

**Scoping Report for the Proposed  
Constructed Wetland, Bar Elias**

**UNICEF – UN Habitat**

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# **1 Introduction**

## **1.1 Background Information**

In August 2019, KREDO sal office was commissioned by UNICEF-UN Habitat, to carry out a feasibility study for a constructed wetland to improve water quality in Zahle Caza. Accordingly, KREDO sal consulted Litani River Authority (LRA) for available public land at the tributaries of Litani River. LRA is already operating a constructed wetland in Kherbet Qanafar, Joub Jennine.

LRA proposed plot 1951 in Bar Elias that falls on the Ghezayel tributary of Litani River. Accordingly, a feasibility study evaluating economic and technical needs, as well as positive impacts of a constructed wetland on plot 1951 was conducted by KREDO. It was found that a constructed wetland is a feasible and recommended intervention for improving the water quality of Ghezayel tributary, which is currently used for irrigation.

The project is funded by UNICEF-UN Habitat, and will be owned and operated by LRA in coordination with Bar Elias municipality. KREDO sal tasked to conduct the EIA report for the said project.

## **1.2 Objective of the Scoping Report**

Following Ministry of Environment's decision at the screening process, and according to Decree No. 8633 of 2012, the constructed wetland requires an EIA. The scoping is the first stage of an EIA, and it aims at defining the extent of the EIA study by identifying the main environmental issues that should be addressed, including their level of detail, in the EIA report. This is achieved through public consultation, review of relevant literature and experiences from similar projects, as well as expert opinion.

The scoping phase streamlines decision making and distinguishes between important and irrelevant issues. It also identifies missing information or data that needs to be obtained for the EIA study.

### 1.3 EIA Study Team

KREDO proposes for the completion of the EIA study a multidisciplinary team, including the following specialists:

- Dr. Mark Saadeh, Hydrogeologist, Senior Environmental Consultant;
- Mrs. Roula Srouji, Senior Civil Engineer;
- Ms. Diana El Halawani, Environmental Engineer,
- Mr. Mahmoud Noun, Surveyor Engineer & GIS expert.

CVs of each of the project team members are presented in **Appendix A**.

### 1.4 Scope of the EIA

Decree No. 8633 of 2012 defines the scope and stages of the EIA process. It provides a list of projects requiring an EIA study, which includes projects related to water treatment. The objectives of the EIA study are to;

- Provide solid foundations for decision making about the design of the project taking into account environmental and socio-economic impacts (analysis of alternatives)
- Ensure that the project is implemented within relevant institutional and legal framework
- Evaluate direct, indirect, short-term, medium term, and long-term impacts of the project during construction and operation
- Provide mitigation measures for potentially negative impacts
- Establish an environmental management plan and an environmental monitoring plan

## 2 Project Description

The proposed location of the constructed wetland is lot #1951 located in the municipality of Bar Elias, in the caza of Zahleh, Bekaa governorate, with the following general coordinates:

- ❖ -434751.5 Northing
- ❖ -296365.5 Easting
- ❖ Approximately 873 mASL

Based on the legal registration document submitted at the project screening (**Appendix B**), the land belongs to Litani River Authority (LRA). It has an area of around 60,000 m<sup>2</sup>. LRA has offered this plot for the construction of a wetland to treat the polluted water in Ghezayel tributary which is currently being used by nearby farmers for irrigation.

According to the Directorate General of Urban Planning, the land falls in a zone classified as E suitable for touristic and residential projects (**Appendix C**). The plot limits map is also attached in **Appendix D**. Figure 1 below shows an aerial photograph of the lot 1951, which is located in a remote area in Bar Elias.



Figure 1: Aerial photograph of lot 1951 in Bar Elias municipality

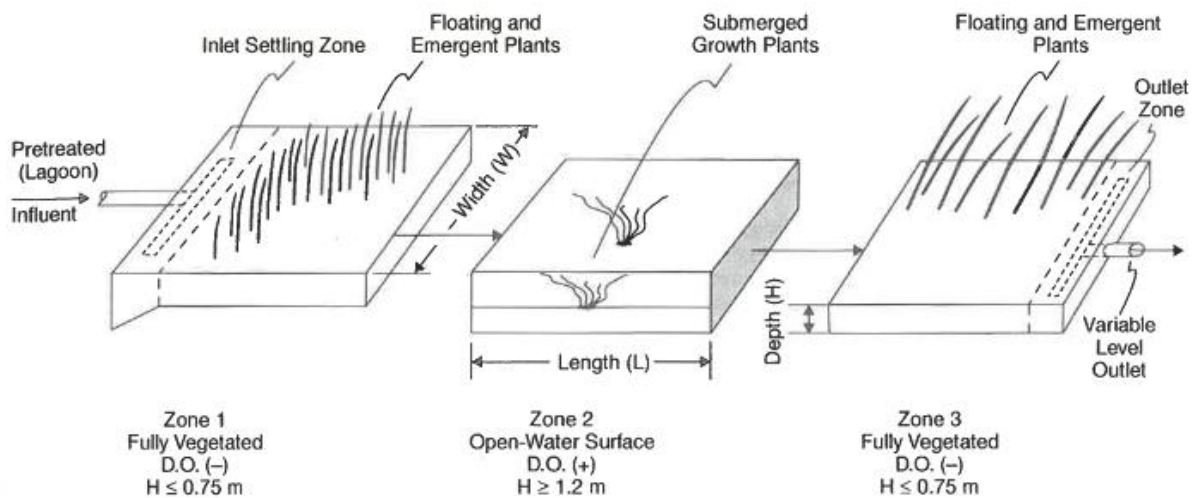
## 2.1 Project Components

Based on the feasibility study, the proposed constructed wetland is a Free Water Surface (FWS) wetland to treat the polluted Ghezayel tributary for the improvement of local irrigation water quality.

The purpose of this constructed wetland is to function as an artificial wastewater treatment system consisting of shallow ponds planted with aquatic flora and relying upon natural microbial, biological, physical and chemical processes to alleviate some of the pollution plaguing the Ghezayel tributary system, and by extension the quality of irrigation water. Additionally, said wetland can eventually provide sanctuary for various fauna.

With a total area of 60,000 m<sup>2</sup> of constructed wetland on the lot offered by the Litani River Authority in Bar Elias, this wetland will be capable of treating up to 6,000 cubic meters per day from Ghezayel’s flow that varies between 26,000 up to 400,000 cubic meters per day going from dry to wet seasons respectively (LRA hydrograph station number 352). The water will be diverted from the stream to the wetland via a pump. After treatment, the water can be discharged back to the stream or sent through a canal parallel to the stream to be used by farmers for irrigation. These options are yet to be determined during the design phase.

Wetland sizing predominantly aims to achieve a certain percentage of contaminant removal based on empirical performance data, while slopes and depths aim at maximising biodiversity of habitat wetlands. Therefore, to design the proposed wetland, water from the Ghezayel stream should be sampled and tested, and empirical flow measurements are needed. This will happen later in the design phase. Generally, a constructed wetland should consist of a minimum of two to three ponds, an open water inlet zone and a macrophyte zone (Wong, Breen, Some, & Lloyd, 1999). The figure below presents elements of the free water surface (FWS) constructed wetland proposed by the United States Environmental Protection System (USEPA) manual.



**Figure 2: Elements of a FWS Constructed Wetland, USEA**



The typical inlet zone (Zone 1) maximises detention storage for sedimentation, and controls inflows. It is generally deep and only has fringing vegetation. Meanwhile macrophyte (plants visible to the unaided eye) zones are shallow and relatively tranquil where particles settle and adhere to vegetation.

The deep water zone (Zone 2) typically consists of a sedimentation pond and submerged water plants, and serves to capture settle-able solids.

## **2.2 Project Schedule and Estimated Costs**

The estimated cost of the wetland is around \$400,000 for construction, mainly involving earthmoving, berms construction, planting, as well as pump and piping.

At this point in time, any time timeframe for the proposed constructed wetland is premature, but construction is expected to take only a few months to complete.

## **3 Policy, Legal, and Administrative Framework**

### **3.1 Introduction**

The project falls mainly under the water sector. Therefore, the relevant legal and institutional framework will be presented accordingly. Laws and decrees pertaining to the protection of the environment and environmental limit values for emissions and effluents are also applicable considering the potential impacts of the project.

### **3.2 Legislative Framework**

Table 1 below lists the relevant legislation for this project, and gives a brief description of their content.

**Table 1: Relevant Lebanese Legislation**

Sector	Ministry	Law/Decree/Decision/Circular	Title	Date	Content
EIA	MoE	Decree No. 8633	Environmental Impact Assessment	16-Aug-12	<ul style="list-style-type: none"> <li>Defines the scope and stages of the national EIA process</li> </ul>
EIA	MoE	Circular 6/1	Fees for EIA and IEE and the pledge	25-Jun-15	<ul style="list-style-type: none"> <li>Documents needed and the process upon registering an IEE or EIA at MoE</li> </ul>
EIA	MoE	Decision 261/1	Guidelines for the revision of EIA Scoping Report and the EIA Report	25-Jun-15	<ul style="list-style-type: none"> <li>Explains the process and the content of the EIA report</li> </ul>
General	MoE	Law 444	Environmental Protection Law	29-Jul-02	Sets general guidelines and definitions on the principle of environmental protection. Called for the need to establish decrees setting ELVs for pollutants to air, water, land.
General	MoE	Law 690	Roles, responsibilities and structure of the MoE	26-Aug-05	<ul style="list-style-type: none"> <li>Define the roles and responsibilities of MoE and the different departments within it</li> <li>Abolishes law 216 of 1993 except for clause 1 (name of the ministry)</li> <li>Abolishes law 667 of 1997 (update on law 216)</li> <li>Defines the qualifications of personnel at MoE based on their position</li> </ul>
General	MoE	Decree No. 2275	Roles, responsibilities and structure of the departments or units of MoE	26-Jun-09	<ul style="list-style-type: none"> <li>A follow up on law 690</li> <li>Detailed description of tasks of the units of MoE</li> </ul>
Water	MoE	Law 77	Water Law	19-Apr-18	<ul style="list-style-type: none"> <li>Aims at the sustainable management of water resources and its protection from overexploitation</li> <li>National Water Committee (prime minister, MoEW, MoE, MoI, MoA, MoH, MoT, WE, etc.) to set a national water strategy (based on watershed/basin management)</li> <li>Define water rights</li> </ul>
Water	MoE	Decision 90/1	Environmental Guidelines for Establishments nearby rivers protected by MoE	17-Oct-00	<ul style="list-style-type: none"> <li>Sets guidelines to obtain permit from MoE for construction near rivers</li> <li>Defines potential pollutants resulting from construction</li> <li>Defines an environmental management plan during construction</li> <li>Provides a schematic representation of a septic tank</li> </ul>
Water	MoE Libnor MoH and others	Decree No. 1039	Water quality standards	12-Aug-99	<ul style="list-style-type: none"> <li>Establishes standards for drinking water, bottled water, and natural mineral water.</li> <li>Indicates ISO standards for testing different water quality parameters.</li> </ul>
Water Air	MoE	Decision 8/1	Update on Decision 52/1 - National Standards for Environmental Quality (NSEQ) related to air pollutants, liquid effluents, effluents from classified establishments into receiving water bodies.	1-Mar-01	<ul style="list-style-type: none"> <li>Annex 1: Classifies air pollutants into 3 categories and sets general ELVs.</li> <li>Annex 2: Sets ELVs for air emissions from different industrial sectors including generators on fuel oils of more than 0.5 MW. It also sets regulations for stack height.</li> <li>Annex 3: ELVs for effluents discharged in the sea.</li> <li>Annex 4: ELVs for effluents discharged in surface water.</li> <li>Annex 5: ELVs for effluents discharged in sewer network.</li> </ul>

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Water Wastewater Noise Air	MoE	Decision 52/1	National Standards for Environmental Quality and Environmental Limit Values (ELVs) for Air, Noise, Water and Soil	12-Sep-96	<b><i>Only the below annexes are valid, the rest were updated in Decision 8/1 -2001:</i></b> <ul style="list-style-type: none"> <li>• Annex 3: ELVs for water to support aquatic life</li> <li>• Annex 4: ELVs for water suitable for swimming</li> <li>• Annex 5: Quality of domestic sewage (per person) and of treated effluent</li> <li>• Annex 10: Allowable noise levels based on duration of exposure, time, and zoning of the area.</li> <li>• Annex 14: ELVs for outdoor air pollution and exposure time.</li> </ul>
Water	FAO	Guidelines	Guidelines for interpretations of water quality for irrigation	1974	In the absence of national standards for water quality for irrigation, FAO guidelines will be adopted.

### International Conventions and Protocols

Lebanon is a signatory to several international environmental treaties, conventions and agreements that include provisions relevant to the project. These agreements are listed in Table 2 below.

**Table 2: Relevant International Agreements Signed by Lebanon**

Agreement	Objective
UNESCO World Heritage Convention (1972)	A UNESCO designated World Heritage Site (since 1998)
Convention on Biological Diversity (1994)	Conservation of biological diversity, sustainable use of its components, and fair and equitable sharing of benefits from genetic resources.
Framework Convention on Climate Change (1/8/1994)	Reduce greenhouse and gas emissions responsible for global warming. Achieve stabilization of greenhouse gas concentrations in the atmosphere to prevent dangerous anthropogenic interference with climate system.
Convention to Combat Desertification (8/12/1995)	Combat desertification and mitigate the effects of drought.
Vienna Convention for the Protection of the Ozone Layer (1993)	Protect human health and environment from any activity that modifies the ozone layer. Adopt measures to control human activities found to have adverse impact on ozone layer.

### 3.3 Institutional Framework

The implementation of the proposed project requires the involvement of several institutions at various levels. Brief statements on the missions/responsibilities of these institutions are summarized in Table 3.

**Table 3: Concerned Authorities and their Responsibilities**

<b>Institution</b>	<b>General Mission/Responsibility</b>
Ministry of Environment	<ol style="list-style-type: none"> <li>1. Monitor and control of environmental protection, prevention of pollution, protection of wildlife, and preservation of environmental balance</li> <li>2. Set environmental standards, specifications and guidelines for sectors that might have an impact on the environment and for the management of natural resources and amenities</li> <li>3. Policy planning and setting laws and regulations required to protect public health and the environment and then to strictly enforce them</li> <li>4. Define the environmental policy and ensure that it is appropriate to the nature, scale and environmental impacts of the activities</li> <li>5. Approve EIA studies giving way to permitting for the establishment of industrial facilities and other types of projects/activities</li> </ol>
Municipality of Bar Elias	<ol style="list-style-type: none"> <li>1. Local presence, supervision and enforcement</li> <li>2. Communicate with local population and solicit their feedback and concerns</li> <li>3. Granting municipal approval in permitting process</li> <li>4. Administrative clearance of documentation submitted for project permitting</li> </ol>
Litani River Authority	<ol style="list-style-type: none"> <li>1. Provide the land</li> <li>2. Operate the constructed wetland, and maintain, when needed</li> <li>3. Monitor water quality and effectiveness of treatment</li> </ol>

## 4 Baseline Conditions

At the scoping phase, a brief description of the baseline conditions is presented based on a site visit done by KREDO sal. Missing information or data is highlighted, and will be obtained for the EIA study, if deemed necessary.

Lot 1951 in Bar Elias municipality, where the project is proposed, is currently a barren land; however, it is occasionally grown with wheat.



**Figure 3: Proposed project location (left)**



**Figure 4: Ghezayel tributary to be treated**

The main physical, biological, and socio-economic baseline conditions of project area are presented in Table 4 below.

