.091	0.078
Control Delay, s/veh	4.3	4.8	4.3
LOS	A	A	A
95th %tile Queue, veh	0	0	0

Intersection	
Int Delay, s/veh	3

Movement	WBL	WBR	NET	NER	SWL	SWT
Lane Configurations						
Traffic Vol, veh/h	78	16	117	91	13	90
Future Vol, veh/h	78	16	117	91	13	90
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	35	10	10	46	10	10
Mvmt Flow	87	18	130	101	14	100

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	309	181	0	0	231	0
Stage 1	181	-	-	-	-	-
Stage 2	128	-	-	-	-	-
Critical Hdwy	6.75	6.3	-	-	4.2	-
Critical Hdwy Stg 1	5.75	-	-	-	-	-
Critical Hdwy Stg 2	5.75	-	-	-	-	-
Follow-up Hdwy	3.815	3.39	-	-	2.29	-
Pot Cap-1 Maneuver	620	841	-	-	1291	-
Stage 1	777	-	-	-	-	-
Stage 2	823	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	613	841	-	-	1291	-
Mov Cap-2 Maneuver	613	-	-	-	-	-
Stage 1	768	-	-	-	-	-
Stage 2	823	-	-	-	-	-

Approach	WB	NE	SW
HCM Control Delay, s	11.7	0	1
HCM LOS	B		

Minor Lane/Major Mvmt	NET	NER	WBLn1	SWL	SWT
Capacity (veh/h)	-	-	643	1291	-
HCM Lane V/C Ratio	-	-	0.162	0.011	-
HCM Control Delay (s)	-	-	11.7	7.8	0
HCM Lane LOS	-	-	B	A	A
HCM 95th %tile Q(veh)	-	-	0.6	0	-

Intersection	
Intersection Delay, s/veh	9.0
Intersection LOS	A

Approach	EB	WB	NB	SB
Entry Lanes	1	1	2	2
Conflicting Circle Lanes	1	1	1	1
Adj Approach Flow, veh/h	100	318	501	332
Demand Flow Rate, veh/h	103	370	613	349
Vehicles Circulating, veh/h	496	323	183	309
Vehicles Exiting, veh/h	162	473	416	384
Follow-Up Headway, s	3.186	3.186	3.186	3.186
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	7.1	11.5	8.6	8.0
Approach LOS	A	B	A	A

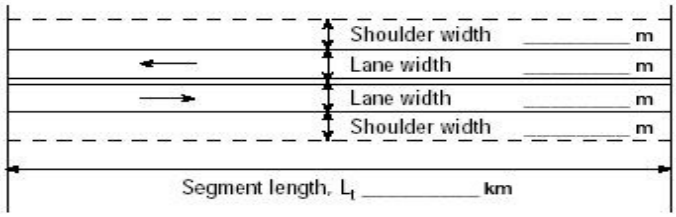
Lane	Left	Left	Left	Right	Left	Right
Designated Moves	LTR	LTR	LT	R	LT	R
Assumed Moves	LTR	LTR	LT	R	LT	R
RT Channelized						
Lane Util	1.000	1.000	0.463	0.537	0.808	0.192
Critical Headway, s	5.193	5.193	5.193	5.193	5.193	5.193
Entry Flow, veh/h	103	370	284	329	282	67
Cap Entry Lane, veh/h	688	818	941	941	830	830
Entry HV Adj Factor	0.973	0.859	0.954	0.699	0.952	0.955
Flow Entry, veh/h	100	318	271	230	268	64
Cap Entry, veh/h	669	703	898	658	790	792
V/C Ratio	0.150	0.452	0.302	0.350	0.340	0.081
Control Delay, s/veh	7.1	11.5	7.2	10.1	8.6	5.3
LOS	A	B	A	B	A	A
95th %tile Queue, veh	1	2	1	2	2	0

TWO-WAY TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		Site Information	
Analyst	*DJ*	Highway	*Port Tripoli*
Agency or Company	*Dima Jawad*	From/To	*Port to Abu Ali*
Date Performed	*10/8/2018*	Jurisdiction	*North*
Analysis Time Period	*10:00-11:00 PM*	Analysis Year	*2020*

Project Description: *Akkar Wind Farms - After Mitigation*

Input Data



☐ Class I highway ☑ Class II highway

Terrain ☑ Level ☐ Rolling

Two-way hourly volume	*520* veh/h
Directional split	*60 / 40*
Peak-hour factor, PHF	*0.90*
No-passing zone	*0*
% Trucks and Buses , P_T	*8 %*
% Recreational vehicles, P_R	*0%*
Access points/ *km*	*10*

Average Travel Speed

Grade adjustment factor, f_G (Exhibit 20-7)	*1.00*
Passenger-car equivalents for trucks, E_T (Exhibit 20-9)	*1.2*
Passenger-car equivalents for RVs, E_R (Exhibit 20-9)	*1.0*
Heavy-vehicle adjustment factor, f_{HV}=1/ (1+ $P_T(E_T-1)+P_R(E_R-1)$)	*0.984*
Two-way flow rate[1], v_p (pc/h)=V/ (PHF * f_G * f_{HV})	*587*
v_p * highest directional split proportion[2] (pc/h)	*352*

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Field Measured speed, S_{FM}	*km/h*	Base free-flow speed, $BFFS_{FM}$	*80.0 km/h*
Observed volume, V_f	*veh/h*	Adj. for lane width and shoulder width[3], f_{LS} (Exhibit 20-5)	*7.5 km/h*
Free-flow speed, FFS FFS=S_{FM}+0.00776(V_f/ f_{HV})	*km/h*	Adj. for access points, f_A (Exhibit 20-6)	*6.7 km/h*
		Free-flow speed, FFS (FSS=BFFS-f_{LS}-f_A)	*65.8 km/h*

Adj. for no-passing zones, f_{np} (*km/h*) (Exhibit 20-11)	*0.0*
Average travel speed, ATS (*km/h*) ATS=FFS-0.00776v_p-f_{np}	*58.5*

Percent Time-Spent-Following

Grade Adjustment factor, f_G (Exhibit 20-8)	*1.00*
Passenger-car equivalents for trucks, E_T (Exhibit 20-10)	*1.1*
Passenger-car equivalents for RVs, E_R (Exhibit 20-10)	*1.0*
Heavy-vehicle adjustment factor, f_{HV}=1/ (1+ $P_T(E_T-1)+P_R(E_R-1)$)	*0.992*
Two-way flow rate[1], v_p (pc/h)=V/ (PHF * f_G * f_{HV})	*582*
v_p * highest directional split proportion[2] (pc/h)	*349*
Base percent time-spent-following, BPTSF(%)=100(1-$e^{-0.000879v_p}$)	*40.0*
Adj. for directional distribution and no-passing zone, $f_{d/hp}$(%)(Exh. 20-12)	*0.0*
Percent time-spent-following, PTSF(%)=BPTSF+$f_{d/np}$	*40.1*

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 20-3 for Class I or 20-4 for Class II)	*B*
Volume to capacity ratio, v/c=V_p/ 3,200	*0.18*
Peak 15-min veh-miles of travel, VMT_{15} (veh- *km*)= 0.25L_t(V/PHF)	*578*

Peak-hour vehicle-miles of travel, VMT_{60}(veh- *km*)=V*L_t	*2080*
Peak 15-min total travel time, TT_{15}(veh-h)= VMT_{15}/ATS	*9.9*
Notes	
1. If Vp >= 3,200 pc/h, terminate analysis-the LOS is F. 2. If highest directional split Vp>= 1,700 pc/h, terminated anlysis-the LOS is F.	

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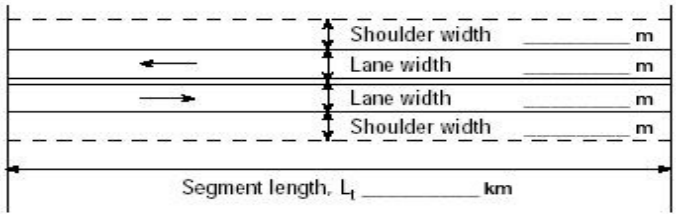
TWO-WAY TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		Site Information	
Analyst	*DJ*	Highway	*Beddawi (2)*
Agency or Company	*Dima Jawad*	From/To	*Abu Ali to Beddawi*
Date Performed	*10/8/2018*	Jurisdiction	*North*
Analysis Time Period	*10:00-11:00 PM*	Analysis Year	*2020*

Project Description: *Akkar Wind Farms - After Mitigation*

Input Data



☐ Class I highway ☑ Class II highway

Terrain ☑ Level ☐ Rolling

Two-way hourly volume	*1032* veh/h
Directional split	*50 / 50*
Peak-hour factor, PHF	*0.90*
No-passing zone	*0*
% Trucks and Buses , P_T	*4 %*
% Recreational vehicles, P_R	*0%*
Access points/ *km*	*5*

Average Travel Speed

Grade adjustment factor, f_G (Exhibit 20-7)	*1.00*
Passenger-car equivalents for trucks, E_T (Exhibit 20-9)	*1.2*
Passenger-car equivalents for RVs, E_R (Exhibit 20-9)	*1.0*
Heavy-vehicle adjustment factor, f_{HV}=1/ (1+ $P_T(E_T-1)+P_R(E_R-1)$)	*0.992*
Two-way flow rate[1], v_p (pc/h)=V/ (PHF * f_G * f_{HV})	*1156*
v_p * highest directional split proportion[2] (pc/h)	*578*

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Field Measured speed, S_{FM}	*km/h*	Base free-flow speed, $BFFS_{FM}$	*100.0 km/h*
Observed volume, V_f	*veh/h*	Adj. for lane width and shoulder width[3], f_{LS} (Exhibit 20-5)	*4.2 km/h*
Free-flow speed, FFS FFS=S_{FM}+0.00776(V_f/ f_{HV})	*km/h*	Adj. for access points, f_A (Exhibit 20-6)	*3.3 km/h*
		Free-flow speed, FFS (FSS=BFFS-f_{LS}-f_A)	*92.5 km/h*

Adj. for no-passing zones, f_{np} (*km/h*) (Exhibit 20-11)	*0.0*
Average travel speed, ATS (*km/h*) ATS=FFS-0.00776v_p-f_{np}	*78.0*

Percent Time-Spent-Following

Grade Adjustment factor, f_G (Exhibit 20-8)	*1.00*
Passenger-car equivalents for trucks, E_T (Exhibit 20-10)	*1.1*
Passenger-car equivalents for RVs, E_R (Exhibit 20-10)	*1.0*
Heavy-vehicle adjustment factor, f_{HV}=1/ (1+ $P_T(E_T-1)+P_R(E_R-1)$)	*0.996*
Two-way flow rate[1], v_p (pc/h)=V/ (PHF * f_G * f_{HV})	*1151*
v_p * highest directional split proportion[2] (pc/h)	*576*
Base percent time-spent-following, BPTSF(%)=100(1-$e^{-0.000879v_p}$)	*63.6*
Adj. for directional distribution and no-passing zone, $f_{d/np}$(%)(Exh. 20-12)	*0.0*
Percent time-spent-following, PTSF(%)=BPTSF+$f_{d/np}$	*63.6*

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 20-3 for Class I or 20-4 for Class II)	*C*
Volume to capacity ratio, v/c=V_p/ 3,200	*0.36*
Peak 15-min veh-miles of travel, VMT_{15} (veh- *km*)= 0.25L_t(V/PHF)	*1233*

Peak-hour vehicle-miles of travel, VMT_{60}(veh- *km*)=V*L_t	*4438*
Peak 15-min total travel time, TT_{15}(veh-h)= VMT_{15}/ATS	*15.8*
Notes	
1. If Vp >= 3,200 pc/h, terminate analysis-the LOS is F. 2. If highest directional split Vp>= 1,700 pc/h, terminated anlysis-the LOS is F.	

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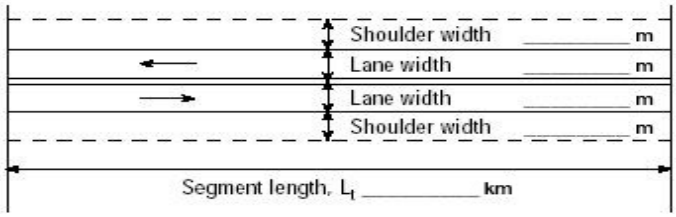
TWO-WAY TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		Site Information	
Analyst	*DJ*	Highway	*Abdeh Rd (3)*
Agency or Company	*Dima Jawad*	From/To	*Beddawi to Abdeh*
Date Performed	*10/8/2018*	Jurisdiction	*North*
Analysis Time Period	*10:00-11:00 PM*	Analysis Year	*2020*

Project Description: *Akkar Wind Farms - with project traffic plan*

Input Data



☐ Class I highway ☑ Class II highway

Terrain ☑ Level ☐ Rolling

Two-way hourly volume	*654* veh/h
Directional split	*50 / 50*
Peak-hour factor, PHF	*0.90*
No-passing zone	*0*
% Trucks and Buses , P_T	*6* %
% Recreational vehicles, P_R	*0%*
Access points/ *km*	*7*

Average Travel Speed

Grade adjustment factor, f_G (Exhibit 20-7)	*1.00*
Passenger-car equivalents for trucks, E_T (Exhibit 20-9)	*1.2*
Passenger-car equivalents for RVs, E_R (Exhibit 20-9)	*1.0*
Heavy-vehicle adjustment factor, f_{HV}=1/ (1+ $P_T(E_T-1)+P_R(E_R-1)$)	*0.988*
Two-way flow rate[1], v_p (pc/h)=V/ (PHF * f_G * f_{HV})	*735*
v_p * highest directional split proportion[2] (pc/h)	*368*

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Field Measured speed, S_{FM}	*km/h*	Base free-flow speed, $BFFS_{FM}$	*100.0 km/h*
Observed volume, V_f	*veh/h*	Adj. for lane width and shoulder width[3], f_{LS} (Exhibit 20-5)	*4.9 km/h*
Free-flow speed, FFS FFS=S_{FM}+0.00776(V_f/ f_{HV})	*km/h*	Adj. for access points, f_A (Exhibit 20-6)	*4.7 km/h*
		Free-flow speed, FFS (FSS=BFFS-f_{LS}-f_A)	*90.4 km/h*

Adj. for no-passing zones, f_{np} (*km/h*) (Exhibit 20-11)	*0.0*
Average travel speed, ATS (*km/h*) ATS=FFS-0.00776v_p-f_{np}	*81.2*

Percent Time-Spent-Following

Grade Adjustment factor, f_G (Exhibit 20-8)	*1.00*
Passenger-car equivalents for trucks, E_T (Exhibit 20-10)	*1.1*
Passenger-car equivalents for RVs, E_R (Exhibit 20-10)	*1.0*
Heavy-vehicle adjustment factor, f_{HV}=1/ (1+ $P_T(E_T-1)+P_R(E_R-1)$)	*0.994*
Two-way flow rate[1], v_p (pc/h)=V/ (PHF * f_G * f_{HV})	*731*
v_p * highest directional split proportion[2] (pc/h)	*366*
Base percent time-spent-following, BPTSF(%)=100(1-$e^{-0.000879v_p}$)	*47.4*
Adj. for directional distribution and no-passing zone, $f_{d/np}$(%)(Exh. 20-12)	*0.0*
Percent time-spent-following, PTSF(%)=BPTSF+$f_{d/np}$	*47.4*

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 20-3 for Class I or 20-4 for Class II)	*B*
Volume to capacity ratio, v/c=V_p/ 3,200	*0.23*
Peak 15-min veh-miles of travel, VMT_{15} (veh- *km*)= 0.25L_t(V/PHF)	*908*

Peak-hour vehicle-miles of travel, VMT_{60}(veh- *km*)=V*L_t	*3270*
Peak 15-min total travel time, TT_{15}(veh-h)= VMT_{15}/ATS	*11.2*
Notes	
1. If Vp >= 3,200 pc/h, terminate analysis-the LOS is F. 2. If highest directional split Vp>= 1,700 pc/h, terminated anlysis-the LOS is F.	

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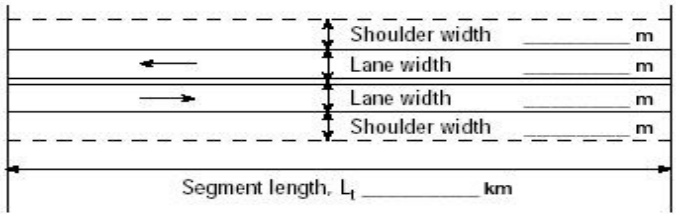
TWO-WAY TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		Site Information	
Analyst	*DJ*	Highway	*Mqaiteh Rd (4)*
Agency or Company	*Dima Jawad*	From/To	*Abdeh to Mqaiteh*
Date Performed	*10/8/2018*	Jurisdiction	*North*
Analysis Time Period	*10:00-11:00 PM*	Analysis Year	*2020*

Project Description: *Akkar Wind Farms - with project traffic plan*

Input Data



☐ Class I highway ☑ Class II highway

Terrain ☑ Level ☐ Rolling

Two-way hourly volume	*475* veh/h
Directional split	*55 / 45*
Peak-hour factor, PHF	*0.90*
No-passing zone	*0*
% Trucks and Buses , P_T	*7* %
% Recreational vehicles, P_R	*0%*
Access points/ *km*	*5*

Average Travel Speed

Grade adjustment factor, f_G (Exhibit 20-7)	*1.00*
Passenger-car equivalents for trucks, E_T (Exhibit 20-9)	*1.7*
Passenger-car equivalents for RVs, E_R (Exhibit 20-9)	*1.0*
Heavy-vehicle adjustment factor, f_{HV}=1/ (1+ $P_T(E_T-1)+P_R(E_R-1)$)	*0.953*
Two-way flow rate[1], v_p (pc/h)=V/ (PHF * f_G * f_{HV})	*554*
v_p * highest directional split proportion[2] (pc/h)	*305*

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Field Measured speed, S_{FM}	*km/h*	Base free-flow speed, $BFFS_{FM}$	*100.0 km/h*
Observed volume, V_f	*veh/h*	Adj. for lane width and shoulder width[3], f_{LS} (Exhibit 20-5)	*4.9 km/h*
Free-flow speed, FFS FFS=S_{FM}+0.00776(V_f/ f_{HV})	*km/h*	Adj. for access points, f_A (Exhibit 20-6)	*3.3 km/h*
		Free-flow speed, FFS (FSS=BFFS-f_{LS}-f_A)	*91.8 km/h*

Adj. for no-passing zones, f_{np} (*km/h*) (Exhibit 20-11)	*0.0*
Average travel speed, ATS (*km/h*) ATS=FFS-0.00776v_p-f_{np}	*84.8*

Percent Time-Spent-Following

Grade Adjustment factor, f_G (Exhibit 20-8)	*1.00*
Passenger-car equivalents for trucks, E_T (Exhibit 20-10)	*1.1*
Passenger-car equivalents for RVs, E_R (Exhibit 20-10)	*1.0*
Heavy-vehicle adjustment factor, f_{HV}=1/ (1+ $P_T(E_T-1)+P_R(E_R-1)$)	*0.993*
Two-way flow rate[1], v_p (pc/h)=V/ (PHF * f_G * f_{HV})	*531*
v_p * highest directional split proportion[2] (pc/h)	*292*
Base percent time-spent-following, BPTSF(%)=100(1-$e^{-0.000879v_p}$)	*37.3*
Adj. for directional distribution and no-passing zone, $f_{d/np}$(%)(Exh. 20-12)	*0.1*
Percent time-spent-following, PTSF(%)=BPTSF+$f_{d/np}$	*37.4*

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 20-3 for Class I or 20-4 for Class II)	*A*
Volume to capacity ratio, v/c=V_p/ 3,200	*0.17*
Peak 15-min veh-miles of travel, VMT_{15} (veh- *km*)= 0.25L_t(V/PHF)	*660*

Peak-hour vehicle-miles of travel, VMT_{60}(veh- *km*)=V*L_t	*2375*
Peak 15-min total travel time, TT_{15}(veh-h)= VMT_{15}/ATS	*7.8*
Notes	
1. If Vp >= 3,200 pc/h, terminate analysis-the LOS is F. 2. If highest directional split Vp>= 1,700 pc/h, terminated anlysis-the LOS is F.	

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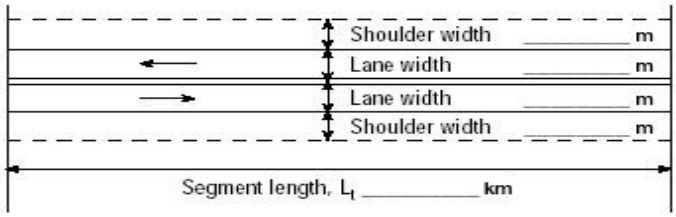
TWO-WAY TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		Site Information	
Analyst	*DJ*	Highway	*Abboudieh Rd (5)*
Agency or Company	*Dima Jawad*	From/To	*Mqaiteh to Aboudieh*
Date Performed	*10/8/2018*	Jurisdiction	*North*
Analysis Time Period	*10:00-11:00 PM*	Analysis Year	*2020*

Project Description: *Akkar Wind Farms - with project traffic plan*

Input Data



☐ Class I highway ☑ Class II highway

Terrain ☑ Level ☐ Rolling

Two-way hourly volume	*460* veh/h
Directional split	*55 / 45*
Peak-hour factor, PHF	*0.90*
No-passing zone	*100*
% Trucks and Buses , P_T	*1* %
% Recreational vehicles, P_R	*7*%
Access points/ *km*	*5*

Average Travel Speed

Grade adjustment factor, f_G (Exhibit 20-7)	*1.00*
Passenger-car equivalents for trucks, E_T (Exhibit 20-9)	*10.0*
Passenger-car equivalents for RVs, E_R (Exhibit 20-9)	*1.7*
Heavy-vehicle adjustment factor, f_{HV}=1/ (1+ $P_T(E_T-1)+P_R(E_R-1)$)	*0.878*
Two-way flow rate[1], v_p (pc/h)=V/ (PHF * f_G * f_{HV})	*582*
v_p * highest directional split proportion[2] (pc/h)	*320*

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Field Measured speed, S_{FM}	*40 km/h*	Base free-flow speed, $BFFS_{FM}$	*km/h*
Observed volume, V_f	*434 veh/h*	Adj. for lane width and shoulder width[3], f_{LS} (Exhibit 20-5)	*km/h*
Free-flow speed, FFS FFS=S_{FM}+0.00776(V_f/ f_{HV})	*km/h*	Adj. for access points, f_A (Exhibit 20-6)	*km/h*
		Free-flow speed, FFS (FSS=BFFS-f_{LS}-f_A)	*46.2 km/h*

Adj. for no-passing zones, f_{np} (*km/h*) (Exhibit 20-11)	*6.3*
Average travel speed, ATS (*km/h*) ATS=FFS-0.00776v_p-f_{np}	*32.6*

Percent Time-Spent-Following

Grade Adjustment factor, f_G (Exhibit 20-8)	*1.00*
Passenger-car equivalents for trucks, E_T (Exhibit 20-10)	*4.0*
Passenger-car equivalents for RVs, E_R (Exhibit 20-10)	*1.1*
Heavy-vehicle adjustment factor, f_{HV}=1/ (1+ $P_T(E_T-1)+P_R(E_R-1)$)	*0.964*
Two-way flow rate[1], v_p (pc/h)=V/ (PHF * f_G * f_{HV})	*530*
v_p * highest directional split proportion[2] (pc/h)	*292*
Base percent time-spent-following, BPTSF(%)=100(1-$e^{-0.000879v_p}$)	*37.2*
Adj. for directional distribution and no-passing zone, $f_{d/hp}$(%)(Exh. 20-12)	*21.6*
Percent time-spent-following, PTSF(%)=BPTSF+$f_{d/np}$	*58.9*

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 20-3 for Class I or 20-4 for Class II)	*C*
Volume to capacity ratio, v/c=V_p/ 3,200	*0.18*
Peak 15-min veh-miles of travel, VMT_{15} (veh- *km*)= 0.25L_t(V/PHF)	*639*
Peak-hour vehicle-miles of travel, VMT_{60}(veh- *km*)=V*L_t	*2300*
Peak 15-min total travel time, TT_{15}(veh-h)= VMT_{15}/ATS	*19.6*

Notes
1. If Vp >= 3,200 pc/h, terminate analysis-the LOS is F. 2. If highest directional split Vp>= 1,700 pc/h, terminated anlysis-the LOS is F.

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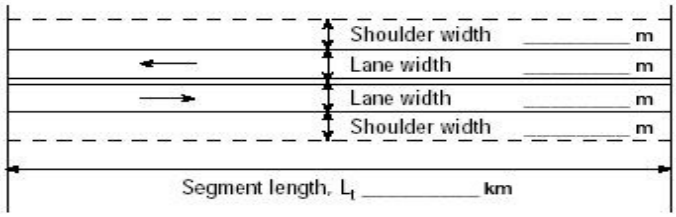
TWO-WAY TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		***Site Information***	
Analyst	*DJ*	Highway	*Menjez (Rd 6)*
Agency or Company	*Dima Jawad*	From/To	*Menjez to Chadra*
Date Performed	*10/8/2018*	Jurisdiction	*North*
Analysis Time Period	*10:00-11:00 PM*	Analysis Year	*2020*

Project Description: *Akkar Wind Farms - with project traffic plan*

Input Data



☐ Class I highway ☑ Class II highway

Terrain ☑ Level ☐ Rolling

Two-way hourly volume	*75* veh/h
Directional split	*55 / 45*
Peak-hour factor, PHF	*0.90*
No-passing zone	*100*
% Trucks and Buses , P_T	*4* %
% Recreational vehicles, P_R	*10%*
Access points/ *km*	*5*

Average Travel Speed

Grade adjustment factor, f_G (Exhibit 20-7)	*1.00*
Passenger-car equivalents for trucks, E_T (Exhibit 20-9)	*4.0*
Passenger-car equivalents for RVs, E_R (Exhibit 20-9)	*1.7*
Heavy-vehicle adjustment factor, f_{HV}=1/ (1+ $P_T(E_T-1)+P_R(E_R-1)$)	*0.840*
Two-way flow rate[1], v_p (pc/h)=V/ (PHF * f_G * f_{HV})	*99*
v_p * highest directional split proportion[2] (pc/h)	*54*

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Field Measured speed, S_{FM}	*40 km/h*	Base free-flow speed, $BFFS_{FM}$	*km/h*
Observed volume, V_f	*434 veh/h*	Adj. for lane width and shoulder width[3], f_{LS} (Exhibit 20-5)	*km/h*
Free-flow speed, FFS FFS=S_{FM}+0.00776(V_f/ f_{HV})	*km/h*	Adj. for access points, f_A (Exhibit 20-6)	*km/h*
		Free-flow speed, FFS (FSS=BFFS-f_{LS}-f_A)	*46.5 km/h*

Adj. for no-passing zones, f_{np} (*km/h*) (Exhibit 20-11)	*2.8*
Average travel speed, ATS (*km/h*) ATS=FFS-0.00776v_p-f_{np}	*42.4*

Percent Time-Spent-Following

Grade Adjustment factor, f_G (Exhibit 20-8)	*1.00*
Passenger-car equivalents for trucks, E_T (Exhibit 20-10)	*4.0*
Passenger-car equivalents for RVs, E_R (Exhibit 20-10)	*1.1*
Heavy-vehicle adjustment factor, f_{HV}=1/ (1+ $P_T(E_T-1)+P_R(E_R-1)$)	*0.885*
Two-way flow rate[1], v_p (pc/h)=V/ (PHF * f_G * f_{HV})	*94*
v_p * highest directional split proportion[2] (pc/h)	*52*
Base percent time-spent-following, BPTSF(%)=100(1-$e^{-0.000879v_p}$)	*7.9*
Adj. for directional distribution and no-passing zone, $f_{d/np}$(%)(Exh. 20-12)	*22.4*
Percent time-spent-following, PTSF(%)=BPTSF+$f_{d/np}$	*30.3*

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 20-3 for Class I or 20-4 for Class II)	*A*
Volume to capacity ratio, v/c=V_p/ 3,200	*0.03*
Peak 15-min veh-miles of travel, VMT_{15} (veh- *km*)= 0.25L_t(V/PHF)	*104*
Peak-hour vehicle-miles of travel, VMT_{60}(veh- *km*)=V*L_t	*375*
Peak 15-min total travel time, TT_{15}(veh-h)= VMT_{15}/ATS	*2.5*

Notes
1. If Vp >= 3,200 pc/h, terminate analysis-the LOS is F. 2. If highest directional split Vp>= 1,700 pc/h, terminated anlysis-the LOS is F.

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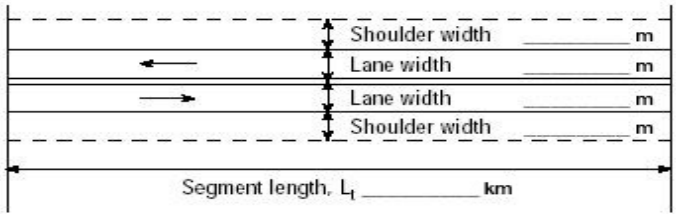
TWO-WAY TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		Site Information	
Analyst	*DJ*	Highway	*Chadra Rd (6)*
Agency or Company	*Dima Jawad*	From/To	*Menjez - Chadra*
Date Performed	*10/8/2018*	Jurisdiction	*North*
Analysis Time Period	*3:00-4:00 pm*	Analysis Year	*2020 with Project*

Project Description: *Akkar Wind Farms TIS*

Input Data



☐ Class I highway ☑ Class II highway

Terrain ☐ Level ☑ Rolling

Two-way hourly volume	*157* veh/h
Directional split	*55 / 45*
Peak-hour factor, PHF	*0.90*
No-passing zone	*0*
% Trucks and Buses , P_T	*24 %*
% Recreational vehicles, P_R	*0%*
Access points/ *km*	*10*

Average Travel Speed

Grade adjustment factor, f_G (Exhibit 20-7)	*0.71*
Passenger-car equivalents for trucks, E_T (Exhibit 20-9)	*2.5*
Passenger-car equivalents for RVs, E_R (Exhibit 20-9)	*1.1*
Heavy-vehicle adjustment factor, f_{HV}=1/ (1+ $P_T(E_T-1)+P_R(E_R-1)$)	*0.735*
Two-way flow rate[1], v_p (pc/h)=V/ (PHF * f_G * f_{HV})	*334*
v_p * highest directional split proportion[2] (pc/h)	*184*

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Field Measured speed, S_{FM}	*km/h*	Base free-flow speed, $BFFS_{FM}$	*80.0 km/h*
Observed volume, V_f	*veh/h*	Adj. for lane width and shoulder width[3], f_{LS} (Exhibit 20-5)	*7.5 km/h*
Free-flow speed, FFS FFS=S_{FM}+0.00776(V_f/ f_{HV})	*km/h*	Adj. for access points, f_A (Exhibit 20-6)	*6.7 km/h*
		Free-flow speed, FFS (FSS=BFFS-f_{LS}-f_A)	*65.8 km/h*

Adj. for no-passing zones, f_{np} (*km/h*) (Exhibit 20-11)	*0.0*
Average travel speed, ATS (*km/h*) ATS=FFS-0.00776v_p-f_{np}	*61.7*

Percent Time-Spent-Following

Grade Adjustment factor, f_G (Exhibit 20-8)	*0.77*
Passenger-car equivalents for trucks, E_T (Exhibit 20-10)	*1.8*
Passenger-car equivalents for RVs, E_R (Exhibit 20-10)	*1.0*
Heavy-vehicle adjustment factor, f_{HV}=1/ (1+ $P_T(E_T-1)+P_R(E_R-1)$)	*0.839*
Two-way flow rate[1], v_p (pc/h)=V/ (PHF * f_G * f_{HV})	*270*
v_p * highest directional split proportion[2] (pc/h)	*149*
Base percent time-spent-following, BPTSF(%)=100(1-$e^{-0.000879v_p}$)	*21.1*
Adj. for directional distribution and no-passing zone, $f_{d/hp}$(%)(Exh. 20-12)	*0.6*
Percent time-spent-following, PTSF(%)=BPTSF+$f_{d/np}$	*21.7*

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 20-3 for Class I or 20-4 for Class II)	*A*
Volume to capacity ratio, v/c=V_p/ 3,200	*0.10*
Peak 15-min veh-miles of travel, VMT_{15} (veh- *km*)= 0.25L_t(V/PHF)	*436*

Peak-hour vehicle-miles of travel, VMT_{60}(veh- *km*)=V*L_t	*1570*
Peak 15-min total travel time, TT_{15}(veh-h)= VMT_{15}/ATS	*7.1*
Notes	
1. If Vp >= 3,200 pc/h, terminate analysis-the LOS is F. 2. If highest directional split Vp>= 1,700 pc/h, terminated anlysis-the LOS is F.	

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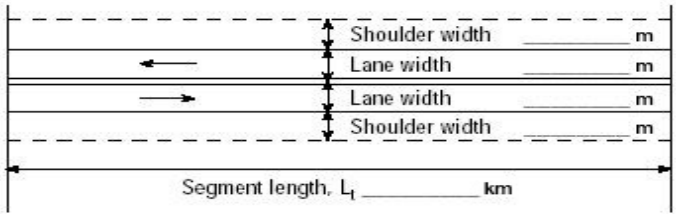
TWO-WAY TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		Site Information	
Analyst	*DJ*	Highway	*Andeqt Rd (RD 7)*
Agency or Company	*Dima Jawad*	From/To	*Andeqt - Qobaiat*
Date Performed	*10/8/2018*	Jurisdiction	*North*
Analysis Time Period	*3:00-4:00 pm*	Analysis Year	*2020 with Project*

Project Description: *Akkar Wind Farms*

Input Data



☐ Class I highway ☑ Class II highway

Terrain ☐ Level ☑ Rolling

Two-way hourly volume	*523* veh/h
Directional split	*50 / 50*
Peak-hour factor, PHF	*0.90*
No-passing zone	*0*
% Trucks and Buses , P_T	*30 %*
% Recreational vehicles, P_R	*0%*
Access points/ *km*	*10*

Average Travel Speed

Grade adjustment factor, f_G (Exhibit 20-7)	*0.93*
Passenger-car equivalents for trucks, E_T (Exhibit 20-9)	*1.9*
Passenger-car equivalents for RVs, E_R (Exhibit 20-9)	*1.1*
Heavy-vehicle adjustment factor, f_{HV}=1/ (1+ $P_T(E_T-1)+P_R(E_R-1)$)	*0.787*
Two-way flow rate[1], v_p (pc/h)=V/ (PHF * f_G * f_{HV})	*794*
v_p * highest directional split proportion[2] (pc/h)	*397*

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Field Measured speed, S_{FM}	*km/h*	Base free-flow speed, $BFFS_{FM}$	*80.0 km/h*
Observed volume, V_f	*veh/h*	Adj. for lane width and shoulder width[3], f_{LS} (Exhibit 20-5)	*4.9 km/h*
Free-flow speed, FFS FFS=S_{FM}+0.00776(V_f/ f_{HV})	*km/h*	Adj. for access points, f_A (Exhibit 20-6)	*6.7 km/h*
		Free-flow speed, FFS (FSS=BFFS-f_{LS}-f_A)	*68.4 km/h*

Adj. for no-passing zones, f_{np} (*km/h*) (Exhibit 20-11)	*0.0*
Average travel speed, ATS (*km/h*) ATS=FFS-0.00776v_p-f_{np}	*58.5*

Percent Time-Spent-Following

Grade Adjustment factor, f_G (Exhibit 20-8)	*0.94*
Passenger-car equivalents for trucks, E_T (Exhibit 20-10)	*1.5*
Passenger-car equivalents for RVs, E_R (Exhibit 20-10)	*1.0*
Heavy-vehicle adjustment factor, f_{HV}=1/ (1+ $P_T(E_T-1)+P_R(E_R-1)$)	*0.870*
Two-way flow rate[1], v_p (pc/h)=V/ (PHF * f_G * f_{HV})	*711*
v_p * highest directional split proportion[2] (pc/h)	*356*
Base percent time-spent-following, BPTSF(%)=100(1-$e^{-0.000879v_p}$)	*46.5*
Adj. for directional distribution and no-passing zone, $f_{d/np}$(%)(Exh. 20-12)	*0.0*
Percent time-spent-following, PTSF(%)=BPTSF+$f_{d/np}$	*46.5*

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 20-3 for Class I or 20-4 for Class II)	*B*
Volume to capacity ratio, v/c=V_p/ 3,200	*0.25*
Peak 15-min veh-miles of travel, VMT_{15} (veh- *km*)= 0.25L_t(V/PHF)	*1453*

Peak-hour vehicle-miles of travel, VMT_{60}(veh- *km*)=V*L_t	*5230*
Peak 15-min total travel time, TT_{15}(veh-h)= VMT_{15}/ATS	*24.8*
Notes	
1. If Vp >= 3,200 pc/h, terminate analysis-the LOS is F. 2. If highest directional split Vp>= 1,700 pc/h, terminated anlysis-the LOS is F.	

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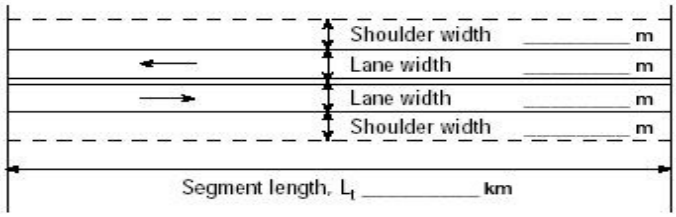
TWO-WAY TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		Site Information	
Analyst	*DJ*	Highway	*Qtalbe Rd (Rd 8)*
Agency or Company	*Dima Jawad*	From/To	*Qobaiat - Qtalbe*
Date Performed	*10/8/2018*	Jurisdiction	*North*
Analysis Time Period	*3:00-4:00 pm*	Analysis Year	*2020 with Project*

Project Description: *Akkar Wind Farms*

Input Data



☐ Class I highway ☑ Class II highway

Terrain ☐ Level ☑ Rolling

Two-way hourly volume	*94* veh/h
Directional split	*60 / 40*
Peak-hour factor, PHF	*0.90*
No-passing zone	*0*
% Trucks and Buses , P_T	*35 %*
% Recreational vehicles, P_R	*0%*
Access points/ *km*	*10*

Average Travel Speed

Grade adjustment factor, f_G (Exhibit 20-7)	*0.71*
Passenger-car equivalents for trucks, E_T (Exhibit 20-9)	*2.5*
Passenger-car equivalents for RVs, E_R (Exhibit 20-9)	*1.1*
Heavy-vehicle adjustment factor, f_{HV}=1/ (1+ $P_T(E_T-1)+P_R(E_R-1)$)	*0.656*
Two-way flow rate[1], v_p (pc/h)=V/ (PHF * f_G * f_{HV})	*224*
v_p * highest directional split proportion[2] (pc/h)	*134*

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Field Measured speed, S_{FM}	*km/h*	Base free-flow speed, $BFFS_{FM}$	*80.0 km/h*
Observed volume, V_f	*veh/h*	Adj. for lane width and shoulder width[3], f_{LS} (Exhibit 20-5)	*7.5 km/h*
Free-flow speed, FFS FFS=S_{FM}+0.00776(V_f/ f_{HV})	*km/h*	Adj. for access points, f_A (Exhibit 20-6)	*6.7 km/h*
		Free-flow speed, FFS (FSS=BFFS-f_{LS}-f_A)	*65.8 km/h*

Adj. for no-passing zones, f_{np} (*km/h*) (Exhibit 20-11)	*0.0*
Average travel speed, ATS (*km/h*) ATS=FFS-0.00776v_p-f_{np}	*63.0*

Percent Time-Spent-Following

Grade Adjustment factor, f_G (Exhibit 20-8)	*0.77*
Passenger-car equivalents for trucks, E_T (Exhibit 20-10)	*1.8*
Passenger-car equivalents for RVs, E_R (Exhibit 20-10)	*1.0*
Heavy-vehicle adjustment factor, f_{HV}=1/ (1+ $P_T(E_T-1)+P_R(E_R-1)$)	*0.781*
Two-way flow rate[1], v_p (pc/h)=V/ (PHF * f_G * f_{HV})	*174*
v_p * highest directional split proportion[2] (pc/h)	*104*
Base percent time-spent-following, BPTSF(%)=100(1-$e^{-0.000879v_p}$)	*14.2*
Adj. for directional distribution and no-passing zone, $f_{d/hp}$(%)(Exh. 20-12)	*1.7*
Percent time-spent-following, PTSF(%)=BPTSF+$f_{d/np}$	*15.9*

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 20-3 for Class I or 20-4 for Class II)	*A*
Volume to capacity ratio, v/c=V_p/ 3,200	*0.07*
Peak 15-min veh-miles of travel, VMT_{15} (veh- *km*)= 0.25L_t(V/PHF)	*261*

Peak-hour vehicle-miles of travel, VMT_{60}(veh- *km*)=V*L_t	*940*
Peak 15-min total travel time, TT_{15}(veh-h)= VMT_{15}/ATS	*4.1*
Notes	
1. If Vp >= 3,200 pc/h, terminate analysis-the LOS is F. 2. If highest directional split Vp>= 1,700 pc/h, terminated anlysis-the LOS is F.	

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APPENDIX L
CRITICAL AND NATURAL HABITATS ASSESSMENT

Intended for
Sustainable Akkar sal

Date
August 2019

Project Number
1690010276

LEBANON WIND POWER CRITICAL AND NATURAL HABITATS ASSESSMENT

RAMBOLL

LEBANON WIND POWER
CRITICAL AND NATURAL HABITATS ASSESSMENT

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1. INTRODUCTION

1.1 Background

This appendix provides the second iteration of the assessment of critical and natural habitats (AKA a critical habitat assessment or CHA) applicable to the Lebanon Wind Power (LWP) Wind Farm Project (the Project) following preparation of the initial CHA in March 2019. The CHA is based on the baseline information provided by the LWP ESIA, which was informed by a literature review, in-field data collection and by additional desk data, as available.

This CHA is based on all available data at the time of ESIA submission in August 2019. Further results from ongoing surveys for birds, bats, mammals and flora will need to be used to update it in the future.

This appendix provides the details of the assessment of critical and natural habitats' presence on the Project site and was used to inform the ESIA biodiversity assessment of potential impacts, design of impact avoidance and reduction mitigation measures and the enhancement/offsetting measures required to achieve no net loss of biodiversity and, where applicable, a net gain for the species or feature for which critical habitat has been assessed to be present.

1.2 Standards and Requirements

This assessment has been completed following the approaches set out in the following two documents and their associated guidance notes:

- International Finance Corporation (2012) Performance Standard 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources[1];
- European Investment Bank (EIB) (2018) Standard 3: Biodiversity and Ecosystems[2]

1 https://www.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/sustainability-at-ifc/policies-standards/performance-standards/ps6

2 https://www.eib.org/en/infocentre/publications/all/environmental-and-social-standards.htm

2. DEFINITIONS

2.1 Critical Habitat

The following definitions are provided. References to species conservation status refer to the International Union for the Conservation of Nature (IUCN) Red List of Threatened Species[3] (Hereafter "the IUCN Red List").

2.1.1 IFC PS6, Paragraph 16.

Critical habitats are areas with high biodiversity value, including (i) habitat of significant importance to Critically Endangered and/or Endangered species; (ii) habitat of significant importance to endemic and/or restricted-range species; (iii) habitat supporting globally significant concentrations of migratory species and/or congregatory species; (iv) highly threatened and/or unique ecosystems; and/or (v) areas associated with key evolutionary processes.

2.1.2 EIB Standard 3, Paragraph 11.

For the purpose of this Standard, an area will be considered "critical" if it supports any of the following features, and is needed to sustain them in a viable state: Highly threatened or unique ecosystem; Population of critically endangered, endangered or vulnerable species, as defined by the IUCN Red List of threatened species and in relevant national legislation; Population, range or distribution of endemic or restricted-range species, or highly distinctive assemblages of species; Habitat required for the survival of migratory species and/or congregatory species; Biodiversity and/or ecosystem with significant social, economic, or cultural importance to local communities and indigenous groups; Habitat of key scientific value and/or associated with key evolutionary processes.

2.2 Natural Habitats

2.2.1 IFC Performance Standard 6, Paragraph 13.

Natural habitats are areas composed of viable assemblages of plant and/or animal species of largely native origin, and/or where human activity has not essentially modified an area's primary ecological functions and species composition.

2.2.2 EIB Standard 3, Paragraph 9.

Natural habitats retain ecological assemblages, functions and species composition that are attributable to natural evolutionary processes and have not been substantially modified by human activities. Truly natural and unaltered habitats are increasingly rare and those that remain are likely to be a high priority for conservation.

[3] https://www.iucnredlist.org/

2.3 Protected Areas

2.3.1 IFC Performance Standard 6, paragraph 20

In circumstances where a proposed project is located within a legally protected area or an internationally recognized area, the client will meet the requirements of paragraphs 13 through 19 of this Performance Standard, as applicable.

In other words, it will be treated as Critical Habitat. Protected Areas are defined in the guidance note as being:

"A clearly defined geographical space, recognized, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values." For the purposes of this Performance Standard, this includes areas proposed by governments for such designation.

2.3.2 EIB Standard 3, Paragraph 17

The EIB will only finance a project within a protected area, or within a nationally or internationally designated or recognised area for biodiversity conservation, if the promoter is able to demonstrate that the development is legally permitted and that the design of the project is consistent with any management plan for such areas that is recognised by the relevant authorities. In the absence of a recognised plan, projects should be compatible with the achievement of the relevant conservation objectives used to designate the area in question.

There is no explicit guidance on whether it would be considered to be critical or natural habitat, however, following the overarching principles of the Standard, this would be determined on a case by case basis and likely align with the IFC approach.

2.4 Methodology

2.4.1 Steps In Critical Habitat Identification

The following steps are described in the Guidance Note to Performance Standard 6 for determining Critical Habitat. No similar guidance exists for EIB, but the process followed is similar. Steps 1 and 2 are detailed in the ESIA sections.

2.4.2 Step 1: Stakeholder Consultation/Initial Literature Review

Aim: To obtain an understanding of biodiversity within the landscape from the perspective of all relevant stakeholders.

Process: Field consultation exercises and desktop research.

2.4.3 Step 2: Field Data Collection and Verification of Available Information

Aim: To collect field data and verify available detailed information necessary for the critical habitat assessment.

Process: Engage qualified specialists to collect field data as necessary both within and outside of the ecologically appropriate area of analysis

2.4.4 Step 3: Critical Habitat Determination

Aim: Determine whether the project is situated in critical habitat.

Process: Analysis and interpretation of the desktop and field data collected to identify an Ecological Area of Analysis/ Ecologically Appropriate Area of Analysis (hereafter "EAA") within which an assessment of potential critical habitat can be completed.

2.5 Steps in Natural Habitat Identification

Although not specified in any of Standards, or Guidance Notes, the approach to identifying natural habitat is based on the results of habitat survey.

3. CRITICAL HABITAT DETERMINATION

3.1 Critically Endangered, Endangered and Vulnerable Species

3.1.1 Flora

Surveys on site have identified the presence or potential for presence[4] of five species of plant that fall into this category:

- Lebanon violet *Viola libanotica* (EN), confirmed to be present;
- Lebanon cedar *Cedrus libani* (VU), confirmed to be present;
- Schweinfurth's buttercup *Ranunculus schweinfurthii* (VU), potentially present;
- Ehrenberg's marjoram *Origanum ehrenbergii* (VU), potentially present; and
- Snow romulea *Romulea nivalis* (VU), potentially present.

Lebanon Violet

Lebanon violet is listed as endangered (EN) on the IUCN Red List[5]. It is endemic to Lebanon. The records of it on the IUCN Red List include locations within all four habitat types identified on the Project site. It is listed as occurring in small, shaded pockets of water retaining organic matter in rocky habitats within shrublands on western slopes of the Mount Lebanon range at approximately 1,500m[6]. The Area of Occupancy (AOO[7]) of the species is considered to be 12-45km^2 within an Extent of Occupancy (EOO[8]) of 860km^2.

The IUCN distribution map shows a number of locations for the species immediately east and west of Turbine 11, at Turbine 13 both in the ecotone subalpine/high mountain zone, a large area 250m south-west of Turbine 15, two areas at Turbine 17, 100m south of Turbine 18, 300m south-west of Turbine 19 and 200m east of Turbine 20, all in the subalpine zone.

During surveys for the proposed development, the species was not recorded at any of the above named locations, but was recorded on the Project site in the area of Turbines 9 and 10 and along the track edges in that area. Its presence in other parts of the Project site could not be confirmed as at the time of the visit when it was identified, there remained areas of snow covering parts of the Project site.

In order to identify whether there is critical habitat for this species that overlaps with the Project site, it is necessary to identify an EAA. EAAs are defined independent of a Project site area, encompassing the habitats and areas within which a species is likely to occur. For Lebanese violet, the EAA at the Project site encompasses all rocky shrubland above 1,900m. An area identified using those parameters is almost identical to the Project site boundary and, as such, that is what is used as the EAA, hereafter the LWP Site EAA, which extends to 3.77km^2, as shown on Figure 1 in Appendix 1. The LWP Site EAA represents 0.43 % of the overall EOO of the species and therefore is **not considered to be critical habitat** for the species.*Lebanon Cedar*

---

[4] Some species are not identifiable from the surveys completed to date as it was not completed during their growth or flowering period. The project's botanical specialist, Dr. Myrna Semaan has identified that the Project site has the potential to support these species. Their presence will be confirmed by further survey.

[5] Leaman, D.J. 2015. *Viola libanotica*. The IUCN Red List of Threatened Species 2015: e.T203580A2768906. http://dx.doi.org/10.2305/IUCN.UK.2015-2.RLTS.T203580A2768906.en . Downloaded on 18 April 2019

[6] Radford, E.A., Catullo, G. and Montmollin, B. de. (eds.) (2011). *Important Plant Areas of the south and east Mediterranean region: priority sites for conservation*. IUCN, Gland, Switzerland and Malaga, Spain. Gland, Switzerland and Malaga, Spain: IUCN. VIII, 108 pp.

[7] The AOO is the total area within which a species occurs.

[8] The EOO is the total area within which all of the AOO falls, as many species have a scattered distribution rather than occurring in one continuous AOO.

Lebanon cedar is listed as vulnerable (VU) on the IUCN Red List[9]. It is not endemic to Lebanon, also occurring in Syria and Turkey. In Lebanon, it has an AOO of c. 22km^2 in two subpopulations in the Mount Lebanon chain, with the closest record being approximately 5km west of the Project site. It occurs in coniferous forest and shrubland at altitudes of 500m–3,000m.

The species was recorded on the Project site within the degraded coniferous forest north of Turbine 10, but only within one area of the habitat. There are very few mature specimens and clear evidence of past felling of trees in the area.

Based on the surveys completed and a consideration of habitat requirements, the EAA is considered to be the degraded coniferous forest habitat which occurs in the northern part of the Project site, along with the coniferous forest further to the north and east with which the degraded coniferous forest is effectively a continuum. The identified (undegraded) coniferous forest is contiguous with much of the boundary of the Karm Chbat Nature Reserve. As such, the EAA is considered to be the combined footprint of those three areas and is hereafter referred to as the LWP CF EAA, as shown on Figure 2 in Appendix 1.

In order for the LWP CF EAA to be considered to be critical habitat for Lebanon cedar it would need to support at least 0.5 % of the global population and at least five reproductive units. The number of mature individuals in the global population is unknown. The surveys completed did not aim to identify every tree present, rather, at this stage, they focussed on identifying the key species and habitat types. Therefore, without more detailed survey, it is not possible to assess accurately whether either of these thresholds are reached. However, working on the assumption that there are at least five reproductive units , the consideration required is whether the LWP CF EAA might reach the threshold of 0.5 % of the EOO. The EOO for Lebanon cedar is 1,024.5km^2 (102,450ha) and the area of the LWP CF EAA is approximately 600ha, which means that it represents 0.58% of the EOO. As such, until more detailed survey is completed that can confirm the number of reproductive units and whether a less conservative EAA could be applied, the LWP CF EAA is **considered to be critical habitat** for Lebanon cedar under EIB Standard 3, but not under IFC PS6.

A total of 9.41ha of potential critical habitat for Lebanon cedar is predicted to be lost within the LWP CF EAA as a result of the proposed development.

Schweinfurth's Buttercup

Schweinfurth's buttercup is listed as vulnerable (VU) on the IUCN Red List[10]. It is endemic to Lebanon. It is known from just four locations, all of which are on the Mount-Lebanon mountain range south-west of the Project site. The species occurs between 1,400–2,000m in seasonally wet areas, such as sink-holes and locations that hold snow for longer periods into the spring.

The Project site is located in the correct altitudinal zone for the species to occur and is subject to heavy snowfall. The closest record of the species as listed on the IUCN Red List is over 60km south-west of the Project site, however it is a named species for the Qammouaa-Dinnyeh Jurd Hermel IPA and, therefore, it seems extremely likely that there are additional locations for the species other than those on the IUCN Red List.

The majority of the site is unlikely to be suitable for such snow areas to persist, however, it is considered possible that areas within the degraded coniferous forest habitat in the northern part of the Project site might provide such conditions and, as such, the LWP CF EAA is likely to be an appropriate area to consider.

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[9] Gardner, M. 2013. Cedrus libani var. libani. The IUCN Red List of Threatened Species 2013: e.T42305A2970821. http://dx.doi.org/10.2305/IUCN.UK.2013-1.RLTS.T42305A2970821.en . Downloaded on 11 July 2019.

[10] Rhazi, L., Grillas, P., Rhazi, M. & Flanagan, D. 2010. *Ranunculus schweinfurthii*. The IUCN Red List of Threatened Species 2010: e.T164065A5742919. http://dx.doi.org/10.2305/IUCN.UK.2010-2.RLTS.T164065A5742919.en . Downloaded on 01 April 2019.

The project floral specialist identified it as a species likely to be present, however as the species has not been confirmed to be present, it is extremely difficult to assess whether there might be critical habitat present on the Project site and, as such, it **cannot be confirmed if critical habitat is present** for Schweinfurth's buttercup.

A total of 9.41ha of potential critical habitat for Schweinfurth's buttercup is predicted to be lost within the LWP CF EAA as a result of the proposed development.

Ehrenberg's Marjoram

Ehrenberg's marjoram is listed as vulnerable (VU) on the IUCN Red List[11]. It is endemic to Lebanon. It is known from up to ten small locations on the west side of Mount Lebanon and further south, all of which lie at least 35km south-west of the Project site. The species occurs between 0–2000m on sandy soils with grassland, shrubland or pine forest.

The northern part of the Project site, in the degraded coniferous forest habitat, is considered to have the appropriate conditions to support the species and as such the LWP CF EAA is likely to be an appropriate area to consider.

The project floral specialist identified it as a species likely to be present, however as the species has not been confirmed to be present, it is extremely difficult to assess whether there might be critical habitat present on the Project site and, as such, it **cannot be confirmed if critical habitat is present** for Ehrenberg's marjoram.

A total of 9.41ha of potential critical habitat for Ehrenberg's marjoram is predicted to be lost within the LWP CF EAA as a result of the proposed development.

Snow Romulea

Snow romulea is listed as vulnerable (VU) on the IUCN Red List[12].It is endemic to Lebanon and known from six locations along the Mount Lebanon and Anti-Lebanon mountain ranges at heights of 1,400–2,600m, with the closest record being approximately 15km south of the Project site. The known locations are spread along the entire lengths of both ranges, growing on grasslands and shrublands that receive snow melt runoff in spring.

The majority of the Project site is unlikely to be suitable for snow areas to persist, however, it is considered possible that areas within the degraded coniferous forest habitat in the northern part of the Project site might provide such conditions and, as such, the LWP CF EAA is likely to be an appropriate area to consider.

The project floral specialist identified it as a species likely to be present, however as the species has not been confirmed to be present, it is extremely difficult to assess whether there might be critical habitat present on the Project site and, as such, it **cannot be confirmed if critical habitat is present** for snow romulea.

A total of 9.41ha of potential critical habitat for snow romulea is predicted to be lost within the LWP CF EAA as a result of the proposed development.

3.1.2 Bats

Long-fingered Bat

Bat surveys on the Project site commenced in May 2019 and data was collected from five locations in the northern part of the Project site (the met mast and Turbines 6, 7, 9, 11) for ten

[11] Leaman, D.J. 2015. Origanum ehrenbergii. The IUCN Red List of Threatened Species 2015: e.T203576A2768878. http://dx.doi.org/10.2305/IUCN.UK.2015-2.RLTS.T203576A2768878.en . Downloaded on 12 July 2019

[12] El Zein, H. & Lansdown, R.V. 2018. Romulea nivalis. The IUCN Red List of Threatened Species 2018: e.T13164084A18613160. http://dx.doi.org/10.2305/IUCN.UK.2018-1.RLTS.T13164084A18613160.en . Downloaded on 12 July 2019.

days from 5th-15th May and from five locations in the (higher) southern part of the Project site (Turbines 16, 17, 19, 21, 23) for ten days from 15th-25th May.

Confirmed long-fingered bat *Myotis capaccinii* activity was recorded from just one location (Turbine 19) during the May survey. Turbine 19 lies within habitats characterised as subalpine, characterised by short herbaceous vegetation and scattered Juniper species, i.e. atypical foraging habitat for the species that is typically associated with (but not limited to) areas of water. Activity was only recorded between 00.00-01.00 hours and constitutes 0.03% of all bat activity recorded on the Project site during the survey period. However, it is notable that Turbine 19 recorded the third highest level of bat activity on the Project site, suggesting that it supports good bat foraging habitat. At this stage, it is considered that the Project site is of extremely limited value to the species, however this is based on just spring monitoring data and it is possible that the summer and autumn data could show a different pattern of activity.

Long-fingered bat is typically a cave-roosting species, particularly favouring limestone karst caves. There are known to be many caves in the wider area around the Project site and it is possible that the species could be using those for breeding or hibernation. No such caves occur on the Project site or immediate area. Additionally, as none of the records were from close to sunset or sunrise, it is considered unlikely that a roost for the species lies close to Turbine 19, as bat activity close to a roost is highest at those times.

For long-fingered bat, the EAA is considered to be the LWP Site EAA. As described previously, the Project site boundary closely follows a natural boundary, above and below which conditions for species are very different. It is considered that the key area to support bats, particularly long-fingered bats, is the area below the site boundary line, i.e. in the lower, wooded areas. As such, the single area of activity on the Project site is **not considered to be critical habitat** for long-fingered bat.

3.1.3 Reptiles

Three reptile species that are endangered and have decreasing populations have ranges shown on the IUCN Red List that lie on or close to the Project site. The species are Lebanon viper *Montivipera bornmuelleri*[13], Fraas' lizard *Parvilacerta fraasii*[14] and the unnamed lizard species *Phoenicolacerta kulzeri*[15]. The range of Fraas' lizard overlaps the southern part of the Project site, *P. kulzeri* occurs immediately to the south and the range of Lebanon viper lies approximately 2km south of the site. As such, it is considered extremely likely that all three species occur on the Project site.

These reptile species all inhabit sparsely vegetated mountainous areas such as found across all of the Project site, i.e. all areas within the LWP Site EAA, which is the appropriate EAA for all three species. No reptile surveys have been completed on the Project site and none of the incidental reptile sightings recorded by surveyors on site completing other surveys have been confirmed as one of the three reptile species. As such, it **cannot be confirmed if critical habitat is present** for any of the three reptile species.

A total of 30.06ha of potential critical habitat for threatened reptile species is predicted to be lost within the LWP Site EAA as a result of the proposed development.

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[13] Mousa Disi, A.M., Hraoui-Bloquet, S., Sadek, R. & Werner, Y. 2006. Montivipera bornmuelleri. The IUCN Red List of Threatened Species 2006: e.T61445A12486224. http://dx.doi.org/10.2305/IUCN.UK.2006.RLTS.T61445A12486224.en . Downloaded on 13 July 2019.

[14] Hraoui-Bloquet, S. & Sadek, R. 2006. Parvilacerta fraasii. The IUCN Red List of Threatened Species 2006: e.T61522A12502475. http://dx.doi.org/10.2305/IUCN.UK.2006.RLTS.T61522A12502475.en . Downloaded on 13 July 2019.

[15] Disi, M., A.M., Hraoui-Bloquet, S., Sadek, R. & Werner, Y. 2006. Phoenicolacerta kulzeri. The IUCN Red List of Threatened Species 2006: e.T61524A12503047. http://dx.doi.org/10.2305/IUCN.UK.2006.RLTS.T61524A12503047.en . Downloaded on 13 July 2019.

3.1.4 Birds

Three bird species that meet the criteria were recorded during the bird surveys on the Project site: Egyptian vulture *Neophron percnopterus* (IUCN Red List EN[16]), greater spotted eagle *Clanga clanga* (IUCN Red List VU[17]) and eastern imperial eagle *Aquila heliaca* (IUCN Red List VU[18]). None were recorded on the Project site itself, all were recorded flying. No observations were made of them roosting on site. Three other species that are endangered or vulnerable in Lebanon, steppe eagle *Aquila nipalensis*, Saker falcon *Falco cherrug* and sociable lapwing *Vanellus gregarius*, were not recorded during field surveys at the Project site.

Egyptian Vulture

Egyptian vultures are resident in Lebanon as well as occurring during migration in spring and autumn. As there was only one observation of the species on or near the Project site and that was of a bird overflying the Project site, there is no evidence that there is a resident pair holding a territory on or near the Project site or that the species uses the Project site or surrounding area as a stopover location during migration. No records of Egyptian vulture roosting on or around the project site were made and limited potential roosting habitat (large cliffs or wooded areas with large trees) is considered to exist on or around the project site.

As such, there is **not considered to be critical habitat** for this species on or near the Project site.

Greater Spotted Eagle

Greater spotted eagles are not resident in Lebanon and only occur on passage during spring and autumn. Two observations of the species flying past the Project site were made during the migration period and no evidence of the species using the Project site or surrounding area as a stopover location during migration was recorded. No records of great-spotted eagles roosting on or around the project site were made and limited potential roosting habitat (large cliffs or wooded areas with large trees) is considered to exist on or around the project site.

As such, there is **not considered to be critical habitat** for this species on or near the Project site.

Eastern Imperial Eagle

Eastern imperial eagles are not resident in Lebanon and only occur on passage during spring and autumn. Two observations of the species flying past the Project site were made during the migration period and no evidence of the species using the Project site or surrounding area as a stopover location during migration was recorded. No records of imperial eagles roosting on or around the project site were made and limited potential roosting habitat (large cliffs or wooded areas with large trees) is considered to exist on or around the project site.

As such, there is **not considered to be critical habitat** for this species on or near the Project site.

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[16] BirdLife International 2017. Neophron percnopterus (amended version of 2016 assessment). The IUCN Red List of Threatened Species 2017: e.T22695180A118600142. http://dx.doi.org/10.2305/IUCN.UK.2017-3.RLTS.T22695180A118600142.en . Downloaded on 08 April 2019.

[17] BirdLife International 2017. Clanga clanga (amended version of 2016 assessment). The IUCN Red List of Threatened Species 2017: e.T22696027A110443604. http://dx.doi.org/10.2305/IUCN.UK.2017-1.RLTS.T22696027A110443604.en . Downloaded on 08 April 2019.

[18] BirdLife International 2017. Aquila heliaca (amended version of 2016 assessment). The IUCN Red List of Threatened Species 2017: e.T22696048A117070289. http://dx.doi.org/10.2305/IUCN.UK.2017-3.RLTS.T22696048A117070289.en. Downloaded on 02 May 2019.

3.1.5 Invertebrates

One threatened species of invertebrate has the potential to occur on the Project site. *Callidium libani* (IUCN Red List EN[19]) is a saproxylic species of beetle that occurs in the branches of Lebanese cedar (itself a vulnerable species as described previously in Section 3.1.1) and Cilician fir *Abies cilicica* (an endemic species described in the following section, e.g. Section 3.2.1), both of which occur on the Project site. All other populations of *C. libani* have been found at elevations between 1,700-1,850m. The northernmost section of the Project site between the site entrance and Turbine 8 lies within those elevations within the degraded coniferous forest zone. Cilician fir was recorded at the locations of Turbine 7, Turbine 8 and north of Turbine 10, with Lebanese cedar also recorded at the latter location that lies marginally higher than the suggested upper altitudinal limit of *C. libani.* As such, the LWP CF EAA is considered to be the appropriate EAA.

Without invertebrate survey data, it is not possible to confirm whether or not the species is present. However, as the Project site contains suitable habitat for the species at the same elevations as other identified locations and there is a known population approximately 5km west in the Fnaideq area, it is considered to be possible that the species is present.

At present, the known EOO of the species covers approximately 550km^2 (55,000ha) but does not include the Project site. The LWP CF EAA extends to 600ha. Were the species to be found to be present within the LWP CF EAA, the EOO would rise to 55,600ha. On the basis that the density of the species is likely to be relatively consistent across sites, 600ha would represent 1% of the global population. It would almost certainly contain sufficient individuals to constitute five reproductive units and the LWP CF EAA would be **considered to be critical habitat** for *C. libani.*

A total of 9.41ha of potential critical habitat for *C. libani* is predicted to be lost within the LWP CF EAA as a result of the proposed development.

3.2 Endemic and Range-Restricted Species and Highly Distinctive Assemblages

3.2.1 Endemic and Range-Restricted Species

Cilician Fir

Cilician fir is an endemic, range-restricted species for which the Western Akroum Key Biodiversity Area (KBA) was designated. It was recorded near Turbines 7, 8 and north of Turbine 10 during surveys on the Project site.

The KBA boundary matches the LWP CF EAA extremely closely, with the addition of an area beyond that incorporates the area around Turbine 11. The full extent of the KBA must be **considered to be critical habitat** for Cilician fir by virtue of being an internationally recognised area.

[19] Buse, J., Verdugo, A., Bartolozzi, L., Galante, E. & Mendez, M. 2016. Callidium libani. The IUCN Red List of Threatened Species 2016: e.T47173811A47693856. http://dx.doi.org/10.2305/IUCN.UK.2016-2.RLTS.T47173811A47693856.en. Downloaded on 10 July 2019.

Qammouaa-Dinnyeh Jurd Hermel IPA Species

The Qammouaa-Dinnyeh Jurd Hermel IPA is classified for the following nine threatened species:

- *Alkanna prasinophylla;*
- *Astragalus angulosus;*
- *Cousinia libanotica;*
- *Erophila gilgiana;*
- *Helichrysum virgineum;*
- *Melissa inodora;*
- *Ranunculus schweinfurthii;*
- *Silene grisea;* and
- *Stachys hydrophila.*

Of the nine species, two were confirmed as present during the 2019 floral surveys on the Project site. *Cousinia libanotica* was recorded at Turbine 9 in the degraded coniferous forest, in the subalpine zones around Turbines 18 and 19 and their connecting roads, and at Turbine 23. *Astragalus angulosus* was recorded within the ecotone subalpine/high mountain zone at Turbine 14.

The project flora specialist considers it likely that *Ranunculus schweinfurthii, Erophila gilgiana* and *Silene grisea* are also present on the Project site.Unlike the Western Akroum KBA, the IPA is not considered to be an internationally recognised area. Therefore, there is no requirement for its area to be considered as critical habitat for the listed endemic species of the IPA confirmed or likely to be present and they must be considered in their own right along with the 14 other endemic and potentially endemic species listed here.

Table 1: Endemic Floral Species

Species Name	Location(s)	Habitat Type	Notes
Acantholimon libanoticum	Turbine 9 Turbine 23	Degraded coniferous forest Subalpine zone	Possibly endemic, status uncertain
Alchemilla diademata	-	-	Endemic, not recorded on Project site, considered likely to be present
Asperula glareosa	Turbine 14	Ecotone subalpine/high mountain zone	Possibly endemic, status uncertain
Astragalus cruentiflorus	Turbine 9 Turbine 23	Degraded coniferous forest Subalpine zone	Possibly endemic, status uncertain
Astragalus dictyocarpus	Turbine 22	Subalpine zone	Endemic, also on turbine connecting road
Astragalus hermoneus	Turbine 23	Subalpine zone	Possibly endemic, status uncertain
Astragalus kurnet-es-saudae	Turbine 17 Turbine 18 Turbine 19	Subalpine zone	Endemic
Asyneuma rigidum	Turbine 23	Subalpine zone	Possibly endemic, status uncertain

Species Name	Location(s)	Habitat Type	Notes
Berberis libanotica	Turbine 9 Turbine 14 Turbine 23	Degraded coniferous forest Ecotone subalpine/high mountain zone Subalpine zone	Endemic
Campanula stricta	Turbine 14 Turbine 15	Ecotone subalpine/high mountain zone	Possibly endemic, status uncertain
Campanula trichopoda	-	-	Endemic, not recorded on Project site, considered likely to be present
Centaurea hololeuca	Turbine 9	Degraded coniferous forest	Possibly endemic, status uncertain
Daphne libanotica	Turbine 22	Subalpine zone	Possibly endemic, status uncertain, also on turbine connecting road
Hypericum libanoticum	Turbine 11	Ecotone subalpine/high mountain zone	Possibly endemic, status uncertain, also on turbine connecting road

As such, the presence of up to 19 endemic plant species on the Project site is possible, with five confirmed endemic species and nine possible endemic species confirmed at present. However, given the paucity of data on the level of endemism of some species and the distribution and locations of the species, it is not possible to make a reasoned assessment of critical habitat status on a species by species basis and it **cannot be confirmed if critical habitat is present** for any individual listed endemic species. However, it is possible that the assemblage of endemic species might be sufficient to trigger critical habitat status. This should be considered further.

3.3 Migratory and Congregatory Species

3.3.1 Bats

As described previously, bat surveys commenced in May 2019. The bat surveys recorded 12 separate species of bat. The 12 bat species that were recorded could all be considered to be both migratory and congregatory. Along with suitable foraging habitat, roosts are the key features for bats in terms of critical habitat. Although caves in excess of 1,000 roosting bats have been identified within the wider area, no roost sites (caves) have been recorded on the Project site or its immediate environs.

In order to be considered to be critical habitat for a migratory or congregatory species, an area would need to support at least 1% of the global population of a species on a cyclical basis or be required by those species during periods of environmental stress to survive.

An appropriate EAA would need to consider bat activity on a landscape scale to consider whether the Project site is situated within an area of importance for populations of any of the bat species of sufficient size to trigger critical habitat for this criterion. The species recorded are all widespread species of limited conservation concern (with the exception of long-fingered bat) and seem to occur in unextraordinary populations. Although further survey data may change this, it is considered extremely likely that there is **no critical habitat** for migratory or congregatory bat species.

3.3.2 Birds

As described in the ESIA, the area within which the Project site is located is part of an important migratory bird flyway. The ESIA includes details of the flyways and the migratory bird activity over the Project site. That activity was low compared to the numbers of migratory birds reported to use areas adjacent to the Project site for migration. However, some migratory birds were recorded flying over the Project site.

The Upper Mountains of Akkar Donnieh Important Bird Area (IBA) includes soaring migratory birds as a designated feature, specifically that up to 50,000 soaring birds pass through the area each year, with the IBA being more important in the autumn when large flocks of levant sparrowhawk *Accipiter brevipes,* great white pelican *Pelecanus onocrotalus*, common crane *Grus grus* and white stork *Ciconia ciconia* pass over it.

However, the surveys completed have not identified sustained or repeated usage of the Project site or surrounding area by migrating birds for feeding or roosting, certainly not by the larger soaring species. It is possible that smaller passerine species also migrating through the area might use areas of woodland or shrubland for roosting or feeding. However, it is considered to be extremely unlikely that 1% of the global population of any species might use the area repeatedly and there is **not considered to be critical habitat** for migratory birds.

3.4 Highly Threatened or Unique Ecosystems

No critical habitat of this type is considered to exist on the Project site.

3.5 Key Evolutionary Processes

No critical habitat of this type is considered to exist on the Project site.

3.6 Biodiversity and/or Ecosystem with Significant Social, Economic, or Cultural Importance

No critical habitat of this type is considered to exist on the Project site.

4. NATURAL HABITATS DETERMINATION

4.1 Natural Habitats

Whilst human activity is evident on the Project site, many of the areas within it are largely unmodified, apart from low-level grazing by sheep and goats. The subalpine zone, the ecotone subalpine/high mountain zone and the coniferous forest are all considered to be examples of natural habitat as defined by IFC PS6 and EIB Standard 3.

Turbines 11-23 are located within these natural habitats.

A total of 15.06ha of natural habitats, not also considered to be critical habitat is predicted to be lost as a result of the proposed development. No net loss of these habitat types should be delivered by the project.

4.2 Semi-Natural Habitats

The degraded coniferous forest is considered to be semi-natural habitat. Many of the constituent features of the coniferous forest are present, however there are few mature trees as they have been previously felled for timber or firewood and, as such, the distribution of trees is very scattered.

Turbines 6-10 are located within this semi-natural habitat.

None of this semi-natural habitat occurs outwith the area already identified as critical habitat.

5. PROTECTED AREAS

5.1 Upper Mountains of Akkar Donnieh IBA

A description of the IBA is provided within the ESIA chapter along with the consideration of impacts upon it. By virtue of its internationally recognised status, the IBA is considered to be critical habitat.

5.2 Western Akroum KBA

A description of the KBA is provided within the ESIA chapter along with the consideration of impacts upon it. By virtue of its internationally recognised status, the KBA is considered to be critical habitat.

5.3 Karm Chbat Nature Reserve

A description of Karm Chbat Nature Reserve is provided within the ESIA chapter along with the consideration of impacts upon it. It was designated for its coniferous woodland, particularly Lebanon cedar and Cilician fir. However, the nature reserve is not considered to be an internationally recognised area and, therefore, is not considered to be critical habitat on that basis. However, it does lie entirely within the LWP CF EAA, which is considered to be critical habitat for Lebanon cedar, and, as such, is effectively considered to be critical habitat.

6. SUMMARY

6.1 Critical Habitats

Table 2 summarises the findings of the CHA, with all those with confirmed critical habitat requiring the project to deliver a net gain.

Table 2: Summary of Critical Habitat Assessment

Topic	IFC PS6 criterion	EIB Criterion	Species	EAA	Critical Habitat Determination	Critical Habitat Area Loss (ha)
Endangered Species etc.	Criterion 1	Criterion 2	Lebanon violet	LWP Site EAA	Not critical habitat	N/A
Endangered Species etc.	Criterion 1	Criterion 2	Lebanon cedar	LWP CF EAA	Critical habitat	9.41
Endangered Species etc.	Criterion 1	Criterion 2	Scheinfurth's buttercup	LWP CF EAA	Unconfirmed	9.41
Endangered Species etc.	Criterion 1	Criterion 2	Ehrenberg's marjoram	LWP CF EAA	Unconfirmed	9.41
Endangered Species etc.	Criterion 1	Criterion 2	Snow romulea	LWP CF EAA	Unconfirmed	9.41
Endangered Species etc.	Criterion 1	Criterion 2	Long-fingered bat	LWP Site EAA	Not critical habitat	N/A
Endangered Species etc.	Criterion 1	Criterion 2	Reptile species	LWP Site EAA	Unconfirmed	30.06
Endangered Species etc.	Criterion 1	Criterion 2	Egyptian vulture	LWP Site EAA	Not critical habitat	N/A
Endangered Species etc.	Criterion 1	Criterion 2	Greater spotted eagle	LWP Site EAA	Not critical habitat	N/A
Endangered Species etc.	Criterion 1	Criterion 2	Eastern imperial eagle	LWP Site EAA	Not critical habitat	N/A
Endangered Species etc.	Criterion 1	Criterion 2	*Callidium libani*	LWP CF EAA	Critical habitat	9.41
Endemic species etc.	Criterion 2	Criterion 3	Cilician fir	KBA area.	Critical habitat (by virtue of KBA)	17.10
Endemic species etc.	Criterion 2	Criterion 3	Assemblage of up to 19 endemic plant species	LWP CF EAA and LWP Site EAA	Unconfirmed	39.47
Migratory Species etc.	Criterion 3	Criterion 4	Bat species	LWP Site EAA	Not critical habitat	N/A
Migratory species etc.	Criterion 3	Criterion 4	Bird Species	LWP Site EAA	Not critical habitat	N/A

6.2 Natural Habitats

All of the turbine locations on the Project site are located within natural habitats and no net loss of biodiversity will need to be delivered in all areas. It is possible that some of the areas might be considered to be critical habitat for endemic plant species once sufficient survey has been completed to allow a further determination. At that point, the requirement for no net loss would switch to a requirement for net gain for those species, likely delivered at the habitat scale.

6.3 Impacts, Mitigation and Offsetting

An assessment of impacts on habitats and species on the Project site has been developed and is provided in the Project ESIA. That impact assessment also considers impacts upon critical and natural habitats and sets out the proposed scheme of mitigation to avoid or reduce impacts. Measures to deliver no net loss of natural habitats and net gain of critical habitats are described and provided in a draft Biodiversity Action and Management Plan (BAMP).

ENVIRONMENT
& HEALTH

APPENDIX M
FLORA SURVEY PROGRAMME

MEMO

Job	**Akkar Windfarms**
Client	**Sustainable Akkar**
Date	**25th April 2019**
To	**Jean-Stephan, Flora Specialist**
From	**Nadine Little, Ramboll Botany Specialist**

Proposed Scope of Flora Survey at Lebanon Wind Power and Sustainable Akkar Wind Farms, Akkar Region, Lebanon

Introduction

As part of the biodiversity impact assessment of the ESIA process, it is necessary to understand the flora and habitat baseline on the proposed wind farm sites. No standardised baseline flora surveys have been completed on the full Lebanon Wind Power (LWP) or Sustainable Akkar (SA) sites, although a habitat survey was completed on parts of both sites and combined with a literature review to verify existing land cover mapping.

Key species recorded were as follows:

- Cilician fir *Abies cilicica*;
- Milk-vetch *Astragalus sp*. Potentially the Qammouaa-Dinnyeh Jurd Hermel Important Plant Area (IPA) species *Astragalus angulosus*;
- Flowering ash *Fraxinus ornus*;
- Syrian juniper *Juniperus drupacea*;
- Greek juniper *Juniperus excelsa*;
- Prickly juniper *Juniperus oxycedrus*;
- Lebanese oregano *Origanum libanoticum*;
- Hop hornbeam *Ostrya carpinifolia*;
- Mock privet *Phillyrea media*;
- Unnamed buttercup *Ranunculus cuneatus*; and
- Buckthorn *Rhamnus cathartica*.

However, from the desk study it seems that the following key species considered to be of higher conservation concern than least concern[1] could be present:

- Lebanon savoy *Clinopodium libanoticum*; and
- Lebanon violet *Viola libanotica*.

[1] https://www.iucnredlist.org

The following IPA species also have the potential to be present on the site, particularly in areas of sparse coniferous forest:

- *Alkanna prasinophylla*;
- *Astragalus angulosus*;
- *Erophila gilgiana;*
- *Helichrysum virgineum;*
- *Ranunculus schweinfurthii;*
- *Silene grisea*; and
- *Stachys hydrophilia*.

Proposed Scope of Surveys

In order to identify habitats and key flora species, an experienced botanist will walk through the two project sites to determine the habitat types on the sites and to record the flora species present. The key target species will be any of those known or considered to occur as described above or any other notable flora species discovered during the survey. These surveys will involve an assessment of key habitats, land use and ecological features, focusing on areas of natural interest that could be affected by the proposed developments. Habitats of potential sensitivity will be recorded as features of potential ecological value in their own right or as potential high-quality habitat for protected species. In addition to general habitat classification, a list will be compiled of observed plant species, with the abundance of each species estimated for each habitat using standard 'DAFOR' codes:

- dominant;
- abundant;
- frequent;
- occasional; and
- rare.

The sites will also be inspected for the presence of non-native invasive flora species.

Plot surveys will be undertaken to cover the different habitat types identified from the site walkover, focusing on areas of natural, undisturbed habitat in the footprint of the proposed developments. The following plot sizes will be used:

- 10 x 10 m^2 for grassland (the maximum size recommended according to Braun-Blanquet[2]); and
- 20 x 20 m^2 in woodlands and forests.

All plants will be identified to species level in each plot, with their percentage cover within the plot classified using the Braun-Blanquet scale[3] as shown in Table 1.

[2] Braun-Blanquet, Josias (1964). Pflanzensoziologie, Grundzüge der Vegetationskunde. (3. Auflage). Springer Verlag, Wien, 865 pages.

[3] http://botanydictionary.org/braun-blanquet-scale.html

Table 1: Braun-Blanquet Scale for Coverage of Plant Species	
Cover (%)	**Braun-Blanquet Scale**
<1	+
1-5	1
6-25	2
26-50	3
51-75	4
76-100	5

Cover is the surface covered by the number of individuals as a percentage. A score for the degree of endemism will also be attributed to each species, as shown in Table 2.

Table 2: Endemism Score	
Degree of Endemism	**Score**
Global, common	0
Mediterranean biome	1
East Mediterranean	2
Lebanon and one or two neighbouring countries	3
Lebanon only	4

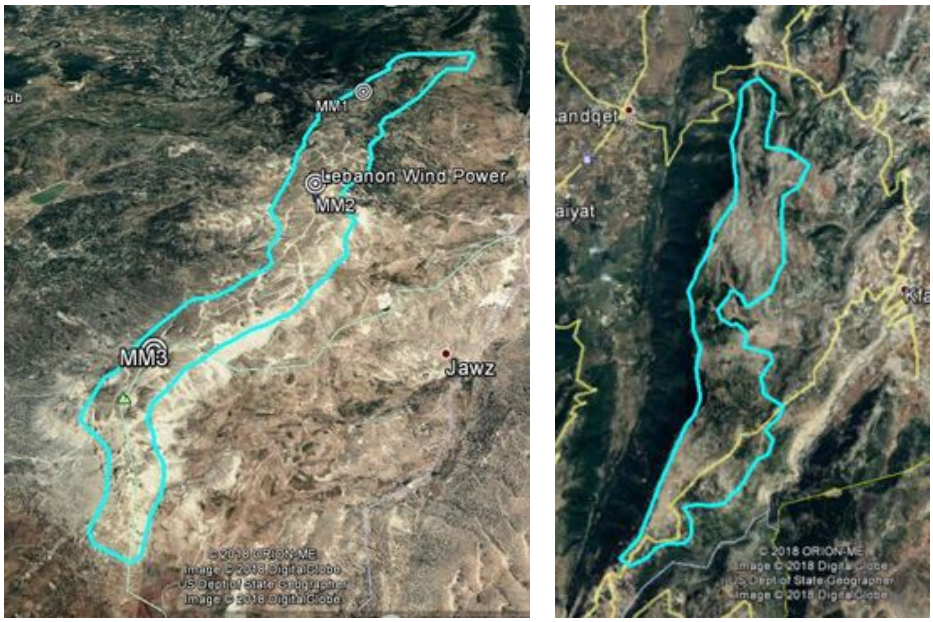
Another score will also be attributed for the species' extent of occurrence in Lebanon (how common/rare it is: restricted or wide distribution according to altitude, soil type, number of habitats, etc.). The rarer the species, the higher the value of the score, as shown in Table 3.

Table 3: Frequency of Distribution in Lebanon	
Frequency	**Score**
Common	0
Restricted to certain environmental range	1
Restricted to a certain environmental range and/or habitat type	2
Rare, restricted presence in specific areas	3

Finally, species will be classified according to their lifeforms, as described in Table 4.

Table 4: Plant Lifeform Type	
Lifeform Type	**Score**
Annual, biennial, herbaceous	1
Bulbs	2
Perennial	3
Shrubs	4
Trees	5

The main survey area will cover the footprint of each proposed project element, e.g. access tracks, turbine bases, buildings, construction areas, or staff areas and a buffer of at least 100 m around those features. Although parts of SA were previously surveyed, the whole site should be surveyed again to ensure a consistent and standardised approach between SA and LWP. At the surveyor's discretion, other features within the immediate study zone (shown below) of each project would also be surveyed:



Immediate zones at LWP and SA to be covered by flora surveys.

The surveys will commence at the earliest possible date within the ideal surveying season for habitats and flora (April to October).

ENVIRONMENT
& HEALTH

APPENDIX N
MAMMAL & BAT REPORTS

1.1.1 Fauna: Ecological Assessment- Mammals Diversity [Nov 2018]

Headed by Mazen Chbib and Shadi El Indary

Due to the functional characteristics of wind turbines, studies have focused on flying vertebrates, specifically birds and bats, by addressing activity patterns, habitat use and mortality (e.g., Baerwald and Barclay 2009; Drewitt and Langston 2006; Kunz et al. 2007; Pearce-Higgins et al. 2009). Impact studies on non-flying vertebrates have been poorly studied, despite several findings that terrestrial animals can be affected by wind farms in various ways.

Mammals are a difficult group of animals to see in the wild, many such as the mice, voles and shrews are small. Other species are nocturnal – or are most active then, such as Badgers and Martens. Mammalian conservation and management strategies are dependent on the efficient and reliable methods for the assessment of species richness and abundance (Trolle and Kery 2005, Gompper et al. 2006), especially in regions where knowledge of mammalian richness is poor and where human and material resources are limited. Mammalian biodiversity studies are accomplished either by a direct method or by an indirect one. The direct method consists of capturing the animal; it is very tricky and delicate given the nocturnal and shy nature of mammals (Lyra-Jorge et al., 2008). Additionally, an animal in captivity might be stressed or even injured using this method. However, the indirect method consists of identification mammalian species by observing signs, footprints, droppings, photos, feeding remains and any other mark left behind (Lyra-Jorge et al., 2008).

In Lebanon, baseline data on mammalian biodiversity is relatively poor and sporadic, and mainly represents protected areas in the country. Biodiversity assessments, species status and population dynamic publications are insufficient for mammalian species (Tohmé et al. 1985, Abi Said, 2010; Nader et al 2011; Abi Said et al. 2012). Species richness in Lebanon is spread on the five geomorphologic regions of Lebanon: the coastal zone, the Mount Lebanon range, the Beqaa plain, the Anti-Lebanon Range, and the south Lebanon (MoE et al., 2016). Of the 59 described mammalian species in Lebanon, 7 species are already extinct, 46% are terrestrial, 31% of the existing mammals are rare, 20% vulnerable and 7.5% are close to extinction (MoE et al., 2016)

OBJECTIVE

This study aims at updating the previous preliminary study entitled "Ecological Assessment of Hawa Akkar Wind Farm Mammals Diversity" delivered in January 2013 through: updating the list of existing mammalian species, identifying risks of the wind turbines on these species present and defining mitigation measures to eliminate or decrease their effect.

MATERIALS AND METHODS

Study area

The study area is situated 150 Km north of the capital Beirut and occupies a surface area of approximately 500 hectares. It ranges in altitude from 500 m to 800 m. The habitat is dominated by the open Mediterranean shrubland and bare rocks in addition to small pine/oak forests (**Figure 1-52**).

Figure 1-1 Study area Akroum

The shrubland main species is the perennial spiny bush Sarcopoterium spinosum (En: Thorny burnet; Ar: بلاّن) covering the area with a very high density reaching more than 90% in certain spots (**Photo 1-55**).

Photo 1-1 Shrubland dominated by spiny bush species Sarcopoterium spinosum

In addition, several abandoned agricultural terraces can be observed in the area and small patches of forests dominated by pine, oak and juniper trees can be found on the South Eastern and South Western side of the study area (**Photo 1-56**).

Photo 1-2 Quercus sp. trees

The forest is subject to logging where trees are cut down in a non-sustainable way degrading the existing habitat and creating pressure on the existing species of the area. Also, the area is under heavy grazing pressure especially in winter and spring seasons where several large herds of goats are found. The surveying team during his field visits has encountered several goat herd of a minimum of 200 animals per herd.

On the other hand, and since the Syrian crisis of 2011 and for security reasons, the Lebanese Army has significantly increased the number of soldiers in the study area being a very strategic site. Several barracks for housing soldiers were installed and dirt road where constructed allowing military vehicles to patrol the area. Parts of the study area are used as training sites for the Lebanese Army soldiers and as shooting fields.

Field survey

Transect method:

The methodology was based on William et al. 2002; a satellite image from Google Earth dated from the year 2017 was used to draw transect lines were drawn (Figure 4) (William et al. 2002). The observations on foot covered a total distance of 6400 m (Transect 1= 3,600 m and Transect 2= 2800 m) with a 4 m sight range (2 m to the right and 2 m to the left of the surveyor; **Figure 1-53**) therefore more than 25,600 m^2 surface area was surveyed. But as transects were covered by two individuals walking in parallel the surface covered will be doubled and estimated more

than 50,000 m^2. Quadrats were surveyed over a period of three days (Sunday November 4th 2018; Saturday November 10th 2018; Saturday November 24th 2018). A special focus was given to rocky areas and wooded patches as mammalian activity will be higher in such areas which provide shelter and food to animals.

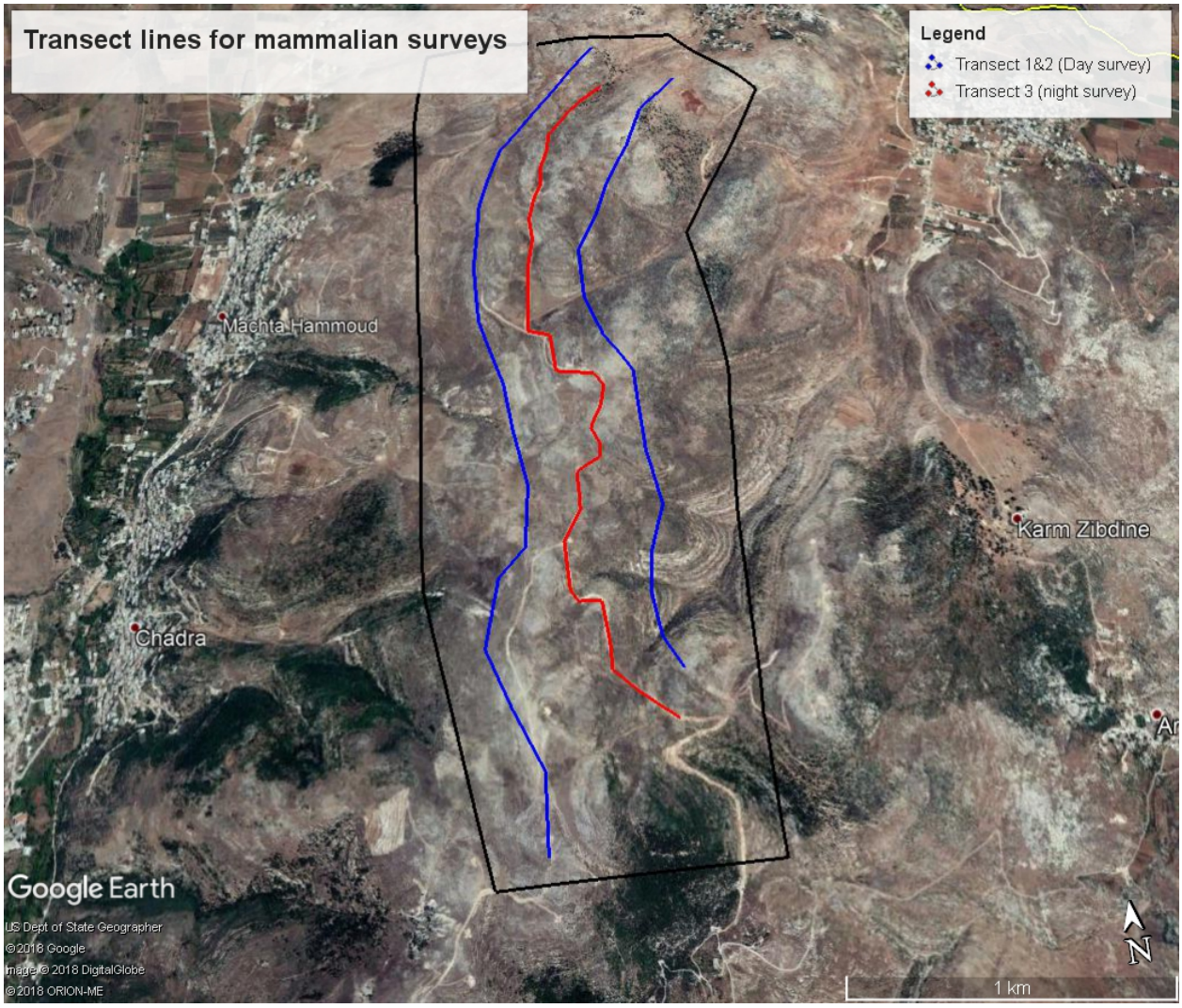


Figure 1-2 Study area and the transect lines

Coordinates of various findings were recorded on a Global Positioning System (GPS) device. Recorded points were then plotted on the map using the ArcGIS ver10.6 software.

Scat and track survey

One of the most common methods for mammalian species listing and monitoring (Bang 2004). Through predefined transects within each sampling unit, scats and tracks are used as an indicator of the presence of the species. A more complex assessment can be added to this method and the "Kilometric Abundance Index (KAI)" can be calculated monthly, seasonally and annually and then compared between time periods and between sampling units. In addition, such assessment can be coupled with genetic validation of detected scats, to avoid misidentifications on the field of wild species with domestic species roaming the area like dogs and cats etc. In our case the assessment was limited to the identification of presence of medium sized mammals as richness and listing of species is only required to fulfill the requirement of EIA. In addition, the study was limited to medium sized mammalian species as the small mammalian species (rodents…) require a totally different methodology. As well, it is believed that the small mammalian species are relatively adaptable and not highly affected with the installation of the wind farm. They are highly adaptable and can tolerate certain disturbance. Animal footprints and droppings spotted were measured, photographed, and identified to the lowest taxonomic using three references: Animal Tracks and Signs (Bang 2004), Tracks and Trailcraft (Jaeger 2002), Mammals of North Africa and the Middle East (Stuart 2008).