**Table 4: Description of Baseline Conditions**

<b>Baseline Conditions</b>	<b>Description</b>
<b>Physical Baseline Conditions</b>	
<b>Climate</b>	<p>Mediterranean climate, humid to sub-humid in the wet season to semi-arid in the dry season. The wet season coincides with the winter period, which lasts from October till May. The dry season coincides with the summer period, which lasts from June till September.</p> <p>Mean annual temperature is 11 °C. January is the coldest month. August is the hottest month with mean daily temperatures that range around 30°C.</p> <p>Average annual rainfall is about 600 mm, with the majority falling between December and March in the Bekaa valley.</p>
<b>Air quality and sources of pollution</b>	<p>Data on air quality could not be obtained due to the high cost of air quality tests. The proposed project location is surrounded by agricultural fields. There are no nearby industries.</p> <p>Sources of water pollution are, based on public consultation, mainly agricultural runoff that often have high concentration of nitrates and phosphates from the excessive use of fertilizers. Domestic sewage might also be a source of pollution. This will be confirmed upon sampling and testing the water in the design phase.</p>
<b>Noise</b>	<p>The noise level was measured using a phone application, and it was found to be less than 70 db.</p>
<b>Geology and Hydrogeology</b>	<p>As shown in Figure 5, the proposed project is underlain by the quaternary (q) formation which is composed of alluvial deposits making said formation an aquifer of the unconfined type. Unconfined aquifers are highly vulnerable to pollution.</p>
<b>Soil</b>	<p>Alluvial deposits of miscellaneous composition, mostly sand and limestone underlay the proposed project site.</p> <p>No soil samples were taken for testing.</p>
<b>Topography</b>	<p>Generally flat area plain with an estimated elevation of 873 mASL (meters above sea level)</p>



<b>Water sources (surface and groundwater)</b>	Ghezayel tributary is used for irrigation despite its polluted state. Farmers, as seen in Figure 4, installed pumps at the stream to irrigate their lands. Private wells exist mainly for irrigational purposes.
<b>Wastewater infrastructure</b>	Wastewater in Bar Elias is ultimately discharged without any form of treatment often ending up in tributaries, thus polluting them.
<b>Biological Baseline Conditions</b>	
<b>Flora and Fauna</b>	<p>As shown in Figures 3 and 4, shrubs and vegetation grow along the stream. No endemic flora exists. All surrounding areas are cultivated agricultural fields.</p> <p>Given the polluted condition of the stream, it is unlikely that aquatic life thrives in the stream. DO levels, determined through water testing, are indicative of suitability of water for aquatic life.</p>
<b>Socio-economic Baseline Conditions</b>	
<b>Population</b>	The municipality of Bar Elias is expectedly reliant on some local farming and agriculture often a high number of employed refugees. Bar Elias approximated population of 30,000. The population of refugees is around 60,000 to 70,000.
<b>Land use/land cover</b>	According to site visits and available literature, the municipality of Bar Elias is largely dominated by croplands (80%) with very few interspersed dwellings.
<b>Archaeology and cultural heritage</b>	No archaeological or cultural heritage site is in the vicinity of the proposed project location.

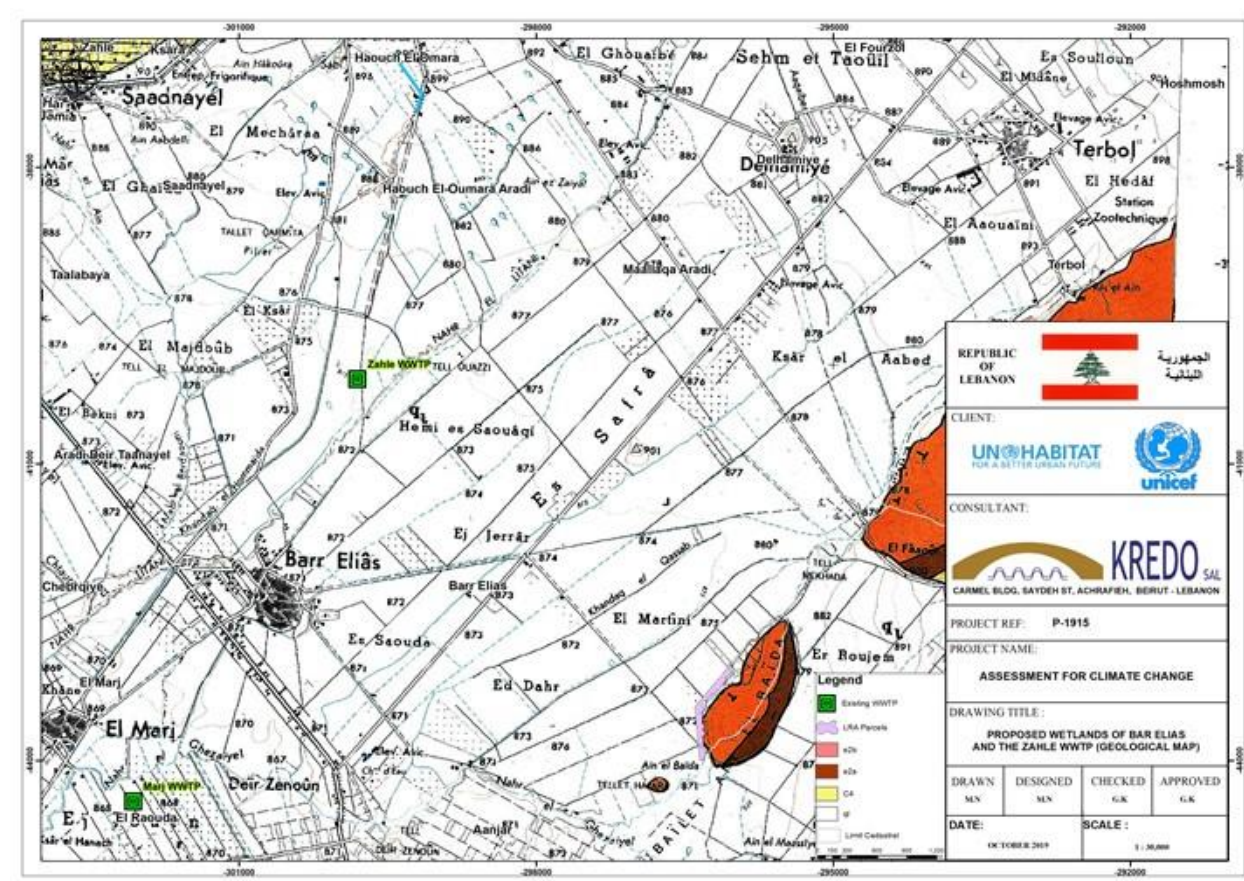


Figure 5: Geology underlying the proposed project site

## 5 Analysis of Alternatives

Analysis of alternatives to the proposed project are based on potential environmental and socio-economic impacts, benefits, costs, technical feasibility, as well as suitability to the context of the area and the country.

### 5.1 “Without Project” Alternative

As can be seen from the figures taken during the site visit, the stream is evidently polluted. Water sampling and testing are needed to identify the sources of pollution. The water is currently being used for irrigation, as can be seen from the pumps installed at the stream.

Without any treatment, there are serious public health risks at hand. The constructed wetland will not only treat the water, but also add biodiversity to the area, and provide an appealing landscape to a currently barren and polluted area.

In addition to the environmental, visual and health benefits of the project, the proposed wetland

is an economically feasible and technically simple option, as proven in the feasibility study.

## 5.2 Location or Site Routing

For the site selection alternatives, this is highly restricted by the availability of public land. In fact, it was based on the availability of lot 1951 of LRA that the project was proposed in Bar Elias. Due to the lack of law enforcement, the protected public zones at the periphery of river beds are often occupied or non-existent. The proposed site is located in an agricultural area, remote from residential agglomerations.

## 5.3 Alternative Technologies

Given the scale and the location of the project, a constructed wetland is the best option to treat polluted water. It is not economically feasible to construct a wastewater treatment plant. Constructed wetlands, whether surface or sub-surface, are known around the world as kidneys of the environment due to their ability to improve the quality of lotic water systems for multi-purposes including irrigation. They have low operation and maintenance costs.

The bio-remediation processes to be used in the constructed wetland cannot be evaluated at this stage because water from the stream has not been sampled and tested. During the design phase, and based on the type of pollutants present in the water, the design of the wetland and the plants to be grown in it will be determined. The plants should be of a native origin.

## 6 Public Participation

A stakeholders' meeting was undertaken in the municipality of Bar Elias on 18 December 2019, in collaboration with myriad local and governmental authorities, all under the auspices of the aforementioned municipality and mayor.

The meeting was held whereby the elements of the project were presented and the EIA process explained. This was followed by a Q&A session. The stakeholders helped in providing some feedback concerning the overall scope of the project and the EIA process. The feedback is taken into consideration within the scoping as well as the subsequent EIA

report.

**Appendix E** contains the following information pertaining to the public hearing held:

- Announcement at the municipality and in newspaper
- Invitees that have received the invitation letter (with signature)
- Meeting minutes
- Meeting attendance sheet
- Pictures
- Presentation given by KREDO sal.

## 7 Potential Environmental Impacts

### 7.1 Methodology

The environmental impact analysis will focus on comparing the expected evolution of the area with and without the implementation of the project. The impacts will be addressed in accordance to the construction and operation phases.

An impact is evaluated based on the likelihood of its occurrence and its severity or consequence, in case it occurred. The assessment is based on;

- Literature review of similar projects and processes
- Expert evaluation of the severity in light of the receiving environment under study (baseline conditions)
- Compatibility with standards and legislation
- Public concerns, interests, or preferences expressed at the public hearing
- Possibility of and effectiveness of mitigation measures

To evaluate the likelihood of the occurrence of an impact, the following three categories are defined.

**Table 5: Impact assessment - likelihood of occurrence**

Description	Likelihood of Occurrence	Score
Impact is unlikely to occur under normal conditions (construction/operation phases) but might occur in exceptional circumstances.	Not Expected	A

Impact may occur under normal conditions (during construction/operation phases).	Expected	B
Impact is highly likely to occur under normal conditions	Unavoidable	C

As for the severity of an impact, it is assessed based on its nature (direct vs. indirect), type (positive vs. negative), extent (in study area vs. beyond study area), duration (short vs. medium vs. long term), and reversibility (reversible vs. irreversible). Accordingly, the following five categories are defined to evaluate the severity of an impact.

**Table 6: Impact assessment - severity**

Description	Severity	Score
Short-term changes in the environment that are unlikely to be noticeable. Area of effect is restricted to the immediate vicinity of the sources.	Negligible	1
Moderate adverse changes in the area. Changes may exceed the range of natural variation with potential for recovery with time without intervention.	Moderate	2
Long-term impact resulting in adverse changes in the environment.	Significant	3
Massive impact over a large area resulting in extensive, potentially irreparable damage to a site of social and/or cultural importance.	Catastrophic	4
Changes result in a net positive impact to the environment and population.	Beneficial	5

Based on the above, impacts can be assessed as;

- Negligible – no mitigation measures are needed. Recommendations can be given.
- Minor – mitigation measures are needed, monitoring is recommended if applicable
- Unacceptable – mitigation measures and strict monitoring are mandatory
- Beneficial – no mitigation measures are needed. Monitoring is recommended to report on project indicators, thus positive impact.

**Table 7: Impact assessment**

		<b>Likelihood of Occurrence Score</b>		
		<b>A</b>	<b>B</b>	<b>C</b>
<b>Severity Score</b>	1	1A	1B	1C
	2	2A	2B	2C
	3	3A	3B	3C
	4	4A	4B	4C
	5	5	5	5
<b>DESCRIPTION</b>				
<i>Consequences</i>		<i>Likelihood</i>	<i>Impact Assessment</i>	
<i>1 – Negligible</i>	<i>4-Catastrophic</i>	<i>A-Unexpected</i>	<i>Negligible</i>	
<i>2-Moderate</i>	<i>5-Beneficial</i>	<i>B- Expected</i>	<i>Minor</i>	
<i>3-Significant</i>		<i>C- Unavoidable</i>	<i>Unacceptable</i>	
			<i>Beneficial</i>	

## 7.2 Impacts

The expected environmental parameters or issues that are typically associated with the implementation of projects include but are not limited to the following:

- Air quality impacts (dust, construction activities, vehicle emissions, etc.)
- Solid waste materials (earth works)
  - Quantity and nature of said waste streams
  - Disposal methods of said wastes
- Natural resources, landscape and some visual intrusion (and relevant protection zones or natural reserves)
- Noise impacts of the project
- Fauna and Flora impacted
  - Loss or disturbance to terrestrial habitats due to momentary construction activities, etc.
- Health and safety issues
  - attraction of insects, mosquito breeding sites
- Transport and traffic planning in and around proposed project
- Socio-economic impacts
  - Increase in job opportunities
  - Quality of life for population living in the project area.
  - Habitat improvement

## **8 Environmental Management and Monitoring Plan**

### ***Environmental Management Plan***

The purpose of the mitigation plan is to eliminate or reduce the potentially negative environmental impacts of the proposed project during the construction and operation phase. The development of mitigation measures will depend on the impact assessment described in Section 7.1 above.

Mitigation measures can be related to technical or management aspects. They will be proposed taking into consideration the cost of implementation with respect to the potential gain or effectiveness of the measure itself.

Lessons learned from the constructed wetland in Joub Jennine, done under the Litani River Basin Management Support project funded by USAID in 2012, will also be taken into consideration, especially for the operation phase.

### ***Environmental Monitoring Plan***

Depending on the outcomes of the impact analysis, a monitoring plan will be developed for the construction and operation phases. Environmental parameters to be monitored with their corresponding locations as well as the frequency and duration of monitoring will be included in the monitoring plan. Moreover, the relevant standards and legislation to which the environmental parameters should be compared will be mentioned.

Required equipment, skills, and cost of the implementation of the monitoring plan will be defined. Training requirements to attain unavailable skills for the proper implementation of the environmental management and monitoring plans will be addressed. Qualifications and responsibilities of key personnel will be defined to assure proper management.

## 9 The EIA Report

The EIA will be prepared in compliance with the Lebanese Environmental Code (Law 444 dated July 2002), the EIA Decree (8633, 2012), and Decision 261/1, 2015 for the content of the EIA.

The scope of the EIA has been outlined in this report. The EIA study will contain the following sections:

- Summary;
- Introduction;
- Project Description;
- Policy, Legal and Administrative Framework;
- Description of Baseline Conditions;
- Public Consultation;
- Analysis of Alternatives;
- Potential Environmental Impacts;
- Environmental Management Plan;
- Environmental Monitoring Plan
- Conclusion and Recommendations;
- Appendices:
  - References
  - List of Attendees in Public Participation session
  - Official Documents Related to Project
  - List of Contributors to EIA Report



## 10 Appendices

### 10.1 References

Wong, T., Breen, P., Somes, N., & Lloyd, S. (1999). Managing urban stormwater using constructed wetlands, (April). Retrieved from <http://www.catchment.crc.org.au/pdfs/industry199807.pdf>

## **10.2 Appendix A – CVs of EIA Team**

## Curriculum Vitae

**Name of Staff:** Mark SAADEH  
**Profession:** Hydrogeologist  
**Date of Birth:** 1968  
**Years with Firm/Entity:** 5 years  
**Nationality:** German/ Lebanese  
**Position for this assignment:** Environmental Specialist / Geologist

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### Education:

- **Ph.D** Hydrogeology “Influence of Overexploitation and Seawater Intrusion on the Quality of Groundwater in Greater Beirut” **RWTH Aachen University in Germany**; 2008.
- **MSc** Hydrogeology “Jeita and Kashkoush Springs: Hydrogeological Correlation and Pollution of the Groundwater.” **American University of Beirut**; 1994
- **BSc** Geology from the **American University of Beirut**; 1990

### Certificates:

- **ArcGIS operative**, 2005
- **SURFER 13 operative**, 2008
- **Professional Association of Diving Instructors (PADI)**, Scuba Diver, 1999
- **National Association of Underwater Instructors (NAUI)**, Scuba Diver, 1999
- **The American Concrete Institute (ACI)**, Special Inspector, 1999

### Key Qualifications:

Dr. Saadeh is a seasoned hydrogeologist and an environmental quality expert with more than 28 years of professional experience. As an academic and practitioner he has contributed to the development of water quality standards and assessment methods in Lebanon and has consulted on a large number of infrastructure projects including dams, hill lakes and tunnels as well as environmental projects covering water, wastewater and solid waste. He has worked with international consultants as well as local consultants where he has prepared assessments, detailed designs, supervision and quality management plans, professional training as well as acting as the lead hydrogeologist and environmental specialist on more than 30 EIA/EMP/IEE/EA studies including dams, hill lakes, marine works, water and wastewater infrastructure, constructed facilities, land and marine development projects and various industries.

### Languages:

	<b>Reading</b>	<b>Speaking</b>	<b>Writing</b>
English	excellent	excellent	excellent
Arabic	excellent	excellent	excellent
French	Good	Good	Good
Italian	Good	Good	Good
German	excellent	excellent	excellent

**Experience Record:**

*Date* : 2014 to Date  
*Employer* : KREDO SAL  
*Position* : Hydrogeologist and Senior Environmental Consultant  
*Location* : Achrafieh, Lebanon

- National Water Sector Strategy Update (2019-ongoing, MEW-UNICEF)
- Design and Supervision of six wells and pump stations in Tripoli (Fund for the Displaced, 2018-2019)
- Master Plan for Irrigation in Akkar, including survey and condition assessment of existing infrastructure including more than 600km of irrigation channels (2018-ongoing, MEW)
- Design and EIA for a small embankment dam and irrigation channels in El Shesh-Bcharre (2017-2018, CDR)
- Supervision and concrete quality control of the rehabilitation of the Rafik El Hariri – Beirut Airport breakwater (MPWT-DG Civil Aviation, 2017-ongoing)
- Supervision of well and pump station in Mansouriet Bhamdoun (Fund for the Displaced, 2018)
- Lecturer on “Applied Hydrogeology: Concepts, Groundwater and Drilling” workshop, funded by the German Government and implemented by arche noVa and Tankamel Sawa in collaboration with North Lebanon Water Establishment (March, 2018)
- Design of Wastewater treatment plant and wastewater network for the Nabeh El Tasseh system in South Lebanon (MEW, 2018-ongoing)
- Design of wells and pump stations (BMLWE, 2017-2018)
- Design and Supervision of well and pump station in Choueifat (Fund for the Displaced, 2017)
- Identification of possible sites and design of Hill Lakes in Metn and Keserwan (MEW, 2017-ongoing)
- Preliminary and Detailed Studies for Hill Lakes in Metn and Kesserwan (2016-ongoing, MEW)
- Engineering consultancy for rehabilitation and supervision of water infrastructures in south Lebanon including the rehabilitation of Taybeh water treatment station for the SLWE(2016-2017, ACF)
- Design and Supervision of wells rehabilitation upgrade and expansion of water supply infrastructure in Saida for the SLWE (2016-2017, CARE)
- Preparation of various EIAs and Environmental Management Plans (solar power plants, dam, hill lakes, water and wastewater infrastructure, wastewater treatment plant, solid waste treatment plant, land development project, oil and gas), IEE (touristic, housing and large construction projects) and EA (winery, concrete batching plant, poultry farm, plastic industry, gas stations) for the MOE (2014-ongoing)

*Date* : 2016 to 2017  
*Employer* : Byblos Municipality  
*Position* : Project Leader, Project Phoenix  
*Location* : Byblos, Lebanon  
*Types of Activities* :

- Water survey of myriad Byblos water sources as part of a memorandum of understanding between AUT and the Byblos Municipality

*Date* : 2014 - 2017  
*Employer* : American University of Technology

*Position* : Chairman, Water Resources Department  
*Location* : Byblos, Lebanon

*Date* : 2011 to 2013  
*Employer* : Associated Consulting Engineers (ACE)  
*Position* : Head of Environmental Department  
*Location* : Beirut, Lebanon  
*Types of Activities* :  
 - Project manager of the Jurd Tannourine-Laqlouq Dams and Hill Lakes Project, Ministry of Energy and Water  
 - Undertaking EIAs for several private entities  
 - Deep water well study for the Dar Al Ajaza Al Islamiah Hospital, Beirut  
 - Several water well studies for the Ministry of Energy and Water in North Lebanon

*Date* : 2009 to 2010  
*Employer* : International Resources Group (IRG)  
 Litani River Basin Management Support Project (LRBMS)  
*Position* : Water Resources Consultant  
*Location* : Beirut, Lebanon  
*Types of Activities* :  
 - Implementing the water quality monitoring program of the Litani River, Qaraoun Reservoir, and Litani Basin groundwater  
 - Undertaking a bathymetric survey of the Qaraoun Reservoir  
 - Diving in the Qaraoun Reservoir for isotopic water sampling and dam inspection  
 - Monitoring pollution of olive oil industry and waste water treatment plants  
 - Design of constructed wetlands for the treatment of waste-water in Khirbet Qanafar / Machghara

*Date* : 2005 to 2011  
*Employer* : Litani River Authority (LRA)  
*Position* : Head of Environmental Unit  
*Location* : Beirut, Lebanon  
*Types of Activities* :  
 - Implementing the water quality monitoring program of the Litani River, Qaraoun Reservoir, and Litani Basin groundwater  
 - Undertaking a bathymetric survey of the Qaraoun Reservoir  
 - Diving in the Qaraoun Reservoir for isotopic water sampling and dam inspection  
 - Monitoring pollution of olive oil industry and waste water treatment plants  
 - Design of constructed wetlands for the treatment of waste-water

*Date* : October 2010  
*Employer* : German Federal Institute for Geosciences and Natural Resources, (BGR)  
*Position* : Water Resources Management Consultant  
*Location* : Euphrates Basin, Syria  
*Types of Activities* :  
 - Supporting the upgrade of surface water monitoring in selected locations within the Euphrates Basin, Syria.

*Date* : 2005 to 2009  
*Employer* : Kaslik Holy Spirit University  
*Position* : University Lecturer, Department of Agriculture  
*Location* : Jounieh, Lebanon  
*Types of Activities* : Teaching various courses on water quality and management

*Date* : 2007  
*Employer* : World Health Organization (WHO),  
*Position* : Water Quality Consultant, National Water Quality Testing Program  
*Location* : Lebanon  
*Types of Activities* :  
 - National training and monitoring program for municipalities and ministries in the latest water quality sampling and testing procedures.

*Date* : 2004 - 2005  
*Employer* : SANA Engineers  
*Position* : Project Manager "Nahr El Bared Saltwater Intrusion Investigation"  
*Location* : Beirut, Lebanon  
*Types of Activities* :  
 - Groundwater monitoring program for the international agency CESVI-Italy, to determine the extent of saltwater intrusion in the Nahr El Bared coastal aquifers

*Date* : 2004 - 2005  
*Employer* : Development Alternatives Inc. (DAI),  
*Position* : Project Manager  
 "Litani Water Quality Management Project (LWQM aka BAMAS)"  
*Location* : Washington, USA  
*Types of Activities* :  
 - Managing an extensive soil, sediment and water quality monitoring program in the Upper Litani River Basin as part of a USAID funded project for the Litani River Authority.

*Date* : 1999 - 2004  
*Employer* : Dames & Moore/EDESSA  
*Position* : Consultant  
*Location* : Beirut, Lebanon  
*Types of Activities* :  
 - Naameh & Bsalim Sanitary Landfill, construction & operation supervision.  
 - Kaoukaba Wastewater Treatment Plant construction, South Lebanon  
 - Selaata Port off-shore investigation (diving)  
 - Preparing and submitting an EIA for Movenpick, Beirut

*Date* : 1996 - 1999  
*Employer* : Dar Al Handasah (Shair and Partners)  
*Position* : Consultant  
*Location* : Beirut, Lebanon  
*Types of Activities* :  
 - Beirut Central District (BCD) & Port of Beirut projects, various materials supervision aspects including soils, concrete, asphalt etc.  
 - Marine supervision (diving) of the Port of Beirut Breakwater

*Date* : 1994 - 1995  
*Employer* : Montgomery Watson, Ministry of Energy & Water  
*Position* : Geologist / Consultant  
*Location* : Beirut, Lebanon  
*Types of Activities* :  
 - Awali-Beirut Water Conveyor Project Feasibility Study

## Professional Development

- Project Phoenix: water quality monitoring regime for the Municipality of Byblos for the American University of Technology, Byblos, Lebanon. Spring 2016
- Conference: Seawater Intrusion in Greater Beirut. Third Annual Conference on Water Resources & Renewable Energy. AUT, Halat. 22 March 2016.
- Symposium: Deterioration of Groundwater in Beirut by Seawater Intrusion. Lebanese Association for the Advancement of Science (LAAS). Saint Joseph University, Beirut. 16 April 2015.
- Scientific Visit: Isotopes in Ground Water Hydrology. International Atomic Energy Agency (IAEA), Vienna, Austria. September 2008.
- Symposium: Influence of Overexploitation and Saltwater Intrusion on the Quality of Groundwater in Greater Beirut. Seminar, World Water Day. European Commission, Rome, Italy. 12-13 March 2008.
- Scientific Visit: Watershed and Water Resources Management (with special emphasis on wastewater treatment through constructed wetlands), US Dept. of Agriculture. US Forest Service, Arizona. June-July 2007.
- Symposium: Water Use Efficiency in the Mediterranean Region, WEMED. Mediterranean Agronomic Institute of Bari, Italy. 26-28 October 2006.
- Symposium: Influence of Overexploitation and Saltwater Intrusion on the Quality of Groundwater in Greater Beirut. Symposium for Environmental Protection in the Middle East and North Africa. Frankfurt, Germany. 18-19 September 2006.
- Scientific Visit: Water Pollution and Water Resources Management for Arabian Countries (with special emphasis on the use of constructed wetlands for wastewater treatment). Center for Environmental Education and Communications (CEEC), Beijing, People's Republic of China. 2-16 June 2006.

## Publications

- Deterioration of Groundwater in Beirut due to Seawater Intrusion, Journal of Hydrology, Saadeh, M., et al. 2016 (submitted)
- Chemical & Biological Analysis of Canal 900, Bekaa Valley, Lebanon, Scientific World Journal, Saadeh, M., Amacha, 2013
- Hydrochemical Characteristics of Surface and Groundwater in the Upper Litani River Basin, Lebanon, Scientific World Journal, Saadeh, M., Semerjian, L., Amacha, ID 462467, 2012
- Chemical & Environmental Isotope Study on Hydrodynamics of Lake Qaraoun, Bekaa, Lebanon, Journal of Environmental Hydrology, Kazpard, V., Saadeh, M. et al. 2009.
- Seawater Intrusion in Greater Beirut, Lebanon, Climatic Changes and Water Resources in the Middle East and North Africa, Saadeh, M., Environmental Science and Engineering, Springer, 2008.
- Geostatistical Assessment of Groundwater Nitrate Contamination with Reflection on DRASTIC Vulnerability Assessment: The Case of the Upper Litani Basin, Lebanon, Water Resources Management, Assaf, H. and Saadeh, M, Springer Netherlands, 0920-4741, July 2008.
- Assessing water quality management options in the Upper Litani Basin, Lebanon, using an integrated GIS-based decision support system, Assaf, H. and Saadeh, M., Elsevier B.V., May 2008.
- Improving Water Use Efficiency for a Sustainable Productivity of Agricultural Systems in Lebanon, International Center for Advanced Mediterranean Studies, Karam, F., Saadeh, M. and Geagea, L., European Commission, Number 72, September 2007.

## Curriculum Vitae

**Name of Firm:** KREDO  
**Name of Staff:** Roula Bassil Srouji  
**Profession:** Civil Engineer  
**Date of Birth:** 1981  
**Years with Firm/Entity:** 10 years  
**Nationality:** Lebanese

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### Education:

- B.E in Civil Engineering (2004), Lebanese American University-Byblos
- MBA (2006), USJ-Ashrafieh /Sorbonne Paris

### Key Qualifications:

Mrs. Bassil Srouji is a civil engineer with 14 years of experience in civil infrastructure design and supervision, site management, project management and planning, and building construction. She has worked on all types of internationally funded complex infrastructure projects in Lebanon developing a solid and highly valuable insight in all project phases and their particular requirements. She is an expert in contract and project management.

During the last ten years she has acted as design lead and project manager on a host of water, irrigation, wastewater and road projects funded by the EU, UNRWA, UNICEF, USAID, UNDP and Saudi Fund as well as locally funded projects through the CDR and the MEW. More recently she has been responsible for the management of large IQC contracts for the design and supervision of a more than 45 irrigation projects for the MEW as well as being responsible for two LTA for WASH projects one with the UNICEF and the other with UNDP across Lebanon covering multiple projects across the country. She is also responsible for coordinating the preparation of environmental studies including EA, IEE and EIAs for a host of private and public projects.

### Professional Membership:

- Member of the Order of Engineers of Lebanon

### Languages:

	<b>Reading</b>	<b>Speaking</b>	<b>Writing</b>
English	Excellent	Excellent	Excellent
Arabic	Excellent	Excellent	Excellent
French	Excellent	Excellent	Excellent

### Experience Record:

*Date* : 2008- to date  
*Employer* : KREDO SAL  
*Position* : Project Manager  
*Location* : Beirut, Lebanon



*Types of Activities* : Responsible for project management, preliminary and detailed design, tenders preparation, pricing, bills of quantities, project planning, and projects supervision. Responsible notably for the following projects:

- Structural assessment of Public School in Zouk Mosbeh and detailed design for extra classes (2019-ongoing, GIZ)
- Design and Supervision of the construction of more than 10 km of agricultural roads in Al-Arkoub, and Hasbaya, South Lebanon, funded by the UNDP. (2018-ongoing)
- Supervision of various irrigation water projects all over Lebanon with the MEW, including open concrete channels, reservoirs, spring catchments, and irrigation pipe networks under an IQC contract (2018-ongoing, MEW).
- Design and Supervision of various WASH projects for the UNDP under an LTA contract including the design, rehabilitation and construction supervision of agricultural roads, irrigation channels, wastewater networks, water networks, ground reservoirs, elevated reservoirs, wells, pumping stations, treatment and chlorination stations (2017-ongoing, UNDP)
- Design and Supervision of various WASH projects for the UNICEF under an LTA contract including the design, rehabilitation and construction supervision of wastewater networks, water networks, ground reservoirs, elevated reservoirs, wells, pumping stations, treatment and chlorination stations (2017-ongoing, UNICEF).
- Coordination of various EIAs (solar power plants, dam, wastewater treatment plant, land development projects etc...), IEEs (touristic, housing and large construction projects) and EAs (winery, concrete batching plant) for the MOE (2017-ongoing)
- Supervision of the rehabilitation and reconstruction works of Daraya-Aanout road, 7.5 km, (2017-ongoing, CDR)
- Supervision of the complementary works for the rehabilitation and reconstruction of Zaytounie-Joun road, ca. 14.5 km, funded by the Saudi Fund. (2017-ongoing, CDR)
- Assessment of water and wastewater infrastructure in Aarsal (2017, ACF)
- Design of hill lakes and water retention ponds and agricultural land development projects in Akkar (ACTED, 2016-2017)
- Design of a parking structure (2015, La Kadisha)
- Structural assessment of two buildings (2014-2015, La Kadisha)
- Design and supervision of a new administrative building for the Oil Installations in Zahrani (2013-2017, Oil Facilities of Tripoli and Zahrani-Ministry of Energy and Power)
- Design for Repair and Rehabilitation of the Civil Works of Richmaya and Nahr el Kalb Power Plants including Water Intake Structures, Tunnel, Headpond, Penstock, Channels, Access Bridge and buildings structures (UNDP, 2012-2013)
- Design for Bikfaya Transformer Building rehabilitation and structural strengthening (2012-EDL)
- Design and Supervision of various WASH projects for the UNICEF under an LTA contract including the design, rehabilitation and construction supervision of wastewater networks, water networks, ground reservoirs, elevated reservoirs, wells, pumping stations, treatment and chlorination stations (2015-2017, UNICEF).