Night field visits visualized on the map above as the red transect line were planned to follow the vehicles dirt road. But these visits were set aside as direct visual observation of species was covered efficiently by the deployed four motion sensor cameras distributed in different habitats of study area.

Assessing volant mammals

The adopted methodology for assessing species belonging to Chiroptera order requires a different perspective than non-Volant mammals (Horn et al., 2008; Benda & Engekberger, 2016). They are nocturnal species and not easily encountered and identified in the field. Therefore, the surveying team adopted a similar methodology held in 2013. Field visits were held to the known and accessible roosting sites of bats. The first visited cave named "Mqaibly cave" was fairly close to the study area it is consisted of two chambers (**Photo 1-57**). The first chamber is shallow with a total depth of 5 m while the second chamber is wider with a depth of more than 20 m. at the entrance of the Cave a new fire place was observed as caves are used by shepherds as shelters during rainy weather. In addition, personnel communication with locals have revealed the common disturbance by teenagers of the bats community inside caves using fire.

Photo 1-3 Mqaibly cave with its entrances

The second visited cave named “Akroum cave” was relatively far from the study area (**Photo 1-58**). It is consisted of two chambers with a narrow tunnel in between. The cave depth is estimated about 10m. Large amount of empty hunting cartridges were seen at the vicinity of the cave with both old and new cartridges. In addition, a man made dig was observed inside of the cave most probably for treasure hunters known in the area due to its ancient history and archeological remnants.

Photo 1-4 Akroum cave entrance

Camera-trapping

Camera-trapping has been used in recent years as a method to assess mammalian presence and relative abundance in relation to wind farm projects (Nader et al., 2011; Ferrão Da Costa et al., 2018). Four motion sensor cameras were deployed in rocky or wooded spots where mammalian activity is higher than open shrubland dominating the study area (**Photo 1-59**). Cameras were not translocated to allow the animals to get used to the continuous presence of the source of food.

Photo 1-5 Motion sensor camera deployed

Bait in front of the camera was set to attract wildlife to allow visual identification of mammalian species and to further confirm their presence in the study area. A variety of vegetables (fruits such as apple, orange, carrot, nuts and corn) and meat leftovers were used to attract both herbivores and carnivores (**Photo 1-60**).

Photo 1-6 Bait used to attract wildlife

Photos were extracted on a weekly basis in the field. Coordinates of each photo-trapped animal were then downloaded on the mammalian distribution map.

Shepherds investigation

During the field visits held by the surveying team, several shepherds were encountered. Due to their regular daily existence in the area especially in winter and spring seasons, they are considered one of the very few people who have the most knowledge of the mammalian species of the study area. Three shepherds were interviewed about the mammalian species they usually see and how frequent it is.

RESULTS

Eleven mammals were identified through the above described methodology during the survey either through visiting their related roosting sites (caves), identification of feces, or through motion camera photos and shepherds sightings. Domestic animals like goats and dogs were seen on cameras and their dropping were locate all around the study area but were not

counted among the identified wild species (**Figure 1-58**). The surveying team observed the characteristic earth hills of mole rats all over the study area as well the motion sensor camera have spotted mouse species in several spots. The small rodents as mentioned previously were not covered under the scope of this assessment and findings were not included in the species lists.

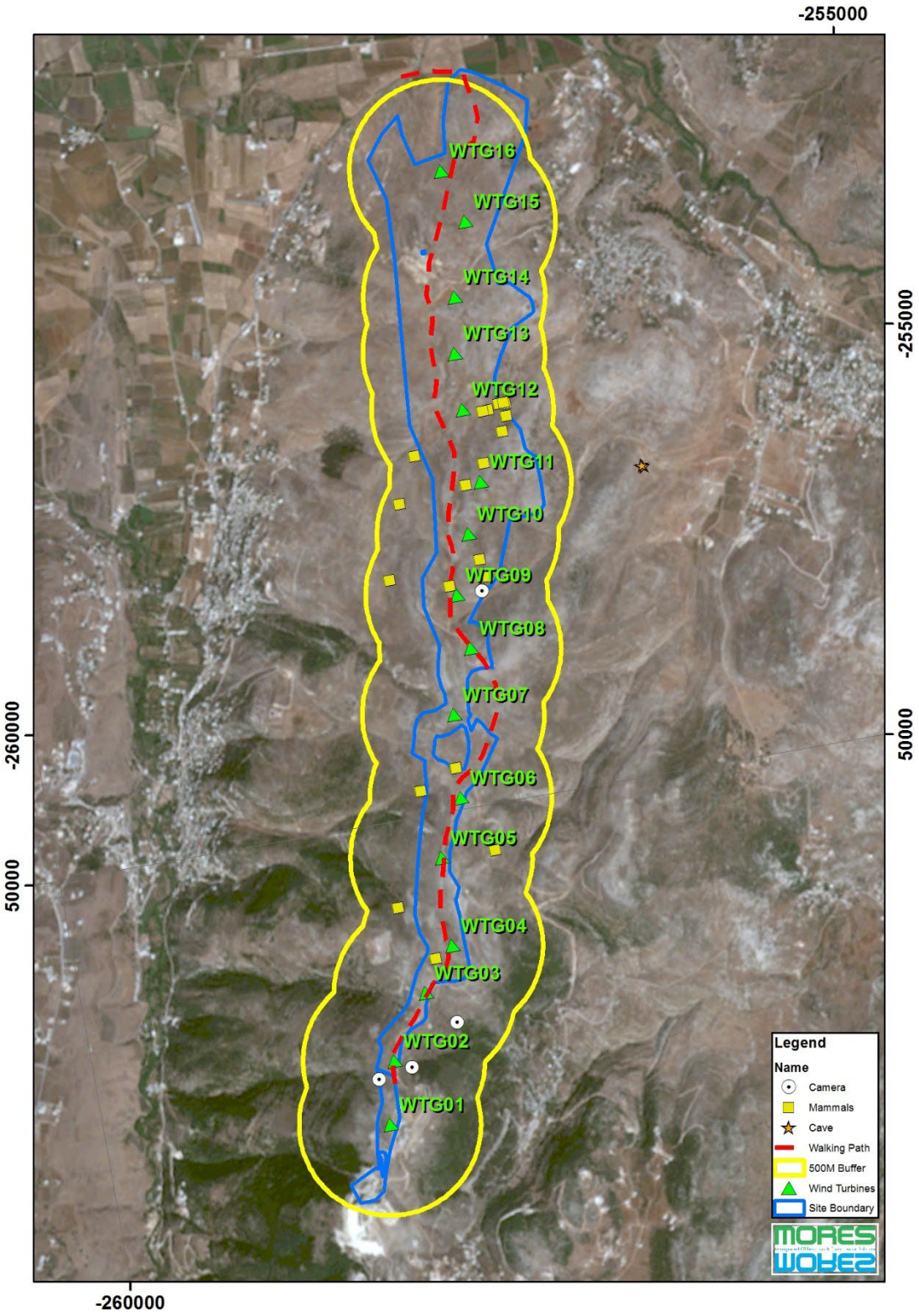


Figure 1-3 Mammalian assessment results

Non-volant Mammals identified

1) **Asian Porcupine** *Hystrix indica*

Common name (Arabic): ألنيص

Photo 1-7 Asian porcupine

Basic Characteristics:

- **Body:** It is the largest rodent in the region; the upper body is covered in long black and white spines and quills. A crest of very long hair extends from the head to the shoulders.
- **Color:** Black and white spines and quills, and black hair.
- **Size:** Shoulder height 25 cm. Almost 1 m in length.
- **Weight:** 10-24 Kg.
- **Dropping:** oblong and slightly curved and tails occur frequently. Its color varies from light brown to black. The animal follows established path leaving feces as a trace.

Behavior: They are nocturnal and can be found in burrows, caves or among the rocks during the day. They are mainly solitary foragers but pairs and family groups are common and can be found sharing burrows. The spines, quills and hairs are all raised when the animal feels danger; this is done to protect it from predators.

Feeding habits: Herbivore: Porcupines feed on a large variety of plants; they dig for bulbs, corns, roots and tree bark.

Natural predator(s): Jackals and hyenas

Sighting: This species was observed on cameras as an individual or as a pair on two different cameras, as well its dropping was recorded. Three shepherds mentioned seeing this species in the study area especially near wooded and agricultural lands.

2) **Cape Hare** *Lepus capensis*

Common name (Arabic): أرنب بري

Basic Characteristics:

- **Body:** Long ears, short black and white tail, very long back legs and soft, dense fur.
- **Color:** Upper part is grizzled to grey-brown but the under part is partly white
- **Size:** 45-70 cm in length
- **Weight:** 1.2-4.5 Kg
- **Dropping:** Regularly round and firm with a diameter of 15-20 mm. Their color varies depending on the diet.

Behavior: Very fast moving, their bodies are capable of absorbing the g-force produced while running at extreme speeds or while escaping predators. They are mainly nocturnal and solitary, but at favored or productive feeding sites several may be seen together. They do not burrow like rabbits but lie up in bush or grass cover or shelter in small depressions dug in the soil.

Feeding habits: Herbivore Mainly grass eaters.

Natural predators: Fox, wolves, raptors, wild cats, jackals

Sighting: The cape hare wasn't taken by camera neither its dropping were found, but it was mentioned by two shepherds. It is worth to mention that both herders emphasized that the cape hare numbers were lower compared to what it was a decade ago.

3) Eurasian Badger *Meles meles*

Common name (Arabic): غُرَيْر

Basic Characteristics:

- **Body type**: Heavily built with coarse and rough hair with a relatively short tail. Its feet are short and stubby with long claws adapted for burrowing.
- **Color:** Upper part is grizzled grey. The head is characterized by two longitudinal black stripes beginning at the muzzle and broadening posterior with a median white stripe. Under part and legs are very dark black
- **Size:** Shoulder height 65-80 cm
- **Weight:** 10-34 Kg
- **Dropping:** Dry and sausage-shaped, or soft and runny, depending on the diet. Contain insect remains, fur from small rodents, seeds and berries

Behavior: It digs for most of its food with its long, powerful claws on its front feet. Badgers excavate large and often complex burrow systems, frequently among tree roots and often on slopping ground. Their family groups are called *clans.* They are nocturnal, but will lie outside den entrances during the day. During severe weather, such as snow storms they may remain in their dens for weeks and even months.

Feeding habits: Omnivore: Earthworms, Small rodents, Rats, Moles, Fruits, Bird's eggs

Natural predators: Humans, wolves, jackals

Sighting: The Eurasian Badger wasn't taken by camera neither its droppings were found, but it was mentioned by three shepherds.

4) Golden Jackal *Canis aureus*

Common name (Arabic): إبن آوى

Photo 1-8 Golden Jackal

Basic Characteristics:

- **Body type:** Skull is similar to that of a dog, but it has larger canines.
- **Color:** Pale golden-brown coat with a little bit of black and grey hair on the back and sides. Tail tip is always dark or black.
- **Size:** Shoulder height 35-50 cm, 60-90cm in length.
- **Weight:** 6-15 kg.
- **Dropping:** Contains remains of fruits, insects and bones for small rodents.

Behavior: Occupy a wide range of habitats, from forests to deserts, from sea level to high altitudes. Jackals can be nocturnal or diurnal depending on the season and the level of human disturbance. Jackals are found together in places where food is abundant, up to 20 jackals can be found together, but these gatherings would be temporary. Several animals may cooperate in the hunting of large prey. When a pair mates they mate for life and together defend their territory.

Feeding habits: Omnivores: Fruits, Insects, Rodents, Carcasses, Fish

Natural Predator(s): Humans, wolves

Sighting: The Golden Jackal photos were taken by two cameras.

5) Red Fox *Vulpes vulpes*

Common name (Arabic): ثعلب أحمر

Photo 1-9 Red Fox

Basic Characteristics:

- **Body type:** Long bushy tail with a white tip, and large dark ears.
- **Color:** Grayish-russet to yellowish-grey coat with a dark dorsal band running from the tail to the head.
- **Size:** Shoulder height 30 cm, 52-66 cm in length.
- **Weight:** 4-10 kg
- **Dropping:** Sausage shaped, 8-15 cm long, 2 cm thick, spirally twisted and pointed at one end. Color varies from black to grey depending on the diet. Contain fur, feathers, and bone fragments from rodents and birds. They might often contain chitin from insects.

Behavior: The red fox is found in a wide range of habitats, but tries to avoid desert areas. They can often be found around human habitats and agricultural lands. Although it is mostly nocturnal, animals can be active during daytime hours. Their dens are usually dug on the sides of hills in protected areas.

Feeding habits: Omnivores: Fruits, Insects, Rodents, Reptiles

Natural Predator(s): Wolves

Sighting: The Red Fox was the most common species in the area, seen live on the first visit by the surveying team, as well its droppings were recorded in several spots (**Photo 1-64**) and its photos were taken by motion sensor cameras. In addition an active den was found with two entrances indicating that this species in a resident in the study area (**Photo 1-65**).

Photo 1-10 Red fox dropping

Photo 1-11 Red fox active den with 2 entrances found

6) **Stone Marten** *Martes foina*

Common name (Arabic): نمس

Basic Characteristics:

- **Body Type**: Slender and agile carnivores. Long and bushy tail (about 25cm).
- **Color**: Coat is uniform chocolate brown except for a lighter throat patch.
- **Size:** 85-110 cm
- **Weight:** 1-2 Kg
- **Dropping:** 8-10 cm long 1.2 cm thick, sausage-shaped, twisted and pointed. Contain fur, feathers, bone splitters and in late autumn berry remains.

Behavior: Stone martens are known to den in rock crevices, boulder clusters, burrows excavated by other species and hollow trees. Most activity takes place at night, but they will move at dusk and dawn in undisturbed areas. Mating takes place in midsummer but fertilized eggs are not implanted at that time and births are delayed until the following spring. Litters of 3-4 young are the norm.

Feeding habits: Omnivore: Smaller mammals, Earthworms, Small to medium-sized birds, Fruits, Eggs

Natural Predators: Raptors, wolves

Sighting: The Stone Marten was a common species in the area, its droppings were recorded in several spots even though its photos wasn't captured using motion sensor cameras (**Photo 1-66**). Pine marten was mentioned in the previous mammalian assessment but its presence wasn't identified in the actual survey.

Photo 1-12 Stone marten dropping

7) **Striped Hyena** *Hyaena hyaena*

Common name (Arabic): ضبع مخطط

Basic Characteristics:

Body type: Shoulders higher than rump, large head, long pointy ears and a relatively long bushy tail.

Color: Buff grey coat covered by transverse black stripes, and rings on the legs.

Size: Shoulder height 72 cm, 85-130 cm in length.

Weight: 20-50 kg.

Dropping: contains hair and bone fragments, mainly chalky and calcium-rich feces. They are deposited in special areas called "latrines" usually at a certain distance from the den.

Behavior: The hyena prefers dry areas that are often associated with rocky outcrops. The majorities of the striped hyenas are solitary animals but are often found in pairs. They are opportunistic hunters and feed on a wide range of animals. Striped hyenas greet each other by sniffing each other's noses and extruded anal pouches. When fighting, striped hyenas bite and attack the throat and legs.

Feeding habits: scavenger: Animal carcasses

Sighting: The Striped Hyena droppings were recorded in one spots (**Photo 1-67**). Shepherds mentioned that this species is becoming less common. They indicated where the striped hyena was seen a year ago and this is where the dropping below was found.

Photo 1-13 Striped hyena dropping

8) **Grey Wolf** *Canis lupus*

Common name (Arabic): ذئب

Basic Characteristics:

- **Body type:** A large predator, at first glance wolves has the appearance of a German Shepherd Dog except that they are longer in the leg and have large paws.
- **Color:** Color predominantly grey or grey-brown, young animals may be mistaken for Golden Jackals.
- **Size:** Shoulder height 60-70 cm.
- **Weight:** 15-55 kg.
- **Dropping:** Long and dark colored, and contains a large amount of fur.

Behavior: Occupy a wide range of habitats, from forests to arid areas, from sea level to high altitudes. Grey wolves are mainly nocturnal and less frequently diurnal depending on the season and the level of human disturbance. Wolves are pack animals with the size of the family depend on food availability.

Feeding habits: Carnivore: Wild boars, Rodents, Insects, Carcasses and domestic stock where natural prey numbers have been depleted.

Natural Predator(s): None, persecuted by humans

Photo 1-14 Grey wolf dropping

Sighting: The Grey Wolf droppings were recorded in one spots (**Photo 1-68**). Shepherds mentioned that this species is becoming less common for several reasons mainly human persecutions and disturbance.

9) **Wild Boar** *Sus Scrofa*

Common name (Arabic): خنزير بري

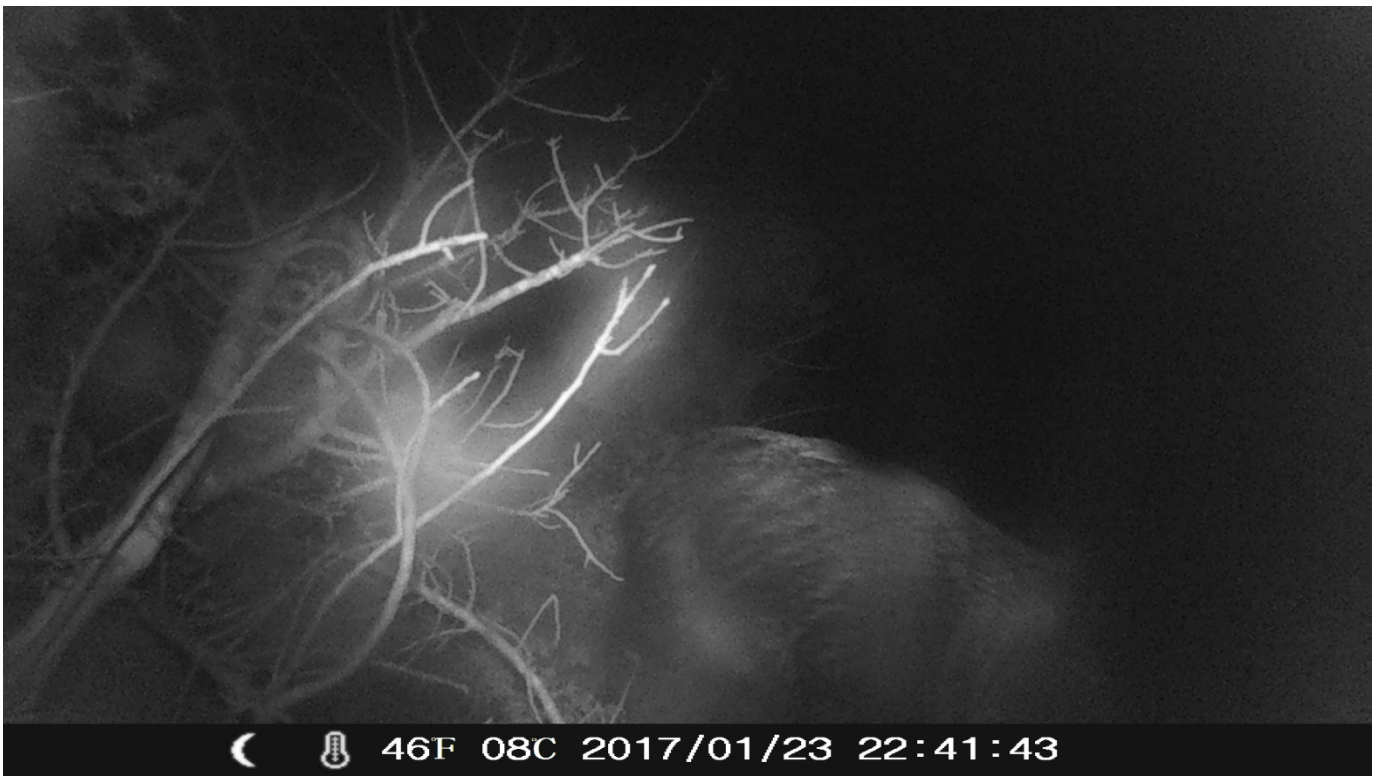


Photo 1-15 Wild boar

Basic Characteristics:

- **Body type:** Large typical pig, elongated forehead with muscular broad long snout, relatively short tusks. Ears are erect, pointed and large. Tail relatively short.
- **Color:**
  - Piglet: Soft brown with longitudinal dark stripes
  - Adult: Grizzled grey or brown.
- **Size:** 120–180 cm in length and around 90 cm shoulder height
- **Weight:** 50-90 Kg
- **Dropping:** Sausage shape, consisting of elongated balls, stuck or more or less fused together.

Behavior: Wild boars live in groups called *sounders*; these groups typically contain 20 animals. The wild boar is usually crepuscular, foraging from dusk till dawn but with resting periods during both night and day. Adult males are not part of the sounder outside of a breeding cycle, and are usually found alone. Birth, called farrowing, usually occurs in a secluded area

away from the sounder; a litter will typically contain 8–12 piglets. Wild boar is the only hoofed animals known to dig burrows.

Feeding habits: Omnivore: They eat anything they come across including grass, nuts, berries, carrion, roots, insects and even young lambs.

Natural Predator(s): Wolves, Humans (hunting)

Sighting: The wild boar photos was recorded on cameras. In addition, shepherds mentioned that this species was scarcely seen. It is located especially in wooded area and near village's agricultural land and dumpsites.

The shepherds' investigation revealed that large species such as wolves and hyenas were more abundant before but not anymore even though they still see them from time to time. They explained that hunting persecution and the arrival of the army and the training they frequently do, these animals became less. In addition, one of the shepherds gave more details by explaining that before predators used to cohabitate with large herds and follow them during their seasonal transhumance. They used to feed on dead goats or sheep or even try to hunt some of them. Transhumance is the traditional seasonal migration of herd between highlands in summer/autumn to lowlands in winter/spring seeking pastures and grazing land. This ancient practice is still common in Lebanon including the study area considered as a wintering ground for herds. But this interrelation between predators and herds have changed according to shepherds, it might be due to the abundance of butchers leftovers thrown near village that these animals may be feeding on. As well this might be due to the population decrease of predators due to human persecution, habitat destruction and disturbance.

Volant mammals

1) **Greater mouse eared bat:** *Myotis myotis*

Basic Characteristics:

- **Body type:** Relatively large compared to other members of its species in the area, back is covered with brown fur. Large ears with very prominent tragus
- **Color:** White belly, the lower part of its body is yellow and its back is covered with brown fur.
- **Size:** Body length reaches 7.7 cm, its tail around 6 cm.
- **Weight:** From 18 to 45 g

Behavior: Inhabits woodlands and roosts in caves and abandoned buildings, fly in a slow and straight line. Females congregate during pregnancy in great numbers that can reach up to tens of thousands but the group disperses again at the onset of summer.

Feeding habits: insectivore: Unlike many bats it does not capture prey by echolocation in flight but instead gleans it from the ground, locating the prey passively – listening for the noises produced by creatures such as carabide beetles, spiders and centipedes

Natural Predator(s): Owls, humans (hunting)

Sighting: greater mouse eared bat have been encountered and photographed in both caves

Photo 1-16 Greater mouse eared bat

2) **Greater horseshoe bat:** *Rhinolopus ferrumequinum*

Basic Characteristics:

- **Body type:** The largest bat among horseshoe bat species in the region, with big ears and very small eyes. There are three bones in each of its claws with the exception of the first claw which has only two bones. Male and female continue to live together during the whole year.
- **Color:** Dark grey
- **Size:** Broad wings measures 37 cm, body 6 cm, tail 4 cm
- **Weight:** from 16 to 28 g

Behavior: Live in large groups in caves, fortresses and uninhabited places. While roosting greater horseshoe bat keep certain distances with other bats inside the cave.

Feeding habits: insectivore: greater horseshoe bat starts to search for its food at night later than other bats. It returns to its hideouts to eat what it hunts. Chases insects up to a height of six meters above ground, it hunts in region designated by it which it visits continuously.

Natural Predator(s): Owls, humans (hunting)

Sighting: Greater mouse eared bat have been encountered and photographed in both caves

Photo 1-17 Greater horseshoe bat

DISCUSSION AND MITIGATION MEASURES

During the surveys the team faced several challenges like rainy weather conditions, rocky grounds covered with dense spiny bushes which makes finding footprints and droppings a hard task. On the other hand, the area is under different stresses due to anthropogenic activities like army trainings and patrolling, wood cutting, and intensive grazing. Therefore, and based on the field surveying and direct observations, It is found that the shrubland showed a low mammalian activity which might be due to its low floral diversity, lack of water sources and food, absence of shelter and existing disturbance. Few ground holes of small rodents were seen but as mentioned above, this group of species was excluded from the assessment due to their demanding of a totally different methodology. For these reasons the shrubland is not an attractive habitat for mammals.

The highest number of droppings and valuable camera photos caught by motion sensor cameras and dens were found near forested lands existing at the edges of the study area.

Certain large carnivore species especially the Grey wolves (Least Concern, according to IUCN red list) and Striped Hyenas (Near threatened, according to IUCN red list) have wide territories and therefore in-depth 12-month study on their populations in the surrounding areas is highly requested in order to evaluate the actual status and the evolution of the population dynamics and its reaction to the upcoming modifications in the area. While other smaller carnivore species like Golden Jackals (Least Concern, according to IUCN red list) and Red Foxes (Least Concern, according to IUCN red list) have smaller territories and occupy different habitats with a wider diet. In addition, the other species as the Eurasian Badger (Least Concern, according to IUCN red list), Stone Marten (Least Concern, according to IUCN red list), Cape Hare (Least Concern, according to IUCN red list), Wild Boar (Least Concern, according to IUCN red list) and the Crested Porcupine (Least Concern, according to IUCN red list) can have a different behavior under stress according to the characteristics of each species. Nevertheless, the focus of this study was to assess the richness of mammalian species of the area as it does not allow the conclusion on population's status and dynamics. The forested lands need to be correctly managed and maintained against above listed stresses as it might attract a rich mammalian species. The study area can play the role of a vital and protected corridor between the agricultural plains in the lowlands of Akkar and the rich forested lands in the upper part of Akkar.

Regarding the existing species of bats, they are considered an essential part of the ecosystem and they feed mainly on invertebrates. The previous mammalian assessment identified four species of bats Greater horseshoe bat (*Rhinolophus ferrumequinum*), lesser horseshoe bat (*Rhinolophus hipposideros*), greater mouse-eared bat (*Myotis myotis*), and *Myotis capaccinii*. While during this update the mammalian richness have listed two species with a remarkable lesser density, Greater horseshoe bat (Least Concern, according to IUCN red list) and Greater mouse eared bat (Least Concern, according to IUCN red list). It's worth mentioning that both caves are located in distant zones of the study area and one of them (Akroum cave) is way far from the core area of the project as well this mountainous area include many unknown inaccessible crevices that can host the colonies of these species. According to references, the Greater horseshoe bat species is oriented during its flight and hunts using the infra sound and therefore it is highly affected by acoustic disturbance. On the other hand, the other species can fly and hunt with or without its echolocation. In the case of these highly active species, it is recommended to hold an in-depth study on the population status and dynamics as we cannot conclude about its real status in Lebanon due to the lack of a national holistic biological study. The study should elucidate the feeding grounds and the seasonal migration patterns as they will highlight the daily and the seasonal flight routes. This will help to understand the level of disturbance of these works on the life cycle of these species. The installation of wind turbines with the noise pollution created and the obstacles that might interfere with their flight routes can cause serious stress to the species and can cause

additional mortalities through collision. In case of the identification of a defined major migratory flight route crossing the core zone of the project the location, functionality and direction of the turbines must take it into consideration.

The effects of wind farms on mammals can be due to habitat destruction and fragmentation during construction; acoustic and visual disturbance from the turbines in operation; and the increase in the vehicle circulation along the road network of the project. Disturbance from traffic, will have significant results especially during the construction phase, in contradiction with the initial situation when the study area, located in a remote mountain ridges, was mostly inaccessible to vehicles (before the arrival of the army).

Based on these findings, several mitigation and compensation measures can be suggested to attenuate wind turbines impacts, such as:

- It is highly recommended to reduce the light pollution at night to avoid the attraction of insects and consequently additional numbers of foraging bats. Therefore, this will reduce the probability of collision with the blades of the turbines.
- Mortality monitoring due to collision with turbines or human activities must be continuously observed and reported for future interventions. The use of thermal infrared (TIR) cameras is recommended to assess the nocturnal behavior of bats and birds at wind turbines as this technology allows the observation of these species independently of light sources.
- The noise pollution and obstacles created by the turbines will affect the behavior of the bats residing or feeding in the area. The EIA team recommends an in-depth 12-month study to assess the flight and feeding behavior of bats to be able to draft a solid conclusion.
- Limiting the access of the road network built for wind power development in order to reduce traffic and direct human disturbance.
- Create a water pond that collect water run off of the constructed roads. Such initiatives can reduce the possibility of any damage due to water run offs and the pond will be attractive for wildlife as well as it will be considered as a prevention against forest fires.
- Rehabilitate the destructed zone where construction where held using native wild plants species to re-create an attractive area for wildlife.
- Protection of identified dens during the two accomplished surveys in addition to any new den that be located during construction site.

Mammalian species identified are usually adaptable species, and their ability to coexist with humans for centuries in a landscape as human-dominated as Lebanon has been the key factor allowing their persistence despite intense human persecution. However, mammalian species can cope with humans to a certain level and in the context of an increasing anthropogenic interference on habitats, the recent wind farm development can become a major concern when other cumulative factors also occur. Further research and monitoring on the effect of wind farms on mammals is needed after the installation of wind turbines. Population dynamics, densities and mortalities must be a part of the monitoring programs conducted in the post-installation phase and will provide valuable insights on the concerns and recommendations that should be taken into account when developing wind farm projects.

This EIA assessment combined with the nearby studies held for similar wind farm projects in the adjacent areas can be compared and analyzed giving a holistic image of the mammalian richness of the area. The areas targeted by different wind farm companies are interlinked with natural existing corridors. Species populations will surely interact therefore mitigation measures can be fine-tuned and be more efficient if a collaboration initiative is held for effective results for both mammalian species and the future of wind farms in Lebanon.

Table 1-1 Species index

English Common Name	Arabic Common Name	Species Scientific Name	Type of Identification			
			Scat	Track	Picture	Shepherd sighting
Asian Porcupine	النيص	*Hystrix indica*			x	x
Cape Hare	أرنب برّي	*Lepus capensis*				x
East European Hedgehog	كبابة شوك / قنفذ	*Erinaceus concolor*				x
Eurasian Badger	غُرير	*Meles meles*				x
Red Fox	ثعلب أحمر	*Vulpes vulpes*	x	x	x	
Stone Marten	نمس	*Martes foina*	x	x	x	
Striped Hyena	ضبع مخطط	*Hyaena hyaena*	x			
Wild Boar	خنزير برّي	*Sus Scrofa*				x
Wild Cat	قطّ برّي	*Felis silvestris*				x
Gray Wolf	ذئب	*Canis lupus*	x			x

Mammals and Reptiles

The current study is a preliminary quick survey that focuses on obtaining data on mammal diversity and highlights any environmental concerns that might arise from the implementation of this project. Accordingly, a very rapid assessment was conducted to have a rough idea and an estimate idea on the mammals that are present on the project site, to be able to oversee any mitigation measures that could be considered.

This rapid study aims at drawing a preliminary database on the mammals present in the site, assessing the conservation value of mammals' diversity, identifying risks of the wind turbines on mammal species present and defining mitigation measures to eliminate or decrease their effect.

MATERIAL AND METHODS

RRA/PRA Methods

Information on local knowledge about mammal diversity was collected from focal group discussions, and from individual interviews from the different villages, Namely Chaddra, Wadi Khaled, Aqaibe, and Akroum, within the site.

The RRA/PRA method used in this study was based on (Chambers 1992) and (Bernard 1995).

Focal group discussions were conducted at the start of the survey with elderly residents in different villages to establish facts on:

Faunal species that were and are present
Population trends

Field Survey:

Reptiles

The study of reptiles and amphibians was conducted using information from previous field work and species records in the literature. Reptiles are cold blooded animals that hibernate the whole winter hence field surveys could not be conducted during this time.

Mammals

Transects Method:

The preliminary study was conducted as follows.

1- During daytime surveys, each area was visited on foot (Plate 1) to search for caves or dens, footprints, tracks and faeces of animals, owl pukes and,

Photo 7-18 Transect survey on foot

2- Night surveys commenced using a 4x4 vehicle (Plate 2). A powerful spot light was used to scan for eye-shine. The pace was slow to increase the chances of sighting the animals.

During surveys a 1-1.5 million candle power spotlight was available to illuminate animals once their eye-shine had been detected to help with the identification.

Photo 7-19 Night Drives Using Hand-held Powerful Spot light

Photo 7-20 Mammal Scat – at cave Entrance near Mqaibleh Porcupine

Photo 7-21 Animal Remains from Mammal Predation – near Mqaibleh

Photo Trapping:

Photo-trapping equipment consisted of four pre-baited active and passive remote camera traps, triggered by both heat and motion, were tied to a tree 40-60cm above ground (Plate 3). However, one camera was stolen hence we had the results from three cameras only. The cameras were programmed to take photographs 24hours/day with a 2-minute interval between photos, and to record date and time on each photograph. The bait used consisted of butchery leftovers, apples and corn seeds (Plate 4). A chosen area selected randomly to discover if mammals were present and where they were moving. However, the work periods were too short to allow detailed preliminary surveying to be carried out and a proper photo-trapping programme to be established; instead the imperative was to get all the traps set as quickly as possible in the first suitable locations in the hope of securing some results. Photos were downloaded on weekly intervals from the camera traps (Plate 5)

Photo 7-22 One of the Camera Traps that was Used in Monitoring Mammals

Photo 7-23 Bait Used in Camera Trapping

Photo 7-24 Downloading the Photos from the camera Trap in the Field

5 new trail cameras were used in 2018 in the field to capture images of mammals including bats

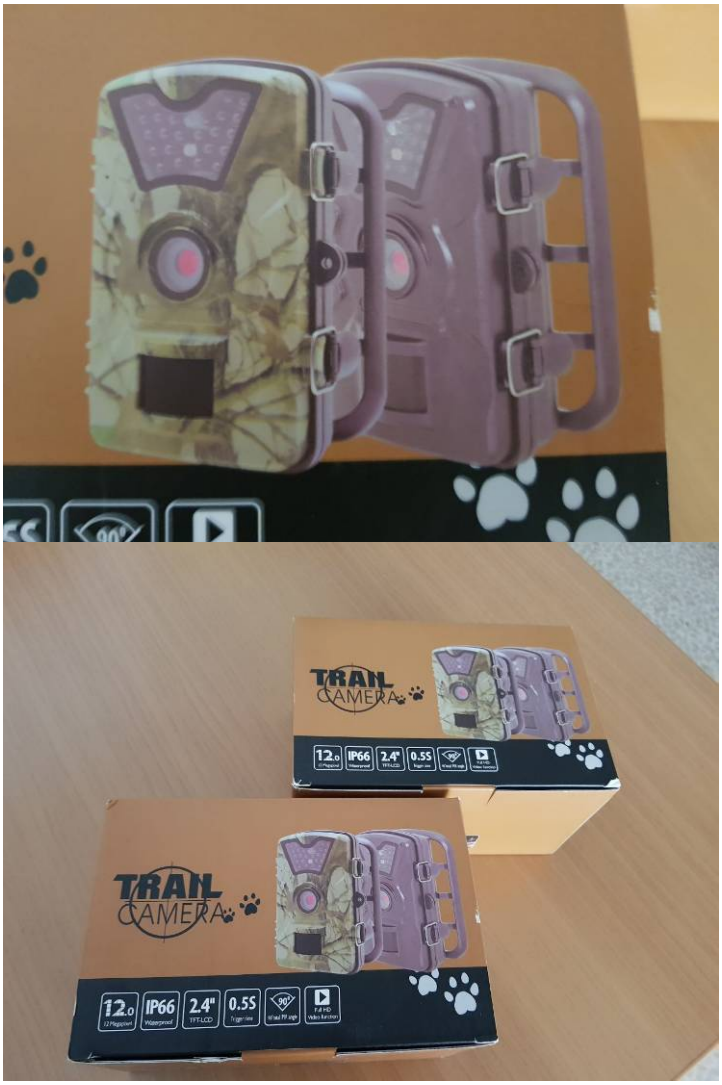


Photo 7-25 Trail Cameras used in the Field in 2018

Installation of cameras:

- Project site (middle zone) in Chadra
- Project site (immediate zone) in Mqaibleh
- Project site (middle zone) in Machta Hammoud
- Cave near Mqaibleh with long-eared bats
- Cave near Akroum with long fingered bats

Rotation of cameras between the caves and open land to cove different locations

Add Map – GPS points from Mazen

Photo 7-26 Map Showing Location of Installation of Trail Cameras as Photo Traps

Bat survey:

The study was conducted in December-January where there is no bat activity therefore, to study bat we have to locate their hibernating roosts. Hence, to locate hibernating roosts we depended on local knowledge of caves and roosts besides searching on our own for caves, roosting sites (Plate 6) and old houses. However, this survey remains incomplete and further search for hibernating roosts and monitoring of bats should be carried out after hibernation.

Photo 7-27 One of the Caves that was Visited during the Survey

Photo 7-28 One of the Caves that was Visited during the Survey (2018)

Photo 7-29 One of the Caves that was Visited during the Survey (2018)

Photo 7-30 One of the Caves that was Visited during the Survey (2018)

Photo 7-31 One of the Caves that was Visited during the Survey (2018)

Data recording

Data describing each direct and indirect animal sign was recorded. Data recorded included the place where the sign was encountered and in which habitat type it was found. Moreover, photos from the camera traps was dated and digitized.

RESULTS

Completeness of Coverage:

Obtaining accurate data on mammals in this very short period is difficult. Mammals need to be habituated to the bait and the equipment used. Besides the survey was conducted in Fall-Winter where the cold weather affects drastically the activity of many mammals and especially bats that are majorly concerned with wind turbines. Thus time was devoted to purely obtaining preliminary data on the mammal diversity to help in predicting the wind turbine effect on it.

Hence it is suspected that the lack of data obtained is a result of time limitation, season and weather conditions that prevailed during the rapid survey.

Add Map – GPS points from Mazen

Photo 7-32 Map Showing Location of Caves around the Project Area based on Extensive Field Survey

Photo 7-33 Bats Identified in One of the Caves in Mqaibleh

Photo 7-34 Bats Identified in One of the Caves in Mqaibleh

Local Knowledge:

Elderly, teachers, shepherds and hunters from the villages in the study site reported several mammals' species. These included foxes, jackals, wolves, wild cats, hyaenas, porcupine, wild rabbits, stone martin, badgers, hedgehogs, and bats of different sizes.

A 25 year-old shepherd from Chaddra informed about the mammals present in the site area

"The area is full of foxes, jackals and pine martin but large carnivores like wolves, hyaenas are found but in low numbers because of hunting. Porcupines are present and you can find wild rabbits but these as well are decreasing in number due to hunting. Wild cats are scarce but you can find them. As far as domestic animals you may find goats mainly in the area plus of course a lot of stray dogs"

Mr. Rabih Rostum a 35 year-old from Chaddra said

"In our area we used to have different kinds of mammals ranging from foxes to jackals, hyaenas, badgers, hedgehogs, martins as well as different kinds of bats that we used to see at

sunset. Porcupines are also present Badwins used to hunt them with their dogs. However, most of these mammals are now decreasing due to urbanization and persecution"

Another 65 year-old shepherd from Kfartoun said

"Hey hey there was a lot of beast in the past but not these days anymore. In the past we used to encounter wolves, hyaenas, big cats, foxes, jackals, wild rabbits… but these days most of these have gone because of people and what we are left with are foxes, jackals sometimes you can see a hyaena"

Mr. Bilal a 30 year-old worker from AlHeesheh said

"The area is a home for different mammals including hyaenas, foxes, jackals, hedgehogs, porcupine, stone martin, and two kinds of bats of different sizes one small and one large that we used to kill them using fire in the caves. The mammal population did not change it is probably still the same"

Mr. Ali a 43 year-old worker from Mqaybleh said

"In the forest of our village you can find some wild mammals like foxes, jackals, striped hyaena and to kinds of bats one big and the other small. However, there were much animals in the past but now they decreased a lot. This decrease could be due to the change in the environment as a whole "

Reptile Species:

The Akkar region is similar to many parts of Lebanon at the same altitude. Due to the period and season of the survey and weather conditions that were not in favor of observations, snake and other species listed are the most likely to be found but more species could be present that have not been observed. Therefore, the species list can likely be expanded based on further field observations. The list of the reptiles and amphibians that are likely to be present in Akkar region and the project area are shown in **Table 7-1**. This list is based on specimens in the Natural History Museums, AUB, some literature, and on speculation based on the local climate and habitat type. This list could not be finally confirmed unless it is verified and expanded by field investigations during the warm season where they become active.

Table 7-2 Amphibian and Reptile Species Reported (c= common, r = rare, endemic or endangered)

Family - Reptiles	*Species*	Common English Name
Lacertidae	*Phoenicolacerta laevis*	Common wall lizard
	Lacerta media	Green lizard

Scincidae	*Chalcides ocellatus*	Ocellated skink
	Eumeces schneideri	Skink
	Trachylepis vittata	Brown skink
Agamidae		Agama, Hardun
Chamaeleonid	*Chamaeleo chamaeleon*	Chameleon
ae		
Gekkonidae	*Cyrtopodion kotschyi*	Kotschy's gecko
	Hemidactylus turcicus	Turkish (house) gecko
Anguidae	*Pseudopus apodus*	
Amphisbaenid	*Blanus strauchii*	
ae		
Typhlopidae	*Typhlops vermicularis* [r]	Worm snake
Colubridae	*Malpolon monspesslanus*	
	Platyceps najadu [r]	Dahl's whip snake
	Dolichophis jugulari [c]	
	Eirenis spp.	
	Telescopus fallax	Mediterranean cat snake
Viperidae	*Macrovipera lebetina* [c]*; Daboia palaestina*	Vipers
Caudata Salamanders	*Salamandra infraimmaculata* [c]	Fire salamander
Ranidae	*Pelophylax bedriagae* [c]	Marsh frog
Bufonidae	*Bufo viridis* [c]	Toad
Hylidae	*Hyla savignyi* [c]	Common tree frog

Mammal Species:

As it was mentioned earlier due to time limitation this study is not representative of the mammal species that are present. However, within this short time the preliminary survey revealed the presence of 12 species of mammals belonging to ten families (Table 2). Other species are expected to exist. These included hedgehogs, badgers, wolves, and several species of bats and rodents. Examples of the expected bat species could be European free tailed bat,

another Pipistrellus sp., Noctule bat… etc. In addition to wild mammals domestic mammals like goats, dogs, and cats were also encountered.

Table 7-3 List of Mammal Species Present on the Three Sites (R= recorded, c= common, r = rare, endemic or endangered on the National level)

Family	Species	Scientific Name	Species Status
Vespertilionidae	Greater mouse-eared bat	*Myotis myotis*	R, r
Vespertilionidae	Long-fingered bat	*Myotis cappaccinii*	R, r
Rhinolophidae	Lesser horseshoe bat	*Rhinolophus hipposideros*	R, c
	Greater horseshoe bat	*Rihnolophus ferrumequinum*	R, c
Canidae	Jackal	*Canis aureus syriacus*	R, c
	Fox	*Vulpus vulpus palaestina*	R, c
Mustelidae	Pine Martin	*Martes foina syriaca*	R, c
Hyaenidae	Striped hyaena	*Hyaena hyaena syriaca*	R, c
Sciuridae	Squirrel	*Sciurus anomalus syriacus*	E, c
Hystricidae	Porcupine	*Hystrix indica indica*	R, c
Spalacidae	Moles	*Spalax leucodon ehrenbergi*	R, c
Muridae	House mouse	*Mus musculus praetextus*	R, c
	Field mouse	*Apodemous mystacinus*	R, c
Microtinae (Subfam.)	Voles	*Microtus sp.*	E, c

Out of the twelve mammal species, four bat species were encountered namely Greater horseshoe bat (Rhinolophus ferrumequinum) (**Figure 7-1**), lesser horseshoe bat (Rhinolophus hipposideros) (**Figure 7-2**), greater mouse-eared bat (Myotis myotis) (**Figure 7-3**), and Myotis capaccinii (**Figure 7-4**).

Figure 7-4 Greater Horseshoe Bat

Figure 7-5 Lesser Horseshoe Bat

Figure 7-6 Greater Mouse-eared Bat

Figure 7-7 Long-fingered Bat

In addition to bats, three carnivore species were documented; Foxes (*Vulpus vulpus palaestina*), pine martin (*Martes foina syriaca*), striped hyaena (*Hyaena hyaena syriaca*).

Figure 7-8 Red fox

Figure 7-9 Pine martin

Figure 7-10: Striped Hyaena

Moreover, tracks and signs of squirrel (*Sciurus anomalus syriacus*), porcupine (*Hystrix indica indica*) (**Figure 7-7** and **Figure 7-8**), and Moles (*Spalax leucodon ehrenbergi*) (**Figure 7-10**) were encountered as well as three species of small rodents were identified from owl pukes (Figure 11). These were house mouse (*Mus musculus praetextus*) field mouse (*Apodemous mystacinus*) and voles (*Microtus* sp.).

Figure 7-11 Porcupine Quills

Figure 7-12 Porcupine Scat

Figure 7-13 Mole Hills

Figure 7-14 Owl Puke with Lots of Rodents Remains

1.2. Field Report

A field inspection was conducted during November and December 2016 by Mr. Mazen Chbib, local resident and environment expert, to confirm field data and observations obtained before 2016. The field assessment confirmed that the data on environmental conditions as described within this report are current, up to date and correct.

Some of the more prominent field observations are as follows:

Site assessment included taking note of any physical changes within the project environment, such as fires, new roads, excavations, new buildings or residential complexes, new agricultural fields, factories, or other possible developments. The field visits showed that none of the listed modifications were observed, and confirmed the descriptions provided within this report.

An assessment and random/spot check of the floral coverage was conducted, which confirmed the findings of the biodiversity assessment. No tree cutting was observed. Some flower species were late to bloom due to a delay in the rainy season and rain events in 2016.

An expansion of the populated areas in the nearby villages was noted; however, these expansions occurred in the opposite direction or far from the wind farm project area. The agricultural fields, used and unused, remain intact with no changes.

As a conclusion the ecosystem and the biodiversity in the area are the same as mentioned in the original report due the absence of any activities.

The lack of physical change in the ecosystem, or its stability, is a good indicator for animals including mammals and bats. The caves where bats were observed to live and their surroundings fields remain intact.

Areas that were visited on foot in previous monitoring remain unchanged, with no obvious modifications in the land topography or human activities.

No vehicle marks were observed; thus indicating that no hunting vehicles were present in the area during field inspection. Based on feedback from local residents, hunting activities are low.

One of the locations where photo trapping was done, near a monastery, has some ongoing construction works that might be a temporary intrusion.

Footprints and other physical indicators (dug-up roots, patches of fur, etc.) of mammals were identified consistent with the biodiversity assessment.

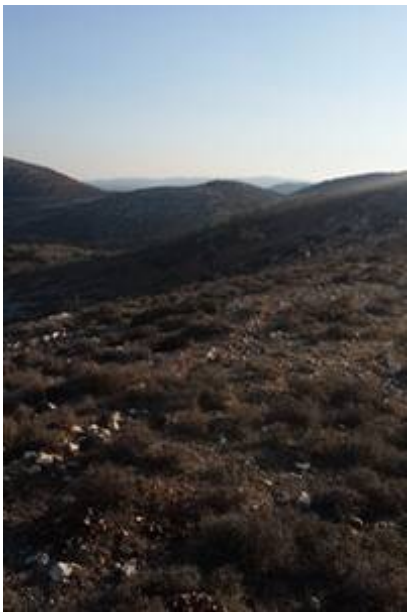


Photo 7-35 Shrubs and Grasses in Project Area (Field Survey 2016)

Photo 7-36 Trees in Project Area (Field Survey 2016)

Photo 7-37 View 1 of Project Area (Field Survey 2016)

Photo 7-38 View 2 of Project Area (Field Survey 2016)

FIRST PROGRESS REPORT ON THE EFFECT OF WIND TURBINES ON BATS AT THE TWO PROPOSED SITES SA AND LWP AKKROUM, AKKAR - LEBANON

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JUNE 2019

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1. INTRODUCTION:

Any source of energy will have its adverse effect on the environment. This effect does not have to be just polluting, it could have direct effect on environment and biodiversity. Wind farm is a fast growing industry of clean renewable energy. However, this clean energy is questionable towards Biodiversity. Many living organisms that are directly influenced by wind energy farms are the aerial species, mainly birds and bats. In Lebanon, establishing a wind energy farm project has its great impact and benefit with great potential in providing clean and affordable energy which is badly needed for the country. However, this energy should be weighed and should not be on the expense of biodiversity. Hence, the overall objective of this study is to draw a baseline information on bat species and their activities over the two proposed sights SA and LWP, while the main objectives are to collect

1- Baseline information on bat species present
2- Baseline information on their activities (Passes/night/WTG)

2. METHODS:

For this survey we followed the method recommended by "*Bats and Onshore Wind Turbines: Survey, assessment and Mitigation Vr. 2019*" (https://www.nature.scot/bats-and-onshore-wind-turbines-survey-assessment-and-mitigation). Two approaches were used

1- Passive Survey
2- Active Survey

2.1 Passive Survey

We selected 19 location on both sites. Nine location at SA including two Mets and 10 locations at LWP including one Met. To maximize the benefit from the installed bat detectors and to cover both sites at the same time interval, we divided both sites into lower area (including WTG 1 – WTG 10 for SA and Met LWP – WTG 11 for LWP) and upper area (including 2nd Met – WTG 25 for SA and WTG 15 – WTG 23 for LWP) depending on the elevation of each site. The detectors were distributed randomly for the lower parts due to the inaccessibility to the wind turbine (WT) location and the still undetermined locations of some wind turbines.

The Anabat Swift Passive Bat Detectors were used and programmed to start recording calls from 18:30 to 06:30. The detectors were installed in different habitats ranging from oak forest, conifer

forest, to bare land (Plate 1). The altitude installment of the microphone was 30m on the met and 1.5m to 3m depending on the available attachment for the microphones on the ground.

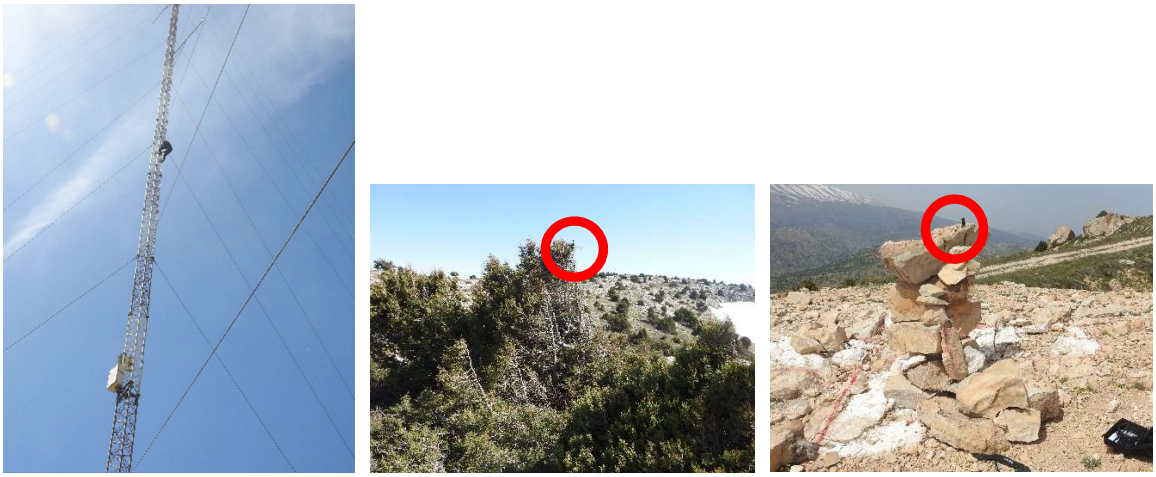


Plate 1. Attaching the Microphone of the bat detector at the Met and others were attached to either at the tree top or attached to a stack of stones, on bare lands,

The Anabat Swift Passive Bat Detectors were installed for 10 nights according to the following schedule:

1- Eight bat detectors were distributed at the lower areas for both sites (3 at SA and 5 at LWP) from May 05 – May 15, 2019) (Figure 1) and, one bat detector was installed later at SA2 from 25 May – 03 June 2019 to cover as much of the lower area

2- Ten passive bat detectors at the upper areas of both sites (5 at SA and 5 at LWP) from May 15 – May 25, 2019 (Figure 1.)

Data from the bat detectors were downloaded from the detectors at the 10th day for later analysis.

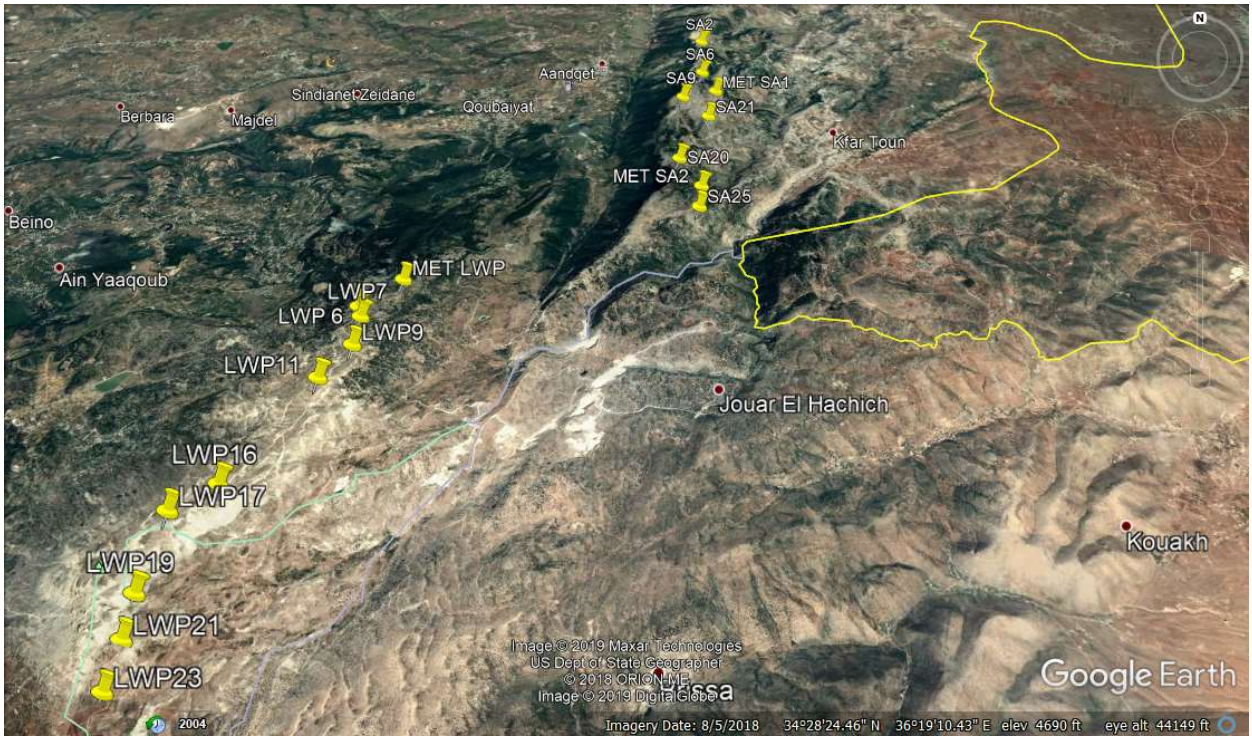


Figure 1. Location of the Anabat Swift Passive Bat Detectors at SA and LWP sites

2.2 Active Survey:

Three active 2-night surveys (drives) were conducted on the evening of (16 – 18 May, 24 – 28 May, and 1 – 3 June) using the Anabat Walkabout Active Detector. We monitored bat acoustic activities during crepuscular and nocturnal hours (one hour before sunset to sunrise). This schedule was selected to cover the period when bats are active. The active survey was conducted using a 4x4 car and driving along the track of the potential wind turbine locations in both SA and LWP at a speed of 20km/hr with 3 minutes stops at each proposed location (Plate 2). Any bat call detected was saved and wind speed, temperature and location were recorded, for later analysis. The night drives were divided into two periods and switched between SA and LWP

a- From sunset to midnight
b- From midnight to dawn

Plate 2. Three-minute stop at one of the sites at LWP (measuring of wind speed and recording of bat calls).

2.3 Data Collection:

The downloaded data collected from both active and passive detectors were analyzed using Analook and Anabat Insight Program. We defined each recording by both passive and active detectors as a bat call or bat pass, using both terms interchangeably. The data were filtered/cleaned and bat calls were identified to the species level. Echolocation call characteristics were compared to reference library of known bat calls. It is worth mentioning that *Myotis* species were identified to the best of our knowledge. However, any misidentification if occurred it will not affect the recommendation and the mitigation measures as they are applied to all *Myotis* species. Some recordings were identified as bat calls but not to the species level, hence they were coded as Unid.

Bat activity was measured as the number of calls (passes)/detector/night.

Bat passes represents indices of bat activities and not the number of individual bats.

3. RESULTS:

3.1 General Bat Activity

All detectors recorded usable data for the whole 10-day period in both sites. Although the cable of the microphone on the SA Met 10 was cut but we were able to retrieve data for the first eight nights. It is worth mentioning that data from the Mets were analyzed with the data from other detectors since for the time being we were concerned about bat passes at each location.

The 190 passive bat detector-days resulted in ca. 140,000 recordings out of which 14,831 were bat calls. A total of 10,972 calls were recorded at the SA with an average of 1214.1 calls/night/detector (range 106 – 4489); and 3904 calls were recorded at the LWP site with an average of 390.4 calls/night/detector (range 49 – 1095). Most calls were identified to the species level and very few were unidentified. Twelve bat species were detected:

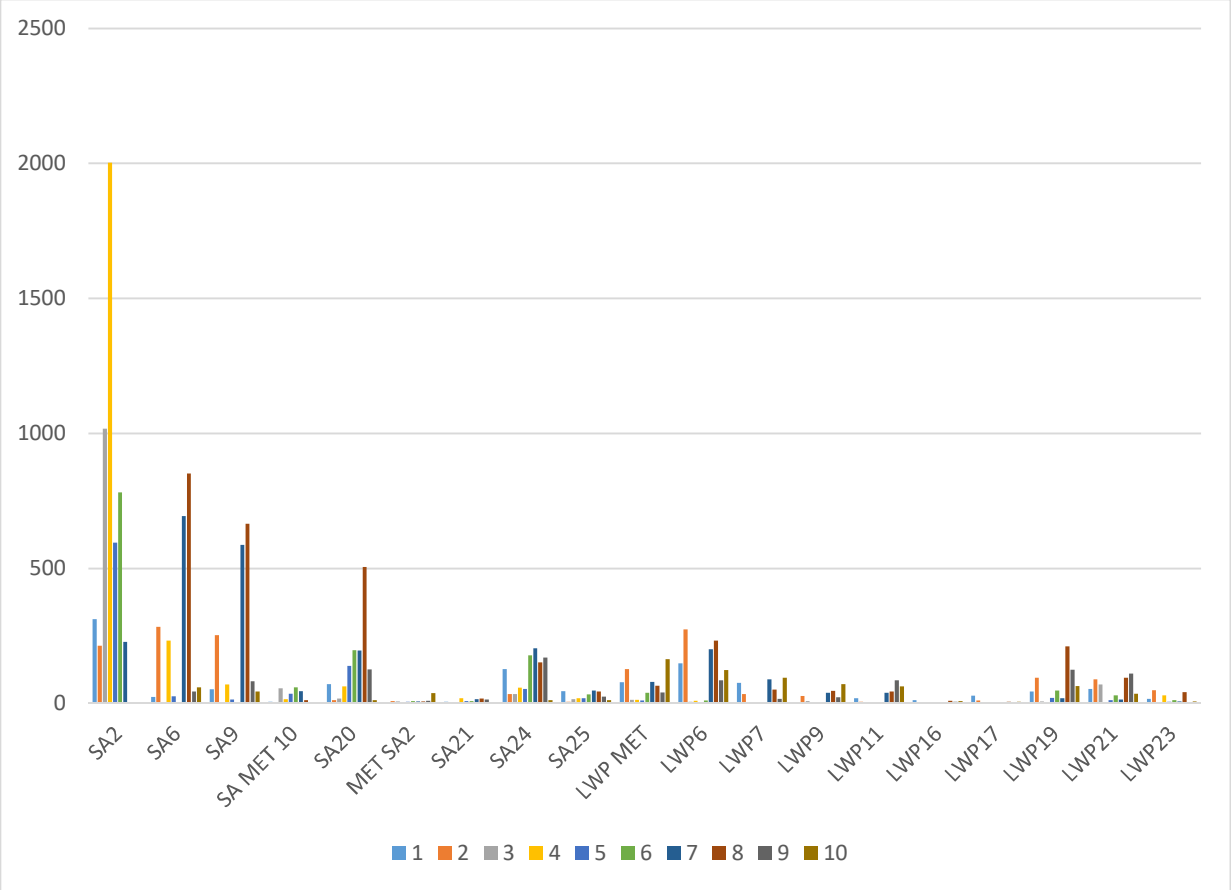
P. pipistrellus (Cpip), *P. Kuhlii* (Kpip), *H. savii* (Spip), *E. serotinus* (Serotine), *N. noctula* (Noctule), *T. teniotis* (Tada), *R. ferrumequinum* (GrHoSh), *R. hipposideros* (LeHoSh), *M. shreibersii*, ca. 3 *Myotis spp* (Myo) probably including (*M. myotis* (MyoMyo), *M. mystacinus* (MyoMys), *M. capaccinii* (MyoCa)).

Of the identified bat species *M. capaccinii* is vulnerable and two *R. ferrumequinum* (GrHoSh), *M. shreibersii* (MiSh) are Near Threatened in the Mediterranean according to IUCN redlist. The rest of the species are of Least Concern. Nonetheless, in Lebanon most of the bat species are threatened due to the diverse risks they face such as habitat destruction, pesticide, direct kills…

3.2 Passive Survey

3.2.1 Bat Activity/Site

Bats were active throughout the duration of monitoring in both sites (Graph 1). Total bat passes differed within site and within location in each site. Furthermore, bat calls differed within nights in each location. At the SA site bat calls ranged from 1 to 2003 calls/night (Table 1), while, at the LWP they ranged from 0 to 233 calls/night. (Table2).



Graph 1. Total bat passes for 10 nights in both sites SA and LWP

Table 1. Total bat passes for 10 nights at the SA site

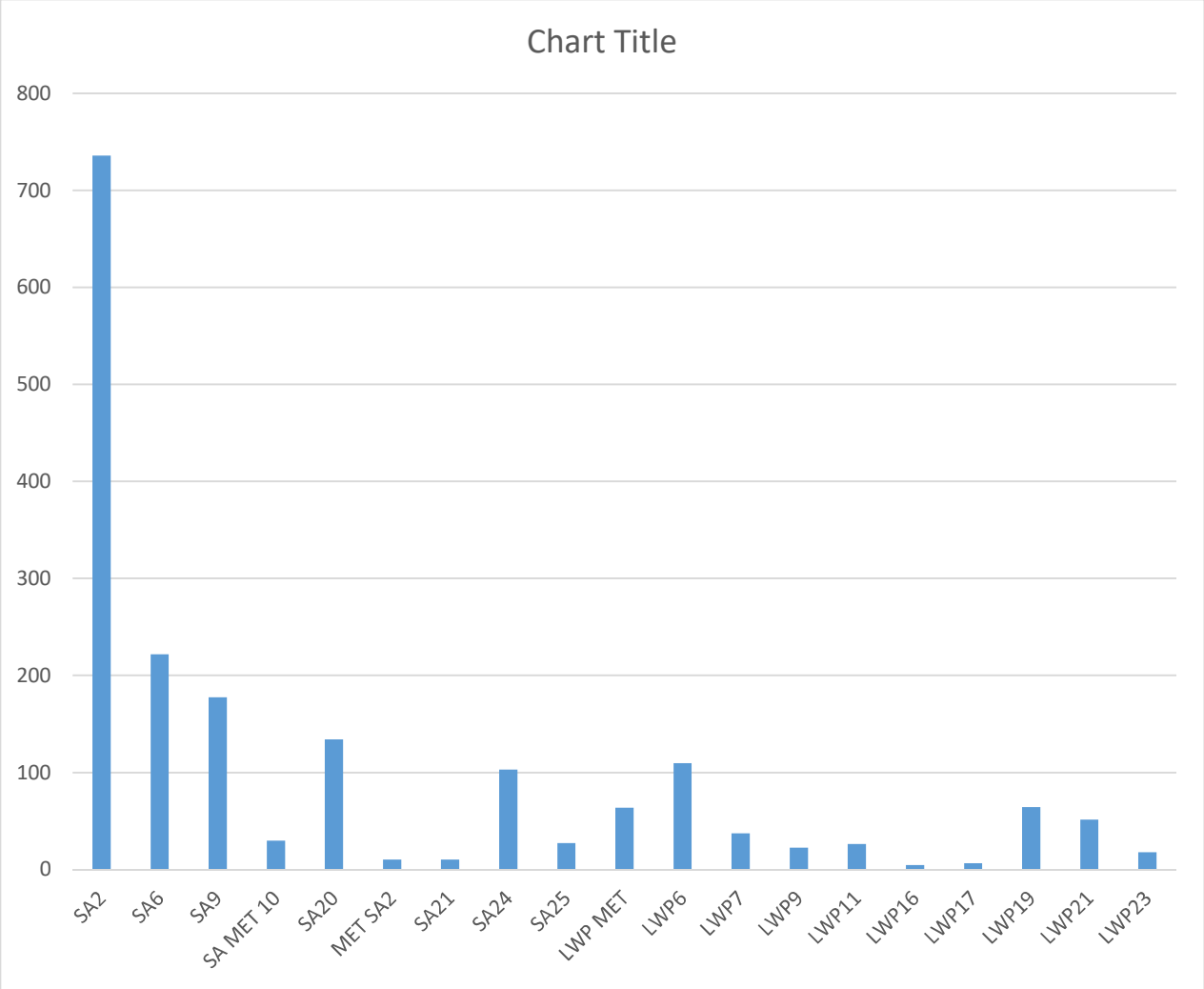
	SA2	SA6	SA9	SA MET 10	SA20	MET SA2	SA21	SA24	SA25
1	312	24	53	7	72	5	6	128	46
2	214	284	253	4	12	9	3	35	7
3	1018	1	1	56	18	8	4	35	16
4	2003	233	71	16	63	2	20	59	20
5	596	27	15	36	139	6	9	54	19
6	782	0	3	60	197	9	9	179	34
7	228	694	587	46	196	8	16	205	48
8		852	666	13	506	8	18	152	45
9		45	82		126	10	15	170	26
10		60	44		12	39	1	13	12
Av./Night	736	222	178	30	134	10	10	103	27

Table 2. Total bat passes for 10 nights at the LWP site

	LWP MET	LWP6	LWP7	LWP9	LWP11	LWP16	LWP17	LWP19	LWP21	LWP23
1	79	149	77	0	20	12	29	44	54	17
2	128	274	35	28	7	4	11	96	89	49
3	14	6	0	9	0	0	0	8	70	0
4	14	10	5	0	2	0	3	3	2	30
5	11	2	0	0	0	3	1	21	13	6
6	40	11	1	5	1	0	1	48	30	12
7	80	201	89	40	40	1	3	20	15	8
8	66	233	52	47	44	10	7	212	95	42
9	41	86	17	23	86	6	5	125	111	5
10	164	124	96	72	64	9	6	65	36	8
Av./Night	64	110	37	22	26	5	7	64	52	18

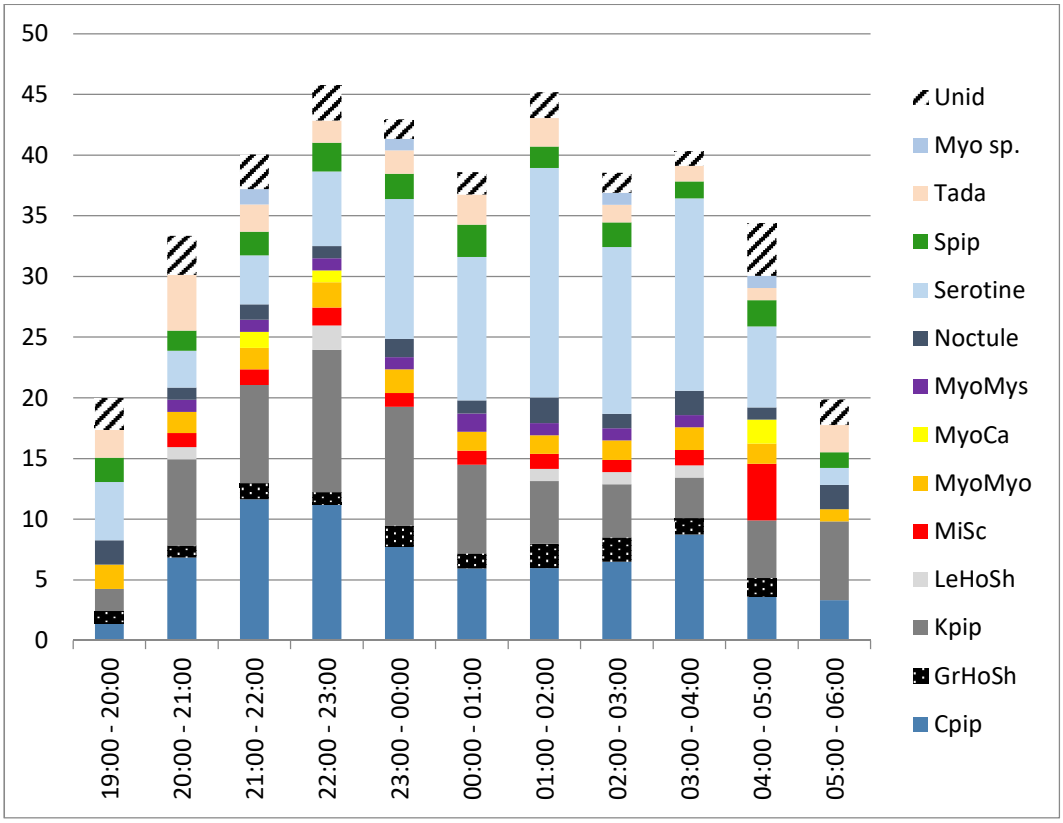
3.2.2 Bat Activity/Location

Mean activities for all bats varied among location of the bat detectors with the highest mean activity being at SA2 (736 calls/night) and the lowest at LWP16 (4.5 calls/night) (Graph 2). Furthermore, there was variation in mean bat activity within site. The highest mean activity at the SA site was at SA2 (736 passes/night) and the lowest at the MET SA2 and SA 20 (ca. 10 calls/night) (Table 1). The highest mean activity at LWP was at LWP Met and LWP19 (ca. 64 calls/night) and the lowest at LWP16 and LWP17 (4.5 and 6.6 calls/night respectively) (Table 2).

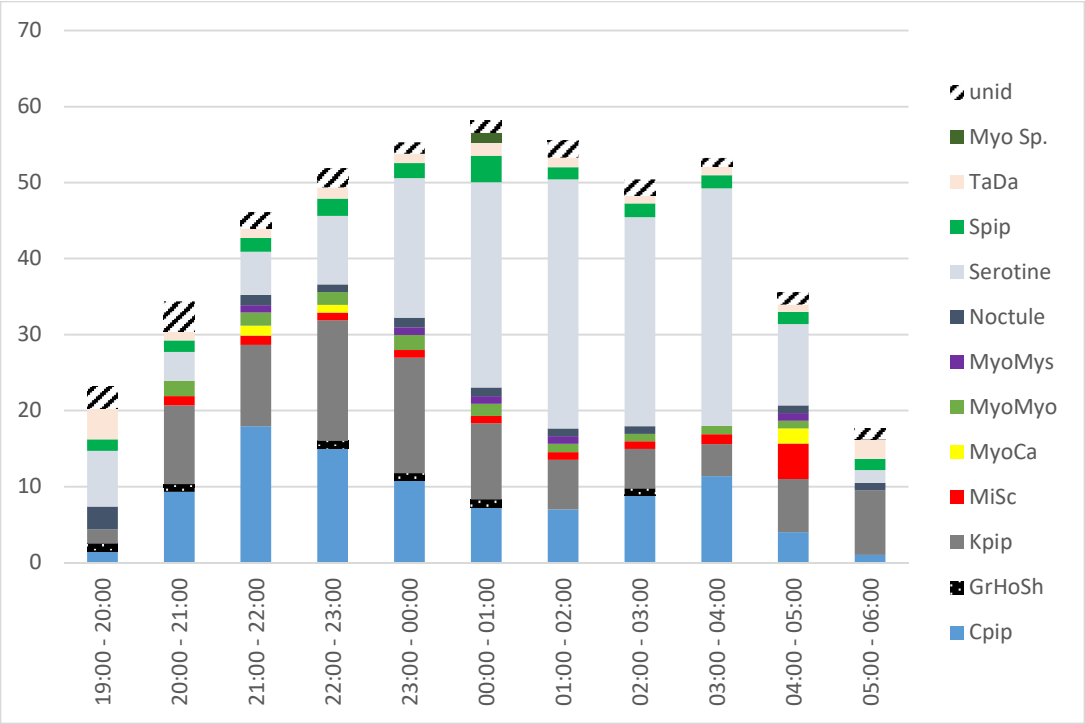


Graph 2. Mean activity of all bats across the location of two sites (SA and LWP)

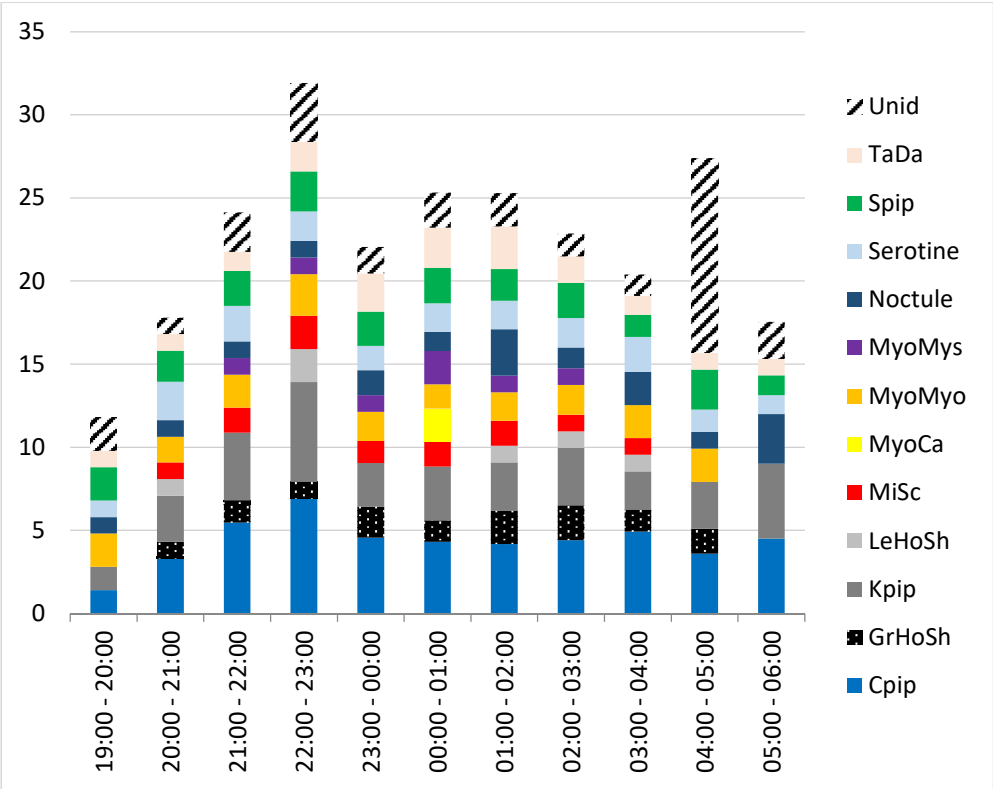
Even though bats were active through the night, yet, their mean activities differed among nocturnal hours. Mean peak nightly activity stretched over 2 hours (22:00 - 23:00) after sunset and 3 hours (01:00 – 02:00) before sunrise (Graph 3). Furthermore, species activity differed on hourly basis where most *Pipistrellus* spp has the highest mean activity between 22:00- 23:00 hrs while serotine has the highest mean activity between 01:00 – 02:00 and Tada has a constant mean activity between 22:00 – 03:00 hrs. (Graph 3). Mean hourly bat activity among the two sites SA (Graph 4) and LWP (Graph 5) followed the same trend



Graph 3. Mean hourly activity of bat species



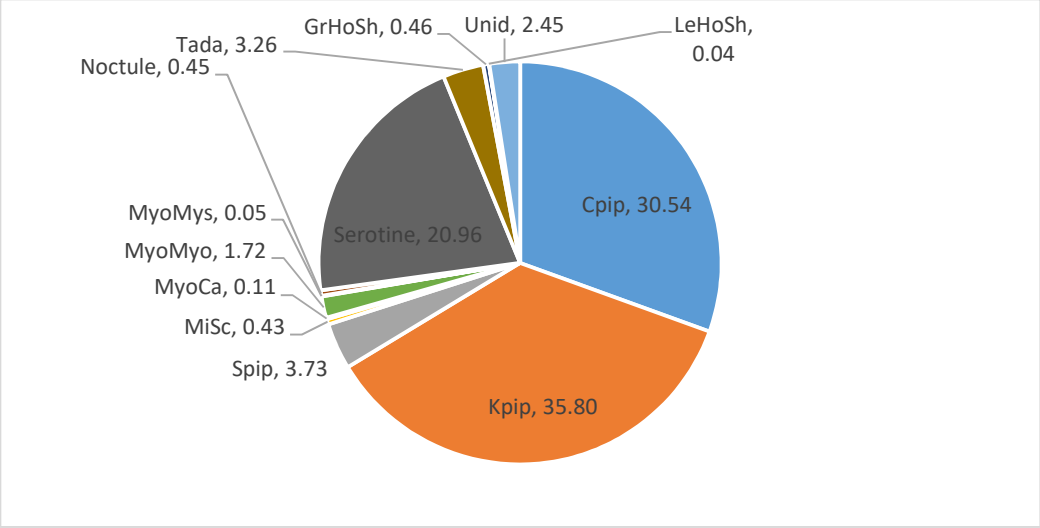
Graph 4. Mean hourly activity of bat species at the SA site



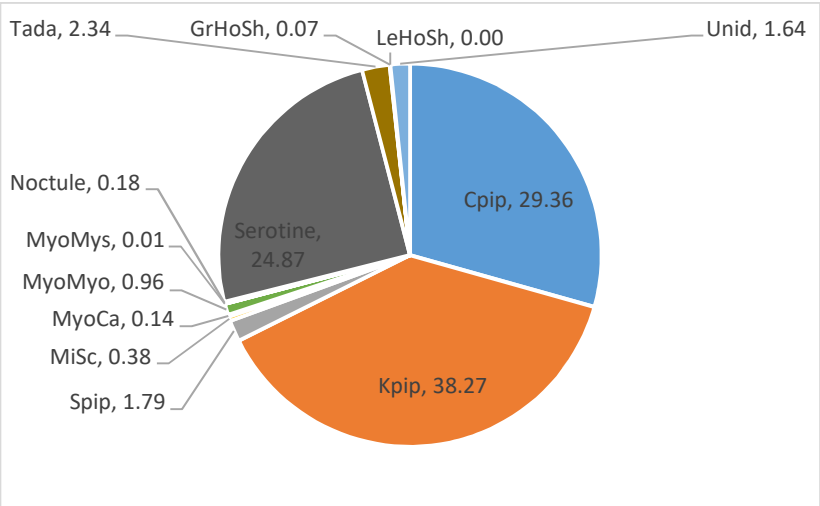
Graph 5. Mean hourly bat activity at the LWP site

3.2.3 Bat Species:

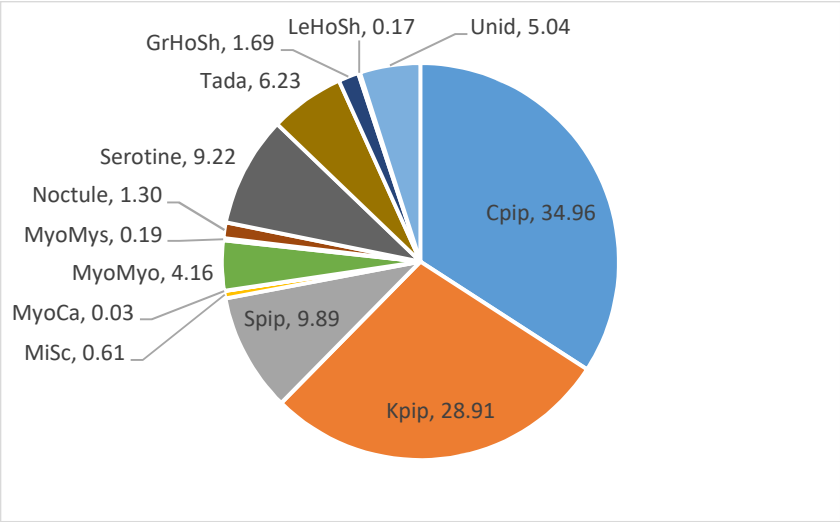
Among the 12 bat species recorded, *Pipistrellus Kuhli* (Kpip) and *Pipistrellus pipistrellus* (Cpip) were the two most commonly recorded species (35.80 and 30.54% respectively) at all the locations of the passive bat detectors in both sites. While, *M. mystacinus* (MyoMys) and *R. hipposideros* (LeHoSh) were least recorded (0.05% and 0.04%, respectively) (Graph 6). Percentage of bat passes by species recorded differed within site. Kpip had the highest (38.27%) percentage of bat passes among all bat species at the SA site (Graph 7) while, Cpip had the highest passes (34.96%) among all bat species at the LWP site (Graph 8). Bat calls differed also within detectors in each site (refer to Appendix A and B)



Graph 6. Percentage of all bat calls by species recorded in both sites (SA and LWP)



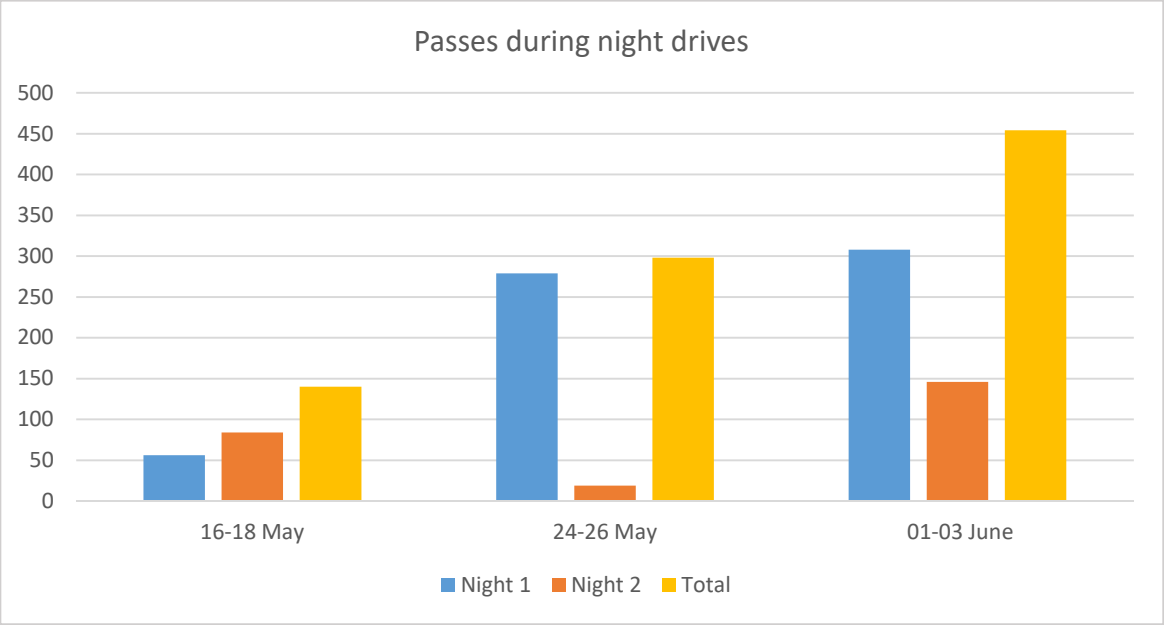
Graph 7. Percentage of all bat calls by species recorded at the SA site



Graph 8. Percentage of all bat species by calls recorded at the LWP site

3.3 Active Night Survey (Drive):

During the active survey a total of 883 bat passes were recorded over the three night drives belonging to six species *P. pipistrellus* (Cpip), *P. Kuhlii* (Kpip), *H. savii* (Spip), *E. serotinus* (Serotine), *T. teniotis* (Tada), and *M. myotis* (MyoMyo). The number of bat calls showed an increase trend over time. A total of 140 bat calls were recorded at the first night survey (16-18 May) and increased to 2988 and 454 bat passes at the second (24-26 May) and third night drive (1-3 June) respectively (Graph 9).



Graph 9. Number of bat passes recorded during the three 2-active night surveys

The number of bat passes during the night survey varied depending on the location. The number of bat passes varied from null to multiple on some wind turbine (WT) proposed location or on the transects between locations. Using GIS symbology property, each night was given a specific point (red circle indicating Night 1 and green triangle indicating Night 2 and have the point increase in size in proportion to the number of calls recorded in that area (Figure 2, 3, 4). In general an increase in overall number of recordings from May 16-18 to June 01-03 with more spread out points in June. The spread of the bat calls showed relatively high consistency between night 1 and night 2, especially during June 01-03 where the points more or less were superposed. Nonetheless, the number of recorded bat passes were influenced by the time that each site was visited and climatic conditions. This was clear in the number of recording in night 1 and night 2 of 16-18 May were less than that of night 1 of 24-25 May but more than night 2 of 24-25 May that recorded the least number of passes (2 passes at SA).