- Supervision of more than 45 irrigation water projects all over Lebanon with the MEW, including open concrete channels, reservoirs, spring catchments, and irrigation pipe networks under three consecutive IQC contracts (2014-2017, MEW).
- EIA for Wastewater Network and Treatment Plant in Dawra-Akkar (2014-2015, EU funded-ESFD)
- Design and supervision of the Daoura village wastewater networks and treatment plant in Akkar for the ESFD, funded by the EU. (2014-2015, ESFD)
- Design and supervision of potable water networks in North Hermel for the ESFD, funded by the EU. (2013-2015, ESFD)
- Supervision of the construction of new water networks in Jezzine by the MEW. (2013-2015, MEW)
- Design and Supervision of the construction of more than 40 km of service and agricultural roads in Akkar, North Lebanon, funded by the EU through the CDR. (2011-2014, CDR)
- Supervision of water projects funded by the EU in Lebanon including small and medium hill lakes in Tarchich, Khraibe, and Niha, and the rehabilitation of springs in Jurd Aley and Iqlim al Tuffah. (2010-2013)
- Design and Supervision of the construction of more than 30 km of service and agricultural roads in Al-Arkoub, Yohmor and Taybeh, South Lebanon, funded by the EU. (2009-2011)
- Supervision of the rehabilitation and reconstruction works of Saadyat-Ain El Haour and Zaytounie-Joun roads, ca. 28.5 km, funded by the Saudi Fund through CDR. (2009-2015)
- Supervision of the construction of the water and wastewater networks in the region of Zgharta-Ehden, CDR. (2009-2015)
- Design for rehabilitation and supervision of Akkar- El Bared main water canal funded by the EU for the NLWE. (2009-2011)
- Design for rehabilitation and supervision of Entrance # 9 Port of Beirut. (2009-2010)
- Supervision of the sewerage, stormwater drainage, and water supply systems rehabilitation at Dbayeh Camp for the UNRWA. (2009-2010)

*Date* : 2003 – 2008

*Employer* : Ashada SAL

*Position* : Civil Engineer

*Location* : Beirut, Lebanon

*Types of Activities* : Responsible for supervision, planning and site management, quantities surveying, and pricing of projects.

- Site Engineer– Villa Abou Ghazale –Faqra
- Site Engineer- Hadath Municipality (Phase 1 Concrete) –Hadath- Sibney –Haret El Botm.
- Construction Engineer- Jawad Jaber Building –Dbayeh near GS center- Main Road.

- Construction Engineer- Rehabilitation works in Cedim Medical Center- Abraj- Furn el Chebak.
- Planning engineer- Infrastructure Project-Underground telephone installation including cables, handholes, and manholes, backfilling, trench reinstatement, and asphaltting. OSP phase 1.

## Curriculum Vitae

**Name of Staff:** Diana El Halawani  
**Profession:** Civil Engineer  
**Date of Birth:** 1993  
**Years with Firm/Entity:** 1 year  
**Nationality:** Lebanese  
**Proposed Position:** Environmental and Social Specialist

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### Education:

- M.Sc. Environmental Studies-Cities and Sustainability, Aalborg U.- Denmark and Universidade de Aveiro- Portugal, 2017 (joint-degree)
- BE in Civil Engineering (Minor Environmental Sc.), LAU, Byblos, Lebanon, 2015.

### Key Qualifications:

Ms. El Halawani is a highly qualified Environmental Engineer and Scientist whose academic training covers the basics of Civil engineering, Environmental Sciences and the Social and Sustainability dimensions. She has been involved in environmental consultancy and has co-founded a start-up to develop a sustainable model for organic waste recycling. She has conducted research on climate change adaptation, sustainable urban mobility, and control of air and water pollution.

### Languages:

	Reading	Speaking	Writing
English	Excellent	Excellent	Excellent
Arabic	Excellent	Excellent	Excellent
French	Excellent	Excellent	Excellent

### Experience Record:

*Date* : 2018 to date  
*Employer* : KREDO SAL  
*Position* : Civil Engineer / Environmental Engineer  
*Location* : Achrafieh, Lebanon  
*Types of Activities* :

- Feasibility study for a sorting and composting solid waste treatment plant.
- Various EIA, IEE and EA studies in support of KREDO team.

*Date* : 2017-2019  
*Employer* : TURBA  
*Position* : Co-Founder /Principal Engineer  
*Location* : Aramoun, Lebanon  
*Types of Activities* :

- Developed, tested and evaluated organic waste recycling on community level and with businesses
- Raised funding from donors and pitching competitions

- Engaged with public and private stakeholders (municipalities, MoE, businesses, donors)
- Implemented pilot projects to test business model monitoring efficiency, waste input, and costs, to produce high quality compost.

*Date* : 2018  
*Employer* : Sanofi  
*Position* : Junior Financial Conptroller  
*Location* : Beirut, Lebanon  
Types of Activities :

### **Honors and Awards**

- Dean's Honor List and Dean's Distinction List 2011-2015

### **Computer Skills**

AutoCAD 2015, AutoCAD civil 3D, Canva, Prezi, GIS, MS-Project, Primavera.

## Curriculum Vitae

**Name of Firm:** KREDO  
**Name of Staff:** Mahmoud Noun  
**Profession:** Civil Engineer  
**Date of Birth:** 1986  
**Years with Firm/Entity:** 7 years  
**Nationality:** Lebanese  
**Position for this assignment:** GIS Engineer/ SP

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### Education:

- Civil/Surveying Engineering Degree, Islamic University of Lebanon (UIL), 2010

### Key Qualifications:

Mr. Noun is an expert mapping and surveying civil engineer with extensive GIS expertise and training. For the last seven years he has been involved in many large infrastructure projects most notably in the development of a full GIS database for the existing and planned water and wastewater infrastructures in the Bekaa as part of the Masterplan being carried out by the BWE under USAID funding. He has also acquired extensive GIS and mapping experience on various projects with the Center of Remote Sensing.

### Professional Membership:

- Member of the Order of Engineers of Lebanon

### Languages:

	Reading	Speaking	Writing
English	Good	Good	Good
Arabic	Excellent	Excellent	Excellent
French	Good	Good	Good

### Experience Record:

*Date* : 2012- to date  
*Employer* : KREDO SAL  
*Position* : Infrastructure/ GIS Engineer  
*Location* : Beirut, Lebanon  
*Types of Activities* :

- Master Plan for Irrigation in Akkar, including survey and condition assessment of existing infrastructure including more than 600km of irrigation channels (2018-ongoing, MEW)
- Design and EIA for a small embankment dam and irrigation channels in El Shesh-Bcharre (2017-ongoing, CDR)
- Preliminary and Detailed Studies for Hill Lakes in Metn and Kesserwan (2016-ongoing, MEW)
- Hill Lake and Water Retention Landscape Design and Supervision (2016-2017, ACTED)

- Engineering consultancy for rehabilitation and supervision of water infrastructures in south Lebanon including the rehabilitation of Taybeh water treatment station for the SLWE(2016-2017, ACF)
- Design and Supervision of wells rehabilitation upgrade and expansion of water supply infrastructure in Saïda for the SLWE (2016-2017, CARE)
- Feasibility Assessment for constructed wetlands wastewater treatment plants at 25 locations in Akkar (2016-ongoing, UNICEF)
- Master Plan for Wastewater in North Lebanon and Akkar (2015-ongoing, MEW)
- Master Plan for Water Supply and Wastewater Systems in the Bekaa, funded by the USAID (2012-2015-DAI):

Development of a full data base of geo-referenced GIS for all existing infrastructure for water, wastewater and irrigation networks and facilities in the Bekaa; development of GIS database for all planned and proposed projects; mapping, and creation of plans of all types with satellite imagery or topographic 1/20,000 scale maps.

Also assisted in a multitude of water and infrastructure projects in the preparation and production of maps and GIS databases including road classification projects and urban planning for the Ministry of Public Works and Transportation.

- Update of study for rehabilitation of Tannoutirne Tahta- Tannourine Fawqa road ca. 7km (2015, CDR)
- Design for rehabilitation and supervision of the breakwater at Beirut International Airport (2015-ongoing, BIA)
- Study for rehabilitation of Daraya-Aanout road ca. 7.5 km (2013-2014, CDR)
- Design and supervision of potable water networks in North Hermel for the ESFD, funded by the EU. (2014-2015)
- Design and supervision of wastewater network in Daoura Akkar for the ESFD, funded by the EU. (2014-2015)
- Roads classification and Urban planning projects for the Ministry of Public Works and Transportation-GIS database

*Date* : 2012  
*Employer* : self  
*Position* : freelance consultant  
*Location* : Bekaa  
*Types of Activities* :

- Road studies in Ain Bourday village (Plans, profiles, cross sections )
- Mapping General Mapping and GIS for the municipalities of Chaat and Aynata

*Date* : 2011 – 2012  
*Employer* : Center of Remote Sensing (CNRS Lebanon)  
*Position* : Researcher Assistant  
*Location* : Beirut, Lebanon  
*Types of Activities* :

- Mapping National Olive Map of Lebanon
  - Satellite image Pre-processing

- Phot-interpretation
  - GIS editing
  - Field validation and statistic analysis
- Mapping National Land Cover Map of Lebanon
    - Elaboration of classification system
    - Satellite image Pre-processing
    - Phot-interpretation
    - GIS editing
    - Field validation and statistic analysis
- Development of Drought Monitoring System
    - Satellite image pre-processing
    - Generation of time series NDVI and LST images
    - Development of Vegetation Health Indicators
- Mapping National Health Bulletin Map of Lebanon
    - GIS data entry and editing
    - GIS analysis
    - GIS layout
- Modeling Forest Fire Risk Map in Nahr Ibrahim watershed
    - Orthorectification of aerial photos
    - Mosaicking
    - Change Detection Analysis
    - Implementation of Fire Risk model using multicriteria method

*Date* : 2010 – 2011

*Employer* : Jihad El Arab contracting company

*Position* : Survey engineer

*Location* : Beirut, Lebanon

*Types of Activities* :

- Working in Infrastructure projects of street Badaro, Kaskas, Barbir, Elmathaf. (Box culvert, pipe culvert , Retaining walls, ... ). Coordination with all trades (civil, architecture, MEP).

*Date* : 2008 – 2011

*Employer* : National Center of Remote Sensing "(CNRS)"

*Position* : Survey engineer

*Location* : Mansourieh, Lebanon

*Types of Activities* :

- Working with Dr. Ghaleb Faour on the following projects:
  - Creation of "olive map" for olive distribution on the whole Lebanese territory, using GIS and ERDAS.
  - LANDUSE and LANDCOVER for Baalbeck-Herrnel region.

*Date* : 2007 – 2008

*Employer* : Lebanese Land Surveying

*Position* : Land surveying

*Location* : Antelias, Lebanon

*Types of Activities* :



- Land surveying for the following villages in the south of Lebanon (Aynata, kabrikha, Bakkifa and Sultaniya), using TOTAL STATION, GPS, AutoCAD and LAND Desktop.

**Training:**

- **March/July 2010:**  
Final year project, entitled "hyperspectral Tele-detection applied on Lebanon - Elaboration of spectral database and Application on water study". Bibliographic and experimental study of spectral signatures of minerals, rocks, sand, water and vegetal detected by EO- I Hyperion.
- **June/July 2009:**  
Training on GPS use at Islamic University (Khalde, Wardenieh)
- **July/August 2007:**  
Training on TOTAL STATION and Level use at Islamic University (Wardenieh, Seblin)

**Skills:**

**Computer:**

- Programming: C/C++ ...
- Microsoft Office: Word, PowerPoint, Excel ...
- Software: GIS, ERDAS, ENVI, AutoCAD, Land Desktop, Civil 3D 2012.

### **10.3 Appendix B – Legal Registration Document**

رقم الطلب : ١٢١٥٧

امانة السجل العقاري في زحلة

بتاريخ ٢٥-٠٩-٢٠١٩

بناء على الطلب المقدم من : رضا الدسوقي

المحلة : ضهر الشمالي الطويل زملة حبود

والدى مراجعة قيود السجل العقاري اعطيت هذه الإفادة الشاملة  
العقار : ١٩٥١ المنطقة العقارية : برالياس

مساحة العقار/القسم (م) : ٦١٦٨٣

النوع الشرعي للعقار : اميري

## محتويات و وصف العقار و الحقوق العينية و الوقوعات

المرجع في السجل اليومي

الرقم التاريخ

وصف العقار : ارض بعل سقي تزرع حبوب وقسم مغروس اشجار تفاح.

نوع العقار : أرض غير مبنية.

ملاحظة: عند طلب اي افادة عن هذا العقار تراجع الصحيفة الاساسية المفرز عنه

المرجع في السجل اليومي

الرقم التاريخ

## الملكية - التصرف

الحصة

سهم

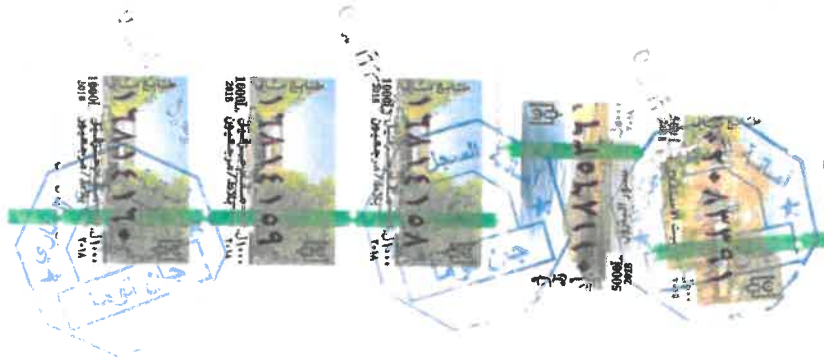
اسماء المالكين

نوع الحق خلاصة العقود

٢٤٠٠

الجمهورية اللبنانية المصلحة الوطنية لنهر اللباني (اميري)

اخرى (تصحيح، حق مختلف) : عملا بالمرسوم ١٨٠٩٧ / ١٧ / ١٢ / ٢٧ بملف ٩٨٢.



استوفي الرسم بموجب لصق تمغة على الطلب

هذا ما تم تسجيله على الصحيفة العقارية حتى تاريخه أعلاه

زحلة في ٢٥-٠٩-٢٠١٩

امين السجل العقاري

## **10.4 Appendix C – Land Classification**

# الجمهورية اللبنانية

وزارة الأشغال العامة والنقل

المديرية العامة للتنظيم المدني

دائرة التنظيم المدني في محافظة البقاع

دائرة التنظيم المدني في قضاء رأس العين

رقم التسجيل: ١٩٧٤

التاريخ: ١٩/١١/٢٠١٩

المنطقة العقارية: بالتك  
 القضاء: رأس العين  
 رقم العقار: ١٩٥١  
 المنطقة الإرتفاقية: كفر دزراعة  
 التخمين: .....