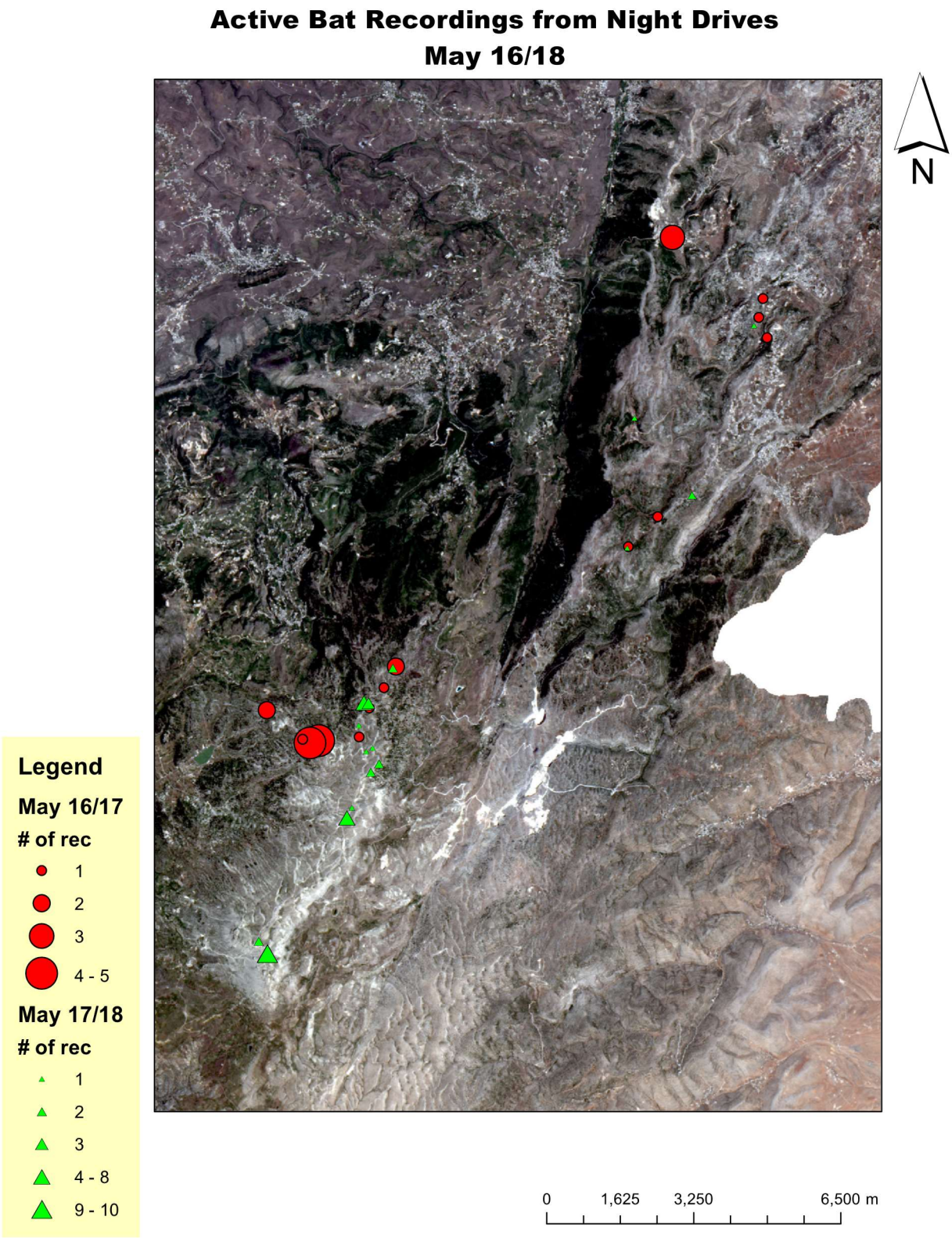


Figure 2. Bat calls and their location during the first night drive 16 – 18 May

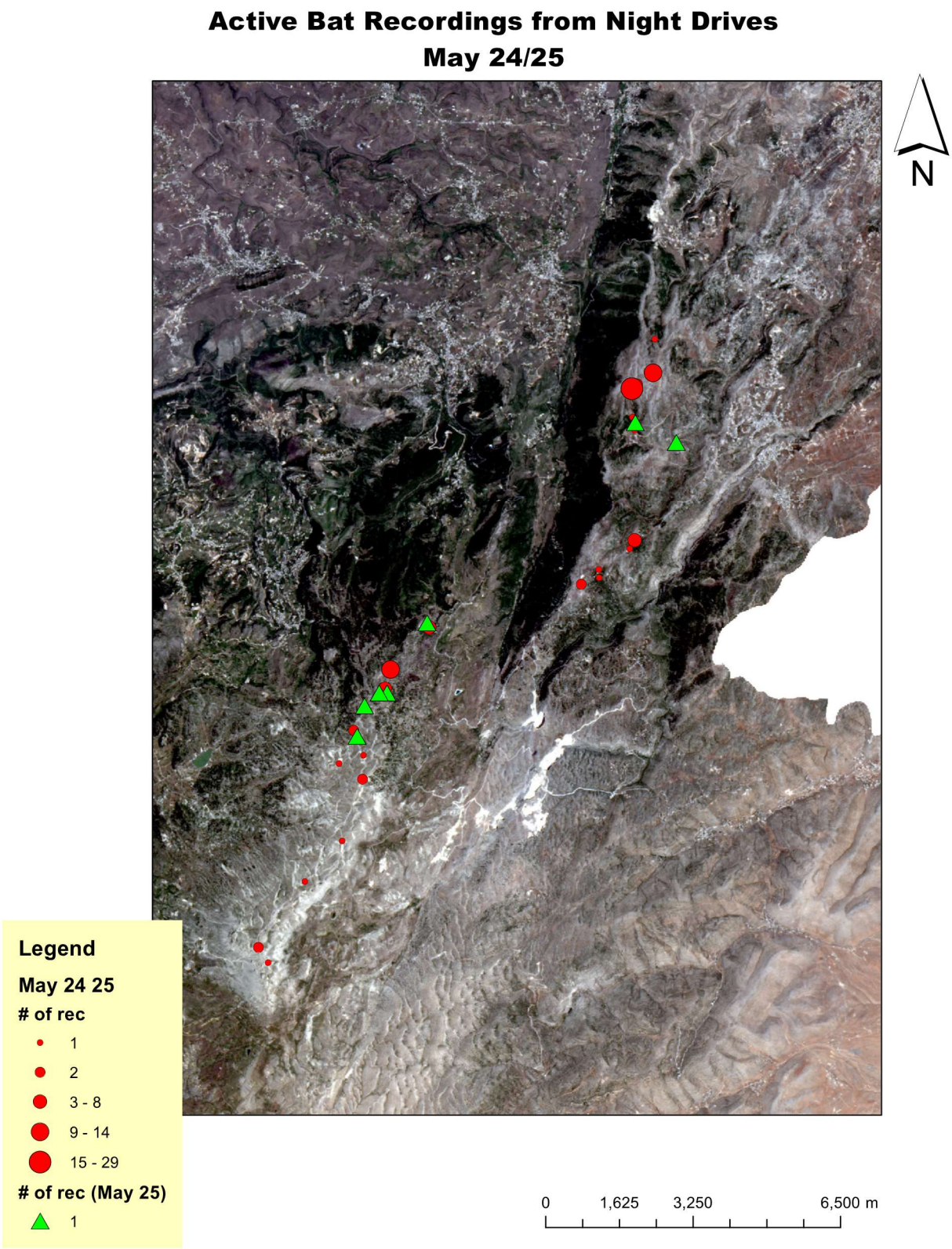


Figure 2. Bat calls and their location during the second night drive 24 – 26 May

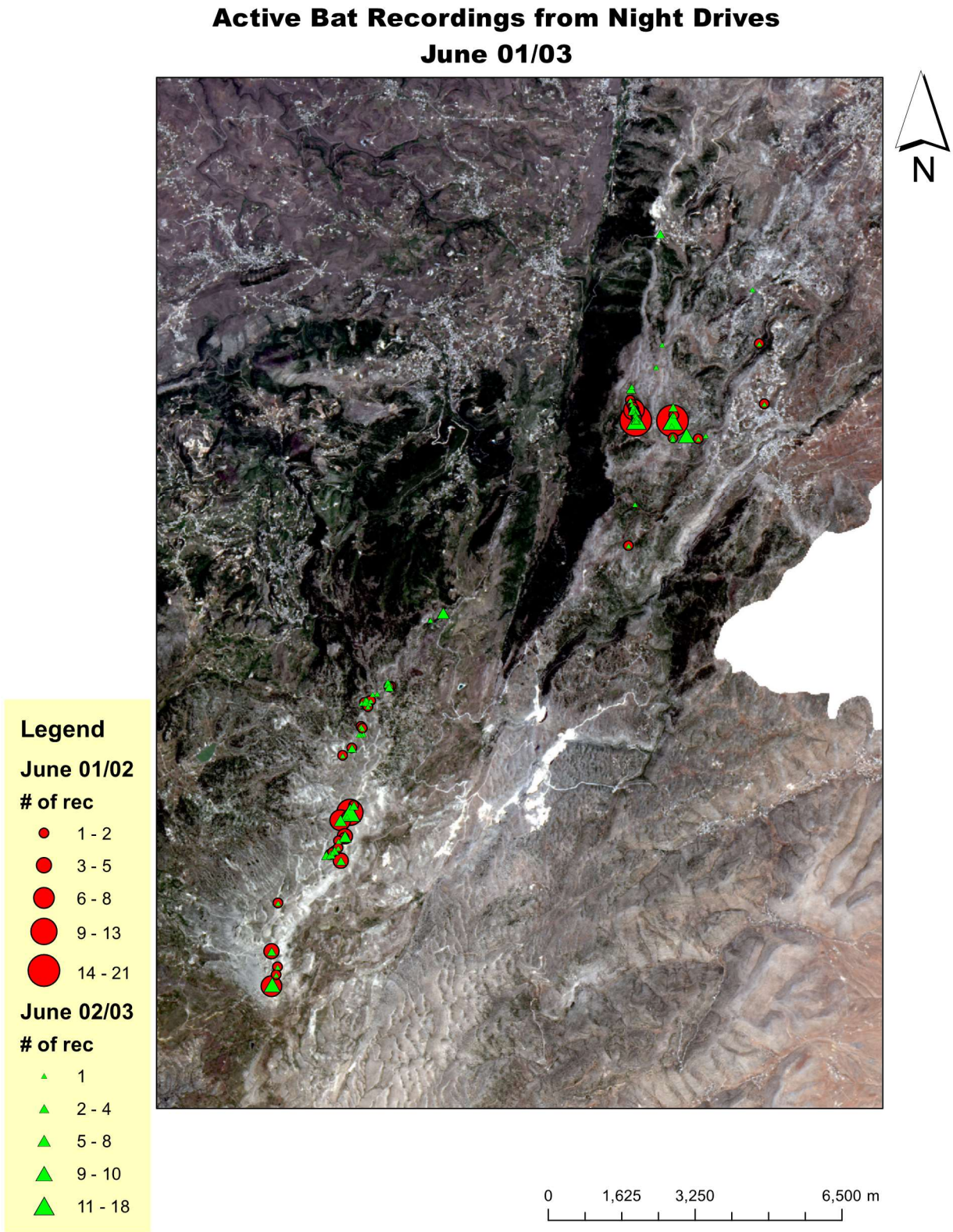
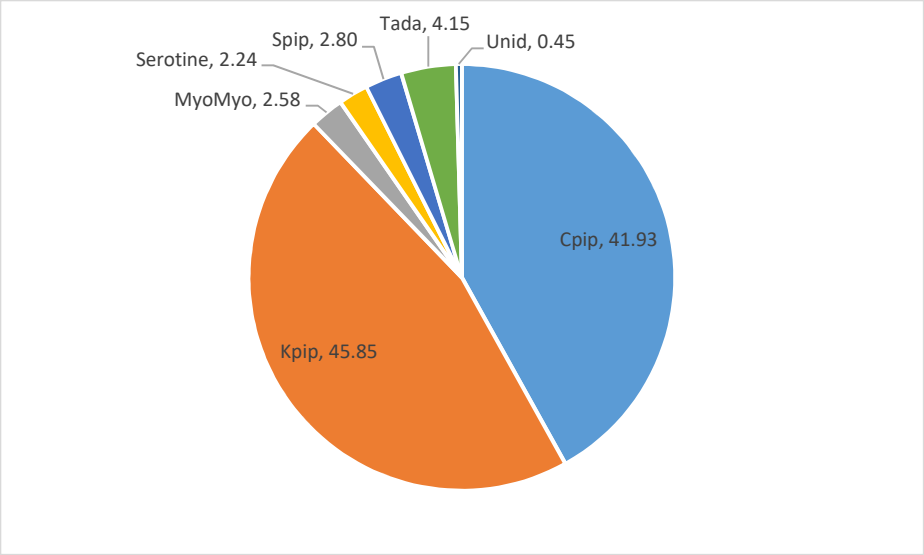


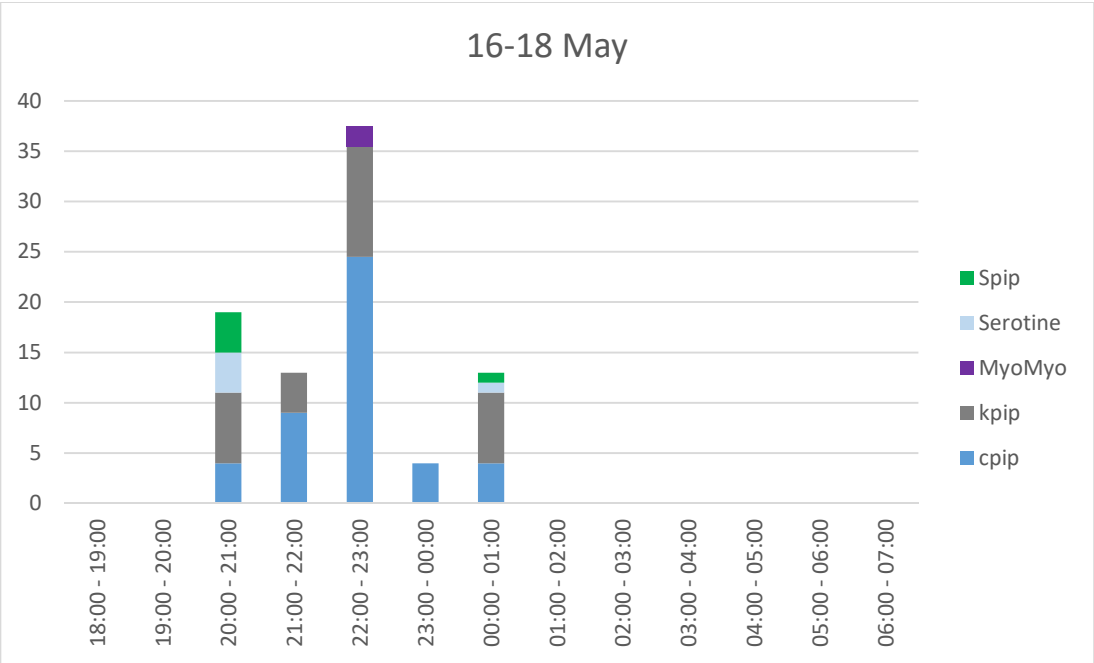
Figure 3. Bat calls and their location during the third night drive 1 – 3 June

Out of the 892 bat calls recorded over the three night surveys, Kpip recorded most (45.85%) of the passes followed by Cpip 41.93% while, serotine bats recorded the least (2.24%) number of bat passes (Graph10)



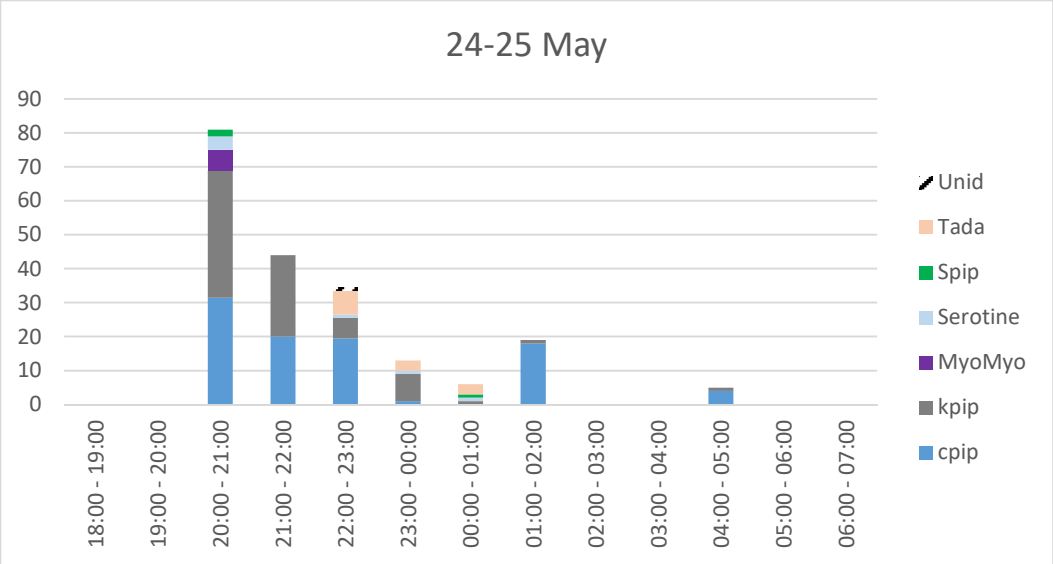
Graph 10. Percentage of total bat species passes recorded during the three 2-active night surveys

Bat calls started 20:00hr and ended at varied times depending on the date of the drive. In addition, peak bat passes was not consistent along the three night surveys. During May 16-18, calls ended at 1:00hr with peak activity between 22:00 - 23:00 mostly being Kpip, Cpip and very few *Myotis* species (Graph 11).



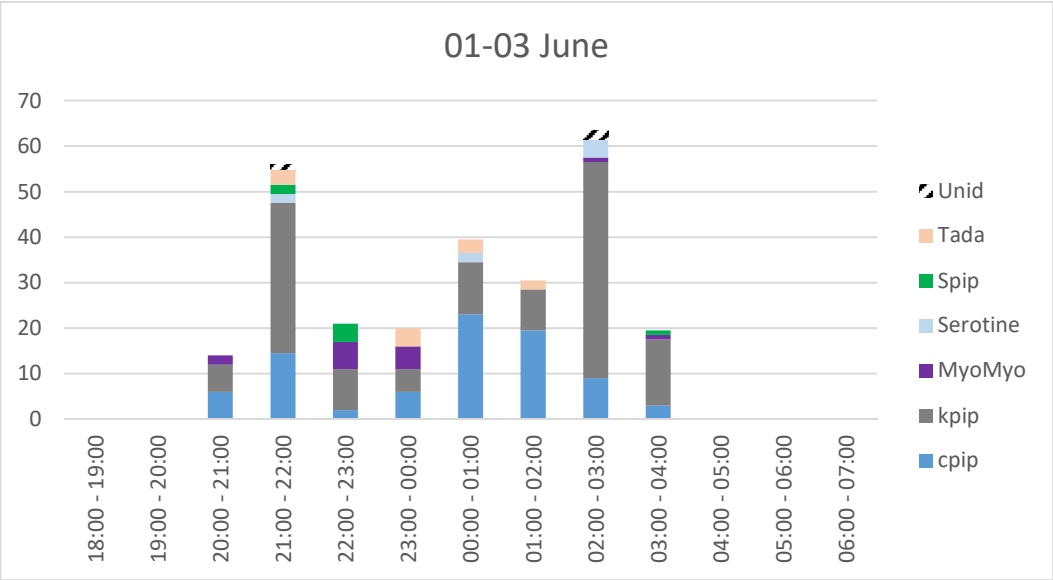
Graph 11. Bat passes by species during the night survey of 16 – 18 May

While during May 24-25, last call was recorded between 4:00 – 5:00 hr with peak activity during 20:00 - 21:00, which is the time interval also for the most species of bats recorded, including Cpip, Kpip, MyoMyo, serotine and Spip (Graph 12).



Graph 12. Bat passes by species during the night survey of 16 – 18 May

During June 01-03, calls ended at 3:00 in the morning with two peak activities during 21:00 - 22:00 hr and 2:00 - 3:00 hr, where Kpip, Cpip, Myotis, Serotine and Tada were detected (Graph 13).



Graph 13. Bat passes by species during the night survey of 1 – 3 June

Most of the incidence of bat calls observed at the LWP were bats commuting and very few occurrence of foraging activities. At the SA site many calls were recorded and bat were seen by the aid of spot light foraging in the area. Activity of pipistrelle species was spread across the two sites. Foraging activities were recorded at many locations at SA site with the highest within the oak forests mainly from the gate of the Adra'a farm to SA9 and the Met at SA10.

4. DISCUSSION:

Any study tackling the effect of wind turbines on bats needs a minimum of one year to come up with sound recommendations and mitigation measures. The collected data and results shown will not allow to build solid recommendations. However, they constitute the basic and the necessary data upon which the final recommendations will be set at the end of the survey. Additionally, this progress report which shows the primary findings of the first survey, will not allow to give a complete and final recommendations or mitigation measures. Nonetheless, these preliminary important findings that were gathered during the spring season survey on bat activities and along the most considerate locations for the wind turbines will add up to the upcoming monitoring program and survey.

These data show the diversity of bat species at both sites, nature of habitat, landscape and climate reflecting their effect on bat activities. It also revealed the importance of some locations, within this season, at which a considerably high bat activity was noticeable, resulting in avoiding the set-ups around these locations, or strict mitigation measures should be applied.

Data from this survey revealed difference in bat activities between the two sites and among the detectors location. The difference in bat activities between sites in this season could be referred to the difference in altitude and the landscape of both sites, this was consistent with other studies (Hayes and Gruver 2000). However, the difference within site could be attributed to different reasons.

1- Location of the proposed wind turbine rather than the habitat. This was clear with bat detectors at SA20 and SA21 that are close to each other and where both installed in an oak forest. SA20 recorded more bat passes than SA21. Same applies to SA24 and SA 25 locations where both were installed in conifer forest but SA24 recorded more bat passes than SA25. Hence we recommend using more detectors to cover most of the WT proposed locations.

2- Proximity to urban areas also played an important role where the highest activity of bats were at SA2 location which is close to urban area.
3- Position within the landscape, SA6 showed the second highest bat activity, which might be acting as a corridor or a route to the close by urban area.
4- Closeness to the foraging site which was the case of SA9 that showed a high bat activity since during the active night survey and close to SA9 location, high bat activity, commuting and foraging were detected and observed

Most (72%) of the locations showed high bat activities while very few 27% indicate a low bat activity during this survey. The locations with the highest bat activity were SA2, SA6, SA9, SA20 and LWP6. These sites should be subject to strict recommendation measures during this time of the year like stopping the turbine, at the active period, i.e. between 20:00 – 05:00 hr., monitoring wind speed, … On the other hand, SA21, LWP16, LWP17, LWP23 recorded the lowest bat activity. Simple mitigation and post-construction monitoring could discontinue or decrease bat fatalities and risks.

We observed peaks in bats' activity 2 – 3 hours after sunset and 3 hours before sunrise. These results are in accordance with other studies (Arnett 2007). Hence, during these peak hours wind turbines should be stopped in the locations that showed high mean bat activities. Nightly activities varied between nights which is expected in such areas where wind speed varies between days and even between hours. Hence, monitoring the wind speed is important for the production of wind turbines and the safety of bat populations.

During the active survey bats were recorded every night, showing an increase in the number of passes towards the third night drive beginning of June. This is probably due to the improvement in the weather while temperature starts increasing. During the first night survey in May the temperature ranged from 11 – 17˚C while it increased towards the third night survey in June to reach a range of 20 – 23˚C. In addition the wind speed was lower during June. The wind speed affects bat activity. Many studies reported that bats cease flying when wind speed is above 6m/s. In this survey we recorded many incidences with bats that are flying above this wind speed. We observed many bat passes at a wind speed of 7 m/s and we recorded bat calls of Cpip and Kpip at LWP14 where the wind speed was around 9.2 m/s. This could be an exception but more monitoring should be considered post construction.

Many studies have shown the positive correlation between number of bat calls and risk of collision with bat turbines (Kunz et al. 2007). However, not all bats have the same risk of collision. Out of the 12 species encountered five have high risk of collisions *T. teniotis, N. noctula, P. pipistrellus, P. kuhlii,* and *H. savii* and one of medium risk *E. serotinus*. These results identified activity patterns of bat within this period which may support useful information for predicting when, where and which species may be mostly at risk of collision with wind turbine.

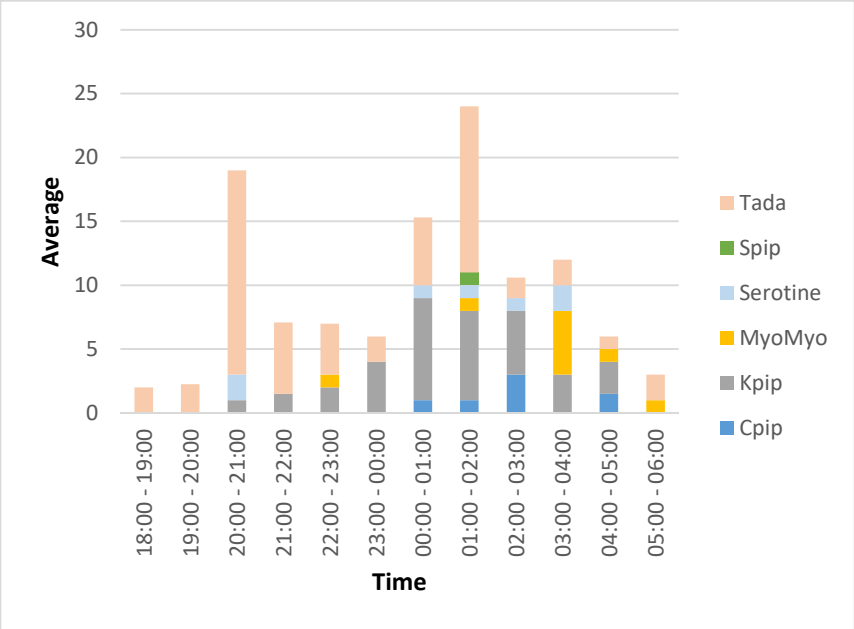
5. Conclusion:

The survey during this period revealed that both sites are used by bat species for commuting and foraging. The key results revealed 1) the peak mean activity of all bats occurring at the two sites during this period differed with site and location, 2) the peak mean activity varied among species with higher activity levels of Cpip, Kpip and serotine that have high risk collision with the wind turbines, 3) peaked activity occurred 2 – 3 hours after sunset and before sunrise in all the locations, 4) variability in mean activity of bats differed between SA and LWP, 5) Some wind turbine locations have low bat activity which in turn might have minimal effect on bat populations.

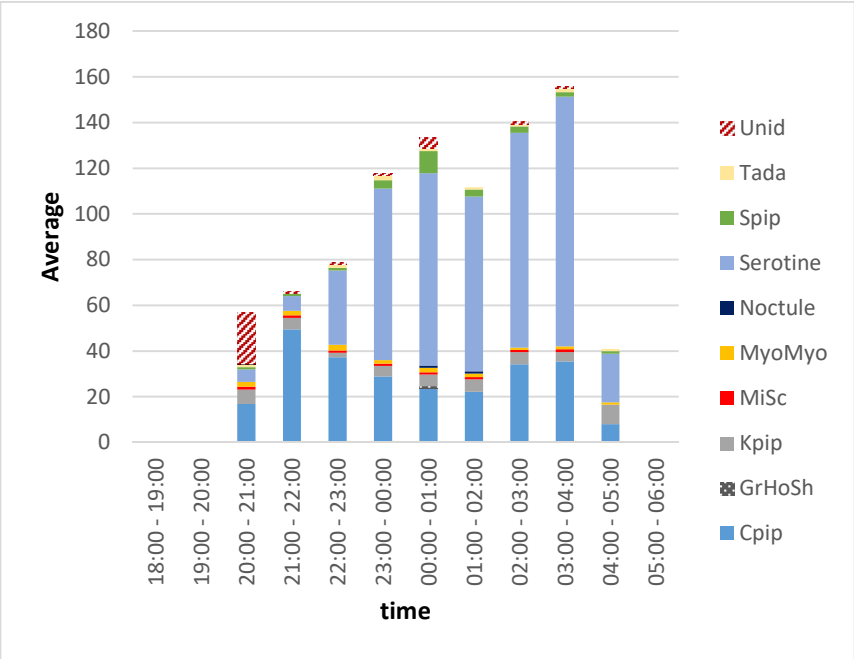
A complete and detailed mitigation measures and recommendations will be provided by the end of the project.

APPENDIX A

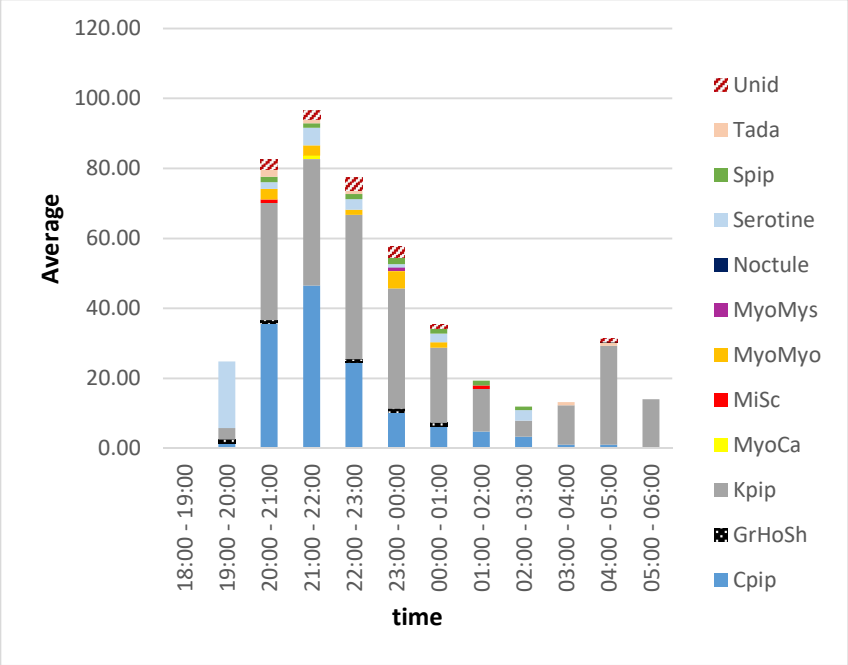
Hourly bat activity by species at the 9 locations of the SA site



SA MET 10



SA2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Noctule
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MyoMyo
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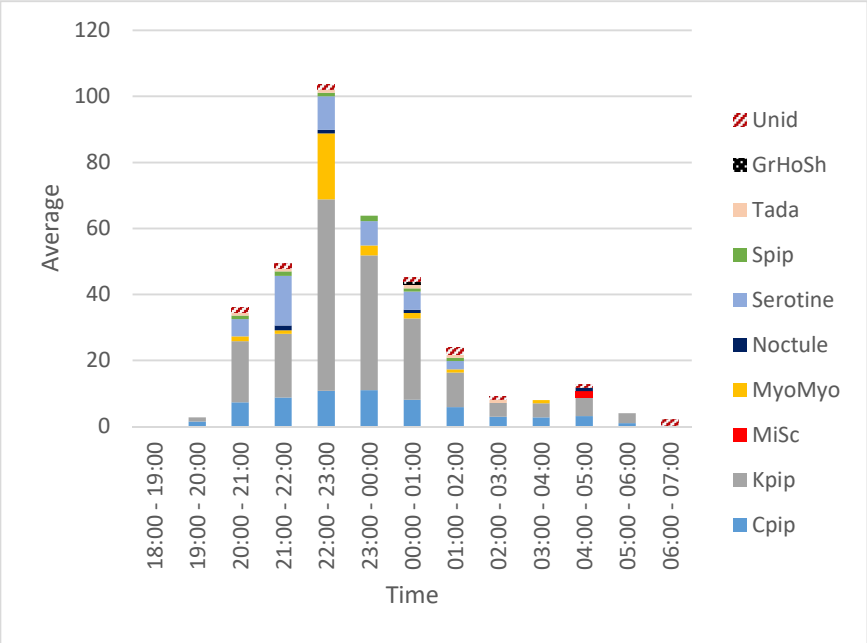
MyoCa
Kpip
GrHoSh
Cpip

SA6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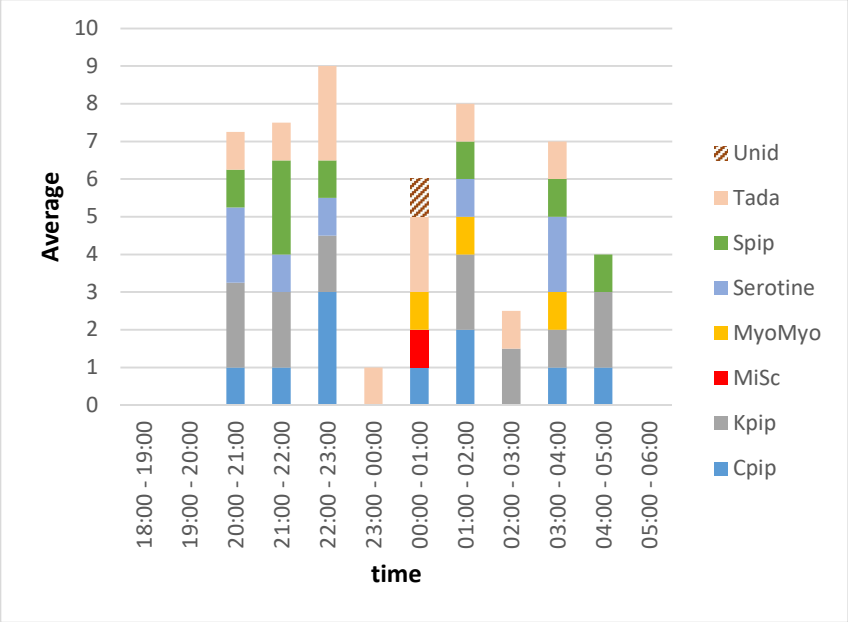
SA9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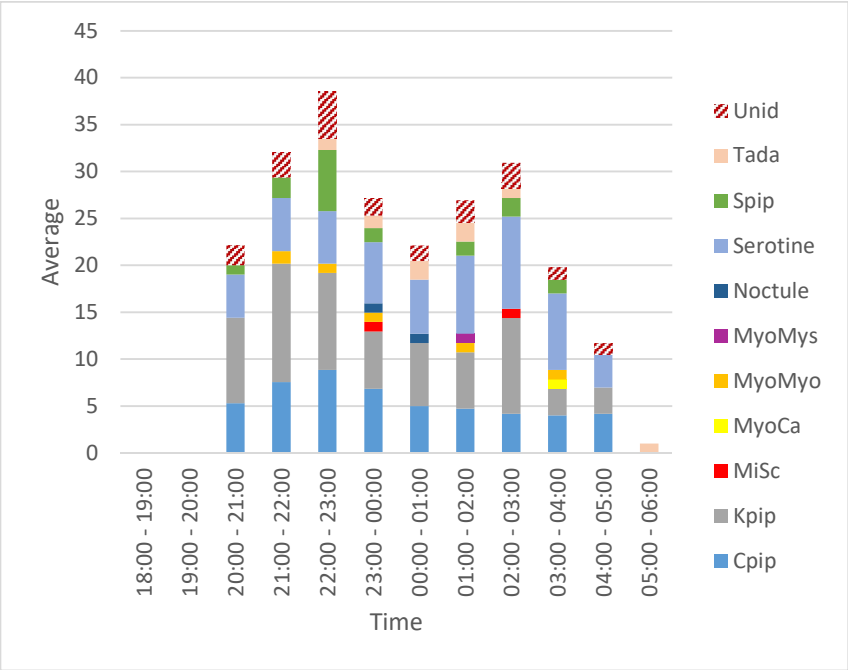
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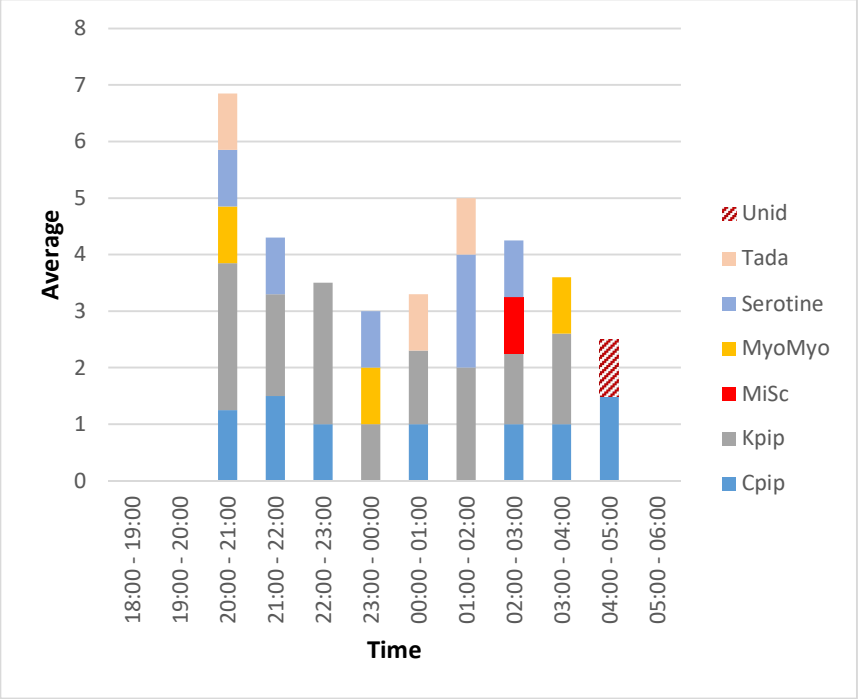
SA 20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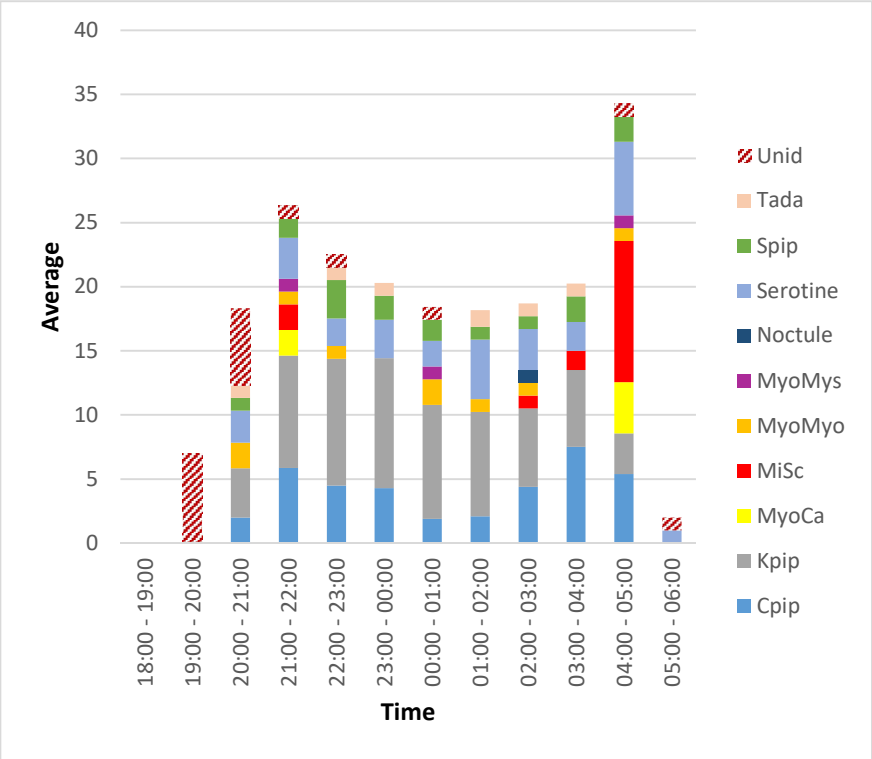
Time
Unid
Tada
Serotine
MyoMyo
MiSc
Kpip
Cpip

SA 21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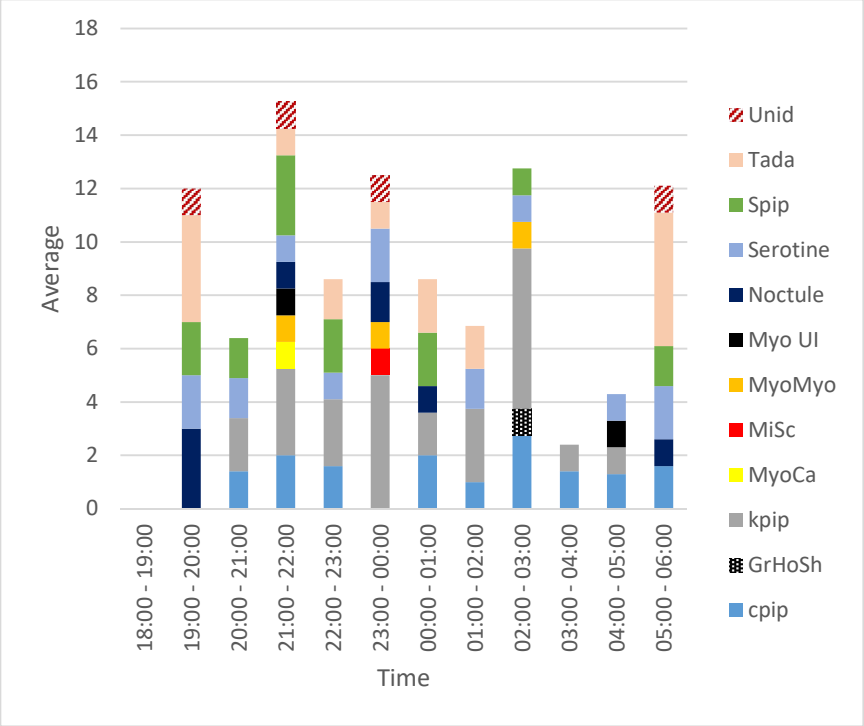
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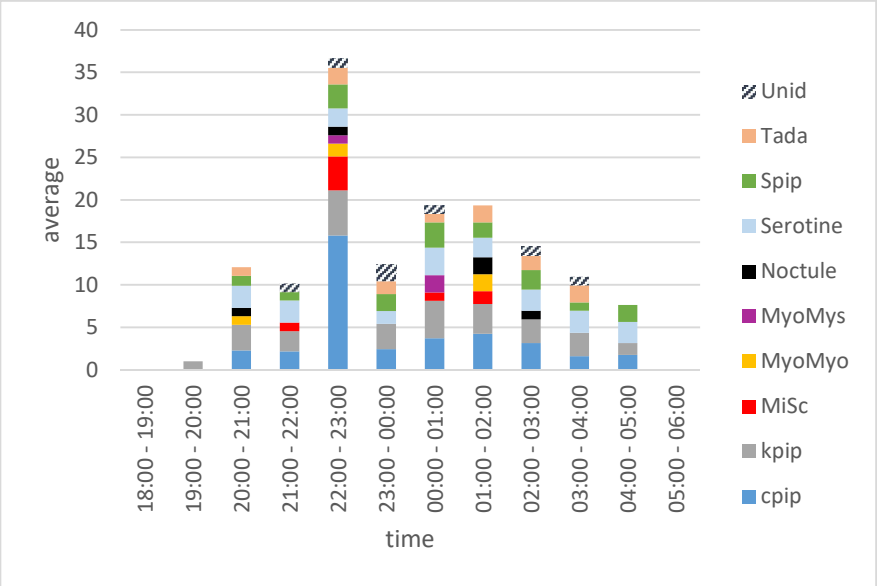
APPENDIX B.

Hourly bat activity by species at the 10 locations of the LWP site



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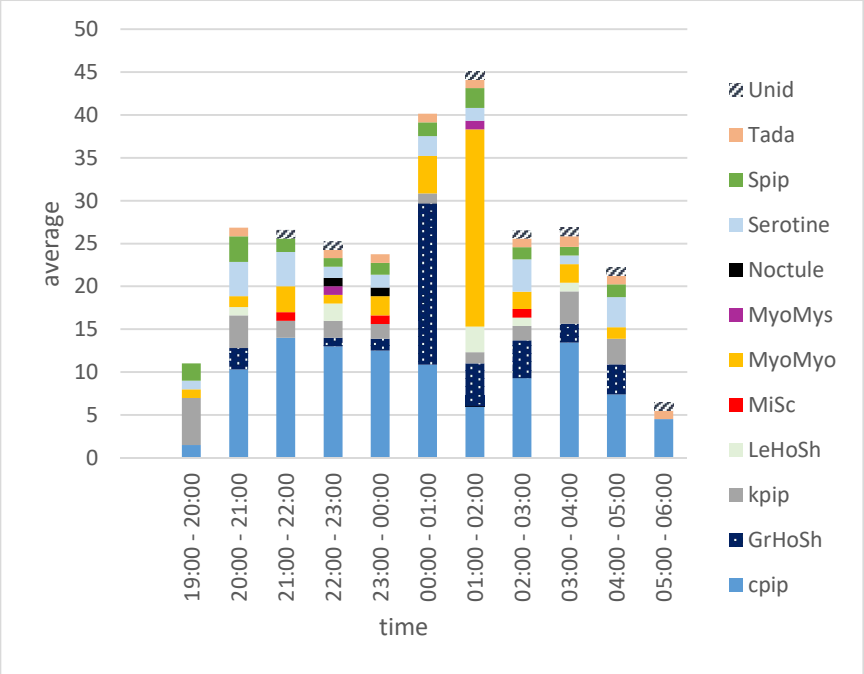

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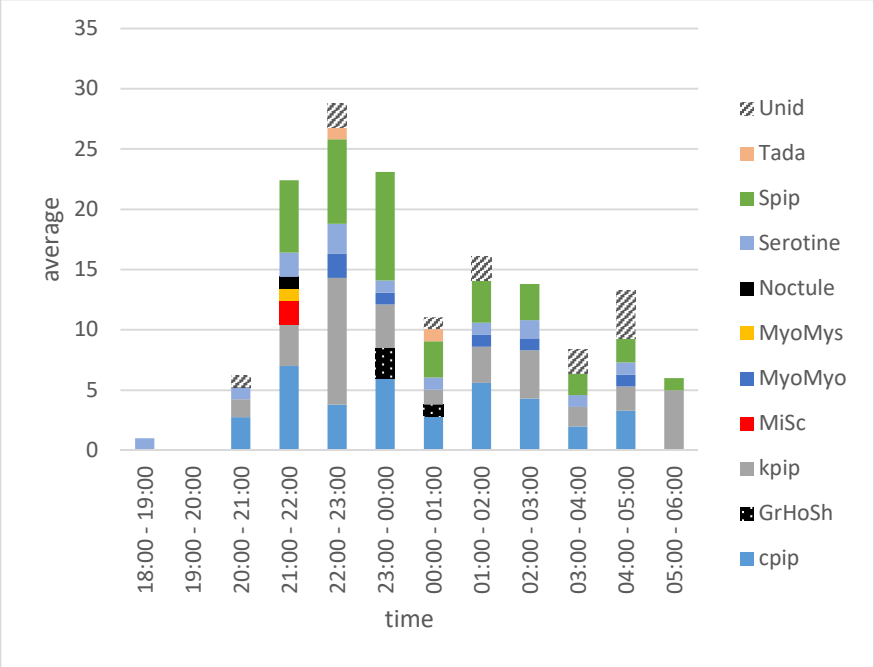
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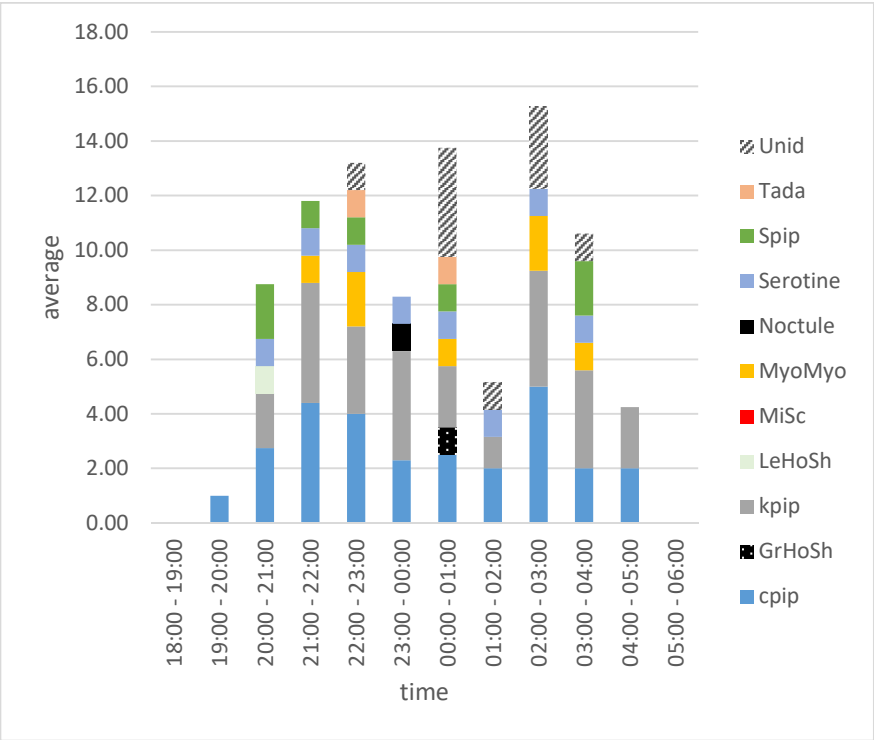
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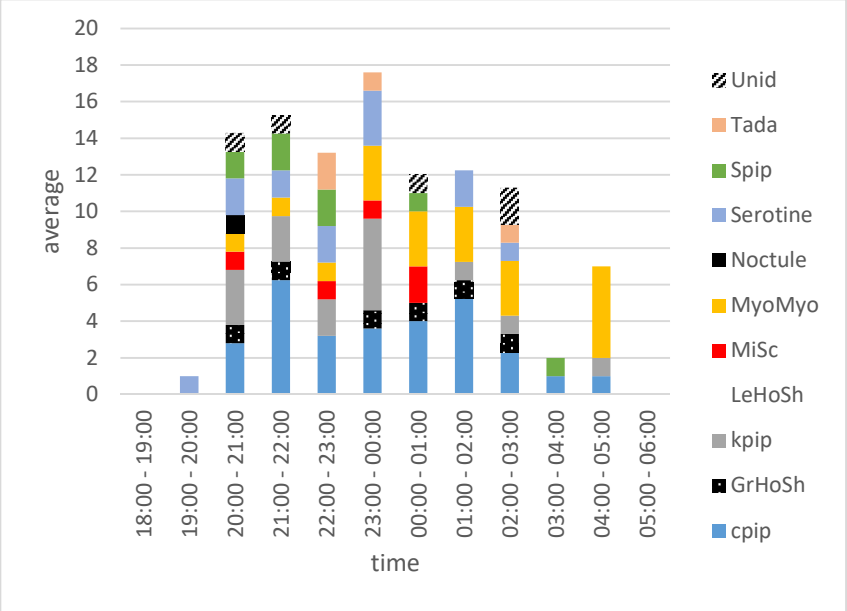
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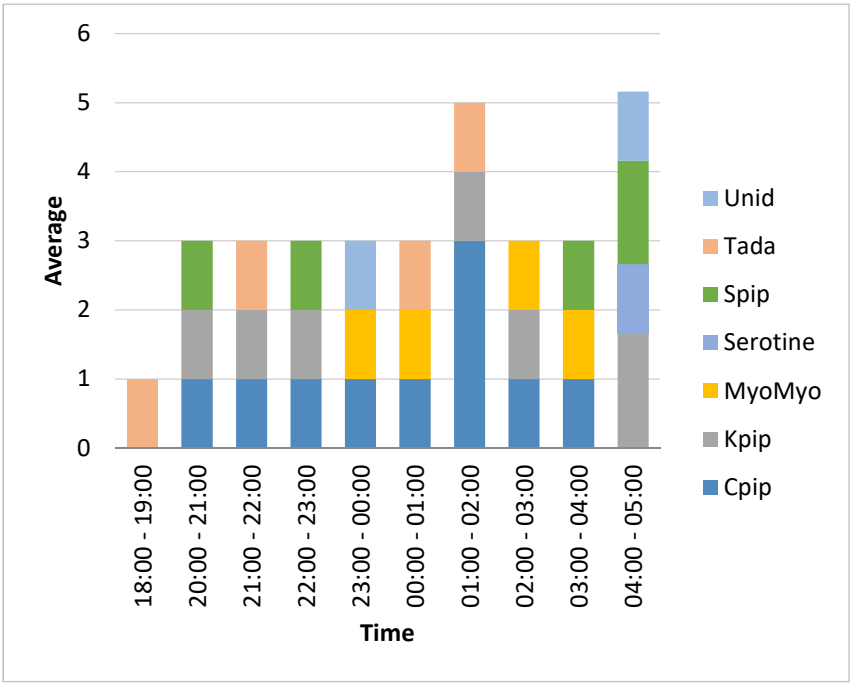
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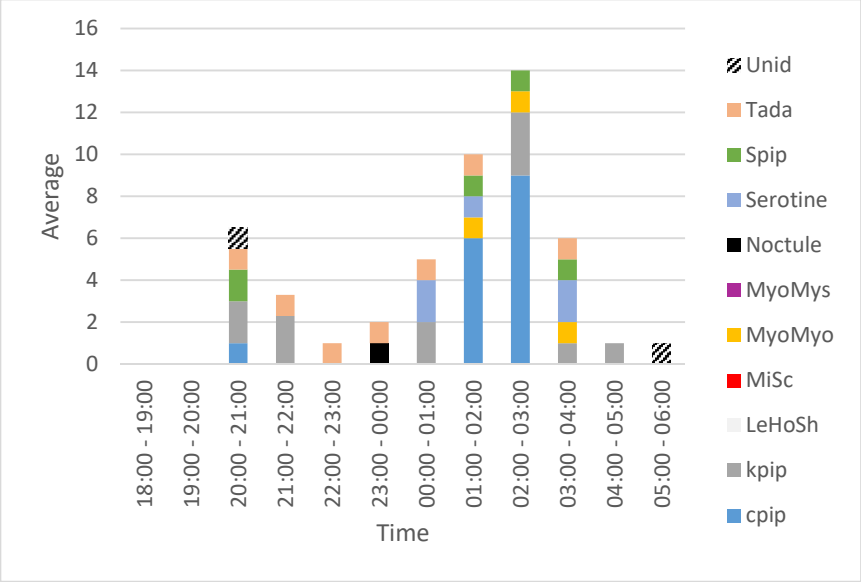
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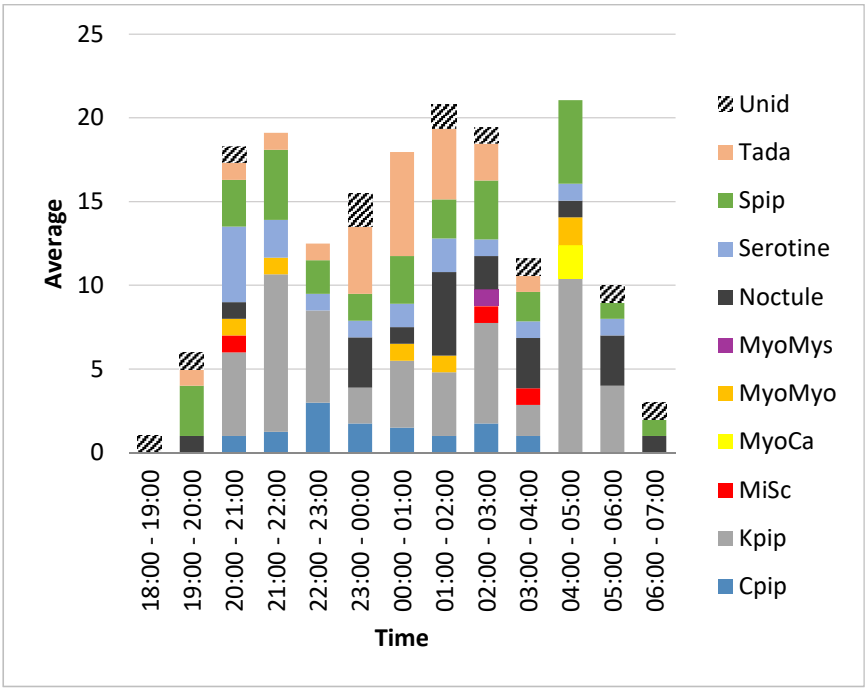
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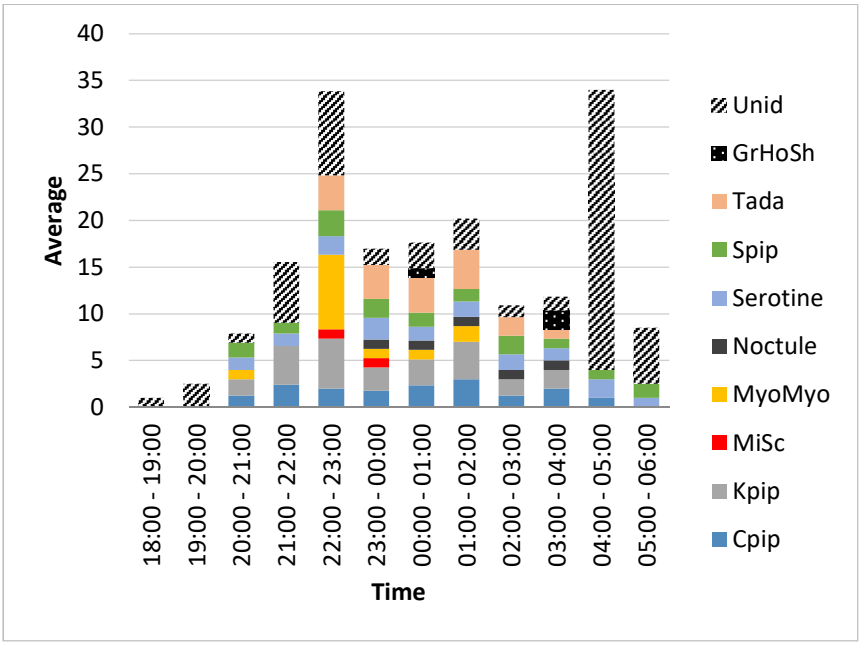
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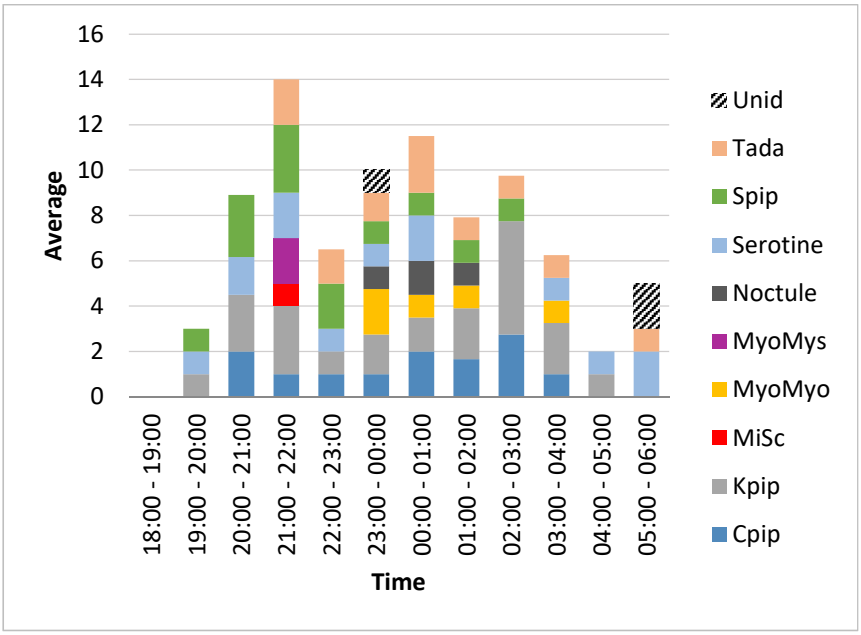
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LWP 23

ECOLOGICAL ASSESSMENT
OF
THE IMPACT OF WIND FARM
ON BAT DIVERSITY
IN AKROUM- AKKAR
(Active Phase: August, September, October)

Submitted to ECODIT

Hazmieh, Lebanon

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October, 2018

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1. INTRODUCTION

With the growing environmental problems due to the use of traditional energy sources, efforts are being directed on finding alternative, clean and renewable energy sources with supposedly minor impacts on the environment. One of these sources is the wind energy, which in turn, is one of the fastest rising energy sectors in North America and Europe (Barclay et al., 2007; Voigt et al., 2012; Roeleke et al., 2016), as it consumes no fuel thus eliminates greenhouse gas emissions once the wind turbines are functioning.

Like any other source of energy, wind energy has its adverse environmental impacts (Barclay et al., 2007) during both phases. Wind farms can affect humans, wildlife as well as landscapes. With respect to biodiversity, the effects of wind farms are of two types: direct mortality, as a result of barotrauma or collision (Rydell et al., 2010a; Grodsky et al., 2011; Huso et al., 2016; Millon et al., 2018) and indirect, with habitat loss, behavioral change and reduction in the population viability (Zimmerling et al., 2013; Arnett and May, 2016; Frick et al., 2017; Millon et al., 2018). The indirect impacts were frequently ignored (Minderman et al., 2012; Arnett and May, 2016) and the direct fatalities of bats and birds by wind turbines were the main focus of most studies (Pereira et al., 2018). Recently, the impact of wind turbines on bats received an international attention. This is credited to the efforts of EUROBATS that demanded to study the effect of wind energy on bat's population and to take the necessary mitigation measures to eliminate or decrease the effect of wind turbines on bat populations. Thus two publications entitled "Guidelines for Consideration of Bats in Wind Farm Projects" were published in 2008 and 2014 and were adopted by all the European Union countries and Member of Parties

Considering the effects of onshore wind farms on mammals whether direct or indirect, Pereira et al. (2018) explained that wind energy affects terrestrial mammals by disturbance and displacement of many species mainly during the operation phase. This displacement and future avoidance of an exploited habitat can lead to the permanent loss of the habitat; moreover, the roads used during construction and the power lines installed can create a barrier effect leading eventually to habitat loss (Abi-Said, 2018). Although animals may adjust their behavior and adapt to changes but the loss of habitat and human induced disturbance and interference put them at threat and limit their access to their niche (Abi-Said, 2018).

Regarding flying mammals, bats are the only flying mammals that are highly affected by wind turbines despite being rarely mentioned in early studies on wind farm effects (e.g., Rogers et al., 1977). Nonetheless, it is not the case anymore as wind turbines, nowadays, are considered to be one of the main causes of bat mortality (O'Shea et al., 2016) mainly assessing direct mortality (Arnett et al., 2016).

Wind farms can create many problems affecting bats, indirectly as well as life-threatening direct effects. These effects will be discussed later under the impact of wind farms on bats

1.1 Wind Farms in Lebanon

Studies from around the world, mainly North America and Europe, have confirmed the impacts of wind turbines on some bat species. Most of the times, the impacts are species-specific, whether related to foraging or migratory behaviors both of which include the choice of roosting, breeding, hibernating and feeding sites. Many bat species mentioned by the previously cited studies reside in different Lebanese regions where possible future wind farms may be planned. Thus, a detailed study must be provided first, even prior to EIA, relating to the behavior and the characteristics of each bat species.

In Lebanon, wind energy has an interesting potential due to sustained strong winds prevailing in many regions, however only few installations exist and they are of low power (Abdeladim et al., 2018). It is worth mentioning that all forms of renewable energy sources in Lebanon account for only 2% in the energy market (ADEME. Technical report. 2015). Yet, the government is aiming to reach a level of 12% of renewable energy production by the year 2020, with a total of 100 MW installed capacity of wind energy specifically (Abdeladim et al., 2018).

With the increased development of wind farms, whether onshore or offshore, in many countries including Lebanon with its new renewable energy projects that are underway, the assessment of wind facilities impacts during the pre- and post-construction phases became crucial.

The current study is a preliminary survey that focuses on obtaining data on active bat diversity and highlights any environmental concerns that might arise from the implementation of the planned wind farm project in Akroum-Akkar. Accordingly, a very condensed short assessment was conducted to have a baseline data on the active bat species in the project site during a trimester namely: August, September, and October. These data will help in building up mitigation measures to be implemented for bat conservation.

2. OBJECTIVES

This condensed short-period assessment study aims to establish a preliminary database on the activity patterns of bats within the study area, their diversity, their conservation value, identifying risks of the wind turbines and defining mitigation measures to eliminate or decrease their effect.

3. MATERIAL AND METHODS

3.1 Field survey

This study was conducted over the three months between August and October, 2018. The assessment is based on a comprehensive literature review, then followed by weekly field visits to the project site following the below approaches:

3.1.1 Detection of Active Bats

Using a 4x4 car the area covering the site was surveyed using ANABAT Walkabout Active Bat Detector (Plate 1). Whenever a bat frequency was detected, it was recorded with time and GPS locality. Bats were identified and data were stored for later analysis

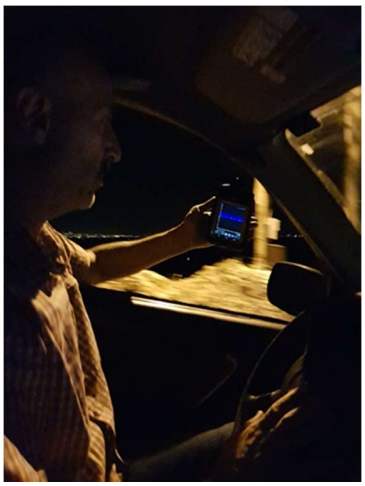

Plate 1. Monitoring bats using the ANABAT Walkabout Active Bat Detector

3.1.2 Automated Passive Bat Detection

ANABAT SD2 Bat Detector was updated to be used as an Automated Passive Bat Detector as it gave better results than the bat box previously used and the recorded calls can be identified easily. Locations for the passive bat detector were located randomly and as close to the proposed location of the Wind Turbine whenever that was possible and accessible. The water-resistant microphone adaptor for the ANABAT SD2 was connected with a 15 meters wire to the ANABAT SD2 Bat Detector. The microphone wherever installed was tied to a pole facing an open area and the ANABAT SD2 was covered in a plastic bag and put in a shelter (Plate 2). The passive detector was set to be active between 19:00 hr. and 06:00 hr. from August 1st till September the 15th and between 18:00 hr. and 06:00 hr. from 16th of September till the 26th of October 2018. Whenever a bat call was detected it was recorded automatically for 15 seconds.

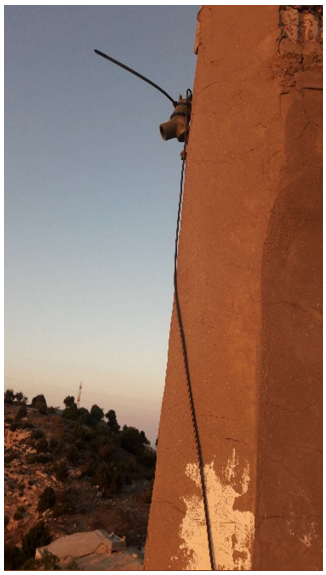

Plate 2. Bat detector microphone was either installed on high trees or poles over roof tops.

The Passive Bat Detector was installed for two consecutive nights at each of the eight selected locations (Table 1, Figure 1). The passive detector was installed at least twice at each location. Data from the passive detector was downloaded before relocating it to the next site.

Table 1. GPS location of the Automated Passive Bat Detector in the study site

STATION	NORTH	EAST
1	34 31 37.60	36 19 15.12
2	34 33 44.70	36 19 45.30
3	34 33 24.10	36 20 56.60
4	34 31 11.50	36 18 34.40
5	34 32 03.16	36 19 38.01
6	34 34 30.10	36 19 48.80
7	34 35 33.08	36 19 58.82
8	34 31 35.48	36 18 53.22

Figure 1. GPS locations of passive bat detector on the project site

3.1.3 Bat Netting

Bat netting was carried out at the only accessible water source (GPS: N 34 32 42.55, E36 20 58.88) on the project site in Wadi AlSabe'a that bats use for drinking. Mist Net 08M/9, 14mm mesh, dimension 9x2.4m with 4 shelves made by ECOTONE was installed at the water source before sunset and removed after 3 hours after sunset (Plate 2). Bats netted were directly removed, identified, and their frequency was recorded before being released.

Plate 2. Setting net for bat capturing over a water source in Wadi AlSabe'a

3.1.4 Roosting sites

During day time some identified caves during the hibernation phase were visited and data on findings were recorded.

3.2 Data Recording

Data on bat frequencies were recorded, bat were identified and GPS point was taken for later analysis.

a- Data of the Active bat detector was downloaded on trip bases
b- Passive detector data was downloaded before relocation to another place
c- Bats netted were identified, photographed and recorded
d- Data on caves finding including species, number, and location were recorded

4. RESULTS

4.1 Completeness of Coverage

Data obtained during the survey for these three months. Namely August, September, October. However, the completeness of coverage of bat species and activities remains incomplete since four important months (April, May, June and July) were not covered. During these four months several bat activities occur like arousing from hibernation, migration, reproduction and extensive feeding. It is noteworthy that acoustic survey gives information on bat species and their activities but not on their height of maximum flight or the area they cover. Accordingly this needs further in depth survey that will not be covered within this project. Undoubtedly, the presence of light source will attract nocturnal insects thus increasing bat activity. However, this was not assessed in this project due to the absence of light source at the proposed location yet, future studies have to take this into consideration

Even though data decency is expected in covering bat species and their activity during their active period. This three month survey identifies the bats that are active and present on the project site during this period and does not reflect the long-term coexistence of bats in the area

4.2 Mammal Species

4.2.1 Non Flying Mammals

The majority of the survey took place after sunset which is the ideal time for mammals other than bat to go out for feeding. Even though the aim of the study was directed towards bat however, mammals encountered during the survey were recorded. Among the recorded non-flying mammals six species were encountered namely red fox, common jackal, stone martin, striped hyaena and field mouse (Table 2). In addition to wild mammals, domestic mammals like goats, dogs and cats were also encountered

Table 2. List of mammal species encountered during the night survey (R= recorded, c= common, r = rare, nt= near threatened, endemic or endangered on the National level)

Family	Species	Scientific Name	Status
Canidae	Red Fox	*Vulpus vulpus palaestina*	R, c
Canidae	Common Jackal	*Canis aures*	R, c
Mustelidae	Stone Martin	*Martes foina syriaca*	R, c
Hyaenidae	Striped hyaena	*Hyaena hyaena syriaca*	R, c
Hystricidae	Porcupine	*Hystrix indica*	R, c
Muridae	Field mouse	*Apodemous mystacinus*	R, c

4.2.2 Bats

Few studies on mammals in general and bats in particular were conducted in Lebanon and very scarce studies on the mammals including bat in the Akkar region and none was reported from Akroum. A rapid field survey was conducted during hibernation period of bats between December and March 2018 in Akroum resulted in five bat species encounter namely: Greater horseshoe bat (Rhinolophus ferrumequinum), lesser horseshoe bat (Rhinolophus hipposideros), Mediterranean horseshoe bat (Rhinolophus euryale), a colony of greater mouse-eared bat (Myotis myotis), and long-fingered bat (Myotis capaccinii) (Abi-Said 2018).

During this survey bats were in their active phase. Through the aid of the automated passive and active bat detectors we were able to identify 10 bat species (Table 3). The calls of three bat species were mostly detected namely pipistrelle (Pipistrellus pipistrillus), Kuhl's pipistrelle (Pipistrellus Kuhlii), and Serotine bat (Eptesicus serotinus). In addition, in many cases more than one species were detected at the same time. For example different species of Pipistrelle or Pipistrelle and Serotine bat (Figure 2)…

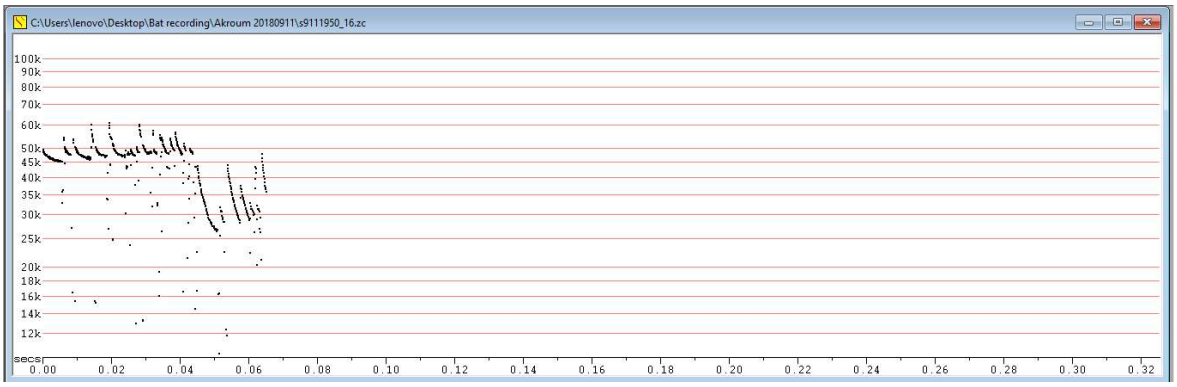

Figure 2. Calls of two species Common Pipistrelle and Serotine bat

Table 3. List of bat species present (R= recorded, Vu= Vulnerable, Lc= Least concern, r = rare, c= common, endemic or endangered on the National level)

Family	Species	Scientific Name	Status IUCN/Trend	Status Lebanon
Rhinolophidae	Greater horseshoe bat	*Rhinolophus ferrumequinum*	Lc/Decreasing	R, c
	Lesser horseshoe bat	*Rhinolophus hipposideros*	Lc/Decreasing	R, c
Molossidae	European Free-tailed bat	*Tadarida teniotis*	Lc/unknown	R, r
Vespertilionidae	Common Noctule bat	*Nyctalus noctula*	Lc/Unknown	R, r
	Greater mouse-eared bat	*Myotis myotis*	Lc/Stable	R, r
	Long-Fingered Bat	*Myotis capaccinii*	Vu A4bce/ decreasing	R, r
	Serotine bat	*Eptesicus serotinus*	Lc/Unknown	R, c
	Common Pipistrelle	*Pipistrellus pipistrellus*	Lc/Stable	R, c
	Kuhl's Pipistrelle	*Pipistrillus kuhlii*	Lc/Unknown	R, c
	Savi's Pipistrelle	*Hypsugo savii*	Lc/Stable	R, r

4.4.2.1 Greater Horseshoe bat (*Rhinolophus ferrumequinum)*

The greater horseshoe bat was encountered while visiting some caves and few calls (Figure 3) were recorded at night by the aid of the active bat detector around and near oak forest. Re-visiting the caves that were visited during the hibernation survey revealed the absence of this bat species from most of the caves where they were encountered. In addition the few incidences of call's recording does not reflect what was encountered during the hibernation survey. No information is available on the fate of these population. It could probably be that they use these caves for hibernation and they migrate afterwards to their feeding sites.

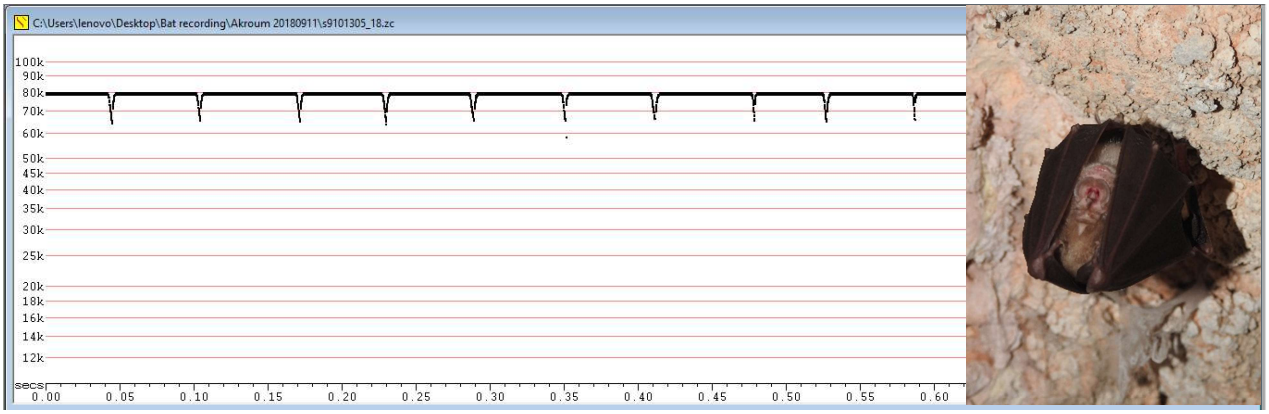

Figure 3. Calls and photo of the Greater Horseshoe Bat (*Rhinolophus ferrumequinum)*

4.4.2.2 Lesser Horseshoe Bat (*Rhinolophus hipposideros)*

The Lesser Horseshoe bat was also detected in caves and very few calls (Figure 4) were recorded over oak forests. Same speculations for the Greater Horseshoe bat could be apploied to this species.

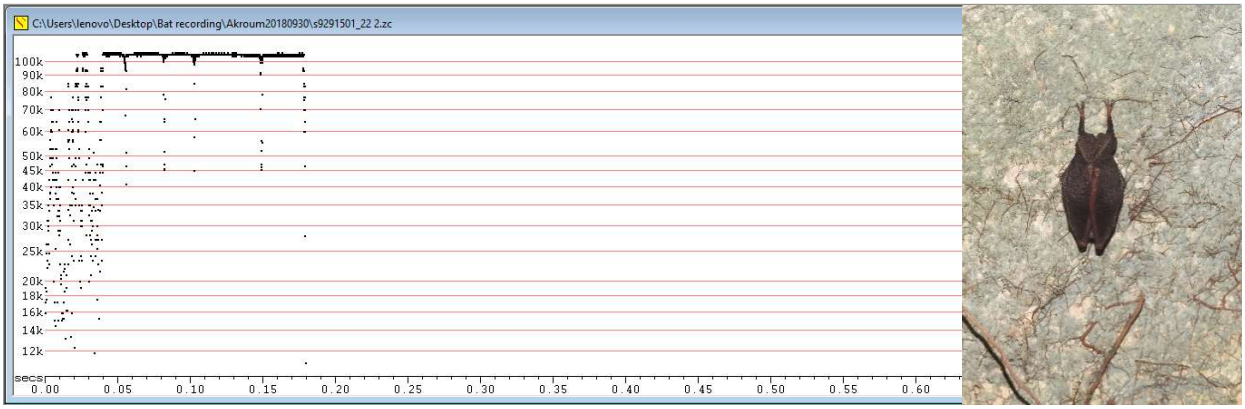

Figure 4. Calls and photo of the Lesser Horseshoe Bat (Rhinolophus hipposideros) recorded over oak forest

4.4.2.3 European Free-Tailed bat (*Tadarida teniotis*) (Plate 3)

The calls of this bat species (Figure 5) was recorded at Station 1 and 4 (Figure 1, Table 1) with the passive detector during late hours of the night.

Plate 3. The European Free-Tailed bat (*Tadarida teniotis*) (Photo by L. Arthur, INPN – MNHN).

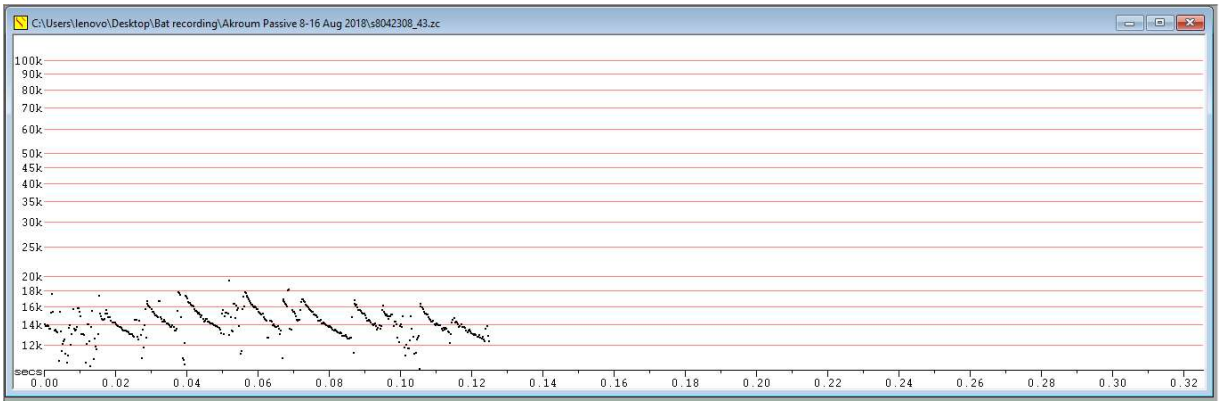

Figure 5. Calls of European Free-Tailed Bat recorded by the Anabat SD2 (*Tadarida teniotis*)

4.4.2.4 Common Noctule Bat (*Nyctalus noctula)* (Plate 4)

Few calls (Figure 6) of this species were recorded by the passive bat detector at higher altitude close to the proposed wind turbine.

Plate 4. Common Noctule bat (*Nyctalus noctula)* (Photo by Branko Karpandza, UNEP/EUROBATS)

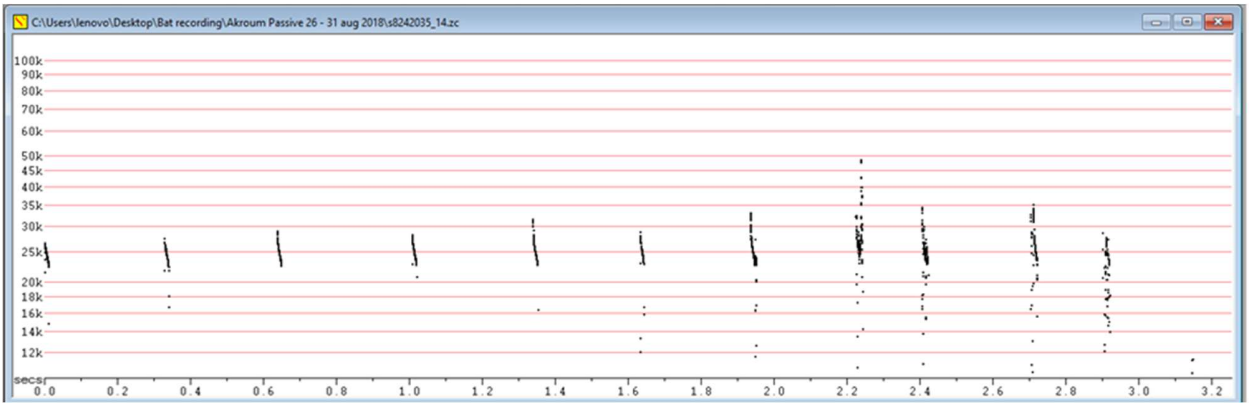

Figure 6. Calls of Common Noctule Bat (*Nyctalus noctula)* recorded by the passive bat detector

4.4.2.5 Greater Mouse-Eared Bat (*Myotis myotis*)

A big colony of Myotis myotis (Plate 5) was discovered during the first phase of the survey the hibernation survey. This colony was considered the largest discovered till now in Lebanon. During this survey the cave was visited again to check on the colony presence. Unfortunately, the cave was invaded by unknown people where they put fire in the cave (Plate 6) and shot all the bat dead (Plates 7). Nonetheless, during the acoustic survey calls of this species were recorded in the area of the project (Figure 7).

Plate 5. A big colony of Greater Mouse-Eared Bat (*Myotis myotis*) before it was destroyed

Plate 6. Burned wheel, fire torch and an empty bullet box used to kill the *Myotis myotis* inside the cave

Plate 7. Dead *Myotis myotis* in the cave

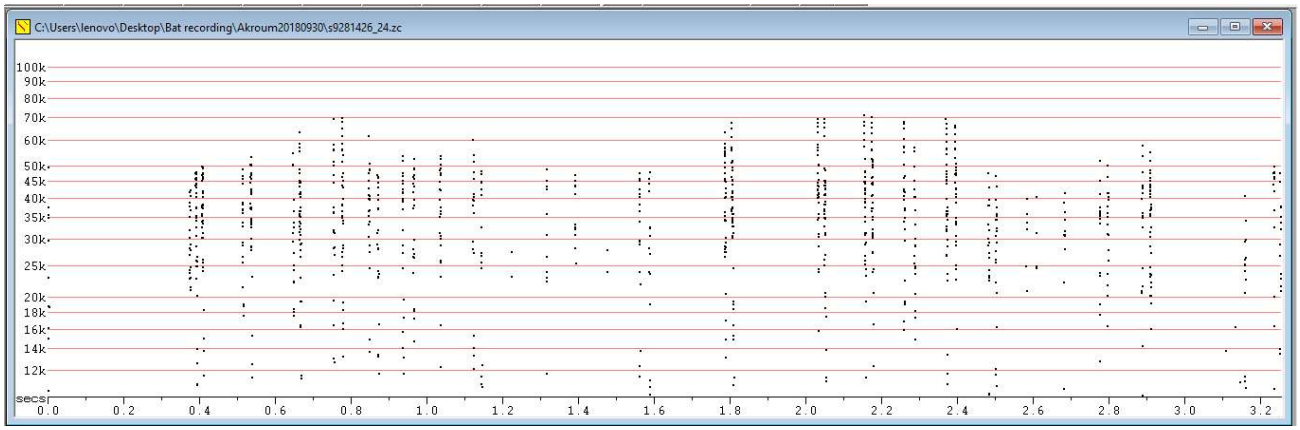

Figure 7. Calls of Greater Mouse-Eared Bat (*Myotis myotis*)

4.4.2.6 Long Fingered Bat (*Myotis capaccinii)* (Plate 8)

This bat was reported during the hibernation phase and its calls were recorded during the active phase of the survey (Figure 8). Wind turbines affect this species by affecting its foraging habitat as mentioned before for the Myotis sp.

Plate 8. Long-Fingered Bat (*Myotis capaccinii)*

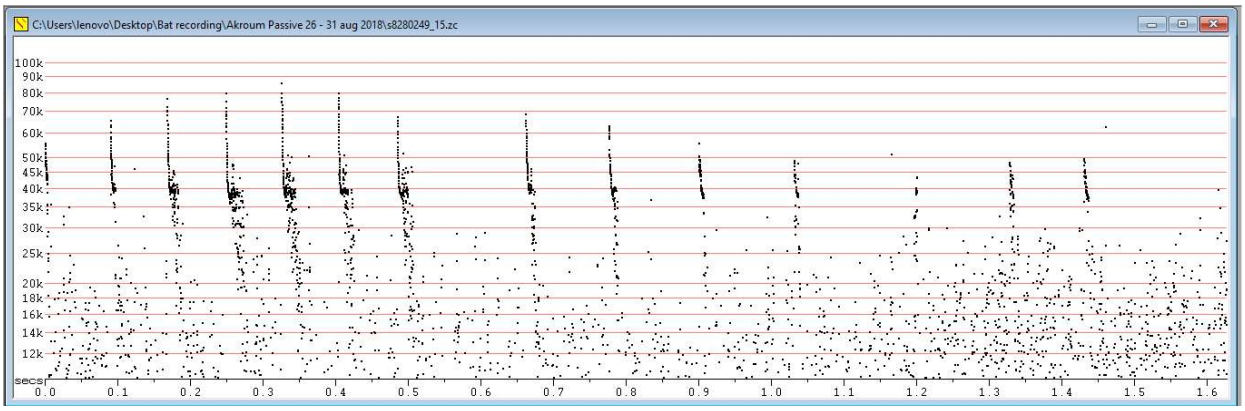

Figure 8. Calls of Long Fingered Bat (*Myotis capaccinii)*

4.4.2.7 Serotine Bat (*Eptesicus serotinus)*

Serotine Bat calls were recorded frequently at different location on the study site through the active and passive bat detectors (Figure 9). In addition, it was captured by the net installed at the water source (Plate 9).

Plate 9. Serotine Bat (*Eptesicus serotinus)* captured during the netting survey

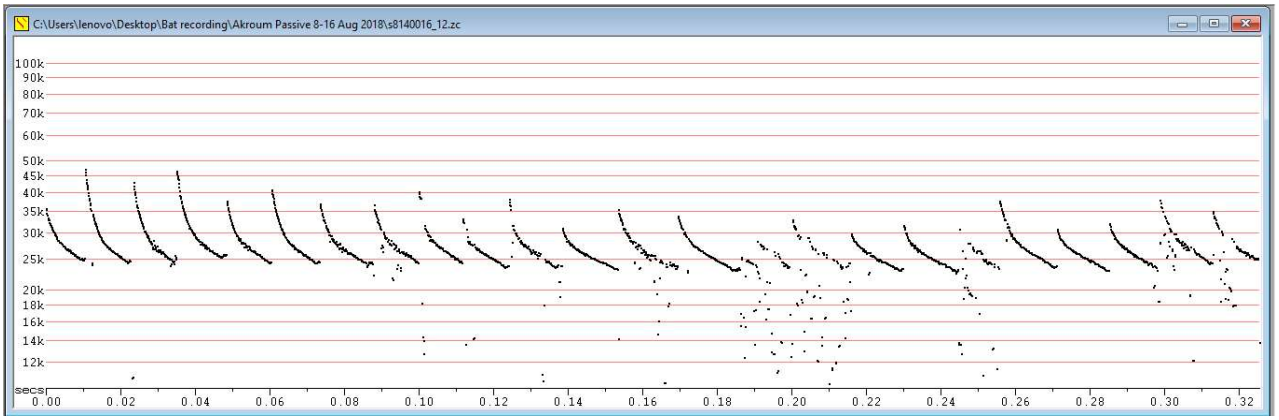

Figure 9. Calls of Serotine Bat (*Eptesicus serotinus)* detected through the active survey

4.4.2.8 Common pipistrelle (*Pipistrellus pipistrellus)*

Common Pipistrelle was the most common species detected through both the passive and active bat detector (Figure 10) as well it was most trapped when netting bats (Plate 10). This species was the first bat to appear among all detected bats. It starts its foraging at sunset and continues through the whole night with some resting hours.

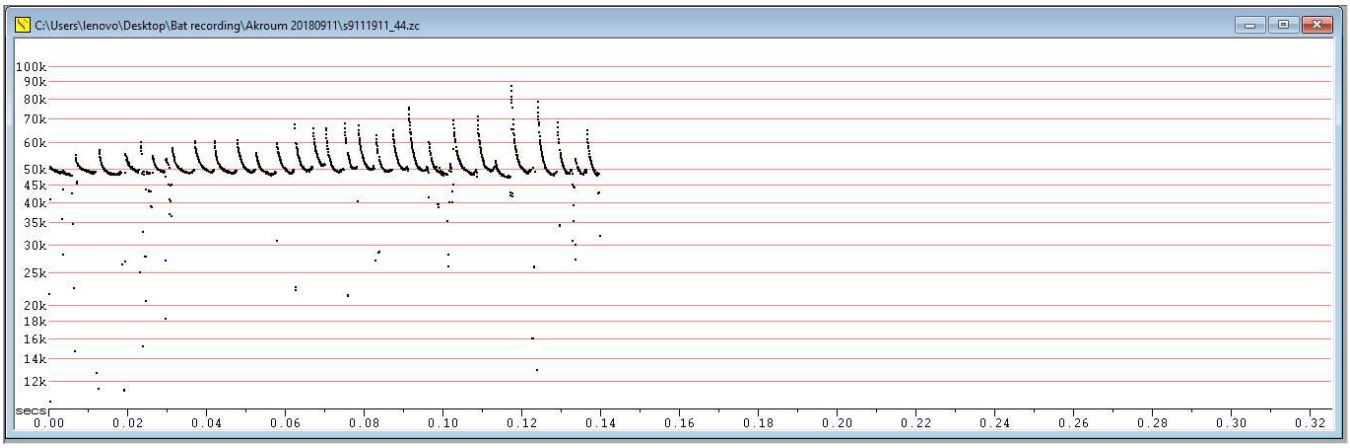

Figure 10. Calls of Common Pipistrelle (*Pipistrellus pipistrillus)*

Plate 10. Common Pipistrelle (*Pipistrillus pipistrellus*) Trapped on the net

4.4.2.9 Kuhl's pipistrelle *(Pipistrellus Kuhlii)*

Kuhl's Pipistrelle was the second common bat observed on the study site. Many of its calls (Figure 11) were recorded both by the passive and active bat detectors during the night drive. In addition many individuals were captured by the net installed at the water source (Plate 11).

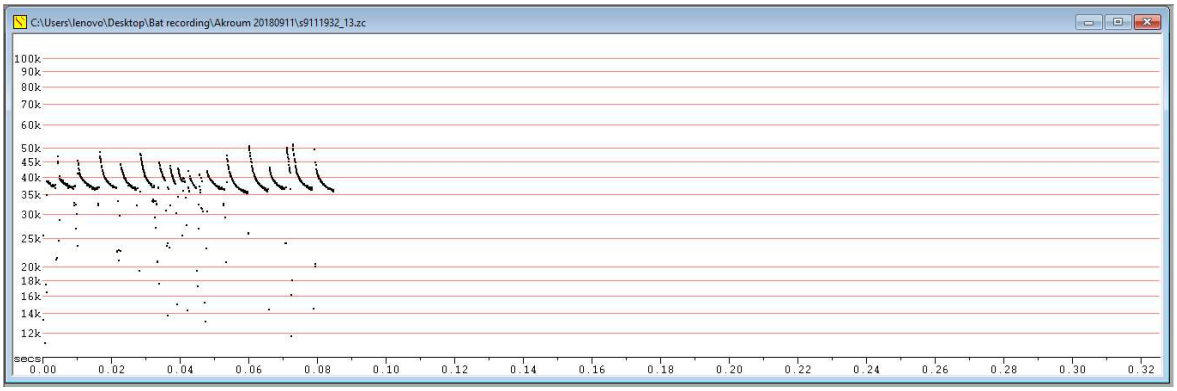

Figure 11. Calls of Kuhl's Pipistrelle (*Pipistrellus Kuhlii*) recorded by the active bat detector during the night drives

Plate 11. Kuhl's Pipistrelle (*Pipistrellus kuhlii*) captured by the net on the water source

4.4.2.10 Savi's Pipistrelle (*Hypsugo savii)*

Savi's Pipistrelle Bat was the least detected among Pipistrellus bat species. Its calls were recorded few times beside the water source and during the night drive survey with the active bat detector (Figure 12).

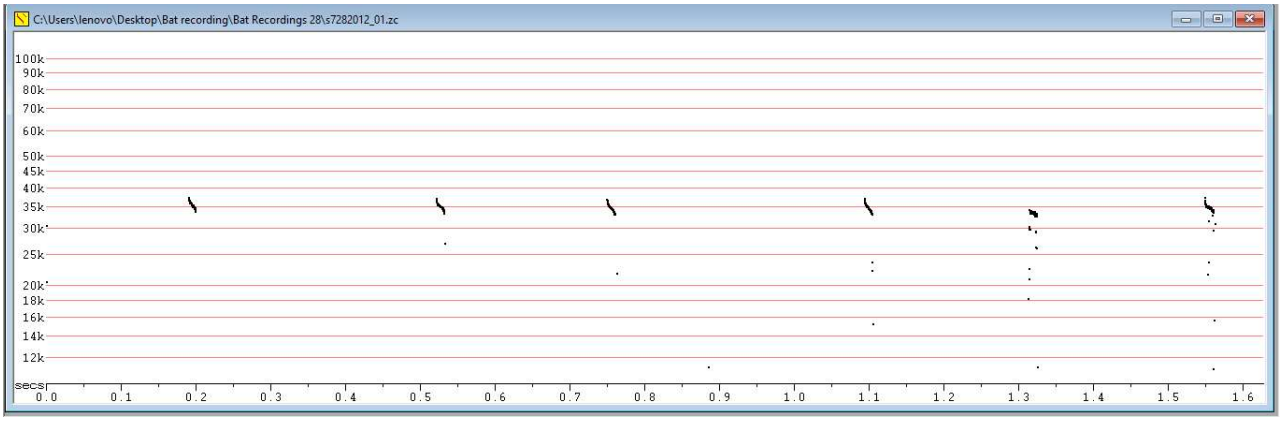

Figure 12. Savi's Pipistrelle calls that were recorded during the night drive by the active bat detector

5. IMPACTS OF WIND FARMS ON BATS

Bats are different and more sensitive than any other mammalian species. Bats have special niche requirements and a slow reproduction rate as they give birth to only one young per year, which is why they are one of the most threatened mammalian species. The low capacity of bats to recover from the decline in their breeding populations, makes the increase in their mortality rate caused by wind turbines even more problematic (Kunz *et al.*, 2007; Voigt *et al.*, 2012). The impact of wind turbine could be indirect or direct

5.1 Indirect impact of wind farms on bats:

5.1.1 Disturbance due to ultrasound emission

Some turbines emit ultrasounds up to 32 kHz whereas others none (Schröder, 1997). Bats using echolocation for orientation can react to these emitted ultrasounds if the latter's intensities fall in the same range as the bats' own calls (Simmons *et al.*, 1978; Neuweiler, 1980; Schmidt and Joerman, 1986; Bach and Rahmel, 2004); yet this reaction disturbing some bat species remain relatively unknown (Bach and Rahmel, 2004).

5.1.2 Loss of foraging habitats

Another indirect wind farm impact is the loss of foraging habitats (Bach and Rahmel, 2004; Millon et al., 2018). Bat species differ greatly in their choice of foraging habitats and their behavior. Most species usually return to the same foraging sites annually, thus they will recognize any new installed wind turbines due to blades rotation and air turbulences formed by the rotor, and they will probably avoid these sites (Bach and Rahmel, 2004). However, a long-term study revealed that the behavior to wind turbines is species-specific, for example the Serotine bats, Eptesicus

serotinus, abandoned their summer foraging habitat while, Pipistrelle bat, Pipistrellus pipistrellus, increased theirs (Bach, 2002; Bach and Rahmel, 2004).

The construction phase also has its impacts on bats; some species lose their foraging habitats during this phase; but, in some cases, it can be only over a short period of time once the vegetation regrows, especially if the area is small, therefore it can be used again by these species (Bach and Rahmel, 2004).

5.1.3 Barrier effect

A similar effect to habitat loss on bats is the loss or shifting of flight routes used by bats when these routes occur within the wind farm. However, the barrier effect of wind farms is also species-specific. It is most destructive on species that continue to use the same flight route crossing the wind farms (Bach and Rahmel, 2004).

5.2 Direct impact (bat mortality) of wind farms on bats

5.2.1 Barotrauma

One direct and fatal effect of wind turbines on bats is barotrauma that induces tissue damage to air-containing structures due to rapid pressure change (Baerwald *et al.*, 2008). Baerwald *et al.* (2008) found that barotrauma resulted in high bat mortality rates near wind turbines. Many authors suggested that the rapid air-pressure reduction close to moving turbine blades results in bats' fatalities as a consequence to barotrauma (Kunz *et al.*, 2007; Dürr and Bach, 2004; Von Hensen, 2004) rather than collision with the blades, given that echolocating bats are able to detect objects in motion better than stationary ones (Jen and McCarty, 1978).

5.2.2 Collision with the blades

One of the most studied cause of bat fatalities by wind turbines is the collision with blades. Many studies indicated that the number of bats killed by wind turbines is often higher than that of birds (Johnson *et al.*, 2000; Bach and Rahmel, 2004; Dürr and Bach, 2004) although there are no suggestions that bats' flight is better or worse than that of birds (Pennycuick, 1971). Migrating species are primarily affected such as *Nyctalus* spp (*N. leisleri*) and *Pipistrellus nathusii* (Bach and Rahmel, 2004; Dürr and Bach, 2004). Many factors result in the increased bat fatalities over the years upon collision as presented hereafter.

5.2.2.1 Location of wind farms

A study conducted in Northwestern Europe reported that the number of bats killed per turbine per year was closely related to landscape features (Rydell *et al.*, 2010a). The highest mortality rates were detected on top of a forested hill and in a marsh area in two different countries (Dulac, 2008).