العقار <del>غير مصاب بأي تخطيط والطرق الموجودة مصنفة وفقاً لما هو مبين على خريطة المساحة المرفقة</del>	افادة تخطيط
العقار مصاب بتخطيط مصدق وفقاً لما هو مبين على خريطة المساحة المرفقة (١) بموجب المرسوم رقم <u>١٨٠٩٢</u> تاريخ <u>٥٧</u> والطريق <u>صفت</u> بموجب المرسوم رقم ..... تاريخ ..... والطريق مصنف بموجب المرسوم رقم ..... تاريخ ..... والطريق مصنف والطرق الموجودة مصنفة <u>لايف كج طريقه ١/٠</u>	افادة تصنيف
العقار مصاب بتخطيط ملحوظ والطريق مصنف : والطرق الموجودة مصنفة :	
العقار يقع خارج أي منطقة مصنفة (١) المنطقة موضوعة تحت الدرس بموجب المرسوم رقم ..... تاريخ ..... والعقار يقع ضمن المنطقة المصنفة بموجب قرار المجلس الأعلى للتنظيم المدني رقم ..... تاريخ .....	
العقار يقع ضمن المنطقة المصنفة (١) بموجب المرسوم رقم <u>٦٩٠٩</u> تاريخ <u>١٠/١٠/٢٠١٩</u> العقار يقع ضمن المنطقة المصنفة (١) بموجب المرسوم رقم ..... تاريخ ..... العقار يقع ضمن المنطقة المصنفة (١) بموجب المرسوم رقم ..... تاريخ .....	
المنطقة هي منطقة اصطياف بموجب المرسوم رقم (١) ..... تاريخ ..... على ظهره نظام المنطقة التي يقع ضمنها العقار ارتفاقات أخرى .....	

يعمل بهذه الافادة لمدة أربعة أشهر من تاريخ .....

رئيس دائرة التنظيم المدني في قضاء رأس العين

المهندس

الطوبى عراف  
فادي مطراي

مهندس المنطقة  
علي العزير

التراجع: المرسوم رقم ١٥٢٩٩ تاريخ ١٩٦٤/٢/٥

طريق اولي: ستة عشر متراً عن المحور على ان لا يقل عن خمسة امتار من حدود الاستملاك  
 طريق رئيسي ثانوي: اثني عشر متراً عن المحور على ان لا يقل عن أربعة امتار ونصف من حدود الاستملاك  
 طريق محلي : عشرة امتار عن المحور على ان لا يقل عن اربعة امتار عن حدود الاستملاك

(١) شطب ما لا يلزم

الشروط المفروضة في المنطقة المصنفة E بموجب المرسوم رقم ٦٩٠٩ تاريخ ٢٠٠١  
 الشروط المفروضة في المنطقة المصنفة E بموجب قرار المجلس الأعلى لتنظيم المدني رقم تاريخ

نظام المنطقة	نظام المنطقة E	E	
	١٠٠٠	٧٠٠٠	المساحة الدنيا
	٣٥	٣٥	الواجهة الدنيا
	٣٥	٣٥	العمق الأدنى
	دون ٣٣ سم % طرفان وهدائن عند الإفراز	٥٠٠٠	المساحة الدنيا
		٣٠	الواجهة الدنيا
		٣٠	العمق الأدنى
	٣-١	٣-١	التراجع عن التخطيط
	٦-١	٦-١	التراجع الخلفي
	٦-١	٦-١	التراجع الجانبي
			معدل الإستثمار
	% ٥	% ٥	السطحي
	٢٠٥	٢٠	معدل الإستثمار الأقصى
	واحد	٢	عدد الطوابق
	٥-١	٧-١	العلو الأقصى
		لكن مالء الصغار وأولاده	وجهة الإستعمال
			نوع البناء
			نوع الواجهات
			ثكنة قرميد
			راجع الشروط الخاصة والعامه

في / / ٢٠

رئيس دائرة التنظيم المدني في قضاء

المهندس

(١) شطب ما لا يلزم

الطوبوغراف  
الترسام

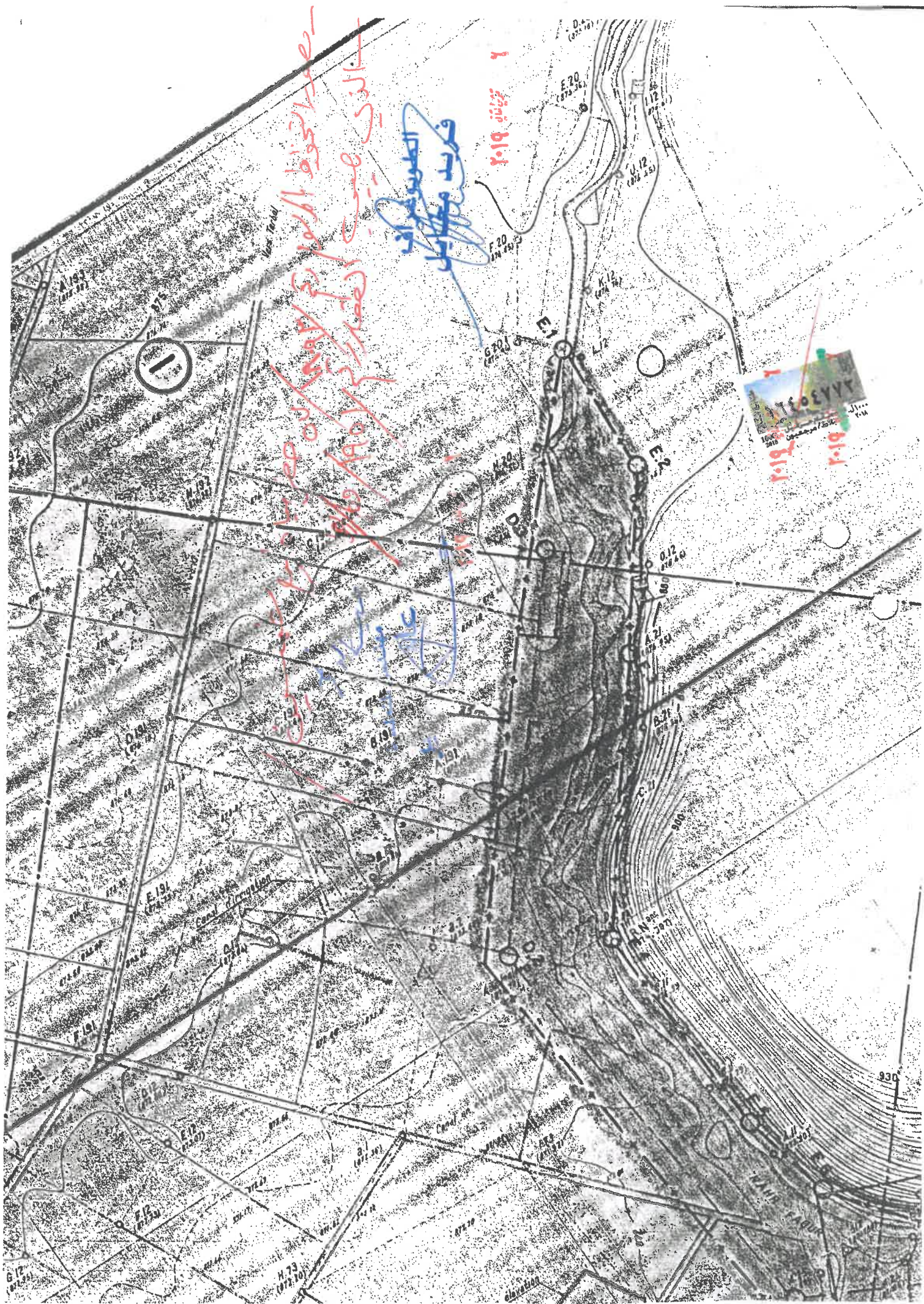
فهد مغازيل

٢٠١٩

مهندس المنطقة

عبدالله

٦ تمريثية ٢٠١٩



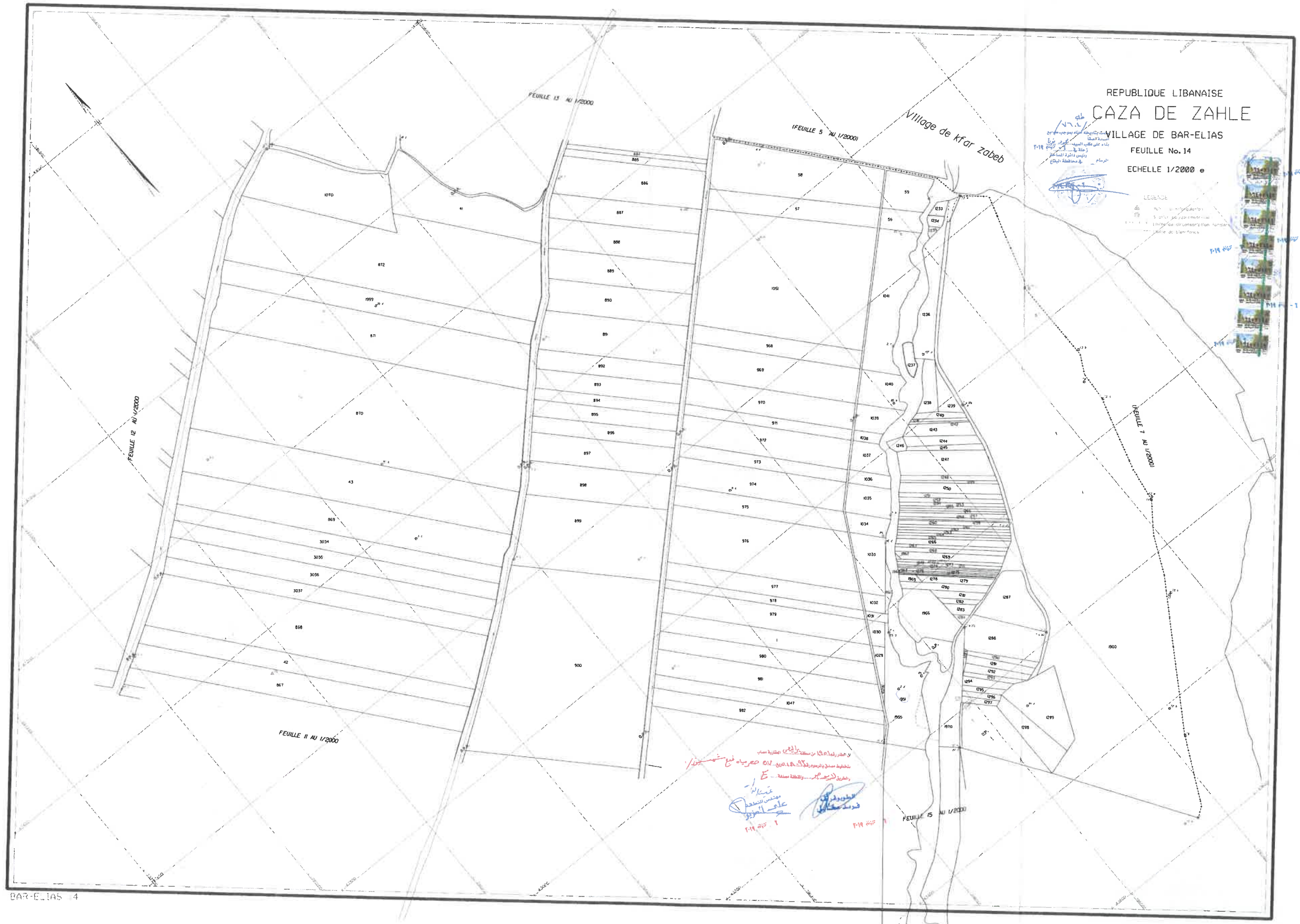
خط الحدود المسمى في الخريطة هو خط الحدود الذي بين الضفة الغربية والضفة الشرقية

فريد مصلح

٢٠١٩



930



REPUBLIQUE LIBANAISE  
CAZA DE ZAHLE  
VILLAGE DE BAR-ELIAS  
FEUILLE No. 14  
ECHELLE 1/2000 e

الجمهورية اللبنانية  
محافظة الزهراء  
قضاء زحلة  
قرية بار إلياس  
الرقم 14  
مقياس 1/2000

LEGENDE  
--- limite cadastrale  
--- limite de concession  
--- limite de terrain  
--- limite de terrain



لا يجوز بيع هذه الأرض إلا بموافقة المجلس البلدي  
محافظة زحلة  
رقم 14  
مقياس 1/2000



## **10.5 Appendix D – Plot Limits**

رقم الطلب : ١٢١٥٧

امانة السجل العقاري في زحلة

بتاريخ ٢٥-٠٩-٢٠١٩

بناء على الطلب المقدم من : رضا الدسوقي

المحلة : ضهر الشمالي الطويل زملة حبود

والدى مراجعة قيود السجل العقاري اعطيت هذه الإفادة الشاملة  
العقار : ١٩٥١ المنطقة العقارية : برالياس

مساحة العقار/القسم (م٢) : ٦١٦٨٣

النوع الشرعي للعقار : اميري

## محتويات و وصف العقار و الحقوق العينية و الوقوعات

المرجع في السجل اليومي

الرقم التاريخ

وصف العقار : ارض بعل سقي تزرع حبوب وقسم مغروس اشجار تفاح.

نوع العقار : أرض غير مبنية.

ملاحظة: عند طلب اي افادة عن هذا العقار تراجع الصحيفة الاساسية المفرز عنه

المرجع في السجل اليومي

الرقم التاريخ

## الملكية - التصرف

الحصة

سهم

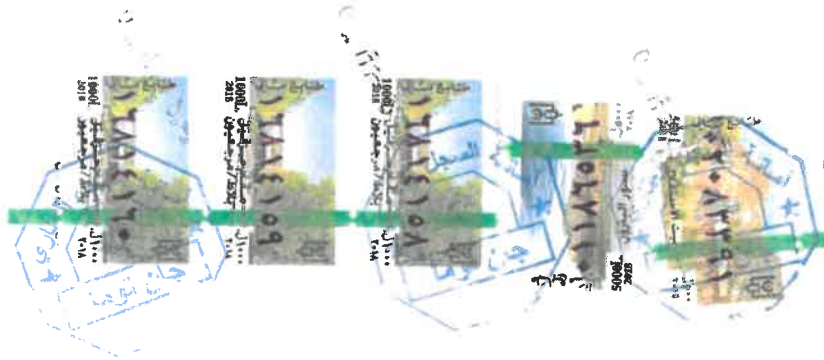
اسماء المالكين

نوع الحق خلاصة العقود

٢٤٠٠

الجمهورية اللبنانية المصلحة الوطنية لنهر اللباني (اميري)

اخرى (تصحيح، حق مختلف) : عملا بالمرسوم ١٨٠٩٧ / ١٧ / ١٢ / ٢٧ بملف ٩٨٢.



استوفي الرسم بموجب لصق تمغة على الطلب

هذا ما تم تسجيله على الصحيفة العقارية حتى تاريخه أعلاه

زحلة في ٢٥-٠٩-٢٠١٩

امين السجل العقاري

## **10.6 Appendix E – Public Consultations**

## دعوة عامة

لقاء تشاوري مع المجتمع المحلي  
لتحديد نطاق الأثر البيئي  
لإنشاء مستنقع (Constructed Wetland)  
في بلدة بر الياس لمعالجة مياه نهر الغزير.