A study conducted in Northwestern Europe reported that the number of bats killed per turbine per year was closely related to landscape features (Rydell *et al.*, 2010a). The highest mortality rates were detected on top of a forested hill and in a marsh area in two different countries (Dulac, 2008). This rate was lower in flat open lands, but then again higher in flat coastal lands (Rydell *et al.*, 2010a). Bats usually dwell in woody or forested areas and thus become more influenced by wind turbines that are currently being built there (Bach and Rahmel, 2004). Endl *et al.* (2004) and Seiche (2008) found that the bats mortality was higher in wind farms located less than 100 m from woodlands and lower in farms further away.

5.2.2.2 Characteristics of wind farms

No significant relationship was found between the number of bats killed per turbine and the number of turbines per farm (Rydell *et al.*, 2010a). However, the mortality rate was found positively correlated to the turbine tower height and rotor diameter but not related to the distance from the ground to the lowest rotor point (Rydell *et al.*, 2010a); Barclay *et al.* (2007) also found that bat fatalities increased exponentially with the increase of turbine height with the highest bat fatality rates recorded at turbines with tower height equal or greater than 65 meters, but the fatality rate was not affected by the diameter of turbine rotor. Seiche (2008) found as well that taller turbines kill more bats. And because of the growing use of wind energy, old turbines are being replaced with modernized taller ones and rotor diameter is being increased to create greater energy output per turbine, from 18 m diameter rotors of 24 m height towers to 90 m diameter rotors of 94 m height towers (Barclay *et al.*, 2007). Thus, the risk on bats is predicted to increase (Hötker, 2006; Smallwood and Karas, 2009; Rydell *et al.*, 2010a), specially that the construction of new turbines is made using tubular monopoles which have been hypothesized to mimic potential roost trees for bats (Kunz *et al.*, 2007).

Bats species that fly at turbine rotor height are considered as “high-risk” groups (Ahlén, 2002; Endl *et al.*, 2004; Ahlén *et al.*, 2007; Seiche, 2008; Bach and Bach, 2010; Bach and Niermann, 2010; Rydell *et al.*, 2010a) such as Nyctalus, Pipistrellus, Vespertilio and Eptesicus; they are characterized by long and narrow wings, use high-intensity echolocation calls with short and narrow-band components in order to detect insects at relatively long distances and forage in open areas (Waters *et al.*, 1995). Whereas bats species that fly below the rotors are said to be “low-risk” species such as Myotis, Plecotus and Barbastella spp. (Endl *et al.*, 2004; Seiche, 2008; Rydell *et al.*, 2010a); they are characterized by more or less broad wings, exhibit high maneuverability in their flight and forage close to the surfaces or within vegetation avoiding open and exposed areas (Baagøe, 1987). These “low-risk” species however, can still be killed occasionally by wind turbines (Rydell et al., 2010a). Some studies suggest that bats are attracted to either the sound or the movement of moving blades (Gruver, 2002; Barclay et al., 2007; Kunz et al., 2007), as many authors indicated that bats do not collide with stationary blades but rather killed by their rotation, in particular at low wind speeds (Fiedler, 2004; Arnett, 2005; Barclay et al., 2007).

5.2.2.3 Seasonality and periodicity

Many studies revealed that bat mortalities are related to weather patterns. Generally, bats limit their flight activity during rainy periods, at low temperatures, and when strong winds prevail (Eckert 1982; Erickson and West 2002; Arnett *et al.*, 2011). As an example, a study showed lower bat activity at some operating wind farms during high wind speeds (> 6.0 m/s) (Reynolds 2006; Horn *et al.*, 2008a; Arnett *et al.*, 2011). Arnett *et al.* (2008) suggested that more bat mortalities occur during relatively low-wind periods such as in summer and fall, and revealed that bats death rate increased before and after the passage of storms; which proves furthermore that bats restrict their flights at high wind speeds with or without the presence of wind facilities.

While the mortality rate is highly variable and periodic over the years, the peak usually occurred late summer and fall (late July till early October) (Barclay *et al.*, 2007; Kunz *et al.*, 2007; Arnett *et al.*, 2008; Rydell *et al.*, 2010a);. Moreover, most bat fatalities occurred during autumn migration and not during the spring one (Johnson *et al.*, 2003; Bach and Rahmel, 2004; Barclay *et al.*, 2007). It is not yet clearly explained but it may be due to bats taking other flight paths in spring and/or exhibiting different migrating behavior (Bach and Rahmel, 2004). Also, most bat fatalities at wind farms are recorded at night (Arnett et al., 2008; Rydell et al., 2010a; Voigt et al., 2012), of which most might be migrants traveling in autumn from breeding to wintering grounds (Voigt et al., 2012)

5.2.2.4 Species-specific

Rydell *et al.* (2010a) postulated that mortality occurs independently of age, sex, resident or migrant species. In addition, wind turbines kill bats from non-resident populations located at far distances and not only on the local population (Voigt *et al.* 2012, Lehnert *et al.* 2014). *Nyctalus* and *Pipistrellus* species were the main concern of bat fatalities among the migrating species (Dürr & Bach, 2004).

5.3 Impact of Wind Turbines on Lebanese Bats

In Lebanon bats are highly threatened and endangered due to several reasons; First, habitat destruction many cases were documented where the roosting sites of bats were destroyed totally like the case of the Egyptian Fruit Bats colony (*Rousettus aegyptiacus*) in Berqayel – Akkar or blocking the entrance of their roosting sites as it was documented in Saleh Cave – Amchit. Second, killing bats through putting fire in caves or shooting them like the recent case (See above) of *Myotis myotis* in Chaddra Cave – Akkar. Third, drying wet lands or cutting forests which are the main feeding sites for bats. Fourth, a newly recognized problem which is the excessive use of pesticide that affect bats directly or indirectly through decreasing their food resources (Horáček et al. 2008, 2009, Benda et al. 2016). Wind turbine could be another factor affecting bats population if prevention and mitigation measures were not considered seriously pre- and post-construction

phases and most importantly during the operation phase. The Impact of wind turbines on the ten identified bat species on the study site is described below

5.3.1 *Rhinolophus* sp.

Both Horseshoe bats species *Rhinolophus ferrumequinum* and *Rhinolophus hipposideros* are common in Lebanon and were reported from several localities (Benda et al 2016). These species practice low flight and forage close to habitat structure hence risk of collision is probably low. Only a total of one fatality of each species were reported from the 20 European countries (Rodrigues *et al*. 2015). However, the lack of causalities does not mean the absence of risk on these species especially if they use the study site as a hibernating site rather than a feeding site. The wind turbine may have an impact on these bats during their migration. More studies needed to confirm this issue

5.3.2 European Free-Tailed bat (*Tadarida teniotis*)

The European Free-Tailed Bat is not that common in Lebanon and is not well distributed (Benda et al. 2016). It has a very large foraging distance ranging from 30 – 100 Km and they can rise to an altitude between from 10 – 300 meters above ground in search for food and up to 3000 meters during their migration (Williams et al.1973). Hence, *Tadarida teniotis* are at higher risk of collision as their activity coincides in the dangerous zone (between 50 – 150 m above ground level) of the turbine (Welling et al. 2018). Furthermore, it was reported by Camina (2012) that 3.5% of the total bat mortality observed at the wind farms sight were *T. teniotis*.

5.3.3 Common Noctule Bat (*Nyctalus noctula)*

This species is a rare in Lebanon and was recorded from very few localities (Benda et al. 2016). Common Noctule cover a large distance up to 26km while foraging for insects. It flies between 10 to a few hundred meters above ground during their search for food. It was reported that the fatalities of this species was among the highest in Europe (Rodrigues et al 2014). It was reported that Common Noctule bat was among the bats that were killed by wind turbines in a Spanish province since they forage in open air or above tree canopies thus moving in the airspace usually occupied by wind turbine blades (Alcalde 2003, Camina 2012, and Rydell, 2010a, 2010b)

5.3.4 Greater Mouse-Eared Bat (*Myotis myotis*)

Both *Myotis* species, the Greater Mouse-Eared Bat (*Myotis myotis*) and the Longer Fingered Bat (*Myotis capaccinii*) are uncommon in Lebanon and were recorded from very few localities (Benda et al. 2016). The Greater Mouse-Eared Bat cover a distance of 25 km and fly up to 50 meters above ground in direct flight. However, there is not much information of their foraging distance or height of their flight. *Myotis* sp. are highly affected prior the operation phase of the wind plants since they

lose their foraging grounds during this phase that they will return to once the vegetation regrows (Bach and Rahmel 2004). Besides *Myotis capaccinii* is a very sensitive species and wind turbines can cause serious damage to it (Tellería, 2009).

5.3.5 Serotine Bat (*Eptesicus serotinus)*

The Serotine bat is moderately frequent in Lebanon (Benda *et al*. 2016). Serotine bats cover a medium distance while foraging up to 12 km. They forage above tree canopy and can reach the height of the rotor and in direct flight they fly up to 50m above ground. Hence disturbance of their foraging sites will affect their persistence in the area. It was reported that *E. serotinus* abandoned their summer foraging habitat after wind farm construction (Bach, 2002; Bach and Rahmel, 2004)

5.3.6 Common pipistrelle (*Pipistrellus pipistrellus)*

This species is very common and well distributed in Lebanon (Benda *et al*. 2016). Common pipistrelle cover a small foraging distance up to 5km and they can fly up to the rotor height while foraging and 50m above ground during direct flight. Hence, they are highly affected by wind turbines. It was reported by Rydell *et al*. (2010a) that *P. pipistrellus* were the most commonly killed species by wind turbines at higher elevations. It was reported that among different species the highest mortality rate (59%) that occurred at the wind farms site in Spain was among *P. pipistrellus* (Alcalde 2003, Camina 2012).

5.3.7 Kuhl's pipistrelle *(Pipistrellus Kuhlii)*

Kuhl's Pipistrelle is common and well distributed in Lebanon (Benda et al. 2016). Information on the foraging distance of Kuhl's Pipistrelle is deficient. However, they fly very low above ground (1m) up to few hundred meters. This will increase the chance of collision with wind turbines. Many reports reported the effect of wind turbines on Pipistrellus Kuhlii (Alcalde 2003, Camina 2012).

5.3.8 Savi's Pipistrelle (*Hypsugo savii)*

Savi's Pipistrelle is a common bat in Lebanon but not well distributed (Benda et al. 2016). Reports on foraging distance of Savi's Pipistrelle is unknown but they can fly up to 100m above ground. However, many reported fatalities of Hypsugo savii due to wind turbine. Camina (2012) reported that 18% of all bat fatalities at the wind farms were Hypsugo savii.

5.4 Collision Risk with Wind Turbines

Of the ten bat species identified on the study site five are of high risk of collision, one of medium risk and four of low risk (Table 4)

Table 4. The level of collision risk among the ten bat species identified on the study site.

High risk	Medium risk	Low risk
European Free-Tailed bat *(Tadarida teniotis)*	Serotine bat (*Eptesicus serotinus)*	Greater Horseshoe bat (*Rhinolophus ferrumequinum)*
Common Noctule bat *(Nyctalus noctula)*		Lesser Horseshoe bat (*Rhinolophus hipposideros)*
Common pipistrelle (*Pipistrellus pipistrellus)*		Greater Mouse-Eared bat (*Myotis myotis)*
Kuhl's pipistrelle (*Pipistrillus kuhlii)*		Long-Fingered bat (*Myotis capaccinii)*
Savi's Pipistrelle (*Hypsugo savii)*		

6. MITIGATION MEASURES

It is important to note that this short survey covered trimester of the bat cycle. The survey during this period identified the active bat species within the site and aided in recommending the mitigation measures to decrease the impacts on the identified species. However, notes on migratory bat species and time of arouse remain largely unkonwn due to the fact that these months were not covered in the survey and no previous work was conducted. Hence, additional studies should be carried out to cover this critical period before the construction phase. It is also highly recommended and essential to carry a one-year, preferably two-years, survey to cover all the seasons and identify all the bats migratory or sedentary to be able to give a comprehensive mitigation measures before the construction phase and determine bat activity index.

Bats are very sensitive and vulnerable species that is protected by international legislation. This urge to consider several mitigation measures to avoid significant adverse impact or mitigate if avoidance is not possible. Therefore, the following should be considered

6.1 Avoidance

The best strategy to conserve bat population is through preventive planning to avoid bat fatalities. Avoidance or at least decreasing bat mortality should be a priority for bat conservation. Avoidance includes

6.1.1 Deciding on site

In the course of wind farm planning, preferred habitat and commuting paths should be known and avoided as preventative measures (Roeleke et al., 2016). To do so, the spatial and foraging behavior of each bat species should be studied despite the difficulties that will face this task. Hence, it is recommended that wind turbines should not be installed within woodlands and it is recommended to have a buffer zone of 200 meters of bat habitat these include: tree lines, hedgerow network, wetlands, waterbodies… This needs further assessment during the active phase that was not covered through this survey

6.1.2 Prevention of habitat destruction

The site area is very rich in potential roosting and hibernating sites. Many caves and suitable rock crevices were encountered during the field survey. Moreover, a sinkhole was observed beside one of the proposed sites. Hence avoiding such sites and minimizing the destruction of other habitats should be avoided. Furthermore, precaution measures such as 1) avoiding construction works during sensitive periods such as hibernation and maternity seasons; 2) out of these seasons a bat specialist have to be on site to monitor the construction activities and to take necessary actions to prevent bat fatality

6.1.3 Elimination of attraction factors

Knowing that most of the bat species encountered within site are insectivores and flying insects are their main source of food. Many factors including light source, water bodies, garbage … that attract insects that will be followed by their predator bats to the site. Therefore, during construction and later during operation of the wind farm all factors that are known to attract bat should be removed. The areas around the turbine and the turbine itself should be managed in order not to attract insects. This include the color of wind turbine to be unattractive to insects, preventing the accumulation of garbage, use lighting only when needed or lights that don't attract insects, avoid water accumulation or stagnant water, remove weeds and new shrub, and forests and orchards should not be allowed to become established within the 200m buffer zone around turbine.

6.1.4 Avoid disturbance of bats

Prevent disturbance of; 1) occupied roosts by restricting construction activities in their vicinity, 2) foraging and commuting sites by restricting construction activity during times of the day before sunset as it was observed that the Pipistrelle bat starts their activity at sunset when there is still light.

6.2 Mitigation

Mitigation should start and be accounted for during the planning of the project. Mitigation starts with the planning or pre-construction, during construction and during the operation phase. During the pre-construction or planning phase sites for the wind turbine should be selected to have minimum impact on bat habitat and foraging sites

During the construction phase certain measures should be taken 1) minimize disturbance and sound pollution through limited access to the area, 2) Minimize impact on foraging sites by conserving the green cover available and abide by the 200 m buffer zone, 3) halt entrance into caves especially during the hibernation period, 4) Prohibit personnel from putting fire in the caves especially during winter where bats will be hibernating, 5) avoid direct persecution of bats, and 6) provide the necessary training and awareness programme for the project employee.

The main aim of the mitigation measures to reduce bat fatality through decreasing the impact on their habitats and foraging sites in addition to decreasing direct fatality caused by collision or barotrauma during their activity. Thus appropriate mitigation measures should be designed and implemented. These include:

1- The construction of the project should be planned for times where bats are not active. During bat hibernation however, precautions should be taken not to disturb bats and their hibernating roosts. Moreover, during this survey many bat species were identified and started their activity before dusk like the *Pipistrellus pipistrellus*. Hence, construction activities should be scheduled accordingly.
2- Additionally, the loss of foraging habitat by avoidance as an indirect impact of wind farms should as well be considered in the mitigation measures as it does not only affect bats but also their role in the ecosystem as pollinator or pest-control, among others. This can be compensated by altering and enhancing surrounding habitats through ponds and safe corridors creation and through establishing artificial bat boxes or changing land-uses into a more suitable niche for bats. Unfortunately, these solutions compensating habitat loss near the wind farms will benefit only local populations and not migratory ones, so more efforts should be made to include and benefit all species.
3- Permanent access of roads will allow people access un-accessible places and destroy or disturb bat roosts and influence the nocturnal life of certain species especially when car trafficking occurs at night. Hence the following should be taken into consideration
    a. Accessibility to wild areas or roosting sites through opening the roads to facilitate access to the wind farms will affect negatively many roosting sites of bats as the case of *Myotis myotis* discussed above. Therefore, it is recommended to close these caves with a bat free access gates (Plate 12) that allow bats in and out but not people

Plate 12. Photo taken from the web[1] for an example of a cave gate

[1]"https://www.google.com.lb/search?q=closing+cave+entrance+with+bat+free+access&source=lnms&tbm=isch&sa=X&ved=0ahUKEwirwrPXg6HeAhUj-YUKHZCJDHsQ_AUIDigB&biw=1366&bih=608#imgdii=HYfXbeBBLWAGyM:&imgrc=N32H6LP5zVTPOM:"

b. Especially after dusk lights coming out of the cars might attract insects and expose bats to accidents in addition to road kills of bats. Hence, avoid night visits to the site or use dim light that have a minimal effect.

4- Further assessment is required for bat's activity during spring as they arose from their hibernation or during their migration. This study showed a great diversity of bats within the site and the wind farms has an impact on most of them. Hence it is expected to encounter more bat species during the Spring season and mitigation measures could be planned accordingly

5- Further inspection for deserted houses, caves, land depressions in the study area and its surroundings during the Winter to determine if they are used as hibernating sites by sedentary or migratory bats.

6- Bats are attracted by their prey and each species feed on different insect prey. Therefore studying of nocturnal insect species in the study site is essential to determine the bat species that are attracted by these insects to the study site. Many methods could be used for example light traps, pheromone traps …

7- Bat activities are high at low wind speed (below 7.5m/sec) and high temperature above 12 degrees C. Weather patterns according to which bats alter their activity, can be predicted thus periods with high bat fatalities at wind turbines can be predicted and avoided; which is why mitigation efforts should focus of periods with high-risk in order to reduce bat mortality.

a. One measure to reduce bat mortalities is by increasing cut-in speed of the turbines when local conditions favor bat activity. However, this might not result in an efficient reduction of bat fatalities.
b. Another way is to use technical innovations at wind facilities in order to deter bats from approaching the turbines such as bat discouraging radar or ultrasonic noise emission
c. One way to avoid possible fatalities for this species is to set a start-up speed, as in to allow wind plant operations only when wind speeds exceeds 7 m/s. Thus, with the lack of efficient deterrents for bats at wind turbines, the regulation of start-up speed is one of the most effective measures specially for mitigating bat fatalities at tall wind turbines even if the electricity industry will have to sacrifice in terms of productivity
d. Night-time restrictions should be implemented all year-round. However, this restriction could be removed in winter months or at certain unfavorable environmental conditions for bats after an intensive monitoring of bats on the site of the turbine.
e. Blade feathering where by adjusting the angle of the rotor blade parallel to the wind or turning the whole unit out of the wind to slow or stop blade rotation. These are proven ways to decrease bat mortality at operating wind farms.

8- Long-term monitoring the impacts of wind farm after construction. The impact of wind farms should also be determined by comparing bats activity prior and post its construction, inside and outside the site and for many years following the set-up (Rodrigues *et al.*, 2008). Therefore, monitoring have to be ongoing as long as the wind farm is in operation. Continuous monitoring of bats for the first five years is a must to mitigate its effect on bats and later frequent monitoring is required. The Monitoring programme should include the following:
    a. Loss of habitat
    b. Acceptability of bats for the enhanced habitat if any
    c. Monitoring mortality
    d. Searching for bat fatalities
    e. Estimate mortality rate
    f. Survey of migratory species
    g. Behavior, reaction and response of species to wind turbines

9- Furthermore Mammals and other terrestrial species (Other than birds) were not studied during this survey. Few mammal encounters were recorded. Hence it is recommended to conduct a comprehensive survey of terrestrial species (amphibians, reptiles and mammals) for the mitigation measures to be complete.

6.3 Assessing Habitat and Species Sensitivity to Standardized Anthropogenic Pressures

This report uses a method of assessing habitat and species sensitivity to standardized anthropogenic pressures following the "Natural England Commissioned Report NECR213 (2016)". The work focused on direct effects and expected consequences on the behavior and fitness of bats in the project site. Resistance and Resilience scores to standardized pressure intensities are here combined into a pre-formulated high level assessments of sensitivity to present or future human activities. In line with the above, a sensitive feature is one which has low Resistance (easily affected by human activity), and/or low Resilience (recovery time following an impact is long or impacts are irreversible). Sensitivity assessments for bats in Akroum have been largely unavailable to date, partially due to the complexity caused by avoidance behaviors of the recorded species (Table 1), extended species range outside Akroum, complex life cycles and indirect effects on supporting habitats and food resources. In part, the complexity of assessing overall effects on bats in comparison to habitat can be greatly reduced by making independent assessments of the direct effects caused on the bats features themselves and the effects on supporting their habitats and attributes by the same pressure. This work follows this strategy and is designed to focus on assessing direct sensitivity of bats' features to anthropogenic derived pressures using best available evidence. To achieve the expected outcomes:

1) Resistance and Resilience information on direct effects of wind turbines on bats were reviewed.
2) A clear and sound high level sensitivity assessment method to identify and score the direct effect of wind turbines (construction, disturbance) on bats and mammals was designed and applied.
3) Direct means of impact were acknowledged, the method was applied to suit the bats' and mammals' composition in the project site area

The high-level initial screening phase and subsequent scoping followed similar steps used in Environmental Impact Assessments. It is important to note that this study focused on direct effect pathways on bats of Akkar. Therefore, only displacement, and lethal or sub-lethal effects on individuals that are likely to have population consequences were assessed.

Indirect effects on bats through direct effects on habitats, food resource or more complex biotic interactions (competition and predation) are likely to exist and should be considered in addition to this sensitivity assessment on direct effects.

Bats' avoidance behaviors probably cause greater population decline and over a shorter time period within a particular site than population declines caused by direct mortality.

Less mobile features or features with restricted access to unaffected areas will be more greatly affected by mortality or loss of fitness if sub-lethal effects prevail. In general, for a given population decline within a site, impacts resulting in the death of a proportion of individuals within

a population will have longer population recovery times (bats more than other mammals) (lower Resilience) than an equivalent decline driven by the (temporary) displacement of individuals from the site (bats less than other mammals).

Bats have the ability to actively avoid harmful pressures. Thus, some pressures (e.g. visual or noise disturbance), may lead to displacement and relocation outside the site boundaries causing significant reductions in population numbers within that site but without introducing mortality or reproductive failure. Nonetheless such pressures would affect the ability of the site to support the bats feature. On the other hand, some pressures which cannot be avoided will lead to direct mortality or reduced productivity of a number of individuals in a population. However, for most pressures, both displacement and mortality/fitness effect pathways are likely to contribute to local population declines. Alternatively, that behavioral flexibility may lead to a higher Resilience score via the displacement pathway in comparison with that through the mortality pathway as individuals which have not suffered mortality may readily return once the pressure is lowered or ceased. Due to the scarcity of direct recovery evidence, Resilience scores have comparatively lower confidence levels.

The following Table (5) summarizes the sensitivity of the species groups to a potential impact of anthropogenic development.

Table 5. The sensitivity of the species groups to a potential impact of anthropogenic development.

Effect	Groups of Species	Collision with structures	Light noise & acoustic disturbance	Barrier to movement
Severity of Impact	Greater horseshoe bat	Low	Moderate	Low
	Lesser horseshoe bat	Moderate	Low	Low
	European Free-Tailed bat	High	High	High
	Common Noctule bat	High	High	High
	Greater mouse-eared bat	High	Low	High
	Long-fingered bat	High	Low	High
	Serotine bat	High	High	High
	Common pipistrelle	High	High	High
	Kuhl's pipistrelle	High	High	High
	Savi's Pipistrelle	High	High	High

6.4 Interpretation and Use of the Sensitivity assessment

It is clear that the outcomes of the animal assessments are subjective in nature. As such the assessment provides an indication of sensitivity rather than a precise evaluation. It is also important to stress that the sensitivity assessments, other than for the purpose of scoping direct effects, take no account of the indirect effects that pressures may have on these bats mediated through significant effects on their supporting habitats or other resources on which they depend. The

construction work has an indirect impact on bats through the destruction of their habitats (removal of roosting or hibernation sites, loss of feeding grounds, loss of their niche habitat). It is also important to note that these assessments are simplifications of functional responses which are necessarily assessed on hypothetical scenarios representing the average expected condition. Clearly the reaction of the species and subsequently group of species should be regarded as a reaction to multiple specific activities. However, the sensitivity assessment is not an impact assessment it should only be used as a guide to inform the site-specific assessments conducted on specific sites and activities. The magnitude of specific activities has not been assessed as the sensitivity assessment is based on theoretical benchmarks. Nevertheless, the following Table (6) shows the possible reaction of bats to the effects indicated in the Table (5).

Table 6. Possible reactions of bats species identified to the effect indicated in Table (6).

Effect	Groups of Species	Collision with structures	Light noise & acoustic disturbance	Barrier to movement
Reaction Or Impact	Greater horseshoe bat	Low decrease of survival	Abandonment	Loss of feeding site / Hibernating site
	Lesser horseshoe bat	Low decrease of survival	Abandonment	Loss of feeding site / hibernating site
	European Free-Tailed bat	High decrease of survival	Abandonment	Loss of feeding site/migration route
	Common Noctule bat	High decrease of survival	Abandonment	Loss of feeding site/ Migration route
	Greater mouse-eared bat	High decrease of survival	Abandonment	Loss of feeding site or breeding sites
	Long-fingered bat	High decrease of survival	Abandonment	Loss of feeding site / Breeding site /Hibernation site
	Serotine bat	High decrease of survival	Abandonment	Loss of feeding site/
	Common pipistrelle	High decrease of survival	Attracted to light	Loss of feeding site/ migration route
	Kuhl's pipistrelle	High decrease of survival	Attracted to light	Loss of feeding site/ migration route
	Savi's Pipistrelle	High decrease of survival	abandonment	Loss of feeding site / migration route

The planned development work will affect some bat species as the impact might be critical and many species such as *Nyctalus noctula, Eptesicus serotinus*, and *Pipistrellus* spp., are directly affected through collision or barotrauma. If the cause of disturbance is temporary they may return after the source of disturbance is gone as the case of *Myotis* spp. Otherwise they will desert the

site for ever if the disturbance is persisting like the case of *Eptisicus serotinus*. This is the case of the bats that are sensitive to changes.

Some bats are known to be very fragile in response to human activities. Under any inappropriate action they will suffer from human development activities and as such, they may contribute to additional declines of the species. Therefore, it will be of high interest to know whether these species are found in the area of the project site or not. Their confirmed presence should call for an EIA report so that mitigation measures can be developed and implemented. In any case, no work should be undertaken under any circumstances on the site during the breeding or hibernating season.

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ENVIRONMENT
& HEALTH

APPENDIX O
JUNE 2019 FLORA REPORT

FLORAL SURVEY

LEBANON WIND POWER WIND FARM

REPORT 1

MYRNA SEMAAN PhD

7 July 2019

FLORAL SURVEY OF LEBANON WIND POWER WIND FARM

I- ECOLOGICAL CHARACTERISTICS OF LWP

Lebanon Wind Power project site (LWP) extends between the subalpine floral and bioclimatic zone and the higher mountain bioclimatic zone at its lower end.

- Almost 70% of the site area falls in the subalpine region, where a large number of the endemic species of Lebanon are concentrated, the zone also hosts a good number of endemics of the region. The subalpine zone is characterized with mainly herbaceous flora, and woody flora take the form or cushion plants the majority of which are *Astragalus* species. Trees that are adapted to this region are mainly *Juniperus excelsa*. (viewed in red highlight under name Subalpine zone on SA LWP .kwz file)
- The high mountain zone is the region of the high forests of Lebanon where coniferous forests expand associated with other high mountain tree species. This is the zone of cedars and junipers. In the Akkar part of the Mount Lebanon range, *Abies cilicica* thrives in its largest populations associated with other conifer species. (viewed in white and green highlight under name Coniferous forest and degraded coniferous forest on SA LWP .kwz file)
- The ecotone zone between these two ecosystems reveals the integration of floral elements of the lower range into the upper system; it occupies a good area on the lower heights of the project zone. It provides grounds for a range of endemics as well. (viewed in purple highlight under name Ecotone subalpine high mountain on SA LWP .kwz file)

II- DESCRIPTIVE CHARACTERIZATION OF LWP SITES

The field survey was conducted on 24-25 June.

❖ WTG 23

- The woody based flora is mainly spread near ground level in the form of cushion species; herbaceous species are spread amongst.
- Vegetation cover is nearly 60%.
- Floral Association observed on site includes:

  Juniperus excelsa two ground level bushes
  Juniperus oxycedrus
  Astragalus cruentiflorus
  Astragalus angustifolius
  Astragalus hermoneus
  Berberis libanotica
  Acantholimon libanoticum
  Cotoneaster nummularifolia
  Prunus prostrata
  Rosa pulverulenta
  Minuartia juniperiana

Asyneuma rigidum
Cousinia libanotica
Phlomis kurdica
Euphorbia macroclada
Alyssum species
Galium species
Achillea species
Graminae species

❖ WTG 22 and their connecting roads

- They exhibit the same habitat structure and vegetation as in WTG 23.
- *Daphne oleoides* and *Daphne libanotica* are in high frequency by the side of the road
- *Astragalus dictyocarpus* is found in remarkable frequency higher than in WTG 23.

❖ WTG 21 and the connecting road

The turbine will be positioned on the peak line of rugged outcrops of eroded rock formations. The bedrock is quite fractured rising in steep slopes with a superficial cover of stones. The surface layer of soil and broken substrate is not stable, it can displace easily. The road that will connect this turbine site runs on similar terrain.

Caution: The type of rock and the steepness of the slopes are a main worry in this area, in addition to the sensitive vegetation. Works on such terrain may lead to more magnified damage since the generated rubble could easily tumble down the slopes and cover large areas exacerbating the impact and augmenting the risk of disturbance exponentially. The impact of rainfall and water flow should also be considered for fear of spreading the rubble over even larger areas.

The floral combination resembles that of WTG 23; there is a high frequency of the following species:
Ziziphora clinopodioides
Thymus leucotrichus
Helichrysum plicatum
Centaurea cheirolopha

Juniperus oxycedrus is found in bushy ground level spread on the western slopes of the road.

❖ WTG 20

This turbine is located on slopes and bedrock (possibly dolomitic) of similar nature to WTG 21 location.

❖ WTG 19, 18 and connecting roads

This location benefits from a higher vegetation cover of nearly 80%.
Cushion species provide a good soil cover.
Cousinia libanotica is quite frequent.
Astragalus kurne- es-saudae exhibits high frequency

Turbine WTG 18 is by the existing road which helps decrease the impact of works and excavations.

❖ WTG 17

This area has much less cover (30%) with more plants at ground level rather than the cushion species.

Astragalus kurnet-es-saudae is well frequent, in addition to
Ziziphora clinopodioides
Thymus leucotrichus

Existing road is close to the turbine location, which reduces the impact.

❖ WTG 16 and its connecting road

The turbine location is on top of a hill with good vegetation cover (80%) mostly in cushion species.

The road to access the location also runs in terrain with similarly high vegetation cover of cushion species.

❖ WTG 15

The site manifests a population of *Juniperus excelsa* and *Juniperus oxycedrus* reduced to ground level bushes. The vegetation cover is high (80-90%).

In addition to the flora pointed at previous locations, this site starts hosting *Morina spicata*, a compositae of the ecosystem of the high mountain zone.

❖ WTG 14

This is a critical location, it is surrounded by winter water courses for the snow thaw, the courses run down a valley that reach the plains of the distant village underneath. The rock formation is erodible so may lead to more rubble production on unstable grounds. It is very important that the gullies and water courses remain open and unobstructed by rubble in the execution and the long-term operation phases due to any circumstance.

The vegetation cover is low. The most frequent species are the following:

Asperula glareosa
Plantago lanceolata
Astragalus angulosus
Helichrysum plicatum

Sedum album
Sedum laconicum
Veronica species

Also *Berberis libanotica* in few samples
Importantly: The largest concentration of *Linum mucronatum syriacum* is found on this and surrounding slopes.

Dry remains of *Crocus* species are found in the area.

❖ WTG 13 – 12 and connecting roads

Marrubium cuneatum started appearing and in appreciated frequency.
The slopes of the mountainous hill that hosts WTG 12 and 13 exhibit a good cover of *Juniperus excelsa* and *J. oxycedrus* in bushy forms at ground level; the cover is almost 90%.

The largest population of *Thymus leucotrichus* spreads on these slopes in remarkable density, constituting 30% of the vegetation cover.

❖ WTG 11 and connecting road

A snow coned valley marks the area where the location of the turbine and/or the connecting road will be crossing. The cone shows main water passages from the sides where green vegetation can be maintained for longer periods through the dry season.

Lotus species, *Medicago* species and *Potentila* species are found in the more humid areas. *Hypericum libanoticum* range of distribution starts at this region.

Juniperus excelsa on the surrounding slopes exist as short trees 3-4 m high.

❖ WTG 10 and connecting road

This location is also set in the vicinity of coned valleys and snow cones. Water paths are of concern. As in WTG 11, *Juniperus excelsa* and *J. oxycedrus* on the surrounding slopes exist as short trees 3-4 m high.

❖ After WTG 10 – the High Mountain Zone

Slightly after WTG 10, a change in the floral zones is very evident moving from the ecotone to the high mountain zone characterized by coniferous forests.

From WTG 23 to WTG10, the terrain was open landscape without canopy cover; at this point the forests of the high mountain system start to appear and increase in density. (34° 29’ 7” N, 36° 13’ 51” E)

After WTG10, an unpaved road is cut across the mountain.

- Above the existing road, *J. excelsa* is found in the form of distorted trees 2-4m high and the density is nearly 40% of ground cover; logging has well contributed to the thinning of the original forest and the distortion of trees.
- Below the existing road, the density of *J. excelsa* gradually increases from the surrounding hills to the SE slopes especially at the base of the slopes; the *J. excelsa* trees maintain their natural stature as well. The forest advances from the SE slopes to the E slopes from a dominance of *J. excelsa* to a coniferous cedar forest dominated by *Cedrus libani* and associated with *Abies cilicica*. Trees are maintained at their full stature reaching heights of 10-12m. The forest is dense and the canopy cover is 100%. Logging cleared some openings in the forest at distant sites.

The forest continues from these slopes to lower altitudes connecting with the coniferous forests of Qamou'a.

❖ WTG 9

The turbine area falls in the degraded forest above the existing road with 2-3 m high trees and stumps of *J. excelsa* and *J. oxycedrus*.

- The underbrush flora still includes members of the higher altitudinal range flora and subalpine ecosystem: *Astragalus cruentiflorus, Berberis libanotica, Cousinia libanotica, Acantholimon libanoticum, Euphorbia macroclada, Helichrysum plicatum, Centaurea hololeuca.*
- But the other *Astragalus* species do not grow at this altitude; *Prunus prostrata* is inexistent as well along with other upper range flora.

This area is surrounding with snow cones that should be maintained along with the proper flow of water.

❖ WTG 7-8

The area for the two turbines and the connecting roads runs in a zone of snow cones and coned valleys, nearly 5 cones make this seemingly hilly landscape. The tree cover in the area is reduced to distorted trees of 2-3 m high, but the coniferous forest is very close by at the surrounding of the cones and down the mountain slopes.

The area may be sensitive to use and introduce roads, excavations and flattening of certain paths that could be the rims of the cones.

❖ WTG 6

The site is by the existing road in a clearing of the original coniferous forest, which expands over the surrounding slopes above and below the site.

III- OTHER BIODIVERSITY OBSERVATIONS

- Birds and small raptors accompanied the survey days; the birds could have been kites hovering in groups of 3-4-5 in the sky.
- Other organisms noted on the survey days include:
    - Butterflies
    - Ladybirds in high density on cushion species
    - Swarms of small insects on *Astragalus* and cushion species
    - Wild bees were bountiful

IV- LIST OF THE SITE OBSERVED FLORA

The file is attached with indication of abundance using DAFOR code, location, life form, and endemism status.

V- LIST OF THE SITE EXPECTED FLORA

File attached

VI- ECOSYSTEM MAPPING

Mapping of ecosystem ranges on google earth was conducted; file attached.

VII- GENERAL REMARKS

- The LWP area extends between the subalpine and the high mountain ecosystems with their transition zone.
- The significance of the site lies in the floral richness in endemics, which mark the subalpine region of Lebanon.
- There are no distinctive habitats in the employed area, however the distribution of the flora vary in density and prevalence of species from site to another rather from the same set of species observed on site in the initial survey conducted on 24-25 June 2019.
- Topographic features that are important to preserve from the impact of project activities are gullies and snow cones to avoid interference with the water system.
- Locations with erodible rocky outcrops and unstable substrate should be offered high attention.

V- GENERAL RECOMMENDATIONS

The recommendations are not meant to influence any decision-making regarding site suitability for influence on flora or biodiversity; however, it is meant to improve on-site activities if they would be granted.

- The rubble generated from site excavations should be carefully managed to avoid increased adverse impacts on flora in the surrounding of excavation sites or in dumping sites. This is a major worry since most of the envisaged roads and turbine sites are situated on tops of hills, excavation works should not spread rubble over underlying slopes thus impacting larger area. Clear

strategy and operation procedures should be defined, implemented and supervised.

- It is highly recommendable that the team of employees and short-term workers on the project, both in the execution and operation phases, be trained and made aware of the existing biodiversity and its significance in order to avoid unnecessary adversities on the sites.

- A good monitoring plan, risk management and best practices regarding flora and biodiversity should be created and implemented.

List of Observed Flora

Species	***Ssp.***	***Var.***	**Status in Natural Habitat - Lebanon**	**Distribution Range**	**Site Abundance**	**In Mapped Zone (refer to google earth mapping)**	**LIFE FORM**
						1= subalpine 2=ecotone 3=high mountain	
Astragalus cruentiflorus		*cruentiflorus*	frequent	Leb+Syr	abundant	1,2,3	woody perennial (shrub)
Astragalus cruentiflorus		*supranubius*	Rare	Leb+Syr	abundant	1	woody perennial (shrub)
Astragalus angustifolius	*angustifolius*	*violaceus*	Localized	L+S+T	frequent	1	woody perennial (shrub)
Astragalus hermoneus			Localized	Leb+Syr	frequent	1	woody perennial (shrub)
Astragalus dictyocarpus			frequent	Lebanon	frequent	1,2	herbaceous perennial
Astragalus angulosus			Rare	Lebanon	occassional	1,2	herbaceous perennial
Berberis libanotica			frequent	Leb+Syr	frequent	1,2,3	woody perennial (shrub)
Onobrychis cornuta			frequent	L+S+T+Ar	occassional	1	woody perennial (shrub)
Acantholimon libanoticum				Leb+Syr	frequent	1,2,3	woody perennial (shrub)
Cotoneaster nummularia			frequent	Levant & M.E.	frequent	1,2	woody perennial (shrub)
*Daphne libanotica **			Rare	Leb+Syr	abundant / frequent	1 /2	woody perennial (shrub)
Daphne oleoides	*oleoides*		frequent	Eurasia	abundant	1,2	woody perennial (shrub)
Prunus prostrata		*prostrata*	Localized	MED	frequent	1	woody perennial (shrub)
Astragalus kurnet-es-saudae			Endangered	Lebanon	frequent	2	herbaceous perennial
Thymus leucotrichus		*austroanatolicus*	Rare	L+S+T	frequent /abundant	1/2	herbaceous perennial
Asperula glareosa			frequent	Leb+Tur	occassional	2	herbaceous perennial
Ziziphora clinopodioides			frequent	L+S+T+Ir+Iq	frequent	1,2,3	herbaceous perennial
Ononis pusilla			frequent	MED	occassional	3	herbaceous perennial
Centaurea hololeuca			frequent	Leb+Syr	frequent	1,2	herbaceous perennial
Centaurea cheirolopha			frequent	L+S+T	frequent	1,2	herbaceous perennial
Rosa pulverulenta			frequent	Eu+West Asia	occassional	1,2,3	woody perennial
Sedum album			frequent	Eu+West Asia	frequent	1,2	herbaceous perennial
Sedum laconicum			frequent	L+S+T+P+Gr+EU	frequent	1,2	herbaceous perennial
Scabiosa columbaria	*ochroleuca*	*webbiana*	frequent	Levant+Aegian	occassional	3	herbaceous perennial
Helichrysum plicatum	*plicatum*		Localized	L+S+T+Ir+Iq+ Bal	frequent	2,3	herbaceous perennial
Minuartia juniperina			Rare	Levant+Aegian	occassional	1,2	herbaceous perennial

Asyneuma rigidum	*sibthorpianum*		frequent	Leb+Tur	abundant / frequent	1,/ 2	herbaceous perennial
Campanula stricta		*libanotica*	frequent	Leb+Tur	occassional	2	herbaceous perennial
Cousinia libanotica			frequent	Lebanon	frequent	1,2,3	herbaceous perennial
Taraxacum assemanii			frequent	L+S+T+Ir+Iq	frequent	1,2	herbaceous perennial
Teucrium polium			Abundant	MED	frequent	1,2,3	herbaceous perennial
Phlomis kurdica			frequent	L+S+T+Iq	frequent	1,2	herbaceous perennial
Plantago lanceolata			frequent	Subcosmic	frequent	1,2,3	herbaceous perennial
Paronychia argentea		*scariosissima*	frequent	MED	occassional	2	herbaceous perennial
Juniperus excelsa	*excelsa*		dominant	Eu+West Asia	occassional / frequent	2, 3	tree
Juniperus oxycedrus	*oxycedrus*		Abundant	MED+EU	frequent	2 ,3	tree
Hypericum libanoticum			frequent	Leb+Syr	occassional	2,3	herbaceous perennial
Hypericum lydium			frequent	L+S+T+Ir+Ar	occassional	2,3	herbaceous perennial
Euphorbia macroclada			Sporadic	L+S+T+Ir+Iq	frequent	1,2,3	herbaceous perennial
Linum mucronatum	*syriacum*		Rare	L+S+P	frequent	2	herbaceous perennial
Marrubium cuneatum			frequent	L+S+T+P+Ir	frequent	3	herbaceous perennial
Cedrus libani	*libani*		dominant		dominant	3 (forest)	tree
Abies cilicica	*cilicica*		frequent		frequent	3 (forest)	tree
Morina persica			frequent	Levant+Aegian	occassional / frequent	2, 3	herbaceous perennial
Anemone blanda			frequent	Levant	frequent	2 ,3	herbaceous perennial
Viola libanotica			Endangered	Lebanon	occassional	2	herbaceous perennial
Viola parvula			frequent	N. Afr+Lev+M.E.	occassional	2 ,3	annual
Cyclamen coum	*coum*		frequent	Levant+Aegian	frequent	2, 3	herbaceous perennial

List of Expected Flora

Species	***Ssp.***	***Var.***	**Status in Natural Habitat -Lebanon**	**Distribution Range**
Arabis montbretina			frequent	Asian
Juncus bufonius			frequent	Cosmic
Poa annua			frequent	Cosmic
Festuca callieri	*callieri*		Rare	E. Eu+Leb.
Lepidium hirtum	*nebrodense*		Localized	E. Eu+Leb.
Radiola linoides			frequent	E. Eu+Leb.
Cnidium silaifolium	*orientale*		Localized	Eu+Leb.+T
Cuscuta palaestina	*balansae*		Localized	Eu+W. As+N.Afr
Hypericum perforatum			frequent	Eu+W. As+N.Afr
Scabiosa columbaria	*ochroleuca*	*ochroleuca*	Rare	Eu+W. As+N.Afr
Eryngium bourgatii	*bourgatii*			Eu+West Asia
Helianthemum ledifolium		*microcarpum*	Rare	Eu+West Asia
Malabaila graveolens			frequent	Eu+West Asia
Myosotis sicula			Rare	Eu+West Asia
Ranunculus constantinopolitanus			frequent	Eu+West Asia
Rosa pulverulenta			frequent	Eu+West Asia
Solenanthus stamineus			frequent	Eu+West Asia
Vinca herbacea			frequent	Eu+West Asia
Bromus squarrosus			frequent	Euasiafri
Carex distans			Localized	Euasiafri
Carex divisa			frequent	Euasiafri
Carex otrubae			Localized	Euasiafri
Carex ovalis			Rare	Euasiafri
Epilobium parviflorum			frequent	Euasiafri
Geum urbanum			Sporadic	Euasiafri
Juncus articulatus			frequent	Euasiafri
Poa pratensis			frequent	Euasiafri
Ranunculus arvensis			frequent	Euasiafri
Turgenia latifolia			frequent	Euasiafri
Viola odorata			Localized	Euasiafri
Agrimonia repens			Rare	Eurasia
Blysmus compressus			Rare	Eurasia
Bupleurum falcatum	*cernuum*		frequent	Eurasia
Bupleurum falcatum	*persicum*		frequent	Eurasia
Carex pallescens		*pallescens*	Endangered	Eurasia
Carex pallescens		*pallescens*	Endangered	Eurasia
Chenopodium foliosum			frequent	Eurasia
Cruciata pedemontana			frequent	Eurasia
Daphne oleoides	*oleoides*		frequent	Eurasia
Galium verticillatum			frequent	Eurasia
Logfia arvensis			frequent	Eurasia
Medicago falcata			Sporadic	Eurasia
Melica ciliata	*ciliata*		frequent	Eurasia
Pimpinella tragium	*lithophila*		frequent	Eurasia
Poa bulbosa			Rare	Eurasia
Prunella laciniata				Eurasia
Rumex nepalensis			frequent	Eurasia
Scandix pecten-veneris		*pecten-veneris*	frequent	Eurasia

Thesium arvense			frequent	Eurasia
Thesium divaricatum			frequent	Eurasia
Ziziphora capitata			frequent	Eurasia
Lotus corniculatus		*alpinus*	frequent	Euro-Siberian
Lotus corniculatus		*corniculatus*	Localized	Euro-Siberian
Lotus glaber corniculatus tenuifolius#			Localized	Euro-Siberian
Rubus canescens		*canescens*	frequent	Euro-Siberian
Sambucus ebulus			Abundant	Euro-Siberian
Taraxacum officinale			frequent	Euro-Siberian
Tussilago farfara			frequent	Euro-Siberian
Urtica dioica			frequent	Euro-Siberian
Bromopsis tomentella Bromus # tomentellus			frequent	Ir-Tr element
Crypsis acuminata	*acuminata*		Endangered	Ir-Tr element
Drabopsis verna			frequent	Ir-Tr element
Gagea gageoides			frequent	Ir-Tr element
Juncus gerardi	*libanoticus*		frequent	Ir-Tr element
Armeria undulata			frequent	L+Gr
Hypericum nanum			frequent	L+S+P
Lathyrus ciliolatus				L+S+P
Romulea bulbocodium		*syriaca*	Endangered	L+S+P
Silene libanotica			Endangered	L+S+P
Stachys libanotica		*libanotica*	Localized	L+S+P
Trigonella berythea			Rare	L+S+P+EG+CY
Colchicum brachyphyllum			Localized	L+S+P+J
Prangos asperula			frequent	L+S+P+Jr
Aethionema capitatum			Rare	L+S+T
Allium bassitense			Rare	L+S+T
Alyssum condensatum	*flexibile*		frequent	L+S+T
Alyssum mouradicum			Endangered	L+S+T
Anthemis pauciloba		*pauciloba*	frequent	L+S+T
Arenaria cassia			Rare	L+S+T
Asperula bargyli			Rare	L+S+T
Aubrieta libanotica			frequent	L+S+T
Bunium pestalozzae			frequent	L+S+T
Carlina involucrata	*libanotica*		frequent	L+S+T
Crepis reuterana	*eigiana*		frequent	L+S+T
Dianthus strictus		*strictus*	frequent	L+S+T
Dianthus strictus		*gracilior*	frequent	L+S+T
Dianthus strictus		*axilliflorus*	frequent	L+S+T
Eryngium bourgatii	*heldreichii*		Localized	L+S+T
Erysimum goniocaulon				L+S+T
Evax anatolica			frequent	L+S+T
Ferulago trachycarpa			frequent	L+S+T
Gagea fistulosa			Rare	L+S+T
Galium incanum	*incanum*		frequent	L+S+T
Galium incanum	*libanoticum*		frequent	L+S+T
Genista libanotica			frequent	L+S+T
Hypericum scabrum			frequent	L+S+T
Lamium ehrenbergii			frequent	L+S+T
Poa diversifolia			frequent	L+S+T

Polygonum cedrorum				L+S+T
Prunus monticola divaricata #	*divaricata #*		frequent	L+S+T
Romulea bulbocodium		*crocea*	Rare	L+S+T
Salvia microstegia			frequent	L+S+T
Tanacetum aucheri			frequent	L+S+T
Thlaspi microstylum			Rare	L+S+T
Verbascum cedreti			frequent	L+S+T
Veronica bombycina			Localized	L+S+T
Veronica polifolia			frequent	L+S+T
Odontites aucheri			Rare	L+S+T+Ar
Onobrychis cornuta			frequent	L+S+T+Ar
Pimpinella anthriscoides		*anthriscoides*	Localized	L+S+T+Ar
Barbarea minor		*minor*	frequent	L+S+T+Ar+Ir
Cerastium fragillimum			Rare	L+S+T+Cy
Allium zebdanense			frequent	L+S+T+Eu
Trifolium repens	*orphanideum*		Endangered	L+S+T+Gr Is
Alyssum condensatum	*condensatum*		frequent	L+S+T+Iq
Sideritis libanotica	*libanotica*		frequent	L+S+T+Iq
Nepeta italica			Abundant	L+S+T+Iq+Italy
Allium affine			Sporadic	L+S+T+Ir
Peltaria angustifolia			Rare	L+S+T+Ir
Rosularia libanotica		*glaber*	Rare	L+S+T+Ir
Sorbus umbellata		*umbellata*	Rare	L+S+T+Ir
Scorzonera rigida			frequent	L+S+T+Ir+Ar
Teucrium orientale		*orientale*	frequent	L+S+T+Ir+Ar
Alyssum contemptum			frequent	L+S+T+Ir+Iq
Euphorbia macroclada			Sporadic	L+S+T+Ir+Iq
Lathyrus hispidulus			Rare	L+S+T+Ir+Iq
Malabaila secacul			frequent	L+S+T+Ir+Iq
Onosma caerulescens			frequent	L+S+T+Ir+Iq
Onosma rascheyanum			Rare	L+S+T+Ir+Iq
Phagnalon kotschyi			Rare	L+S+T+Ir+Iq
Picris strigosa			frequent	L+S+T+Ir+Iq
Siebera nana			frequent	L+S+T+Ir+Iq
Siebera pungens			frequent	L+S+T+Ir+Iq
Silene odontopetala			Rare	L+S+T+Ir+Iq
Taraxacum assemanii			frequent	L+S+T+Ir+Iq
Valerianella dactylophylla			Localized	L+S+T+Ir+Iq
Veronica orientalis	*orientalis*		frequent	L+S+T+Ir+Iq
Ziziphora clinopodioides			frequent	L+S+T+Ir+Iq
Helichrysum plicatum	*plicatum*		Localized	L+S+T+Ir+Iq+ Bal
Allium stamineum			frequent	L+S+T+Ir+Iq+Gr
Amygdalus korschinskyi			Rare	L+S+T+P
Erysimum scabrum				L+S+T+P
Ferulago syriaca			frequent	L+S+T+P
Lathyrus cassius			frequent	L+S+T+P
Nepeta cilicica			frequent	L+S+T+P
Ornithogalum lanceolatum			frequent	L+S+T+P
Polystichum aculeatum			Endangered	L+S+T+P
Trifolium plebeium			frequent	L+S+T+P

Colchicum troodii			frequent	L+S+T+P+Cy
Anthemis hyalina			frequent	L+S+T+P+Iq+Ir
Anthriscus lamprocarpa			frequent	L+S+T+P+J
Achillea kotschyi	*kotschyi*		Localized	L+T+Blg+Gr
Rochelia cancellata			Rare	L+T+Iq
Potentilla geranioides		*geranioides*	Rare	L+T+Ir
Trigonella brachycarpa		*aucheri*	Rare	L+T+Ir
Corydalis erdelii			Localized	L+T+P+Ar
Echinops viscosus	*macrolepis*		frequent	Leb+Pal
Acantholimon libanoticum			frequent	Leb+Syr
Asperula breviflora			frequent	Leb+Syr
Astragalus cruentiflorus		*cruentiflorus*	frequent	Leb+Syr
Astragalus trichopterus			Endangered	Leb+Syr
Berberis libanotica			frequent	Leb+Syr
Centaurea drabifolia	*libanotica*		Endangered	Leb+Syr
Crepis robertioides			Rare	Leb+Syr
Draba oxycarpa			Endangered	Leb+Syr
Euphorbia caudiculosa			Rare	Leb+Syr
Gagea foliosa		*micrantha*	Rare	Leb+Syr
Galium libanoticum			Abundant	Leb+Syr
Hypericum libanoticum				Leb+Syr
Lathyrus basalticus			Localized	Leb+Syr
Lepidium hirtum	*nebrodense*	*microstylum*		Leb+Syr
Peucedanum depauperatum		*alpinum*	frequent	Leb+Syr
Phlomis brevilabris			frequent	Leb+Syr
Pimpinella tragium	*tragium*	*depauperata*	Endangered	Leb+Syr
Potentilla geranioides		*syriaca*	Rare	Leb+Syr
Romulea nivalis			Rare	Leb+Syr
Scutellaria utriculata			frequent	Leb+Syr
Silene makmeliana			Rare	Leb+Syr
Tulipa aleppensis			Endangered	Leb+Syr
Thlaspi kotschyanum			Endangered	Leb+Syr+Gr
Senecio doriiformis	*doriiformis*		frequent	Leb+Syr+T-Iq
Acantholimon ulicinum		*lycaonicum*	Rare	Leb+Tur
Allium rupicola			Endangered	Leb+Tur
Anthemis kotschyana		*discoidea*	Sporadic	Leb+Tur
Asperula glareosa			frequent	Leb+Tur
Asplenium lepidum				Leb+Tur
Asyneuma rigidum	*sibthorpianum*		frequent	Leb+Tur
Campanula cymbalaria			frequent	Leb+Tur
Campanula stricta		*libanotica*	frequent	Leb+Tur
Dianthus strictus		*subenervis*	Endangered	Leb+Tur
Dorycnium pentaphyllum	*anatolicum*		Endangered	Leb+Tur
Eremurus spectabilis				Leb+Tur
Fritillaria hermonis	*amana*		Endangered	Leb+Tur
Gypsophila libanotica			Rare	Leb+Tur
Ononis adenotricha		*stenophylla*	Localized	Leb+Tur
Ranunculus demissus		*major*	frequent	Leb+Tur
Silene capitellata			Endangered	Leb+Tur
Stachys libanotica		*minor*	Localized	Leb+Tur

Sesleria alba			Endangered	Leb+Tur+E Eu
Festuca pinifolia		*pinifolia*	Endangered	Leb+Tur+Si
Alchemilla diademata			Rare	Lebanon
Allium sannineum			Endangered	Lebanon
Anchonium billardieri			Endangered	Lebanon
Asperula libanotica			Abundant	Lebanon
Astragalus dictyocarpus			frequent	Lebanon
Campanula trichopoda			frequent	Lebanon
Cousinia libanotica			frequent	Lebanon
Dianthus karami			Rare	Lebanon
Dorycnium pentaphyllum	*anatolicum*	*libanoticum*	Endangered	Lebanon
Draba vescicaria			Endangered	Lebanon
Erophila gilgiana			Rare	Lebanon
Fritillaria hermonis	*hermonis*		Endangered	Lebanon
Leontodon libanoticus			frequent	Lebanon
Noaea mucronata	*mucronata*	*humilis*	Endangered	Lebanon
Origanum ehrenbergii			Endangered	Lebanon
Orobanche astragali			Endangered	Lebanon
Puschkinia scilloides		*libanotica*	frequent	Lebanon
Ranunculus schweinfurthii			Endangered	Lebanon
Sanguisorba compactum			Endangered	Lebanon
Scorzonera mackmeliana			frequent	Lebanon
Silene grisea			Rare	Lebanon
Stachys ehrenbergii			Rare	Lebanon
Trifolium modestum			Rare	Lebanon
Trifolium sannineum			Endangered	Lebanon
Tripleurospermum sannineum			Endangered	Lebanon
Viola libanotica			Endangered	Lebanon
Asyneuma rigidum	*sinaï*		Endangered	Lebanon+Sinaï
Ajuga chamaepitys	*palaestina*		frequent	Levant
Ajuga chamaepitys	*glareosa*		frequent	Levant
Ajuga chamaepitys	*mesogitana*		frequent	Levant
Anemone blanda			frequent	Levant
Arabis caucasica	*brevifolia*		Localized	Levant
Arabis caucasica	*caucasica*		Localized	Levant
Arabis ionocalyx			Localized	Levant
Arum conophalloides		*conophalloides*	frequent	Levant
Convolvulus libanoticus			frequent	Levant
Coronilla emerus	*emeroides*		frequent	Levant
Crocus cancellatus	*cancellatus*		Endangered	Levant
Crocus cancellatus	*damascenus*		Endangered	Levant
Dryopteris pallida		*libanotica*	Localized	Levant
Ononis adenotricha		*adenotricha*	frequent	Levant
Onosma aucheranum			frequent	Levant
Polygonum bellardi			frequent	Levant
Trifolium pauciflorum			frequent	Levant
Trifolium physodes		*psilocalyx*	Rare	Levant
Scorzonera cana		*alpina*	frequent	Levant & M.E.
Scorzonera mollis	*mollis*		Abundant	Levant & M.E.
Trifolium dasyurum			frequent	Levant & M.E.

Viola sieheana			Rare	Levant & M.E.
Cerastium illyricum	*comatum*		Localized	Levant+Aegian
Dactylorhiza iberica			frequent	Levant+Aegian
Dactylorhiza saccifera			frequent	Levant+Aegian
Echinops viscosus	*viscosus*		frequent	Levant+Aegian
Echinops viscosus	*bithynicus*		frequent	Levant+Aegian
Hypericum montbretii			frequent	Levant+Aegian
Morina persica				Levant+Aegian
Scabiosa columbaria	*ochroleuca*	*webbiana*	frequent	Levant+Aegian
Trigonella coerulescens			frequent	Levant+Aegian
Astragalus gummifer			Abundant	M.E.
Astragalus gummifer			Abundant	M.E.
Bunium paucifolium		*junceum*	frequent	M.E.
Bunium paucifolium		*paucifolium*	frequent	M.E.
Eremopoa persica			frequent	M.E.
Minuartia meyeri			frequent	M.E.
Polygonum polycnemoides			frequent	M.E.
Pyrus syriaca		*syriaca*	frequent	M.E.
Trigonella filipes			frequent	M.E.
Alopecurus gerardi		*gerardi*	Localized	MED
Buglossoides incrassata			frequent	MED
Bupleurum gerardii			frequent	MED
Cerasus prostrata		*prostrata*	Localized	MED
Daucus carota	*maximus*		frequent	MED
Elymus panormitanus		*panormitanus*	frequent	MED
Erodium acaule			frequent	MED
Gagea foliosa		*foliosa*	frequent	MED
Galium debile			Rare	MED
Herniaria glabra			frequent	MED
Linum bienne			frequent	MED
Minuartia hamata			Localized	MED
Moenchia erecta	*octandra*		frequent	MED
Prangos ferulacea			Rare	MED
Romulea bulbocodium		*bulbocodium*	Abundant	MED
Rubus canescens		*glabratus*	frequent	MED
Salix pedicillata	*pedicillata*		frequent	MED
Satureja cuneifolia			Localized	MED
Teucrium polium			Abundant	MED
Trifolium arvense	*arvense*		Localized	MED
Trifolium physodes		*physodes*	Localized	MED
Trifolium stellatum		*stellatum*	frequent	MED
Trifolium stellatum		*adpressum*	frequent	MED
Poa infirma			frequent	MED & ASIA
Adenocarpus complicatus			frequent	MED+EU
Athyrium filix-femina			Abundant	MED+EU
Daucus carota	*maritimus*		frequent	MED+EU
Daucus carota	*carota*		frequent	MED+EU
Hibiscus trionum			Abundant	MED+EU
Lathyrus hirsutus			Rare	MED+EU
Vulpia unilateralis			Rare	MED+EU+ASIA

Helianthemum ledifolium		*ledifolium*	frequent	MED+West Asia
Viola parvula			frequent	N. Afr+Lev+M.E.
Carex echinata			Rare	Subcosmic
Juncus effusus			frequent	Subcosmic
Molinia caerulea			Rare	Subcosmic
Myosotis laxa	*caespitosa*		Rare	Subcosmic
Plantago lanceolata			frequent	Subcosmic
Poa compressa			frequent	Subcosmic
Prunella vulgaris			frequent	Subcosmic
Rochelia persica			Rare	West Asia
Veronica hispidula	*hispidula*		Rare	West Asia
Veronica pusilla		*pusilla*	Rare	West Asia
Cystopteris fragilis				

ENVIRONMENT
& HEALTH

APPENDIX P
ORNITHOLOGY SURVEY

Training on bird identification and counting

The below description is applied on all trainees working on windfarms sites.

The trainees were informed on the possible status of all species encountered in a wind farm: wintering, summering, breeding, migrating in autumn, migrating in spring. They were told that numbers of individuals per species should be recorded with the distance from the observer, provided that the observer's location is documented with GPS from the mobile.

The identification of species is crucial for windfarms. One should know how to identify species and separate them into two categories: one for priority species and one for non-priority species. The priority species are those soaring birds that rely mostly on using thermals. The thermal is similar to a bus transporting soaring birds with a blind driver. Some of the birds facing wind turbines may save themselves but the others will most probably will need assistance from us, humans. The priority species list should include all globally threatened species, and the regionally and nationally species that are categorized threatened in accordance with IUCN criteria.

The training on identification was limited to the priority species of soaring and semi-soaring (cranes and pelicans) as well as globally threatened species, especially that Lebanon has no bird red-listing till today.

Example on training: A Lesser Spotted Eagle generally differs from Greater spotted eagle by having lighter front underwing that the secondaries (opposite in Greater) and having bars on the secondaries reaching the end of the feathers (half way bars in the Greater). However, the trainees must photograph all bird seen and submit them to the ornithologist for indoor WhatsApp identification or confirmation.

The methodology of Point counts and Vantage points is explained to them. The trainees are requested to count each species recorded within the circle of 250 meters radius with indication of each species in the circle and record of the number of the individuals per species seen.

The trainees have to record the wind direction and speed every one hour, the height of the flying birds with their direction and the band of height for each species and individual. Since the rotors are varying in size with the lowest point reaching 30 meters above ground and the highest point reaching 200 meters above ground, any bird flying between 30 meters (easy to judge) and 200 meters should be treated as colliding with the rotors. The height above the rotors should also be recorded.

The trainees learned to develop migratory soaring bird watching, counting and identification skills, and acquired an understanding of the migration, threats and priority actions for their monitoring and conservation.

The trainees were given each, a bird guide book in Arabic to make it easy for them to see the description, and were provided with binoculars and cameras. All records of the surveyors are evaluated by the Senior Ornithologist. Illogical records are omitted and photos taken are double checked by the ornithologist.

In addition, the trainees were given the attached recording field-sheet to fill one at each point of observation. In each case, explanation is given.

	Monitoring Sheet – Lebanon Wind Power				
MONITORING SHEET	***Name or number of the plot*** (station): إسم المحطة يوضع رقم النقطة التي من المفترض أنها موجودة على الخريطة وهي تدل على مكان المروحة المستقبلي Name of the Transectإسم الخط	***GPS coordinates*** نقطة الإحداثيات نزل على تلفونك تطبيق GPS وتأخذ الإحداثيات عند كل نقطة وتسجلها هنا مستخدما ورقة لكل نقطة دراسة	***Clouds:*** غيوم Mist: رذاذ Fog: ضباب ***No clouds:*** *إنقشاع* Sunny: مشمس Rainy: ممطر Vision: نسبة الرؤية ضع إشارة صح أمام الوضع المناسب	***Wind speed:*** Ex: 5 km/h at 2.30PM **Direction of wind:** **Ex:** From NNE **Temperature:** الحرارة إذا كان الهواء عادي فهو أقل من 5 كلم/ساعة يجب كتابة حرارة الجو	Name of the observer إسم المراقب **إكتب إسمك هنا**
Day اليوم مثلاً الأربعاء Date التاريخ **مثلاً** **2019/1/20.**	Starting Time of observation ساعة إبتداء المراقبة مثلاً: 8.00 Duration of observation: From to إلى - من مدة المراقبة مثلاً: 8.20-8.00	***Method used:*** 1) Point Count تعداد من نقطة 2) Transect تعداد على مسار خط 3) VP نقطة مراقبة ضع علامة صح أمام الطريقة المستخدمة. مثلاً 1) عند نقطة، 2) خلال المشي، 3 من نقطة ثابتة (VP) من على مرتفع ومدتها 8 ساعات باليوم.	Add info أضف معلومت أخرى هنا أضف أي شيء في بالك يهم الدراسة وليس مذكوراً على هذه الورقة	Add info أضف معلومت أخرى هنا مثلاً: مشي بسرعة 10 كلم بالساعة	Add info أضف معلومت أخرى هنا مثلاً: مشي بسرعة 10 كلم بالساعة
Species Recorded **النوع المسجل**	**Name in any language:** **English/Arabic/Latin.....** **Known/Spp/Unknown** **الإسم بأي لغة، معروف، معروف الجني فقط، غير معروف**	**# of individuals** **عدد الأفراد**	**Direction** **إتجاه الطيران**	**Height** **الإرتفاع عن سطح الأرض التي يقف عليها المراقب**	***Behavior*** **تصرفات** ***Seen outside the windfarm indicate the location.*** **خارج المنطقة** ***Photo taken?*** **أخذت صورة؟**

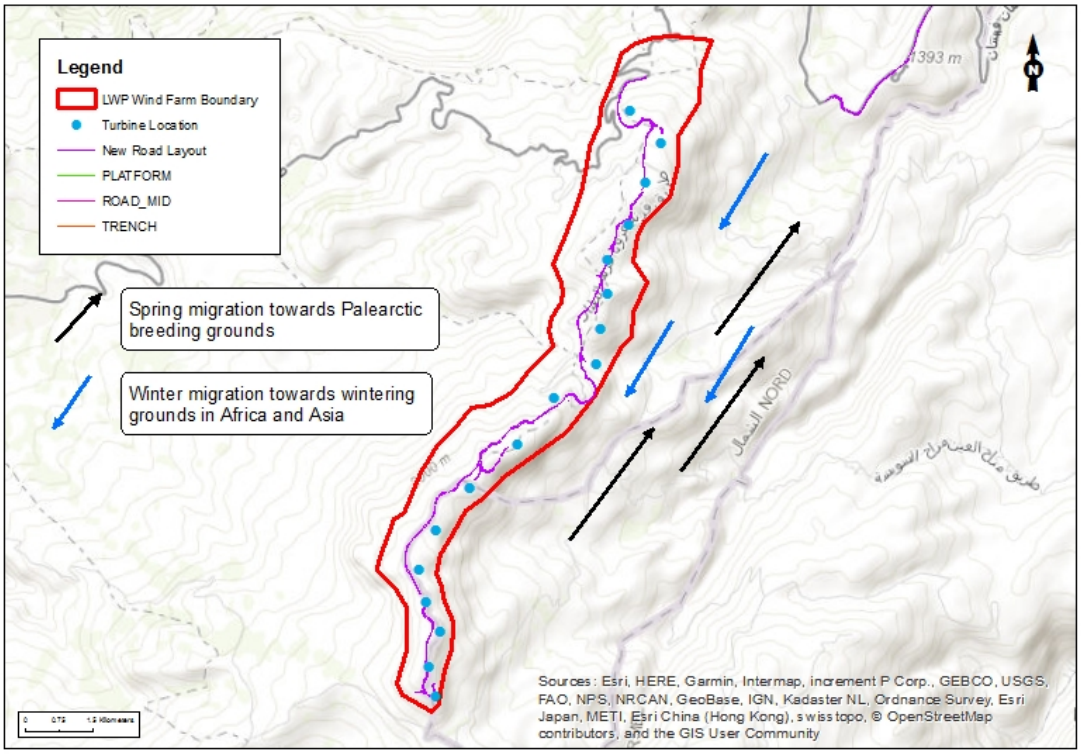
					Time during which each bird was in the study area. **الوقت الذي أمضاه الطائر تحت مراقبة المراقب**
1- في منطقة المراوح مباشرة	***حسون***	4	***نحو الشمل***	***10 متر***	***تم أخذ صورة. شوهدوا لمدة 3 دقائق قبل أن يرحلوا***
2- في منطقة الشجيرات الخفيفة على جانب منطقة المراوح	***Cuckoo***	1	نحو الشمال الشرقي	2 متر	شوهد يطير لمدة دقيقة ثم إختفى بين الأشجار
3- بعيداً عن منطقة المراوح بـ 600 متر في أماكن الأحراج الأكثر كثافة.	***مرطيزة***	3	نحو الغرب الشمالي	على الأرض ثم طاروا على إرتفاع 15 متر	شوهدت في مكان به مياه أمطار لمدة 3 دقائق ثم طارت بعيداً لمدة دقيقة قبل أن تختفي عن الأنظار
4-	***دخن أرطلان***	5	نحو الشرق	على الأرض ثم طاروا على إرتفاع 3 متر	شوهد لمدة دقيقتان قبل أن يطير وقتله أحد الصيادين
5-	***Crested Lark***	17	نحو الشمال	على إرتفاع 100 متر	شوهد يرتفع عاموديا أثناء فترة التزاوج بشكل متكرر في نفس المكان لمدة 20 دقيقة قبل الإنتقال إلى نقطة دراسة أخرى.
6-	***Fauvette a tete noire خوري وشماس***	2	نحو الجنوب الشرقي	على إرتفاع 3 متر	شوهدا لفترة 20 دقيقة قبل الإنتقال إلى نقطة أخرى
7-	***عقاب الحيات***	2	نحو الشرق، الخ	على إرتفاع 200 متر	شوهد فوق الرأس يرفرف مكانه لمدة 12 دقيقة ثم طار إلى الشرق لمدة 4 دقائق قبل أن يختفي
8-					
9-					
10-					

Site Conditions and Observations

14.1.1 Flyways of Migratory Birds

Figure 14-5 shows the flyways of migratory birds. The study area crossed by the multicolored transect line is located to the west of the southern exit of the Oudine Valley (the dark blue line shows the topography of the area). The Oudine Valley is a bottleneck for migratory birds as they tend to fly through the valleys that cross the perpendicular mountainous hills ahead of them. In fact, the Oudine Valley leads the birds to a shallower valley along its direction NNE-SSW. This shallow valley continues south until it joins the Wadi Al Arayish of Zahleh, and it constitutes one of the main flyways of soaring migratory birds in Lebanon (Beale and Ramadan-Jaradi, 2001).

Figure 14-5 Indicative Flyways of Migratory Birds Near Study Area



The black and white arrows show the typical migration routes based on the records of the SPNL (BirdLife Intl. Partner) Center during the five years between 2012-2016. The top of the figure faces north-west. As such, the white arrows show spring migration of birds into their palearctic breeding grounds, with the black arrows showing their return journeys in autumn towards wintering grounds in Africa or Asia. The multicolored line corresponds to the line of the Lebanon Wind Power wind farm. The blue horizontal line shows the topography. The house represents the bird center of SPNL (BirdLife Partner).

At night, when the thermals that birds use to migrate are not present, birds will land and roost in trees or on the ground. At dawn the birds then start to fly again, using thermals that can then function again due to the warming effect of the sun. A key roosting location is located to the east and south-east of the proposed development.

14.1.2 Occurrence and Movement of Breeding Species

The occurrence of the 27 breeding bird species is affected by the time/season and altitude. The summer breeders arrive late and may start breeding at the lowest altitude before having a second brood at a higher altitude. For example, this is the case for the red-backed shrike *Lanius collurio*, which was observed at the Project site only from mid-May onwards. The localities of the higher densities of a species reflect the habitats of preference for this species.

The resistance of the breeding bird species to the higher wind levels on the Project site compared to the other study zones varies from one species to another. For example, rock bunting, western black redstart, horned lark, rock sparrow and wheatears *Oenanthe sp.* protect themselves by nesting in holes, cracks of rocks or in excavated small depressions below the rocks. They represent the species found at higher altitudes. Other species like the goldfinch, greenfinch *Carduelis chloris*, chaffinch *Fringilla coelebs*, and Eurasian blackbird *Turdus merula* need to nest in trees. Their high density is limited to the furthest zone. Lesser whitethroat breeds in a variety of habitats but at higher altitudes, the warbler nests in thick bushes of small juniper trees above 1,900m.

The wintering bird species (1/5 of the total avifauna recorded) are rare due to the harsh weather and because most of the breeding birds (common linnet, chaffinch, and goldfinch) descend to lower altitudes in winter. As for the migratory species, their occurrence is related to the corridors that are represented by the valleys and located outside the study area (see above). The wind blows most of the year, but it is at its minimum speed in September-October, a period during which the soaring birds are more numerous (adults and juveniles) and also benefit from the “thermals” instead of the “uplifts”. As such, they would fly high (even above the Lebanon Wind Power wind farm) before the thermals dissipate at higher altitudes.

14.1.3 Peaks of Passage of Vulnerable Birds

The present study and previous studies conducted by the ornithologist provide the periods of passage and the periods of peaks for the recorded soaring birds during the spring and autumn migration seasons, as shown in **Table 14-6** and **Table 14-7**. The peaks have not changed during the last two decades.

A total of 74 avian species and an additional three unidentified raptors[1] and seven unidentified passerines (mainly warblers and buntings) were observed during the surveys. Where species are considered to be potentially at risk to collision risk, further descriptions been given of the flight activity recorded.

Table 14-6 Spring Passage and Peaks for Some Soaring and Semi-soaring Birds

Spring Migration	March				April				May				June			
Lesser Spotted Eagle																
Levant Sparrowhawk																

[1] One harrier species, one eagle species and one buzzard species.

Short-toed Snake Eagle																
Egyptian Vulture																

Note: Spring passage= light grey; Peaks= dark grey

Table 14-7 Autumn Passage and Peaks (for Some Soaring and Semi-soaring Birds

Autumn Migration	August				September				October				November			
Lesser Spotted Eagle																
Honey Buzzard																
Levant Sparrowhawk																
Steppe Buzzard																
White Pelican																
White Stork																
Short-toed Snake Eagle																
Common Crane																
Greater Spotted Eagle																
Imperial Eagle																

Note: Autumn passage= light grey; Peaks= dark grey

Further Field Survey Results

Table 14-1 List of Migratory Species and Winter Visitor Species

English Name	Scientific Name	STATUS in Lebanon*	DEGREE OF OCCURRENCE									
			Zones *	FB	PMS	PMA	WV	Common	Uncommon	Scarce	Rare	Very Rare
Western White Stork	Ciconia ciconia	PM	1,2,3			1				1		
Great White Pelican	Pelecanus onocrotalus	PM	1,2,3			1				1		
Common Kestrel	Falco tinnunculus	r, PM, WV	1,2,3		1	1	1		1			
Honey Buzzard	Pernis apivorus	PM	1,2,3			1			1			
Black Kite	Milvus migrans	pm, wv	2,3			1			1			
Egyptian Vulture (CR)	Neophron percnopterus **(EN)**	pm	1,2	1	1							1
Eurasian Griffon Vulture	Gyps fulvus	pm, wv, r, b	1,2	1		1						1
Short-toed Snake Eagle	Circaetus gallicus	SB, PM	1,2,3		1	1		1				
Levant Sparrowhawk	Accipiter brevipes	PM	2,3	1	1	1		1				
Eurasian Sparrowhawk	Accipiter nisus	PM, wv	1,2,3		1	1					1	
Common Buzzard	Buteo b. buteo	PM, WV	1,2,3			1	1			1		

English Name	Scientific Name	STATUS in Lebanon*	DEGREE OF OCCURRENCE									
			Zones *	FB	PMS	PMA	WV	Common	Uncommon	Scarce	Rare	Very Rare
Steppe Buzzard	Buteo b. vulpinus	PM, WV	1,2,3			1			1			
Long-legged Buzzard	Buteo rufinus	r, PM, wv	1,2,3			1						1
Lesser Spotted Eagle	Clanga pomarina	PM, wv, s	1,2,3		1	1	1		1			
Greater Spotted Eagle	Clanga clanga **(VU)**	pm, wv	2			1						1
Booted Eagle	Aquila pennata	sb, pm, wv	2,3			1				1		
Common Crane	Grus grus	PM, wv	1,2,3			1				1		
Common Cuckoo	Cuculus canorus	sb, PM	3		1	1			1			
European Nightjar	Caprimulgus europaeus	PM, ?sb	2,3	1		1				1		
Alpine Swift	Tachymarptis melba	pm	1,2,3		1	1					1	
Common Swift	Apus apus	SB, PM	2		1	1		1				
European Bee-eater	Merops apiaster	PM	1,2,3			1			1			
Eurasian Hoopoe	Upupa epops	R, sb, PM, wv	3			1	1			1		
Woodchat Shrike	Lanius senator	PM	2,3			1						1
Masked Shrike	Lanius nubicus	sb, PM	2,3			1			1			
Barn Swallow	Hirundo rustica	SB, PM, wv	3		1	1	1	1				

English Name	Scientific Name	STATUS in Lebanon*	DEGREE OF OCCURRENCE									
			Zones *	FB	PMS	PMA	WV	Common	Uncommon	Scarce	Rare	Very Rare
Common House Martin	Delichon urbicum	SB, PM	3		1	1		1				
Willow Warbler	Phylloscopus trochilus	PM	2,3			1				1		
Eurasian Blackcap	Sylvia atricapilla	sb, PM, WV	3		1	1	1		1			
Lesser Whitethroat	Sylvia curruca	SB, PM, ?wv	2,3		1	1			1			
Common Whitethroat	Sylvia communis	sb, PM	3			1				1		
Eurasian Blackbird	Turdus merula	R, pm, wv	1		1	1	1	1				
Fieldfare	Turdus pilaris	pm, wv	1,3			1	1			1		
Redwing	Turdus iliacus	pm, WV	1,2			1					1	
Song Thrush	Turdus philomelos	PM, wv	1,2,3		1	1	1		1			
Mistle Thrush	Turdus viscivorus	sb, pm, WV	1,2,3		1	1	1		1			
Isabelline Wheatear	Oenanthe isabellina	SB, PM, wv	1,2			1			1			
Northern Wheatear	Oenanthe Oenanthe	sb, PM, wv	1,2		1	1			1			
Black-eared Wheatear	Oenanthe hispanica	sb, PM	1,2		1	1			1			
Spotted Flycatcher	Muscicapa striata	sb, PM	3		1	1				1		
Alpine Accentor	Prunella collaris	pm	2,3			1					1	

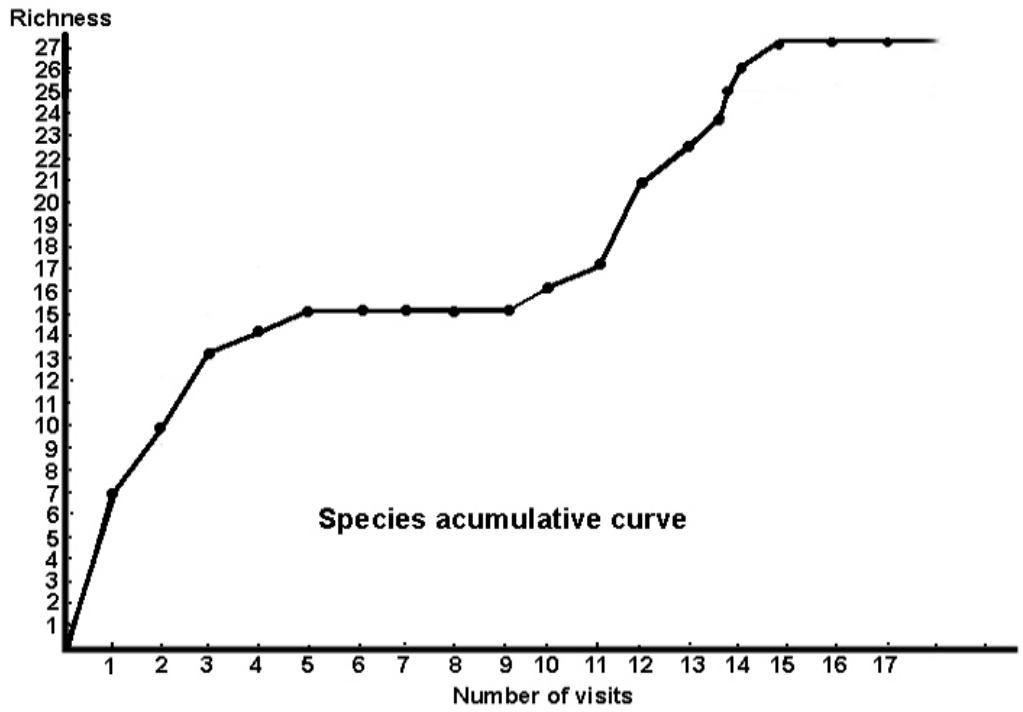
English Name	Scientific Name	STATUS in Lebanon*	DEGREE OF OCCURRENCE									
			Zones *	FB	PMS	PMA	WV	Common	Uncommon	Scarce	Rare	Very Rare
Common Chaffinch	Fringilla coelebs	R, PM, WV	3		1	1	1	1				
European Greenfinch	Carduelis chloris	R, WV, pm	3		1	1	1	1				
European Goldfinch	Carduelis carduelis	R, WV, pm	3		1	1	1	1				
Corn Bunting	Emberiza calandra	R, PM, WV	2		1		1		1			
Ortolan Bunting	Emberiza hortulana	sb, PM	2		1	1				1		
Black-headed Bunting	Emberiza melanocephala	SB, PM	2,3			1					1	
Totals	47			4	25	45	15	9	16	12	5	5

*Notes: R= Resident with definite breeding record; SB= Breeding summer visitor; S= Non-breeding summer visitor; WV= Winter visitor; SPM= Spring passage migrant; APM= Autumn passage migrant; FB= Formerly bred: no breeding records since 1987; V= Vagrant; e= Extinct in Lebanon, if any; CR= Critically Endangered as per Birdlife International 2018; EN= Endangered as per Birdlife International 2018; VU= Vulnerable as per Birdlife International 2018; NT= Near Threatened as per Birdlife International 2018; Lower case abbreviations eg. r, sb, s, wv, pm=Species uncommon or rare; zone 1: Project site; zone 2: mid-zone; zone 3: furthest zone; question mark (?) indicates uncertain status.

14.1.1 Richness of Breeding Species

The total number of breeding species is 27 bird species (17 resident/sedentary and 10 summer breeding) obtained through the point counts method. A species accumulative curve was developed in order to test whether maximum species richness was reached. The species accumulation curve continued to increase until it reached the first final asymptote at the 5th visit, with the resident/sedentary species. The arrival of the summer breeders made the curve increase again until the second final asymptote at the 15th visit, as shown in **Figure 14-6**.

Figure 14-6 Cumulative Richness Curve of Birds at the Lebanon Wind Power Site



Since two species were recorded only once (a) during the 17 visits (n), the formula of the curve (a/n) indicates that, theoretically, 10 more visits are needed to obtain one more species (Ramadan-Jaradi, 1984).

14.1.2 Flight Heights and Flightlines for Priority Species

Table 14-12 shows the percentage of individuals/species in each of the altitudinal bands as observed from vantage points during autumn 2017, spring 2018 and autumn 2018. **Figure 14-7** shows indicative flightlines of priority species as observed during the field campaign.

Based on the vantage point surveys, two species dominated the majority of observations: hooded crow *Corvus cornix* and common kestrel, not because of being an abundant species but due to their common and regular frequentation of the Project site with small or medium numbers.

The hooded crow appeared with a mean frequency of 0.85 (per 20-minute unit) whereas the common kestrel was seen with a mean frequency of 0.82. These two species are followed in importance by another five species, including three residents (rock bunting, common linnet and horned lark) and two summer breeders (lesser whitethroat and common swift). Together, these seven species comprised nearly half the frequencies of all recorded species and 38% of birds observed during the vantage point surveys.

Table 14-12 Distribution of Percentage of Individuals of Each Priority Bird Species Recorded Per Height Band over Study Area, Including Project Immediate Study Zone, Middle Study Zone and Furthest Study Zone

Flight Heights of Soaring Species (m)	<50	50-100	100-150	150-200	200-300	300-400	400-500	500-600	600-700	700-800	≥800	Total %
Lesser Spotted Eagle (SA)			10		14	28	29		19			100
Honey Buzzard (SA)		4	19	30	22		25					100
Levant Sparrowhawk (SA)			13			52				35		100
Eurasian Sparrowhawk (A)			25			75						100
Short-toed Snake Eagle (SA)			23	19	19	9	10	20				100
Egyptian Vulture (A)									100			100
Griffon Vulture (A)			50								50	100
Common Buzzard (A)			16	24	31	11	18					100
Steppe Buzzard (A)		1	19			34	22	17	7			100
White Pelican (A)			41				59					100
White Stork (A)			19			81						100
Greater Spotted Eagle (A)							100					100
Common Kestrel (SA)		9	16	75								100
Long-legged Buzzard (SA)	2		31	37	26	4						100
Common Crane (A)			18		49	33						100
Booted Eagle (A)					100							100

*Note: S: recorded in Spring, A: recorded in Autumn and SA in both.

Rock bunting, common linnet and horned lark were characteristic of the Project site above 1,800m, where they were commonly recorded, but their distribution in a range between c.1,800m and c.2,100m has reduced their frequencies.

Lesser whitethroat is a summer breeding species from sea level to c.2,000m above sea level. This species is not like the rock bunting, common linnet and horned lark, which were limited in their distribution within the study area, as its distribution is limited to a certain period of time during the year (mainly May-June). The reason is that this species is flexible in choosing its breeding sites, which made it occupy the 6th rank among the species that dominated the majority of observations.

The most abundant raptor species observed were, in order, short-toed snake eagle, honey buzzard *Pernis apivorus*, levant sparrowhawk and lesser spotted eagle *Clanga pomarina* (in the Project site and mid-zone). On average, approximately one short-toed snake eagle was observed every four surveys, one honey buzzard every 3.8 surveys, one levant sparrowhawk every 3.5 surveys and one lesser spotted eagle every two surveys. The latter species are likely to nest in inaccessible areas located beyond the furthest study zone.

Lebanese Science Journal, Vol. 16, No. 1, 2015

SPRING FLYWAYS OF MIGRATING SOARING BIRDS IN AKKAR/NORTHERN LEBANON

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(Received 11 September 2014 - Accepted 12 November 2014)

ABSTRACT

Beale and Ramadan-Jaradi initiated in 2001 the first large scale survey in Lebanon to trace the main routes of migrating raptors and other soaring birds, aiming at contributing to the conservation of flyways and stopover sites through the identification of areas where protection is most needed. Nowadays, the study of the flyways and stopover sites at micro level becomes necessary following the development of the national wind atlas map that will assist among others in locating potential wind farms which on their turn may influence the migratory birds' flyways, especially that the wind farms use winds for their function and the soaring birds use wind for their transportation. The present work starts from where the work of Beale and Ramadan-Jaradi ended but in an attempt to provide policy makers, scientists and experts with a conceptual framework, as well as methodological and operational tools for dealing with wind farms impacts and to prevent collisions of birds with blades of wind turbines. The study is meant to be conducted during spring and autumn passage of birds. This paper concerns the spring migration as at the time of writing it the autumn migration didn't start yet. The present spring season study revealed among others that the migratory soaring birds that may use the wind ridge lifts for their soaring travel in windy areas are more influenced by two other main factors: 1) presence of depressions perpendicular to mountain's ridges and 2) abundance of the thermals in these depressions, a matter that naturally reduces the impact of wind turbines by attracting the birds away from their blades.

Keywords: wind farms, migratory flyways, soaring birds, Lebanon

INTRODUCTION

As the demand for clean energy increases, wind power generating stations are being constructed across many countries, including Lebanon as their infrastructure is under installation in north Lebanon's mountain since the end of 2011. However, concerns have been raised about the possible impact of these power generating stations on birds, especially when endangered raptors were observed being injured and killed after flying into wind turbines in various wind farms where research has focused primarily on mortality caused by birds striking turbine blades and associated wires. Researchers like Airola (1987), Crockford (1992), Desholm and Kahlert (2005), McIssak (2001) and Craig *et al*. (2010) have focused their work on the potential impact of wind turbines on bird species. Meek *et al*. (1993) and Percival (1999 have attempted, among others, to bring birds and wind turbines to coexist through mitigating the wind turbines impact. Unfortunately, Lebanon's literature is lacking avian studies in relation to wind energy, whilst the disturbance to breeding, wintering or staging birds as a result of turbines functioning has not been examined in the country yet because these turbines, as

indicated above, are still under installation. In this case, this study of the spring flyways at micro level over the windy area of Lebanon will not only complement the study of the fall flyways in Lebanon of Beale & Ramadan-Jaradi (2001) but will also assist in detecting if the windy areas and the soaring bird flyways will overlap and in predicting the specific impact of wind turbines on soaring birds in the country.

With respect to avian mortality at wind power generating stations, the greatest concern has been for raptors and other soaring birds. The concern stems from the fact that many populations are small and thus even a few deaths can lead to declines (Morrison,.1998). Subsequent to this, all soaring bird species will be recorded and analyzed in attempt to avoid installing wind farms in places where threatened species are at the stake.

The goal of the project behind the present study is fourfold: 1) Trace the micro-bird-flyways within the windy areas (potential sites of wind farms) in Lebanon, 2) Study the effect of wind farms installation on the existing habitats, 3) Recommend ways of reducing potential impacts of turbines on birds in windy areas of North Lebanon, including preventing wind farms installation on the bird flyways, and 4) Recommend a program whereby potential effects of wind turbines on birds can be monitored at the windiest parts of Lebanon that are indicated on the Wind Atlas of the country. Most of these goals will not be fully achieved before studying the micro flyways of the fall migration. Even though, the first fold is presently fully achieved.

STUDY AREA

The study area lies in an elliptical shape area with a center at a longitude of 36°15'23.68"E and a latitude of 34°26'27.98"N (Fig. 1). It covers about 800 km^2 of mountain range running NNE-SSW. The ridge of these mountains varies roughly between 1000 meters a.s.l. in the north and 2840 meters in the south of the northern quart. The most important feature of the range is its western slopes of mainly NE-SW oriented hills and valleys that provide a variety of lift types to soaring birds.

METHODS

To chart the picture of micro migration in the northern quart of Lebanon during the spring 2014, three groups of sites were selected (Figure 1) running in a W-E direction across the mountain range. The first northern group includes three sites (Aydamoun 34°35'57.48"N & 36°16'28.94"E, Oudine Valley 34°35'33.69"N & 36°19'21.98"E and Akroum 34°35'7.69"N & 36°21'4.57"E), the second central group of the northern quart contains three sites (Akkar Attiqa 34°31'19.23"N & 36°14'32.74"E, Chambouq 34°31'10.29"N & 36°17'55.13"E and Bustane 34°30'34.88"N & 36°19'34.39"E) and the third group lies further to the south to encompass also three sites (Jroud El Dounniyeh 34°24'28.81"N & 36° 8'23.96"E, Marjhine 34°24'3.00"N & 36°14'37.39"E and Jroud El Hermel 34°24'28.98"N & 36°21'7.08"E). In addition to the three groups, a study was also conducted at a tenth site in Mrebin 34°20'5.73"N & 36° 9'41.89"E so that the most important windy sites are covered. From all these sites, one gathered information concerning routes, numbers, dates and species diversity. Observations took place between the last week of February and the first week of June 2014, and were made continuously between 08:30 and 18:00 on 10 days from hillsides where good vision is possible. Each group of sites was studied on a similar number of survey days (3 days). Observations made during the period of the study involved identification of all species of soaring and semi-soaring birds. Numbers of individuals were recorded, together with an indication of distance

from the observer and approximate direction of flight. Where birds were seen at great distance or darkened under brightening sky and could not be specifically identified, they were identified to the highest taxa possible, *e.g. Falco* sp.).

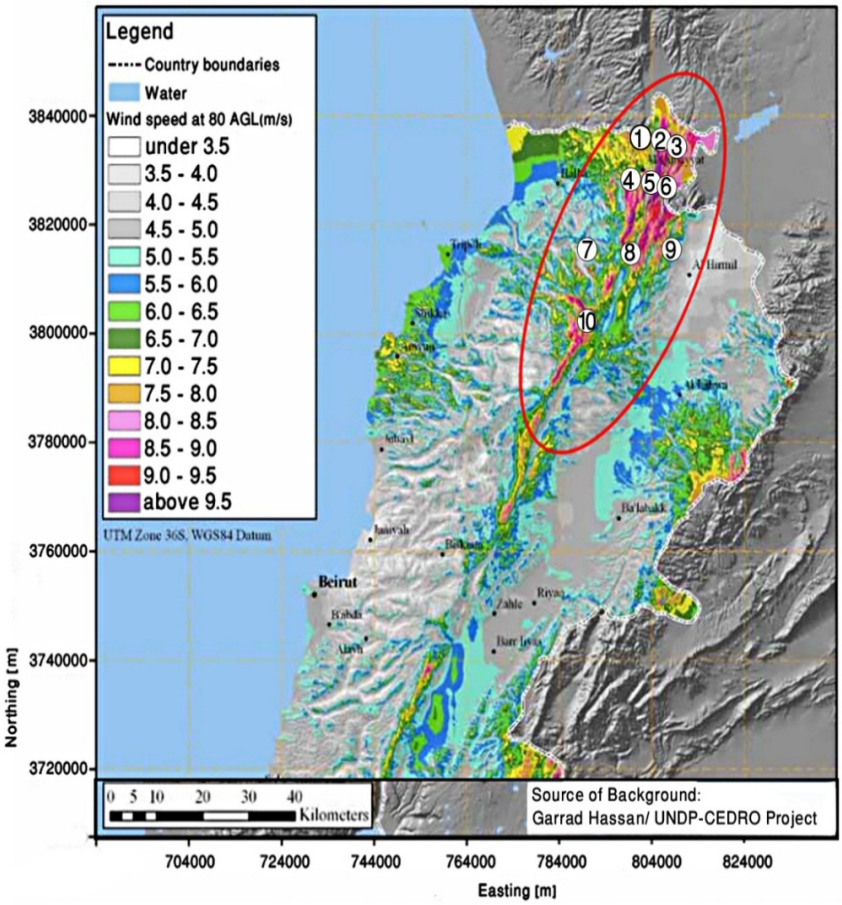


Figure 1. Wind map of Lebanon with circled study area and numbered study stations.

RESULTS AND DISCUSSION

During 10 days in the study period, 12397 individuals of soaring birds were counted in 10 different sites. They belong to 17 soaring raptor species and 4 non-raptor soaring bird species (Ramadan-Jaradi *et al.*, 2008). Of these 21 species, the most abundant and significant nine were totalling 10854 individuals, to which were added 10 individuals belonging to four globally threatened species (the last 4 species in Table 1) as they are of high significance (Birdlife International, 2010) even if they are represented by one individual each (Table 1).

TABLE 1

Number of Birds' Individuals per Species and Sites

Of the raptors, the most abundant are the Lesser Spotted Eagle *Aquila pomarina*

Species	Total	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8	Site 9	Site 10
Lesser Spotted Eagle	3128	113	518	38	55	680	213	355	627	239	290
Honey Buzzard	3034	107	558	89	30	543	180	213	676	254	384
Levant Sparrowhawk	1695	16	450	235	75	254	118	42	116	124	265
Steppe Buzzard	968	48	195	56	67	175	61	134	161	48	23
Red-footed Falcon	549	30	93	22	25	106	15	0	200	41	17
White Pelican	465	14	88	60	33	76	42	16	45	37	54
White Stork	411	45	150	11	2	64	0	35	31	12	61
Short-toed Eagle	376	4	18	26	32	59	27	55	81	0	74
Common Crane	228	12	27	14	0	35	8	7	66	0	59
Greater Spotted Eagle	4	0	1	0	1	2	0	0	0	0	0
Imperial Eagle	4	1	1	0	0	0	0	0	2	0	0
Egyptian Vulture	1	0	0	0	0	1	0	0	0	0	0
Cinereous Vulture	1	0	0	0	0	0	0	1	0	0	0
Total	10864	390	2099	551	320	1995	664	858	2005	755	1227

(3128 individuals) and the Honey Buzzard *Pernis apivorus* (3034) followed by the Levant Sparrowhawk *Accipiter brevipes* (1695), Steppe Buzzard *Buteo buteo vulpinus* (968), Red-footed Falcon *Falco vespertinus* (549) and the Short-toed Eagle *Circaetus gallicus* (376). Of the non-raptor soaring birds, the most abundant is the White Pelican *Pelecanus onocrotalus* with 465 individuals followed by the White Stork *Ciconia ciconia* with 411 individuals and the Common Crane *Grus grus* with 228 individuals. The abundance of these 9 species is visualized in Figure 2; whereas the peaks for the most abundant species are given in Table 2.

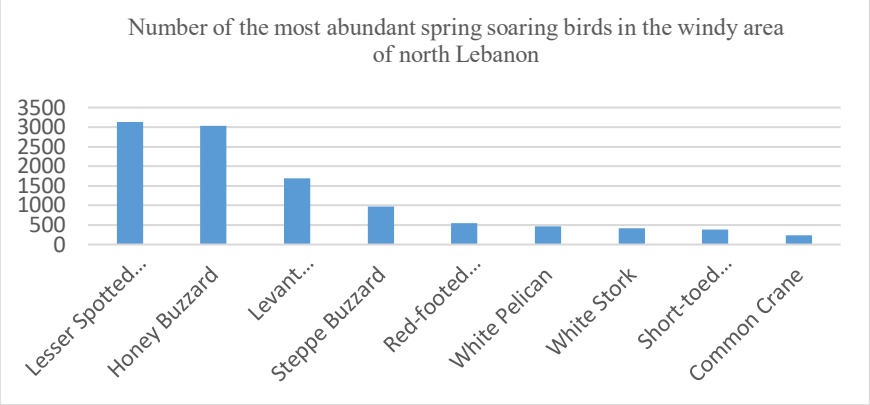
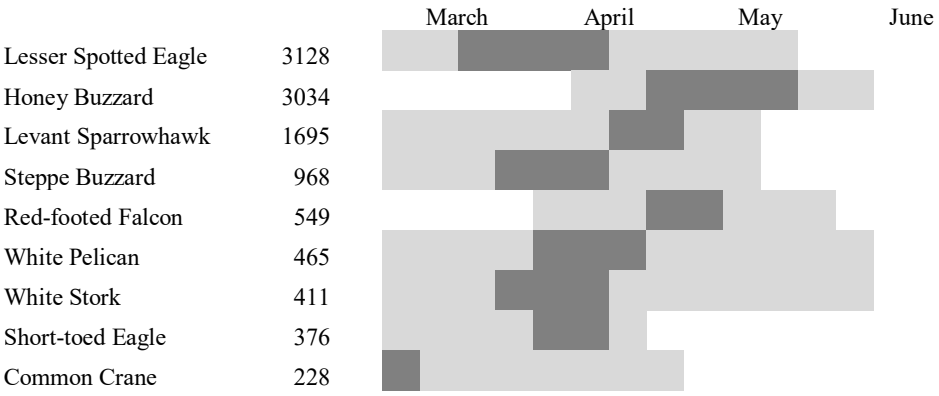


Figure 2. Total recorded numbers of the most abundant soaring bird species in the study area of the north Lebanon.

TABLE 2

Peaks Periods for Each of the Most Abundant Soaring Migratory Species in North Lebanon



Generally, Table 2 records show that the most abundant nine species peaked from end of March till end of April. This is the case of Lesser Spotted Eagle, Steppe Buzzard, White Pelican, White Stork and Short-toed Eagle. The Honey Buzzard, Levant Sparrowhawk and Red-footed Falcon peak in late April – early May. Only the Common Crane peaks in early March.

The number of migrants in each of the different inspected sites (Figure 2) suggests the migratory front in northern Lebanon is wide. Moreover, there were migrants passing between the sites of each group (pers. obs.) indicating clearly that our total will be lower than the true figure for the entire spring migration in the observed area. Nevertheless, the survey allows a clear idea of the pattern of migration. The results in Plate 2 indicate that Oudine Valley, Chambouq, Marjhine and to a lesser extent Mrebine which are longitudinally aligned, account for 67 % of the total recorded. With the volume of concentration they have between Oudine Valley and Mrebine, the birds trace the main route of spring migration in the northern quart of Lebanon. This route differs slightly from the fall route in the same quart that was traced by Beale & Ramadan-Jaradi in 2001 (Figure 3).

Jabal Akroum is a mountain (Jabal) with many villages on its slopes, one of which is also called Akroum (Site 3). The latter represents 5% of the individuals of the most 9 abundant species, whereas in the south of Jabal Akroum, more precisely at Bustane area (site 9), the total recorded is insignificantly higher (7%). Compared to the 67% at the main spring flyway, the sites 3 and 9 of Jabal Akroum hold about 10% of those birds passing in the main flyway. In addition, our own observation showed that the migratory soaring birds fly under the effect of ridge lift at a relatively high altitude above the recently installed few wind turbines that are under testing and waiting for Environmental Impact Assessment (EIA) before they are increased to establish wind farms. As for the Oudine Valley that extends along c.14 km in N-S direction, it forms an ideal rich in thermals passage that is a depression perpendicular to the mountain ridge, where birds prefer to soar either in thermals rising from the floor of the valley or in lifts. Such depression may create a bottleneck for the soaring birds Ramadan-Jaradi, in

prep.). The lifts are created by updrafts that are generated when a steady wind strikes a hill, cliff, and this is referred to as obstruction lift. The latter is formed on the eastern facing west slopes of the valley.

Figure 3. Fall migration routes traced by Beale and Ramadan-Jaradi (2001) and spring migration route determined by the present study.

CONCLUSIONS AND RECOMMENDATIONS

These surveys confirmed that the main spring flyway of the soaring bird species is not traversing the potential wind farms area in Jabal Akroum. But this finding doesn't mean that an EIA is not a must everywhere there is a plan to erect wind turbines and their accessories.

Recognizing that the migration of soaring birds differs in numbers and pattern between autumn and spring, the fall migration needs to be explored during the second phase of our project in the study area in order to trace the true flyways within or adjacent to the potential wind farms.

Key species found during this study (example: globally threatened species) should be covered by conservation activities and their frequented sensitive sites should be determined with the hope to incorporate them in a network of sites that are termed important for transiting or over flying soaring birds and worthy of management and protection. Further studies in the Anti-Lebanon Range would assist in the estimation of the overall size of migrants in Lebanon and may identify new hotspots or significant stopover sites for inclusion in the network of important bird areas (Evans, 1994) as well as for promoting bird watching as a tool of awareness and eco-tourism in the country.

ACKNOWLEDGEMENT

Our thanks to the National Council for Scientific Research (CNRS) / Lebanon for providing facilities and financial support to this study.

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ORNITHOLOGICAL SOCIETY OF THE MIDDLE EAST
CAUCASUS AND CENTRAL ASIA
OSME

Autumn routes of migrating raptors and other soaring birds in Lebanon

COLIN M. BEALE AND GHASSAN RAMADAN-JARADI

Lebanon lies on the major flyway for migrant soaring birds in the east Mediterranean. Despite detailed studies to the north and south of Lebanon, the only surveys of raptor passage through the country are either casual observations or short-term counts over part of the passage period. In a attempt to gain data on routes, timing and numbers of birds passing through the whole country, two surveys, one in the north and one across central Lebanon, were organised in autumn 2000. Total passage was estimated significantly over 107,000 birds between late August and mid-October when field work was curtailed due to mounting political tension in the region. A important concentration of birds was located and their route over the western slopes of the Mount Lebanon chain and Bekaa Valley is plotted. This route confirmed by casual observations in the previous literature, permitting earlier notes to be contextualised. Priorities for conservation and future work a outlined in the light of our findings.

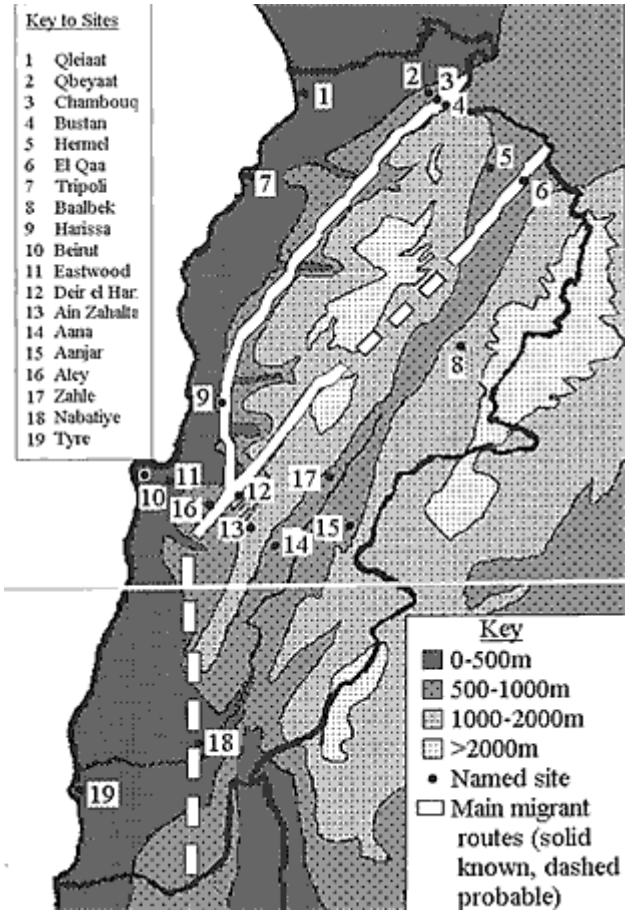
INTRODUCTION

THE MIGRATION OF LARGE SOARING BIRDS through the Middle East is a well-documented phenomenon, with detailed observations available from a number of sites; well-known observation points include the Bosphorus in Turkey, Eilat in Israel and at Suez in Egypt. There have been a number of small-scale observations made in the Lebanon by, e.g., Nielsen & Christensen (1970) in 1968-1969, Macfarlane (1978) in 1974-1975 and Khairallah (1991) in 1981 (with all previous work being summarised by Shirihai et al. 2000). However, no large-scale survey has been attempted, and routes used by raptors are still incompletely known.

Conservation of raptors and other large soaring birds is regarded as an international priority, due to many species' global scarcity and known

population declines (Tucker & Evans 1997, Shirihai *et al*. 2000, Zalles & Bildstein 2000). Counting large soaring birds on migration serves two main conservation purposes. Due to the concentration of significant percentages, or even the entire population, of some species over narrow corridors because of their dependence on thermals, overall numbers may be monitored with relative ease. Most species are dispersed over extremely broad areas and at low densities in their breeding and wintering grounds, making accurate population estimates, and hence monitoring, extremely difficult. It is important to precisely determine their routes to ensure adequate protection is provided on migration; raptors tend to have low reproductive rates, making them especially vulnerable to threats such as illegal hunting at passage bottlenecks. Obviously their protection on these routes is a responsibility that Lebanon must assume. Given this, two surveys were undertaken in autumn 2000 to assess numbers and routes of birds passing over the country.

METHODS



To assemble the most complete picture of migration in autumn 2000, a detailed survey was initiated across the centre of the country to provide information concerning routes, numbers, dates and species diversity, with a smaller scale survey further north, which was designed solely to confirm route choice. The former survey was planned to consist of two parts: one at low level from late August until early November, with a second phase targeted to the period when most birds were expected to pass, namely the last week of September and first week of October. Observations commenced in late August and were made continuously between 08.00 and 18.00 on one day per week, from a hillside where numbers of birds were known to pass, near Deir el Harf above Beirut (see Fig. 1). Unfortunately, due to political tension in the region from mid-October, the survey had to be curtailed and observations in the final period were not possible. During the period of intensive field work on 25 September-6 October, observations were made on weekdays between 08.00 and c.

18.00. Additional volunteers joined the survey from the U. K. at this time, and observations were made at five sites in an approximate line across the country, with three sites being visited each day.

Observations made over the intensive period and during weekly counts involved identification of all species of soaring birds. Numbers of individuals were recorded, together with an indication of distance from the observer and approximate direction of flight. Where birds were seen at great distance and could not be specifically identified, they were identified to the highest level possible, e.g. Aquila sp.

In the north, six sites running broadly east to west across the country were watched regularly for short periods throughout 9 September-21 October. Six observers participated in this survey, watching for periods of 45-150 minutes at each site before moving to another watchpoint. Three to five of the six sites were visited on 13 days during the period. All sites are indicated in Fig. 1. Only binoculars were used in this survey, resulting in a lower percentage of birds being specifically identified.

RESULTS AND DISCUSSION

Dates

The first day of the survey, 31 August, recorded a passage of 3398 birds over Deir el Harf, including 3387 Honey Buzzards *Pernis apivorus*. This suggests that for this species, at least, passage began earlier in August, a hypothesis supported by Ramadan-Jaradi & Ramadan-Jaradi (1999). The curtailment of observations at this site in mid-October meant that for some late migrants, notably Steppe Buzzard *Buteo buteo vulpinus* and Eurasian Sparrowhawk *Accipiter nisus*, an unknown proportion of individuals will have passed after the survey ended. These gaps should be noted when comparing totals from our survey with those of other locations along the East Mediterranean flyway. Nevertheless, for the principal migrant species it is clear that passage through

the Lebanon is extended. Table 1 records the dates of peak passage for those migrants with over 500 individuals recorded during the main survey.

Table 1. Dates of peak passage for selected species.		
English name	**Scientific name**	**Peak passage period**
White Pelican	*Pelecanus onocrotalus*	No noticeable peak
Honey Buzzard	*Pernis apivorus*	Late August to early September
Levant Sparrowhawk	*Accipiter brevipes*	Mid-September
Steppe Buzzard	*Buteo buteo vulpinus*	Early to mid-October
Lesser Spotted Eagle	*Aquila pomarina*	Late September to early October
Red-footed Falcon	*Falco vespertinus*	Late September

As Lebanon has a responsibility for all these species any measures designed to protect them on passage must operate throughout their entire passage periods. It is clear that such measures must be in place from mid-August to late October.

Weather

Weather conditions are known to affect numbers of migrants. With the exception of 28-29 September and the final count on 12 October, weather conditions were favourable for migration, with varying wind strengths. In line with 'poor' weather conditions, lower numbers were seen on these days than on those with 'better' weather. With improved conditions on 30 September, large numbers of birds were observed passing that afternoon and the following morning, unfortunately coinciding with days when systematic counts were not undertaken. Minimum estimates of the passage on these days were made, and can be added to the totals from the systematic counts.

Totals

During the central survey a total of 16,904 birds of 33 species (29 of them raptors) was counted. Full details of species, dates and numbers are available on request from CB. The most common raptors were Honey Buzzard and Lesser Spotted Eagle *Aquila pomarina*, each with 4046 individuals. Next most abundant was Levant Sparrowhawk Accipiter brevipes (2721 individuals), while the commonest non-raptor was White Pelican (1365 individuals). Additionally, on the afternoon of 30 September at least 7000 birds, probably mostly Lesser Spotted Eagle, were estimated to have passed over Aana and western Bekaa. Passage continued next morning when another 3000 birds (mostly Lesser Spotted Eagle, with smaller numbers of Steppe Buzzard) followed Barouk Ridge above Aana. This passage coincided with improved weather conditions, following two days of bad weather with poor thermal conditions.

A minimum estimate of total passage during the intensive survey was produced by calculating the mean daily totals at each site, multiplied by the number of days with counts (see Table 2). For example, at Eastwood, the total number counted was 925 birds, on seven days. Therefore the main daily total was 132 (925 divided by seven). Given that the total number of days of the survey was

12, the estimated total for Eastwood becomes 1584 (132 multiplied by 12). This number can be further adjusted by adding the c. 10,000 additional birds that passed Aana on 30 September-1 October, rather than employing the site mean for the two days. Overall, an estimated c. 30,500 individuals passed over Lebanon during the 12-day period, 25 September-6 October.

Table 2. Totals per site and estimated total passage of all raptor species.

Site	Total number counted	Days counted	Estimated total
Eastwood	925	seven	1584
Deir el Harf	4153	six	8304
Ain Zahalta	1379	five	3240
Aana	2183	six	13,660 (includes 10,000)
Aanjar	2166	six	3708

Weekly counts were made at Deir el Harf throughout the autumn passage in an attempt to determine the overall phenology of migration through Lebanon. Provided daily variation is low, one count per week will provide a reasonable figure from which to estimate the approximate scale of totals on days between points. An overall estimate is therefore possible using linear interpolation to estimate passage on days without counts, and their sum provides an overall estimate of passage for those periods not covered by the intensive survey. The accuracy of this depends on the level of daily variation in totals, which can be estimated using data from the intensive survey at Deir el Harf. Daily totals at the latter never varied by more than 25% between consecutive days, suggesting that an estimate using these data may be acceptable. Interpolation between all days with observations during 31 August to 12 October gives a total estimate of over 41,200 birds at Deir el Harf. When counts were undertaken simultaneously at Deir el Harf and other sites, daily totals at the former were consistently higher than at other watchpoints. Assuming such a pattern throughout the migration period, an estimate of total passage over Lebanon may be made by extrapolating the proportion at this site during the intensive survey. Daily means during the intensive observation period revealed that 38.4% of total passage over Lebanon passed this site. Taking this proportion as an estimate for the entire autumn suggests 107,000 birds passed over the country between 31 August and 12 October 2000. With passage of some species probably starting c. 2 weeks before and ending c. 2 weeks after the survey, it is clear that this total, if accurate, will be lower than the true figure for the entire autumn migration.

Routes

Central survey From numbers of birds at each location it is clear that soaring birds move on a broad front across Lebanon. However, a notable concentration (c. 40% of total numbers) occurred at Deir el Harf. Here, birds arrived from two principal directions, one due north, and the other north-east over Bois de Bologne. All tended to depart south-west. Protection of those passing on this route is clearly a conservation priority. Smaller concentrations were also noted following Barouk Ridge and the eastern edge of the Bekaa (see Fig. 1).

Northern survey Mean hourly totals were calculated for each of the five sites visited. These confirm a broad-front passage, though with a clear peak west of the Mount Lebanon chain. This peak, which passed Bustan and Chambouq, accounted for c. 60% of the total passage observed during the northern survey. These sites are relatively close together and some double counting may have occurred, though the general trend is clear. Somewhat higher totals were found over El Qaa and Hermel, in the northern Bekaa Valley, than nearer the coast, confirming the pattern found by the central survey. The results are illustrated in Fig. 1.

Overall pattern Reference to the few published records of other observers can further elucidate the main routes. Nielsen & Christensen (1970) noted passage over Harissa, while Macfarlane (1978) watched two streams of raptors at Bikfaya, which he believed to converge south of there. Benson (1970) reported large numbers of birds near Aley. Our results suggest that a westerly route passes from Chambouq and Bustan to Harissa over the slopes of the Mount Lebanon chain, thence south to Deir el Harf. This route then turns south-west to pass below Aley, and appears to follow land at 750-1500 metres above sea level, thus passing inland and at higher altitude than that over Beirut and Mansouriye. This route is joined by a second stream arriving from the north-east, at Deir el Harf, probably consisting of birds passing El Qaa and Hermel, and crossing the Mount Lebanon chain north of Mount Sannine. Thus it would appear that Macfarlane (1978) observed these two routes prior to the streams converging, Benson (1970) recorded the enlarged single stream, and Nielsen & Christensen (1970) observed birds on only one of these routes.

It is interesting to speculate how birds reach the country from the north. Observations from Syria suggest that a route runs along the Alawite Mountains (Pyman 1953), a stream that clearly forms the passage first noted in Lebanon at Chambouq and Bustan. Once this stream and that passing El Qaa and Hermel converge south of Aley, the next observations are from Palestine and Israel (see Shirihai *et al*. 2000, Alon *et al*. in prep.). Counts from watchpoints east of Haifa suggest most birds remain at an altitude of c. 500 metres, indicating that the stream continues at broadly the same altitude from Aley through south Lebanon. Clearly further surveys, particularly in the south of the country are required to verify these routes before they can be properly protected at other points.

CONCLUSIONS AND RECOMMENDATIONS

Internationally important numbers of raptors and other large soaring birds pass over Lebanon in autumn. Many have a negative conservation status and require adequate conservation while on passage. Passage appears to commence in August and continues to at least late October. Our surveys revealed a large concentration of birds in a narrow corridor over the western slopes of the Mount Lebanon range near Bustan and Chambouq, Harissa, Bikfaya, Deir el Harf and Aley. This is joined, at Deir el Harf, by a second stream probably from the northern Bekaa, crossing the Mount Lebanon range between Mount Sannine and Qornet es Sauda. Smaller concentrations occur along Barouk ridge and the

east side of the Bekaa valley. In order to adequately protect these migrant large soaring birds in Lebanon, it is imperative that the hunting ban is rigorously enforced during passage periods, especially along these routes. Further studies south of Aley should determine the most sensitive sites in the south of the country, where protection is most needed.

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APPENDIX Q
SOCIOECONOMIC DATA - STATISTICS LEBANON

Fnaidek

Population	
20,000 (3,000 families) in summer	18,561 (1,100 families) in the winter
4,961 Households	Average of 7 family members/household

Ethnic Composition			
Alawi	**Christian**	**Sunna**	**Chiaa**
0%	0%	100%	0%

Gender		Age				
Female	**Male**	**<22**	**22-39**	**40-59**	**≥60**	**Total**
48.9%	51.1%	23.69%	41.67%	23.84%	10.80%	100%

Education Level						
Illiterate	**Elementary**	**Intermediate**	**Secondary**	**Technical**	**University**	**Higher Degree**
6.6%	25.7%	27.6%	16.0%	11.0%	12.1%	1.0%

Employment					
Freelancer	**Employee**	**Unemployed**	**Student**	**Housewife**	**Retired**
25.4%	42.7%	8.3%	3.3%	16%	3.3%

Monthly Income				
<500$	**501-1,000$**	**1,001-2,000$**	**2,001-3,500$**	**>3,500$**
24.0%	57.0%	16.0%	2.7%	0.3%

Population % by Sector		
Agriculture	**Commerce**	**Service**
75%	14%	10%

Population by Occupation								
Large Enterp.	**Medium Enterp.**	**Small Enterp.**	**Admin.**	**Services**	**Armed Forces**	**Agri.**	**Primary Jobs**	**Special**
2%	2%	10%	1%	5%	50%	70%	20%	20%

Akroum

Population	
4,500 (750 families) in summer	3,500 (500 families) in the winter
700 Households	Average of 5 family members/household

Ethnic Composition			
Alawi	**Christian**	**Sunna**	**Chiaa**
0%	0%	99.14%	0.86%

Gender		Age				
Female	**Male**	**<22**	**22-39**	**40-59**	**≥60**	**Total**
50.1%	49.9%	24.10%	38.52%	25.70%	11.68%	100%

Education Level						
Illiterate	**Elementary**	**Intermediate**	**Secondary**	**Technical**	**University**	**Higher Degree**
1.0%	21.0%	25.0%	17.0%	13.0%	20.0%	3.0%

Employment					
Freelancer	**Employee**	**Unemployed**	**Student**	**Housewife**	**Retired**
21.0%	38%	8.6%	4.7%	19%	8.7%

Monthly Income				
<500$	**501-1,000$**	**1,001-2,000$**	**2,001-3,500$**	**>3,500$**
28.0%	50.0%	15.3%	5.0%	1.7%

Population % by Sector		
Agriculture	**Commerce**	**Service**
80%	9%	9%

Population by Occupation								
Large Enterp.	**Medium Enterp.**	**Small Enterp.**	**Admin.**	**Services**	**Armed Forces**	**Agri.**	**Primary Jobs**	**Special**
3%	8%	11%	8%	2%	75%	40%	18%	12%

Kfartoun

Population	
5,500 (800 families) in summer	4,500 (650 families) in the winter
750 Households	Average of 6 family members/household

Ethnic Composition			
Alawi	**Christian**	**Sunna**	**Chiaa**
0%	0%	100.00%	0%

Gender		Age				
Female	**Male**	**<22**	**22-39**	**40-59**	**≥60**	**Total**
50.1%	49.9%	24.36%	37.47%	26.21%	11.97%	100%

Education Level						
Illiterate	**Elementary**	**Intermediate**	**Secondary**	**Technical**	**University**	**Higher Degree**
3.0%	25.0%	28.0%	15.0%	11.0%	16.0%	2.0%

Employment					
Freelancer	**Employee**	**Unemployed**	**Student**	**Housewife**	**Retired**
24.0%	35%	9.0%	5.0%	18%	9.0%

Monthly Income				
<500$	**501-1,000$**	**1,001-2,000$**	**2,001-3,500$**	**>3,500$**
31.0%	47.0%	17.0%	3.0%	2.0%

Population % by Sector		
Agriculture	**Commerce**	**Service**
75%	15%	5%

Population by Occupation								
Large Enterp.	**Medium Enterp.**	**Small Enterp.**	**Admin.**	**Services**	**Armed Forces**	**Agri.**	**Primary Jobs**	**Special**
1%	4%	15%	10%	20%	45%	30%	10%	10%

Aandqet

Population	
3,000 (300 families) in summer	1,200 (200 families) in the winter
1,253 Households	Average of 3.5 family members/household

Ethnic Composition			
Alawi	**Christian**	**Sunna**	**Chiaa**
0%	100%	0%	0%

Gender		Age				
Female	**Male**	**<22**	**22-39**	**40-59**	**≥60**	**Total**
51.1%	48.9%	25.10%	21.02%	32.07%	21.81%	100%

Education Level						
Illiterate	**Elementary**	**Intermediate**	**Secondary**	**Technical**	**University**	**Higher Degree**
5.9%	17.4%	31.1%	19.3%	12.0%	12.8%	2.0%

Employment					
Freelancer	**Employee**	**Unemployed**	**Student**	**Housewife**	**Retired**
24.3%	34.4%	10.3%	5.2%	18%	7.8%

Monthly Income				
<500$	**501-1,000$**	**1,001-2,000$**	**2,001-3,500$**	**>3,500$**
14.3%	50.5%	29.7%	1.1%	4.4%

Population % by Sector		
Agriculture	**Commerce**	**Service**
60%	22%	15%

Population by Occupation								
Large Enterp.	**Medium Enterp.**	**Small Enterp.**	**Admin.**	**Services**	**Armed Forces**	**Agri.**	**Primary Jobs**	**Special**
1%	2%	6%	5%	2%	40%	40%	4%	4%

Quobaiyat

Population	
5,500 (1,000 families) in summer	3,500 (600 families) in the winter
1,850 Households	Average of 4 family members/household

Ethnic Composition			
Alawi	**Christian**	**Sunna**	**Chiaa**
0.23%	99.54%	0.24%	0%

Gender		Age				
Female	**Male**	**<22**	**22-39**	**40-59**	**≥60**	**Total**
51.0%	49.0%	23.70%	23.81%	28.20%	24.29%	100%

Education Level						
Illiterate	**Elementary**	**Intermediate**	**Secondary**	**Technical**	**University**	**Higher Degree**
2.4%	14.0%	29.0%	21.5%	7.7%	22.2%	3.2%

Employment					
Freelancer	**Employee**	**Unemployed**	**Student**	**Housewife**	**Retired**
22.0%	43.6%	7.4%	4.6%	13.0%	9.4%

Monthly Income				
<500$	**501-1,000$**	**1,001-2,000$**	**2,001-3,500$**	**>3,500$**
6.9%	55.6%	20.8%	8.8%	7.9%

Population % by Sector		
Agriculture	**Commerce**	**Service**
10%	50%	35%

Population by Occupation								
Large Enterp.	**Medium Enterp.**	**Small Enterp.**	**Admin.**	**Services**	**Armed Forces**	**Agri.**	**Primary Jobs**	**Special**
20%	10%	10%	5%	30%	60%	10%	5%	8%

Rweimeh Village

Population	
550 (50 families) in summer	120 (30 families) in the winter
55 Households	Average of 5 family members/household

Ethnic Composition			
Alawi	**Christian**	**Sunna**	**Chiaa**
0%	0%	0%	100%

Gender		Age				
Female	**Male**	**<22**	**22-39**	**40-59**	**≥60**	**Total**
%	%	%	%	%	%	100%

Education Level						
Illiterate	**Elementary**	**Intermediate**	**Secondary**	**Technical**	**University**	**Higher Degree**
8%	31.0%	30.0%	10.0%	10.0%	10.0%	1.0%

Employment					
Freelancer	**Employee**	**Unemployed**	**Student**	**Housewife**	**Retired**
35.0%	34.0%	6.0%	4.0%	17.0%	4.0%

Monthly Income				
<500$	**501-1,000$**	**1,001-2,000$**	**2,001-3,500$**	**>3,500$**
27.0%	57.0%	14.0%	1.0%	1.0%

Population % by Sector		
Agriculture	**Commerce**	**Service**
60%	20%	10%

Population by Occupation								
Large Enterp.	**Medium Enterp.**	**Small Enterp.**	**Admin.**	**Services**	**Armed Forces**	**Agri.**	**Primary Jobs**	**Special**
7%	20%	10%	9%	10%	15%	10%	10%	9%

Beddaoui

Population						
28,000						
32,000 Households						
Ethnic Composition						
Alawi	**Christian**	**Sunna**	**Chiaa**			
0%	0%	100%	0%			
Gender		**Age**				
Female	**Male**	**<22**	**22-39**	**40-59**	**≥60**	**Total**
49.9%	50.2%	23.00%	34.88%	27.67%	14.09%	100%

Haysaa

Population						
650						
1,335 Households						
Ethnic Composition						
Alawi	**Christian**	**Sunna**	**Chiaa**			
54.4%	0%	45.6%	0%			
Gender		**Age**				
Female	**Male**	**<22**	**22-39**	**40-59**	**≥60**	**Total**
48.8%	51.2%	23.50%	39.94%	25.61%	10.95%	100%

Dibbabiyé

Population						
710						
261 Households						
Ethnic Composition						
Alawi	**Christian**	**Sunna**	**Chiaa**			
0%	43.52%	56.48%	0%			
Gender		**Age**				
Female	**Male**	**<22**	**22-39**	**40-59**	**≥60**	**Total**
51.2%	48.8%	22.00%	33.95%	28.94%	15.11%	100%

Sammouniyé

Population						
700						
196 Households						
Ethnic Composition						
Alawi	**Christian**	**Sunna**	**Chiaa**			
0%	0%	100%	0%			
Gender		**Age**				
Female	**Male**	**<22**	**22-39**	**40-59**	**≥60**	**Total**
47.1%	52.9%	22.32%	50.26%	18.28%	9.14%	100%

Al Amayer

Population						
Households						
Ethnic Composition						
Alawi	**Christian**	**Sunna**	**Chiaa**			
0%	0%	100%	0%			
Gender		**Age**				
Female	**Male**	**<22**	**22-39**	**40-59**	**≥60**	**Total**
48.4%	51.6%	22.30%	44.72%	26.79%	6.20%	100%

Kouachra

Population						
1,350						
2,916 Households						
Ethnic Composition						
Alawi	**Christian**	**Sunna**	**Chiaa**			
0%	0%	100%	0%			
Gender		**Age**				
Female	**Male**	**<22**	**22-39**	**40-59**	**≥60**	**Total**
48.9%	51.1%	25.63%	35.71%	26.25%	12.40%	100%

Mhammaret

Population						
3,000						
500 Households						
Ethnic Composition						
Alawi	**Christian**	**Sunna**	**Chiaa**			
0%	0%	100%	0%			
Gender		**Age**				
Female	**Male**	**<22**	**22-39**	**40-59**	**≥60**	**Total**
50.9%	49.1%	23.32%	42.17%	25.25%	9.26%	100%

Mqaible

Population						
2,000						
0 Households						
Ethnic Composition						
Alawi	**Christian**	**Sunna**	**Chiaa**			
0%	9.20%	89.92%	0.88%			
Gender		**Age**				
Female	**Male**	**<22**	**22-39**	**40-59**	**≥60**	**Total**
48.9%	51.1%	25.32%	43.11%	21.90%	9.67%	100%

Mqaiteaa

Population						
2,100						
449 Households						
Ethnic Composition						
Alawi	**Christian**	**Sunna**	**Chiaa**			
0%	0%	100%	0%			
Gender		**Age**				
Female	**Male**	**<22**	**22-39**	**40-59**	**≥60**	**Total**
50.1%	49.9%	23.64%	38.32%	25.77%	12.27%	100%

Minie

Population						
20,000						
13,002 Households						
Ethnic Composition						
Alawi	**Christian**	**Sunna**	**Chiaa**			
0%	8.89%	91.10%	0.01%			
Gender		**Age**				
Female	**Male**	**<22**	**22-39**	**40-59**	**≥60**	**Total**
50.1%	49.9%	22.22%	34.15%	28.73%	14.89%	100%

Nabi Youcheaa

Population						
7,000						
6,662 Households						
Ethnic Composition						
Alawi	**Christian**	**Sunna**	**Chiaa**			
0%	0%	100%	0%			
Gender		**Age**				
Female	**Male**	**<22**	**22-39**	**40-59**	**≥60**	**Total**
50.2%	49.8%	24.26%	36.45%	27.82%	11.47%	100%

Bebnine

Population						
14,000						
19,000 Households						
Ethnic Composition						
Alawi	**Christian**	**Sunna**	**Chiaa**			
0%	0%	100%	0%			
Gender		**Age**				
Female	**Male**	**<22**	**22-39**	**40-59**	**≥60**	**Total**
50.6%	49.4%	24.00%	40.65%	25.38%	9.97%	100%

Borj El-Yahoudiyé

Population						
800						
1,050 Households						
Ethnic Composition						
Alawi	**Christian**	**Sunna**	**Chiaa**			
0%	0%	100%	0%			
Gender		**Age**				
Female	**Male**	**<22**	**22-39**	**40-59**	**≥60**	**Total**
50.2%	49.8%	23.00%	39.64%	25.45%	11.91%	100%

Tall Aabbas El-Charqi

Population						
500						
220 Households						
Ethnic Composition						
Alawi	**Christian**	**Sunna**	**Chiaa**			
77.14%	0%	22.86%	0%			
Gender		**Age**				
Female	**Male**	**<22**	**22-39**	**40-59**	**≥60**	**Total**
50.4%	49.6%	23.00%	31.45%	29.43%	16.13%	100%

Tall Aabas El-Gharbi

Population						
2,100						
1,305 Households						
Ethnic Composition						
Alawi	**Christian**	**Sunna**	**Chiaa**			
0%	94.95%	5.05%	0%			
Gender		**Age**				
Female	**Male**	**<22**	**22-39**	**40-59**	**≥60**	**Total**
51.0%	49.0%	23.32%	25.57%	31.17%	19.94%	100%

Tall Hmayra

Population						
1,500						
600 Households						
Ethnic Composition						
Alawi	**Christian**	**Sunna**	**Chiaa**			
21.05%	2.48%	76.47%	0%			
Gender		**Age**				
Female	**Male**	**<22**	**22-39**	**40-59**	**≥60**	**Total**
50.1%	49.9%	21.63%	41.49%	24.78%	12.10%	100%

Deir Amar

Population						
6,000						
4,500 Households						
Ethnic Composition						
Alawi	**Christian**	**Sunna**	**Chiaa**			
0%	0%	100%	0%			
Gender		**Age**				
Female	**Male**	**<22**	**22-39**	**40-59**	**≥60**	**Total**
50.1%	49.9%	24.32%	34.55%	28.60%	12.53%	100%

Rmah

Population						
400						
257 Households						
Ethnic Composition						
Alawi	**Christian**	**Sunna**	**Chiaa**			
15.29%	66.51%	18.20%	0%			
Gender		**Age**				
Female	**Male**	**<22**	**22-39**	**40-59**	**≥60**	**Total**
49.5%	50.5%	23.33%	27.20%	24.33%	25.14%	100%

Chadra

Population						
600						
850 Households						
Ethnic Composition						
Alawi	**Christian**	**Sunna**	**Chiaa**			
0%	97.89%	0.59%	1.52%			
Gender		**Age**				
Female	**Male**	**<22**	**22-39**	**40-59**	**≥60**	**Total**
49.2%	50.8%	21.32%	24.73%	31.69%	22.25%	100%

Chikhlar

Population						
650						
250 Households						
Ethnic Composition						
Alawi	**Christian**	**Sunna**	**Chiaa**			
0%	89.55%	10.45%	0%			
Gender		**Age**				
Female	**Male**	**<22**	**22-39**	**40-59**	**≥60**	**Total**
48.9%	51.1%	22.32%	21.45%	34.49%	21.74%	100%

Aamaret El-Baykat

Population						
800						
491 Households						
Ethnic Composition						
Alawi	**Christian**	**Sunna**	**Chiaa**			
7.55%	0%	92.45%	0%			
Gender		**Age**				
Female	**Male**	**<22**	**22-39**	**40-59**	**≥60**	**Total**
51.4%	48.6%	23.36%	37.01%	24.78%	14.85%	100%

Aamara

Population						
Households						
Ethnic Composition						
Alawi	**Christian**	**Sunna**	**Chiaa**			
0%	0%	100%	0%			
Gender		**Age**				
Female	**Male**	**<22**	**22-39**	**40-59**	**≥60**	**Total**
55.2%	44.8%	24.00%	32.76%	34.07%	9.17%	100%

Fraidis Akkar

Population						
350						
200 Households						
Ethnic Composition						
Alawi	**Christian**	**Sunna**	**Chiaa**			
9.09%	0%	90.91%	0%			
Gender		**Age**				
Female	**Male**	**<22**	**22-39**	**40-59**	**≥60**	**Total**
50.0%	50.0%	23.36%	34.03%	28.94%	13.67%	100%

Kobbet Bchamra

Population						
Households						
Ethnic Composition						
Alawi		**Christian**		**Sunna**		**Chiaa**
0%		0%		100%		0%
Gender		**Age**				
Female	**Male**	**<22**	**22-39**	**40-59**	**≥60**	**Total**
52.5%	47.5%	25.00%	38.31%	26.21%	10.48%	100%

Qachlaq

Population						
250						
374 Households						
Ethnic Composition						
Alawi	**Christian**	**Sunna**	**Chiaa**			
9.74%	0%	86.70%	3.56%			
Gender		**Age**				
Female	**Male**	**<22**	**22-39**	**40-59**	**≥60**	**Total**
51.7%	48.3%	26.00%	40.78%	25.40%	7.82%	100%

Machta Hassan

Population						
3,000						
1,050 Households						
Ethnic Composition						
Alawi	**Christian**	**Sunna**	**Chiaa**			
1.17%	0%	98.83%	0%			
Gender		**Age**				
Female	**Male**	**<22**	**22-39**	**40-59**	**≥60**	**Total**
47.5%	52.5%	24.63%	34.18%	27.28%	13.91%	100%

Zoug Bhannine

Population						
4,000						
1,300 Households						
Ethnic Composition						
Alawi	**Christian**	**Sunna**	**Chiaa**			
%	%	%	%			
Gender		**Age**				
Female	**Male**	**<22**	**22-39**	**40-59**	**≥60**	**Total**
%	%	%	%	%	%	100%

APPENDIX R
SAMPLE HOUSEHOLD SURVEY

الاستبيان مناطقي –مشروع طواحين الهواء المولدة للكهرباء

SES Sustainable Environmental Solutions

مرحبا .اسمي _____ مع المنظمة "سيس".
أقوم بتقييم احصائي في المنطقة لتحديد الاحتياجات الحالية و المرجوة في الكهرباء و تأثيرها على البيوت و الاعمال اقتصاديا و اجتماعيا .

هدفنا هو اخذ معلومات تفيدنا و انتم عل ان نساعد الشركة المسؤولة عن تنفيذ "طواحين الهواء" على فهم احتياجات و الصعوبات مع التوقعات المرتقبة من هذا المشروع النوعي .

لذلك أود أن أطلب وقتك لمناقشة بعض الأسئلة التي تم أعدادها من فريق متخصص . يجب ألا يستغرق الاستبيان أكثر من ١٥ دقائق.

مع جزيل الشكر لتعاونكم معنا

للمزارعين و اصحاب الاراضي الزراعية الانتاجية, تعاونيات

الاسم:_____ البلدة:_____ التاريخ:_____

للمزارعين و اصحاب الاراضي الزراعية الانتاجية, تعاونيات	
ما هي طبيعة عملك؟	زراعة □ صناعة □ حدمات □ سياحة □ تكنولوجيا □ تجارة □
هل عملك موسمي أو على مدار السنة؟	سنوي□ موسمي □ غير□
هل يعتمد عملك على الكهرباء سواء كان الدولة أو الاشتراك؟	كلا □ نعم □ اشرح:
ما هي نفقات الطاقة الخاصة بك في الشهر؟	$$:_____ ليرة:-_____ امبير: كيلو وات:
هل سيساعد الإمداد الطاقة الهوائية الأرخص للطاقة على تحسين سبل المعيشة وعمليات الشركات في المنطقة؟	كلا □ نعم □ اشرح:
هل تملك هذه الارض؟	كلا □ نعم □ اشرح:
ما هو استهلاكك للطاقة التي تحتاجها لكل شهر / موسم؟ حدد كمية و كلفة؟	$$:_____ ليرة:-_____ امبير: كيلو وات:
هل تمتلك مولدًا أو تستخدم الاشتراك؟	مولد خاص □ اشتراك □ اشرح:
ماذا كانت تكلفة الوقود عليك؟	اشرح:
هل يتأثر عملك بتكلفة و تقنين الكهرباء هنا؟	كلا □ نعم □ اشرح:
هل تعتقد أنه يمكن أن يكون حلاً؟	كلا □ نعم □ اشرح:
ما هو السيناريو الأفضل للشركات في المناطق الريفية؟	كلا □ نعم □ اشرح:
هل ستدعم الطاقة البديلة في قريتك؟ كيف	كلا □ نعم □ اشرح:
هل أنت على علم بأي نموذج ناجح يتم فيه تنفيذ الطاقة الخضراء؟	كلا □ نعم □ اشرح:

ماذا كان التأثير؟ اشرح:	
هل ستزيد ساعات العمل إذا كانت الكهرباء وإمدادات الطاقة الفعالة موجودة؟	كلا □ نعم □ اشرح:
هل سيؤدي هذا إلى حدوث تحسن في حالة المعيشة بشكل عام نتيجة لذلك؟	كلا □ نعم □ اشرح:

ما هو مستوى استهلاك الكهرباء الحكومية في المنزل / kw/ القيمة شهريا	الاعلى القيمة؟ الطاقة:	االادنى القيمة؟ الطاقة:
كم ساعة انقطاع الكهرباء في اليوم؟		
هل لديك اشتيراك مولد للمنزل؟	نعم	كلا
ما هي القدرة التي تطلبها من اشتيراك / KW / القيمة / بالشهر	KWA:_____ Ampere:_____ القيمة:_____	
هل السعة المطلوبة من اشتيراك كافية لتلبية الحاجات لمنزلك؟	كلا□ نعم□ اشرح ؟	
هل تسيعرة الكهرباء الاشتراك مرتفعة او مقبولة؟	عالية: القيمة:	
هل يتغير استهلاكك للطاقة من موسم إلى آخر؟ شرح	كلا □ نعم □ اشرح ؟	
هل لديك عمل تجارية او صناعي, زراعي تعتمد على الاشتراك؟	كلا □ نعم □ اشرح ؟	
ما هي القدرة التي تطلبها من اشتيراك / القيمة / بالشهر	KWA:_____ Ampere:_____ القيمة:_____	
هل السعة المطلوبة من اشتيراك كافية لتلبية الحاجات لمنزلك؟	كلا□ نعم□ اشرح ؟	
هل تعتقد أن شبكة الكهرباء الاشتراك جيدة؟	كلا□ نعم□ اشرح ؟	
هل تعتقد أن شبكة الكهرباء الاشتراك تصل إلى الجميع؟	كلا□ نعم□ اشرح؟	
ماذا تعرف عن الطاقة الخضراء او الطاقة البديلة؟		

اسئلة عن الطاقة البديلة- طواحين الهواء للشركات

ماذا تعرف عن طواحين الهواء المولدة للطاقة؟	
هل تعتقد أن قريتك مستعدة لهذا النوع من الحلول في الطاقة البديلة؟ إذا نعم ، لماذا	
هل تعتقد أن طاقة طواحين الهواء يمكن أن توفر إمدادات كافية من الكهرباء إلى قريتك؟ إذا كان الجواب نعم ، كيف	
هل تعتقد أن هذه التكنولوجيا سيكون لها تأثير على القرية والاقتصاد؟ و كيف	سلبي □ ايجابي □ ، كيف
هل تفضل أن يتم إدارة طواحين الهواء من قبل شركة خاصة؟ لماذا ا	
ما هي توقعاتك من هذا المشروع إذا حدث؟ اشرح	
هل تؤيد و تدعم هذه الفكرة وتروج لها؟ و كيف	
هل لديك أي مشاكل مع أصحاب المولدات " اشتراك"؟	كلا □ نعم □
هل تتسبب المولدات الكبيرة في أي ضرر تعرفه او ممكن تصوره؟	كلا □ نعم □ صحيا □ بيئيا □
هل هذا يسبب عبئا ماليا على ميزانية المنزل؟ في قيمة أو نسبة الدخل	كلا□ نعم□ كيف؟
هل تشجع على ان يكون هناك إمدادات كهربائية أرخص وفعالة اكثر؟	كلا□ نعم□ اشرح؟
هل تؤمن بدور البلدية لتنظيم هذا القطاع " قطاع الكهرباء"؟	كلا□ نعم□ اشرح؟
هل تشجع البلدية على ادارة طواحين الهواء في حال وجدت؟	كلا□ نعم□ اشرح؟
هل هناك قطاعات اقتصادية تعتمد على الكهرباء في منطقتك؟	كلا□ نعم□ اشرح؟
هل تعتقد أن طواحين الهواء سيكون لها تأثير مالي إيجابي على الأسر؟ إذا كان الجواب نعم ، كيف	كلا□ نعم□ اشرح؟

شكرا على تعاونكم

اسم الباحث:_____

امضاء الباحث:_____

ملاحظات:

_____

_____

_____

_____

_____

_____

_____

_____

يهدف المشروع إلى توفير إمدادات الطاقة الخضراء لثلاث بلديات من خلال تركيب طواحين الهواء المولدة للطاقة . سوف توفر طواحين الهواء الطاقة من الجو ومن خلال شبكة جديدة .ستكون هذه الشبكة جاهزة عام ٢٠٢٠. وهي تهدف إلى تحسين حالة الانتاجية و المعيشية في المنطقة وتحسين حياة الأسرة المعيشية في المنطقة عن طريق توفير كهرباء لساعات اكثر و اقل كلفة.

المعلومات المنزلية العامة ـ احصاء مبدئي اولي

الاسم رب الأسرة المعيشية						تاريخ المقابلة:_____/_____/٢٠١٨
العمر						
البلدية						
الجنس						
الوضع العئلي						
هل تملك البيت او اجار؟	ملك : _____ اجار:_____ قرض:_____					
عدد افراد العائلة المقيمين؟	عدد:_____ موسميا:_____					
عدد الاولاد في العائلة " دون ال ١٦"	ذكر:_____ انثى:_____					
المهنة		موظف	صاحب عمل	مزارع	عاطل عن العمل	مدخول تقديريا
هل تعمل الزوجة؟	نعم ؟ ماذا			كلا		
ما هوالمصدر المالي الاساسي للعائلة؟	عمل الزوج	اساسي	عمل الزوجة؟	ثانوي	غير؟	
في تعمل العائلة مزارعة وهل تملك الارض؟	نعم		كلا			
هل هناك مدخول من اقارب في الغربة؟	نعم		كلا			
مدحول الاعائلة الاجمالي في الشهر؟						*تقريبيا في حال لا يريدون الاجابة*
ما طبيعة الاقامة في البلدة ؟ بالاشهر	دائمة		موسمية		اخر	
ما هو أعلى تحصيل تعليمي (أبدا ، ابتدائي ، متوسط ، ثانوي ، مهني ، جامعي)						
هل تستخدم الكهرباء للتدفئة والتبريد في المنزل؟	كلا□ نعم□ اشرح؟					

ما هو مستوى استهلاك الكهرباء الحكومية في المنزل / kw/ القيمة شهريا	الاعلى القيمة؟ الطاقة:	االادنى القيمة؟ الطاقة:
كم ساعة انقطاع الكهرباء في اليوم؟		
هل لديك اشتيراك مولد للمنزل؟	نعم	كلا
ما هي القدرة التي تطلبها من اشتيراك / KW / القيمة / بالشهر	KWA:_____ Ampere:_____ القيمة:_____	
هل السعة المطلوبة من اشتيراك كافية لتلبية الحاجات لمنزلك؟	كلا□ نعم□ اشرح ؟	
هل تسيعرة الكهرباء الاشتراك مرتفعة او مقبولة؟	عالية: القيمة:	
هل يتغير استهلاكك للطاقة من موسم إلى آخر؟ شرح	كلا □ نعم □ اشرح ؟	
هل لديك عمل تجارية او صناعي, زراعي تعتمد على الاشتراك؟	كلا □ نعم □ اشرح ؟	
ما هي القدرة التي تطلبها من اشتيراك / القيمة / بالشهر	KWA:_____ Ampere:_____ القيمة:_____	

هل السعة المطلوبة من اشتيراك كافية لتلبية الحاجات لمنزلك؟	كلا□ نعم□ اشرح ؟
هل تعتقد أن شبكة الكهرباء الاشتراك جيدة؟	كلا□ نعم□ اشرح ؟
هل تعتقد أن شبكة الكهرباء الاشتراك تصل إلى الجميع؟	كلا□ نعم□ اشرح؟
ماذا تعرف عن الطاقة الخضراء او الطاقة البديلة؟	

ماذا تعرف عن طواحين الهواء المولدة للطاقة؟	
هل تعتقد أن قريتك مستعدة لهذا النوع من الحلول في الطاقة البديلة؟ إذا نعم ، لماذا	
هل تعتقد أن طاقة طواحين الهواء يمكن أن توفر إمدادات كافية من الكهرباء إلى قريتك؟ إذا كان الجواب نعم ، كيف	
هل تعتقد أن هذه التكنولوجيا سيكون لها تأثير على القرية والاقتصاد؟ و كيف	سلبي □ ايجابي □ ، كيف
هل تفضل أن يتم إدارة طواحين الهواء من قبل شركة خاصة؟ لماذا ا	
ما هي توقعاتك من هذا المشروع إذا حدث؟ اشرح	
هل تؤيد و تدعم هذه الفكرة وتروج لها؟ و كيف	
هل لديك أي مشاكل مع أصحاب المولدات " اشتراك"؟	كلا □ نعم □
هل تتسبب المولدات الكبيرة في أي ضرر تعرفه او ممكن تصوره؟	كلا □ نعم □ صحيا □ بيئيا □
هل هذا يسبب عبئا ماليا على ميزانية المنزل؟ في قيمة أو نسبة الدخل	كلا□ نعم□ كيف؟
هل تشجع على ان يكون هناك إمدادات كهربائية أرخص وفعالة اكثر؟	كلا□ نعم□ اشرح؟
هل تؤمن بدور البلدية لتنظيم هذا القطاع " قطاع الكهرباء"؟	كلا□ نعم□ اشرح؟
هل تشجع البلدية على ادارة طواحين الهواء في حال وجدت؟	كلا□ نعم□ اشرح؟
هل هناك قطاعات اقتصادية تعتمد على الكهرباء في منطقتك؟	كلا□ نعم□ اشرح؟

اذا كان من اصحاب العمل او مزارع او شركة خاصة

للمزارعين و اصحاب الاراضي الزراعية الانتاجية, تعاونيات	
ما هي طبيعة عملك؟	زراعة □ صناعة □ حدمات □ سياحة □ تكنولوجيا □ تجارة □
هل عملك موسمي أو على مدار السنة؟	سنوي□ موسمي □ غير□
هل يعتمد عملك على الكهرباء سواء كان الدولة أو الاشتراك؟	كلا □ نعم □ اشرح:
ما هي نفقات الطاقة الخاصة بك في الشهر؟	$$:_____ ليرة:-_____ امبير: كيلو وات:
هل سيساعد الإمداد الطاقة الهوائية الأرخص للطاقة على تحسين سبل المعيشة وعمليات الشركات في المنطقة؟	كلا □ نعم □ اشرح:
هل تملك هذه الارض؟	كلا □ نعم □ اشرح:
ما هو استهلاكك للطاقة التي تحتاجها لكل شهر / موسم؟ حدد كمية و كلفة؟	$$:_____ ليرة:-_____ امبير: كيلو وات:
هل تمتلك مولدًا أو تستخدم الاشتراك؟	مولد خاص □ اشتراك □ اشرح:
ماذا كانت تكلفة الوقود عليك؟	اشرح:
هل يتأثر عملك بتكلفة و تقنين الكهرباء هنا؟	كلا □ نعم □ اشرح:
هل تعتقد أنه يمكن أن يكون حلاً؟	كلا □ نعم □ اشرح:
ما هو السيناريو الأفضل للشركات في المناطق الريفية؟	كلا □ نعم □ اشرح:
هل ستدعم الطاقة البديلة في قريتك؟ كيف	كلا □ نعم □ اشرح:
هل أنت على علم بأي نموذج ناجح يتم فيه تنفيذ الطاقة الخضراء؟	كلا □ نعم □ اشرح:

ماذا كان التأثير؟ اشرح:	
هل ستزيد ساعات العمل إذا كانت الكهرباء وإمدادات الطاقة الفعالة موجودة؟	كلا □ نعم □ اشرح:
هل سيؤدي هذا إلى حدوث تحسن في حالة المعيشة بشكل عام نتيجة لذلك؟	كلا □ نعم □ اشرح:

اسئلة عن الطاقة البديلة- طواحين الهواء للشركات (للمنازل أيضا)

ماذا تعرف عن الطاقة الخضراء او الطاقة البديلة؟	
ماذا تعرف عن طواحين الهواء المولدة للطاقة؟	
هل تعتقد أن قريتك مستعدة لهذا النوع من الحلول في الطاقة البديلة؟ إذا نعم ، لماذا	
هل تعتقد أن طاقة طواحين الهواء يمكن أن توفر إمدادات كافية من الكهرباء إلى قريتك؟ إذا كان الجواب نعم ، كيف	
هل تعتقد أن هذه التكنولوجيا سيكون لها تأثير على القرية والاقتصاد؟ و كيف	
هل تعتقد أن طواحين الهواء سيكون لها تأثير مالي إيجابي على الأسر؟ إذا كان الجواب نعم ، كيف	
هل تفضل أن يتم إدارة طواحين الهواء من قبل شركة خاصة؟ لماذا	
ما هي توقعاتك من هذا المشروع إذا حدث؟ اشرح	
هل تؤيد و تدعم هذه الفكرة وتروج لها؟ و كيف	

شكرا على تعاونكم

اسم الباحث:_____

امضاء الباحث:_____

ملاحظات:

_____

_____

_____

_____

_____

_____

_____

_____

يهدف المشروع إلى توفير إمدادات الطاقة الخضراء لثلاث بلديات من خلال تركيب طواحين الهواء المولدة للطاقة . سوف توفر طواحين الهواء الطاقة من الجو ومن خلال شبكة جديدة .ستكون هذه الشبكة جاهزة عام ٢٠٢٠. وهي تهدف إلى تحسين حالة الانتاجية و المعيشية في المنطقة وتحسين حياة الأسرة المعيشية في المنطقة عن طريق توفير كهرباء لساعات اكثر و اقل كلفة.

ENVIRONMENT
& HEALTH

APPENDIX S
NOISE ASSESSMENT

Project:
18-1-3019

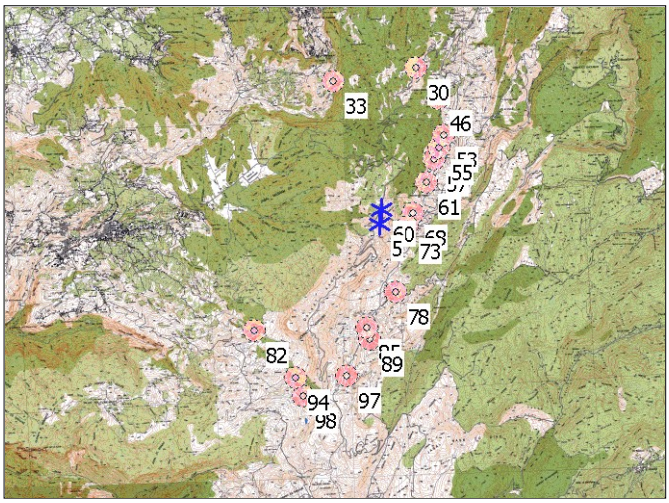
Description:
Akkar Wind Farm

Licensed user:
Ramboll IMS Ingenieurgesellschaft mbH
Stadtdeich 7
DE-20097 Hamburg
+49 40 302020-132
Jonas Feja / jonas.feja@ramboll.com
Calculated:
26.01.2019 19:40/3.2.737

DECIBEL - Main Result

Calculation: construction: tracks laying

Noise calculation model:
ISO 9613-2 General
Wind speed (in 10 m height):
Loudest up to 95% rated power
Ground attenuation:
Alternative
Meteorological coefficient, C0:
0,0 dB
Type of demand in calculation:
1: WTG noise is compared to demand (DK, DE, SE, NL etc.)
Noise values in calculation:
All noise values are mean values (Lwa) (Normal)
Pure tones:
Fixed penalty added to source noise of WTGs with pure tones
WTG catalogue
Height above ground level, when no value in NSA object:
5,0 m; Allow override of model height with height from NSA object
Uncertainty margin:
0,0 dB; Uncertainty margin in NSA has priority
Deviation from "official" noise demands. Negative is more restrictive, positive is less restrictive.:
0,0 dB(A)



Scale 1:200.000
Existing WTG
Noise sensitive area

WTGs

	Longitude	Latitude	Z [m]	Row data/Description	WTG type Valid	Manufact.	Type-generator	Power, rated [kW]	Rotor diameter [m]	Hub height [m]	Noise data Creator	Name	Wind speed [m/s]	LwA,ref [dB(A)]	Pure tones
1	36,261248° E	34,478274° N	1.922,3	Excavator	No	ABC	Machinery-1/1	1	1,0	2,5	USER	Excavator	(95%)	107,0	No
2	36,260583° E	34,474870° N	1.934,9	Excavator	No	ABC	Machinery-1/1	1	1,0	2,5	USER	Excavator	(95%)	107,0	No
3	36,261248° E	34,478274° N	1.922,3	Roller	No	ABC	Machinery-1/1	1	1,0	2,5	USER	Roller	(95%)	107,0	No
4	36,260583° E	34,474870° N	1.934,9	Roller	No	ABC	Machinery-1/1	1	1,0	2,5	USER	Roller	(95%)	107,0	No
5	36,260583° E	34,474870° N	1.934,9	Dump truck	No	ABC	Machinery-1/1	1	1,0	2,5	USER	Dump Truck	(95%)	115,0	No
6	36,261248° E	34,478274° N	1.922,3	Dump truck	No	ABC	Machinery-1/1	1	1,0	2,5	USER	Dump Truck	(95%)	115,0	No
7	36,260583° E	34,474870° N	1.934,9	Dump truck	No	ABC	Machinery-1/1	1	1,0	2,5	USER	Dump Truck	(95%)	115,0	No
8	36,261248° E	34,478274° N	1.922,3	Dump truck	No	ABC	Machinery-1/1	1	1,0	2,5	USER	Dump Truck	(95%)	115,0	No
9	36,260583° E	34,474870° N	1.934,9	Dozer	No	ABC	Machinery-1/1	1	1,0	2,5	USER	Dozer	(95%)	109,0	No
10	36,261248° E	34,478274° N	1.922,3	Dozer	No	ABC	Machinery-1/1	1	1,0	2,5	USER	Dozer	(95%)	109,0	No

Calculation Results

Sound level

Noise sensitive area No.	Name	Longitude	Latitude	Z [m]	Imission height [m]	Demands Noise [dB(A)]	Sound level From WTGs [dB(A)]	Demands fulfilled ? Noise
30	LWP 30: house under construction	36,272567° E	34,511469° N	1.430,9	5,0	55	30	Yes
33	LWP 33:house	36,248528° E	34,508982° N	1.194,7	5,0	55	30	Yes
46	LWP 46:occupied house in summer	36,278525° E	34,504084° N	1.396,2	5,0	55	32	Yes
53	LWP 53:house	36,279899° E	34,495307° N	1.495,7	5,0	55	35	Yes
55	LWP 55:villa	36,278413° E	34,492443° N	1.554,1	5,0	55	37	Yes
57	LWP 57:house	36,277015° E	34,489582° N	1.579,6	5,0	55	39	Yes
61	LWP 61:house	36,274565° E	34,484235° N	1.584,6	5,0	55	43	Yes
68	LWP 68: house	36,270268° E	34,477126° N	1.696,3	5,0	55	48	Yes
73	LWP 73: house	36,268675° E	34,473917° N	1.700,8	5,0	55	49	Yes
78	LWP 78: house	36,264729° E	34,458423° N	1.714,2	5,0	55	39	Yes
82	LWP 82: house	36,223728° E	34,450359° N	1.755,7	5,0	55	28	Yes
85	LWP 85: house	36,256086° E	34,450161° N	1.850,8	5,0	55	34	Yes
89	LWP 89: house	36,256862° E	34,447384° N	1.838,9	5,0	55	33	Yes
94	LWP 94: house	36,235096° E	34,438907° N	1.959,5	5,0	55	27	Yes
97	LWP 97: house	36,249680° E	34,438785° N	1.954,6	5,0	55	28	Yes
98	LWP 98: house	36,237141° E	34,434363° N	1.916,0	5,0	55	25	Yes

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Calculated:
26.01.2019 19:40/3.2.737

DECIBEL - Main Result

Calculation: construction: tracks laying

Distances (m)

	WTG									
NSA	1	2	3	4	5	6	7	8	9	10
30	3828	4208	3828	4208	4208	3828	4208	3828	4208	3828
33	3603	3944	3603	3944	3944	3603	3944	3603	3944	3603
46	3275	3637	3275	3637	3637	3275	3637	3275	3637	3275
53	2551	2880	2551	2880	2880	2551	2880	2551	2880	2551
55	2227	2547	2227	2547	2547	2227	2547	2227	2547	2227
57	1917	2224	1917	2224	2224	1917	2224	1917	2224	1917
61	1391	1653	1391	1653	1653	1391	1653	1391	1653	1391
68	839	925	839	925	925	839	925	839	925	839
73	836	751	836	751	751	836	751	836	751	836
78	2226	1864	2226	1864	1864	2226	1864	2226	1864	2226
82	4636	4345	4636	4345	4345	4636	4345	4636	4345	4636
85	3156	2773	3156	2773	2773	3156	2773	3156	2773	3156
89	3452	3069	3452	3069	3069	3452	3069	3452	3069	3452
94	4986	4628	4986	4628	4628	4986	4628	4986	4628	4986
97	4509	4128	4509	4128	4128	4509	4128	4509	4128	4509
98	5353	4985	5353	4985	4985	5353	4985	5353	4985	5353

Project:
18-1-3019

Description:
Akkar Wind Farm

Licensed user:
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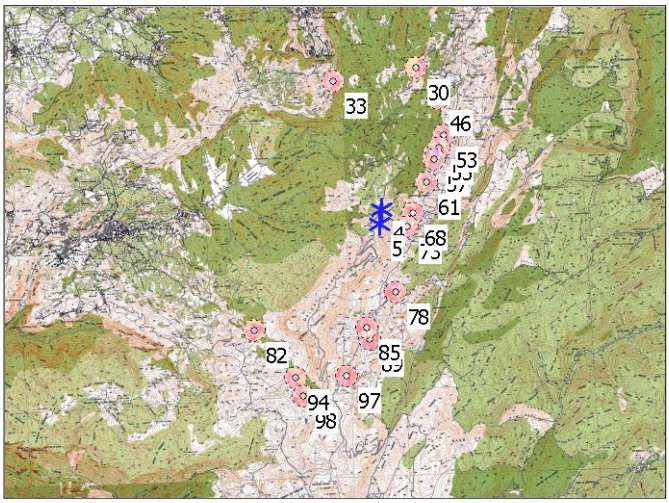
Jonas Feja / jonas.feja@ramboll.com
Calculated:
26.01.2019 19:41/3.2.737

DECIBEL - Main Result

Calculation: construction: foundation excavation

Noise calculation model:
ISO 9613-2 General
Wind speed (in 10 m height):
Loudest up to 95% rated power
Ground attenuation:
Alternative
Meteorological coefficient, C0:
0,0 dB
Type of demand in calculation:
1: WTG noise is compared to demand (DK, DE, SE, NL etc.)
Noise values in calculation:
All noise values are mean values (Lwa) (Normal)
Pure tones:
Fixed penalty added to source noise of WTGs with pure tones
WTG catalogue
Height above ground level, when no value in NSA object:
5,0 m; Allow override of model height with height from NSA object
Uncertainty margin:
0,0 dB; Uncertainty margin in NSA has priority
Deviation from "official" noise demands. Negative is more restrictive, positive is less restrictive.:
0,0 dB(A)



Scale 1:200.000
Existing WTG
Noise sensitive area

WTGs

	Longitude	Latitude	Z [m]	Row data/Description	WTG type Valid	Manufact.	Type-generator	Power, rated [kW]	Rotor diameter [m]	Hub height [m]	Noise data Creator	Name	Wind speed [m/s]	LwA,ref [dB(A)]	Pure tones
1	36,260583° E	34,474870° N	1.934,9	Dump truck	No	ABC	Machinery-1/1	1	1,0	2,5	USER	Dump Truck	(95%)	115,0	No
2	36,261248° E	34,478274° N	1.922,3	Dump truck	No	ABC	Machinery-1/1	1	1,0	2,5	USER	Dump Truck	(95%)	115,0	No
3	36,260583° E	34,474870° N	1.934,9	Dump truck	No	ABC	Machinery-1/1	1	1,0	2,5	USER	Dump Truck	(95%)	115,0	No
4	36,261248° E	34,478274° N	1.922,3	Dump truck	No	ABC	Machinery-1/1	1	1,0	2,5	USER	Dump Truck	(95%)	115,0	No
5	36,260583° E	34,474870° N	1.934,9	Breaker	No	ABC	Machinery-1/1	1	1,0	2,5	USER	Breaker	(95%)	120,0	No
6	36,261248° E	34,478274° N	1.922,3	Breaker	No	ABC	Machinery-1/1	1	1,0	2,5	USER	Breaker	(95%)	120,0	No
7	36,260583° E	34,474870° N	1.934,9	Excavator	No	ABC	Machinery-1/1	1	1,0	2,5	USER	Excavator	(95%)	107,0	No
8	36,261248° E	34,478274° N	1.922,3	Excavator	No	ABC	Machinery-1/1	1	1,0	2,5	USER	Excavator	(95%)	107,0	No

Calculation Results

Sound level

Noise sensitive area No.	Name	Longitude	Latitude	Z [m]	Imission height [m]	Demands Noise [dB(A)]	Sound level From WTGs [dB(A)]	Demands fulfilled ? Noise
30	LWP 30: house under construction	36,272567° E	34,511469° N	1.430,9	5,0	55	33	Yes
33	LWP 33:house	36,248528° E	34,508982° N	1.194,7	5,0	55	34	Yes
46	LWP 46:occupied house in summer	36,278525° E	34,504084° N	1.396,2	5,0	55	35	Yes
53	LWP 53:house	36,279899° E	34,495307° N	1.495,7	5,0	55	39	Yes
55	LWP 55:villa	36,278413° E	34,492443° N	1.554,1	5,0	55	40	Yes
57	LWP 57:house	36,277015° E	34,489582° N	1.579,6	5,0	55	42	Yes
61	LWP 61:house	36,274565° E	34,484235° N	1.584,6	5,0	55	46	Yes
68	LWP 68: house	36,270268° E	34,477126° N	1.696,3	5,0	55	52	Yes
73	LWP 73: house	36,268675° E	34,473917° N	1.700,8	5,0	55	53	Yes
78	LWP 78: house	36,264729° E	34,458423° N	1.714,2	5,0	55	42	Yes
82	LWP 82: house	36,223728° E	34,450359° N	1.755,7	5,0	55	31	Yes
85	LWP 85: house	36,256086° E	34,450161° N	1.850,8	5,0	55	38	Yes
89	LWP 89: house	36,256862° E	34,447384° N	1.838,9	5,0	55	36	Yes
94	LWP 94: house	36,235096° E	34,438907° N	1.959,5	5,0	55	30	Yes
97	LWP 97: house	36,249680° E	34,438785° N	1.954,6	5,0	55	32	Yes
98	LWP 98: house	36,237141° E	34,434363° N	1.916,0	5,0	55	28	Yes

Distances (m)

NSA	WTG 1	2	3	4	5	6	7	8
30	4208	3828	4208	3828	4208	3828	4208	3828
33	3944	3603	3944	3603	3944	3603	3944	3603
46	3637	3275	3637	3275	3637	3275	3637	3275
53	2880	2551	2880	2551	2880	2551	2880	2551

To be continued on next page...

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Calculated:
26.01.2019 19:41/3.2.737

DECIBEL - Main Result

Calculation: construction: foundation excavation

...continued from previous page

	WTG							
NSA	1	2	3	4	5	6	7	8
55	2547	2227	2547	2227	2547	2227	2547	2227
57	2224	1917	2224	1917	2224	1917	2224	1917
61	1653	1391	1653	1391	1653	1391	1653	1391
68	925	839	925	839	925	839	925	839
73	751	836	751	836	751	836	751	836
78	1864	2226	1864	2226	1864	2226	1864	2226
82	4345	4636	4345	4636	4345	4636	4345	4636
85	2773	3156	2773	3156	2773	3156	2773	3156
89	3069	3452	3069	3452	3069	3452	3069	3452
94	4628	4986	4628	4986	4628	4986	4628	4986
97	4128	4509	4128	4509	4128	4509	4128	4509
98	4985	5353	4985	5353	4985	5353	4985	5353

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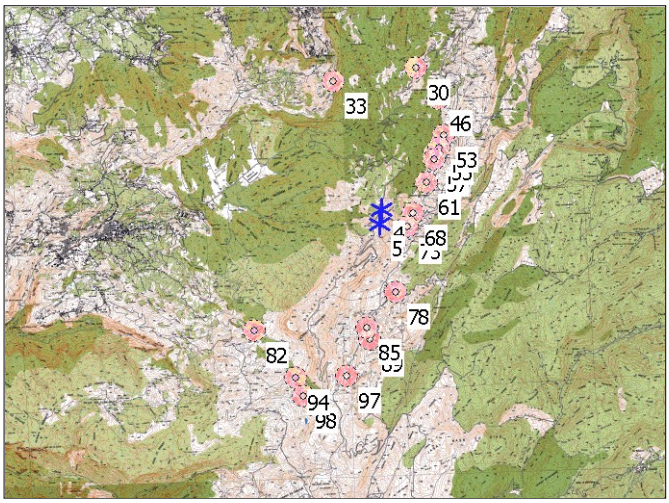
Calculated:
26.01.2019 19:40/3.2.737

DECIBEL - Main Result

Calculation: construction: concreting

Noise calculation model:
ISO 9613-2 General
Wind speed (in 10 m height):
Loudest up to 95% rated power
Ground attenuation:
Alternative
Meteorological coefficient, C0:
0,0 dB
Type of demand in calculation:
1: WTG noise is compared to demand (DK, DE, SE, NL etc.)
Noise values in calculation:
All noise values are mean values (Lwa) (Normal)
Pure tones:
Fixed penalty added to source noise of WTGs with pure tones
WTG catalogue
Height above ground level, when no value in NSA object:
5,0 m; Allow override of model height with height from NSA object
Uncertainty margin:
0,0 dB; Uncertainty margin in NSA has priority
Deviation from "official" noise demands. Negative is more restrictive, positive is less restrictive.:
0,0 dB(A)



Scale 1:200.000
Existing WTG
Noise sensitive area

WTGs

	Longitude	Latitude	Z [m]	Row data/Description	WTG type Valid	Manufact.	Type-generator	Power, rated [kW]	Rotor diameter [m]	Hub height [m]	Noise data Creator	Name	Wind speed [m/s]	LwA,ref [dB(A)]	Pure tones
1	36,260583° E	34,474870° N	1.934,9	Mixer truck	No	ABC	Machinery-1/1	1	1,0	2,5	USER	Mixer Truck	(95%)	108,0	No
2	36,261248° E	34,478274° N	1.922,3	Mixer truck	No	ABC	Machinery-1/1	1	1,0	2,5	USER	Mixer Truck	(95%)	108,0	No
3	36,260583° E	34,474870° N	1.934,9	Mixer truck	No	ABC	Machinery-1/1	1	1,0	2,5	USER	Mixer Truck	(95%)	108,0	No
4	36,261248° E	34,478274° N	1.922,3	Mixer truck	No	ABC	Machinery-1/1	1	1,0	2,5	USER	Mixer Truck	(95%)	108,0	No
5	36,260583° E	34,474870° N	1.934,9	Mixer truck (idling)	No	ABC	Machinery-1/1	1	1,0	2,5	USER	Mixer Truck (idling)	(95%)	99,0	No
6	36,261248° E	34,478274° N	1.922,3	Mixer truck (idling)	No	ABC	Machinery-1/1	1	1,0	2,5	USER	Mixer Truck (idling)	(95%)	99,0	No
7	36,260583° E	34,474870° N	1.934,9	Concrete Pumping	No	ABC	Machinery-1/1	1	1,0	2,5	USER	Concrete Pumping	(95%)	106,0	No
8	36,261248° E	34,478274° N	1.922,3	Concrete Pumping	No	ABC	Machinery-1/1	1	1,0	2,5	USER	Concrete Pumping	(95%)	106,0	No

Calculation Results

Sound level

Noise sensitive area No.	Name	Longitude	Latitude	Z [m]	Imission height [m]	Demands Noise [dB(A)]	Sound level From WTGs [dB(A)]	Demands fulfilled ? Noise
30	LWP 30: house under construction	36,272567° E	34,511469° N	1.430,9	5,0	55	23	Yes
33	LWP 33:house	36,248528° E	34,508982° N	1.194,7	5,0	55	24	Yes
46	LWP 46:occupied house in summer	36,278525° E	34,504084° N	1.396,2	5,0	55	25	Yes
53	LWP 53:house	36,279899° E	34,495307° N	1.495,7	5,0	55	29	Yes
55	LWP 55:villa	36,278413° E	34,492443° N	1.554,1	5,0	55	30	Yes
57	LWP 57:house	36,277015° E	34,489582° N	1.579,6	5,0	55	32	Yes
61	LWP 61:house	36,274565° E	34,484235° N	1.584,6	5,0	55	36	Yes
68	LWP 68: house	36,270268° E	34,477126° N	1.696,3	5,0	55	42	Yes
73	LWP 73: house	36,268675° E	34,473917° N	1.700,8	5,0	55	43	Yes
78	LWP 78: house	36,264729° E	34,458423° N	1.714,2	5,0	55	33	Yes
82	LWP 82: house	36,223728° E	34,450359° N	1.755,7	5,0	55	21	Yes
85	LWP 85: house	36,256086° E	34,450161° N	1.850,8	5,0	55	28	Yes
89	LWP 89: house	36,256862° E	34,447384° N	1.838,9	5,0	55	26	Yes
94	LWP 94: house	36,235096° E	34,438907° N	1.959,5	5,0	55	20	Yes
97	LWP 97: house	36,249680° E	34,438785° N	1.954,6	5,0	55	22	Yes
98	LWP 98: house	36,237141° E	34,434363° N	1.916,0	5,0	55	19	Yes

Distances (m)

	WTG							
NSA	1	2	3	4	5	6	7	8
30	4208	3828	4208	3828	4208	3828	4208	3828
33	3944	3603	3944	3603	3944	3603	3944	3603
46	3637	3275	3637	3275	3637	3275	3637	3275
53	2880	2551	2880	2551	2880	2551	2880	2551

To be continued on next page...

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Calculated:
26.01.2019 19:40/3.2.737

DECIBEL - Main Result

Calculation: construction: concreting

...continued from previous page

	WTG							
NSA	1	2	3	4	5	6	7	8
55	2547	2227	2547	2227	2547	2227	2547	2227
57	2224	1917	2224	1917	2224	1917	2224	1917
61	1653	1391	1653	1391	1653	1391	1653	1391
68	925	839	925	839	925	839	925	839
73	751	836	751	836	751	836	751	836
78	1864	2226	1864	2226	1864	2226	1864	2226
82	4345	4636	4345	4636	4345	4636	4345	4636
85	2773	3156	2773	3156	2773	3156	2773	3156
89	3069	3452	3069	3452	3069	3452	3069	3452
94	4628	4986	4628	4986	4628	4986	4628	4986
97	4128	4509	4128	4509	4128	4509	4128	4509
98	4985	5353	4985	5353	4985	5353	4985	5353

Project:
18-1-3019

Description:
Akkar Wind Farm

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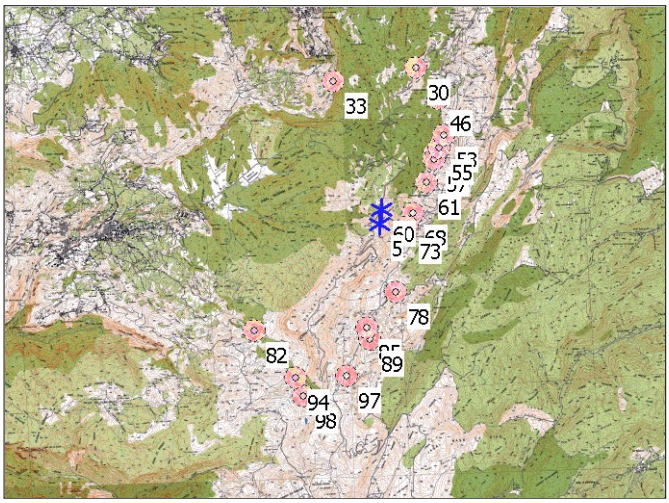
26.01.2019 19:41/3.2.737

DECIBEL - Main Result

Calculation: construction: turbine erection

Noise calculation model:
ISO 9613-2 General
Wind speed (in 10 m height):
Loudest up to 95% rated power
Ground attenuation:
Alternative
Meteorological coefficient, C0:
0,0 dB
Type of demand in calculation:
1: WTG noise is compared to demand (DK, DE, SE, NL etc.)
Noise values in calculation:
All noise values are mean values (Lwa) (Normal)
Pure tones:
Fixed penalty added to source noise of WTGs with pure tones
WTG catalogue
Height above ground level, when no value in NSA object:
5,0 m; Allow override of model height with height from NSA object
Uncertainty margin:
0,0 dB; Uncertainty margin in NSA has priority
Deviation from "official" noise demands. Negative is more restrictive, positive is less restrictive.:
0,0 dB(A)



Scale 1:200.000
Existing WTG
Noise sensitive area

WTGs

	Longitude	Latitude	Z [m]	Row data/Description	WTG type Valid	Manufact.	Type-generator	Power, rated [kW]	Rotor diameter [m]	Hub height [m]	Noise data Creator	Name	Wind speed [m/s]	LwA,ref [dB(A)]	Pure tones
1	36,260583° E	34,474870° N	1.934,9	mobile crane	No	ABC	Machinery-1/1	1	1,0	2,5	USER	Mobile crane	(95%)	106,0	No
2	36,261248° E	34,478274° N	1.922,3	mobile crane	No	ABC	Machinery-1/1	1	1,0	2,5	USER	Mobile crane	(95%)	106,0	No
3	36,260583° E	34,474870° N	1.934,9	mobile crane	No	ABC	Machinery-1/1	1	1,0	2,5	USER	Mobile crane	(95%)	106,0	No
4	36,261248° E	34,478274° N	1.922,3	mobile crane	No	ABC	Machinery-1/1	1	1,0	2,5	USER	Mobile crane	(95%)	106,0	No
5	36,260583° E	34,474870° N	1.934,9	fladbed truck	No	ABC	Machinery-1/1	1	1,0	2,5	USER	Flatbed Truck	(95%)	108,0	No
6	36,261248° E	34,478274° N	1.922,3	flatbed truck	No	ABC	Machinery-1/1	1	1,0	2,5	USER	Flatbed Truck	(95%)	108,0	No
7	36,260583° E	34,474870° N	1.934,9	fladbed truck	No	ABC	Machinery-1/1	1	1,0	2,5	USER	Flatbed Truck	(95%)	108,0	No
8	36,261248° E	34,478274° N	1.922,3	flatbed truck	No	ABC	Machinery-1/1	1	1,0	2,5	USER	Flatbed Truck	(95%)	108,0	No
9	36,260583° E	34,474870° N	1.934,9	fladbed truck	No	ABC	Machinery-1/1	1	1,0	2,5	USER	Flatbed Truck	(95%)	108,0	No
10	36,261248° E	34,478274° N	1.922,3	flatbed truck	No	ABC	Machinery-1/1	1	1,0	2,5	USER	Flatbed Truck	(95%)	108,0	No

Calculation Results

Sound level

Noise sensitive area No.	Name	Longitude	Latitude	Z [m]	Imission height [m]	Demands Noise [dB(A)]	Sound level From WTGs [dB(A)]	Demands fulfilled ? Noise
30	LWP 30: house under construction	36,272567° E	34,511469° N	1.430,9	5,0	55	25	Yes
33	LWP 33:house	36,248528° E	34,508982° N	1.194,7	5,0	55	26	Yes
46	LWP 46:occupied house in summer	36,278525° E	34,504084° N	1.396,2	5,0	55	27	Yes
53	LWP 53:house	36,279899° E	34,495307° N	1.495,7	5,0	55	31	Yes
55	LWP 55:villa	36,278413° E	34,492443° N	1.554,1	5,0	55	32	Yes
57	LWP 57:house	36,277015° E	34,489582° N	1.579,6	5,0	55	34	Yes
61	LWP 61:house	36,274565° E	34,484235° N	1.584,6	5,0	55	38	Yes
68	LWP 68: house	36,270268° E	34,477126° N	1.696,3	5,0	55	44	Yes
73	LWP 73: house	36,268675° E	34,473917° N	1.700,8	5,0	55	45	Yes
78	LWP 78: house	36,264729° E	34,458423° N	1.714,2	5,0	55	35	Yes
82	LWP 82: house	36,223728° E	34,450359° N	1.755,7	5,0	55	23	Yes
85	LWP 85: house	36,256086° E	34,450161° N	1.850,8	5,0	55	30	Yes
89	LWP 89: house	36,256862° E	34,447384° N	1.838,9	5,0	55	28	Yes
94	LWP 94: house	36,235096° E	34,438907° N	1.959,5	5,0	55	22	Yes
97	LWP 97: house	36,249680° E	34,438785° N	1.954,6	5,0	55	24	Yes
98	LWP 98: house	36,237141° E	34,434363° N	1.916,0	5,0	55	20	Yes

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26.01.2019 19:41/3.2.737

DECIBEL - Main Result

Calculation: construction: turbine erection

Distances (m)

	WTG									
NSA	1	2	3	4	5	6	7	8	9	10
30	4208	3828	4208	3828	4208	3828	4208	3828	4208	3828
33	3944	3603	3944	3603	3944	3603	3944	3603	3944	3603
46	3637	3275	3637	3275	3637	3275	3637	3275	3637	3275
53	2880	2551	2880	2551	2880	2551	2880	2551	2880	2551
55	2547	2227	2547	2227	2547	2227	2547	2227	2547	2227
57	2224	1917	2224	1917	2224	1917	2224	1917	2224	1917
61	1653	1391	1653	1391	1653	1391	1653	1391	1653	1391
68	925	839	925	839	925	839	925	839	925	839
73	751	836	751	836	751	836	751	836	751	836
78	1864	2226	1864	2226	1864	2226	1864	2226	1864	2226
82	4345	4636	4345	4636	4345	4636	4345	4636	4345	4636
85	2773	3156	2773	3156	2773	3156	2773	3156	2773	3156
89	3069	3452	3069	3452	3069	3452	3069	3452	3069	3452
94	4628	4986	4628	4986	4628	4986	4628	4986	4628	4986
97	4128	4509	4128	4509	4128	4509	4128	4509	4128	4509
98	4985	5353	4985	5353	4985	5353	4985	5353	4985	5353

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04.02.2019 10:13/3.2.737

DECIBEL - Main Result

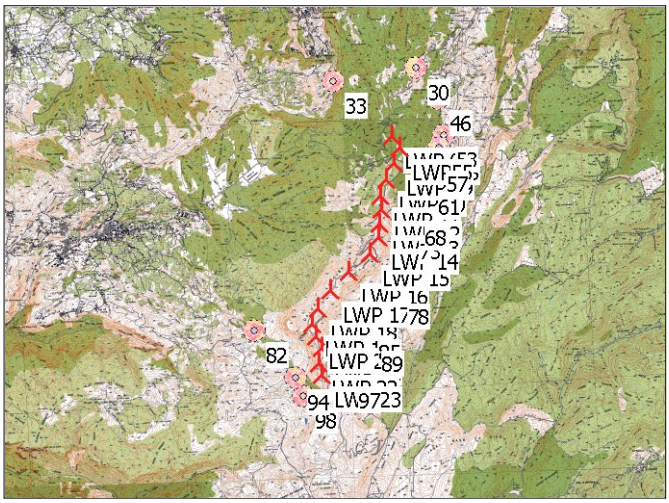
Calculation: LWP Vetsas V150

ISO 9613-2 Germany

The calculation is based on the international norm "ISO 9613-2 Acoustics - Attenuation of sound during propagation outdoors"

Loudest up to 95% rated power
Meteorological correction factor, C0: 0,0 dB

All coordinates are in
Geo [deg]-WGS84



Scale 1:200.000

New WTG Noise sensitive area

WTGs

	Longitude	Latitude	Z [m]	Row data/Description	WTG type Valid	Manufact.	Type-generator	Power, rated [kW]	Rotor diameter [m]	Hub height [m]	Noise data Creator	Name	Wind speed [m/s]	LwA,ref [dB(A)]	Pure tones
LWP 07	36,264865° E	34,495376° N	1.814,4	VESTAS V150-4.2 4200 150...	Yes	VESTAS	V150-4.2-4.200	4.200	150,0	105,0	USER	104,9 dB(A) + 1 dB(A)	(95%)	105,9	No
LWP 08	36,267003° E	34,492722° N	1.829,7	VESTAS V150-4.2 4200 150...	Yes	VESTAS	V150-4.2-4.200	4.200	150,0	105,0	USER	104,9 dB(A) + 1 dB(A)	(95%)	105,9	No
LWP 09	36,265293° E	34,488954° N	1.903,8	VESTAS V150-4.2 4200 150...	Yes	VESTAS	V150-4.2-4.200	4.200	150,0	105,0	USER	104,9 dB(A) + 1 dB(A)	(95%)	105,9	No
LWP 10	36,262879° E	34,485213° N	1.914,9	VESTAS V150-4.2 4200 150...	Yes	VESTAS	V150-4.2-4.200	4.200	150,0	105,0	USER	104,9 dB(A) + 1 dB(A)	(95%)	105,9	No
LWP 11	36,261147° E	34,481430° N	1.936,5	VESTAS V150-4.2 4200 150...	Yes	VESTAS	V150-4.2-4.200	4.200	150,0	105,0	USER	104,9 dB(A) + 1 dB(A)	(95%)	105,9	No
LWP 12	36,261248° E	34,478274° N	1.922,3	VESTAS V150-4.2 4200 150...	Yes	VESTAS	V150-4.2-4.200	4.200	150,0	105,0	USER	104,9 dB(A) + 1 dB(A)	(95%)	105,9	No
LWP 13	36,260583° E	34,474870° N	1.934,9	VESTAS V150-4.2 4200 150...	Yes	VESTAS	V150-4.2-4.200	4.200	150,0	105,0	USER	104,9 dB(A) + 1 dB(A)	(95%)	105,9	No
LWP 14	36,260211° E	34,471455° N	1.851,7	VESTAS V150-4.2 4200 150...	Yes	VESTAS	V150-4.2-4.200	4.200	150,0	105,0	USER	104,9 dB(A) + 1 dB(A)	(95%)	105,9	No
LWP 15	36,257625° E	34,467738° N	1.988,4	VESTAS V150-4.2 4200 150...	Yes	VESTAS	V150-4.2-4.200	4.200	150,0	105,0	USER	104,9 dB(A) + 1 dB(A)	(95%)	105,9	No
LWP 16	36,251352° E	34,463613° N	2.072,4	VESTAS V150-4.2 4200 150...	Yes	VESTAS	V150-4.2-4.200	4.200	150,0	105,0	USER	104,9 dB(A) + 1 dB(A)	(95%)	105,9	No
LWP 17	36,245957° E	34,459301° N	2.107,8	VESTAS V150-4.2 4200 150...	Yes	VESTAS	V150-4.2-4.200	4.200	150,0	105,0	USER	104,9 dB(A) + 1 dB(A)	(95%)	105,9	No
LWP 18	36,242165° E	34,455185° N	2.115,4	VESTAS V150-4.2 4200 150...	Yes	VESTAS	V150-4.2-4.200	4.200	150,0	105,0	USER	104,9 dB(A) + 1 dB(A)	(95%)	105,9	No
LWP 19	36,240424° E	34,451469° N	2.139,2	VESTAS V150-4.2 4200 150...	Yes	VESTAS	V150-4.2-4.200	4.200	150,0	105,0	USER	104,9 dB(A) + 1 dB(A)	(95%)	105,9	No
LWP 20	36,241245° E	34,448386° N	2.184,4	VESTAS V150-4.2 4200 150...	Yes	VESTAS	V150-4.2-4.200	4.200	150,0	105,0	USER	104,9 dB(A) + 1 dB(A)	(95%)	105,9	No
LWP 21	36,242901° E	34,445685° N	2.193,4	VESTAS V150-4.2 4200 150...	Yes	VESTAS	V150-4.2-4.200	4.200	150,0	105,0	USER	104,9 dB(A) + 1 dB(A)	(95%)	105,9	No
LWP 22	36,241779° E	34,442166° N	2.204,3	VESTAS V150-4.2 4200 150...	Yes	VESTAS	V150-4.2-4.200	4.200	150,0	105,0	USER	104,9 dB(A) + 1 dB(A)	(95%)	105,9	No
LWP 23	36,242651° E	34,439372° N	2.149,3	VESTAS V150-4.2 4200 150...	Yes	VESTAS	V150-4.2-4.200	4.200	150,0	105,0	USER	104,9 dB(A) + 1 dB(A)	(95%)	105,9	No