تتشرف شركة كريدو ش.م.ل. (Kredo SAL)  
بدعوتكم لحضور اللقاء التشاوري  
(Public Hearing)

الذي سوف يتناول عرضاً للمشروع ومناقشة الآثار البيئية والاجتماعية المحتملة  
لمشروع إنشاء مستنقع (Constructed Wetland) في بلدة بر الياس لمعالجة مياه نهر الغزير

وذلك يوم الأربعاء الواقع في ١٨ كانون الأول ٢٠١٩  
الساعة الحادة عشرة قبل الظهر وذلك في مقر بلدية بر الياس

### دعوة عامة

لقاء تشاوري مع المجتمع المحلي لتحديد نطاق الأثر البيئي

لإنشاء مستنقع (Constructed Wetland)

في بلدة بر الياس لمعالجة مياه نهر الغزير.

تتشرف شركة كزيدو ش.م. ل (Kredo SAL)

بدعوتكم لحضور اللقاء التشاوري

(Public Hearing)

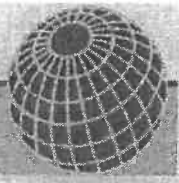
الذي سوف يتناول عرضاً للمشروع ومناقشة الآثار البيئية والاجتماعية

المحتملة لمشروع إنشاء مستنقع (Constructed Wetland) في بلدة بر

الياس لمعالجة مياه نهر الغزير

وذلك يوم الاربعاء الواقع في 18 كانون الاول 2019

الساعة الحادية عشرة قبل الظهر وذلك في مقر بلدية بر الياس



**دعوة عامة**

لقاء تشاوري مع المجتمع المحلي لتحديد نطاق الأثر البيئي  
لإنشاء مستنقع (Constructed Wetland)  
في بلدة بر الياس لمعالجة مياه نهر الغزير.

تتشرف شركة كريدو ش.م.ل (Kredo sal)

بدعوتكم لحضور اللقاء التشاوري

(Public Hearing)

الذي سوف يتناول عرضاً للمشروع ومناقشة الأثر البيئي  
والاجتماعية المحتملة لمشروع إنشاء مستنقع (Constructed

Wetland) في بلدة بر الياس لمعالجة مياه نهر الغزير

وذلك يوم الاربعاء الواقع في ١٨ كانون الاول ٢٠١٩

الساعة الحادية عشرة قبل الظهر وذلك في مقر بلدية بر الياس

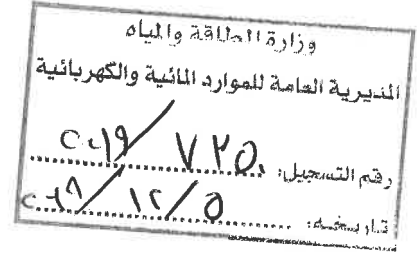
بيروت في ٣ كانون الأول ٢٠١٩

رقم: P-1915-376/19

جانب وزارة الطاقة والمياه

دعوة للقاء التشاوري (Public Hearing)  
لإنشاء مستنقع (Constructed Wetland)  
في بلدة بر الياس لمعالجة مياه نهر  
الغزير.

دراسة أثر البيئي لمشروع إنشاء  
مستنقع (Constructed Wetland) في  
بلدة بر الياس لمعالجة مياه نهر الغزير.

الموضوع:المرجع:

تحية واحتراماً ،

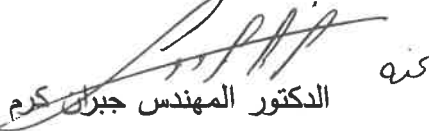
بالإشارة إلى الموضوع والمرجع المبيّنين أعلاه،

ولما كانت شركتنا تقوم، بتكليف من UN-Habitat بإعداد دراسة أثر بيئي لمشروع إنشاء مستنقع  
(Constructed Wetland) في بلدة بر الياس لمعالجة مياه نهر الغزير.

ندعوكم للقاء تشاوري (Public Hearing) لتحديد نطاق تقييم الأثر البيئي وذلك يوم الأربعاء الواقع في  
١٨ كانون الأول ٢٠١٩ الساعة الحادية عشرة قبل الظهر وذلك في مقر بلدية بر الياس.

وتفضلوا بقبول فائق الإحترام

شركة كريدو ش.م.ل.



د. كرم  
الدكتور المهندس جبريل كرم

رئيس مجلس الإدارة - المدير العام



بيروت في ٣ كانون الأول ٢٠١٩

رقم: P-1915-377/19

جانب وزارة البيئة

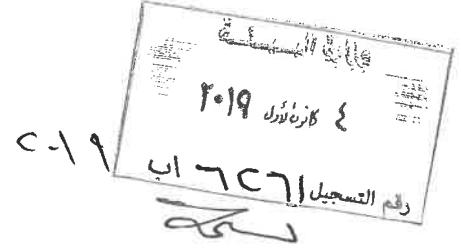
دعوة للقاء التشاوري (Public Hearing)

الموضوع:

لإنشاء مستنقع (Constructed Wetland)  
في بلدة بر الياس لمعالجة مياه نهر  
الغزير.

دراسة أثر البيئي لمشروع إنشاء مستنقع  
(Constructed Wetland) في بلدة بر  
الياس لمعالجة مياه نهر الغزير.

المرجع:



تحية وإحتراماً ،


بالإشارة إلى الموضوع والمرجع المبيئين أعلاه،

ولما كانت شركتنا تقوم، بتكليف من UN-Habitat بإعداد دراسة أثر بيئي لمشروع إنشاء مستنقع  
(Constructed Wetland) في بلدة بر الياس لمعالجة مياه نهر الغزير.

ندعوكم للقاء تشاوري (Public Hearing) لتحديد نطاق تقييم الأثر البيئي وذلك يوم الأربعاء الواقع في  
١٨ كانون الأول ٢٠١٩ الساعة الحادية عشرة قبل الظهر وذلك في مقر بلدية بر الياس.

وتفضلوا بقبول فائق الإحترام

شركة كريدو ش.م.ل.

  
الدكتور المهندس جبران جبر  
رئيس مجلس الإدارة - المدير العام





بيروت في ٣ كانون الأول ٢٠١٩

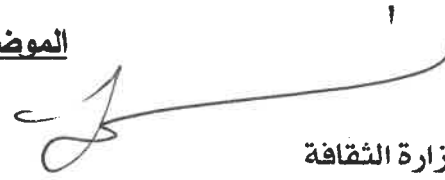
رقم: P-1915-378/19

جانب وزارة الثقافة

دعوة للقاء التشاوري (Public Hearing)  
لإنشاء مستنقع (Constructed Wetland)  
في بلدة بر الياس لمعالجة مياه نهر  
الغزيل.

دراسة أثر البيئي لمشروع إنشاء مستنقع  
(Constructed Wetland) في بلدة بر  
الياس لمعالجة مياه نهر الغزيل.

الموضوع:



وزارة الثقافة  
المصلحة الإدارية المشتركة

وارد: ٩٧٠ / ٣ / ٢٠١٩  
تاريخ: ١٤٥ / ٩ / ٢٠١٩

المرجع:

تحية واحتراماً ،

بالإشارة إلى الموضوع والمرجع المبينين أعلاه،

ولما كانت شركتنا نقوم، بتكليف من UN-Habitat بإعداد دراسة أثر بيئي لمشروع إنشاء مستنقع  
(Constructed Wetland) في بلدة بر الياس لمعالجة مياه نهر الغزيل.

ندعوكم للقاء تشاوري (Public Hearing) لتحديد نطاق تقييم الأثر البيئي وذلك يوم الأربعاء الواقع في  
١٨ كانون الأول ٢٠١٩ الساعة الحادية عشرة قبل الظهر وذلك في مقر بلدية بر الياس.

وتفضلوا بقبول فائق الإحترام

شركة كريدو ش.م.ل.

منه  
الدكتور المهندس جبران كرم

رئيس مجلس الإدارة - المدير العام



بيروت في ٣ كانون الأول ٢٠١٩

رقم: P-1915-379/19

جانب وزارة الزراعة

دعوة للقاء التشاوري (Public Hearing)  
لإنشاء مستنقع (Constructed Wetland)  
في بلدة بر الياص لمعالجة مياه نهر  
الغزيل.

الموضوع:

الجمهورية اللبنانية - وزارة الزراعة  
مصلحة الديوان  
تاريخ الورود : ٢٠١٩ - ٤  
رقم: ٣١/.....

دراسة أثر البيئي لمشروع إنشاء مستنقع  
(Constructed Wetland) في بلدة بر  
الياص لمعالجة مياه نهر الغزيل.

المرجع:

تحية واحتراماً ،

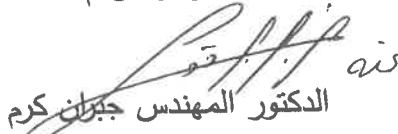
بالإشارة إلى الموضوع والمرجع المبيئين أعلاه،

ولما كانت شركتنا تقوم، بتكليف من UN-Habitat بإعداد دراسة أثر بيئي لمشروع إنشاء مستنقع  
(Constructed Wetland) في بلدة بر الياص لمعالجة مياه نهر الغزيل.

ندعوكم للقاء تشاوري (Public Hearing) لتحديد نطاق تقييم الأثر البيئي وذلك يوم الأربعاء الواقع في  
١٨ كانون الأول ٢٠١٩ الساعة الحادية عشرة قبل الظهر وذلك في مقر بلدية بر الياص.

وتفضلوا بقبول فائق الإحترام

شركة كريدو ش.م.ل.

  
الدكتور المهندس جبران كرم  
رئيس مجلس الإدارة - المدير العام



بيروت في ٣ كانون الأول ٢٠١٩

رقم: P-1915-380/19

جانب المصلحة الوطنية لنهر الليطاني

**الموضوع:** دعوة للقاء التشاوري (Public Hearing)

لإنشاء مستنقع (Constructed Wetland)  
في بلدة بر الياس لمعالجة مياه نهر  
الغزير.

**المرجع:** دراسة أثر البيئي لمشروع إنشاء مستنقع

(Constructed Wetland) في بلدة بر  
الياس لمعالجة مياه نهر الغزير.

تحية واحتراماً ،

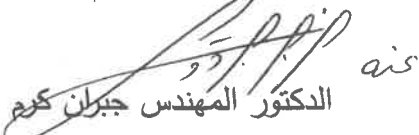
بالإشارة إلى الموضوع والمرجع المبينين أعلاه،

ولما كانت شركتنا تقوم، بتكليف من UN-Habitat بإعداد دراسة أثر بيئي لمشروع إنشاء مستنقع  
(Constructed Wetland) في بلدة بر الياس لمعالجة مياه نهر الغزير.

ندعوكم للقاء تشاوري (Public Hearing) لتحديد نطاق تقييم الأثر البيئي وذلك يوم الأربعاء الواقع في  
١٨ كانون الأول ٢٠١٩ الساعة الحادية عشرة قبل الظهر وذلك في مقر بلدية بر الياس.

وتفضلوا بقبول فائق الإحترام

شركة كريدو ش.م.ل.

  
الدكتور المهندس جبران كرم

رئيس مجلس الإدارة - المدير العام



السيد انبال شمس الدين  
الوزير  
١٤

د/ع ٤٨٥٢  
 ٤/٤/٢٠١٩

جروت في ٢ كانون الأول ٢٠١٩  
 رقم: ٤٨٥٢/٤/٢٠١٩

جانب مؤسسة مياه البقاع

**الموضوع:** دعوة لقاء التشاور (Public Hearing) لإنشاء مستطع (Constructed Wetland) في بلدة بر البقاع لمعالجة مياه نهر الغزل.  
**الموضوع:** ترسية أثر تهيئة المشروع لإنشاء مستطع (Constructed Wetland) في بلدة بر البقاع لمعالجة مياه نهر الغزل.

تحية واحتراماً ،

بالإشارة إلى الموضوع والمرفع المبيّن أعلاه

ولما كانت شركتنا تقوم بتكليف من VNA-Habitat بإعداد دراسة أثر بيئي لمشروع إنشاء مستطع (Constructed Wetland) في بلدة بر البقاع لمعالجة مياه نهر الغزل.

لذا نعوّظكم لقاء التشاور (Public Hearing) الذي سيقام في بلدة بر البقاع وذلك يوم الأربعاء الموافق ١٨ كانون الأول ٢٠١٩ الساعة العاشرة عشراً من الظهر وذلك من أجل مناقشة الأثر البيئي.

بإستعداد لقاء الأثر البيئي  
 شركة كريدو  
 المهندس محمد كرم  
 رئيس مجلس الإدارة - المهندس محمد كرم

بيروت في ٣ كانون الأول ٢٠١٩  
رقم: P-1915-382/19

٢٩٧٦  
١٥/٥  
٢٠١٩  
تاريخ

جاناب المجلس الوطني للبحوث العلمية

**الموضوع:** دعوة للقاء التشاوري (Public Hearing)

لإنشاء مستنقع (Constructed Wetland)  
في بلدة بر الياس لمعالجة مياه نهر  
الغزير.

**المرجع:** دراسة أثر البيئي لمشروع إنشاء مستنقع  
(Constructed Wetland) في بلدة بر  
الياس لمعالجة مياه نهر الغزير.

تحية واحتراماً ،

بالإشارة إلى الموضوع والمرجع المبينين أعلاه،

ولما كانت شركتنا تقوم، بتكليف من UN-Habitat بإعداد دراسة أثر بيئي لمشروع إنشاء مستنقع  
(Constructed Wetland) في بلدة بر الياس لمعالجة مياه نهر الغزير.

ندعوكم للقاء تشاوري (Public Hearing) لتحديد نطاق تقييم الأثر البيئي وذلك يوم الأربعاء الواقع في  
١٨ كانون الأول ٢٠١٩ الساعة الحادية عشرة قبل الظهر وذلك في مقر بلدية بر الياس.

وتفضلوا بقبول فائق الإحترام

شركة كريدو ش.م.ل.

رئيس مجلس الإدارة - المدير العام  
الدكتور المهندس جبران كرم  
منه

KREDO SAL  
1000L  
2018  
3 DEC. 2019



**KREDO** SAL

the Karim Research, Engineering & Design Office  
Capital 50,000,000 LBP

Consultants

P.O.B. 166864 Beirut, Lebanon - www.kredo.net  
Tel. (01) 204 957/8/9 - Fax: (01) 336 399

بيروت في ٣ كانون الأول ٢٠١٩

رقم: P-1915-383/19

السيد مومى عراجي

رئيس بلدية بر النياس

الشارع ٢٠٠

حضرة السيد مومى عراجي المحترم

رئيس بلدية بر النياس

**الموضوع:**

دعوة للقاء التشاوري (Public Hearing)

لإنشاء مستنقع (Constructed Wetland)

في بلدة بر النياس لمعالجة مياه نهر

الغزير.

**المرجع:**

دراسة أثر البيئي لمشروع إنشاء

مستنقع (Constructed Wetland) في

بلدة بر النياس لمعالجة مياه نهر الغزير.

تحية واحتراماً ،

بالإشارة إلى الموضوع والمرجع المبينين أعلاه،

ولما كانت شركتنا تقوم، بتكليف من UN-Habitat بإعداد دراسة أثر بيئي لمشروع إنشاء مستنقع (Constructed Wetland) في بلدة بر النياس لمعالجة مياه نهر الغزير.

ندعوكم للقاء تشاوري (Public Hearing) لتحديد نطاق تقييم الأثر البيئي وذلك يوم الأربعاء الواقع في ١٨ كانون الأول ٢٠١٩ الساعة الحادية عشرة قبل الظهر وذلك في مقر بلدية بر النياس.

وتفضلوا بقبول فائق الاحترام

**KREDO** SAL

بيروت في ٣ كانون الأول ٢٠١٩  
رقم: P-1915-384/19

سعادة القاضي كمال أبو جودة المحترم  
محافظة البقاع

دعوة للقاء التشاوري (Public Hearing)  
لإنشاء مستنقع (Constructed Wetland)  
في بلدة بر الياس لمعالجة مياه نهر  
الغزيل.  
دراسة أثر البيئي لمشروع إنشاء مستنقع  
(Constructed Wetland) في بلدة بر  
الياس لمعالجة مياه نهر الغزيل..