Calculation Results

Sound level

Noise sensitive area

No.	Name	Longitude	Latitude	Z [m]	Imission height [m]	Demands Noise [dB(A)]	Sound level From WTGs [dB(A)]	Demands fulfilled ? Noise
30	LWP: 30 house under construction	36,272567° E	34,511469° N	1.430,9	5,0	45,0	29,0	Yes
33	LWP: 33 house	36,248528° E	34,508982° N	1.194,7	5,0	45,0	27,2	Yes
46	LWP: 46 occupied house in summer	36,278525° E	34,504084° N	1.396,2	5,0	45,0	30,5	Yes
53	LWP: 53 house	36,279899° E	34,495307° N	1.495,7	5,0	45,0	34,0	Yes
55	LWP: 55 villa	36,278413° E	34,492443° N	1.554,1	5,0	45,0	35,5	Yes
57	LWP: 57 house	36,277015° E	34,489582° N	1.579,6	5,0	45,0	37,2	Yes
61	LWP: 61 house	36,274565° E	34,484235° N	1.584,6	5,0	45,0	38,0	Yes
68	LWP: 68 house	36,270268° E	34,477126° N	1.696,3	5,0	45,0	40,3	Yes
73	LWP: 73 house	36,268675° E	34,473917° N	1.700,8	5,0	45,0	41,3	Yes
78	LWP: 78 house	36,264729° E	34,458423° N	1.714,2	5,0	45,0	35,9	Yes
82	LWP: 82 house	36,223728° E	34,450359° N	1.755,7	5,0	45,0	34,3	Yes
85	LWP: 85 house	36,256086° E	34,450161° N	1.850,8	5,0	45,0	38,3	Yes
89	LWP: 89 house	36,256862° E	34,447384° N	1.838,9	5,0	45,0	37,4	Yes
94	LWP: 94 house	36,235096° E	34,438907° N	1.959,5	5,0	45,0	40,1	Yes
97	LWP: 97 house	36,249680° E	34,438785° N	1.954,6	5,0	45,0	41,2	Yes
98	LWP: 98 house	36,237141° E	34,434363° N	1.916,0	5,0	45,0	38,3	Yes

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Calculated:
04.02.2019 10:13/3.2.737

DECIBEL - Main Result

Calculation: LWP Vetsas V150

Distances (m)

WTG	30	33	46	53	55	57	61	68	73	78	82	85	89	94	97	98
LWP 07	1921	2129	1584	1381	1287	1288	1524	2085	2407	4101	6265	5082	5376	6838	6433	7234
LWP 08	2142	2477	1646	1219	1049	984	1170	1757	2092	3812	6158	4828	5117	6653	6194	7034
LWP 09	2586	2704	2073	1516	1266	1079	1000	1390	1697	3388	5739	4387	4678	6209	5749	6588
LWP 10	3047	2949	2540	1924	1637	1386	1079	1125	1362	2978	5283	3940	4234	5738	5293	6119
LWP 11	3495	3270	2978	2311	2003	1716	1272	965	1083	2574	4870	3501	3799	5292	4848	5670
LWP 12	3828	3603	3275	2551	2227	1917	1391	839	836	2226	4636	3156	3452	4986	4509	5353
LWP 13	4208	3944	3637	2880	2547	2224	1653	925	751	1864	4345	2773	3069	4628	4128	4985
LWP 14	4583	4301	3993	3206	2868	2536	1937	1118	824	1505	4090	2393	2689	4287	3752	4630
LWP 15	5043	4653	4467	3681	3342	3009	2403	1561	1225	1223	3664	1956	2260	3811	3295	4155
LWP 16	5657	5041	5139	4388	4052	3724	3129	2296	1960	1358	2935	1555	1871	3123	2759	3499
LWP 17	6284	5518	5801	5069	4735	4409	3817	2984	2644	1728	2272	1377	1659	2474	2302	2884
LWP 18	6842	5999	6373	5644	5310	4983	4389	3550	3203	2105	1778	1396	1605	1920	1947	2356
LWP 19	7284	6426	6808	6069	5733	5404	4803	3954	3598	2364	1540	1447	1578	1478	1645	1922
LWP 20	7569	6758	7067	6303	5964	5631	5021	4158	3793	2429	1625	1378	1440	1194	1318	1601
LWP 21	7793	7043	7261	6472	6130	5793	5174	4301	3928	2455	1837	1310	1297	1040	987	1363
LWP 22	8195	7441	7656	6859	6517	6179	5557	4681	4304	2776	1892	1587	1503	713	818	965
LWP 23	8460	7744	7902	7089	6745	6405	5779	4899	4519	2931	2124	1720	1580	697	650	752

Project:
18-1-3019

Description:
Akkar Wind Farm

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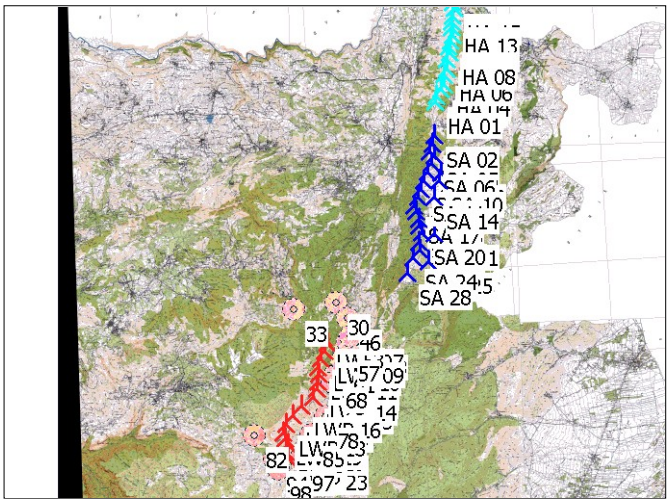
Calculated:
04.02.2019 10:21/3.2.737

DECIBEL - Main Result

Calculation: LWP Vestas V150 cumulativ: with WF Sustainable Akkar and WF Hawa Akkar

Noise calculation model:
ISO 9613-2 General
Wind speed (in 10 m height):
Loudest up to 95% rated power
Ground attenuation:
Alternative
Meteorological coefficient, C0:
0,0 dB
Type of demand in calculation:
1: WTG noise is compared to demand (DK, DE, SE, NL etc.)
Noise values in calculation:
All noise values are mean values (Lwa) (Normal)
Pure tones:
Fixed penalty added to source noise of WTGs with pure tones
WTG catalogue
Height above ground level, when no value in NSA object:
5,0 m; Allow override of model height with height from NSA object
Uncertainty margin:
0,0 dB; Uncertainty margin in model has priority
Deviation from "official" noise demands. Negative is more restrictive, positive is less restrictive.:
0,0 dB(A)



Scale 1:400.000

New WTG Noise sensitive area

WTGs

	Longitude	Latitude	Z [m]	Row data/Description	WTG type Valid	Manufact.	Type-generator	Power, rated [kW]	Rotor diameter [m]	Hub height [m]	Noise data Creator	Name	Wind speed [m/s]	LwA,ref [dB(A)]	Pure tones
HA 01	36,332394° E	34,603649° N	848,4	VESTAS V150-4.2 4200 150....	Yes	VESTAS	V150-4.2-4.200	4.200	150,0	105,0	USER	104,9 dB(A) + 1 dB(A)	(95%)	105,9	No
HA 02	36,333189° E	34,606740° N	789,3	VESTAS V150-4.2 4200 150....	Yes	VESTAS	V150-4.2-4.200	4.200	150,0	105,0	USER	104,9 dB(A) + 1 dB(A)	(95%)	105,9	No
HA 03	36,335620° E	34,609831° N	804,6	VESTAS V150-4.2 4200 150....	Yes	VESTAS	V150-4.2-4.200	4.200	150,0	105,0	USER	104,9 dB(A) + 1 dB(A)	(95%)	105,9	No
HA 04	36,337634° E	34,611975° N	816,1	VESTAS V150-4.2 4200 150....	Yes	VESTAS	V150-4.2-4.200	4.200	150,0	105,0	USER	104,9 dB(A) + 1 dB(A)	(95%)	105,9	No
HA 05	36,337789° E	34,616333° N	789,3	VESTAS V150-4.2 4200 150....	Yes	VESTAS	V150-4.2-4.200	4.200	150,0	105,0	USER	104,9 dB(A) + 1 dB(A)	(95%)	105,9	No
HA 06	36,339466° E	34,619146° N	740,4	VESTAS V150-4.2 4200 150....	Yes	VESTAS	V150-4.2-4.200	4.200	150,0	105,0	USER	104,9 dB(A) + 1 dB(A)	(95%)	105,9	No
HA 07	36,339759° E	34,623272° N	701,3	VESTAS V150-4.2 4200 150....	Yes	VESTAS	V150-4.2-4.200	4.200	150,0	105,0	USER	104,9 dB(A) + 1 dB(A)	(95%)	105,9	No
HA 08	36,341350° E	34,626390° N	710,0	VESTAS V150-4.2 4200 150....	Yes	VESTAS	V150-4.2-4.200	4.200	150,0	105,0	USER	104,9 dB(A) + 1 dB(A)	(95%)	105,9	No
HA 09	36,341012° E	34,629105° N	669,8	VESTAS V150-4.2 4200 150....	Yes	VESTAS	V150-4.2-4.200	4.200	150,0	105,0	USER	104,9 dB(A) + 1 dB(A)	(95%)	105,9	No
HA 10	36,342218° E	34,632007° N	668,8	VESTAS V150-4.2 4200 150....	Yes	VESTAS	V150-4.2-4.200	4.200	150,0	105,0	USER	104,9 dB(A) + 1 dB(A)	(95%)	105,9	No
HA 11	36,343425° E	34,634512° N	638,1	VESTAS V150-4.2 4200 150....	Yes	VESTAS	V150-4.2-4.200	4.200	150,0	105,0	USER	104,9 dB(A) + 1 dB(A)	(95%)	105,9	No
HA 12	36,343003° E	34,638163° N	561,2	VESTAS V150-4.2 4200 150....	Yes	VESTAS	V150-4.2-4.200	4.200	150,0	105,0	USER	104,9 dB(A) + 1 dB(A)	(95%)	105,9	No
HA 13	36,342989° E	34,640984° N	538,6	VESTAS V150-4.2 4200 150....	Yes	VESTAS	V150-4.2-4.200	4.200	150,0	105,0	USER	104,9 dB(A) + 1 dB(A)	(95%)	105,9	No
HA 14	36,343501° E	34,643735° N	484,0	VESTAS V150-4.2 4200 150....	Yes	VESTAS	V150-4.2-4.200	4.200	150,0	105,0	USER	104,9 dB(A) + 1 dB(A)	(95%)	105,9	No
HA 15	36,344782° E	34,647360° N	464,2	VESTAS V150-4.2 4200 150....	Yes	VESTAS	V150-4.2-4.200	4.200	150,0	105,0	USER	104,9 dB(A) + 1 dB(A)	(95%)	105,9	No
HA 16	36,343792° E	34,650007° N	407,4	VESTAS V150-4.2 4200 150....	Yes	VESTAS	V150-4.2-4.200	4.200	150,0	105,0	USER	104,9 dB(A) + 1 dB(A)	(95%)	105,9	No
LWP 07	36,264865° E	34,495376° N	1.814,4	VESTAS V150-4.2 4200 150....	Yes	VESTAS	V150-4.2-4.200	4.200	150,0	105,0	USER	104,9 dB(A) + 1 dB(A)	(95%)	105,9	No
LWP 08	36,267003° E	34,492722° N	1.829,7	VESTAS V150-4.2 4200 150....	Yes	VESTAS	V150-4.2-4.200	4.200	150,0	105,0	USER	104,9 dB(A) + 1 dB(A)	(95%)	105,9	No
LWP 09	36,265293° E	34,488954° N	1.903,8	VESTAS V150-4.2 4200 150....	Yes	VESTAS	V150-4.2-4.200	4.200	150,0	105,0	USER	104,9 dB(A) + 1 dB(A)	(95%)	105,9	No
LWP 10	36,262879° E	34,485213° N	1.914,9	VESTAS V150-4.2 4200 150....	Yes	VESTAS	V150-4.2-4.200	4.200	150,0	105,0	USER	104,9 dB(A) + 1 dB(A)	(95%)	105,9	No
LWP 11	36,261147° E	34,481430° N	1.936,5	VESTAS V150-4.2 4200 150....	Yes	VESTAS	V150-4.2-4.200	4.200	150,0	105,0	USER	104,9 dB(A) + 1 dB(A)	(95%)	105,9	No
LWP 12	36,261248° E	34,478274° N	1.922,3	VESTAS V150-4.2 4200 150....	Yes	VESTAS	V150-4.2-4.200	4.200	150,0	105,0	USER	104,9 dB(A) + 1 dB(A)	(95%)	105,9	No
LWP 13	36,260583° E	34,474870° N	1.934,9	VESTAS V150-4.2 4200 150....	Yes	VESTAS	V150-4.2-4.200	4.200	150,0	105,0	USER	104,9 dB(A) + 1 dB(A)	(95%)	105,9	No
LWP 14	36,260211° E	34,471455° N	1.851,7	VESTAS V150-4.2 4200 150....	Yes	VESTAS	V150-4.2-4.200	4.200	150,0	105,0	USER	104,9 dB(A) + 1 dB(A)	(95%)	105,9	No
LWP 15	36,257625° E	34,467738° N	1.988,4	VESTAS V150-4.2 4200 150....	Yes	VESTAS	V150-4.2-4.200	4.200	150,0	105,0	USER	104,9 dB(A) + 1 dB(A)	(95%)	105,9	No
LWP 16	36,251352° E	34,463613° N	2.072,4	VESTAS V150-4.2 4200 150....	Yes	VESTAS	V150-4.2-4.200	4.200	150,0	105,0	USER	104,9 dB(A) + 1 dB(A)	(95%)	105,9	No
LWP 17	36,245957° E	34,459301° N	2.107,8	VESTAS V150-4.2 4200 150....	Yes	VESTAS	V150-4.2-4.200	4.200	150,0	105,0	USER	104,9 dB(A) + 1 dB(A)	(95%)	105,9	No
LWP 18	36,242165° E	34,455185° N	2.115,4	VESTAS V150-4.2 4200 150....	Yes	VESTAS	V150-4.2-4.200	4.200	150,0	105,0	USER	104,9 dB(A) + 1 dB(A)	(95%)	105,9	No
LWP 19	36,240424° E	34,451469° N	2.139,2	VESTAS V150-4.2 4200 150....	Yes	VESTAS	V150-4.2-4.200	4.200	150,0	105,0	USER	104,9 dB(A) + 1 dB(A)	(95%)	105,9	No
LWP 20	36,241245° E	34,448386° N	2.184,4	VESTAS V150-4.2 4200 150....	Yes	VESTAS	V150-4.2-4.200	4.200	150,0	105,0	USER	104,9 dB(A) + 1 dB(A)	(95%)	105,9	No
LWP 21	36,242901° E	34,445685° N	2.193,4	VESTAS V150-4.2 4200 150....	Yes	VESTAS	V150-4.2-4.200	4.200	150,0	105,0	USER	104,9 dB(A) + 1 dB(A)	(95%)	105,9	No
LWP 22	36,241779° E	34,442166° N	2.204,3	VESTAS V150-4.2 4200 150....	Yes	VESTAS	V150-4.2-4.200	4.200	150,0	105,0	USER	104,9 dB(A) + 1 dB(A)	(95%)	105,9	No
LWP 23	36,242651° E	34,439372° N	2.149,3	VESTAS V150-4.2 4200 150....	Yes	VESTAS	V150-4.2-4.200	4.200	150,0	105,0	USER	104,9 dB(A) + 1 dB(A)	(95%)	105,9	No
SA 02	36,330964° E	34,587939° N	914,2	NORDEX N149/4.0-4.5 4500...	Yes	NORDEX	N149/4.0-4.5-4.500	4.500	149,0	105,0	USER	108,1 dB(A) + 1 dB(A)	(95%)	109,1	No
SA 03	36,329828° E	34,584283° N	949,8	NORDEX N149/4.0-4.5 4500...	Yes	NORDEX	N149/4.0-4.5-4.500	4.500	149,0	105,0	USER	108,1 dB(A) + 1 dB(A)	(95%)	109,1	No
SA 04	36,327887° E	34,580411° N	965,4	NORDEX N149/4.0-4.5 4500...	Yes	NORDEX	N149/4.0-4.5-4.500	4.500	149,0	105,0	USER	108,1 dB(A) + 1 dB(A)	(95%)	109,1	No
SA 05	36,330809° E	34,578547° N	959,2	NORDEX N149/4.0-4.5 4500...	Yes	NORDEX	N149/4.0-4.5-4.500	4.500	149,0	105,0	USER	108,1 dB(A) + 1 dB(A)	(95%)	109,1	No
SA 06	36,328890° E	34,574900° N	1.048,1	NORDEX N149/4.0-4.5 4500...	Yes	NORDEX	N149/4.0-4.5-4.500	4.500	149,0	105,0	USER	108,1 dB(A) + 1 dB(A)	(95%)	109,1	No
SA 07	36,326668° E	34,571152° N	1.083,8	NORDEX N149/4.0-4.5 4500...	Yes	NORDEX	N149/4.0-4.5-4.500	4.500	149,0	105,0	USER	108,1 dB(A) + 1 dB(A)	(95%)	109,1	No
SA 08	36,334428° E	34,570455° N	1.065,9	NORDEX N149/4.0-4.5 4500...	Yes	NORDEX	N149/4.0-4.5-4.500	4.500	149,0	105,0	USER	108,1 dB(A) + 1 dB(A)	(95%)	109,1	No
SA 09	36,324544° E	34,567019° N	1.074,9	NORDEX N149/4.0-4.5 4500...	Yes	NORDEX	N149/4.0-4.5-4.500	4.500	149,0	105,0	USER	108,1 dB(A) + 1 dB(A)	(95%)	109,1	No
SA 10	36,333188° E	34,566940° N	1.077,5	NORDEX N149/4.0-4.5 4500...	Yes	NORDEX	N149/4.0-4.5-4.500	4.500	149,0	105,0	USER	108,1 dB(A) + 1 dB(A)	(95%)	109,1	No
SA 11	36,322257° E	34,563207° N	1.036,3	NORDEX N149/4.0-4.5 4500...	Yes	NORDEX	N149/4.0-4.5-4.500	4.500	149,0	105,0	USER	108,1 dB(A) + 1 dB(A)	(95%)	109,1	No
SA 13	36,320570° E	34,559367° N	1.056,2	NORDEX N149/4.0-4.5 4500...	Yes	NORDEX	N149/4.0-4.5-4.500	4.500	149,0	105,0	USER	108,1 dB(A) + 1 dB(A)	(95%)	109,1	No
SA 14	36,330057° E	34,559516° N	1.100,2	NORDEX N149/4.0-4.5 4500...	Yes	NORDEX	N149/4.0-4.5-4.500	4.500	149,0	105,0	USER	108,1 dB(A) + 1 dB(A)	(95%)	109,1	No
SA 15	36,318416° E	34,555775° N	1.026,0	NORDEX N149/4.0-4.5 4500...	Yes	NORDEX	N149/4.0-4.5-4.500	4.500	149,0	105,0	USER	108,1 dB(A) + 1 dB(A)	(95%)	109,1	No
SA 17	36,319296° E	34,552888° N	1.036,1	NORDEX N149/4.0-4.5 4500...	Yes	NORDEX	N149/4.0-4.5-4.500	4.500	149,0	105,0	USER	108,1 dB(A) + 1 dB(A)	(95%)	109,1	No
SA 18	36,321037° E	34,549404° N	1.124,2	NORDEX N149/4.0-4.5 4500...	Yes	NORDEX	N149/4.0-4.5-4.500	4.500	149,0	105,0	USER	108,1 dB(A) + 1 dB(A)	(95%)	109,1	No
SA 19	36,320700° E	34,545967° N	1.154,3	NORDEX N149/4.0-4.5 4500...	Yes	NORDEX	N149/4.0-4.5-4.500	4.500	149,0	105,0	USER	108,1 dB(A) + 1 dB(A)	(95%)	109,1	No
SA 20	36,322239° E	34,542980° N	1.168,5	NORDEX N149/4.0-4.5 4500...	Yes	NORDEX	N149/4.0-4.5-4.500	4.500	149,0	105,0	USER	108,1 dB(A) + 1 dB(A)	(95%)	109,1	No
SA 21	36,329271° E	34,542225° N	1.153,2	NORDEX N149/4.0-4.5 4500...	Yes	NORDEX	N149/4.0-4.5-4.500	4.500	149,0	105,0	USER	108,1 dB(A) + 1 dB(A)	(95%)	109,1	No
SA 22	36,320636° E	34,538496° N	1.175,6	NORDEX N149/4.0-4.5 4500...	Yes	NORDEX	N149/4.0-4.5-4.500	4.500	149,0	105,0	USER	108,1 dB(A) + 1 dB(A)	(95%)	109,1	No
SA 23	36,320604° E	34,534624° N	1.208,1	NORDEX N149/4.0-4.5 4500...	Yes	NORDEX	N149/4.0-4.5-4.500	4.500	149,0	105,0	USER	108,1 dB(A) + 1 dB(A)	(95%)	109,1	No
SA 24	36,317041° E	34,531159° N	1.237,8	NORDEX N149/4.0-4.5 4500...	Yes	NORDEX	N149/4.0-4.5-4.500	4.500	149,0	105,0	USER	108,1 dB(A) + 1 dB(A)	(95%)	109,1	No

To be continued on next page...

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04.02.2019 10:21/3.2.737

DECIBEL - Main Result

Calculation: LWP Vestas V150 cumulativ: with WF Sustainable Akkar and WF Hawa Akkar

...continued from previous page

	Longitude	Latitude	Z [m]	Row data/Description	WTG type Valid	Manufact.	Type-generator	Power, rated [kW]	Rotor diameter [m]	Hub height [m]	Noise data Creator	Name	Wind speed [m/s]	LwA,ref [dB(A)]	Pure tones
SA 25	36,325734° E	34,529126° N	1.257,2	NORDEX N149/4.0-4.5 4500...	Yes	NORDEX	N149/4.0-4.5-4.500	4.500	149,0	105,0	USER	108,1 dB(A) + 1 dB(A)	(95%)	109,1	No
SA 28	36,313252° E	34,524313° N	1.285,8	NORDEX N149/4.0-4.5 4500...	Yes	NORDEX	N149/4.0-4.5-4.500	4.500	149,0	105,0	USER	108,1 dB(A) + 1 dB(A)	(95%)	109,1	No

Calculation Results

Sound level

Noise sensitive area No.	Name	Longitude	Latitude	Z [m]	Imission height [m]	Demands Noise [dB(A)]	Sound level From WTGs [dB(A)]	Demands fulfilled ? Noise
30	LWP: 30 house under construction	36,272567° E	34,511469° N	1.430,9	5,0	45,0	30,0	Yes
33	LWP: 33 house	36,248528° E	34,508982° N	1.194,7	5,0	45,0	27,6	Yes
46	LWP: 46 occupied house in summer	36,278525° E	34,504084° N	1.396,2	5,0	45,0	31,4	Yes
53	LWP: 53 house	36,279899° E	34,495307° N	1.495,7	5,0	45,0	34,3	Yes
55	LWP: 55 villa	36,278413° E	34,492443° N	1.554,1	5,0	45,0	35,7	Yes
57	LWP: 57 house	36,277015° E	34,489582° N	1.579,6	5,0	45,0	37,3	Yes
61	LWP: 61 house	36,274565° E	34,484235° N	1.584,6	5,0	45,0	38,0	Yes
68	LWP: 68 house	36,270268° E	34,477126° N	1.696,3	5,0	45,0	40,3	Yes
73	LWP: 73 house	36,268675° E	34,473917° N	1.700,8	5,0	45,0	41,3	Yes
78	LWP: 78 house	36,264729° E	34,458423° N	1.714,2	5,0	45,0	35,9	Yes
82	LWP: 82 house	36,223728° E	34,450359° N	1.755,7	5,0	45,0	34,3	Yes
85	LWP: 85 house	36,256086° E	34,450161° N	1.850,8	5,0	45,0	38,3	Yes
89	LWP: 89 house	36,256862° E	34,447384° N	1.838,9	5,0	45,0	37,4	Yes
94	LWP: 94 house	36,235096° E	34,438907° N	1.959,5	5,0	45,0	40,1	Yes
97	LWP: 97 house	36,249680° E	34,438785° N	1.954,6	5,0	45,0	41,2	Yes
98	LWP: 98 house	36,237141° E	34,434363° N	1.916,0	5,0	45,0	38,3	Yes

Distances (m)

WTG	30	33	46	53	55	57	61	68	73	78	82	85	89	94	97	98
HA 01	11611	13025	12105	12953	13299	13641	14276	15155	15540	17273	19723	18418	18677	20349	19810	20724
HA 02	11948	13346	12449	13299	13644	13987	14622	15501	15886	17619	20056	18763	19023	20690	20155	21065
HA 03	12355	13754	12853	13700	14046	14388	15023	15902	16287	18019	20464	19165	19424	21096	20557	21470
HA 04	12652	14055	13145	13990	14336	14678	15313	16193	16578	18308	20763	19456	19714	21391	20848	21764
HA 05	13087	14459	13593	14444	14790	15132	15767	16646	17031	18764	21189	19908	20168	21832	21300	22209
HA 06	13435	14804	13941	14791	15136	15479	16114	16993	17378	19111	21536	20256	20515	22180	21647	22557
HA 07	13856	15199	14372	15227	15572	15915	16549	17428	17813	19548	21949	20690	20951	22605	22081	22985
HA 08	14230	15568	14747	15602	15948	16290	16925	17803	18188	19923	22322	21066	21326	22980	22457	23360
HA 09	14488	15804	15013	15872	16218	16560	17195	18073	18458	20195	22571	21334	21596	23240	22725	23623
HA 10	14826	16135	15353	16213	16558	16901	17535	18413	18798	20535	22907	21674	21936	23579	23065	23962
HA 11	15124	16430	15652	16512	16857	17200	17834	18712	19097	20834	23204	21974	22235	23878	23364	24261
HA 12	15475	16754	16013	16878	17223	17566	18200	19077	19462	21201	23544	22337	22600	24231	23727	24617
HA 13	15759	17022	16304	17172	17517	17860	18494	19370	19755	21496	23821	22630	22893	24516	24019	24904
HA 14	16057	17309	16605	17475	17821	18163	18797	19673	20058	21799	24114	22932	23196	24815	24321	25204
HA 15	16472	17716	17023	17894	18239	18581	19216	20092	20476	22218	24525	23350	23614	25230	24739	25620
HA 16	16706	17927	17266	18141	18486	18828	19463	20338	20722	22465	24747	23594	23860	25464	24982	25857
LWP 07	1921	2129	1584	1381	1287	1288	1524	2085	2407	4101	6265	5082	5376	6838	6433	7234
LWP 08	2142	2477	1646	1219	1049	984	1170	1757	2092	3812	6158	4828	5117	6653	6194	7034
LWP 09	2586	2704	2073	1516	1266	1079	1000	1390	1697	3388	5739	4387	4678	6209	5749	6588
LWP 10	3047	2949	2540	1924	1637	1386	1079	1125	1362	2978	5283	3940	4234	5738	5293	6119
LWP 11	3495	3270	2978	2311	2003	1716	1272	965	1083	2574	4870	3501	3799	5292	4848	5670
LWP 12	3828	3603	3275	2551	2227	1917	1391	839	836	2226	4636	3156	3452	4986	4509	5353
LWP 13	4208	3944	3637	2880	2547	2224	1653	925	751	1864	4345	2773	3069	4628	4128	4985
LWP 14	4583	4301	3993	3206	2868	2536	1937	1118	824	1505	4090	2393	2689	4287	3752	4630
LWP 15	5043	4653	4467	3681	3342	3009	2403	1561	1225	1223	3664	1956	2260	3811	3295	4155
LWP 16	5657	5041	5139	4388	4052	3724	3129	2296	1960	1358	2935	1555	1871	3123	2759	3499
LWP 17	6284	5518	5801	5069	4735	4409	3817	2984	2644	1728	2272	1377	1659	2474	2302	2884
LWP 18	6842	5999	6373	5644	5310	4983	4389	3550	3203	2105	1778	1396	1605	1920	1947	2356
LWP 19	7284	6426	6808	6069	5733	5404	4803	3954	3598	2364	1540	1447	1578	1478	1645	1922
LWP 20	7569	6758	7067	6303	5964	5631	5021	4158	3793	2429	1625	1378	1440	1194	1318	1601
LWP 21	7793	7043	7261	6472	6130	5793	5174	4301	3928	2455	1837	1310	1297	1040	987	1363
LWP 22	8195	7441	7656	6859	6517	6179	5557	4681	4304	2776	1892	1587	1503	713	818	965
LWP 23	8460	7744	7902	7089	6745	6405	5779	4899	4519	2931	2124	1720	1580	697	650	752
SA 02	10038	11579	10478	11299	11644	11987	12620	13501	13886	15607	18169	16765	17018	18737	18158	19098
SA 03	9640	11205	10070	10886	11232	11574	12207	13089	13474	15193	17772	16353	16605	18330	17746	18689

To be continued on next page...

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Calculated:
04.02.2019 10:21/3.2.737

DECIBEL - Main Result

Calculation: LWP Vestas V150 cumulativ: with WF Sustainable Akkar and WF Hawa Akkar

...continued from previous page

WTG	30	33	46	53	55	57	61	68	73	78	82	85	89	94	97	98
SA 04	9183	10767	9607	10422	10767	11110	11743	12624	13009	14728	17316	15888	16140	17867	17281	18226
SA 05	9166	10802	9557	10353	10698	11040	11671	12553	12938	14647	17295	15814	16062	17817	17207	18168
SA 06	8735	10391	9119	9912	10258	10599	11230	12113	12497	14206	16862	15373	15621	17378	16766	17728
SA 07	8279	9954	8657	9449	9794	10136	10767	11649	12033	13743	16405	14910	15158	16916	16303	17265
SA 08	8667	10429	8978	9727	10070	10409	11035	11916	12298	13984	16764	15165	15404	17216	16556	17549
SA 09	7796	9498	8163	8952	9297	9638	10270	11152	11536	13245	15918	14412	14660	16421	15805	16769
SA 10	8300	10090	8594	9335	9677	10016	10641	11521	11903	13585	16386	14768	15006	16825	16159	17156
SA 11	7334	9058	7693	8480	8825	9166	9797	10680	11064	12773	15452	13940	14188	15950	15333	16297
SA 13	6906	8662	7249	8030	8375	8716	9347	10229	10613	12321	15016	13489	13736	15504	14882	15849
SA 14	7503	9355	7761	8485	8826	9163	9786	10665	11046	12723	15561	13908	14144	15977	15298	16302
SA 15	6473	8256	6806	7586	7930	8271	8902	9784	10168	11876	14578	13044	13291	15060	14437	15404
SA 17	6288	8123	6584	7343	7687	8027	8656	9538	9921	11620	14372	12794	13038	14827	14186	15165
SA 18	6127	8029	6367	7093	7435	7773	8398	9278	9660	11344	14168	12526	12765	14585	13917	14913
SA 19	5848	7796	6050	6756	7097	7433	8055	8934	9315	10992	13855	12177	12413	14248	13567	14572
SA 20	5748	7750	5895	6566	6903	7237	7853	8729	9108	10769	13695	11960	12191	14053	13347	14368
SA 21	6227	8283	6296	6905	7235	7561	8165	9031	9405	11029	14070	12231	12451	14364	13611	14661
SA 22	5337	7389	5435	6080	6416	6747	7360	8233	8611	10264	13227	11457	11686	13562	12843	13871
SA 23	5106	7206	5140	5746	6077	6404	7011	7880	8255	9892	12910	11090	11315	13212	12473	13513
SA 24	4633	6757	4642	5241	5572	5900	6507	7377	7752	9394	12406	10591	10817	12708	11975	13011
SA 25	5262	7436	5150	5640	5955	6268	6849	7698	8063	9642	12816	10851	11060	13023	12221	13299
SA 28	4000	6184	3901	4444	4770	5093	5693	6559	6932	8564	11620	9762	9986	11892	11145	12189

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04.02.2019 10:09/3.2.737

DECIBEL - Main Result

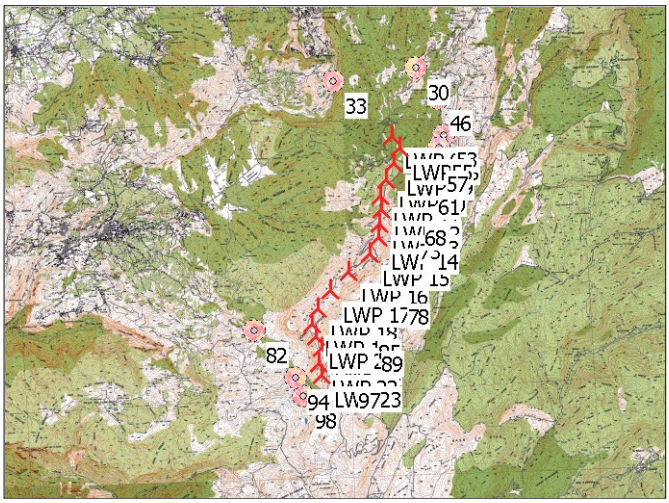
Calculation: LWP Nordex N149

ISO 9613-2 Germany

The calculation is based on the international norm "ISO 9613-2 Acoustics - Attenuation of sound during propagation outdoors"

Loudest up to 95% rated power
Meteorological correction factor, C0: 0,0 dB

All coordinates are in
Geo [deg]-WGS84



Scale 1:200.000
New WTG
Noise sensitive area

WTGs

	Longitude	Latitude	Z [m]	Row data/Description	WTG type Valid	Manufact.	Type-generator	Power, rated [kW]	Rotor diameter [m]	Hub height [m]	Noise data Creator	Name	Wind speed [m/s]	LwA,ref [dB(A)]	Pure tones
LWP 07	36,264865° E	34,495376° N	1.814,4	NORDEX N149/4.0-4.5 4500...	Yes	NORDEX	N149/4.0-4.5-4.500	4.500	149,0	105,0	USER	108,1 dB(A) + 1 dB(A)	(95%)	109,1	No
LWP 08	36,267003° E	34,492722° N	1.829,7	NORDEX N149/4.0-4.5 4500...	Yes	NORDEX	N149/4.0-4.5-4.500	4.500	149,0	105,0	USER	108,1 dB(A) + 1 dB(A)	(95%)	109,1	No
LWP 09	36,265293° E	34,488954° N	1.903,8	NORDEX N149/4.0-4.5 4500...	Yes	NORDEX	N149/4.0-4.5-4.500	4.500	149,0	105,0	USER	108,1 dB(A) + 1 dB(A)	(95%)	109,1	No
LWP 10	36,262879° E	34,485213° N	1.914,9	NORDEX N149/4.0-4.5 4500...	Yes	NORDEX	N149/4.0-4.5-4.500	4.500	149,0	105,0	USER	108,1 dB(A) + 1 dB(A)	(95%)	109,1	No
LWP 11	36,261147° E	34,481430° N	1.936,5	NORDEX N149/4.0-4.5 4500...	Yes	NORDEX	N149/4.0-4.5-4.500	4.500	149,0	105,0	USER	108,1 dB(A) + 1 dB(A)	(95%)	109,1	No
LWP 12	36,261248° E	34,478274° N	1.922,3	NORDEX N149/4.0-4.5 4500...	Yes	NORDEX	N149/4.0-4.5-4.500	4.500	149,0	105,0	USER	108,1 dB(A) + 1 dB(A)	(95%)	109,1	No
LWP 13	36,260583° E	34,474870° N	1.934,9	NORDEX N149/4.0-4.5 4500...	Yes	NORDEX	N149/4.0-4.5-4.500	4.500	149,0	105,0	USER	108,1 dB(A) + 1 dB(A)	(95%)	109,1	No
LWP 14	36,260211° E	34,471455° N	1.851,7	NORDEX N149/4.0-4.5 4500...	Yes	NORDEX	N149/4.0-4.5-4.500	4.500	149,0	105,0	USER	108,1 dB(A) + 1 dB(A)	(95%)	109,1	No
LWP 15	36,257625° E	34,467738° N	1.988,4	NORDEX N149/4.0-4.5 4500...	Yes	NORDEX	N149/4.0-4.5-4.500	4.500	149,0	105,0	USER	108,1 dB(A) + 1 dB(A)	(95%)	109,1	No
LWP 16	36,251352° E	34,463613° N	2.072,4	NORDEX N149/4.0-4.5 4500...	Yes	NORDEX	N149/4.0-4.5-4.500	4.500	149,0	105,0	USER	108,1 dB(A) + 1 dB(A)	(95%)	109,1	No
LWP 17	36,245957° E	34,459301° N	2.107,8	NORDEX N149/4.0-4.5 4500...	Yes	NORDEX	N149/4.0-4.5-4.500	4.500	149,0	105,0	USER	108,1 dB(A) + 1 dB(A)	(95%)	109,1	No
LWP 18	36,242165° E	34,455185° N	2.115,4	NORDEX N149/4.0-4.5 4500...	Yes	NORDEX	N149/4.0-4.5-4.500	4.500	149,0	105,0	USER	108,1 dB(A) + 1 dB(A)	(95%)	109,1	No
LWP 19	36,240424° E	34,451469° N	2.139,2	NORDEX N149/4.0-4.5 4500...	Yes	NORDEX	N149/4.0-4.5-4.500	4.500	149,0	105,0	USER	108,1 dB(A) + 1 dB(A)	(95%)	109,1	No
LWP 20	36,241245° E	34,448386° N	2.184,4	NORDEX N149/4.0-4.5 4500...	Yes	NORDEX	N149/4.0-4.5-4.500	4.500	149,0	105,0	USER	108,1 dB(A) + 1 dB(A)	(95%)	109,1	No
LWP 21	36,242901° E	34,445685° N	2.193,4	NORDEX N149/4.0-4.5 4500...	Yes	NORDEX	N149/4.0-4.5-4.500	4.500	149,0	105,0	USER	108,1 dB(A) + 1 dB(A)	(95%)	109,1	No
LWP 22	36,241779° E	34,442166° N	2.204,3	NORDEX N149/4.0-4.5 4500...	Yes	NORDEX	N149/4.0-4.5-4.500	4.500	149,0	105,0	USER	108,1 dB(A) + 1 dB(A)	(95%)	109,1	No
LWP 23	36,242651° E	34,439372° N	2.149,3	NORDEX N149/4.0-4.5 4500...	Yes	NORDEX	N149/4.0-4.5-4.500	4.500	149,0	105,0	USER	108,1 dB(A) + 1 dB(A)	(95%)	109,1	No

Calculation Results

Sound level

Noise sensitive area No.	Name	Longitude	Latitude	Z [m]	Imission height [m]	Demands Noise [dB(A)]	Sound level From WTGs [dB(A)]	Demands fulfilled ? Noise
30	LWP: 30 house under construction	36,272567° E	34,511469° N	1.430,9	5,0	45,0	32,2	Yes
33	LWP: 33 house	36,248528° E	34,508982° N	1.194,7	5,0	45,0	30,4	Yes
46	LWP: 46 occupied house in summer	36,278525° E	34,504084° N	1.396,2	5,0	45,0	33,7	Yes
53	LWP: 53 house	36,279899° E	34,495307° N	1.495,7	5,0	45,0	37,2	Yes
55	LWP: 55 villa	36,278413° E	34,492443° N	1.554,1	5,0	45,0	38,7	Yes
57	LWP: 57 house	36,277015° E	34,489582° N	1.579,6	5,0	45,0	40,4	Yes
61	LWP: 61 house	36,274565° E	34,484235° N	1.584,6	5,0	45,0	41,2	Yes
68	LWP: 68 house	36,270268° E	34,477126° N	1.696,3	5,0	45,0	43,5	Yes
73	LWP: 73 house	36,268675° E	34,473917° N	1.700,8	5,0	45,0	44,5	Yes
78	LWP: 78 house	36,264729° E	34,458423° N	1.714,2	5,0	45,0	39,1	Yes
82	LWP: 82 house	36,223728° E	34,450359° N	1.755,7	5,0	45,0	37,5	Yes
85	LWP: 85 house	36,256086° E	34,450161° N	1.850,8	5,0	45,0	41,5	Yes
89	LWP: 89 house	36,256862° E	34,447384° N	1.838,9	5,0	45,0	40,6	Yes
94	LWP: 94 house	36,235096° E	34,438907° N	1.959,5	5,0	45,0	43,3	Yes
97	LWP: 97 house	36,249680° E	34,438785° N	1.954,6	5,0	45,0	44,4	Yes
98	LWP: 98 house	36,237141° E	34,434363° N	1.916,0	5,0	45,0	41,5	Yes

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Calculated:
04.02.2019 10:09/3.2.737

DECIBEL - Main Result

Calculation: LWP Nordex N149

Distances (m)

WTG	30	33	46	53	55	57	61	68	73	78	82	85	89	94	97	98
LWP 07	1921	2129	1584	1381	1287	1288	1524	2085	2407	4101	6265	5082	5376	6838	6433	7234
LWP 08	2142	2477	1646	1219	1049	984	1170	1757	2092	3812	6158	4828	5117	6653	6194	7034
LWP 09	2586	2704	2073	1516	1266	1079	1000	1390	1697	3388	5739	4387	4678	6209	5749	6588
LWP 10	3047	2949	2540	1924	1637	1386	1079	1125	1362	2978	5283	3940	4234	5738	5293	6119
LWP 11	3495	3270	2978	2311	2003	1716	1272	965	1083	2574	4870	3501	3799	5292	4848	5670
LWP 12	3828	3603	3275	2551	2227	1917	1391	839	836	2226	4636	3156	3452	4986	4509	5353
LWP 13	4208	3944	3637	2880	2547	2224	1653	925	751	1864	4345	2773	3069	4628	4128	4985
LWP 14	4583	4301	3993	3206	2868	2536	1937	1118	824	1505	4090	2393	2689	4287	3752	4630
LWP 15	5043	4653	4467	3681	3342	3009	2403	1561	1225	1223	3664	1956	2260	3811	3295	4155
LWP 16	5657	5041	5139	4388	4052	3724	3129	2296	1960	1358	2935	1555	1871	3123	2759	3499
LWP 17	6284	5518	5801	5069	4735	4409	3817	2984	2644	1728	2272	1377	1659	2474	2302	2884
LWP 18	6842	5999	6373	5644	5310	4983	4389	3550	3203	2105	1778	1396	1605	1920	1947	2356
LWP 19	7284	6426	6808	6069	5733	5404	4803	3954	3598	2364	1540	1447	1578	1478	1645	1922
LWP 20	7569	6758	7067	6303	5964	5631	5021	4158	3793	2429	1625	1378	1440	1194	1318	1601
LWP 21	7793	7043	7261	6472	6130	5793	5174	4301	3928	2455	1837	1310	1297	1040	987	1363
LWP 22	8195	7441	7656	6859	6517	6179	5557	4681	4304	2776	1892	1587	1503	713	818	965
LWP 23	8460	7744	7902	7089	6745	6405	5779	4899	4519	2931	2124	1720	1580	697	650	752

Project:
18-1-3019

Description:
Akkar Wind Farm

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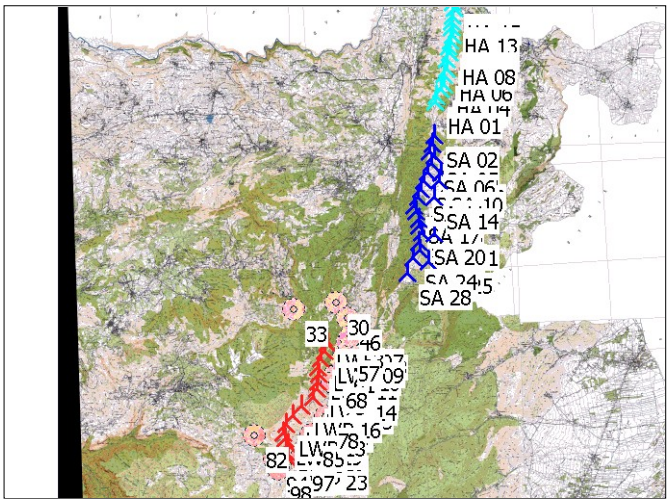
Calculated:
01.02.2019 11:37/3.2.737

DECIBEL - Main Result

Calculation: LWP Nordex N149 cumulativ: with WF Sustainable Akkar and WF Hawa Akkar

Noise calculation model:
ISO 9613-2 General
Wind speed (in 10 m height):
Loudest up to 95% rated power
Ground attenuation:
Alternative
Meteorological coefficient, C0:
0,0 dB
Type of demand in calculation:
1: WTG noise is compared to demand (DK, DE, SE, NL etc.)
Noise values in calculation:
All noise values are mean values (Lwa) (Normal)
Pure tones:
Fixed penalty added to source noise of WTGs with pure tones
WTG catalogue
Height above ground level, when no value in NSA object:
5,0 m; Allow override of model height with height from NSA object
Uncertainty margin:
0,0 dB; Uncertainty margin in model has priority
Deviation from "official" noise demands. Negative is more restrictive, positive is less restrictive.:
0,0 dB(A)



Scale 1:400.000

New WTG Noise sensitive area

WTGs

	Longitude	Latitude	Z [m]	Row data/Description	WTG type Valid	Manufact.	Type-generator	Power, rated [kW]	Rotor diameter [m]	Hub height [m]	Noise data Creator	Name	Wind speed [m/s]	LwA,ref [dB(A)]	Pure tones
HA 01	36,332394° E	34,603649° N	848,4	VESTAS V150-4.2 4200 150....	Yes	VESTAS	V150-4.2-4.200	4.200	150,0	105,0	USER	104,9 dB(A) + 1 dB(A)	(95%)	105,9	No
HA 02	36,333189° E	34,606740° N	789,3	VESTAS V150-4.2 4200 150....	Yes	VESTAS	V150-4.2-4.200	4.200	150,0	105,0	USER	104,9 dB(A) + 1 dB(A)	(95%)	105,9	No
HA 03	36,335620° E	34,609831° N	804,6	VESTAS V150-4.2 4200 150....	Yes	VESTAS	V150-4.2-4.200	4.200	150,0	105,0	USER	104,9 dB(A) + 1 dB(A)	(95%)	105,9	No
HA 04	36,337634° E	34,611975° N	816,1	VESTAS V150-4.2 4200 150....	Yes	VESTAS	V150-4.2-4.200	4.200	150,0	105,0	USER	104,9 dB(A) + 1 dB(A)	(95%)	105,9	No
HA 05	36,337789° E	34,616333° N	789,3	VESTAS V150-4.2 4200 150....	Yes	VESTAS	V150-4.2-4.200	4.200	150,0	105,0	USER	104,9 dB(A) + 1 dB(A)	(95%)	105,9	No
HA 06	36,339466° E	34,619146° N	740,4	VESTAS V150-4.2 4200 150....	Yes	VESTAS	V150-4.2-4.200	4.200	150,0	105,0	USER	104,9 dB(A) + 1 dB(A)	(95%)	105,9	No
HA 07	36,339759° E	34,623272° N	701,3	VESTAS V150-4.2 4200 150....	Yes	VESTAS	V150-4.2-4.200	4.200	150,0	105,0	USER	104,9 dB(A) + 1 dB(A)	(95%)	105,9	No
HA 08	36,341350° E	34,626390° N	710,0	VESTAS V150-4.2 4200 150....	Yes	VESTAS	V150-4.2-4.200	4.200	150,0	105,0	USER	104,9 dB(A) + 1 dB(A)	(95%)	105,9	No
HA 09	36,341012° E	34,629105° N	669,8	VESTAS V150-4.2 4200 150....	Yes	VESTAS	V150-4.2-4.200	4.200	150,0	105,0	USER	104,9 dB(A) + 1 dB(A)	(95%)	105,9	No
HA 10	36,342218° E	34,632007° N	668,8	VESTAS V150-4.2 4200 150....	Yes	VESTAS	V150-4.2-4.200	4.200	150,0	105,0	USER	104,9 dB(A) + 1 dB(A)	(95%)	105,9	No
HA 11	36,343425° E	34,634512° N	638,1	VESTAS V150-4.2 4200 150....	Yes	VESTAS	V150-4.2-4.200	4.200	150,0	105,0	USER	104,9 dB(A) + 1 dB(A)	(95%)	105,9	No
HA 12	36,343003° E	34,638163° N	561,2	VESTAS V150-4.2 4200 150....	Yes	VESTAS	V150-4.2-4.200	4.200	150,0	105,0	USER	104,9 dB(A) + 1 dB(A)	(95%)	105,9	No
HA 13	36,342989° E	34,640984° N	538,6	VESTAS V150-4.2 4200 150....	Yes	VESTAS	V150-4.2-4.200	4.200	150,0	105,0	USER	104,9 dB(A) + 1 dB(A)	(95%)	105,9	No
HA 14	36,343501° E	34,643735° N	484,0	VESTAS V150-4.2 4200 150....	Yes	VESTAS	V150-4.2-4.200	4.200	150,0	105,0	USER	104,9 dB(A) + 1 dB(A)	(95%)	105,9	No
HA 15	36,344782° E	34,647360° N	464,2	VESTAS V150-4.2 4200 150....	Yes	VESTAS	V150-4.2-4.200	4.200	150,0	105,0	USER	104,9 dB(A) + 1 dB(A)	(95%)	105,9	No
HA 16	36,343792° E	34,650007° N	407,4	VESTAS V150-4.2 4200 150....	Yes	VESTAS	V150-4.2-4.200	4.200	150,0	105,0	USER	104,9 dB(A) + 1 dB(A)	(95%)	105,9	No
LWP 07	36,264865° E	34,495376° N	1.814,4	NORDEX N149/4.0-4.5 4500...	Yes	NORDEX	N149/4.0-4.5-4.500	4.500	149,0	105,0	USER	108,1 dB(A) + 1 dB(A)	(95%)	109,1	No
LWP 08	36,267003° E	34,492722° N	1.829,7	NORDEX N149/4.0-4.5 4500...	Yes	NORDEX	N149/4.0-4.5-4.500	4.500	149,0	105,0	USER	108,1 dB(A) + 1 dB(A)	(95%)	109,1	No
LWP 09	36,265293° E	34,488954° N	1.903,8	NORDEX N149/4.0-4.5 4500...	Yes	NORDEX	N149/4.0-4.5-4.500	4.500	149,0	105,0	USER	108,1 dB(A) + 1 dB(A)	(95%)	109,1	No
LWP 10	36,262879° E	34,485213° N	1.914,9	NORDEX N149/4.0-4.5 4500...	Yes	NORDEX	N149/4.0-4.5-4.500	4.500	149,0	105,0	USER	108,1 dB(A) + 1 dB(A)	(95%)	109,1	No
LWP 11	36,261147° E	34,481430° N	1.936,5	NORDEX N149/4.0-4.5 4500...	Yes	NORDEX	N149/4.0-4.5-4.500	4.500	149,0	105,0	USER	108,1 dB(A) + 1 dB(A)	(95%)	109,1	No
LWP 12	36,261248° E	34,478274° N	1.922,3	NORDEX N149/4.0-4.5 4500...	Yes	NORDEX	N149/4.0-4.5-4.500	4.500	149,0	105,0	USER	108,1 dB(A) + 1 dB(A)	(95%)	109,1	No
LWP 13	36,260583° E	34,474870° N	1.934,9	NORDEX N149/4.0-4.5 4500...	Yes	NORDEX	N149/4.0-4.5-4.500	4.500	149,0	105,0	USER	108,1 dB(A) + 1 dB(A)	(95%)	109,1	No
LWP 14	36,260211° E	34,471455° N	1.851,7	NORDEX N149/4.0-4.5 4500...	Yes	NORDEX	N149/4.0-4.5-4.500	4.500	149,0	105,0	USER	108,1 dB(A) + 1 dB(A)	(95%)	109,1	No
LWP 15	36,257625° E	34,467738° N	1.988,4	NORDEX N149/4.0-4.5 4500...	Yes	NORDEX	N149/4.0-4.5-4.500	4.500	149,0	105,0	USER	108,1 dB(A) + 1 dB(A)	(95%)	109,1	No
LWP 16	36,251352° E	34,463613° N	2.072,4	NORDEX N149/4.0-4.5 4500...	Yes	NORDEX	N149/4.0-4.5-4.500	4.500	149,0	105,0	USER	108,1 dB(A) + 1 dB(A)	(95%)	109,1	No
LWP 17	36,245957° E	34,459301° N	2.107,8	NORDEX N149/4.0-4.5 4500...	Yes	NORDEX	N149/4.0-4.5-4.500	4.500	149,0	105,0	USER	108,1 dB(A) + 1 dB(A)	(95%)	109,1	No
LWP 18	36,242165° E	34,455185° N	2.115,4	NORDEX N149/4.0-4.5 4500...	Yes	NORDEX	N149/4.0-4.5-4.500	4.500	149,0	105,0	USER	108,1 dB(A) + 1 dB(A)	(95%)	109,1	No
LWP 19	36,240424° E	34,451469° N	2.139,2	NORDEX N149/4.0-4.5 4500...	Yes	NORDEX	N149/4.0-4.5-4.500	4.500	149,0	105,0	USER	108,1 dB(A) + 1 dB(A)	(95%)	109,1	No
LWP 20	36,241245° E	34,448386° N	2.184,4	NORDEX N149/4.0-4.5 4500...	Yes	NORDEX	N149/4.0-4.5-4.500	4.500	149,0	105,0	USER	108,1 dB(A) + 1 dB(A)	(95%)	109,1	No
LWP 21	36,242901° E	34,445685° N	2.193,4	NORDEX N149/4.0-4.5 4500...	Yes	NORDEX	N149/4.0-4.5-4.500	4.500	149,0	105,0	USER	108,1 dB(A) + 1 dB(A)	(95%)	109,1	No
LWP 22	36,241779° E	34,442166° N	2.204,3	NORDEX N149/4.0-4.5 4500...	Yes	NORDEX	N149/4.0-4.5-4.500	4.500	149,0	105,0	USER	108,1 dB(A) + 1 dB(A)	(95%)	109,1	No
LWP 23	36,242651° E	34,439372° N	2.149,3	NORDEX N149/4.0-4.5 4500...	Yes	NORDEX	N149/4.0-4.5-4.500	4.500	149,0	105,0	USER	108,1 dB(A) + 1 dB(A)	(95%)	109,1	No
SA 02	36,330964° E	34,587939° N	914,2	NORDEX N149/4.0-4.5 4500...	Yes	NORDEX	N149/4.0-4.5-4.500	4.500	149,0	105,0	USER	108,1 dB(A) + 1 dB(A)	(95%)	109,1	No
SA 03	36,329828° E	34,584283° N	949,8	NORDEX N149/4.0-4.5 4500...	Yes	NORDEX	N149/4.0-4.5-4.500	4.500	149,0	105,0	USER	108,1 dB(A) + 1 dB(A)	(95%)	109,1	No
SA 04	36,327887° E	34,580411° N	965,4	NORDEX N149/4.0-4.5 4500...	Yes	NORDEX	N149/4.0-4.5-4.500	4.500	149,0	105,0	USER	108,1 dB(A) + 1 dB(A)	(95%)	109,1	No
SA 05	36,330809° E	34,578547° N	959,2	NORDEX N149/4.0-4.5 4500...	Yes	NORDEX	N149/4.0-4.5-4.500	4.500	149,0	105,0	USER	108,1 dB(A) + 1 dB(A)	(95%)	109,1	No
SA 06	36,328890° E	34,574900° N	1.048,1	NORDEX N149/4.0-4.5 4500...	Yes	NORDEX	N149/4.0-4.5-4.500	4.500	149,0	105,0	USER	108,1 dB(A) + 1 dB(A)	(95%)	109,1	No
SA 07	36,326668° E	34,571152° N	1.083,8	NORDEX N149/4.0-4.5 4500...	Yes	NORDEX	N149/4.0-4.5-4.500	4.500	149,0	105,0	USER	108,1 dB(A) + 1 dB(A)	(95%)	109,1	No
SA 08	36,334428° E	34,570455° N	1.065,9	NORDEX N149/4.0-4.5 4500...	Yes	NORDEX	N149/4.0-4.5-4.500	4.500	149,0	105,0	USER	108,1 dB(A) + 1 dB(A)	(95%)	109,1	No
SA 09	36,324544° E	34,567019° N	1.074,9	NORDEX N149/4.0-4.5 4500...	Yes	NORDEX	N149/4.0-4.5-4.500	4.500	149,0	105,0	USER	108,1 dB(A) + 1 dB(A)	(95%)	109,1	No
SA 10	36,333188° E	34,566940° N	1.077,5	NORDEX N149/4.0-4.5 4500...	Yes	NORDEX	N149/4.0-4.5-4.500	4.500	149,0	105,0	USER	108,1 dB(A) + 1 dB(A)	(95%)	109,1	No
SA 11	36,322257° E	34,563207° N	1.036,3	NORDEX N149/4.0-4.5 4500...	Yes	NORDEX	N149/4.0-4.5-4.500	4.500	149,0	105,0	USER	108,1 dB(A) + 1 dB(A)	(95%)	109,1	No
SA 13	36,320570° E	34,559367° N	1.056,2	NORDEX N149/4.0-4.5 4500...	Yes	NORDEX	N149/4.0-4.5-4.500	4.500	149,0	105,0	USER	108,1 dB(A) + 1 dB(A)	(95%)	109,1	No
SA 14	36,330057° E	34,559516° N	1.100,2	NORDEX N149/4.0-4.5 4500...	Yes	NORDEX	N149/4.0-4.5-4.500	4.500	149,0	105,0	USER	108,1 dB(A) + 1 dB(A)	(95%)	109,1	No
SA 15	36,318416° E	34,555775° N	1.026,0	NORDEX N149/4.0-4.5 4500...	Yes	NORDEX	N149/4.0-4.5-4.500	4.500	149,0	105,0	USER	108,1 dB(A) + 1 dB(A)	(95%)	109,1	No
SA 17	36,319296° E	34,552888° N	1.036,1	NORDEX N149/4.0-4.5 4500...	Yes	NORDEX	N149/4.0-4.5-4.500	4.500	149,0	105,0	USER	108,1 dB(A) + 1 dB(A)	(95%)	109,1	No
SA 18	36,321037° E	34,549404° N	1.124,2	NORDEX N149/4.0-4.5 4500...	Yes	NORDEX	N149/4.0-4.5-4.500	4.500	149,0	105,0	USER	108,1 dB(A) + 1 dB(A)	(95%)	109,1	No
SA 19	36,320700° E	34,545967° N	1.154,3	NORDEX N149/4.0-4.5 4500...	Yes	NORDEX	N149/4.0-4.5-4.500	4.500	149,0	105,0	USER	108,1 dB(A) + 1 dB(A)	(95%)	109,1	No
SA 20	36,322239° E	34,542980° N	1.168,5	NORDEX N149/4.0-4.5 4500...	Yes	NORDEX	N149/4.0-4.5-4.500	4.500	149,0	105,0	USER	108,1 dB(A) + 1 dB(A)	(95%)	109,1	No
SA 21	36,329271° E	34,542225° N	1.153,2	NORDEX N149/4.0-4.5 4500...	Yes	NORDEX	N149/4.0-4.5-4.500	4.500	149,0	105,0	USER	108,1 dB(A) + 1 dB(A)	(95%)	109,1	No
SA 22	36,320636° E	34,538496° N	1.175,6	NORDEX N149/4.0-4.5 4500...	Yes	NORDEX	N149/4.0-4.5-4.500	4.500	149,0	105,0	USER	108,1 dB(A) + 1 dB(A)	(95%)	109,1	No
SA 23	36,320604° E	34,534624° N	1.208,1	NORDEX N149/4.0-4.5 4500...	Yes	NORDEX	N149/4.0-4.5-4.500	4.500	149,0	105,0	USER	108,1 dB(A) + 1 dB(A)	(95%)	109,1	No
SA 24	36,317041° E	34,531159° N	1.237,8	NORDEX N149/4.0-4.5 4500...	Yes	NORDEX	N149/4.0-4.5-4.500	4.500	149,0	105,0	USER	108,1 dB(A) + 1 dB(A)	(95%)	109,1	No

To be continued on next page...

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DECIBEL - Main Result

Calculation: LWP Nordex N149 cumulativ: with WF Sustainable Akkar and WF Hawa Akkar

...continued from previous page

	Longitude	Latitude	Z [m]	Row data/Description	WTG type Valid	Manufact.	Type-generator	Power, rated [kW]	Rotor diameter [m]	Hub height [m]	Noise data Creator	Name	Wind speed [m/s]	LwA,ref [dB(A)]	Pure tones
SA 25	36,325734° E	34,529126° N	1.257,2	NORDEX N149/4.0-4.5 4500...	Yes	NORDEX	N149/4.0-4.5-4.500	4.500	149,0	105,0	USER	108,1 dB(A) + 1 dB(A)	(95%)	109,1	No
SA 28	36,313252° E	34,524313° N	1.285,8	NORDEX N149/4.0-4.5 4500...	Yes	NORDEX	N149/4.0-4.5-4.500	4.500	149,0	105,0	USER	108,1 dB(A) + 1 dB(A)	(95%)	109,1	No

Calculation Results

Sound level

Noise sensitive area No.	Name	Longitude	Latitude	Z [m]	Imission height [m]	Demands Noise [dB(A)]	Sound level From WTGs [dB(A)]	Demands fulfilled ? Noise
30	LWP: 30 house under construction	36,272567° E	34,511469° N	1.430,9	5,0	45,0	32,7	Yes
33	LWP: 33 house	36,248528° E	34,508982° N	1.194,7	5,0	45,0	30,6	Yes
46	LWP: 46 occupied house in summer	36,278525° E	34,504084° N	1.396,2	5,0	45,0	34,2	Yes
53	LWP: 53 house	36,279899° E	34,495307° N	1.495,7	5,0	45,0	37,3	Yes
55	LWP: 55 villa	36,278413° E	34,492443° N	1.554,1	5,0	45,0	38,8	Yes
57	LWP: 57 house	36,277015° E	34,489582° N	1.579,6	5,0	45,0	40,5	Yes
61	LWP: 61 house	36,274565° E	34,484235° N	1.584,6	5,0	45,0	41,2	Yes
68	LWP: 68 house	36,270268° E	34,477126° N	1.696,3	5,0	45,0	43,5	Yes
73	LWP: 73 house	36,268675° E	34,473917° N	1.700,8	5,0	45,0	44,5	Yes
78	LWP: 78 house	36,264729° E	34,458423° N	1.714,2	5,0	45,0	39,1	Yes
82	LWP: 82 house	36,223728° E	34,450359° N	1.755,7	5,0	45,0	37,5	Yes
85	LWP: 85 house	36,256086° E	34,450161° N	1.850,8	5,0	45,0	41,5	Yes
89	LWP: 89 house	36,256862° E	34,447384° N	1.838,9	5,0	45,0	40,6	Yes
94	LWP: 94 house	36,235096° E	34,438907° N	1.959,5	5,0	45,0	43,3	Yes
97	LWP: 97 house	36,249680° E	34,438785° N	1.954,6	5,0	45,0	44,4	Yes
98	LWP: 98 house	36,237141° E	34,434363° N	1.916,0	5,0	45,0	41,5	Yes

Distances (m)

WTG	30	33	46	53	55	57	61	68	73	78	82	85	89	94	97	98
HA 01	11611	13025	12105	12953	13299	13641	14276	15155	15540	17273	19723	18418	18677	20349	19810	20724
HA 02	11948	13346	12449	13299	13644	13987	14622	15501	15886	17619	20056	18763	19023	20690	20155	21065
HA 03	12355	13754	12853	13700	14046	14388	15023	15902	16287	18019	20464	19165	19424	21096	20557	21470
HA 04	12652	14055	13145	13990	14336	14678	15313	16193	16578	18308	20763	19456	19714	21391	20848	21764
HA 05	13087	14459	13593	14444	14790	15132	15767	16646	17031	18764	21189	19908	20168	21832	21300	22209
HA 06	13435	14804	13941	14791	15136	15479	16114	16993	17378	19111	21536	20256	20515	22180	21647	22557
HA 07	13856	15199	14372	15227	15572	15915	16549	17428	17813	19548	21949	20690	20951	22605	22081	22985
HA 08	14230	15568	14747	15602	15948	16290	16925	17803	18188	19923	22322	21066	21326	22980	22457	23360
HA 09	14488	15804	15013	15872	16218	16560	17195	18073	18458	20195	22571	21334	21596	23240	22725	23623
HA 10	14826	16135	15353	16213	16558	16901	17535	18413	18798	20535	22907	21674	21936	23579	23065	23962
HA 11	15124	16430	15652	16512	16857	17200	17834	18712	19097	20834	23204	21974	22235	23878	23364	24261
HA 12	15475	16754	16013	16878	17223	17566	18200	19077	19462	21201	23544	22337	22600	24231	23727	24617
HA 13	15759	17022	16304	17172	17517	17860	18494	19370	19755	21496	23821	22630	22893	24516	24019	24904
HA 14	16057	17309	16605	17475	17821	18163	18797	19673	20058	21799	24114	22932	23196	24815	24321	25204
HA 15	16472	17716	17023	17894	18239	18581	19216	20092	20476	22218	24525	23350	23614	25230	24739	25620
HA 16	16706	17927	17266	18141	18486	18828	19463	20338	20722	22465	24747	23594	23860	25464	24982	25857
LWP 07	1921	2129	1584	1381	1287	1288	1524	2085	2407	4101	6265	5082	5376	6838	6433	7234
LWP 08	2142	2477	1646	1219	1049	984	1170	1757	2092	3812	6158	4828	5117	6653	6194	7034
LWP 09	2586	2704	2073	1516	1266	1079	1000	1390	1697	3388	5739	4387	4678	6209	5749	6588
LWP 10	3047	2949	2540	1924	1637	1386	1079	1125	1362	2978	5283	3940	4234	5738	5293	6119
LWP 11	3495	3270	2978	2311	2003	1716	1272	965	1083	2574	4870	3501	3799	5292	4848	5670
LWP 12	3828	3603	3275	2551	2227	1917	1391	839	836	2226	4636	3156	3452	4986	4509	5353
LWP 13	4208	3944	3637	2880	2547	2224	1653	925	751	1864	4345	2773	3069	4628	4128	4985
LWP 14	4583	4301	3993	3206	2868	2536	1937	1118	824	1505	4090	2393	2689	4287	3752	4630
LWP 15	5043	4653	4467	3681	3342	3009	2403	1561	1225	1223	3664	1956	2260	3811	3295	4155
LWP 16	5657	5041	5139	4388	4052	3724	3129	2296	1960	1358	2935	1555	1871	3123	2759	3499
LWP 17	6284	5518	5801	5069	4735	4409	3817	2984	2644	1728	2272	1377	1659	2474	2302	2884
LWP 18	6842	5999	6373	5644	5310	4983	4389	3550	3203	2105	1778	1396	1605	1920	1947	2356
LWP 19	7284	6426	6808	6069	5733	5404	4803	3954	3598	2364	1540	1447	1578	1478	1645	1922
LWP 20	7569	6758	7067	6303	5964	5631	5021	4158	3793	2429	1625	1378	1440	1194	1318	1601
LWP 21	7793	7043	7261	6472	6130	5793	5174	4301	3928	2455	1837	1310	1297	1040	987	1363
LWP 22	8195	7441	7656	6859	6517	6179	5557	4681	4304	2776	1892	1587	1503	713	818	965
LWP 23	8460	7744	7902	7089	6745	6405	5779	4899	4519	2931	2124	1720	1580	697	650	752
SA 02	10038	11579	10478	11299	11644	11987	12620	13501	13886	15607	18169	16765	17018	18737	18158	19098
SA 03	9640	11205	10070	10886	11232	11574	12207	13089	13474	15193	17772	16353	16605	18330	17746	18689

To be continued on next page...

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01.02.2019 11:37/3.2.737

DECIBEL - Main Result

Calculation: LWP Nordex N149 cumulativ: with WF Sustainable Akkar and WF Hawa Akkar

...continued from previous page

WTG	30	33	46	53	55	57	61	68	73	78	82	85	89	94	97	98
SA 04	9183	10767	9607	10422	10767	11110	11743	12624	13009	14728	17316	15888	16140	17867	17281	18226
SA 05	9166	10802	9557	10353	10698	11040	11671	12553	12938	14647	17295	15814	16062	17817	17207	18168
SA 06	8735	10391	9119	9912	10258	10599	11230	12113	12497	14206	16862	15373	15621	17378	16766	17728
SA 07	8279	9954	8657	9449	9794	10136	10767	11649	12033	13743	16405	14910	15158	16916	16303	17265
SA 08	8667	10429	8978	9727	10070	10409	11035	11916	12298	13984	16764	15165	15404	17216	16556	17549
SA 09	7796	9498	8163	8952	9297	9638	10270	11152	11536	13245	15918	14412	14660	16421	15805	16769
SA 10	8300	10090	8594	9335	9677	10016	10641	11521	11903	13585	16386	14768	15006	16825	16159	17156
SA 11	7334	9058	7693	8480	8825	9166	9797	10680	11064	12773	15452	13940	14188	15950	15333	16297
SA 13	6906	8662	7249	8030	8375	8716	9347	10229	10613	12321	15016	13489	13736	15504	14882	15849
SA 14	7503	9355	7761	8485	8826	9163	9786	10665	11046	12723	15561	13908	14144	15977	15298	16302
SA 15	6473	8256	6806	7586	7930	8271	8902	9784	10168	11876	14578	13044	13291	15060	14437	15404
SA 17	6288	8123	6584	7343	7687	8027	8656	9538	9921	11620	14372	12794	13038	14827	14186	15165
SA 18	6127	8029	6367	7093	7435	7773	8398	9278	9660	11344	14168	12526	12765	14585	13917	14913
SA 19	5848	7796	6050	6756	7097	7433	8055	8934	9315	10992	13855	12177	12413	14248	13567	14572
SA 20	5748	7750	5895	6566	6903	7237	7853	8729	9108	10769	13695	11960	12191	14053	13347	14368
SA 21	6227	8283	6296	6905	7235	7561	8165	9031	9405	11029	14070	12231	12451	14364	13611	14661
SA 22	5337	7389	5435	6080	6416	6747	7360	8233	8611	10264	13227	11457	11686	13562	12843	13871
SA 23	5106	7206	5140	5746	6077	6404	7011	7880	8255	9892	12910	11090	11315	13212	12473	13513
SA 24	4633	6757	4642	5241	5572	5900	6507	7377	7752	9394	12406	10591	10817	12708	11975	13011
SA 25	5262	7436	5150	5640	5955	6268	6849	7698	8063	9642	12816	10851	11060	13023	12221	13299
SA 28	4000	6184	3901	4444	4770	5093	5693	6559	6932	8564	11620	9762	9986	11892	11145	12189

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DECIBEL - Main Result

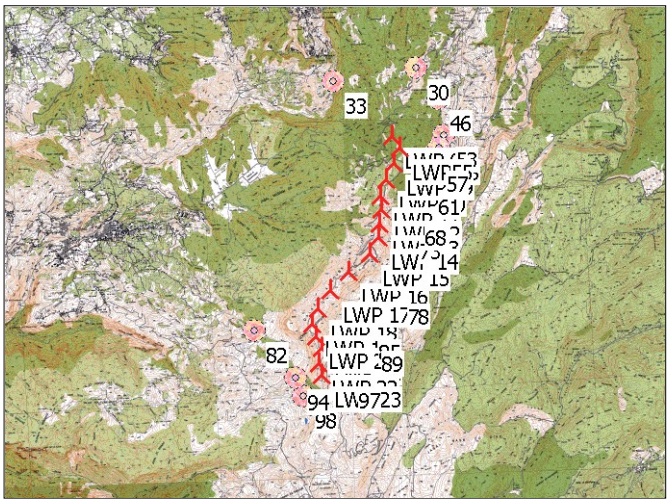
Calculation: LWP GE Wind 5.3-158

ISO 9613-2 Germany

The calculation is based on the international norm "ISO 9613-2 Acoustics - Attenuation of sound during propagation outdoors"

Loudest up to 95% rated power
Meteorological correction factor, C0: 0,0 dB

All coordinates are in
Geo [deg]-WGS84



Scale 1:200.000

New WTG Noise sensitive area

WTGs

	Longitude	Latitude	Z [m]	Row data/Description	WTG type Valid	Manufact.	Type-generator	Power, rated [kW]	Rotor diameter [m]	Hub height [m]	Noise data Creator	Name	Wind speed [m/s]	LwA,ref [dB(A)]	Pure tones
LWP 07	36,264865° E	34,495376° N	1.814,4	GE WIND ENERGY GE 5.3-15...	Yes	GE WIND ENERGY	GE 5.3-158-5.300	5.300	158,0	121,0	USER	106,0 dB(A) + 1 dB(A)	(95%)	107,0	No
LWP 08	36,267003° E	34,492722° N	1.829,7	GE WIND ENERGY GE 5.3-15...	Yes	GE WIND ENERGY	GE 5.3-158-5.300	5.300	158,0	121,0	USER	106,0 dB(A) + 1 dB(A)	(95%)	107,0	No
LWP 09	36,265293° E	34,488954° N	1.903,8	GE WIND ENERGY GE 5.3-15...	Yes	GE WIND ENERGY	GE 5.3-158-5.300	5.300	158,0	121,0	USER	106,0 dB(A) + 1 dB(A)	(95%)	107,0	No
LWP 10	36,262879° E	34,485213° N	1.914,9	GE WIND ENERGY GE 5.3-15...	Yes	GE WIND ENERGY	GE 5.3-158-5.300	5.300	158,0	121,0	USER	106,0 dB(A) + 1 dB(A)	(95%)	107,0	No
LWP 11	36,261147° E	34,481430° N	1.936,5	GE WIND ENERGY GE 5.3-15...	Yes	GE WIND ENERGY	GE 5.3-158-5.300	5.300	158,0	121,0	USER	106,0 dB(A) + 1 dB(A)	(95%)	107,0	No
LWP 12	36,261248° E	34,478274° N	1.922,3	GE WIND ENERGY GE 5.3-15...	Yes	GE WIND ENERGY	GE 5.3-158-5.300	5.300	158,0	121,0	USER	106,0 dB(A) + 1 dB(A)	(95%)	107,0	No
LWP 13	36,260583° E	34,474870° N	1.934,9	GE WIND ENERGY GE 5.3-15...	Yes	GE WIND ENERGY	GE 5.3-158-5.300	5.300	158,0	121,0	USER	106,0 dB(A) + 1 dB(A)	(95%)	107,0	No
LWP 14	36,260211° E	34,471455° N	1.851,7	GE WIND ENERGY GE 5.3-15...	Yes	GE WIND ENERGY	GE 5.3-158-5.300	5.300	158,0	121,0	USER	106,0 dB(A) + 1 dB(A)	(95%)	107,0	No
LWP 15	36,257625° E	34,467738° N	1.988,4	GE WIND ENERGY GE 5.3-15...	Yes	GE WIND ENERGY	GE 5.3-158-5.300	5.300	158,0	121,0	USER	106,0 dB(A) + 1 dB(A)	(95%)	107,0	No
LWP 16	36,251352° E	34,463613° N	2.072,4	GE WIND ENERGY GE 5.3-15...	Yes	GE WIND ENERGY	GE 5.3-158-5.300	5.300	158,0	121,0	USER	106,0 dB(A) + 1 dB(A)	(95%)	107,0	No
LWP 17	36,245957° E	34,459301° N	2.107,8	GE WIND ENERGY GE 5.3-15...	Yes	GE WIND ENERGY	GE 5.3-158-5.300	5.300	158,0	121,0	USER	106,0 dB(A) + 1 dB(A)	(95%)	107,0	No
LWP 18	36,242165° E	34,455185° N	2.115,4	GE WIND ENERGY GE 5.3-15...	Yes	GE WIND ENERGY	GE 5.3-158-5.300	5.300	158,0	121,0	USER	106,0 dB(A) + 1 dB(A)	(95%)	107,0	No
LWP 19	36,240424° E	34,451469° N	2.139,2	GE WIND ENERGY GE 5.3-15...	Yes	GE WIND ENERGY	GE 5.3-158-5.300	5.300	158,0	121,0	USER	106,0 dB(A) + 1 dB(A)	(95%)	107,0	No
LWP 20	36,241245° E	34,448386° N	2.184,4	GE WIND ENERGY GE 5.3-15...	Yes	GE WIND ENERGY	GE 5.3-158-5.300	5.300	158,0	121,0	USER	106,0 dB(A) + 1 dB(A)	(95%)	107,0	No
LWP 21	36,242901° E	34,445685° N	2.193,4	GE WIND ENERGY GE 5.3-15...	Yes	GE WIND ENERGY	GE 5.3-158-5.300	5.300	158,0	121,0	USER	106,0 dB(A) + 1 dB(A)	(95%)	107,0	No
LWP 22	36,241779° E	34,442166° N	2.204,3	GE WIND ENERGY GE 5.3-15...	Yes	GE WIND ENERGY	GE 5.3-158-5.300	5.300	158,0	121,0	USER	106,0 dB(A) + 1 dB(A)	(95%)	107,0	No
LWP 23	36,242651° E	34,439372° N	2.149,3	GE WIND ENERGY GE 5.3-15...	Yes	GE WIND ENERGY	GE 5.3-158-5.300	5.300	158,0	121,0	USER	106,0 dB(A) + 1 dB(A)	(95%)	107,0	No

Calculation Results

Sound level

Noise sensitive area

No.	Name	Longitude	Latitude	Z [m]	Imission height [m]	Demands Noise [dB(A)]	Sound level From WTGs [dB(A)]	Demands fulfilled ? Noise
30	LWP: 30 house under construction	36,272567° E	34,511469° N	1.430,9	5,0	45,0	30,2	Yes
33	LWP: 33 house	36,248528° E	34,508982° N	1.194,7	5,0	45,0	28,3	Yes
46	LWP: 46 occupied house in summer	36,278525° E	34,504084° N	1.396,2	5,0	45,0	31,9	Yes
53	LWP: 53 house	36,279899° E	34,495307° N	1.495,7	5,0	45,0	35,4	Yes
55	LWP: 55 villa	36,278413° E	34,492443° N	1.554,1	5,0	45,0	36,7	Yes
57	LWP: 57 house	36,277015° E	34,489582° N	1.579,6	5,0	45,0	38,6	Yes
61	LWP: 61 house	36,274565° E	34,484235° N	1.584,6	5,0	45,0	39,2	Yes
68	LWP: 68 house	36,270268° E	34,477126° N	1.696,3	5,0	45,0	41,5	Yes
73	LWP: 73 house	36,268675° E	34,473917° N	1.700,8	5,0	45,0	42,6	Yes
78	LWP: 78 house	36,264729° E	34,458423° N	1.714,2	5,0	45,0	37,5	Yes
82	LWP: 82 house	36,223728° E	34,450359° N	1.755,7	5,0	45,0	35,5	Yes
85	LWP: 85 house	36,256086° E	34,450161° N	1.850,8	5,0	45,0	39,6	Yes
89	LWP: 89 house	36,256862° E	34,447384° N	1.838,9	5,0	45,0	38,7	Yes
94	LWP: 94 house	36,235096° E	34,438907° N	1.959,5	5,0	45,0	41,6	Yes
97	LWP: 97 house	36,249680° E	34,438785° N	1.954,6	5,0	45,0	42,6	Yes
98	LWP: 98 house	36,237141° E	34,434363° N	1.916,0	5,0	45,0	39,6	Yes

Licensed user:
Ramboll IMS Ingenieurgesellschaft mbH
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DE-20097 Hamburg
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Jonas Feja / jonas.feja@ramboll.com
Calculated:
04.02.2019 10:14/3.2.737

DECIBEL - Main Result

Calculation: LWP GE Wind 5.3-158

Distances (m)

WTG	30	33	46	53	55	57	61	68	73	78	82	85	89	94	97	98
LWP 07	1921	2129	1584	1381	1287	1288	1524	2085	2407	4101	6265	5082	5376	6838	6433	7234
LWP 08	2142	2477	1646	1219	1049	984	1170	1757	2092	3812	6158	4828	5117	6653	6194	7034
LWP 09	2586	2704	2073	1516	1266	1079	1000	1390	1697	3388	5739	4387	4678	6209	5749	6588
LWP 10	3047	2949	2540	1924	1637	1386	1079	1125	1362	2978	5283	3940	4234	5738	5293	6119
LWP 11	3495	3270	2978	2311	2003	1716	1272	965	1083	2574	4870	3501	3799	5292	4848	5670
LWP 12	3828	3603	3275	2551	2227	1917	1391	839	836	2226	4636	3156	3452	4986	4509	5353
LWP 13	4208	3944	3637	2880	2547	2224	1653	925	751	1864	4345	2773	3069	4628	4128	4985
LWP 14	4583	4301	3993	3206	2868	2536	1937	1118	824	1505	4090	2393	2689	4287	3752	4630
LWP 15	5043	4653	4467	3681	3342	3009	2403	1561	1225	1223	3664	1956	2260	3811	3295	4155
LWP 16	5657	5041	5139	4388	4052	3724	3129	2296	1960	1358	2935	1555	1871	3123	2759	3499
LWP 17	6284	5518	5801	5069	4735	4409	3817	2984	2644	1728	2272	1377	1659	2474	2302	2884
LWP 18	6842	5999	6373	5644	5310	4983	4389	3550	3203	2105	1778	1396	1605	1920	1947	2356
LWP 19	7284	6426	6808	6069	5733	5404	4803	3954	3598	2364	1540	1447	1578	1478	1645	1922
LWP 20	7569	6758	7067	6303	5964	5631	5021	4158	3793	2429	1625	1378	1440	1194	1318	1601
LWP 21	7793	7043	7261	6472	6130	5793	5174	4301	3928	2455	1837	1310	1297	1040	987	1363
LWP 22	8195	7441	7656	6859	6517	6179	5557	4681	4304	2776	1892	1587	1503	713	818	965
LWP 23	8460	7744	7902	7089	6745	6405	5779	4899	4519	2931	2124	1720	1580	697	650	752

Project:
18-1-3019

Description:
Akkar Wind Farm

Licensed user:
Ramboll IMS Ingenieurgesellschaft mbH
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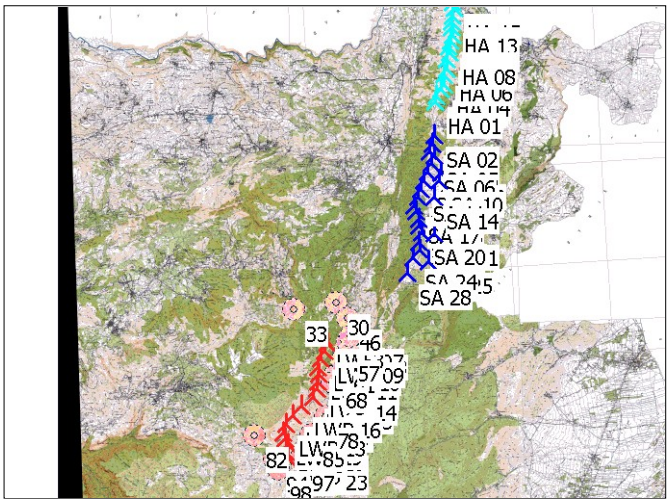
DE-20097 Hamburg
+49 40 302020-132
Jonas Feja / jonas.feja@ramboll.com
Calculated:
01.02.2019 11:46/3.2.737

DECIBEL - Main Result

Calculation: LWP GE 5.3-158 cumulativ: with WF Sustainable Akkar and WF Hawa Akkar

Noise calculation model:
ISO 9613-2 General
Wind speed (in 10 m height):
Loudest up to 95% rated power
Ground attenuation:
Alternative
Meteorological coefficient, C0:
0,0 dB
Type of demand in calculation:
1: WTG noise is compared to demand (DK, DE, SE, NL etc.)
Noise values in calculation:
All noise values are mean values (Lwa) (Normal)
Pure tones:
Fixed penalty added to source noise of WTGs with pure tones
WTG catalogue
Height above ground level, when no value in NSA object:
5,0 m; Allow override of model height with height from NSA object
Uncertainty margin:
0,0 dB; Uncertainty margin in model has priority
Deviation from "official" noise demands. Negative is more restrictive, positive is less restrictive.:
0,0 dB(A)



Scale 1:400.000

New WTG Noise sensitive area

WTGs

	Longitude	Latitude	Z [m]	Row data/Description	WTG type Valid	Manufact.	Type-generator	Power, rated [kW]	Rotor diameter [m]	Hub height [m]	Noise data Creator	Name	Wind speed [m/s]	LwA,ref [dB(A)]	Pure tones
HA 01	36,332394° E	34,603649° N	848,4	VESTAS V150-4.2 4200 150.0 ...	Yes	VESTAS	V150-4.2-4.200	4.200	150,0	105,0	USER	104,9 dB(A) + 1 dB(A)	(95%)	105,9	No
HA 02	36,333189° E	34,606740° N	789,3	VESTAS V150-4.2 4200 150.0 ...	Yes	VESTAS	V150-4.2-4.200	4.200	150,0	105,0	USER	104,9 dB(A) + 1 dB(A)	(95%)	105,9	No
HA 03	36,335620° E	34,609831° N	804,6	VESTAS V150-4.2 4200 150.0 ...	Yes	VESTAS	V150-4.2-4.200	4.200	150,0	105,0	USER	104,9 dB(A) + 1 dB(A)	(95%)	105,9	No
HA 04	36,337634° E	34,611975° N	816,1	VESTAS V150-4.2 4200 150.0 ...	Yes	VESTAS	V150-4.2-4.200	4.200	150,0	105,0	USER	104,9 dB(A) + 1 dB(A)	(95%)	105,9	No
HA 05	36,337789° E	34,616333° N	789,3	VESTAS V150-4.2 4200 150.0 ...	Yes	VESTAS	V150-4.2-4.200	4.200	150,0	105,0	USER	104,9 dB(A) + 1 dB(A)	(95%)	105,9	No
HA 06	36,339466° E	34,619146° N	740,4	VESTAS V150-4.2 4200 150.0 ...	Yes	VESTAS	V150-4.2-4.200	4.200	150,0	105,0	USER	104,9 dB(A) + 1 dB(A)	(95%)	105,9	No
HA 07	36,339759° E	34,623272° N	701,3	VESTAS V150-4.2 4200 150.0 ...	Yes	VESTAS	V150-4.2-4.200	4.200	150,0	105,0	USER	104,9 dB(A) + 1 dB(A)	(95%)	105,9	No
HA 08	36,341350° E	34,626390° N	710,0	VESTAS V150-4.2 4200 150.0 ...	Yes	VESTAS	V150-4.2-4.200	4.200	150,0	105,0	USER	104,9 dB(A) + 1 dB(A)	(95%)	105,9	No
HA 09	36,341012° E	34,629105° N	669,8	VESTAS V150-4.2 4200 150.0 ...	Yes	VESTAS	V150-4.2-4.200	4.200	150,0	105,0	USER	104,9 dB(A) + 1 dB(A)	(95%)	105,9	No
HA 10	36,342218° E	34,632007° N	668,8	VESTAS V150-4.2 4200 150.0 ...	Yes	VESTAS	V150-4.2-4.200	4.200	150,0	105,0	USER	104,9 dB(A) + 1 dB(A)	(95%)	105,9	No
HA 11	36,343425° E	34,634512° N	638,1	VESTAS V150-4.2 4200 150.0 ...	Yes	VESTAS	V150-4.2-4.200	4.200	150,0	105,0	USER	104,9 dB(A) + 1 dB(A)	(95%)	105,9	No
HA 12	36,343003° E	34,638163° N	561,2	VESTAS V150-4.2 4200 150.0 ...	Yes	VESTAS	V150-4.2-4.200	4.200	150,0	105,0	USER	104,9 dB(A) + 1 dB(A)	(95%)	105,9	No
HA 13	36,342989° E	34,640984° N	538,6	VESTAS V150-4.2 4200 150.0 ...	Yes	VESTAS	V150-4.2-4.200	4.200	150,0	105,0	USER	104,9 dB(A) + 1 dB(A)	(95%)	105,9	No
HA 14	36,343501° E	34,643735° N	484,0	VESTAS V150-4.2 4200 150.0 ...	Yes	VESTAS	V150-4.2-4.200	4.200	150,0	105,0	USER	104,9 dB(A) + 1 dB(A)	(95%)	105,9	No
HA 15	36,344782° E	34,647360° N	464,2	VESTAS V150-4.2 4200 150.0 ...	Yes	VESTAS	V150-4.2-4.200	4.200	150,0	105,0	USER	104,9 dB(A) + 1 dB(A)	(95%)	105,9	No
HA 16	36,343792° E	34,650007° N	407,4	VESTAS V150-4.2 4200 150.0 ...	Yes	VESTAS	V150-4.2-4.200	4.200	150,0	105,0	USER	104,9 dB(A) + 1 dB(A)	(95%)	105,9	No
LWP 07	36,264865° E	34,495376° N	1.814,4	GE WIND ENERGY GE 5.3-158...	Yes	GE WIND ENERGY	GE 5.3-158-5.300	5.300	158,0	121,0	USER	106,0 dB(A) + 1 dB(A)	(95%)	107,0	No
LWP 08	36,267003° E	34,492722° N	1.829,7	GE WIND ENERGY GE 5.3-158...	Yes	GE WIND ENERGY	GE 5.3-158-5.300	5.300	158,0	121,0	USER	106,0 dB(A) + 1 dB(A)	(95%)	107,0	No
LWP 09	36,265293° E	34,488954° N	1.903,8	GE WIND ENERGY GE 5.3-158...	Yes	GE WIND ENERGY	GE 5.3-158-5.300	5.300	158,0	121,0	USER	106,0 dB(A) + 1 dB(A)	(95%)	107,0	No
LWP 10	36,262879° E	34,485213° N	1.914,9	GE WIND ENERGY GE 5.3-158...	Yes	GE WIND ENERGY	GE 5.3-158-5.300	5.300	158,0	121,0	USER	106,0 dB(A) + 1 dB(A)	(95%)	107,0	No
LWP 11	36,261147° E	34,481430° N	1.936,5	GE WIND ENERGY GE 5.3-158...	Yes	GE WIND ENERGY	GE 5.3-158-5.300	5.300	158,0	121,0	USER	106,0 dB(A) + 1 dB(A)	(95%)	107,0	No
LWP 12	36,261248° E	34,478274° N	1.922,3	GE WIND ENERGY GE 5.3-158...	Yes	GE WIND ENERGY	GE 5.3-158-5.300	5.300	158,0	121,0	USER	106,0 dB(A) + 1 dB(A)	(95%)	107,0	No
LWP 13	36,260583° E	34,474870° N	1.934,9	GE WIND ENERGY GE 5.3-158...	Yes	GE WIND ENERGY	GE 5.3-158-5.300	5.300	158,0	121,0	USER	106,0 dB(A) + 1 dB(A)	(95%)	107,0	No
LWP 14	36,260211° E	34,471455° N	1.851,7	GE WIND ENERGY GE 5.3-158...	Yes	GE WIND ENERGY	GE 5.3-158-5.300	5.300	158,0	121,0	USER	106,0 dB(A) + 1 dB(A)	(95%)	107,0	No
LWP 15	36,257625° E	34,467738° N	1.988,4	GE WIND ENERGY GE 5.3-158...	Yes	GE WIND ENERGY	GE 5.3-158-5.300	5.300	158,0	121,0	USER	106,0 dB(A) + 1 dB(A)	(95%)	107,0	No
LWP 16	36,251352° E	34,463613° N	2.072,4	GE WIND ENERGY GE 5.3-158...	Yes	GE WIND ENERGY	GE 5.3-158-5.300	5.300	158,0	121,0	USER	106,0 dB(A) + 1 dB(A)	(95%)	107,0	No
LWP 17	36,245957° E	34,459301° N	2.107,8	GE WIND ENERGY GE 5.3-158...	Yes	GE WIND ENERGY	GE 5.3-158-5.300	5.300	158,0	121,0	USER	106,0 dB(A) + 1 dB(A)	(95%)	107,0	No
LWP 18	36,242165° E	34,455185° N	2.115,4	GE WIND ENERGY GE 5.3-158...	Yes	GE WIND ENERGY	GE 5.3-158-5.300	5.300	158,0	121,0	USER	106,0 dB(A) + 1 dB(A)	(95%)	107,0	No
LWP 19	36,240424° E	34,451469° N	2.139,2	GE WIND ENERGY GE 5.3-158...	Yes	GE WIND ENERGY	GE 5.3-158-5.300	5.300	158,0	121,0	USER	106,0 dB(A) + 1 dB(A)	(95%)	107,0	No
LWP 20	36,241245° E	34,448386° N	2.184,4	GE WIND ENERGY GE 5.3-158...	Yes	GE WIND ENERGY	GE 5.3-158-5.300	5.300	158,0	121,0	USER	106,0 dB(A) + 1 dB(A)	(95%)	107,0	No
LWP 21	36,242901° E	34,445685° N	2.193,4	GE WIND ENERGY GE 5.3-158...	Yes	GE WIND ENERGY	GE 5.3-158-5.300	5.300	158,0	121,0	USER	106,0 dB(A) + 1 dB(A)	(95%)	107,0	No
LWP 22	36,241779° E	34,442166° N	2.204,3	GE WIND ENERGY GE 5.3-158...	Yes	GE WIND ENERGY	GE 5.3-158-5.300	5.300	158,0	121,0	USER	106,0 dB(A) + 1 dB(A)	(95%)	107,0	No
LWP 23	36,242651° E	34,439372° N	2.149,3	GE WIND ENERGY GE 5.3-158...	Yes	GE WIND ENERGY	GE 5.3-158-5.300	5.300	158,0	121,0	USER	106,0 dB(A) + 1 dB(A)	(95%)	107,0	No
SA 02	36,330964° E	34,587939° N	914,2	NORDEX N149/4.0-4.5 4500 1...	Yes	NORDEX	N149/4.0-4.5-4.500	4.500	149,0	105,0	USER	108,1 dB(A) + 1 dB(A)	(95%)	109,1	No
SA 03	36,329828° E	34,584283° N	949,8	NORDEX N149/4.0-4.5 4500 1...	Yes	NORDEX	N149/4.0-4.5-4.500	4.500	149,0	105,0	USER	108,1 dB(A) + 1 dB(A)	(95%)	109,1	No
SA 04	36,327887° E	34,580411° N	965,4	NORDEX N149/4.0-4.5 4500 1...	Yes	NORDEX	N149/4.0-4.5-4.500	4.500	149,0	105,0	USER	108,1 dB(A) + 1 dB(A)	(95%)	109,1	No
SA 05	36,330809° E	34,578547° N	959,2	NORDEX N149/4.0-4.5 4500 1...	Yes	NORDEX	N149/4.0-4.5-4.500	4.500	149,0	105,0	USER	108,1 dB(A) + 1 dB(A)	(95%)	109,1	No
SA 06	36,328890° E	34,574900° N	1.048,1	NORDEX N149/4.0-4.5 4500 1...	Yes	NORDEX	N149/4.0-4.5-4.500	4.500	149,0	105,0	USER	108,1 dB(A) + 1 dB(A)	(95%)	109,1	No
SA 07	36,326668° E	34,571152° N	1.083,8	NORDEX N149/4.0-4.5 4500 1...	Yes	NORDEX	N149/4.0-4.5-4.500	4.500	149,0	105,0	USER	108,1 dB(A) + 1 dB(A)	(95%)	109,1	No
SA 08	36,334428° E	34,570455° N	1.065,9	NORDEX N149/4.0-4.5 4500 1...	Yes	NORDEX	N149/4.0-4.5-4.500	4.500	149,0	105,0	USER	108,1 dB(A) + 1 dB(A)	(95%)	109,1	No
SA 09	36,324544° E	34,567019° N	1.074,9	NORDEX N149/4.0-4.5 4500 1...	Yes	NORDEX	N149/4.0-4.5-4.500	4.500	149,0	105,0	USER	108,1 dB(A) + 1 dB(A)	(95%)	109,1	No
SA 10	36,333188° E	34,566940° N	1.077,5	NORDEX N149/4.0-4.5 4500 1...	Yes	NORDEX	N149/4.0-4.5-4.500	4.500	149,0	105,0	USER	108,1 dB(A) + 1 dB(A)	(95%)	109,1	No
SA 11	36,322257° E	34,563207° N	1.036,3	NORDEX N149/4.0-4.5 4500 1...	Yes	NORDEX	N149/4.0-4.5-4.500	4.500	149,0	105,0	USER	108,1 dB(A) + 1 dB(A)	(95%)	109,1	No
SA 13	36,320570° E	34,559367° N	1.056,2	NORDEX N149/4.0-4.5 4500 1...	Yes	NORDEX	N149/4.0-4.5-4.500	4.500	149,0	105,0	USER	108,1 dB(A) + 1 dB(A)	(95%)	109,1	No
SA 14	36,330057° E	34,559516° N	1.100,2	NORDEX N149/4.0-4.5 4500 1...	Yes	NORDEX	N149/4.0-4.5-4.500	4.500	149,0	105,0	USER	108,1 dB(A) + 1 dB(A)	(95%)	109,1	No
SA 15	36,318416° E	34,555775° N	1.026,0	NORDEX N149/4.0-4.5 4500 1...	Yes	NORDEX	N149/4.0-4.5-4.500	4.500	149,0	105,0	USER	108,1 dB(A) + 1 dB(A)	(95%)	109,1	No
SA 17	36,319296° E	34,552888° N	1.036,1	NORDEX N149/4.0-4.5 4500 1...	Yes	NORDEX	N149/4.0-4.5-4.500	4.500	149,0	105,0	USER	108,1 dB(A) + 1 dB(A)	(95%)	109,1	No
SA 18	36,321037° E	34,549404° N	1.124,2	NORDEX N149/4.0-4.5 4500 1...	Yes	NORDEX	N149/4.0-4.5-4.500	4.500	149,0	105,0	USER	108,1 dB(A) + 1 dB(A)	(95%)	109,1	No
SA 19	36,320700° E	34,545967° N	1.154,3	NORDEX N149/4.0-4.5 4500 1...	Yes	NORDEX	N149/4.0-4.5-4.500	4.500	149,0	105,0	USER	108,1 dB(A) + 1 dB(A)	(95%)	109,1	No
SA 20	36,322239° E	34,542980° N	1.168,5	NORDEX N149/4.0-4.5 4500 1...	Yes	NORDEX	N149/4.0-4.5-4.500	4.500	149,0	105,0	USER	108,1 dB(A) + 1 dB(A)	(95%)	109,1	No
SA 21	36,329271° E	34,542225° N	1.153,2	NORDEX N149/4.0-4.5 4500 1...	Yes	NORDEX	N149/4.0-4.5-4.500	4.500	149,0	105,0	USER	108,1 dB(A) + 1 dB(A)	(95%)	109,1	No
SA 22	36,320636° E	34,538496° N	1.175,6	NORDEX N149/4.0-4.5 4500 1...	Yes	NORDEX	N149/4.0-4.5-4.500	4.500	149,0	105,0	USER	108,1 dB(A) + 1 dB(A)	(95%)	109,1	No
SA 23	36,320604° E	34,534624° N	1.208,1	NORDEX N149/4.0-4.5 4500 1...	Yes	NORDEX	N149/4.0-4.5-4.500	4.500	149,0	105,0	USER	108,1 dB(A) + 1 dB(A)	(95%)	109,1	No
SA 24	36,317041° E	34,531159° N	1.237,8	NORDEX N149/4.0-4.5 4500 1...	Yes	NORDEX	N149/4.0-4.5-4.500	4.500	149,0	105,0	USER	108,1 dB(A) + 1 dB(A)	(95%)	109,1	No
SA 25	36,325734° E	34,529126° N	1.257,2	NORDEX N149/4.0-4.5 4500 1...	Yes	NORDEX	N149/4.0-4.5-4.500	4.500	149,0	105,0	USER	108,1 dB(A) + 1 dB(A)	(95%)	109,1	No
SA 28	36,313252° E	34,524313° N	1.285,8	NORDEX N149/4.0-4.5 4500 1...	Yes	NORDEX	N149/4.0-4.5-4.500	4.500	149,0	105,0	USER	108,1 dB(A) + 1 dB(A)	(95%)	109,1	No

Calculation Results

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Jonas Feja / jonas.feja@ramboll.com
Calculated:
01.02.2019 11:46/3.2.737

DECIBEL - Main Result

Calculation: LWP GE 5.3-158 cumulativ: with WF Sustainable Akkar and WF Hawa Akkar

Sound level

Noise sensitive area No.	Name	Longitude	Latitude	Z [m]	Imission height [m]	Demands Noise [dB(A)]	Sound level From WTGs [dB(A)]	Demands fulfilled ? Noise
30	LWP: 30 house under construction	36,272567° E	34,511469° N	1.430,9	5,0	45,0	30,9	Yes
33	LWP: 33 house	36,248528° E	34,508982° N	1.194,7	5,0	45,0	28,6	Yes
46	LWP: 46 occupied house in summer	36,278525° E	34,504084° N	1.396,2	5,0	45,0	32,6	Yes
53	LWP: 53 house	36,279899° E	34,495307° N	1.495,7	5,0	45,0	35,6	Yes
55	LWP: 55 villa	36,278413° E	34,492443° N	1.554,1	5,0	45,0	36,8	Yes
57	LWP: 57 house	36,277015° E	34,489582° N	1.579,6	5,0	45,0	38,6	Yes
61	LWP: 61 house	36,274565° E	34,484235° N	1.584,6	5,0	45,0	39,3	Yes
68	LWP: 68 house	36,270268° E	34,477126° N	1.696,3	5,0	45,0	41,5	Yes
73	LWP: 73 house	36,268675° E	34,473917° N	1.700,8	5,0	45,0	42,6	Yes
78	LWP: 78 house	36,264729° E	34,458423° N	1.714,2	5,0	45,0	37,5	Yes
82	LWP: 82 house	36,223728° E	34,450359° N	1.755,7	5,0	45,0	35,5	Yes
85	LWP: 85 house	36,256086° E	34,450161° N	1.850,8	5,0	45,0	39,6	Yes
89	LWP: 89 house	36,256862° E	34,447384° N	1.838,9	5,0	45,0	38,7	Yes
94	LWP: 94 house	36,235096° E	34,438907° N	1.959,5	5,0	45,0	41,6	Yes
97	LWP: 97 house	36,249680° E	34,438785° N	1.954,6	5,0	45,0	42,6	Yes
98	LWP: 98 house	36,237141° E	34,434363° N	1.916,0	5,0	45,0	39,6	Yes

Distances (m)

WTG	30	33	46	53	55	57	61	68	73	78	82	85	89	94	97	98
HA 01	11611	13025	12105	12953	13299	13641	14276	15155	15540	17273	19723	18418	18677	20349	19810	20724
HA 02	11948	13346	12449	13299	13644	13987	14622	15501	15886	17619	20056	18763	19023	20690	20155	21065
HA 03	12355	13754	12853	13700	14046	14388	15023	15902	16287	18019	20464	19165	19424	21096	20557	21470
HA 04	12652	14055	13145	13990	14336	14678	15313	16193	16578	18308	20763	19456	19714	21391	20848	21764
HA 05	13087	14459	13593	14444	14790	15132	15767	16646	17031	18764	21189	19908	20168	21832	21300	22209
HA 06	13435	14804	13941	14791	15136	15479	16114	16993	17378	19111	21536	20256	20515	22180	21647	22557
HA 07	13856	15199	14372	15227	15572	15915	16549	17428	17813	19548	21949	20690	20951	22605	22081	22985
HA 08	14230	15568	14747	15602	15948	16290	16925	17803	18188	19923	22322	21066	21326	22980	22457	23360
HA 09	14488	15804	15013	15872	16218	16560	17195	18073	18458	20195	22571	21334	21596	23240	22725	23623
HA 10	14826	16135	15353	16213	16558	16901	17535	18413	18798	20535	22907	21674	21936	23579	23065	23962
HA 11	15124	16430	15652	16512	16857	17200	17834	18712	19097	20834	23204	21974	22235	23878	23364	24261
HA 12	15475	16754	16013	16878	17223	17566	18200	19077	19462	21201	23544	22337	22600	24231	23727	24617
HA 13	15759	17022	16304	17172	17517	17860	18494	19370	19755	21496	23821	22630	22893	24516	24019	24904
HA 14	16057	17309	16605	17475	17821	18163	18797	19673	20058	21799	24114	22932	23196	24815	24321	25204
HA 15	16472	17716	17023	17894	18239	18581	19216	20092	20476	22218	24525	23350	23614	25230	24739	25620
HA 16	16706	17927	17266	18141	18486	18828	19463	20338	20722	22465	24747	23594	23860	25464	24982	25857
LWP 07	1921	2129	1584	1381	1287	1288	1524	2085	2407	4101	6265	5082	5376	6838	6433	7234
LWP 08	2142	2477	1646	1219	1049	984	1170	1757	2092	3812	6158	4828	5117	6653	6194	7034
LWP 09	2586	2704	2073	1516	1266	1079	1000	1390	1697	3388	5739	4387	4678	6209	5749	6588
LWP 10	3047	2949	2540	1924	1637	1386	1079	1125	1362	2978	5283	3940	4234	5738	5293	6119
LWP 11	3495	3270	2978	2311	2003	1716	1272	965	1083	2574	4870	3501	3799	5292	4848	5670
LWP 12	3828	3603	3275	2551	2227	1917	1391	839	836	2226	4636	3156	3452	4986	4509	5353
LWP 13	4208	3944	3637	2880	2547	2224	1653	925	751	1864	4345	2773	3069	4628	4128	4985
LWP 14	4583	4301	3993	3206	2868	2536	1937	1118	824	1505	4090	2393	2689	4287	3752	4630
LWP 15	5043	4653	4467	3681	3342	3009	2403	1561	1225	1223	3664	1956	2260	3811	3295	4155
LWP 16	5657	5041	5139	4388	4052	3724	3129	2296	1960	1358	2935	1555	1871	3123	2759	3499
LWP 17	6284	5518	5801	5069	4735	4409	3817	2984	2644	1728	2272	1377	1659	2474	2302	2884
LWP 18	6842	5999	6373	5644	5310	4983	4389	3550	3203	2105	1778	1396	1605	1920	1947	2356
LWP 19	7284	6426	6808	6069	5733	5404	4803	3954	3598	2364	1540	1447	1578	1478	1645	1922
LWP 20	7569	6758	7067	6303	5964	5631	5021	4158	3793	2429	1625	1378	1440	1194	1318	1601
LWP 21	7793	7043	7261	6472	6130	5793	5174	4301	3928	2455	1837	1310	1297	1040	987	1363
LWP 22	8195	7441	7656	6859	6517	6179	5557	4681	4304	2776	1892	1587	1503	713	818	965
LWP 23	8460	7744	7902	7089	6745	6405	5779	4899	4519	2931	2124	1720	1580	697	650	752
SA 02	10038	11579	10478	11299	11644	11987	12620	13501	13886	15607	18169	16765	17018	18737	18158	19098
SA 03	9640	11205	10070	10886	11232	11574	12207	13089	13474	15193	17772	16353	16605	18330	17746	18689
SA 04	9183	10767	9607	10422	10767	11110	11743	12624	13009	14728	17316	15888	16140	17867	17281	18226
SA 05	9166	10802	9557	10353	10698	11040	11671	12553	12938	14647	17295	15814	16062	17817	17207	18168
SA 06	8735	10391	9119	9912	10258	10599	11230	12113	12497	14206	16862	15373	15621	17378	16766	17728
SA 07	8279	9954	8657	9449	9794	10136	10767	11649	12033	13743	16405	14910	15158	16916	16303	17265
SA 08	8667	10429	8978	9727	10070	10409	11035	11916	12298	13984	16764	15165	15404	17216	16556	17549
SA 09	7796	9498	8163	8952	9297	9638	10270	11152	11536	13245	15918	14412	14660	16421	15805	16769
SA 10	8300	10090	8594	9335	9677	10016	10641	11521	11903	13585	16386	14768	15006	16825	16159	17156
SA 11	7334	9058	7693	8480	8825	9166	9797	10680	11064	12773	15452	13940	14188	15950	15333	16297
SA 13	6906	8662	7249	8030	8375	8716	9347	10229	10613	12321	15016	13489	13736	15504	14882	15849

To be continued on next page...

Project:
18-1-3019-NS_jf

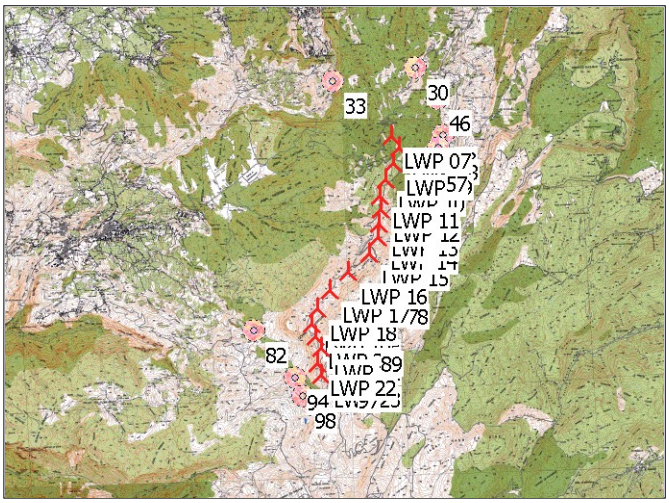
Description:
Akkar Wind Farm

Licensed user:
Ramboll GmbH
Stadtdeich 7
DE-20097 Hamburg
+49 40 302020-132
Jonas Feja / jonas.feja@ramboll.com
Calculated:
11.08.2019 13:42/3.3.261

DECIBEL - Main Result

Calculation: LWP Vestas V150 screening calculation

Noise calculation model:
ISO 9613-2 General
Wind speed (in 10 m height):
95% rated power else 10,0 m/s
Ground attenuation:
Alternative
Meteorological coefficient, C0:
0,0 dB
Type of demand in calculation:
1: WTG noise is compared to demand (DK, DE, SE, NL etc.)
Noise values in calculation:
All noise values are 90% exceedance values (L90)
Pure tones:
Fixed penalty added to source noise of WTGs with pure tones
WTG catalogue
Height above ground level, when no value in NSA object:
5,0 m; Allow override of model height with height from NSA object
Uncertainty margin:
0,0 dB; Uncertainty margin in model has priority
Deviation from "official" noise demands. Negative is more restrictive, positive is less restrictive.:
0,0 dB(A)



Scale 1:200.000
New WTG
Noise sensitive area

WTGs

	Longitude	Latitude	Z [m]	Row data/Description	WTG type Valid	Manufact.	Type-generator	Power, rated [kW]	Rotor diameter [m]	Hub height [m]	Noise data Creator	Name	Wind speed [m/s]	LwA,ref [dB(A)]	Pure tones
LWP 07	36,264865° Ost	34,495376° Nord	1.814,3	VESTAS V150-4.2 4200 150.0 !...	Yes	VESTAS	V150-4.2-4.200	4.200	150,0	105,0	USER	Level 0 - - Mode 0/PO1 - 10-2017	10,0	104,9	No
LWP 08	36,267003° Ost	34,492722° Nord	1.829,7	VESTAS V150-4.2 4200 150.0 !...	Yes	VESTAS	V150-4.2-4.200	4.200	150,0	105,0	USER	Level 0 - - Mode 0/PO1 - 10-2017	10,0	104,9	No
LWP 09	36,265293° Ost	34,488954° Nord	1.903,8	VESTAS V150-4.2 4200 150.0 !...	Yes	VESTAS	V150-4.2-4.200	4.200	150,0	105,0	USER	Level 0 - - Mode 0/PO1 - 10-2017	10,0	104,9	No
LWP 10	36,262879° Ost	34,485213° Nord	1.914,9	VESTAS V150-4.2 4200 150.0 !...	Yes	VESTAS	V150-4.2-4.200	4.200	150,0	105,0	USER	Level 0 - - Mode 0/PO1 - 10-2017	10,0	104,9	No
LWP 11	36,261147° Ost	34,481430° Nord	1.936,4	VESTAS V150-4.2 4200 150.0 !...	Yes	VESTAS	V150-4.2-4.200	4.200	150,0	105,0	USER	Level 0 - - Mode 0/PO1 - 10-2017	10,0	104,9	No
LWP 12	36,261248° Ost	34,478274° Nord	1.922,9	VESTAS V150-4.2 4200 150.0 !...	Yes	VESTAS	V150-4.2-4.200	4.200	150,0	105,0	USER	Level 0 - - Mode 0/PO1 - 10-2017	10,0	104,9	No
LWP 13	36,260583° Ost	34,474870° Nord	1.933,4	VESTAS V150-4.2 4200 150.0 !...	Yes	VESTAS	V150-4.2-4.200	4.200	150,0	105,0	USER	Level 0 - - Mode 0/PO1 - 10-2017	10,0	104,9	No
LWP 14	36,260211° Ost	34,471455° Nord	1.851,4	VESTAS V150-4.2 4200 150.0 !...	Yes	VESTAS	V150-4.2-4.200	4.200	150,0	105,0	USER	Level 0 - - Mode 0/PO1 - 10-2017	10,0	104,9	No
LWP 15	36,257625° Ost	34,467738° Nord	1.988,4	VESTAS V150-4.2 4200 150.0 !...	Yes	VESTAS	V150-4.2-4.200	4.200	150,0	105,0	USER	Level 0 - - Mode 0/PO1 - 10-2017	10,0	104,9	No
LWP 16	36,251352° Ost	34,463613° Nord	2.072,3	VESTAS V150-4.2 4200 150.0 !...	Yes	VESTAS	V150-4.2-4.200	4.200	150,0	105,0	USER	Level 0 - - Mode 0/PO1 - 10-2017	10,0	104,9	No
LWP 17	36,245957° Ost	34,459301° Nord	2.107,6	VESTAS V150-4.2 4200 150.0 !...	Yes	VESTAS	V150-4.2-4.200	4.200	150,0	105,0	USER	Level 0 - - Mode 0/PO1 - 10-2017	10,0	104,9	No
LWP 18	36,242165° Ost	34,455185° Nord	2.115,4	VESTAS V150-4.2 4200 150.0 !...	Yes	VESTAS	V150-4.2-4.200	4.200	150,0	105,0	USER	Level 0 - - Mode 0/PO1 - 10-2017	10,0	104,9	No
LWP 19	36,240424° Ost	34,451469° Nord	2.139,4	VESTAS V150-4.2 4200 150.0 !...	Yes	VESTAS	V150-4.2-4.200	4.200	150,0	105,0	USER	Level 0 - - Mode 0/PO1 - 10-2017	10,0	104,9	No
LWP 20	36,241245° Ost	34,448386° Nord	2.184,4	VESTAS V150-4.2 4200 150.0 !...	Yes	VESTAS	V150-4.2-4.200	4.200	150,0	105,0	USER	Level 0 - - Mode 0/PO1 - 10-2017	10,0	104,9	No
LWP 21	36,242901° Ost	34,445685° Nord	2.193,3	VESTAS V150-4.2 4200 150.0 !...	Yes	VESTAS	V150-4.2-4.200	4.200	150,0	105,0	USER	Level 0 - - Mode 0/PO1 - 10-2017	10,0	104,9	No
LWP 22	36,241779° Ost	34,442166° Nord	2.204,1	VESTAS V150-4.2 4200 150.0 !...	Yes	VESTAS	V150-4.2-4.200	4.200	150,0	105,0	USER	Level 0 - - Mode 0/PO1 - 10-2017	10,0	104,9	No
LWP 23	36,242651° Ost	34,439372° Nord	2.149,0	VESTAS V150-4.2 4200 150.0 !...	Yes	VESTAS	V150-4.2-4.200	4.200	150,0	105,0	USER	Level 0 - - Mode 0/PO1 - 10-2017	10,0	104,9	No

Calculation Results

Sound level

Noise sensitive area No.	Name	Longitude	Latitude	Z [m]	Imission height [m]	Demands Noise [dB(A)]	Sound level From WTGs [dB(A)]	Demands fulfilled ? Noise
30	LWP: 30 house under construction	36,272567° Ost	34,511469° Nord	1.431,1	5,0	45,0	26,0	Yes
33	LWP: 33 house	36,248528° Ost	34,508982° Nord	1.194,2	5,0	45,0	24,2	Yes
46	LWP: 46 occupied house in summer	36,278525° Ost	34,504084° Nord	1.396,4	5,0	45,0	27,5	Yes
53	LWP: 53 house	36,279899° Ost	34,495307° Nord	1.495,9	5,0	45,0	31,0	Yes
55	LWP: 55 villa	36,278413° Ost	34,492443° Nord	1.554,5	5,0	45,0	32,8	Yes
57	LWP: 57 house	36,277015° Ost	34,489582° Nord	1.579,6	5,0	45,0	34,2	Yes
61	LWP: 61 house	36,274565° Ost	34,484235° Nord	1.584,1	5,0	45,0	35,0	Yes
68	LWP: 68 house	36,270268° Ost	34,477126° Nord	1.696,4	5,0	45,0	37,3	Yes
73	LWP: 73 house	36,268675° Ost	34,473917° Nord	1.701,3	5,0	45,0	38,3	Yes
78	LWP: 78 house	36,264729° Ost	34,458423° Nord	1.714,3	5,0	45,0	33,4	Yes
82	LWP: 82 house	36,223728° Ost	34,450359° Nord	1.755,6	5,0	45,0	31,3	Yes
85	LWP: 85 house	36,256086° Ost	34,450161° Nord	1.851,0	5,0	45,0	35,3	Yes
89	LWP: 89 house	36,256862° Ost	34,447384° Nord	1.839,0	5,0	45,0	34,4	Yes
94	LWP: 94 house	36,235096° Ost	34,438907° Nord	1.959,7	5,0	45,0	37,1	Yes
97	LWP: 97 house	36,249680° Ost	34,438785° Nord	1.954,5	5,0	45,0	38,2	Yes
98	LWP: 98 house	36,237141° Ost	34,434363° Nord	1.915,9	5,0	45,0	35,3	Yes

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Calculated:
11.08.2019 13:42/3.3.261

DECIBEL - Main Result

Calculation: LWP Vestas V150 screening calculation

Distances (m)

WTG	30	33	46	53	55	57	61	68	73	78	82	85	89	94	97	98
LWP 07	1921	2129	1584	1381	1287	1288	1524	2085	2407	4101	6265	5082	5376	6838	6433	7234
LWP 08	2142	2477	1646	1219	1049	984	1170	1757	2092	3812	6158	4828	5117	6653	6194	7034
LWP 09	2586	2704	2073	1516	1266	1079	1000	1390	1697	3388	5739	4387	4678	6209	5749	6588
LWP 10	3047	2949	2540	1924	1637	1386	1079	1125	1362	2978	5283	3940	4234	5738	5293	6119
LWP 11	3495	3270	2978	2311	2003	1716	1272	965	1083	2574	4870	3501	3799	5292	4848	5670
LWP 12	3828	3603	3275	2551	2227	1917	1391	839	836	2226	4636	3156	3452	4986	4509	5353
LWP 13	4208	3944	3637	2880	2547	2224	1653	925	751	1864	4345	2773	3069	4628	4128	4985
LWP 14	4583	4301	3993	3206	2868	2536	1937	1118	824	1505	4090	2393	2689	4287	3752	4630
LWP 15	5043	4653	4467	3681	3342	3009	2403	1561	1225	1223	3664	1956	2260	3811	3295	4155
LWP 16	5657	5041	5139	4388	4052	3724	3129	2296	1960	1358	2935	1555	1871	3123	2759	3499
LWP 17	6284	5518	5801	5069	4735	4409	3817	2984	2644	1728	2272	1377	1659	2474	2302	2884
LWP 18	6842	5999	6373	5644	5310	4983	4389	3550	3203	2105	1778	1396	1605	1920	1947	2356
LWP 19	7284	6426	6808	6069	5733	5404	4803	3954	3598	2364	1540	1447	1578	1478	1645	1922
LWP 20	7569	6758	7067	6303	5964	5631	5021	4158	3793	2429	1625	1378	1440	1194	1318	1601
LWP 21	7793	7043	7261	6472	6130	5793	5174	4301	3928	2455	1837	1310	1297	1040	987	1363
LWP 22	8195	7441	7656	6859	6517	6179	5557	4681	4304	2776	1892	1587	1503	713	818	965
LWP 23	8460	7744	7902	7089	6745	6405	5779	4899	4519	2931	2124	1720	1580	697	650	752

3.3 Operational Envelope – Conditions for Power Curve and Ct Values (at Hub Height)

Consult Section 6 and following sections, p. 12 for power curves and C_t values.

Conditions for Power Curve and C_t Values (at Hub Height)	
Wind Shear, *α*	0.00-0.30 (10 minute average)
Turbulence Intensity, *I*	6-12% (10 minute average)
Blades	Clean
Rain	No
Ice/Snow on Blades	No
Leading Edge	No damage
Terrain	IEC 61400-12-1
Inflow Angle (Vertical)	0 ±2°
Grid Voltage	Nominal Voltage ±2.5%
Grid Frequency	Nominal Frequency ±0.5 Hz
Grid Active Power (LV-side)	Per tabulated values in Section 6 and following sections
Grid Reactive Power (LV-side)	Power Factor 1.0

Table 3-7: Conditions for power curve and Ct values

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	104.9 dBA	Yes (standard)	105 / 123 / 145 / 155 / 166 m
0-0S	108.0 dBA	No (option)	105 / 123 / 145 / 155 / 166 m
PO1	104.9 dBA	Yes (standard)	105 / 123 / 145 / 155 / 166 m
PO1-0S	108.0 dBA	No (option)	105 / 123 / 145 / 155 / 166 m

Table 3-8: Available sound performance

NOTE The turbine is as standard equipped with serrated trailing edges on the blades. Optionally, Mode 0-0S can be offered without serrated trailing edges mounted on the blades.

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In addition, Sound Optimized (SO) modes as listed below are available as options for the turbine.

Sound Optimized (SO) modes			
Mode No.	**Maximum Sound Level**	**Serrated trailing edges**	**Available hub heights**
SO1	103.4 dBA	Yes	105 / 123 / 155 / 166 m
SO2	102.0 dBA	Yes	105 / 123 / 166 m
SO3	99.5 dBA	Yes	105 / 123 / 145 / 155 / 166 m
SO11	99.2 dBA	Yes	105 m
SO12	99.9 dBA	Yes	105 m
SO13	97.0 dBA	Yes	105 m

Table 3-9: Available Sound Optimized modes

NOTE Sound Optimized (SO) modes are only available with serrated trailing edges on the blades. For further details on sound performance and in case of specific requests for sound modes per tower, please contact Vestas Wind Systems A/S.

3.5 Load Modes

The Load Optimized (LO) modes listed below are available for the turbine.

Load Optimized (LO) modes				
Mode No.	**Power**	**Maximum Sound Level**	**Serrated trailing edges**	**Available hub heights**
LO1	3.8 MW	104.9 dBA	Yes	105 / 123 / 145 / 155 / 166 m
LO2	3.6 MW	104.9 dBA	Yes	105 / 123 / 145 / 155 / 166 m

Table 3-10: Available Load Optimized modes

NOTE Load Optimized (LO) modes are only available with serrated trailing edges mounted on the blades.

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GE Renewable Energy

– Original –

Technical Documentation
Wind Turbine Generator Systems
5.3-158 - 50 Hz

Product Acoustic Specifications

Normal Operation according to IEC

Incl. Octave and 1/3rd Octave Band Spectra

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1 Introduction

1.1 General

This document summarizes the acoustic emission characteristics of 5.3-158 wind turbine for normal operation, including apparent sound power levels $L_{WA,k}$, as well as uncertainty levels associated with the sound power levels, tonal audibility, and octave and 1/3rd-octave band sound power levels.

All provided sound power levels are A-weighted.

GE continuously verifies specifications with measurements, including those performed by independent institutes.

1.2 Wind Farm Noise Management (available as an option)

In noise-constrained areas it is often necessary to adapt the wind turbine operation to satisfy far-field noise limits. GE offers a dedicated Farm Noise Management system that provides greater flexibility and higher energy yield than standard turbine controls. This advanced scheme allows to continuously adjust the farm operation based on the environmental variables that influence farm noise emission, essentially wind speed and wind direction.

The Wind Farm Noise Management package includes the following service and hardware:

- Park level noise propagation modeling and optimization of wind farm operation,
- Table with optimum turbine set-points across the park as a function of wind speed and wind sector,
- Installation and commissioning of the Farm Noise Management Software Package.

2 Normal Operation Apparent Sound Power Levels

The apparent sound power levels $L_{WA,k}$ are given as a function of the hub height wind speed v_{HH}. The corresponding wind speeds v_{10m} at 10 m height above ground level have been derived assuming a logarithmic wind profile. In this case a reference surface roughness according to IEC 61400-11 of $z_{0,ref}$ = 0.05 m has been used, which is representative of average terrain conditions[1].

$$v_{10m} = v_{HH} \frac{\ln\left(10m / z_{0ref}\right)}{\ln\left(hub\ height / z_{0ref}\right)}$$ [2]

The apparent sound power levels $L_{WA,k}$ and the associated octave-band spectra are given in Table 1 for different hub heights. The values are provided for Normal Operation (NO) turbine mode.

[1] Note, that under site-specific conditions, other values of roughness length might be appropriate.

[2] Simplified from IEC 61400-11, ed. 2.1: 2006 equation 7

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Normal Operation - A-weighted Octave Spectra [dB]													
Hub Height Wind Speed [m/s]		**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
Wind speed at 10 m height for a hub height of 101 m [m/s]		**2.8**	**3.5**	**4.2**	**4.9**	**5.6**	**6.3**	**7.0**	**7.7**	**8.4**	**9.0**	**9.7**	**10.4**
Wind speed at 10 m height for a hub height of 120.9 m [m/s]		**2.7**	**3.4**	**4.1**	**4.8**	**5.4**	**6.1**	**6.8**	**7.5**	**8.2**	**8.8**	**9.5**	**10.2**
Wind speed at 10 m height for a hub height of 150 m [m/s]		**2.6**	**3.3**	**4.0**	**4.6**	**5.3**	**6.0**	**6.6**	**7.3**	**7.9**	**8.6**	**9.3**	**9.9**
Wind speed at 10 m height for a hub height of 161 m [m/s]		**2.6**	**3.3**	**3.9**	**4.6**	**5.2**	**5.9**	**6.6**	**7.2**	**7.9**	**8.5**	**9.2**	**9.8**
Frequency [Hz]	**16**	53.9	54.0	56.3	59.4	62.0	64.5	64.5	64.5	64.5	64.5	64.5	64.5
	32	67.4	67.3	69.6	72.8	75.5	78.0	78.0	78.0	78.0	78.0	78.0	78.0
	63	76.3	77.1	79.2	82.0	84.6	87.2	87.2	87.2	87.2	87.2	87.2	87.2
	125	83.0	85.0	87.1	89.0	91.0	92.6	92.6	92.6	92.6	92.6	92.6	92.6
	250	86.8	88.7	91.8	94.1	96.1	97.2	97.2	97.2	97.2	97.2	97.2	97.2
	500	87.2	87.7	91.7	95.5	98.3	99.7	99.7	99.7	99.7	99.7	99.7	99.7
	1000	87.6	87.0	90.6	95.1	98.7	101.3	101.3	101.3	101.3	101.3	101.3	101.3
	2000	86.4	86.4	88.7	92.4	95.9	99.1	99.1	99.1	99.1	99.1	99.1	99.1
	4000	80.9	82.2	84.0	86.6	89.1	91.7	91.7	91.7	91.7	91.7	91.7	91.7
	8000	65.1	67.2	69.6	72.4	74.6	76.0	76.0	76.0	76.0	76.0	76.0	76.0
Total Sound Power Level [dB]		**93.8**	**94.5**	**97.6**	**101.0**	**103.9**	**106.0**	**106.0**	**106.0**	**106.0**	**106.0**	**106.0**	**106.0**

Table 1: Normal Operation Apparent Sound Power Level as a function of wind speeds

3 Uncertainty Levels

The apparent sound power levels given above are mean values of representative batches of turbines under evaluation. Uncertainty levels are not included. The uncertainty levels u_c, σ_P, σ_R and σ_T associated with measurements and mean values are described in IEC 61400-11 and IEC/TS 61400-14.

For GE wind turbines, a typical value of σ_P = 0.8 dB can be assumed.

The uncertainties for octave and 1/3rd-octave sound power levels are generally higher than for total sound power levels. Guidance is given in IEC 61400-11.

4 Tonal Audibility

The tonal audibility, when measured in accordance with the IEC 61400-11 standard, for the 5.3-158 is $\Delta L_{a,k} \leq 2$ dB.

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5 IEC 61400-11 and IEC/TS 61400-14 Terminology

- $L_{WA,k}$ is the wind turbine apparent sound power level (referenced to 10^{-12}W) measured with A-weighting as a function of wind speed. Derived from multiple measurement reports per IEC 61400-11, it is considered to be a mean value
- u_c is the measurement uncertainty for acoustic testing as defined in IEC 61400-11. It is not a characteristic of the product, but of the measurement, and cannot be specified by GE. For average testing conditions, typical values of u_c are 0,7 dB – 1,0 dB.
- σ_P is the 5.3-158 unit-to-unit product variation according to IEC/TS 61400-14. It is a characteristic of the product and can therefore be specified by GE (see chapter 3).
- σ_R is the overall measurement testing reproducibility as defined in IEC/TS 61400-14. It is not a characteristic of the product, but of the measurements, and cannot be specified by GE. For typical testing according to IEC 61400-11, a value of σ_R = 0,5 dB is widely accepted.
- σ_T is the total standard deviation combining both σ_P and σ_R (see IEC/TS 61400-14).
- $\Delta L_{a,k}$ is the tonal audibility according to IEC 61400-11, described as potentially audible narrow band sound

6 1/3rd-Octave Band Spectra

The tables in Annex I are showing the 1/3rd-octave band values for different wind speeds.

7 Reference Documents

- IEC 61400-11, wind turbine generator systems part 11: Acoustic noise measurement techniques, ed. 2.1 (2006-11), or ed. 3 (2012-11)
- IEC/TS 61400-14, Wind turbines – part 14: Declaration of apparent sound power level and tonality values, ed. 1 (2005-03)
- MNPT – Machine Noise Performance Test, Technical documentation

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Appendix - 1/3rd-Octave Band Apparent Sound Power Level $L_{WA,k}$

Normal Operation – 1/3rd-Octave Spectra [dB]													
Hub Height Wind Speed [m/s]		**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
Wind speed at 10 m height for a hub height of 101 m [m/s]		**2.8**	**3.5**	**4.2**	**4.9**	**5.6**	**6.3**	**7.0**	**7.7**	**8.4**	**9.0**	**9.7**	**10.4**
Wind speed at 10 m height for a hub height of 120.9 m [m/s]		**2.7**	**3.4**	**4.1**	**4.8**	**5.4**	**6.1**	**6.8**	**7.5**	**8.2**	**8.8**	**9.5**	**10.2**
Wind speed at 10 m height for a hub height of 150 m [m/s]		**2.6**	**3.3**	**4.0**	**4.6**	**5.3**	**6.0**	**6.6**	**7.3**	**7.9**	**8.6**	**9.3**	**9.9**
Wind speed at 10 m height for a hub height of 161 m [m/s]		**2.6**	**3.3**	**3.9**	**4.6**	**5.2**	**5.9**	**6.6**	**7.2**	**7.9**	**8.5**	**9.2**	**9.8**
Frequency [Hz]	**12.5**	40.6	40.9	43.2	46.3	48.9	51.5	51.5	51.5	51.5	51.5	51.5	51.5
	16	47.3	47.4	49.7	52.8	55.4	57.9	57.9	57.9	57.9	57.9	57.9	57.9
	20	52.6	52.6	54.9	58.0	60.6	63.1	63.1	63.1	63.1	63.1	63.1	63.1
	25	57.3	57.3	59.6	62.7	65.3	67.8	67.8	67.8	67.8	67.8	67.8	67.8
	32	61.5	61.6	63.9	67.0	69.6	72.2	72.2	72.2	72.2	72.2	72.2	72.2
	40	65.4	65.4	67.7	70.9	73.6	76.1	76.1	76.1	76.1	76.1	76.1	76.1
	50	68.4	68.5	70.8	74.0	76.7	79.4	79.4	79.4	79.4	79.4	79.4	79.4
	63	71.2	71.8	73.9	76.9	79.6	82.2	82.2	82.2	82.2	82.2	82.2	82.2
	80	73.6	74.7	76.7	79.3	81.8	84.4	84.4	84.4	84.4	84.4	84.4	84.4
	100	75.8	77.4	79.3	81.6	83.8	86.1	86.1	86.1	86.1	86.1	86.1	86.1
	125	78.1	80.2	82.2	84.1	86.0	87.7	87.7	87.7	87.7	87.7	87.7	87.7
	160	79.8	82.0	84.3	86.0	87.9	89.2	89.2	89.2	89.2	89.2	89.2	89.2
	200	81.1	83.3	85.9	87.9	89.7	90.8	90.8	90.8	90.8	90.8	90.8	90.8
	250	82.1	84.0	87.1	89.4	91.3	92.3	92.3	92.3	92.3	92.3	92.3	92.3
	315	82.7	84.2	87.8	90.5	92.6	93.6	93.6	93.6	93.6	93.6	93.6	93.6
	400	82.4	83.3	87.3	90.6	92.9	94.1	94.1	94.1	94.1	94.1	94.1	94.1
	500	82.5	83.0	87.0	90.9	93.6	94.9	94.9	94.9	94.9	94.9	94.9	94.9
	630	82.4	82.6	86.5	90.8	93.9	95.5	95.5	95.5	95.5	95.5	95.5	95.5
	800	82.4	82.1	86.1	90.4	93.9	96.0	96.0	96.0	96.0	96.0	96.0	96.0
	1000	82.7	82.1	85.7	90.2	93.9	96.5	96.5	96.5	96.5	96.5	96.5	96.5
	1250	83.3	82.5	85.8	90.4	94.0	97.0	97.0	97.0	97.0	97.0	97.0	97.0
	1600	82.4	82.0	84.6	88.9	92.5	95.7	95.7	95.7	95.7	95.7	95.7	95.7
	2000	81.7	81.8	83.9	87.6	91.1	94.3	94.3	94.3	94.3	94.3	94.3	94.3
	2500	80.5	81.0	82.9	86.0	89.2	92.3	92.3	92.3	92.3	92.3	92.3	92.3
	3150	78.6	79.7	81.5	84.1	86.9	89.7	89.7	89.7	89.7	89.7	89.7	89.7
	4000	75.6	77.0	78.9	81.5	83.7	85.9	85.9	85.9	85.9	85.9	85.9	85.9
	5000	71.5	73.2	75.3	77.9	80.0	81.8	81.8	81.8	81.8	81.8	81.8	81.8
	6300	64.8	66.8	69.2	71.9	74.1	75.5	75.5	75.5	75.5	75.5	75.5	75.5
	8000	54.2	56.6	59.3	62.2	64.6	65.9	65.9	65.9	65.9	65.9	65.9	65.9
	10000	40.1	42.5	45.7	49.1	51.8	53.3	53.3	53.3	53.3	53.3	53.3	53.3
Total Sound Power Level [dB]		**93.8**	**94.5**	**97.6**	**101.0**	**103.9**	**106.0**	**106.0**	**106.0**	**106.0**	**106.0**	**106.0**	**106.0**

Table 2: Apparent 1/3rd-Octave Band Sound Power Levels (A-weighted) as function of Wind Speed

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Noise Monitoring Report

Final Report

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March 5, 2019

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I. Introduction

Sustainable Akkar (SA) is one of the three private investors, selected to build an Wind Farm Power Plant (WFPP) in Akkar, North of Lebanon (Figure 1). Noise from WFPPs can cause annoyance to people living or working in the nearby residences, farms and institutions.

As part of the ESIA, SA has engaged the services of Charbel Afif to established baseline noise levels in the project area in order to identify potential impacted areas related to project activities. In the following, a brief description of the noise measurement campaign methodology is presented along with the results obtained.

Figure 1. *Project location in Akkar - Lebanon*

II. Baseline Survey Methodology

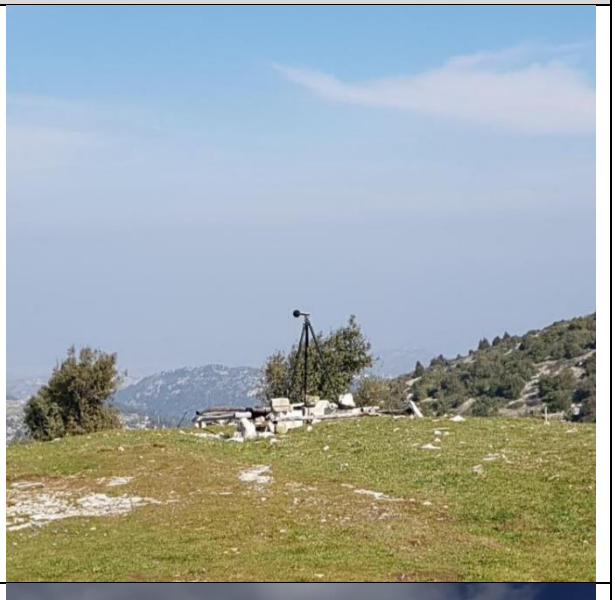
Baseline noise measurements between 12th and 25th of February 2019. Two (2) locations were chosen for the measurement campaign: one in SA and the other in LWP. The coordinates, photos and details of the monitoring locations/campaign are presented in ***Table 1*** and shown in **Figure 2**. Noise was measured for an interrupted period of 48 hours at each location as per the IFC guidelines.

The noise measurements were made by a class 1 Sound Level Meter. The Type 1 sound level meter used complies with the latest IEC standards and American National Standards Institute (ANSI). It was factory-calibrated in 2018. It was also calibrated before and after each measurement according to the manufacturer's guidelines.

Meteorological data was acquired from the nearest meteorological station operated by SA. Wind speed was measured at 40.4 m height. The following formula was used to calculate the wind speed at 10 m height (Institute of Acoustics, 2014) with 0.05 being the standard ground roughness length.

$$WS_{10m} = WS_{40.4m} \times \frac{\ln(10/0.05)}{\ln(40.4/0.05)}$$

Table 1. *Details of the Noise Monitoring Locations/Campaign*

Monitoring Location	Coordinates	Details of The Monitoring Campaign	Photos
NM SA - IP34	Zone 37S/ 34.527319°N, 36.321035°E	Start date: 2/12/2019 8h40 End date: 2/14/2019 8h50 Period 48.16 hours Height: 1.5 m above ground	
NM LWP - IP73	Zone 37S/ 34.473917°N, 36.268675°E	Start date: 2/23/2019 16h50 End date: 2/25/2019 17h50 Period 49 hours Height: 1.5 m above ground	

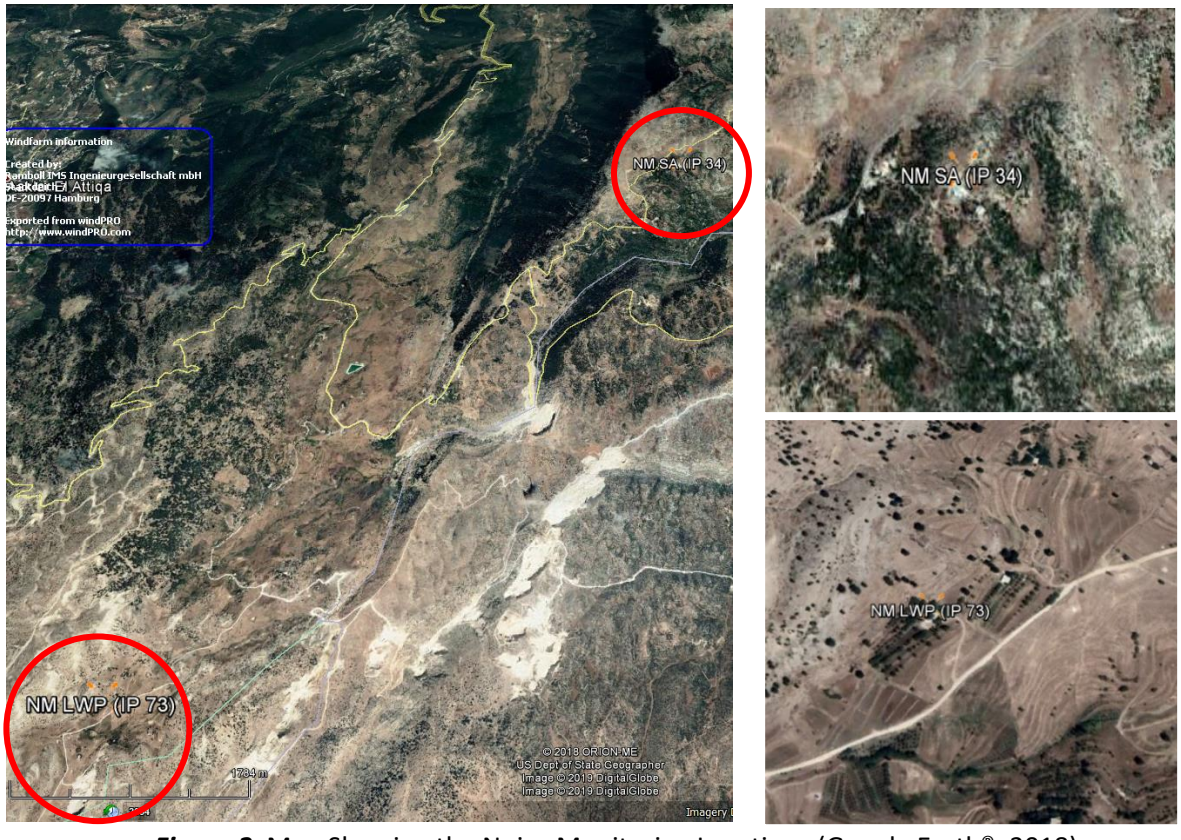


Figure 2. Map Showing the Noise Monitoring Locations (Google Earth®, 2018)

III. Baseline Results

A summary of the 10-min baseline noise levels is provided in ***Table 2*** and ***Table 3.***

Table 2. *Summary of Measured Baseline Noise Levels – 10 min Data/WS Measured at 40.4 m*

IP 34 – wind speed measured at 40.4 m												
	0<WS<1	**1<WS<2**	**2<WS<3**	**3<WS<4**	**4<WS<5**	**5<WS<6**	**6<WS<7**	**7<WS<8**	**8<WS<9**	**9<WS<10**	**10<WS<11**	**11<WS<12**
Count	2	20	41	47	63	36	25	28	21	4	1	1
Wind speed (m/s)	0.96	1.54	2.58	3.54	4.48	5.53	6.46	7.51	8.53	9.31	10.18	11.12
Temperature (°C)	6.49	5.74	5.23	6.17	5.83	6.72	7.59	7.15	8.12	8.39	7.50	8.25
Wind direction (°)	148.02	144.76	113.78	94.61	151.84	131.72	129.82	137.16	150.97	158.04	130.30	150.20
Humidity (%)	44.59	61.69	66.39	70.91	81.27	75.29	62.22	68.34	51.91	50.23	58.53	54.10
Air pressure (mbar)	628.91	629.79	629.34	633.42	634.76	633.44	634.07	632.74	632.23	632.41	631.53	632.13
Leq - 10 min daytime	-	36.90	35.37	37.13	36.77	36.65	40.79	37.41	46.35	46.66	-	-
LA90 - 10 min daytime	-	34.23	32.92	34.46	34.17	33.76	37.95	34.76	42.79	43.16	-	-
Leq - 10 min nighttime	30.93	30.96	31.01	32.38	32.98	34.81	40.87	46.12	47.31	47.40	50.05	47.82
LA90 - 10 min nighttime	29.56	28.72	29.20	30.17	30.43	32.49	37.77	42.37	43.44	43.70	45.05	45.37
IP73 – wind speed measured at 40.4 m												
	0<WS<1	**1<WS<2**	**2<WS<3**	**3<WS<4**	**4<WS<5**	**5<WS<6**	**6<WS<7**	**7<WS<8**	**8<WS<9**	**9<WS<10**	**10<WS<11**	**11<WS<12**
Count	56	84	55	28	11	8	6	14	18	9	5	0
Wind speed (m/s)	0.66	1.52	2.42	3.4	4.37	5.54	6.51	7.53	8.42	9.33	10.44	0
Temperature (°C)	5.31	4.69	4.61	5.03	4.77	4.56	2.92	4.35	3.79	2.79	2.16	0
Wind direction (°)	320.71	305.37	306.93	240.06	189.34	161.05	149.78	162.73	150.68	144.12	144.13	0
Humidity (%)	56.64	71.68	75.59	66.63	64.36	70.57	91.43	74.06	89.16	97.5	99.99	0
Air pressure (mbar)	848.4	848.15	848.34	848.72	848.62	849.14	848.77	848.86	849.04	848.77	848.59	0
Leq - 10 min daytime	32.86	33.16	33.07	35.52	36.64	32.62	42.1	45.41	38.61	47.67	49.75	-

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LA90 - 10 min daytime	31.13	31.03	30.95	33	33.83	30.95	40.15	42.06	36.05	44.83	46.78	-
Leq - 10 min nighttime	30.73	32.53	33.69	33.07	34	34.63	34.8	39.15	39.7	42.28	40	-
LA90 - 10 min nighttime	29.22	30.82	31.70	31.25	32.05	32.14	32.34	36.35	36.77	39.22	37.8	-

CA

Table 3. *Summary of Baseline Noise Levels – 10 min data/WS corrected to 10 m*

IP 34 – wind speed corrected to 10 m									
	0<WS<1	**1<WS<2**	**2<WS<3**	**3<WS<4**	**4<WS<5**	**5<WS<6**	**6<WS<7**	**7<WS<8**	**8<WS<9**
Count	6	34	56	77	43	34	27	10	2
Wind speed (m/s)	0.85	1.58	2.49	3.46	4.45	5.49	6.42	7.19	8.43
Temperature (°C)	5.41	5.51	5.72	5.96	6.78	7.64	7.50	8.18	7.88
Wind direction (°)	150.80	122.20	107.04	132.27	130.58	133.17	147.00	151.40	140.25
Humidity (%)	59.32	64.78	68.62	79.18	73.27	63.79	60.25	52.39	56.32
Air pressure (mbar)	628.64	629.62	631.34	634.84	633.29	634.30	631.80	632.23	631.83
Leq - 10 min daytime	36.78	36.67	35.83	36.94	36.97	39.02	43.22	47.07	-
LA90 - 10 min daytime	34.68	34.03	33.28	34.31	34.12	36.32	39.85	43.52	-
Leq - 10 min nighttime	31.46	30.97	31.72	32.61	35.37	43.81	46.75	47.94	48.94
LA90 - 10 min nighttime	29.22	29.05	29.70	30.16	32.92	40.57	42.88	43.83	45.21
IP73 – wind speed corrected to 10 m									
	0<WS<1	**1<WS<2**	**2<WS<3**	**3<WS<4**	**4<WS<5**	**5<WS<6**	**6<WS<7**	**7<WS<8**	**8<WS<9**
Count	77	98	42	17	10	12	21	12	5
Wind speed (m/s)	0.63	1.47	2.39	3.33	4.47	5.63	6.47	7.31	8.26
Temperature (°C)	5.24	4.52	5.01	4.81	4.09	4.17	3.86	3.03	2.16
Wind direction (°)	314.93	310.88	270.45	193.35	158.10	162.29	152.91	144.61	144.13
Humidity (%)	59.29	75.03	69.86	63.04	76.46	73.42	87.36	96.03	99.99
Air pressure (mbar)	848.40	848.09	848.71	848.69	849.06	848.81	848.97	848.88	848.59
Leq - 10 min daytime	33.07	33.21	33.22	37	32.62	45.33	40.71	44.6	49.75
LA90 - 10 min daytime	31.23	31.01	31.16	34.22	30.95	42.27	37.65	42.25	46.68
Leq - 10 min nighttime	31.16	33.23	32.99	34.45	34.4	35.7	39.64	41.8	40
LA90 - 10 min nighttime	29.55	31.33	31.26	32.59	32.15	32.90	36.59	38.96	37.8

CA

References

Institute of Acoustics (2014). Supplementary guidance note 4: wind shear, page 5.

Appendix A – Raw Data for IP34

Date/local time	Leq - 10 min	L90 – 10 min	Wind speed (m/s) at 40.4 m	Wind speed (m/s) at 10 m	Wind direction (°)	Humidity (%)	Temperature (°C)	Air pressure (mbar)
2/12/2019 8:50	37.81	35.09	3.54	2.80	281.55	78.30	6.63	641.76
2/12/2019 9:00	39.76	36.77	4.14	3.28	296.79	78.25	6.56	641.77
2/12/2019 9:10	38.24	35.60	3.86	3.05	286.59	79.95	6.50	641.10
2/12/2019 9:20	40.24	37.21	4.51	3.57	295.99	83.11	6.48	641.30
2/12/2019 9:30	39.65	36.86	3.95	3.13	298.00	87.67	5.96	640.72
2/12/2019 9:40	40.62	37.68	4.41	3.49	287.95	87.72	6.11	640.75
2/12/2019 9:50	37.58	34.82	4.66	3.69	278.80	84.89	6.42	641.40
2/12/2019 10:00	37.75	36.98	4.73	3.74	276.70	82.05	6.76	641.74
2/12/2019 10:10	36.60	33.60	4.88	3.86	283.09	82.46	6.97	641.77
2/12/2019 10:20	37.84	35.06	4.88	3.86	291.68	89.81	6.15	640.60
2/12/2019 10:30	37.04	34.63	4.45	3.52	293.06	93.52	5.83	639.18
2/12/2019 10:40	36.10	33.45	3.41	2.70	292.29	95.98	5.68	635.58
2/12/2019 10:50	38.46	35.64	4.15	3.28	278.12	98.01	5.49	634.34
2/12/2019 11:00	38.20	35.85	4.84	3.83	277.29	98.94	5.45	635.09
2/12/2019 11:10	35.93	33.69	3.71	2.94	283.64	99.72	5.37	635.02
2/12/2019 11:20	37.03	34.32	4.17	3.30	277.92	99.93	5.34	633.57
2/12/2019 11:30	38.61	35.74	4.81	3.81	284.23	99.98	5.30	633.87
2/12/2019 11:40	38.46	35.62	4.22	3.34	274.45	100.00	5.27	634.12
2/12/2019 11:50	37.62	34.86	4.63	3.66	281.82	100.00	5.35	636.54
2/12/2019 12:00	39.84	34.86	4.93	3.90	289.85	100.00	5.44	633.21
2/12/2019 12:10	38.86	34.97	4.13	3.27	287.87	100.00	5.28	632.58
2/12/2019 12:20	35.61	33.27	4.89	3.87	273.16	100.00	5.15	632.27
2/12/2019 12:30	35.76	33.65	4.64	3.67	279.75	100.00	5.10	632.13
2/12/2019 12:40	39.33	35.96	5.25	4.16	277.98	100.00	4.85	631.77
2/12/2019 12:50	36.80	34.20	4.93	3.90	277.93	100.00	4.47	631.42
2/12/2019 13:00	35.56	33.04	4.43	3.51	267.85	100.00	4.30	631.42
2/12/2019 13:10	35.65	33.08	4.77	3.78	277.12	100.00	4.20	631.55

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2/12/2019 13:20	34.47	32.05	4.19	3.32	277.09	100.00	4.20	631.55
2/12/2019 13:30	36.69	34.03	3.22	2.55	276.65	100.00	4.27	631.41
2/12/2019 13:40	37.90	35.90	2.74	2.17	281.91	100.00	4.32	631.27
2/12/2019 13:50	36.84	34.15	4.41	3.49	286.55	100.00	4.37	631.17
2/12/2019 14:00	37.97	35.17	4.86	3.85	279.07	100.00	4.37	631.07
2/12/2019 14:10	41.29	38.20	3.81	3.02	275.37	100.00	4.39	631.04
2/12/2019 14:20	35.27	32.74	4.63	3.66	277.07	100.00	4.36	630.99
2/12/2019 14:30	37.87	36.12	3.66	2.90	268.28	100.00	4.34	630.94
2/12/2019 14:40	34.33	32.50	3.50	2.77	274.48	100.00	4.35	630.88
2/12/2019 14:50	33.71	32.80	3.71	2.94	272.10	100.00	4.34	630.81
2/12/2019 15:00	33.52	31.63	2.92	2.31	272.15	100.00	4.35	630.70
2/12/2019 15:10	31.24	28.12	3.12	2.47	264.92	100.00	4.36	630.67
2/12/2019 15:20	35.87	32.28	3.03	2.40	259.61	100.00	4.29	630.60
2/12/2019 15:30	29.86	27.67	2.98	2.36	255.85	100.00	4.28	630.52
2/12/2019 15:40	35.86	33.84	2.68	2.12	254.32	100.00	4.27	630.48
2/12/2019 15:50	33.28	30.45	2.01	1.59	227.14	100.00	4.22	630.42
2/12/2019 16:00	36.44	35.18	4.22	3.34	157.19	100.00	4.51	630.22
2/12/2019 16:10	33.30	29.97	5.22	4.13	145.92	100.00	4.99	630.07
2/12/2019 16:20	28.86	26.35	5.54	4.38	142.58	100.00	5.14	630.09
2/12/2019 16:30	29.87	27.86	4.21	3.33	132.79	100.00	5.15	630.16
2/12/2019 16:40	34.69	32.29	4.58	3.62	127.91	99.99	5.12	630.13
2/12/2019 16:50	33.18	30.86	5.35	4.23	123.76	99.99	5.29	630.12
2/12/2019 17:00	32.45	30.28	5.70	4.51	131.62	100.00	5.35	630.19
2/12/2019 17:10	32.41	30.56	5.77	4.57	133.10	100.00	5.24	630.19
2/12/2019 17:20	31.61	29.50	7.82	6.19	126.20	100.00	5.30	630.18
2/12/2019 17:30	29.93	27.98	7.90	6.25	130.64	100.00	5.29	630.20
2/12/2019 17:40	31.03	28.97	7.30	5.78	133.94	100.00	5.15	630.15
2/12/2019 17:50	32.81	29.60	7.61	6.02	133.36	100.00	5.10	630.10
2/12/2019 18:00	32.35	30.68	7.23	5.72	137.02	100.00	4.98	630.05
2/12/2019 18:10	33.66	32.80	7.72	6.11	140.10	100.00	4.91	629.98

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2/12/2019 18:20	33.43	31.60	7.31	5.79	141.40	100.00	4.90	629.95
2/12/2019 18:30	33.55	31.25	7.25	5.74	143.03	100.00	4.90	629.89
2/12/2019 18:40	33.29	30.25	6.74	5.33	142.39	100.00	4.88	629.86
2/12/2019 18:50	35.49	31.80	5.84	4.62	137.97	100.00	4.85	629.81
2/12/2019 19:00	37.61	34.55	5.62	4.45	141.33	100.00	4.85	629.75
2/12/2019 19:10	40.29	37.62	5.39	4.27	137.47	100.00	4.96	629.76
2/12/2019 19:20	39.52	36.80	5.94	4.70	138.64	100.00	5.20	629.78
2/12/2019 19:30	41.98	38.89	5.64	4.46	138.68	100.00	5.32	629.83
2/12/2019 19:40	42.14	38.93	5.36	4.24	139.98	99.25	5.43	629.83
2/12/2019 19:50	43.89	40.50	5.36	4.24	145.63	94.77	5.61	629.83
2/12/2019 20:00	43.87	39.87	3.99	3.16	137.16	87.15	5.75	629.78
2/12/2019 20:10	42.89	39.69	1.74	1.38	130.87	82.74	5.48	629.57
2/12/2019 20:20	39.96	37.90	1.17	0.93	136.40	80.31	5.37	629.19
2/12/2019 20:30	38.17	35.35	1.30	1.03	156.24	78.44	5.24	628.83
2/12/2019 20:40	36.92	34.22	2.75	2.18	150.11	75.35	5.42	628.54
2/12/2019 20:50	34.36	31.63	2.01	1.59	100.10	78.30	5.28	628.59
2/12/2019 21:00	36.32	33.89	2.31	1.83	104.53	81.46	4.87	628.72
2/12/2019 21:10	35.89	33.89	2.19	1.73	116.59	81.52	4.79	628.72
2/12/2019 21:20	36.28	34.60	3.52	2.79	143.34	80.87	4.90	628.73
2/12/2019 21:30	33.32	31.65	4.67	3.70	139.74	75.81	5.65	628.82
2/12/2019 21:40	29.95	29.65	4.78	3.78	139.11	75.60	5.52	629.02
2/12/2019 21:50	29.47	27.56	4.33	3.43	144.70	75.37	5.43	629.16
2/12/2019 22:00	29.26	27.33	4.42	3.50	157.10	77.07	5.17	629.13
2/12/2019 22:10	29.13	27.96	5.65	4.47	164.32	73.19	5.31	629.03
2/12/2019 22:20	30.78	28.90	5.78	4.57	171.46	63.01	5.82	629.05
2/12/2019 22:30	29.85	27.68	5.29	4.19	181.21	56.39	6.26	629.12
2/12/2019 22:40	30.65	29.58	2.72	2.15	213.37	49.11	6.41	629.10
2/12/2019 22:50	29.89	29.54	1.89	1.50	199.07	43.49	6.44	628.76
2/12/2019 23:00	29.93	27.95	1.87	1.48	216.49	44.19	6.37	628.47
2/12/2019 23:10	30.82	28.77	2.09	1.65	208.45	43.43	6.53	628.51

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2/12/2019 23:20	32.28	30.26	1.61	1.27	192.92	42.85	6.60	628.63
2/12/2019 23:30	31.55	29.35	1.01	0.80	200.48	41.82	6.59	628.87
2/12/2019 23:40	31.63	28.47	1.00	0.79	212.19	43.64	6.48	628.81
2/12/2019 23:50	32.33	30.10	1.32	1.04	174.10	45.27	6.47	628.76
2/13/2019 0:00	31.72	29.50	1.18	0.93	118.07	44.62	6.60	628.96
2/13/2019 0:10	30.83	28.45	1.59	1.26	116.86	45.47	6.58	629.11
2/13/2019 0:20	29.98	27.98	1.45	1.15	131.69	45.85	6.54	629.08
2/13/2019 0:30	30.93	29.56	0.92	0.73	83.84	45.54	6.49	629.01
2/13/2019 0:40	30.65	27.59	1.81	1.43	68.09	47.08	6.23	628.93
2/13/2019 0:50	32.04	29.84	2.71	2.14	87.35	50.00	5.95	628.91
2/13/2019 1:00	31.34	28.60	2.20	1.74	95.97	51.67	5.83	628.84
2/13/2019 1:10	29.21	27.66	2.42	1.92	93.40	53.79	5.79	628.60
2/13/2019 1:20	29.49	27.54	2.55	2.02	93.44	57.23	5.74	628.27
2/13/2019 1:30	30.33	28.97	2.48	1.96	105.65	53.30	5.54	628.05
2/13/2019 1:40	29.91	27.98	2.62	2.07	142.35	46.67	5.68	627.85
2/13/2019 1:50	30.19	28.19	2.74	2.17	133.85	42.28	6.26	627.98
2/13/2019 2:00	30.53	28.40	2.51	1.99	120.96	43.38	6.31	628.42
2/13/2019 2:10	29.43	27.65	2.67	2.11	124.71	43.30	6.37	628.57
2/13/2019 2:20	28.58	26.72	2.82	2.23	120.80	42.39	6.63	628.81
2/13/2019 2:30	28.60	26.90	2.93	2.32	127.42	41.23	6.78	629.01
2/13/2019 2:40	29.46	28.63	2.42	1.92	155.95	39.04	6.99	629.13
2/13/2019 2:50	29.73	26.54	1.33	1.05	142.14	37.95	7.18	629.24
2/13/2019 3:00	30.96	28.94	1.93	1.53	133.02	37.27	7.20	629.35
2/13/2019 3:10	31.02	30.64	2.34	1.85	117.80	36.58	7.28	629.46
2/13/2019 3:20	30.98	29.98	2.20	1.74	104.85	35.36	7.29	629.57
2/13/2019 3:30	30.81	29.79	2.80	2.22	90.83	34.65	7.41	629.67
2/13/2019 3:40	31.17	29.08	3.30	2.61	90.22	34.29	7.48	629.76
2/13/2019 3:50	31.12	29.60	3.44	2.72	86.58	33.24	7.57	629.78
2/13/2019 4:00	31.51	28.36	3.00	2.37	75.83	32.61	7.60	629.80
2/13/2019 4:10	31.32	29.18	2.71	2.14	78.10	32.72	7.45	629.75

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2/13/2019 4:20	31.80	29.50	2.87	2.27	72.34	32.20	7.38	629.79
2/13/2019 4:30	31.17	29.73	3.16	2.50	68.05	31.42	7.52	630.10
2/13/2019 4:40	30.37	28.70	3.30	2.61	79.04	32.46	7.54	630.41
2/13/2019 4:50	30.10	28.09	3.89	3.08	90.72	32.49	7.62	631.49
2/13/2019 5:00	30.15	28.50	3.64	2.88	94.93	32.04	7.76	632.26
2/13/2019 5:10	33.59	32.23	3.60	2.85	91.63	31.71	7.71	632.01
2/13/2019 5:20	30.99	28.89	3.93	3.11	124.93	30.74	7.77	631.84
2/13/2019 5:30	30.43	28.38	5.22	4.13	144.66	31.35	7.56	631.97
2/13/2019 5:40	31.11	28.96	4.61	3.65	142.97	30.49	7.69	633.01
2/13/2019 5:50	32.03	29.40	3.81	3.02	143.45	29.65	7.77	632.93
2/13/2019 6:00	31.85	28.60	3.19	2.52	114.84	28.08	8.27	633.82
2/13/2019 6:10	30.17	28.67	2.86	2.26	108.89	27.20	8.45	634.87
2/13/2019 6:20	32.24	30.50	2.81	2.22	108.22	26.63	8.52	635.50
2/13/2019 6:30	32.84	31.25	3.35	2.65	141.21	25.95	8.63	635.82
2/13/2019 6:40	32.18	29.69	4.27	3.38	149.91	26.12	8.52	636.14
2/13/2019 6:50	32.19	29.45	4.71	3.73	153.17	28.50	7.96	636.02
2/13/2019 7:00	32.09	29.62	4.02	3.18	158.38	30.10	7.62	637.98
2/13/2019 7:10	32.01	31.03	4.53	3.59	158.56	30.96	7.76	641.23
2/13/2019 7:20	32.94	29.65	5.20	4.12	156.84	32.71	8.21	643.18
2/13/2019 7:30	33.55	31.65	7.07	5.60	158.09	37.61	8.35	643.72
2/13/2019 7:40	35.02	33.50	6.40	5.07	162.79	43.51	8.57	644.15
2/13/2019 7:50	33.30	30.20	5.76	4.56	159.44	48.56	8.78	644.50
2/13/2019 8:00	33.52	30.50	5.86	4.64	153.19	53.82	8.48	644.40
2/13/2019 8:10	32.59	30.33	4.42	3.50	143.11	57.24	8.32	643.69
2/13/2019 8:20	33.92	30.25	4.76	3.77	133.59	60.23	8.34	643.70
2/13/2019 8:30	35.13	32.61	3.97	3.14	124.85	63.74	8.24	643.32
2/13/2019 8:40	33.80	31.42	3.32	2.63	125.84	64.92	8.09	643.10
2/13/2019 8:50	38.38	35.54	4.42	3.50	115.15	64.21	8.31	643.39
2/13/2019 9:00	39.91	36.91	4.36	3.45	109.36	66.02	8.10	643.12
2/13/2019 9:10	40.31	37.80	3.80	3.01	114.03	64.62	8.39	640.66

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2/13/2019 9:20	39.93	36.82	4.13	3.27	110.77	63.04	8.67	640.61
2/13/2019 9:30	37.18	33.56	4.19	3.32	85.08	71.00	8.03	640.58
2/13/2019 9:40	38.09	35.82	4.05	3.21	76.21	77.46	7.33	640.60
2/13/2019 9:50	40.29	37.69	4.04	3.20	72.37	80.38	7.13	640.72
2/13/2019 10:00	39.83	36.96	3.53	2.79	66.02	80.68	7.24	640.80
2/13/2019 10:10	38.77	35.80	3.83	3.03	67.11	78.90	7.36	640.97
2/13/2019 10:20	37.65	34.88	4.19	3.32	68.57	78.23	7.34	640.86
2/13/2019 10:30	37.83	35.06	4.23	3.35	79.83	78.40	7.44	640.58
2/13/2019 10:40	36.26	32.63	4.65	3.68	73.70	78.91	7.60	640.51
2/13/2019 10:50	38.90	36.01	5.34	4.23	69.78	81.48	7.49	640.43
2/13/2019 11:00	37.25	35.68	6.00	4.75	74.25	80.98	7.50	640.27
2/13/2019 11:10	32.36	30.20	6.55	5.18	78.93	81.10	7.45	640.21
2/13/2019 11:20	32.43	30.22	5.63	4.46	77.83	80.20	7.75	640.08
2/13/2019 11:30	35.21	32.86	5.34	4.23	72.21	78.96	7.99	640.16
2/13/2019 11:40	34.88	32.60	6.35	5.03	71.65	76.77	8.21	640.25
2/13/2019 11:50	36.04	34.65	6.72	5.32	77.29	75.87	8.32	640.26
2/13/2019 12:00	37.72	34.94	7.46	5.90	81.15	74.98	8.43	640.03
2/13/2019 12:10	36.72	34.70	7.56	5.98	77.62	74.31	8.59	639.88
2/13/2019 12:20	40.17	37.50	7.22	5.71	80.43	72.25	8.74	639.85
2/13/2019 12:30	41.14	38.50	6.67	5.28	83.97	69.44	8.93	639.75
2/13/2019 12:40	38.84	35.80	6.44	5.10	86.53	66.27	9.29	639.74
2/13/2019 12:50	35.35	31.90	5.86	4.64	88.24	63.53	9.57	639.81
2/13/2019 13:00	38.35	35.60	5.74	4.54	78.62	62.80	9.73	639.80
2/13/2019 13:10	41.27	36.89	5.97	4.72	78.55	62.20	9.84	639.78
2/13/2019 13:20	42.44	39.16	5.53	4.38	82.25	61.97	9.84	639.60
2/13/2019 13:30	41.65	38.48	4.68	3.70	82.28	60.58	9.92	639.47
2/13/2019 13:40	41.56	38.48	3.93	3.11	80.27	59.46	9.96	639.37
2/13/2019 13:50	40.43	37.92	3.31	2.62	77.29	58.19	10.09	639.31
2/13/2019 14:00	38.91	35.02	3.01	2.38	78.07	57.41	10.16	639.19
2/13/2019 14:10	47.49	42.74	3.02	2.39	75.43	57.52	10.11	639.15

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2/13/2019 14:20	48.04	45.20	2.52	1.99	77.58	57.68	10.11	638.99
2/13/2019 14:30	41.97	38.78	1.92	1.52	95.05	57.77	10.14	638.82
2/13/2019 14:40	34.97	32.45	1.87	1.48	133.96	58.63	10.20	638.58
2/13/2019 14:50	32.97	30.56	3.46	2.74	139.55	59.92	9.84	635.77
2/13/2019 15:00	32.97	30.67	3.52	2.79	134.37	63.51	9.25	634.65
2/13/2019 15:10	32.77	31.17	4.01	3.17	131.80	66.25	8.83	634.05
2/13/2019 15:20	29.60	27.60	3.85	3.05	133.00	65.51	8.58	633.70
2/13/2019 15:30	30.13	28.50	5.45	4.31	143.91	62.45	8.54	633.45
2/13/2019 15:40	33.34	30.57	4.15	3.28	136.05	58.12	8.58	633.25
2/13/2019 15:50	30.00	28.20	5.14	4.07	149.66	52.54	8.43	633.02
2/13/2019 16:00	31.49	29.60	7.12	5.64	165.57	43.84	8.98	632.98
2/13/2019 16:10	32.24	30.42	7.28	5.76	166.37	42.28	8.98	633.06
2/13/2019 16:20	32.49	31.20	8.71	6.89	164.76	41.56	8.96	633.05
2/13/2019 16:30	37.69	34.53	9.05	7.16	162.78	41.15	8.97	633.07
2/13/2019 16:40	38.98	36.89	8.42	6.66	160.28	40.66	8.94	633.10
2/13/2019 16:50	39.77	36.89	8.21	6.50	172.21	39.93	9.00	633.04
2/13/2019 17:00	35.49	32.96	6.15	4.87	152.50	40.40	9.01	632.98
2/13/2019 17:10	41.74	38.65	7.53	5.96	134.80	41.28	8.78	632.82
2/13/2019 17:20	44.66	41.25	8.93	7.07	129.73	43.71	8.74	632.71
2/13/2019 17:30	46.94	43.54	6.00	4.75	136.09	46.66	8.40	632.74
2/13/2019 17:40	46.24	42.62	4.28	3.39	141.08	47.83	8.13	632.67
2/13/2019 17:50	44.97	42.80	6.92	5.48	143.95	47.17	8.14	632.49
2/13/2019 18:00	45.00	42.50	8.09	6.40	143.66	46.50	8.23	632.40
2/13/2019 18:10	42.87	39.86	6.32	5.00	145.58	46.86	8.14	632.32
2/13/2019 18:20	39.47	36.52	5.99	4.74	143.30	45.84	8.23	632.22
2/13/2019 18:30	46.66	42.90	6.37	5.04	144.65	45.96	8.28	632.23
2/13/2019 18:40	45.71	42.13	5.90	4.67	141.26	47.45	8.19	632.28
2/13/2019 18:50	45.07	42.68	7.08	5.60	142.61	47.94	8.23	632.26
2/13/2019 19:00	46.98	42.90	7.41	5.86	139.50	48.05	8.32	632.36
2/13/2019 19:10	47.14	43.42	8.61	6.81	141.56	48.04	8.42	632.50

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2/13/2019 19:20	46.36	41.80	7.45	5.90	142.39	48.61	8.39	632.55
2/13/2019 19:30	47.56	41.20	7.69	6.09	143.57	49.23	8.23	632.52
2/13/2019 19:40	48.13	44.18	8.24	6.52	142.11	50.46	8.16	632.43
2/13/2019 19:50	47.72	43.94	8.41	6.66	144.72	51.09	8.18	632.38
2/13/2019 20:00	50.20	46.86	7.88	6.24	141.75	51.81	8.10	632.36
2/13/2019 20:10	51.90	47.80	6.83	5.41	142.37	52.22	8.03	632.33
2/13/2019 20:20	54.26	48.23	6.77	5.36	144.80	52.39	7.99	632.22
2/13/2019 20:30	54.41	48.97	8.09	6.40	149.72	53.00	8.01	632.15
2/13/2019 20:40	50.99	46.96	9.55	7.56	156.49	53.01	8.21	632.17
2/13/2019 20:50	51.31	47.98	9.01	7.13	154.99	53.39	8.21	632.24
2/13/2019 21:00	50.88	46.87	8.95	7.08	151.91	54.53	8.05	632.20
2/13/2019 21:10	50.10	46.90	8.46	6.70	150.44	54.99	8.01	632.15
2/13/2019 21:20	49.24	44.32	8.78	6.95	154.54	55.28	7.96	632.12
2/13/2019 21:30	47.21	43.98	8.87	7.02	158.72	54.42	8.00	632.05
2/13/2019 21:40	50.01	45.01	8.10	6.41	160.36	53.05	8.15	632.03
2/13/2019 21:50	49.11	45.19	8.74	6.92	161.77	52.28	8.34	632.08
2/13/2019 22:00	46.73	43.05	8.94	7.08	160.30	52.55	8.34	632.14
2/13/2019 22:10	47.39	43.69	9.64	7.63	157.91	53.36	8.17	632.15
2/13/2019 22:20	47.82	45.37	11.12	8.80	150.20	54.10	8.25	632.12
2/13/2019 22:30	48.80	44.36	8.99	7.12	142.82	55.44	8.02	632.10
2/13/2019 22:40	44.15	39.74	6.72	5.32	143.74	57.69	7.69	632.02
2/13/2019 22:50	45.85	42.26	8.28	6.55	141.93	60.27	7.42	631.86
2/13/2019 23:00	46.49	42.84	7.79	6.17	134.42	61.54	7.25	631.72
2/13/2019 23:10	44.62	42.56	5.69	4.50	128.66	62.69	7.02	631.62
2/13/2019 23:20	47.52	43.85	7.77	6.15	133.34	63.70	6.90	631.51
2/13/2019 23:30	47.62	43.45	8.88	7.03	137.80	62.31	7.08	631.46
2/13/2019 23:40	47.86	44.08	6.97	5.52	139.04	61.68	7.14	631.44
2/13/2019 23:50	48.74	45.89	7.48	5.92	131.05	60.49	7.24	631.46
2/14/2019 0:00	50.05	45.05	10.18	8.06	130.30	58.53	7.50	631.53
2/14/2019 0:10	47.24	43.67	7.82	6.19	143.99	58.38	7.36	631.63

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2/14/2019 0:20	47.38	43.87	8.05	6.37	150.91	57.11	7.43	631.61
2/14/2019 0:30	47.72	43.90	7.91	6.26	149.46	56.26	7.53	631.60
2/14/2019 0:40	47.54	41.50	7.67	6.07	148.16	56.15	7.47	631.58
2/14/2019 0:50	45.03	42.10	6.46	5.11	147.98	56.80	7.31	631.49
2/14/2019 1:00	45.92	42.26	6.03	4.77	143.62	58.69	7.08	631.37
2/14/2019 1:10	49.86	45.56	6.32	5.00	147.32	61.90	6.99	631.26
2/14/2019 1:20	46.89	43.25	8.35	6.61	150.09	62.86	7.03	631.21
2/14/2019 1:30	44.12	40.78	7.76	6.14	155.52	62.58	6.93	631.19
2/14/2019 1:40	39.62	36.50	7.16	5.67	161.61	62.28	6.87	631.09
2/14/2019 1:50	36.59	33.58	6.27	4.96	171.73	60.22	7.34	631.07
2/14/2019 2:00	38.42	35.69	6.78	5.37	169.87	60.56	7.23	631.08
2/14/2019 2:10	36.80	35.00	6.54	5.18	170.67	58.89	7.46	631.12
2/14/2019 2:20	41.47	38.32	5.23	4.14	167.76	57.83	7.75	631.16
2/14/2019 2:30	42.23	38.17	5.23	4.14	146.99	59.84	7.35	631.05
2/14/2019 2:40	39.24	36.31	4.10	3.24	156.31	59.99	7.12	630.90
2/14/2019 2:50	31.94	29.57	4.50	3.56	95.36	66.30	6.61	630.67
2/14/2019 3:00	32.23	28.89	4.57	3.62	95.57	73.19	5.63	630.05
2/14/2019 3:10	32.11	29.87	6.14	4.86	92.09	76.27	5.26	629.58
2/14/2019 3:20	31.99	29.79	6.08	4.81	102.20	77.14	5.17	629.42
2/14/2019 3:30	31.26	29.35	5.16	4.08	104.53	78.52	4.95	629.15
2/14/2019 3:40	31.77	28.87	4.72	3.74	92.53	84.03	4.27	628.74
2/14/2019 3:50	33.99	31.56	2.95	2.33	290.50	85.55	4.22	628.48
2/14/2019 4:00	33.69	30.32	2.48	1.96	344.02	79.94	5.19	628.50
2/14/2019 4:10	36.29	33.66	3.70	2.93	30.93	84.36	4.23	628.35
2/14/2019 4:20	36.34	32.75	3.70	2.93	52.68	92.90	2.61	628.18
2/14/2019 4:30	32.71	30.70	3.86	3.05	63.67	96.77	1.71	628.13
2/14/2019 4:40	33.48	31.12	5.06	4.00	64.52	98.95	1.57	628.11
2/14/2019 4:50	31.86	29.68	4.96	3.93	69.56	99.86	1.55	628.10
2/14/2019 5:00	35.08	31.75	4.69	3.71	69.74	100.00	1.53	627.94
2/14/2019 5:10	33.00	32	4.79	3.79	72.86	100.00	1.52	628.01

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2/14/2019 5:20	32.97	29.86	4.41	3.49	85.35	100.00	1.51	628.12
2/14/2019 5:30	32.54	30.23	4.66	3.69	78.62	100.00	1.60	627.94
2/14/2019 5:40	33.49	31.14	4.00	3.17	81.00	100.00	1.61	627.90
2/14/2019 5:50	35.23	32.75	3.33	2.64	75.10	100.00	1.58	627.95
2/14/2019 6:00	32.46	31.36	2.18	1.73	53.07	100.00	1.59	627.74
2/14/2019 6:10	32.57	29.98	2.89	2.29	67.93	100.00	1.60	627.75
2/14/2019 6:20	32.08	29.48	3.14	2.49	17.25	100.00	1.82	627.81
2/14/2019 6:30	32.13	29.90	3.85	3.05	30.24	100.00	2.00	627.79
2/14/2019 6:40	32.77	31.26	2.58	2.04	43.99	100.00	1.84	627.78
2/14/2019 6:50	32.97	30.25	2.48	1.96	93.62	100.00	1.81	627.82
2/14/2019 7:00	33.47	31.60	3.59	2.84	156.18	100.00	1.73	627.55
2/14/2019 7:10	34.51	32.54	4.62	3.66	166.25	100.00	1.14	627.12
2/14/2019 7:20	33.88	32.70	3.74	2.96	131.25	100.00	1.22	626.85
2/14/2019 7:30	32.64	29.67	2.61	2.07	115.32	100.00	1.43	626.89
2/14/2019 7:40	33.66	30.29	2.99	2.37	232.97	100.00	1.30	626.97
2/14/2019 7:50	33.60	31.45	1.18	0.93	154.79	100.00	0.94	627.00
2/14/2019 8:00	32.96	31.07	2.50	1.98	129.66	100.00	1.25	627.18
2/14/2019 8:10	32.07	29.86	1.89	1.50	121.06	100.00	1.45	627.52
2/14/2019 8:20	33.96	31.56	2.39	1.89	73.79	100.00	1.58	628.13
2/14/2019 8:30	34.81	31.33	1.39	1.10	9.12	100.00	1.55	628.69
2/14/2019 8:40	34.98	31.28	3.20	2.53	283.14	100.00	1.47	628.88
2/14/2019 8:50	33.64	31.28	1.41	1.12	287.52	100.00	1.58	629.50

CA

Appendix B – Raw Data for IP73

CA

Date/Local time	Leq - 10 min	L90 – 10 min	Wind speed (m/s) at 40.4 m	Wind speed (m/s) at 10 m	Wind direction (°)	Humidity (%)	Temperature (°C)	Air pressure (mbar)
2/23/2019 17:00	33.80	31.24	1.59	1.26	256.94	71.04	4.06	846.47
2/23/2019 17:10	32.60	30.34	1.38	1.09	260.91	69.52	4.32	846.51
2/23/2019 17:20	33.90	32.90	0.72	0.57	273.95	67.79	4.86	846.61
2/23/2019 17:30	31.80	29.60	0.52	0.41	267.78	64.03	5.79	846.67
2/23/2019 17:40	33.60	31.24	0.45	0.36	270.09	61.96	6.16	846.72
2/23/2019 17:50	33.90	31.50	0.28	0.22	308.73	59.38	6.91	846.79
2/23/2019 18:00	31.50	29.50	0.79	0.63	308.63	59.72	6.87	846.89
2/23/2019 18:10	31.30	29.16	0.83	0.66	312.64	61.31	6.47	847.01
2/23/2019 18:20	29.90	27.56	1.20	0.95	345.27	62.72	6.16	847.00
2/23/2019 18:30	33.30	30.35	1.42	1.12	346.03	63.98	5.85	847.04
2/23/2019 18:40	33.40	31.07	1.34	1.06	335.66	65.08	5.75	847.10
2/23/2019 18:50	37.40	34.40	1.47	1.16	331.64	66.21	5.54	847.11
2/23/2019 19:00	31.90	30.87	2.15	1.70	346.53	70.77	4.74	847.16
2/23/2019 19:10	35.80	33.50	1.75	1.39	342.66	70.46	5.01	847.20
2/23/2019 19:20	33.80	31.40	2.15	1.70	13.06	70.15	5.09	847.21
2/23/2019 19:30	35.80	32.70	2.19	1.73	2.61	70.11	4.99	847.21
2/23/2019 19:40	30.90	28.00	2.60	2.06	305.85	74.25	4.28	847.25
2/23/2019 19:50	33.70	30.10	2.11	1.67	306.87	78.18	3.85	847.29
2/23/2019 20:00	30.20	28.90	1.78	1.41	330.39	80.14	3.67	847.32
2/23/2019 20:10	33.10	30.10	1.74	1.38	321.82	77.24	4.12	847.39
2/23/2019 20:20	30.90	28.60	2.16	1.71	0.84	78.33	4.35	847.45
2/23/2019 20:30	33.90	30.51	3.50	2.77	357.24	83.34	3.91	847.47
2/23/2019 20:40	32.30	30.03	2.81	2.22	323.04	87.33	3.37	847.47
2/23/2019 20:50	31.80	30.60	2.13	1.69	297.78	87.71	3.27	847.43
2/23/2019 21:00	33.60	31.20	1.67	1.32	308.29	89.17	3.44	847.45
2/23/2019 21:10	32.50	30.50	1.85	1.46	10.48	90.90	3.71	847.45
2/23/2019 21:20	39.40	34.80	2.23	1.76	352.31	92.54	3.19	847.37
2/23/2019 21:30	32.90	30.50	2.19	1.73	344.82	94.17	3.37	847.34

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2/23/2019 21:40	32.10	29.63	1.94	1.54	351.87	94.31	3.26	847.32
2/23/2019 21:50	33.70	31.56	1.69	1.34	322.99	94.84	3.12	847.29
2/23/2019 22:00	33.00	30.70	1.51	1.20	345.17	95.13	3.29	847.30
2/23/2019 22:10	31.20	29.03	2.03	1.61	356.68	94.09	3.30	847.26
2/23/2019 22:20	33.70	32.10	2.20	1.74	354.63	92.47	3.27	847.24
2/23/2019 22:30	35.40	32.68	2.07	1.64	338.40	93.30	3.31	847.24
2/23/2019 22:40	34.40	31.22	1.95	1.54	315.29	94.80	3.09	847.26
2/23/2019 22:50	33.30	30.95	1.90	1.50	323.73	95.45	3.00	847.29
2/23/2019 23:00	30.10	28.09	1.77	1.40	326.47	95.03	3.22	847.30
2/23/2019 23:10	33.40	31.40	1.93	1.53	328.36	93.75	3.60	847.31
2/23/2019 23:20	42.80	39.40	2.03	1.61	354.43	93.84	3.51	847.29
2/23/2019 23:30	30.90	27.81	2.26	1.79	351.07	94.10	3.38	847.29
2/23/2019 23:40	33.10	29.79	2.15	1.70	356.60	94.32	3.14	847.33
2/23/2019 23:50	36.80	34.80	1.68	1.33	351.69	94.99	3.10	847.38
2/24/2019 0:00	32.70	31.10	1.78	1.41	320.66	95.26	3.18	847.39
2/24/2019 0:10	37.10	35.20	1.77	1.40	321.85	95.87	3.25	847.38
2/24/2019 0:20	37.30	34.80	1.78	1.41	317.20	95.26	3.62	847.35
2/24/2019 0:30	39.90	36.80	2.52	1.99	320.08	94.78	3.43	847.35
2/24/2019 0:40	32.50	30.56	2.12	1.68	326.30	94.72	3.22	847.42
2/24/2019 0:50	33.10	30.15	1.97	1.56	336.46	95.06	3.24	847.44
2/24/2019 1:00	36.70	34.02	1.62	1.28	338.49	95.82	3.30	847.40
2/24/2019 1:10	37.80	35.05	1.66	1.31	345.19	95.92	3.41	847.41
2/24/2019 1:20	32.60	30.40	1.53	1.21	354.95	95.97	3.34	847.58
2/24/2019 1:30	30.60	28.54	0.75	0.59	6.27	95.61	3.58	847.74
2/24/2019 1:40	31.40	29.50	1.12	0.89	358.36	95.17	3.65	847.68
2/24/2019 1:50	31.60	29.60	0.72	0.57	22.46	95.23	3.70	847.50
2/24/2019 2:00	30.70	28.67	0.93	0.74	110.75	94.73	4.11	847.42
2/24/2019 2:10	31.30	29.68	1.47	1.16	0.80	93.74	4.36	847.46
2/24/2019 2:20	29.90	29.00	2.38	1.88	355.36	93.48	3.73	847.74
2/24/2019 2:30	28.90	28.50	1.38	1.09	351.90	95.97	3.27	847.96