الموضوع:

المرجع:

تحية واحتراماً ،

بالإشارة إلى الموضوع والمرجع المبينين أعلاه،

ولما كانت شركتنا تقوم، بتكليف من UN-Habitat بإعداد دراسة الأثر البيئي لمشروع إنشاء مستنقع  
(Constructed Wetland) في بلدة بر الياس لمعالجة مياه نهر الغزيل.

ندعوكم للقاء تشاوري (Public Hearing) لتحديد نطاق تقييم الأثر البيئي وذلك يوم الأربعاء الواقع في  
١٨ كانون الأول ٢٠١٩ الساعة الحادية عشرة قبل الظهر وذلك في مقر بلدية بر الياس.

ونفضلوا بقبول فائق الاحترام

شركة كريدو س.م.ل.

الدكتور المهندس كجران كرم  
رئيس مجلس الإدارة - المدير العام

  
ECCA  
١٤٤٠  
KREDO SAL  
DEC. 2019

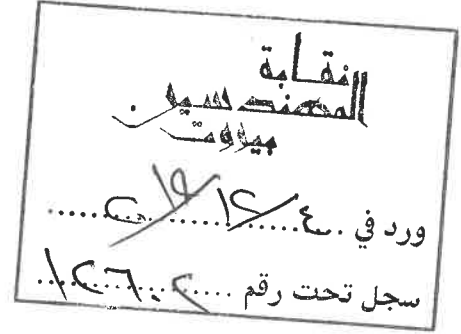
بيروت في ٣ كانون الأول ٢٠١٩

رقم: P-1915-385/19

جانب نقابة المهندسين

دعوة للقاء التشاوري (Public Hearing)  
لإنشاء مستنقع (Constructed Wetland)  
في بلدة بر الياس لمعالجة مياه نهر  
الغزير.

دراسة أثر البيئي لمشروع إنشاء مستنقع  
(Constructed Wetland) في بلدة بر  
الياس لمعالجة مياه نهر الغزير.

الموضوع:المرجع:

تحية واحتراماً ،

بالإشارة إلى الموضوع والمرجع المبينين أعلاه،

ولما كانت شركتنا تقوم، بتكليف من UN-Habitat بإعداد دراسة أثر بيئي لمشروع إنشاء مستنقع  
(Constructed Wetland) في بلدة بر الياس لمعالجة مياه نهر الغزير.

ندعوكم للقاء تشاوري (Public Hearing) لتحديد نطاق تقييم الأثر البيئي وذلك يوم الأربعاء الواقع في  
١٨ كانون الأول ٢٠١٩ الساعة الحادية عشرة قبل الظهر وذلك في مقر بلدية بر الياس.

وتفضلوا بقبول فائق الإحترام

شركة كريدو ش.م.ل.

الدكتور المهندس جبران كرم  
رئيس مجلس الإدارة - المدير العام





بيروت في ٣ كانون الأول ٢٠١٩

رقم: P-1915-386/19

جانب التنظيم المدني  
وزارة الأشغال العامة والنقل

**الموضوع:** دعوة للقاء التشاوري (Public Hearing)  
لإنشاء مستنقع (Constructed Wetland)  
في بلدة بر الياس لمعالجة مياه نهر  
الغزير.

**المرجع:** دراسة أثر البيئي لمشروع إنشاء مستنقع  
(Constructed Wetland) في بلدة بر  
الياس لمعالجة مياه نهر الغزير

تحية وإحتراماً ،

بالإشارة إلى الموضوع والمرجع المبينين أعلاه،

ولما كانت شركتنا تقوم، بتكليف من UN-Habitat بإعداد دراسة أثر بيئي لمشروع إنشاء مستنقع  
(Constructed Wetland) في بلدة بر الياس لمعالجة مياه نهر الغزير.

ندعوكم للقاء تشاوري (Public Hearing) لتحديد نطاق تقييم الأثر البيئي وذلك يوم الأربعاء الواقع في  
١٨ كانون الأول ٢٠١٩ الساعة الحادية عشرة قبل الظهر وذلك في مقر بلدية بر الياس.

وتفضلوا بقبول فائق الإحترام

شركة كريدو ش.م.ل.

  
الدكتور المهندس جبريل كرم

رئيس مجلس الإدارة - المدير العام

المديرية العامة للتنظيم المدني  
الديوان  
رقم ٨.٦٤٣  
تاريخ ١٨/١٢/٢٠١٩

  
KREDO SAL  
1000L 2018 ١٠٠٠ ٢٠١٨

03 DEC. 2019

بيروت في ٣ كانون الأول ٢٠١٩

رقم: P-1915-387/19

H2 ALL Consortium Member

**الموضوع:** دعوة للقاء التشاوري (Public Hearing)

لإنشاء مستنقع (Constructed Wetland)  
في بلدة بر الياس لمعالجة مياه نهر  
الغزير.

**المرجع:** دراسة أثر البيئي لمشروع إنشاء مستنقع

(Constructed Wetland) في بلدة بر  
الياس لمعالجة مياه نهر الغزير.

تحية وإحتراماً ،

بالإشارة إلى الموضوع والمرجع المبيّنين أعلاه،

ولما كانت شركتنا تقوم، بتكليف من UN-Habitat بإعداد دراسة أثر بيئي لمشروع إنشاء مستنقع  
(Constructed Wetland) في بلدة بر الياس لمعالجة مياه نهر الغزير.

ندعوكم للقاء تشاوري (Public Hearing) لتحديد نطاق تقييم الأثر البيئي وذلك يوم الأربعاء الواقع في  
١٨ كانون الأول ٢٠١٩ الساعة الحادية عشرة قبل الظهر وذلك في مقر بلدية بر الياس.

وتفضّلوا بقبول فائق الإحترام

شركة كريدو ش.م.ل.

  
الدكتور المهندس جبران كرم

رئيس مجلس الإدارة - المدير العام

  
Anthony

بيروت في ٣ كانون الأول ٢٠١٩

رقم: P-1915-388/19

GVC

**الموضوع:** دعوة للقاء التشاوري (Public Hearing)  
لإنشاء مستنقع (Constructed Wetland)  
في بلدة بر الياس لمعالجة مياه نهر  
الغزير.

**المرجع:** دراسة أثر البيئي لمشروع إنشاء مستنقع  
(Constructed Wetland) في بلدة بر  
الياس لمعالجة مياه نهر الغزير.

تحية واحتراماً ،

بالإشارة إلى الموضوع والمرجع المبينين أعلاه،

ولما كانت شركتنا تقوم، بتكليف من UN-Habitat بإعداد دراسة أثر بيئي لمشروع إنشاء مستنقع  
(Constructed Wetland) في بلدة بر الياس لمعالجة مياه نهر الغزير.

ندعوكم للقاء تشاوري (Public Hearing) لتحديد نطاق تقييم الأثر البيئي وذلك يوم الأربعاء الواقع في  
١٨ كانون الأول ٢٠١٩ الساعة الحادية عشرة قبل الظهر وذلك في مقر بلدية بر الياس.

وتفضلوا بقبول فائق الإحترام

شركة كريدو ش.م.ل.

  
الدكتور المهندس جبران كرم

رئيس مجلس الإدارة - المدير العام

  
Ahinwa

بيروت في ٣ كانون الأول ٢٠١٩

رقم: P-1915-389/19

OXFAM

**الموضوع:** دعوة للقاء التشاوري (Public Hearing)  
لإنشاء مستنقع (Constructed Wetland)  
في بلدة بر الياس لمعالجة مياه نهر  
الغزير.

**المرجع:** دراسة أثر البيئي لمشروع إنشاء مستنقع  
(Constructed Wetland) في بلدة بر  
الياس لمعالجة مياه نهر الغزير.

تحية واحتراماً ،

بالإشارة إلى الموضوع والمرجع المبينين أعلاه،

ولما كانت شركتنا تقوم، بتكليف من UN-Habitat بإعداد دراسة أثر بيئي لمشروع إنشاء مستنقع  
(Constructed Wetland) في بلدة بر الياس لمعالجة مياه نهر الغزير.


ندعوكم للقاء تشاوري (Public Hearing) لتحديد نطاق تقييم الأثر البيئي وذلك يوم الأربعاء الواقع في  
١٨ كانون الأول ٢٠١٩ الساعة الحادية عشرة قبل الظهر وذلك في مقر بلدية بر الياس.

وتفضلوا بقبول فائق الإحترام

شركة كريدو ش.م.ل.

  
الدكتور المهندس جبران كرم

رئيس مجلس الإدارة - المدير العام

  
4/12/2019

بيروت في ٣ كانون الأول ٢٠١٩

رقم: P-1915-390/19

Norwegian Refugee Council (NRC)

**الموضوع:** دعوة للقاء التشاوري (Public Hearing)  
لإنشاء مستنقع (Constructed Wetland)  
في بلدة بر الياص لمعالجة مياه نهر  
الغزيل.

**المرجع:** دراسة أثر البيئي لمشروع إنشاء مستنقع  
(Constructed Wetland) في بلدة بر  
الياص لمعالجة مياه نهر الغزيل.

تحية وإحتراماً ،

بالإشارة إلى الموضوع والمرجع المبيّنين أعلاه،

ولما كانت شركتنا تقوم، بتكليف من UN-Habitat بإعداد دراسة أثر بيئي لمشروع إنشاء مستنقع  
(Constructed Wetland) في بلدة بر الياص لمعالجة مياه نهر الغزيل.

ندعوكم للقاء تشاوري (Public Hearing) لتحديد نطاق تقييم الأثر البيئي وذلك يوم الأربعاء الواقع في  
١٨ كانون الأول ٢٠١٩ الساعة الحادية عشرة قبل الظهر وذلك في مقر بلدية بر الياص.

وتفضلوا بقبول فائق الإحترام

شركة كريدو ش.م.ل.

د.ع  
الدكتور المهندس جبران كرم  
رئيس مجلس الإدارة - المدير العام

5/12/19  


بيروت في ٣ كانون الأول ٢٠١٩

رقم: P-1915-391/19

World Vision

**الموضوع:** دعوة للقاء التشاوري (Public Hearing)  
لإنشاء مستنقع (Constructed Wetland)  
في بلدة بر النياس لمعالجة مياه نهر  
الغزير.

**المراجع:** دراسة أثر البيئي لمشروع إنشاء مستنقع  
(Constructed Wetland) في بلدة بر  
النياس لمعالجة مياه نهر الغزير.

تحية واحتراماً ،

بالإشارة إلى الموضوع والمراجع المرفقين أعلاه ،

ولما كانت شركتنا تقوم، بتكليف من UN-Habitat بإعداد دراسة الأثر البيئي لمشروع إنشاء مستنقع  
(Constructed Wetland) في بلدة بر النياس لمعالجة مياه نهر الغزير

ندعوكم للقاء تشاوري (Public Hearing) لتحديد نطاق تقييم الأثر البيئي وذلك يوم الأربعاء الموافق في  
١٨ كانون الأول ٢٠١٩ الساعة العاشرة صباحاً في الظاهر وذلك في مقر بلدية بر النياس

وتسليماً معقولاً للإمراد

شركتنا كredo في هذا

شركتنا كredo في هذا

رئيس مجلس الإدارة - السيد أحمد

Charbel Fourn

4/12/2019

بيروت في ٣ كانون الأول ٢٠١٩

رقم: P-1915-392/19

UN Habitat

**الموضوع:** دعوة للقاء التشاوري (Public Hearing)  
لإنشاء مستنقع (Constructed Wetland)  
في بلدة بر الياس لمعالجة مياه نهر  
الغزير.

**المرجع:** دراسة أثر البيئي لمشروع إنشاء مستنقع  
(Constructed Wetland) في بلدة بر  
الياس لمعالجة مياه نهر الغزير.

تحية واحتراماً ،


بالإشارة إلى الموضوع والمرجع المبينين أعلاه،

ولما كانت شركتنا تقوم، بتكليف من UN-Habitat بإعداد دراسة أثر بيئي لمشروع إنشاء مستنقع  
(Constructed Wetland) في بلدة بر الياس لمعالجة مياه نهر الغزير.

ندعوكم للقاء تشاوري (Public Hearing) لتحديد نطاق تقييم الأثر البيئي وذلك يوم الأربعاء الواقع في  
١٨ كانون الأول ٢٠١٩ الساعة الحادية عشرة قبل الظهر وذلك في مقر بلدية بر الياس.

وتفضلوا بقبول فائق الإحترام

شركة كريدو ش.م.ل.

  
الدكتور المهندس جبريل كرم  
رئيس مجلس الإدارة - المدير العام



بيروت في ٣ كانون الأول ٢٠١٩

رقم: P-1915-393/19

UNHCR

**الموضوع:** دعوة للقاء التشاوري (Public Hearing)  
لإنشاء مستنقع (Constructed Wetland)  
في بلدة بر الياس لمعالجة مياه نهر  
الغزير.

**المرجع:** دراسة أثر البيئي لمشروع إنشاء مستنقع  
(Constructed Wetland) في بلدة بر  
الياس لمعالجة مياه نهر الغزير.

تحية وإحتراماً ،

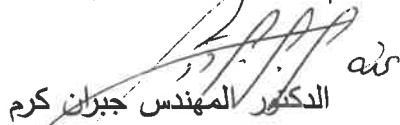
بالإشارة إلى الموضوع والمرجع المبيئين أعلاه،

ولما كانت شركتنا تقوم، بتكليف من UN-Habitat بإعداد دراسة أثر بيئي لمشروع إنشاء مستنقع  
(Constructed Wetland) في بلدة بر الياس لمعالجة مياه نهر الغزير.

ندعوكم للقاء تشاوري (Public Hearing) لتحديد نطاق تقييم الأثر البيئي وذلك يوم الأربعاء الواقع في  
١٨ كانون الأول ٢٠١٩ الساعة الحادية عشرة قبل الظهر وذلك في مقر بلدية بر الياس.

وتفضلوا بقبول فائق الإحترام

شركة كريدو ش.م.ل.

  
الدكتور المهندس جبران كرم

رئيس مجلس الإدارة - المدير العام

Received

4/12/19





بيروت في ٢٧ تشرين الثاني ٢٠١٩

رقم: P-1915-394/19

UNICEF

**الموضوع:** دعوة للقاء التشاوري (Public Hearing)  
لإنشاء مستنقع (Constructed Wetland)  
في بلدة بر الياس لمعالجة مياه نهر  
الغزير.

**المرجع:** دراسة أثر البيئي لمشروع إنشاء مستنقع  
(Constructed Wetland) في بلدة بر  
الياس لمعالجة مياه نهر الغزير.

تحية واحتراماً ،

بالإشارة إلى الموضوع والمرجع المبينين أعلاه،

ولما كانت شركتنا تقوم، بتكليف من UN-Habitat بإعداد دراسة أثر بيئي لمشروع إنشاء مستنقع  
(Constructed Wetland) في بلدة بر الياس لمعالجة مياه نهر الغزير.

ندعوكم للقاء تشاوري (Public Hearing) لتحديد نطاق تقييم الأثر البيئي وذلك يوم الأربعاء الواقع في  
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رئيس مجلس الإدارة - المدير العام  
الدكتور المهندس جبران كرم

9/12/2019





## STAKEHOLDERS MEETING ATTENDANCE

### CONSTRUCTED WETLAND IN BAR ELIAS PUBLIC HEARING FOR SCOPING OF EIA

DATE AND TIME: December 18<sup>th</sup>, 2019 – 11:00 A.M. – 12:16 P.M.