CA

2/24/2019 2:40	30.10	29.00	0.91	0.72	37.31	96.73	3.28	848.16
2/24/2019 2:50	29.20	29.00	1.44	1.14	30.38	97.12	3.22	848.30
2/24/2019 3:00	30.20	29.50	2.74	2.17	302.60	96.66	2.81	848.43
2/24/2019 3:10	28.70	28.50	2.32	1.84	271.38	97.88	2.18	848.49
2/24/2019 3:20	31.20	30.00	1.79	1.42	244.86	98.32	2.07	848.48
2/24/2019 3:30	31.20	29.90	1.62	1.28	170.12	98.82	2.17	848.45
2/24/2019 3:40	32.00	30.50	1.94	1.54	357.60	98.26	2.28	848.55
2/24/2019 3:50	31.00	30.10	1.33	1.05	311.79	98.45	1.96	848.60
2/24/2019 4:00	29.90	29.40	1.64	1.30	161.26	99.27	2.13	848.62
2/24/2019 4:10	33.90	30.90	1.02	0.81	84.72	98.90	2.49	848.62
2/24/2019 4:20	31.00	29.50	1.13	0.89	75.86	98.39	2.58	848.61
2/24/2019 4:30	29.40	29.00	0.61	0.48	102.57	98.30	2.49	848.66
2/24/2019 4:40	32.60	30.80	1.25	0.99	93.63	98.41	2.40	848.76
2/24/2019 4:50	41.60	38.56	2.19	1.73	117.37	98.62	2.33	848.79
2/24/2019 5:00	41.20	38.65	2.84	2.25	118.33	98.91	2.27	848.85
2/24/2019 5:10	35.80	34.22	3.85	3.05	124.62	99.31	2.21	848.84
2/24/2019 5:20	33.40	32.50	4.71	3.73	128.10	99.61	2.27	848.88
2/24/2019 5:30	33.80	31.42	4.93	3.90	126.98	99.78	2.31	848.85
2/24/2019 5:40	34.80	32.25	5.54	4.38	136.26	100.00	2.30	848.74
2/24/2019 5:50	36.60	33.94	6.72	5.32	146.33	100.00	2.26	848.68
2/24/2019 6:00	34.20	32.78	6.09	4.82	151.28	100.00	2.15	848.73
2/24/2019 6:10	33.90	31.56	6.08	4.81	142.51	100.00	2.25	848.76
2/24/2019 6:20	34.50	32.09	6.67	5.28	145.94	100.00	2.31	848.69
2/24/2019 6:30	35.50	33.45	9.02	7.14	138.39	100.00	2.33	848.64
2/24/2019 6:40	40.00	38.50	9.95	7.87	137.02	100.00	2.30	848.58
2/24/2019 6:50	40.20	37.16	9.64	7.63	144.38	100.00	2.13	848.53
2/24/2019 7:00	40.00	37.80	10.39	8.22	140.65	100.00	2.09	848.51
2/24/2019 7:10	51.50	48.50	10.21	8.08	144.54	100.00	2.10	848.59
2/24/2019 7:20	53.00	48.90	10.58	8.37	143.22	100.00	2.17	848.60
2/24/2019 7:30	47.40	44.60	10.64	8.42	146.34	99.98	2.22	848.61

CA

2/24/2019 7:40	47.10	44.70	10.36	8.20	145.92	99.97	2.24	848.63
2/24/2019 7:50	50.50	46.80	9.59	7.59	144.65	99.83	2.27	848.65
2/24/2019 8:00	45.00	42.90	9.09	7.19	156.26	99.65	2.29	848.63
2/24/2019 8:10	47.50	44.80	9.03	7.15	159.63	97.99	2.98	848.50
2/24/2019 8:20	49.50	45.80	8.49	6.72	159.52	93.62	3.64	848.51
2/24/2019 8:30	34.60	32.67	8.29	6.56	162.37	91.08	3.85	848.55
2/24/2019 8:40	41.80	39.50	7.83	6.20	160.72	88.17	4.04	848.47
2/24/2019 8:50	50.20	46.18	8.13	6.43	160.84	85.43	4.16	848.47
2/24/2019 9:00	50.60	46.28	7.72	6.11	159.51	81.93	4.14	848.42
2/24/2019 9:10	33.30	30.20	8.10	6.41	161.82	76.20	4.05	848.42
2/24/2019 9:20	32.30	30.80	8.72	6.90	165.83	69.71	4.24	848.45
2/24/2019 9:30	41.20	36.80	7.97	6.31	167.68	62.64	4.64	848.46
2/24/2019 9:40	38.60	35.78	7.55	5.98	170.08	59.42	4.69	848.49
2/24/2019 9:50	48.00	46.20	7.25	5.74	172.86	58.89	4.72	848.49
2/24/2019 10:00	58.40	56.20	7.25	5.74	174.88	58.55	4.72	848.45
2/24/2019 10:10	44.30	40.45	7.33	5.80	178.42	56.33	4.88	848.41
2/24/2019 10:20	42.10	40.15	6.77	5.36	174.62	54.76	4.95	848.45
2/24/2019 10:30	51.70	47.86	7.12	5.64	182.31	53.62	5.07	848.44
2/24/2019 10:40	36.40	34.45	5.58	4.42	189.39	53.14	5.06	848.50
2/24/2019 10:50	33.20	30.80	3.82	3.02	203.49	55.21	4.71	848.51
2/24/2019 11:00	46.60	42.68	3.97	3.14	213.26	55.60	4.74	848.55
2/24/2019 11:10	40.20	37.80	3.26	2.58	227.31	57.85	4.60	848.56
2/24/2019 11:20	31.60	29.60	2.76	2.18	233.84	57.67	4.62	848.50
2/24/2019 11:30	39.30	36.20	2.54	2.01	233.13	58.09	4.61	848.48
2/24/2019 11:40	36.40	34.68	1.16	0.92	281.75	60.29	4.54	848.29
2/24/2019 11:50	35.80	33.20	0.51	0.40	316.14	62.43	4.41	848.07
2/24/2019 12:00	38.30	35.70	0.86	0.68	109.79	62.53	4.15	847.95
2/24/2019 12:10	32.40	30.90	0.18	0.14	292.51	65.13	4.00	847.78
2/24/2019 12:20	35.60	33.70	0.80	0.63	123.55	65.13	3.89	847.62
2/24/2019 12:30	39.10	37.60	0.72	0.57	64.69	62.64	4.05	847.56

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2/24/2019 12:40	43.20	39.80	0.37	0.29	329.97	65.30	4.06	847.57
2/24/2019 12:50	31.70	29.50	0.52	0.41	332.89	65.98	4.09	847.63
2/24/2019 13:00	36.20	33.70	0.43	0.34	297.71	66.39	4.04	847.57
2/24/2019 13:10	42.20	38.16	1.17	0.93	262.32	66.69	4.11	847.55
2/24/2019 13:20	42.50	39.75	1.38	1.09	266.59	66.01	4.21	847.55
2/24/2019 13:30	43.00	39.78	1.64	1.30	264.09	65.64	4.26	847.54
2/24/2019 13:40	36.00	33.50	1.50	1.19	266.10	65.27	4.27	847.53
2/24/2019 13:50	33.60	31.24	1.55	1.23	277.83	65.24	4.28	847.52
2/24/2019 14:00	34.20	32.56	1.14	0.90	297.94	64.99	4.24	847.52
2/24/2019 14:10	33.40	31.40	1.13	0.89	238.84	65.10	4.16	847.54
2/24/2019 14:20	34.20	32.20	1.12	0.89	256.13	64.73	4.16	847.54
2/24/2019 14:30	30.80	29.50	0.85	0.67	287.19	64.07	4.20	847.56
2/24/2019 14:40	39.30	36.32	0.74	0.59	256.09	64.21	4.17	847.59
2/24/2019 14:50	27.70	27.00	0.90	0.71	264.80	64.77	4.13	847.59
2/24/2019 15:00	30.00	29.00	0.27	0.21	261.43	65.18	4.05	847.58
2/24/2019 15:10	38.90	36.20	0.98	0.78	163.08	65.49	3.73	847.57
2/24/2019 15:20	44.00	40.20	2.41	1.91	166.50	61.92	3.87	847.61
2/24/2019 15:30	34.40	30.96	1.71	1.35	215.94	58.58	4.13	847.60
2/24/2019 15:40	35.40	31.86	1.30	1.03	234.73	59.27	4.23	847.62
2/24/2019 15:50	32.80	30.20	3.35	2.65	175.40	57.99	4.25	847.59
2/24/2019 16:00	37.00	34.60	4.99	3.95	176.89	56.60	4.66	847.55
2/24/2019 16:10	44.90	42.20	4.38	3.47	179.88	55.58	4.87	847.54
2/24/2019 16:20	34.50	31.56	4.11	3.25	179.47	56.19	4.88	847.56
2/24/2019 16:30	35.10	32.90	3.10	2.45	180.88	57.30	4.84	847.70
2/24/2019 16:40	31.50	29.80	1.58	1.25	190.97	56.85	4.96	847.80
2/24/2019 16:50	37.10	34.64	3.24	2.56	176.66	57.00	4.72	847.92
2/24/2019 17:00	34.20	32.78	3.76	2.98	165.00	54.75	5.07	847.93
2/24/2019 17:10	34.70	32.45	4.03	3.19	166.56	52.63	5.90	848.22
2/24/2019 17:20	39.70	36.75	3.84	3.04	176.06	53.79	6.27	848.32
2/24/2019 17:30	33.80	31.56	1.82	1.44	171.44	53.19	6.74	848.48

CA

2/24/2019 17:40	31.80	29.90	1.18	0.93	344.88	52.97	7.02	848.48
2/24/2019 17:50	34.40	32.16	1.18	0.93	328.16	53.20	6.99	848.52
2/24/2019 18:00	35.80	33.24	1.02	0.81	313.00	54.05	6.98	848.55
2/24/2019 18:10	30.40	29.80	1.47	1.16	327.21	54.42	6.89	848.64
2/24/2019 18:20	29.20	28.90	1.59	1.26	347.19	55.51	6.89	848.72
2/24/2019 18:30	28.40	27.50	1.68	1.33	318.48	54.64	6.98	848.78
2/24/2019 18:40	28.70	27.60	1.71	1.35	301.02	54.31	6.88	848.77
2/24/2019 18:50	30.10	29.80	2.76	2.18	306.09	55.03	6.75	848.77
2/24/2019 19:00	32.70	30.42	2.69	2.13	314.77	56.70	6.42	848.77
2/24/2019 19:10	32.00	29.60	2.55	2.02	310.63	57.40	5.88	848.80
2/24/2019 19:20	32.30	30.25	1.17	0.93	284.25	58.24	5.57	848.83
2/24/2019 19:30	32.10	29.89	0.96	0.76	278.09	57.48	5.64	848.84
2/24/2019 19:40	31.30	29.15	1.21	0.96	307.60	59.72	5.61	848.86
2/24/2019 19:50	32.10	29.64	1.19	0.94	251.29	59.32	5.83	848.86
2/24/2019 20:00	32.90	29.61	1.56	1.23	226.51	59.38	6.26	848.86
2/24/2019 20:10	32.10	29.60	1.41	1.12	259.10	61.32	6.07	848.87
2/24/2019 20:20	27.80	27.20	0.83	0.66	278.11	63.06	5.74	848.88
2/24/2019 20:30	30.80	29.40	0.75	0.59	329.69	64.48	5.53	848.90
2/24/2019 20:40	30.40	29.50	0.62	0.49	23.54	64.50	5.67	848.89
2/24/2019 20:50	31.20	29.90	0.66	0.52	323.62	65.10	5.87	848.91
2/24/2019 21:00	32.80	30.25	1.03	0.82	301.14	65.74	5.99	848.89
2/24/2019 21:10	32.00	30.68	1.67	1.32	281.90	67.72	5.55	848.87
2/24/2019 21:20	31.70	30.45	2.15	1.70	282.66	70.94	5.20	848.90
2/24/2019 21:30	34.90	32.12	2.35	1.86	290.01	73.14	5.41	848.87
2/24/2019 21:40	31.90	30.45	2.41	1.91	294.27	75.43	5.78	848.85
2/24/2019 21:50	31.90	30.78	2.91	2.30	285.03	76.22	5.81	848.82
2/24/2019 22:00	32.30	31.70	2.98	2.36	278.74	77.49	5.43	848.83
2/24/2019 22:10	33.30	30.87	3.53	2.79	298.24	79.73	5.15	848.83
2/24/2019 22:20	33.70	30.33	3.00	2.37	315.33	80.05	5.00	848.84
2/24/2019 22:30	32.20	30.23	2.22	1.76	291.31	78.82	5.16	848.83

CA

2/24/2019 22:40	30.00	29.60	2.43	1.92	301.19	78.16	5.24	848.83
2/24/2019 22:50	37.00	34.60	2.60	2.06	304.06	77.76	5.26	848.83
2/24/2019 23:00	31.40	29.60	2.79	2.21	300.22	76.81	5.29	848.82
2/24/2019 23:10	36.40	33.64	2.16	1.71	324.61	75.59	5.57	848.80
2/24/2019 23:20	32.70	31.23	3.29	2.60	308.17	76.28	5.73	848.79
2/24/2019 23:30	31.90	30.80	2.70	2.14	304.37	77.16	5.43	848.80
2/24/2019 23:40	35.80	33.24	3.00	2.37	304.63	77.43	5.31	848.81
2/24/2019 23:50	33.10	30.78	2.86	2.26	308.83	79.32	5.22	848.84
2/25/2019 0:00	33.30	30.28	3.02	2.39	298.50	80.92	5.02	848.88
2/25/2019 0:10	31.10	29.89	3.06	2.42	288.41	81.77	4.99	848.86
2/25/2019 0:20	31.40	30.50	3.01	2.38	301.90	84.24	5.03	848.88
2/25/2019 0:30	30.30	29.68	3.34	2.64	314.20	85.82	5.00	848.89
2/25/2019 0:40	34.80	32.23	4.08	3.23	293.93	85.95	4.93	848.91
2/25/2019 0:50	36.00	34.23	3.09	2.45	293.16	85.62	4.93	848.93
2/25/2019 1:00	31.90	30.40	3.23	2.56	288.32	82.67	5.16	848.92
2/25/2019 1:10	34.50	32.80	2.28	1.80	284.98	80.45	5.23	848.89
2/25/2019 1:20	32.80	30.14	2.16	1.71	289.57	76.50	5.32	848.92
2/25/2019 1:30	31.60	30.20	2.22	1.76	310.21	78.24	5.24	848.98
2/25/2019 1:40	33.00	30.20	2.40	1.90	292.87	81.23	5.07	849.01
2/25/2019 1:50	32.20	30.90	1.49	1.18	279.59	82.45	5.02	848.99
2/25/2019 2:00	31.30	29.96	1.62	1.28	322.27	84.28	4.98	848.95
2/25/2019 2:10	30.70	29.40	1.07	0.85	322.33	88.05	4.85	848.93
2/25/2019 2:20	31.20	29.60	1.34	1.06	339.70	89.19	4.84	848.94
2/25/2019 2:30	30.80	29.80	1.25	0.99	315.81	90.05	4.79	849.05
2/25/2019 2:40	30.00	29.00	0.82	0.65	282.26	90.61	4.74	849.09
2/25/2019 2:50	30.30	29.70	0.46	0.36	192.38	90.90	4.90	849.07
2/25/2019 3:00	33.10	30.24	0.91	0.72	127.60	90.41	4.96	849.03
2/25/2019 3:10	30.80	30.00	1.61	1.27	141.60	87.95	4.75	849.03
2/25/2019 3:20	31.00	29.60	2.92	2.31	129.94	90.16	4.24	849.07
2/25/2019 3:30	31.50	30.10	3.01	2.38	155.46	92.01	3.75	849.14

CA

2/25/2019 3:40	30.00	29.70	2.94	2.33	152.33	85.96	3.98	849.17
2/25/2019 3:50	34.50	32.06	5.10	4.04	135.87	88.64	3.98	849.23
2/25/2019 4:00	34.60	32.10	5.49	4.34	138.07	92.84	3.65	849.28
2/25/2019 4:10	34.80	31.32	6.72	5.32	138.68	93.81	3.59	849.31
2/25/2019 4:20	43.00	39.45	8.02	6.35	138.61	93.56	3.69	849.23
2/25/2019 4:30	48.70	44.75	8.51	6.74	138.29	93.02	3.74	849.09
2/25/2019 4:40	48.40	44.58	9.22	7.30	139.03	92.83	3.68	849.04
2/25/2019 4:50	49.90	45.89	9.31	7.37	139.55	92.79	3.69	849.05
2/25/2019 5:00	44.60	42.10	8.95	7.08	141.76	93.13	3.74	849.10
2/25/2019 5:10	36.10	34.26	8.94	7.08	145.87	93.19	3.71	849.21
2/25/2019 5:20	36.40	33.40	8.24	6.52	146.78	91.89	3.82	849.25
2/25/2019 5:30	40.90	37.80	7.86	6.22	148.52	90.64	3.83	849.31
2/25/2019 5:40	39.80	37.15	7.83	6.20	146.97	89.71	3.88	849.45
2/25/2019 5:50	36.90	34.26	7.56	5.98	139.85	90.50	3.78	849.45
2/25/2019 6:00	36.80	34.00	8.19	6.48	133.24	92.82	3.54	849.35
2/25/2019 6:10	39.70	35.73	9.09	7.19	138.36	94.45	3.40	849.29
2/25/2019 6:20	37.40	34.66	8.81	6.97	148.98	95.06	3.41	849.23
2/25/2019 6:30	36.40	33.76	8.45	6.69	149.59	94.70	3.48	849.20
2/25/2019 6:40	37.60	33.84	8.25	6.53	150.83	93.43	3.49	849.27
2/25/2019 6:50	40.00	37.50	8.12	6.43	147.11	92.58	3.42	849.34
2/25/2019 7:00	39.00	36.20	7.68	6.08	153.43	91.29	3.49	849.33
2/25/2019 7:10	35.40	34.50	8.97	7.10	150.59	88.46	3.83	849.33
2/25/2019 7:20	33.80	31.42	8.21	6.50	156.42	85.15	4.06	849.32
2/25/2019 7:30	39.80	36.82	8.21	6.50	153.74	81.86	4.36	849.34
2/25/2019 7:40	40.30	36.27	7.36	5.82	158.85	78.42	4.47	849.39
2/25/2019 7:50	39.20	35.28	7.03	5.56	163.94	76.76	4.54	849.42
2/25/2019 8:00	34.40	31.65	5.70	4.51	163.63	70.24	4.93	849.42
2/25/2019 8:10	32.20	30.65	5.40	4.27	172.80	66.45	4.93	849.43
2/25/2019 8:20	36.80	32.44	4.57	3.62	167.92	56.97	5.19	849.34
2/25/2019 8:30	29.70	29.00	5.83	4.61	172.00	49.21	5.57	849.25

CA

2/25/2019 8:40	30.40	29.00	5.65	4.47	179.84	44.03	6.03	849.29
2/25/2019 8:50	36.30	32.50	3.43	2.71	202.38	42.56	5.96	849.28
2/25/2019 9:00	37.90	34.90	4.05	3.21	224.98	43.10	5.97	849.32
2/25/2019 9:10	43.00	39.70	3.60	2.85	229.85	45.76	5.87	849.32
2/25/2019 9:20	37.90	34.20	3.90	3.09	231.48	50.89	5.65	849.36
2/25/2019 9:30	35.30	32.70	4.00	3.17	238.85	51.38	5.68	849.33
2/25/2019 9:40	32.00	29.80	4.26	3.37	238.39	50.13	5.75	849.32
2/25/2019 9:50	30.50	29.80	3.97	3.14	232.21	48.88	5.82	849.31
2/25/2019 10:00	26.00	23.00	3.30	2.61	239.91	48.49	5.84	849.32
2/25/2019 10:10	30.80	29.20	3.23	2.56	250.65	48.84	5.85	849.33
2/25/2019 10:20	30.40	29.20	2.76	2.18	256.47	49.02	5.80	849.30
2/25/2019 10:30	33.40	31.20	2.28	1.80	262.55	49.05	5.76	849.30
2/25/2019 10:40	29.80	29.00	2.28	1.80	258.04	48.74	5.74	849.30
2/25/2019 10:50	31.20	29.00	2.70	2.14	259.87	49.90	5.71	849.30
2/25/2019 11:00	29.00	28.60	2.72	2.15	255.87	50.39	5.66	849.27
2/25/2019 11:10	30.90	27.81	2.02	1.60	268.52	51.28	5.57	849.23
2/25/2019 11:20	34.70	31.20	1.85	1.46	269.92	50.86	5.52	849.22
2/25/2019 11:30	29.00	26.90	1.73	1.37	259.25	50.44	5.54	849.18
2/25/2019 11:40	32.20	30.25	1.62	1.28	261.11	50.60	5.51	849.15
2/25/2019 11:50	29.50	29.10	1.35	1.07	267.80	50.35	5.50	849.12
2/25/2019 12:00	30.30	29.60	0.99	0.78	253.97	49.46	5.44	849.08
2/25/2019 12:10	29.60	27.90	0.61	0.48	261.24	48.99	5.38	849.05
2/25/2019 12:20	31.10	30.65	0.35	0.28	87.12	48.40	5.11	849.02
2/25/2019 12:30	30.70	30.10	0.27	0.21	91.42	46.59	5.19	849.01
2/25/2019 12:40	30.90	29.87	0.97	0.77	286.38	48.51	5.06	849.04
2/25/2019 12:50	29.80	27.69	1.99	1.57	268.99	53.46	5.18	849.06
2/25/2019 13:00	32.90	29.61	1.71	1.35	262.93	54.23	5.15	849.04
2/25/2019 13:10	31.30	29.70	1.50	1.19	256.64	52.66	5.15	849.05
2/25/2019 13:20	35.60	33.05	0.58	0.46	239.79	47.90	5.15	849.03
2/25/2019 13:30	30.00	29.20	0.58	0.46	90.06	45.64	4.96	849.03

CA

2/25/2019 13:40	26.70	25.90	0.49	0.39	74.50	44.86	5.19	849.03
2/25/2019 13:50	30.10	29.30	0.40	0.32	340.98	46.18	5.06	849.03
2/25/2019 14:00	34.50	31.05	0.59	0.47	319.08	46.76	5.07	849.04
2/25/2019 14:10	33.30	29.87	0.81	0.64	321.35	47.76	5.16	849.04
2/25/2019 14:20	30.90	29.80	0.92	0.73	312.18	49.24	5.19	849.05
2/25/2019 14:30	30.50	30.10	0.56	0.44	324.98	49.97	5.11	849.05
2/25/2019 14:40	30.20	29.60	0.76	0.60	358.31	48.51	5.06	849.06
2/25/2019 14:50	32.60	31.60	0.89	0.70	50.52	44.78	5.26	849.08
2/25/2019 15:00	33.30	31.50	2.42	1.92	120.92	44.42	5.44	849.08
2/25/2019 15:10	31.00	30.50	3.39	2.68	130.92	41.51	5.46	849.10
2/25/2019 15:20	29.90	29.00	1.47	1.16	213.17	19.12	6.19	849.11
2/25/2019 15:30	34.40	32.69	1.07	0.85	280.60	18.74	6.84	849.11
2/25/2019 15:40	30.20	30.00	0.38	0.30	279.85	21.62	6.64	849.10
2/25/2019 15:50	32.90	29.60	0.53	0.42	44.61	22.09	6.15	849.12
2/25/2019 16:00	35.10	32.56	0.97	0.77	140.18	19.41	6.23	849.14
2/25/2019 16:10	35.20	32.78	0.71	0.56	175.83	20.42	6.38	849.16
2/25/2019 16:20	30.80	30.00	0.06	0.05	281.85	21.66	6.30	849.19
2/25/2019 16:30	30.70	29.98	0.44	0.35	168.00	20.32	6.36	849.21
2/25/2019 16:40	30.50	29.63	1.22	0.97	135.08	18.21	7.03	849.21
2/25/2019 16:50	35.10	32.23	2.15	1.70	117.13	17.92	7.69	849.28
2/25/2019 17:00	33.40	31.40	1.93	1.53	83.98	18.01	8.20	849.31
2/25/2019 17:10	28.60	28.00	1.88	1.49	92.21	17.72	8.66	849.36
2/25/2019 17:20	35.00	33.60	1.92	1.52	110.08	17.91	8.85	849.38
2/25/2019 17:30	33.90	31.00	0.99	0.78	99.76	18.13	9.40	849.35
2/25/2019 17:40	34.40	31.96	0.78	0.62	87.51	17.40	10.65	849.38
2/25/2019 17:50	39.90	36.87	0.67	0.53	54.78	16.65	11.74	849.49

CA

ENVIRONMENT
& HEALTH

APPENDIX T
SHADOW FLICKER ASSESSMENT

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Calculated:
31.01.2019 12:16/3.2.737

SHADOW - Main Result

Calculation: LWP Vestas V150

Assumptions for shadow calculations

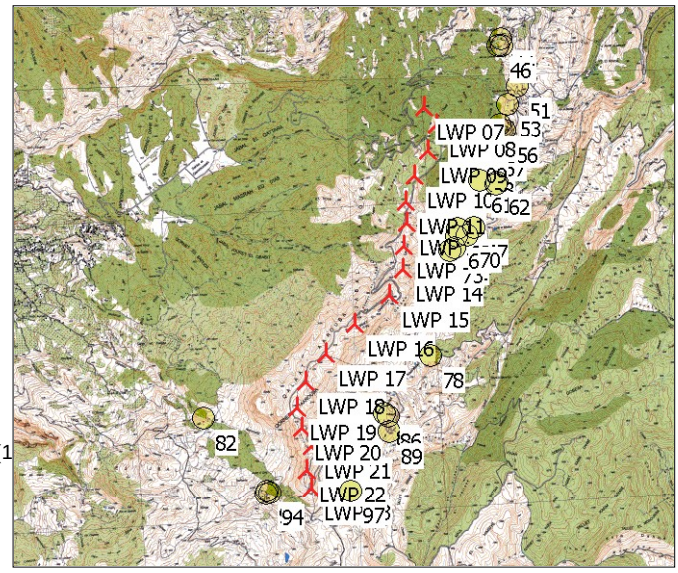
Maximum distance for influence
Calculate only when more than 20 % of sun is covered by the blade
Please look in WTG table

Minimum sun height over horizon for influence	3	°
Day step for calculation	1	days
Time step for calculation	1	minutes

The calculated times are "worst case" given by the following assumptions:
- The sun is shining all the day, from sunrise to sunset
- The rotor plane is always perpendicular to the line from the WTG to the sun
- The WTG is always operating

A ZVI (Zones of Visual Influence) calculation is performed before flicker calculation so non visible WTG do not contribute to calculated flicker values. A WTG will be visible if it is visible from any part of the receiver window. The ZVI calculation is based on the following assumptions:
Height contours used: Höhenraster-Objekt: 18-1-3019-ZB_EMDGrid_2.wpg (1
Obstacles used in calculation
Eye height for map: 1,5 m
Grid resolution: 1,0 m

All coordinates are in
Geo [deg]-WGS84



Scale 1:125.000
New WTG Shadow receptor

WTGs

	Longitude	Latitude	Z [m]	Row data/Description	WTG type Valid	Manufact.	Type-generator	Power, rated [kW]	Rotor diameter [m]	Hub height [m]	Shadow data Calculation distance [m]	RPM [RPM]
LWP 07	36,264865° E	34,495376° N	1.814,4	VESTAS V150-4.2 42...	Yes	VESTAS	V150-4.2-4.200	4.200	150,0	105,0	1.905	10,4
LWP 08	36,267003° E	34,492722° N	1.829,7	VESTAS V150-4.2 42...	Yes	VESTAS	V150-4.2-4.200	4.200	150,0	105,0	1.905	10,4
LWP 09	36,265293° E	34,488954° N	1.903,8	VESTAS V150-4.2 42...	Yes	VESTAS	V150-4.2-4.200	4.200	150,0	105,0	1.905	10,4
LWP 10	36,262879° E	34,485213° N	1.914,9	VESTAS V150-4.2 42...	Yes	VESTAS	V150-4.2-4.200	4.200	150,0	105,0	1.905	10,4
LWP 11	36,261147° E	34,481430° N	1.936,5	VESTAS V150-4.2 42...	Yes	VESTAS	V150-4.2-4.200	4.200	150,0	105,0	1.905	10,4
LWP 12	36,261248° E	34,478274° N	1.922,3	VESTAS V150-4.2 42...	Yes	VESTAS	V150-4.2-4.200	4.200	150,0	105,0	1.905	10,4
LWP 13	36,260583° E	34,474870° N	1.934,9	VESTAS V150-4.2 42...	Yes	VESTAS	V150-4.2-4.200	4.200	150,0	105,0	1.905	10,4
LWP 14	36,260211° E	34,471455° N	1.851,7	VESTAS V150-4.2 42...	Yes	VESTAS	V150-4.2-4.200	4.200	150,0	105,0	1.905	10,4
LWP 15	36,257625° E	34,467738° N	1.988,4	VESTAS V150-4.2 42...	Yes	VESTAS	V150-4.2-4.200	4.200	150,0	105,0	1.905	10,4
LWP 16	36,251352° E	34,463613° N	2.072,4	VESTAS V150-4.2 42...	Yes	VESTAS	V150-4.2-4.200	4.200	150,0	105,0	1.905	10,4
LWP 17	36,245957° E	34,459301° N	2.107,8	VESTAS V150-4.2 42...	Yes	VESTAS	V150-4.2-4.200	4.200	150,0	105,0	1.905	10,4
LWP 18	36,242165° E	34,455185° N	2.115,4	VESTAS V150-4.2 42...	Yes	VESTAS	V150-4.2-4.200	4.200	150,0	105,0	1.905	10,4
LWP 19	36,240424° E	34,451469° N	2.139,2	VESTAS V150-4.2 42...	Yes	VESTAS	V150-4.2-4.200	4.200	150,0	105,0	1.905	10,4
LWP 20	36,241245° E	34,448386° N	2.184,4	VESTAS V150-4.2 42...	Yes	VESTAS	V150-4.2-4.200	4.200	150,0	105,0	1.905	10,4
LWP 21	36,242901° E	34,445685° N	2.193,4	VESTAS V150-4.2 42...	Yes	VESTAS	V150-4.2-4.200	4.200	150,0	105,0	1.905	10,4
LWP 22	36,241779° E	34,442166° N	2.204,3	VESTAS V150-4.2 42...	Yes	VESTAS	V150-4.2-4.200	4.200	150,0	105,0	1.905	10,4
LWP 23	36,242651° E	34,439372° N	2.149,3	VESTAS V150-4.2 42...	Yes	VESTAS	V150-4.2-4.200	4.200	150,0	105,0	1.905	10,4

Shadow receptor-Input

No.	Name	Longitude	Latitude	Z [m]	Width [m]	Height [m]	Elevation a.g.l. [m]	Slope of window [°]	Direction mode	Eye height (ZVI) a.g.l. [m]
44	house	36,279070° E	34,505060° N	1.379,4	0,1	0,1	2,0	0,0	"Green house mode"	2,0
46	house	36,278525° E	34,504084° N	1.396,2	0,1	0,1	2,0	0,0	"Green house mode"	2,0
47	house	36,279277° E	34,504064° N	1.393,3	0,1	0,1	2,0	0,0	"Green house mode"	2,0
51	house	36,281704° E	34,498052° N	1.456,0	0,1	0,1	2,0	0,0	"Green house mode"	2,0
53	house	36,279899° E	34,495307° N	1.495,7	0,1	0,1	2,0	0,0	"Green house mode"	2,0
55	villa	36,278413° E	34,492443° N	1.554,1	0,1	0,1	2,0	0,0	"Green house mode"	2,0
56	villa	36,279303° E	34,491526° N	1.541,0	0,1	0,1	2,0	0,0	"Green house mode"	2,0
57	house	36,277015° E	34,489582° N	1.579,6	0,1	0,1	2,0	0,0	"Green house mode"	2,0
58	house	36,274699° E	34,486492° N	1.582,3	0,1	0,1	2,0	0,0	"Green house mode"	2,0
61	house	36,274565° E	34,484235° N	1.584,6	0,1	0,1	2,0	0,0	"Green house mode"	2,0
62	house	36,277658° E	34,483872° N	1.560,3	0,1	0,1	2,0	0,0	"Green house mode"	2,0
63	house	36,277386° E	34,483523° N	1.569,7	0,1	0,1	2,0	0,0	"Green house mode"	2,0
67	house	36,273214° E	34,477255° N	1.646,0	0,1	0,1	2,0	0,0	"Green house mode"	2,0

To be continued on next page...

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31.01.2019 12:16/3.2.737

SHADOW - Main Result

Calculation: LWP Vestas V150

...continued from previous page

No.	Name	Longitude	Latitude	Z [m]	Width [m]	Height [m]	Elevation a.g.l. [m]	Slope of window [°]	Direction mode	Eye height (ZVI) a.g.l. [m]
68	house	36,270268° E	34,477126° N	1.696,3	0,1	0,1	2,0	0,0	"Green house mode"	2,0
69	house	36,269975° E	34,476101° N	1.693,0	0,1	0,1	2,0	0,0	"Green house mode"	2,0
70	house	36,271890° E	34,476117° N	1.662,8	0,1	0,1	2,0	0,0	"Green house mode"	2,0
72	house	36,269694° E	34,474382° N	1.694,3	0,1	0,1	2,0	0,0	"Green house mode"	2,0
73	house	36,268675° E	34,473917° N	1.700,8	0,1	0,1	2,0	0,0	"Green house mode"	2,0
78	house	36,264729° E	34,458423° N	1.714,2	0,1	0,1	2,0	0,0	"Green house mode"	2,0
82	house	36,223728° E	34,450359° N	1.755,7	0,1	0,1	2,0	0,0	"Green house mode"	2,0
85	house	36,256086° E	34,450161° N	1.850,8	0,1	0,1	2,0	0,0	"Green house mode"	2,0
86	house	36,256820° E	34,449682° N	1.845,7	0,1	0,1	2,0	0,0	"Green house mode"	2,0
89	house	36,256862° E	34,447384° N	1.838,9	0,1	0,1	2,0	0,0	"Green house mode"	2,0
92	house	36,234578° E	34,439112° N	1.952,0	0,1	0,1	2,0	0,0	"Green house mode"	2,0
94	house	36,235096° E	34,438907° N	1.959,5	0,1	0,1	2,0	0,0	"Green house mode"	2,0
95	house	36,234483° E	34,438686° N	1.946,7	0,1	0,1	2,0	0,0	"Green house mode"	2,0
97	house	36,249680° E	34,438785° N	1.954,6	0,1	0,1	2,0	0,0	"Green house mode"	2,0

Calculation Results

Shadow receptor

No.	Name	Shadow, worst case: Shadow hours per year [h/year]	Shadow days per year [days/year]	Max shadow hours per day [h/day]
44	house	10:33	41	0:20
46	house	15:35	64	0:22
47	house	19:11	73	0:21
51	house	22:29	85	0:22
53	house	29:18	94	0:26
55	villa	58:17	164	0:31
56	villa	58:51	171	0:29
57	house	32:33	103	0:29
58	house	38:35	131	0:28
61	house	55:36	174	0:30
62	house	26:49	95	0:24
63	house	36:37	132	0:25
67	house	54:48	163	0:29
68	house	112:10	248	0:40
69	house	94:18	225	0:36
70	house	81:25	201	0:34
72	house	66:21	154	0:37
73	house	101:35	202	0:42
78	house	0:00	0	0:00
82	house	33:56	120	0:21
85	house	29:58	98	0:25
86	house	51:01	176	0:24
89	house	62:27	210	0:24
92	house	37:39	69	0:42
94	house	47:55	85	0:45
95	house	43:59	83	0:42
97	house	70:43	120	0:47

Total amount of flickering on the shadow receptors caused by each WTG

No.	Name	Worst case [h/year]
LWP 07	VESTAS V150-4.2 4200 150.0 !O! hub: 105,0 m (TOT: 180,0 m) (471)	75:30
LWP 08	VESTAS V150-4.2 4200 150.0 !O! hub: 105,0 m (TOT: 180,0 m) (472)	63:44
LWP 09	VESTAS V150-4.2 4200 150.0 !O! hub: 105,0 m (TOT: 180,0 m) (473)	49:18
LWP 10	VESTAS V150-4.2 4200 150.0 !O! hub: 105,0 m (TOT: 180,0 m) (474)	61:52
LWP 11	VESTAS V150-4.2 4200 150.0 !O! hub: 105,0 m (TOT: 180,0 m) (475)	36:40
LWP 12	VESTAS V150-4.2 4200 150.0 !O! hub: 105,0 m (TOT: 180,0 m) (476)	109:47
LWP 13	VESTAS V150-4.2 4200 150.0 !O! hub: 105,0 m (TOT: 180,0 m) (477)	143:45
LWP 14	VESTAS V150-4.2 4200 150.0 !O! hub: 105,0 m (TOT: 180,0 m) (478)	77:10
LWP 15	VESTAS V150-4.2 4200 150.0 !O! hub: 105,0 m (TOT: 180,0 m) (479)	50:42
LWP 16	VESTAS V150-4.2 4200 150.0 !O! hub: 105,0 m (TOT: 180,0 m) (480)	0:00

To be continued on next page...

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Calculated:
31.01.2019 12:16/3.2.737

SHADOW - Main Result

Calculation: LWP Vestas V150

...continued from previous page

No.	Name	Worst case [h/year]
LWP 17	VESTAS V150-4.2 4200 150.0 !O! hub: 105,0 m (TOT: 180,0 m) (481)	0:00
LWP 18	VESTAS V150-4.2 4200 150.0 !O! hub: 105,0 m (TOT: 180,0 m) (482)	18:17
LWP 19	VESTAS V150-4.2 4200 150.0 !O! hub: 105,0 m (TOT: 180,0 m) (483)	46:20
LWP 20	VESTAS V150-4.2 4200 150.0 !O! hub: 105,0 m (TOT: 180,0 m) (484)	30:27
LWP 21	VESTAS V150-4.2 4200 150.0 !O! hub: 105,0 m (TOT: 180,0 m) (485)	25:43
LWP 22	VESTAS V150-4.2 4200 150.0 !O! hub: 105,0 m (TOT: 180,0 m) (486)	16:46
LWP 23	VESTAS V150-4.2 4200 150.0 !O! hub: 105,0 m (TOT: 180,0 m) (487)	156:58

Total times in Receptor wise and WTG wise tables can differ, as a WTG can lead to flicker at 2 or more receptors simultaneously and/or receptors may receive flicker from 2 or more WTGs simultaneously.

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01.02.2019 09:30/3.2.737

SHADOW - Main Result

Calculation: LWP Nordex N149

Assumptions for shadow calculations

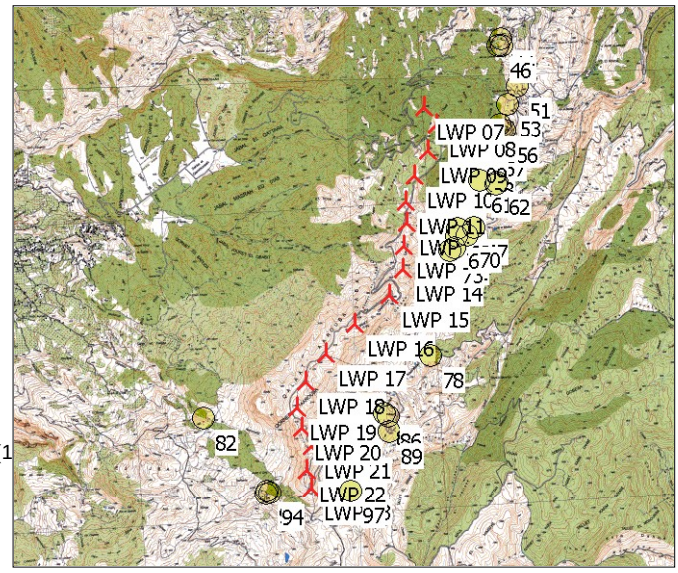
Maximum distance for influence
Calculate only when more than 20 % of sun is covered by the blade
Please look in WTG table

Minimum sun height over horizon for influence	3	°
Day step for calculation	1	days
Time step for calculation	1	minutes

The calculated times are "worst case" given by the following assumptions:
- The sun is shining all the day, from sunrise to sunset
- The rotor plane is always perpendicular to the line from the WTG to the sun
- The WTG is always operating

A ZVI (Zones of Visual Influence) calculation is performed before flicker calculation so non visible WTG do not contribute to calculated flicker values. A WTG will be visible if it is visible from any part of the receiver window. The ZVI calculation is based on the following assumptions:
Height contours used: Höhenraster-Objekt: 18-1-3019-ZB_EMDGrid_2.wpg (1
Obstacles used in calculation
Eye height for map: 1,5 m
Grid resolution: 1,0 m

All coordinates are in
Geo [deg]-WGS84



Scale 1:125.000
New WTG Shadow receptor

WTGs

	Longitude	Latitude	Z	Row data/Description	WTG type Valid	Manufact.	Type-generator	Power, rated	Rotor diameter	Hub height	Shadow data Calculation distance	RPM
			[m]					[kW]	[m]	[m]	[m]	[RPM]
LWP 07	36,264865° E	34,495376° N	1.814,4	NORDEX N149/4.0-4....	Yes	NORDEX	N149/4.0-4.5-4.500	4.500	149,0	105,0	1.809	10,7
LWP 08	36,267003° E	34,492722° N	1.829,7	NORDEX N149/4.0-4....	Yes	NORDEX	N149/4.0-4.5-4.500	4.500	149,0	105,0	1.809	10,7
LWP 09	36,265293° E	34,488954° N	1.903,8	NORDEX N149/4.0-4....	Yes	NORDEX	N149/4.0-4.5-4.500	4.500	149,0	105,0	1.809	10,7
LWP 10	36,262879° E	34,485213° N	1.914,9	NORDEX N149/4.0-4....	Yes	NORDEX	N149/4.0-4.5-4.500	4.500	149,0	105,0	1.809	10,7
LWP 11	36,261147° E	34,481430° N	1.936,5	NORDEX N149/4.0-4....	Yes	NORDEX	N149/4.0-4.5-4.500	4.500	149,0	105,0	1.809	10,7
LWP 12	36,261248° E	34,478274° N	1.922,3	NORDEX N149/4.0-4....	Yes	NORDEX	N149/4.0-4.5-4.500	4.500	149,0	105,0	1.809	10,7
LWP 13	36,260583° E	34,474870° N	1.934,9	NORDEX N149/4.0-4....	Yes	NORDEX	N149/4.0-4.5-4.500	4.500	149,0	105,0	1.809	10,7
LWP 14	36,260211° E	34,471455° N	1.851,7	NORDEX N149/4.0-4....	Yes	NORDEX	N149/4.0-4.5-4.500	4.500	149,0	105,0	1.809	10,7
LWP 15	36,257625° E	34,467738° N	1.988,4	NORDEX N149/4.0-4....	Yes	NORDEX	N149/4.0-4.5-4.500	4.500	149,0	105,0	1.809	10,7
LWP 16	36,251352° E	34,463613° N	2.072,4	NORDEX N149/4.0-4....	Yes	NORDEX	N149/4.0-4.5-4.500	4.500	149,0	105,0	1.809	10,7
LWP 17	36,245957° E	34,459301° N	2.107,8	NORDEX N149/4.0-4....	Yes	NORDEX	N149/4.0-4.5-4.500	4.500	149,0	105,0	1.809	10,7
LWP 18	36,242165° E	34,455185° N	2.115,4	NORDEX N149/4.0-4....	Yes	NORDEX	N149/4.0-4.5-4.500	4.500	149,0	105,0	1.809	10,7
LWP 19	36,240424° E	34,451469° N	2.139,2	NORDEX N149/4.0-4....	Yes	NORDEX	N149/4.0-4.5-4.500	4.500	149,0	105,0	1.809	10,7
LWP 20	36,241245° E	34,448386° N	2.184,4	NORDEX N149/4.0-4....	Yes	NORDEX	N149/4.0-4.5-4.500	4.500	149,0	105,0	1.809	10,7
LWP 21	36,242901° E	34,445685° N	2.193,4	NORDEX N149/4.0-4....	Yes	NORDEX	N149/4.0-4.5-4.500	4.500	149,0	105,0	1.809	10,7
LWP 22	36,241779° E	34,442166° N	2.204,3	NORDEX N149/4.0-4....	Yes	NORDEX	N149/4.0-4.5-4.500	4.500	149,0	105,0	1.809	10,7
LWP 23	36,242651° E	34,439372° N	2.149,3	NORDEX N149/4.0-4....	Yes	NORDEX	N149/4.0-4.5-4.500	4.500	149,0	105,0	1.809	10,7

Shadow receptor-Input

No.	Name	Longitude	Latitude	Z	Width	Height	Elevation a.g.l.	Slope of window	Direction mode	Eye height (ZVI) a.g.l.
				[m]	[m]	[m]	[m]	[°]		[m]
44	house	36,279070° E	34,505060° N	1.379,4	0,1	0,1	2,0	0,0	"Green house mode"	2,0
46	house	36,278525° E	34,504084° N	1.396,2	0,1	0,1	2,0	0,0	"Green house mode"	2,0
47	house	36,279277° E	34,504064° N	1.393,3	0,1	0,1	2,0	0,0	"Green house mode"	2,0
51	house	36,281704° E	34,498052° N	1.456,0	0,1	0,1	2,0	0,0	"Green house mode"	2,0
53	house	36,279899° E	34,495307° N	1.495,7	0,1	0,1	2,0	0,0	"Green house mode"	2,0
55	villa	36,278413° E	34,492443° N	1.554,1	0,1	0,1	2,0	0,0	"Green house mode"	2,0
56	villa	36,279303° E	34,491526° N	1.541,0	0,1	0,1	2,0	0,0	"Green house mode"	2,0
57	house	36,277015° E	34,489582° N	1.579,6	0,1	0,1	2,0	0,0	"Green house mode"	2,0
58	house	36,274699° E	34,486492° N	1.582,3	0,1	0,1	2,0	0,0	"Green house mode"	2,0
61	house	36,274565° E	34,484235° N	1.584,6	0,1	0,1	2,0	0,0	"Green house mode"	2,0
62	house	36,277658° E	34,483872° N	1.560,3	0,1	0,1	2,0	0,0	"Green house mode"	2,0
63	house	36,277386° E	34,483523° N	1.569,7	0,1	0,1	2,0	0,0	"Green house mode"	2,0
67	house	36,273214° E	34,477255° N	1.646,0	0,1	0,1	2,0	0,0	"Green house mode"	2,0
68	house	36,270268° E	34,477126° N	1.696,3	0,1	0,1	2,0	0,0	"Green house mode"	2,0

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SHADOW - Main Result

Calculation: LWP Nordex N149

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No.	Name	Longitude	Latitude	Z [m]	Width [m]	Height [m]	Elevation a.g.l. [m]	Slope of window [°]	Direction mode	Eye height (ZVI) a.g.l. [m]
69	house	36,269975° E	34,476101° N	1.693,0	0,1	0,1	2,0	0,0	"Green house mode"	2,0
70	house	36,271890° E	34,476117° N	1.662,8	0,1	0,1	2,0	0,0	"Green house mode"	2,0
72	house	36,269694° E	34,474382° N	1.694,3	0,1	0,1	2,0	0,0	"Green house mode"	2,0
73	house	36,268675° E	34,473917° N	1.700,8	0,1	0,1	2,0	0,0	"Green house mode"	2,0
78	house	36,264729° E	34,458423° N	1.714,2	0,1	0,1	2,0	0,0	"Green house mode"	2,0
82	house	36,223728° E	34,450359° N	1.755,7	0,1	0,1	2,0	0,0	"Green house mode"	2,0
85	house	36,256086° E	34,450161° N	1.850,8	0,1	0,1	2,0	0,0	"Green house mode"	2,0
86	house	36,256820° E	34,449682° N	1.845,7	0,1	0,1	2,0	0,0	"Green house mode"	2,0
89	house	36,256862° E	34,447384° N	1.838,9	0,1	0,1	2,0	0,0	"Green house mode"	2,0
92	house	36,234578° E	34,439112° N	1.952,0	0,1	0,1	2,0	0,0	"Green house mode"	2,0
94	house	36,235096° E	34,438907° N	1.959,5	0,1	0,1	2,0	0,0	"Green house mode"	2,0
95	house	36,234483° E	34,438686° N	1.946,7	0,1	0,1	2,0	0,0	"Green house mode"	2,0
97	house	36,249680° E	34,438785° N	1.954,6	0,1	0,1	2,0	0,0	"Green house mode"	2,0

Calculation Results

Shadow receptor

No.	Name	Shadow, worst case: Shadow hours per year [h/year]	Shadow days per year [days/year]	Max shadow hours per day [h/day]
44	house	10:26	40	0:20
46	house	15:19	64	0:21
47	house	18:55	73	0:21
51	house	15:15	55	0:22
53	house	28:58	94	0:26
55	villa	57:30	164	0:30
56	villa	57:58	170	0:29
57	house	32:06	102	0:29
58	house	35:16	111	0:28
61	house	54:50	173	0:29
62	house	26:26	94	0:24
63	house	28:41	99	0:25
67	house	43:16	123	0:29
68	house	110:49	248	0:40
69	house	92:57	225	0:36
70	house	80:39	201	0:33
72	house	65:25	153	0:37
73	house	100:35	200	0:41
78	house	0:00	0	0:00
82	house	15:31	58	0:21
85	house	29:33	98	0:25
86	house	50:21	175	0:23
89	house	61:54	208	0:24
92	house	37:00	68	0:42
94	house	47:12	84	0:45
95	house	43:25	82	0:42
97	house	69:52	120	0:47

Total amount of flickering on the shadow receptors caused by each WTG

No.	Name	Worst case [h/year]
LWP 07	NORDEX N149/4.0-4.5 4500 149.0 !O! hub: 105,0 m (TOT: 179,5 m) (507)	74:38
LWP 08	NORDEX N149/4.0-4.5 4500 149.0 !O! hub: 105,0 m (TOT: 179,5 m) (508)	63:03
LWP 09	NORDEX N149/4.0-4.5 4500 149.0 !O! hub: 105,0 m (TOT: 179,5 m) (509)	41:41
LWP 10	NORDEX N149/4.0-4.5 4500 149.0 !O! hub: 105,0 m (TOT: 179,5 m) (510)	61:17
LWP 11	NORDEX N149/4.0-4.5 4500 149.0 !O! hub: 105,0 m (TOT: 179,5 m) (511)	36:13
LWP 12	NORDEX N149/4.0-4.5 4500 149.0 !O! hub: 105,0 m (TOT: 179,5 m) (512)	108:48
LWP 13	NORDEX N149/4.0-4.5 4500 149.0 !O! hub: 105,0 m (TOT: 179,5 m) (513)	132:06
LWP 14	NORDEX N149/4.0-4.5 4500 149.0 !O! hub: 105,0 m (TOT: 179,5 m) (514)	76:39
LWP 15	NORDEX N149/4.0-4.5 4500 149.0 !O! hub: 105,0 m (TOT: 179,5 m) (515)	48:27
LWP 16	NORDEX N149/4.0-4.5 4500 149.0 !O! hub: 105,0 m (TOT: 179,5 m) (516)	0:00
LWP 17	NORDEX N149/4.0-4.5 4500 149.0 !O! hub: 105,0 m (TOT: 179,5 m) (517)	0:00

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01.02.2019 09:30/3.2.737

SHADOW - Main Result

Calculation: LWP Nordex N149

...continued from previous page

No.	Name	Worst case [h/year]
LWP 18	NORDEX N149/4.0-4.5 4500 149.0 !O! hub: 105,0 m (TOT: 179,5 m) (518)	0:00
LWP 19	NORDEX N149/4.0-4.5 4500 149.0 !O! hub: 105,0 m (TOT: 179,5 m) (519)	45:58
LWP 20	NORDEX N149/4.0-4.5 4500 149.0 !O! hub: 105,0 m (TOT: 179,5 m) (520)	30:06
LWP 21	NORDEX N149/4.0-4.5 4500 149.0 !O! hub: 105,0 m (TOT: 179,5 m) (521)	25:25
LWP 22	NORDEX N149/4.0-4.5 4500 149.0 !O! hub: 105,0 m (TOT: 179,5 m) (522)	16:32
LWP 23	NORDEX N149/4.0-4.5 4500 149.0 !O! hub: 105,0 m (TOT: 179,5 m) (523)	155:17

Total times in Receptor wise and WTG wise tables can differ, as a WTG can lead to flicker at 2 or more receptors simultaneously and/or receptors may receive flicker from 2 or more WTGs simultaneously.

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Calculated:
01.02.2019 09:54/3.2.737

SHADOW - Main Result

Calculation: LWP GE Wind 5.3-158

Assumptions for shadow calculations

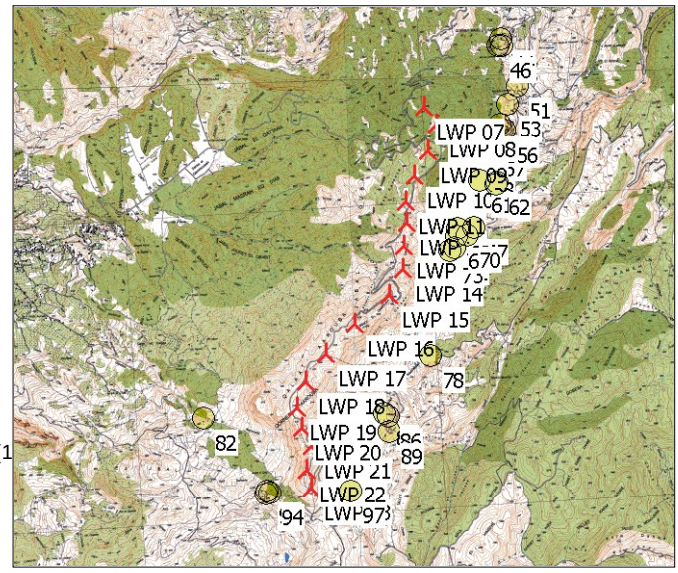
Maximum distance for influence
Calculate only when more than 20 % of sun is covered by the blade
Please look in WTG table

Minimum sun height over horizon for influence	3	°
Day step for calculation	1	days
Time step for calculation	1	minutes

The calculated times are "worst case" given by the following assumptions:
- The sun is shining all the day, from sunrise to sunset
- The rotor plane is always perpendicular to the line from the WTG to the sun
- The WTG is always operating

A ZVI (Zones of Visual Influence) calculation is performed before flicker calculation so non visible WTG do not contribute to calculated flicker values. A WTG will be visible if it is visible from any part of the receiver window. The ZVI calculation is based on the following assumptions:
Height contours used: Höhenraster-Objekt: 18-1-3019-ZB_EMDGrid_2.wpg (1
Obstacles used in calculation
Eye height for map: 1,5 m
Grid resolution: 1,0 m

All coordinates are in
Geo [deg]-WGS84



Scale 1:125.000
New WTG Shadow receptor

WTGs

	Longitude	Latitude	Z	Row data/Description	WTG type Valid	Manufact.	Type-generator	Power, rated	Rotor diameter	Hub height	Shadow data Calculation distance	RPM
			[m]					[kW]	[m]	[m]	[m]	[RPM]
LWP 07	36,264865° E	34,495376° N	1.814,4	GE WIND ENERGY GE 5...	Yes	GE WIND ENERGY	GE 5.3-158-5.300	5.300	158,0	121,0	1.819	9,7
LWP 08	36,267003° E	34,492722° N	1.829,7	GE WIND ENERGY GE 5...	Yes	GE WIND ENERGY	GE 5.3-158-5.300	5.300	158,0	121,0	1.819	9,7
LWP 09	36,265293° E	34,488954° N	1.903,8	GE WIND ENERGY GE 5...	Yes	GE WIND ENERGY	GE 5.3-158-5.300	5.300	158,0	121,0	1.819	9,7
LWP 10	36,262879° E	34,485213° N	1.914,9	GE WIND ENERGY GE 5...	Yes	GE WIND ENERGY	GE 5.3-158-5.300	5.300	158,0	121,0	1.819	9,7
LWP 11	36,261147° E	34,481430° N	1.936,5	GE WIND ENERGY GE 5...	Yes	GE WIND ENERGY	GE 5.3-158-5.300	5.300	158,0	121,0	1.819	9,7
LWP 12	36,261248° E	34,478274° N	1.922,3	GE WIND ENERGY GE 5...	Yes	GE WIND ENERGY	GE 5.3-158-5.300	5.300	158,0	121,0	1.819	9,7
LWP 13	36,260583° E	34,474870° N	1.934,9	GE WIND ENERGY GE 5...	Yes	GE WIND ENERGY	GE 5.3-158-5.300	5.300	158,0	121,0	1.819	9,7
LWP 14	36,260211° E	34,471455° N	1.851,7	GE WIND ENERGY GE 5...	Yes	GE WIND ENERGY	GE 5.3-158-5.300	5.300	158,0	121,0	1.819	9,7
LWP 15	36,257625° E	34,467738° N	1.988,4	GE WIND ENERGY GE 5...	Yes	GE WIND ENERGY	GE 5.3-158-5.300	5.300	158,0	121,0	1.819	9,7
LWP 16	36,251352° E	34,463613° N	2.072,4	GE WIND ENERGY GE 5...	Yes	GE WIND ENERGY	GE 5.3-158-5.300	5.300	158,0	121,0	1.819	9,7
LWP 17	36,245957° E	34,459301° N	2.107,8	GE WIND ENERGY GE 5...	Yes	GE WIND ENERGY	GE 5.3-158-5.300	5.300	158,0	121,0	1.819	9,7
LWP 18	36,242165° E	34,455185° N	2.115,4	GE WIND ENERGY GE 5...	Yes	GE WIND ENERGY	GE 5.3-158-5.300	5.300	158,0	121,0	1.819	9,7
LWP 19	36,240424° E	34,451469° N	2.139,2	GE WIND ENERGY GE 5...	Yes	GE WIND ENERGY	GE 5.3-158-5.300	5.300	158,0	121,0	1.819	9,7
LWP 20	36,241245° E	34,448386° N	2.184,4	GE WIND ENERGY GE 5...	Yes	GE WIND ENERGY	GE 5.3-158-5.300	5.300	158,0	121,0	1.819	9,7
LWP 21	36,242901° E	34,445685° N	2.193,4	GE WIND ENERGY GE 5...	Yes	GE WIND ENERGY	GE 5.3-158-5.300	5.300	158,0	121,0	1.819	9,7
LWP 22	36,241779° E	34,442166° N	2.204,3	GE WIND ENERGY GE 5...	Yes	GE WIND ENERGY	GE 5.3-158-5.300	5.300	158,0	121,0	1.819	9,7
LWP 23	36,242651° E	34,439372° N	2.149,3	GE WIND ENERGY GE 5...	Yes	GE WIND ENERGY	GE 5.3-158-5.300	5.300	158,0	121,0	1.819	9,7

Shadow receptor-Input

No.	Name	Longitude	Latitude	Z	Width	Height	Elevation a.g.l.	Slope of window	Direction mode	Eye height (ZVI) a.g.l.
				[m]	[m]	[m]	[m]	[°]		[m]
44	house	36,279070° E	34,505060° N	1.379,4	0,1	0,1	2,0	0,0	"Green house mode"	2,0
46	house	36,278525° E	34,504084° N	1.396,2	0,1	0,1	2,0	0,0	"Green house mode"	2,0
47	house	36,279277° E	34,504064° N	1.393,3	0,1	0,1	2,0	0,0	"Green house mode"	2,0
51	house	36,281704° E	34,498052° N	1.456,0	0,1	0,1	2,0	0,0	"Green house mode"	2,0
53	house	36,279899° E	34,495307° N	1.495,7	0,1	0,1	2,0	0,0	"Green house mode"	2,0
55	villa	36,278413° E	34,492443° N	1.554,1	0,1	0,1	2,0	0,0	"Green house mode"	2,0
56	villa	36,279303° E	34,491526° N	1.541,0	0,1	0,1	2,0	0,0	"Green house mode"	2,0
57	house	36,277015° E	34,489582° N	1.579,6	0,1	0,1	2,0	0,0	"Green house mode"	2,0
58	house	36,274699° E	34,486492° N	1.582,3	0,1	0,1	2,0	0,0	"Green house mode"	2,0
61	house	36,274565° E	34,484235° N	1.584,6	0,1	0,1	2,0	0,0	"Green house mode"	2,0
62	house	36,277658° E	34,483872° N	1.560,3	0,1	0,1	2,0	0,0	"Green house mode"	2,0
63	house	36,277386° E	34,483523° N	1.569,7	0,1	0,1	2,0	0,0	"Green house mode"	2,0
67	house	36,273214° E	34,477255° N	1.646,0	0,1	0,1	2,0	0,0	"Green house mode"	2,0
68	house	36,270268° E	34,477126° N	1.696,3	0,1	0,1	2,0	0,0	"Green house mode"	2,0
69	house	36,269975° E	34,476101° N	1.693,0	0,1	0,1	2,0	0,0	"Green house mode"	2,0

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01.02.2019 09:54/3.2.737

SHADOW - Main Result

Calculation: LWP GE Wind 5.3-158

...continued from previous page

No.	Name	Longitude	Latitude	Z [m]	Width [m]	Height [m]	Elevation a.g.l. [m]	Slope of window [°]	Direction mode	Eye height (ZVI) a.g.l. [m]
70	house	36,271890° E	34,476117° N	1.662,8	0,1	0,1	2,0	0,0	"Green house mode"	2,0
72	house	36,269694° E	34,474382° N	1.694,3	0,1	0,1	2,0	0,0	"Green house mode"	2,0
73	house	36,268675° E	34,473917° N	1.700,8	0,1	0,1	2,0	0,0	"Green house mode"	2,0
78	house	36,264729° E	34,458423° N	1.714,2	0,1	0,1	2,0	0,0	"Green house mode"	2,0
82	house	36,223728° E	34,450359° N	1.755,7	0,1	0,1	2,0	0,0	"Green house mode"	2,0
85	house	36,256086° E	34,450161° N	1.850,8	0,1	0,1	2,0	0,0	"Green house mode"	2,0
86	house	36,256820° E	34,449682° N	1.845,7	0,1	0,1	2,0	0,0	"Green house mode"	2,0
89	house	36,256862° E	34,447384° N	1.838,9	0,1	0,1	2,0	0,0	"Green house mode"	2,0
92	house	36,234578° E	34,439112° N	1.952,0	0,1	0,1	2,0	0,0	"Green house mode"	2,0
94	house	36,235096° E	34,438907° N	1.959,5	0,1	0,1	2,0	0,0	"Green house mode"	2,0
95	house	36,234483° E	34,438686° N	1.946,7	0,1	0,1	2,0	0,0	"Green house mode"	2,0
97	house	36,249680° E	34,438785° N	1.954,6	0,1	0,1	2,0	0,0	"Green house mode"	2,0

Calculation Results

Shadow receptor

No.	Name	Shadow, worst case Shadow hours per year [h/year]	Shadow days per year [days/year]	Max shadow hours per day [h/day]
44	house	11:09	40	0:21
46	house	20:17	74	0:22
47	house	23:15	80	0:22
51	house	16:48	58	0:23
53	house	32:21	101	0:27
55	villa	64:18	167	0:32
56	villa	62:59	178	0:30
57	house	35:29	107	0:30
58	house	38:32	115	0:30
61	house	60:20	178	0:31
62	house	29:40	99	0:25
63	house	32:13	107	0:26
67	house	48:15	129	0:31
68	house	125:24	253	0:43
69	house	95:08	217	0:37
70	house	85:55	203	0:35
72	house	72:52	161	0:39
73	house	108:38	203	0:43
78	house	0:00	0	0:00
82	house	17:28	64	0:22
85	house	32:55	101	0:26
86	house	57:07	184	0:25
89	house	67:28	212	0:25
92	house	42:05	75	0:44
94	house	54:50	95	0:47
95	house	51:00	94	0:44
97	house	78:12	118	0:49

Total amount of flickering on the shadow receptors caused by each WTG

No.	Name	Worst case [h/year]
LWP 07	GE WIND ENERGY GE 5.3-158 5300 158.0 !O! hub: 121,0 m (TOT: 200,0 m) (526)	79:57
LWP 08	GE WIND ENERGY GE 5.3-158 5300 158.0 !O! hub: 121,0 m (TOT: 200,0 m) (527)	73:06
LWP 09	GE WIND ENERGY GE 5.3-158 5300 158.0 !O! hub: 121,0 m (TOT: 200,0 m) (528)	45:45
LWP 10	GE WIND ENERGY GE 5.3-158 5300 158.0 !O! hub: 121,0 m (TOT: 200,0 m) (529)	68:17
LWP 11	GE WIND ENERGY GE 5.3-158 5300 158.0 !O! hub: 121,0 m (TOT: 200,0 m) (530)	39:41
LWP 12	GE WIND ENERGY GE 5.3-158 5300 158.0 !O! hub: 121,0 m (TOT: 200,0 m) (531)	117:04
LWP 13	GE WIND ENERGY GE 5.3-158 5300 158.0 !O! hub: 121,0 m (TOT: 200,0 m) (532)	141:24
LWP 14	GE WIND ENERGY GE 5.3-158 5300 158.0 !O! hub: 121,0 m (TOT: 200,0 m) (533)	80:57
LWP 15	GE WIND ENERGY GE 5.3-158 5300 158.0 !O! hub: 121,0 m (TOT: 200,0 m) (534)	52:28
LWP 16	GE WIND ENERGY GE 5.3-158 5300 158.0 !O! hub: 121,0 m (TOT: 200,0 m) (535)	0:00
LWP 17	GE WIND ENERGY GE 5.3-158 5300 158.0 !O! hub: 121,0 m (TOT: 200,0 m) (536)	0:00
LWP 18	GE WIND ENERGY GE 5.3-158 5300 158.0 !O! hub: 121,0 m (TOT: 200,0 m) (537)	0:00

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SHADOW - Main Result

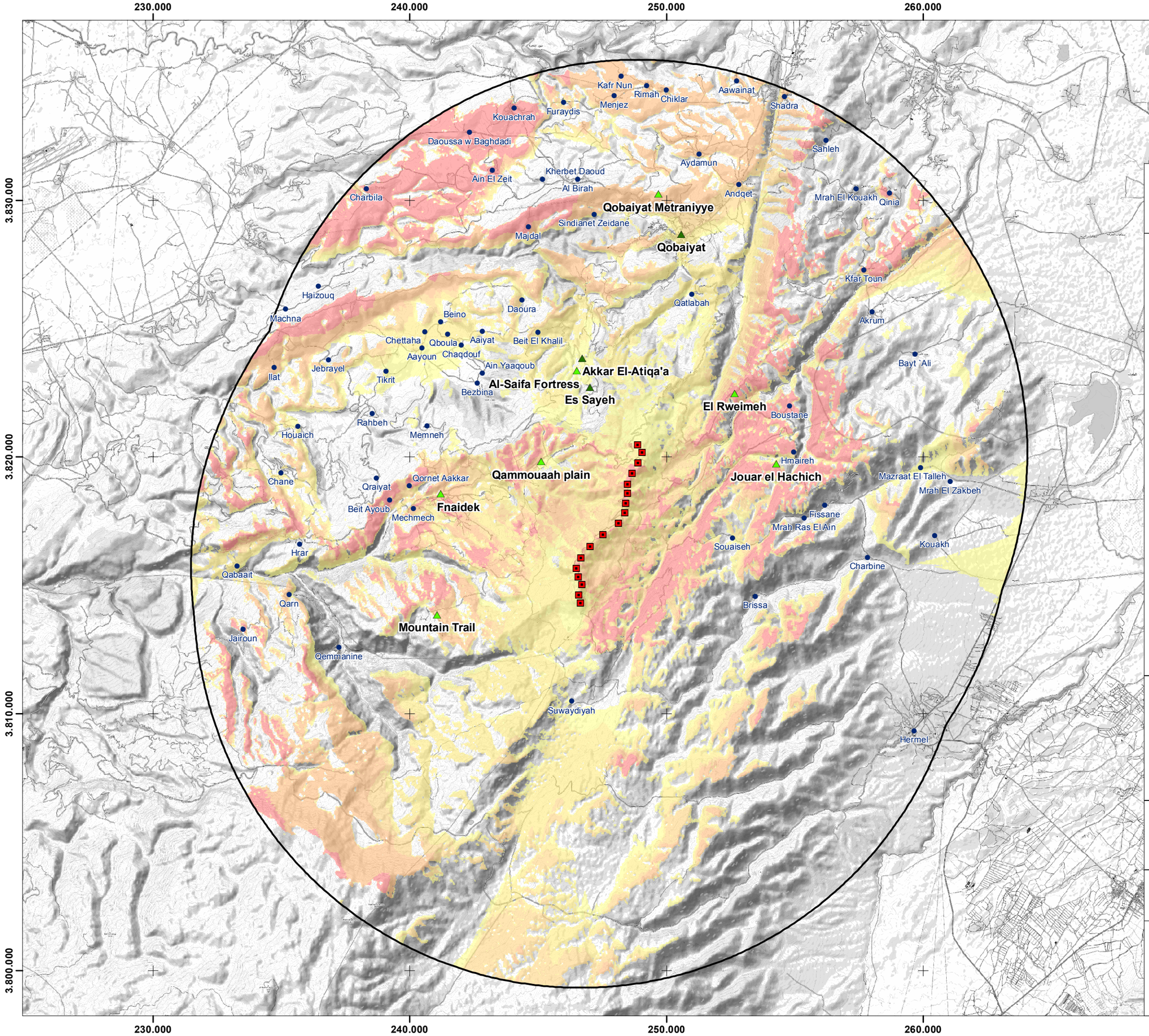
Calculation: LWP GE Wind 5.3-158

...continued from previous page

No.	Name	Worst case [h/year]
LWP 19	GE WIND ENERGY GE 5.3-158 5300 158.0 !O! hub: 121,0 m (TOT: 200,0 m) (538)	50:17
LWP 20	GE WIND ENERGY GE 5.3-158 5300 158.0 !O! hub: 121,0 m (TOT: 200,0 m) (539)	33:26
LWP 21	GE WIND ENERGY GE 5.3-158 5300 158.0 !O! hub: 121,0 m (TOT: 200,0 m) (540)	27:47
LWP 22	GE WIND ENERGY GE 5.3-158 5300 158.0 !O! hub: 121,0 m (TOT: 200,0 m) (541)	18:12
LWP 23	GE WIND ENERGY GE 5.3-158 5300 158.0 !O! hub: 121,0 m (TOT: 200,0 m) (542)	176:25

Total times in Receptor wise and WTG wise tables can differ, as a WTG can lead to flicker at 2 or more receptors simultaneously and/or receptors may receive flicker from 2 or more WTGs simultaneously.

APPENDIX U
LANDSCAPE VISUALIZATIONS



ZTV (zones of theoretical visibility) Libanon Wind Power

Planned WTG

- total height 200 m

Study area

- 15,000 m radius

WTG visibility

- 1; 2; 3; 4
- 5; 6; 7; 8
- 9; 10; 11; 12
- 13; 14; 15; 16
- 17

Receptor

- without visualization
- including visualization

Settlement

- scoped out for detailed assessment

Data basis

elevation model: srtm-data
eye level: 1.5 m
Resolution of the calculation: 25 m
Coordinate system: UTM WGS 84, zone 37
map basis: OpenTopoMap.org

scale 1:140.000

0 2 4 6 Kilometer

Editor: Dipl.-Geogr. Marc Brüning
Date: 11 July 2019

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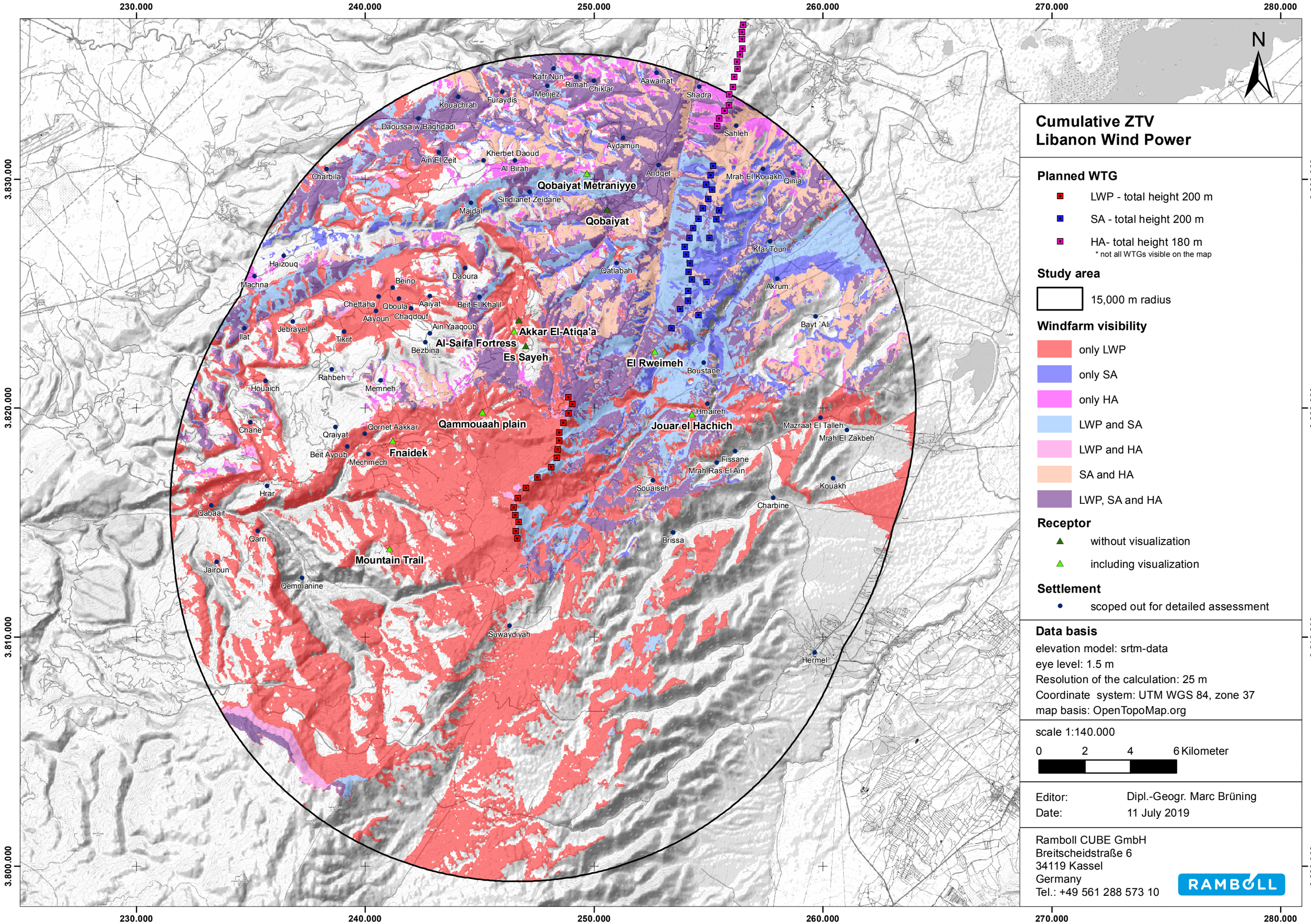

Cumulative ZTV
Libanon Wind Power

Planned WTG

- LWP - total height 200 m
- SA - total height 200 m
- HA- total height 180 m

* not all WTGs visible on the map

Study area

15,000 m radius

Windfarm visibility

- only LWP
- only SA
- only HA
- LWP and SA
- LWP and HA
- SA and HA
- LWP, SA and HA

Receptor

- without visualization
- including visualization

Settlement

- scoped out for detailed assessment

Data basis

elevation model: srtm-data
eye level: 1.5 m
Resolution of the calculation: 25 m
Coordinate system: UTM WGS 84, zone 37
map basis: OpenTopoMap.org

scale 1:140.000

0 2 4 6 Kilometer

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Al-Saifa fortress Akkar el-Atiqa‘a - Current state

Al-Saifa fortress Akkar el-Atiqa‘a - Sketch

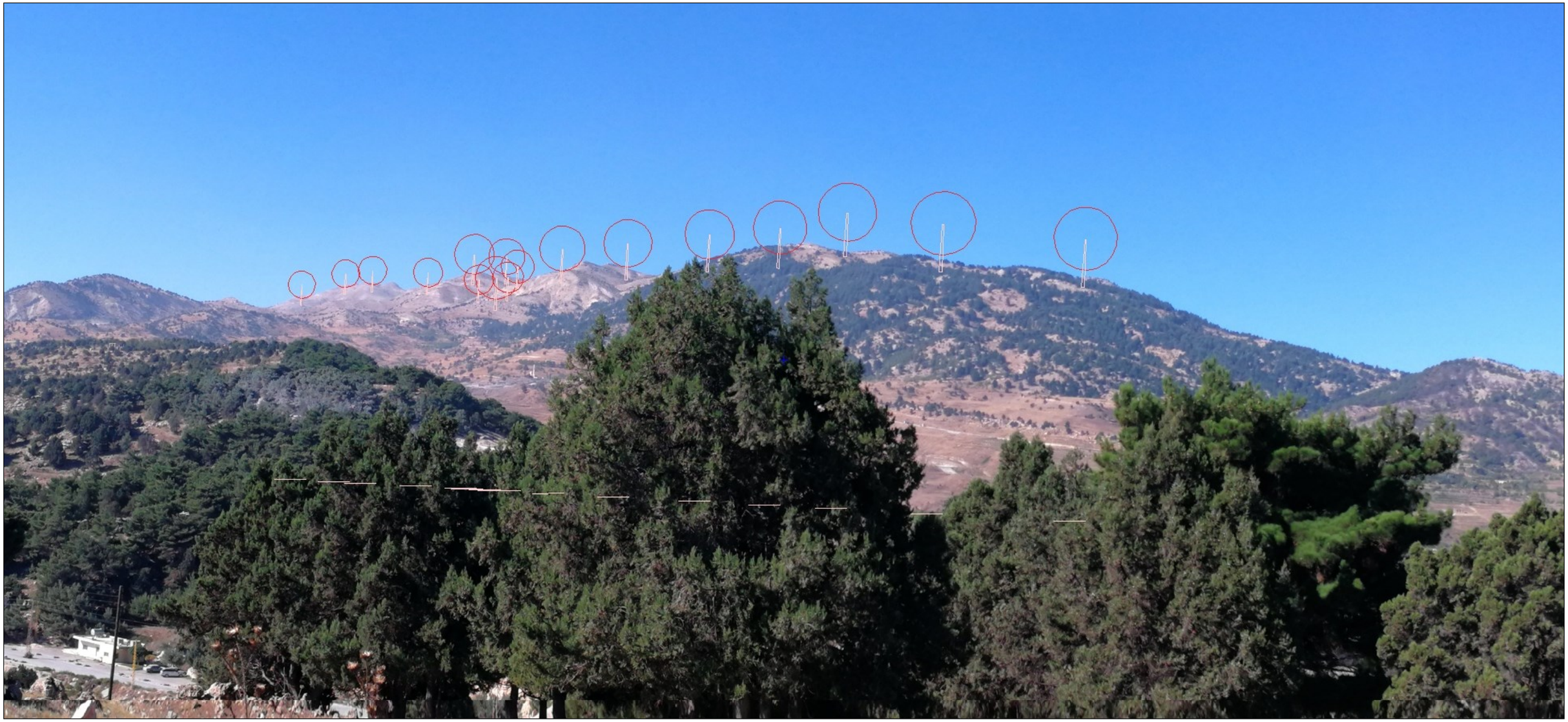
Al-Saifa fortress Akkar el-Atiqa‘a - Sketch - Cumulative Vision

Al-Saifa fortress Akkar el-Atiqa‘a - Photomontage

Recommended observation distance: 13 cm - Photo exposed: 18.10.2018, 13:40, Geo WGS84 East: 36,237733 North: 34,519878, Panorama field of view: 175.0°, Direction of photo: 101°

El Rwaimeh - Current state

El Rwaimeh - Sketch



El Rwaimeh - Photomontage

Recommended observation distance: 44 cm - Photo exposed: 17.10.2018, 16:30, Geo WGS84 East: 36,305637 North: 34,514351, Panorama field of view: 51.8°, Direction of photo: 231°

Jouer el Hachich - Current state

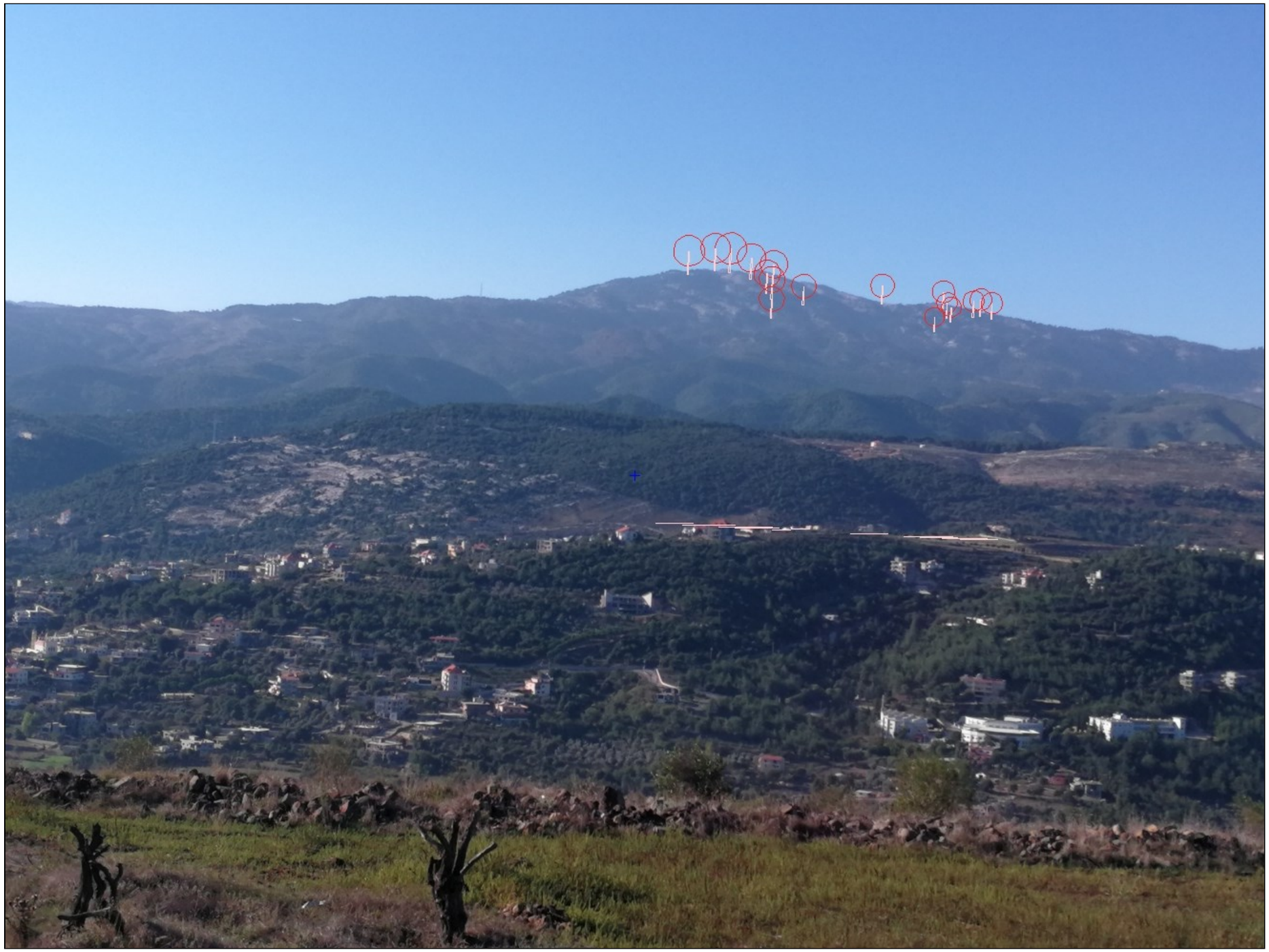
Jouer el Hachich - Sketch

Jouer el Hachich - Photomontage

Recommended observation distance: 31 cm - Photo exposed: 17.10.2018, 15:51, Geo WGS84 East: 36,323972 North: 34,489931, Panorama field of view: 72.0°, Direction of photo: 256°

Qoubaiyat metraniyye - Current state

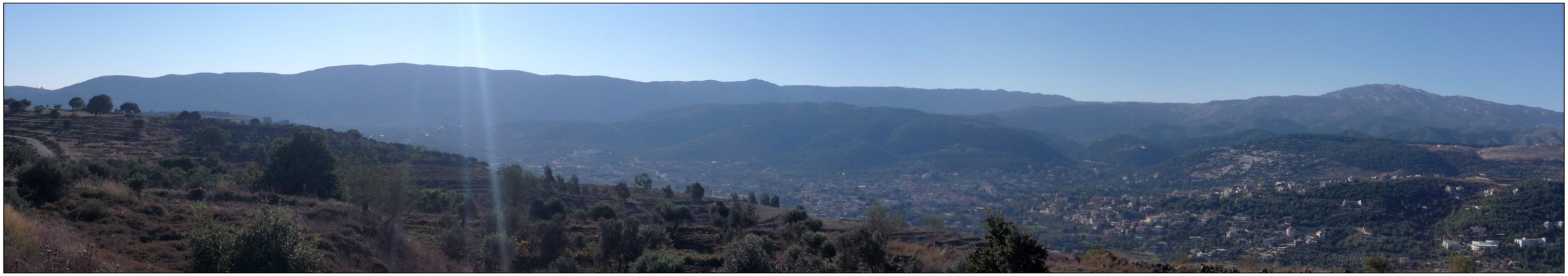
Qoubaiyat metraniyye - Sketch



Qoubaiyat metraniyye - Photomontage

Recommended observation distance: 47 cm - Photo exposed: 24.09.2018, 08:24, Geo WGS84 East: 36,270939 North: 34,583538, Lens: 54 mm, Direction of photo: 181°

Qoubaiyat metraniyye - Current state



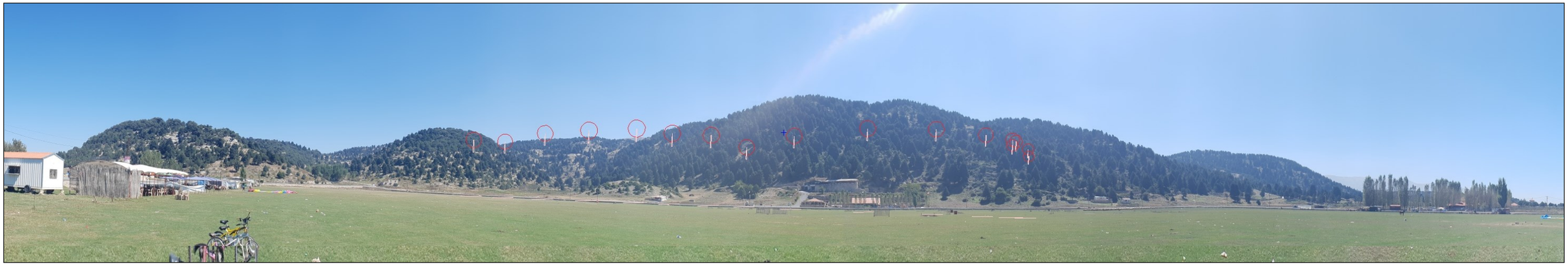
Qoubaiyat metraniyye - Sketch - Cumulative Vision

Qoubaiyat metraniyye - Photomontage - Cumulative Vision

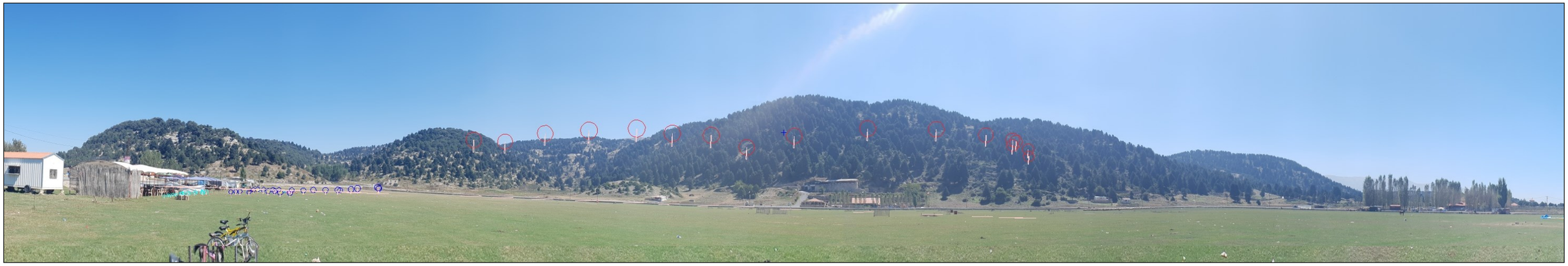
Recommended observation distance: 18 cm - Photo exposed: 18.10.2018, 10:43, Geo WGS84 East: 36,270939 North: 34,583538, Panorama field of view: 125.4°, Direction of photo: 135°

Qammouaah plain - Current state

Qammouaah plain - Sketch



Qammouaah plain - Sketch - Cumulative Vision



Qammouaah plain - Photomontage

Recommended observation distance: 9 cm - Photo exposed: 08.10.2018, 15:43, Geo WGS84 East: 36,224614 North: 34,488450, Panorama field of view: 238.6°, Direction of photo: 126°

Fnaydek - Current state

Fnaydek - Sketch

Fnaydek - Photomontage

Recommended observation distance: 47 cm - Photo exposed: 22.03.2019, 15:30, Geo WGS84 East: 36,178608 North: 34,477600, Lens: 54 mm, Direction of photo: 114°

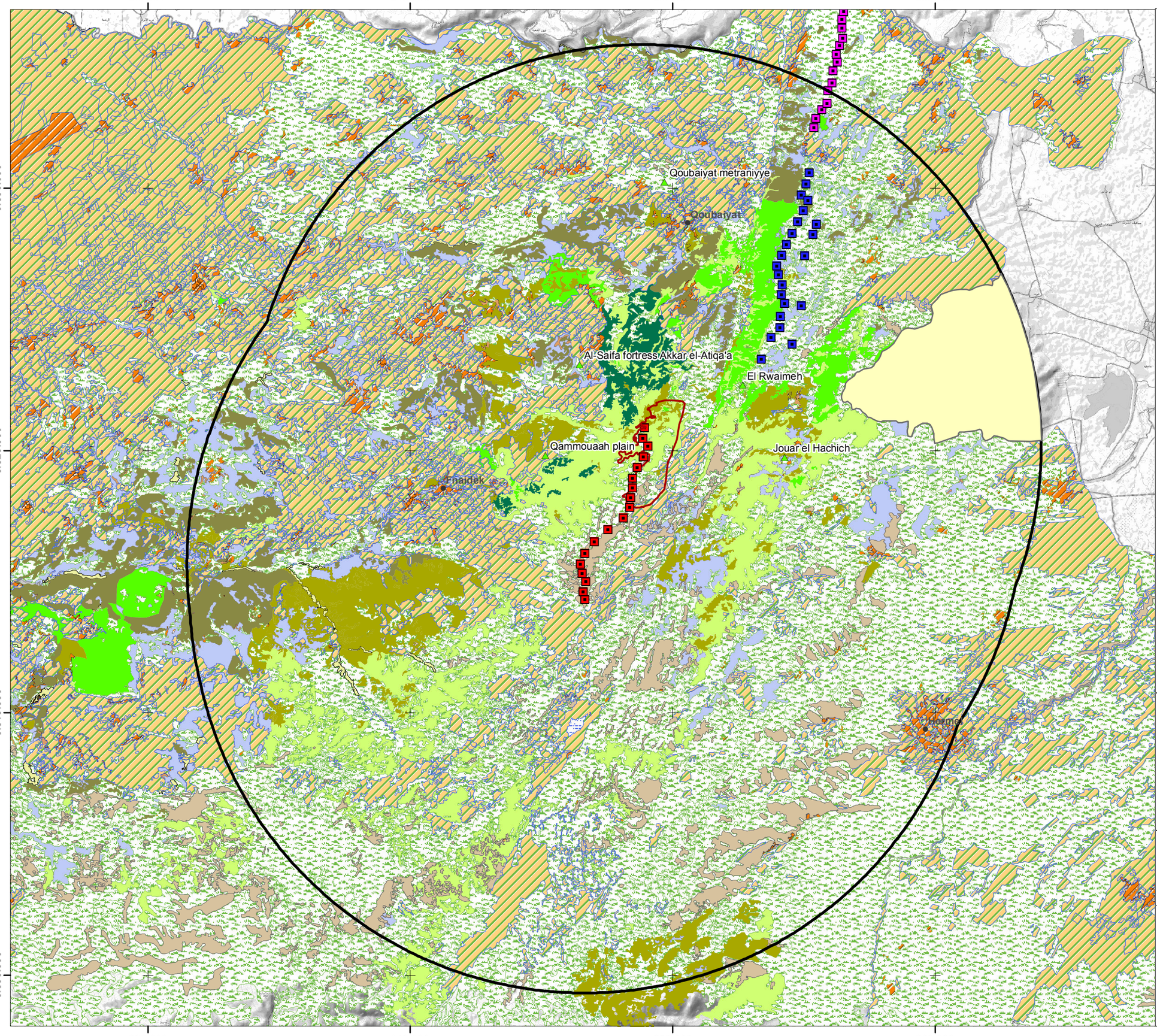
Mountain Trail (Nazih Qamaredine house) - Current state

Mountain Trail (Nazih Qamaredine house) - Sketch

Mountain Trail (Nazih Qamaredine house) - Cumulative Vision

Mountain Trail (Nazih Qamaredine house) - Photomontage

Recommended observation distance: 44 cm - Photo exposed: 10.07.2019, 11:16, Geo WGS84 East: 36,181954 North: 34,433797, Panorama field of view: 50,9°, Direction of photo: 63°



Landscape units
Libanon Wind Power

Planned WTG

- LWP -total height: 200 m
- SA - total height: 200 m
- HA - total height: 180 m

* not all WTGs visible on the map

Examination area

- 15,000 m radius

Landscape units

- no data
- Protected Area
- AgriculturalAreas
- DenseAbiesForests
- DensePinusForests
- DenseQuercusForests
- MixedForests
- OtherDenseLeafyForests
- RockyLand
- Shrublands
- SparseConiferous
- SparseLeafyForests
- Swamps
- UrbanArtificial
- UrbanExpansion
- viewpoint visualisation

Data basis

Coordinate system: UTM WGS 84, zone 37
map basis: OpenTopoMap.org
scale 1:140.000

N

0 2 4 8 Kilometers

Editor: Dipl.- landscape ecologist Stefan Buscher

Date: 14 February 2019

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