LOCATION: Bar Elias Municipality

NAME (الاسم)	ORGANIZATION (الجهة)	EMAIL (البريد الإلكتروني)	PHONE NUMBER (رقم الهاتف)
Dr. Mark Saadeh	KREDO	<a href="mailto:mssaadeh@kredo.net">mssaadeh@kredo.net</a>	03/237308
Diana El Halawani	KREDO	<a href="mailto:dhalawani@kredo.net">dhalawani@kredo.net</a>	76/365975
Georges Abi Sleiman	UN-Habitat	<a href="mailto:Georges.abi-sleiman@un.org">Georges.abi-sleiman@un.org</a>	03/175127
Maryam Nazzal	UN-Habitat	<a href="mailto:Maryam.nazzal@un.org">Maryam.nazzal@un.org</a>	70/899609
Karen Sawaya	UN-Habitat	<a href="mailto:Karen.sawaya@un.org">Karen.sawaya@un.org</a>	70/575655
Wael Sinno	UN-Habitat	<a href="mailto:Wael.sinno@un.org">Wael.sinno@un.org</a>	03/710995
Ahmad Al Baff	World Vision	<a href="mailto:Ahmad_albaff@wvi.org">Ahmad_albaff@wvi.org</a>	81/622062
Christel Berchachy	UN-Habitat	<a href="mailto:Christelle.bercachy@un.org">Christelle.bercachy@un.org</a>	71/603433
Elie Mansour	UN-Habitat	<a href="mailto:Elie.mansour@un.org">Elie.mansour@un.org</a>	03/034657
Mawas Araji	Mayor of Bar Elias		03/639850
Maria Saidy	UNICEF	<a href="mailto:msaidy@unicef.org">msaidy@unicef.org</a>	70/996617

## MINUTES OF MEETING

### CONSTRUCTED WETLAND IN BAR ELIAS PUBLIC HEARING FOR SCOPING OF EIA

<b>Date</b>	Wednesday December 18 <sup>th</sup> , 2019
<b>Location</b>	Bar Elias Municipality
<b>Facilitator</b>	Dr. Mark Saadeh
<b>Notes taker</b>	Diana El Halawani
<b>Call to order</b>	11:17 am
<b>Meeting adjournment</b>	12:16 pm

#### Opening Statement

Since 2012, and as per Decree 8633, the Ministry of Environment (MOE) requires most projects to carry on an EIA (Environmental Impact Assessment) before project initiation to explore the potential impacts of this project on its surrounding.

There also exist two other types of possible studies that can be done depending on the scale and type of project;

- IEE (Initial Environmental Examination) which is simpler than an EIA.
- EAR (Environmental Audit Report) which is used for existing projects as a type of retrofitting.

The scale of our project entails the need for an EIA, and the public hearing is the first step of the EIA's implementation.

#### Project Background

KREDO was approached in September 2019 by UN Habitat to carry out a feasibility study and consequently an EIA for a constructed wetland intervention under the Adaptation Fund for climate change. KREDO has consulted Litani River Authority, the director Dr. Sami Alawieh, to discuss the wetland project. LRA has done a similar wetland project under LRBMS USAID funded project in Joub Jennine – Kherbet Kanafar, and the wetland is still operational. LRA proposed two plots in Bar Elias on Ghzayel or Rafid al Faour stream to construct the wetland. Plot 1951 of an area 63000 m<sup>3</sup> is was found suitable in terms of location and size for the constructed wetland.

#### Project Description

KREDO has visited the land and the stream with a representative from BWE, and based on the pictures taken, the stream has polluted water that is currently being used for irrigation (apparent pumps withdrawing water from the stream). The objective of the constructed wetland is to treat the water in the stream that is used for irrigation purposes only.

There are two types of constructed wetlands – surface and subsurface. The one proposed is a free surface wetland. The geometry of the constructed wetland is very flexible. The cells can be in series or in parallel. There would be different types of plants in the cells of the wetland capable of purifying the water through different bioremediation processes. Some of the plant species are available in Lebanon, such as fragmites. The water can be diverted to the wetland for a residence time of 5 to 10 days, then discharged back to the stream or to a reservoir for use by surrounding farmers.

### Possible Environmental Impacts

	Construction Phase	Operation Phase
Fauna	Affected negatively	Affected positively
Flora	Affected negatively	Affected positively
Noise pollution	Affected negatively	Not affected
New road or other transportation infrastructure	Not affected	Affected positively
Social impact (tourism and recreational activities)	Not affected	Affected positively
Economic impact (job opportunities)	Affected positively	Affected positively

### Q&A // Discussions

- Mr. Moussa Araji, the mayor, commented on the potential sources of pollution of the stream. He noted that the area is not connected to the sewer network, and the village of Kfarzabad usually transfers the sewage to the stream. There are no heavy metals in their sewer because there are no industries.

Dr. Mark Saadeh noted that it is clear that the water is polluted. To identify the sources of pollution, it needs to be tested. What is certain is that the constructed wetland will help improve the quality of water in the stream.
- Mr. Elie Mansour, from UN-Habitat, asked whether the plants would attract insects or reptiles, and what would the impact be on the surrounding.

Dr. Mark Saadeh responded that these plants have a positive impact on the surrounding. They will attract different species and birds, as in the wetland in Kherbet Qanafar, thus creating a new ecosystem in the area.
- Ms. Maryam Nazzal, from UN-Habitat, asked about the date of establishment of the wetland in Kherbet Qanafar.

Dr. Mark Saadeh responded that it was established in 2012-2013 and it is a successful and good solution to treat polluted water compared to the expensive, high maintenance wastewater treatment plants.

4. Mr. Elie Mansour, from UN-Habitat, asked whether the plants are capable of treating pollutants present in effluents from industries.

Dr. Mark Saadeh responded that an expert in constructed wetland is needed to select the type of plants needed in order to treat the water. To do so, water sampling and testing is needed. There are types of plants that can treat water polluted with heavy metals, and even radioactive material. Some plants stabilize pollutants in the roots, others absorb them into the stock and leaves, so they would need to be cut and disposed of. Others rely on the process of phytovolatilization. An expert is needed to identify the type of plants in the cells of the wetland, based on the available pollutants.

5. Mr. Moussa Araji, the mayor, asked about the location of the project, since LRA does not have property at Khzayel River.

Dr. Mark Saadeh commented that there might be a disagreement on the name of the stream, but it is in Bar Elias adjacent to the land owned by LRA based on the legal registration document of the plot and the maps.

6. Mr. Elie Mansour, from UN-Habitat, asked about who will cover the operation costs of the constructed wetland.

Mr. Moussa Araji noted that the municipality cannot cover any costs.

Dr. Mark Saadeh said that the LRA can pay for operation costs. They are low maintenance. The wetland would be fenced for safety.

7. Mr. Moussa Araji, the mayor, asked where the water will be taken.

Dr. Mark Saadeh reiterated that the water will be diverted from the stream because it is currently polluted and not suitable for irrigation. The water will be pumped from the stream to the wetland, treated, and recirculated back to the stream.

8. Mr. Elie Mansour, from UN-Habitat, asked whether the wetland is expected to improve the agriculture in the surrounding area. TO what extent can the water be extracted? Are there any regulations from the Ministry of Energy and Water?

Dr. Mark Saadeh, said that the points of irrigation from the treated water coming out of the wetland can be several. This would be determined later. The treated water can be stored or directly abstracted from the outlet of the wetland. It is important to not decrease the volume of the water in the stream.

9. Mr. Ahmad Al Baff, from World Vision, asked whether all the stream will be diverted and treated, and the estimated flow.

Dr. Mark Saadeh, said that not all the stream will be diverted, part of it. This will be determined at the design stage, when the flow is measured and known. As a rule of thumb, for every two to four hectares, 1000 m<sup>3</sup> of water can be treated in a free surface water wetland.

10. Ms. Maryam Nazzal, from UN-Habitat, asked about how often are the plants cut or replanted, and what are potential negative impacts based on the experience from the wetland in Kherbet Qanafar.  
Dr. Mark Saadeh responded that it depends. In the wetland at Kherbet Qanafar they had the plants for around five years. Potential problems might arise from mosquito breeding sites; however, the area is remote so it will not disturb any residents.
11. Ms. Maria Saidy, from UN-Habitat, if the insects attracted by the wetland will have an impact the surrounding agricultural lands.  
Dr. Mark Saadeh can't refute it 100%; however, in case this happens, there are mitigation measures, such as the introduction of a type of fish called tilapia that feeds on mosquito eggs (remediation measure done in the USA). There will be a balance in the ecosystem created.
12. Georges Abi Sleiman, from UN-Habitat, asked on who is operating the wetland in Kherbet Qanafar.  
Dr. Mark Saadeh responded that it is the LRA.
13. Ms. Christelle Bercachy, from UN-Habitat, noted that it is important to use native species only to avoid any negative impacts.  
Dr. Mark Saadeh agreed, noting that the hired expert in constructed wetland would determine the native species needed.
14. Ms. Maria Saidy, from UNICEF, asked about the watershed of the stream. Do we know about the kind of runoff disposing in this stream, given the high precipitation rates in the area?  
Dr. Mark Saadeh responded that such questions are to be addressed at stage two of the project. The water from the stream needs to be sampled and tested and then we can evaluate the size and design of the wetland, as well as the flooding of the stream.
15. Mr. Wael Sinno, from UN-Habitat, asked about the social and economic benefits of such a project.  
Dr. Mark Saadeh noted that job opportunities will be created during the construction of the project. Moreover, water of better quality will be available for irrigation.
16. Mr. Moussa Araji, the mayor, noted that the Litani River was used for drinking 40 years ago. Bar Elias has a problem with treating sewage, currently it is being disposed of at Ghzayel River.  
Dr. Mark Saadeh responded that constructed wetlands, with their low operation and maintenance costs, can be a solution for treating wastewater, on land that can be offered by the municipality. Mr. Moussa Araji agreed that this is a possible solution. He recalled that in rural areas in Germany, bamboo is planted to treat polluted water. They had bamboo planted next to a stream in Bar Elias, but they were cut by LRA.



17. Mr. Elie Mansour, from UN-Habitat, asked about any estimates of the number of beneficiaries. Mr. Moussa Araji, the mayor, said that 80% of the population in Bar Elias relies on agriculture. There are 30,000 residents in Bar Elias, and around 60,000 to 70,000 Syrian refugees in 84 camps.

Closing note: Mr. Elie Mansour said to the mayor that when the project is cleared, UN-Habitat will visit the municipality, and would also like to discuss other projects in Bar Elias under the adaptation fund.





## Public Meeting for Scoping of EIA

لقاء تشاوري لتحديد نطاق دراسة الأثر البيئي

### Bar Elias Constructed Wetland

Bar Elias Municipality, Zahleh Caza  
Bekaa Valley

Kredo S.A.L



UN HABITAT  
FOR SUSTAINABLE URBANIZATION

18 December 2018

## Introduction

المقدمة

- During August 2018, KREDO sal was commissioned by UN-Habitat to carry out an EIA for the project entitled "Bar Elias Constructed Wetland" in the municipality of Bar Elias, Zahleh caza.
- The scope of this project is:
  - To carry out all required aspects related to preparing a scoping report followed by an environmental impact assessment (EIA) report for the constructed wetland in the municipality of Bar Elias, Bekaa.
  - Said EIA study compliant with current governmental regulations, notably Decree 8633, 7 August 2012, Ministry of Environment (MoE).

## Project Background & Rational

The Environmental Impact Assessment (EIA) report is requested by the Ministry of Environment, for a Free Water Surface (FWS) constructed wetland located on approximately 60,000 m<sup>2</sup> of public land owned by the Litani River Authority (LRA). The proposed project is located on Plot No. 1951.

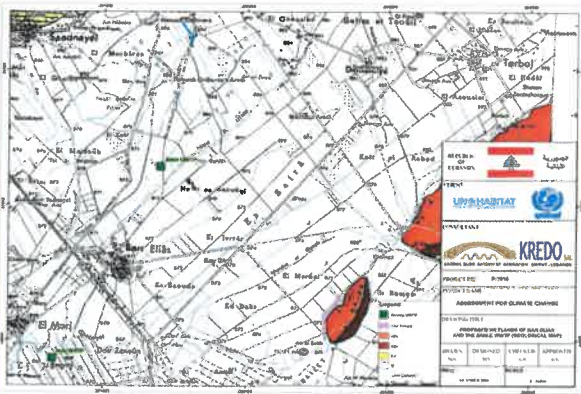
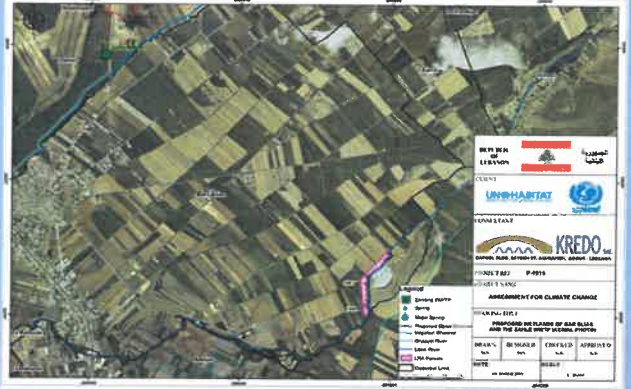
The main objective of the constructed wetland is to partially divert the polluted Ghezayel tributary through the wetland in order to improve the quality of said water for irrigational purposes.

## Project Description

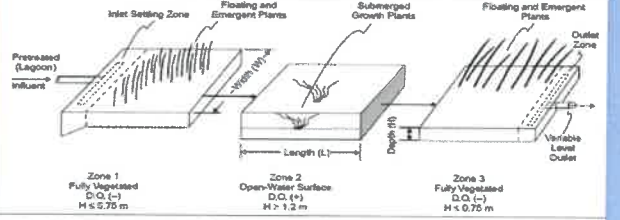
مواصفات المشروع

- **Project Location:**
  - Bar Elias Municipality, Zahleh caza, Bekaa
  - Local Population: approximately 50,000 local residents
  - Project location: Plot #1951 with an area of roughly 60,000 m<sup>2</sup>
  - Project construction duration approximately three months
- **Coordinates:**
  - 434751.5 Northing
  - 296365.8 Easting
  - Approximately 873 mASL
- Underlying geology pertains to the Quaternary deposits (q) which is an aquifer
- The proposed constructed wetland (free water surface, FWS) is capable of treating roughly 6,000 m<sup>3</sup> of Ghezayel's flow per day before redirecting it back into said tributary.

Ghezayel Tributary, Bar Elias



### Typical Elements of FWS Wetland



Constructed Wetlands: Treatment of Municipal Wastewaters, EPA 2000

## Typical Flora Found in Constructed Wetlands



## Possible Environmental Impacts

## التأثيرات البيئية المحتملة

Possible Environmental Impact التأثير البيئي المحتمل	Construction بناء	Operation تشغيل
Fauna الحيوانات	✓+	✓+
Flora - Locally النباتات - محلي	✓+	✓+
Noise Pollution تلوث الضوضاء	✓-	X
New road, or other transport infrastructure طريق جديد أو بنية تحتية أخرى	X	✓-
Social Impact (Tourism and recreational activities) التأثير الاجتماعي (السياحة والترفيه)	X	✓+
Economic Impact (Job opportunities) التأثير الاقتصادي (فرص العمل)	✓+	✓+

✓+ affected positively;  
تأثير إيجابي إيجابي

✓- affected negatively;  
تأثير سلبي سلبي

X not affected;  
لا تتأثر

? Uncertain whether it will  
be affected or not.

غير مؤكد ما إذا كانت ستتأثر أم لا

Thank you for your attention

QUESTIONS?

شكرا على انتباهكم

أسئلة ؟