



Republic of Lebanon - Council for Development and Reconstruction

Road and Employment Project (REP)

Environmental and Social Management Plan (ESMP)

LOT 2: Caza of Aley

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Final



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## Abbreviations and Acronyms

CDR	Council for Development and Reconstruction
CoC	Code of Conduct
CoM	Council of Ministers
DLIPS	Department of Labour Inspection, Prevention and Safety
EHS	Environment Health and Safety
ESMP	Environmental and Social Management Plan
EIA	Environmental Impact Assessment
EMoP	Environmental Monitoring Plan
ESMF	Environmental and Social Management Framework
EU	European Union
FHH	Female Headed Household
GBV	Gender Based Violence
GDP	Gross Domestic Product
GOL	Government of Lebanon
GRM	Grievance Redress Mechanism
HH	Household
IFC	International Finance Cooperation
IUCN	International Union for Conservation of Nature and Natural Resources
ILO	International Labour Organization
LULC	Land Use Land Cover Map
MoA	Ministry of Agriculture
MOE	Ministry of Environment
MoIM	Ministry of Interior and Municipalities
MoL	Ministry of Labour
MOPH	Ministry of Public Health
MOPWT	Ministry of Public Works and Transportation
MoSA	Ministry of Social Affairs
NGOs	Non-Governmental Organizations
OP	Operational Plan
OHS	Occupational Health and Safety
PAPs	Project Affected Persons
PHS	Public Health and Safety
PIU	Project Implementation Unit
PM	Particulate Matter
PDO	Project Development Objective
REP	Roads and Employment Project
SAP	Safeguards Action Plan
SEA	Sexual Exploitation and Abuse
SH	Sexual Harassment.
UNESCO	United Nations Educational, Scientific and Cultural Organization
WB	World Bank
WBG	World Bank Group
WEF	World Economic Forum
WWTP	Waste Water Treatment Plant

## EXECUTIVE SUMMARY

### Introduction

Lebanon Roads and Employment Project (REP) funded by the World Bank (WB) aims to improve the roads conditions and traffic safety by rehabilitation of road networks in Lebanon, especially in rural lagging regions, and to create job opportunities for displaced Syrians and Lebanese citizens through the labor-intensive works of rehabilitation.

The project works will be executed on the main road network which is under the jurisdiction of the Ministry of Public Works and Transportation (MoPWT). In this context, the Lebanese Council for Development and Reconstruction (CDR) will implement Lebanon REP on behalf of the government/MoPWT.

Considering that the anticipated civil works will result in environmental and social impacts, an Environmental and Social Management Plan (ESMP) shall be prepared under the requirements of OP4.01 that classifies the project as Category B to limit potential implications. Accordingly, Dar Al Handasah Nazih Taleb & Partners developed in this report a specific ESMP for Aley Caza.

The objective of the ESMP is to identify and assess the potential environmental and social impacts of REP and consult relevant stakeholders to prepare a management plan that includes mitigation measures for the expected social and environmental risks and a monitoring plan, as well as to define responsibilities in the operationalization of the ESMP.

### Project Description

The project covers classified roads in 25 Cazas throughout Lebanon with an expected total length of 835 km. Four of the proposed roads fall in Aley Caza. The land acquisition did not occur during the design of any road under study.

This ESMP is specific to four selected roads for rehabilitation in Aley with a total length of around 20.8 km.

- ✓ **Aley Road 1a (Aley R1a)**: consists of a single alignment with a total length of 7.2 km. It starts in El-Azouniyeh, passes through Charoun, and ends in Ain Sofar.
- ✓ **Aley Road 1b (Aley R1b)**: consists of a single alignment with a total length of 7.1 km. It starts at El-Kahale, passes through Bsous, Ain-Rommane, and ends in El-Kamatiyeh.
- ✓ **Aley Road 1c (Aley R1c)**: consists of two sections or alignments that have a combined length of 5.3 km.
  - Section 1 starts at El-Kamatiyeh, passes through Ain-Rommane and Aley, and ends in Bkhichtay.
  - Section 2 starts at El-Kamatiyeh and ends in Ain-Rommane.
- ✓ **Aley Road 1d (Aley R1d)**: consists of a single alignment with a total length of 1.2 km. It starts at El-Kamatiyeh and ends in Bdedoune.

Road upgrading activities are limited to maintenance, minor construction, as well as to traffic management and regulation. In the case of Aley Caza, rehabilitation activities to be performed vary between Aley R1a, Aley R1b, Aley R1c, and Aley R1d; depending on the current state of



each surveyed road. In summary, activities to be performed in Aley Caza include pavement works (complete reconstruction when needed and milling and overlay for roads that are in better condition); improvement and installation of drainage facilities, construction of retaining walls and installation of safety barriers, marking and signing, and fixing of lighting poles. The rehabilitation works for Aley roads will involve 128 workers and require a total of 18 months.

During the execution of rehabilitation activities, activities, roads will not be closed or shutdown. Works will be executed on the road right of way/passageway only and will not use or undermine any existing adjacent facilities. In addition, the rehabilitation activities will maintain a passing corridor within the alignment to grant access to nearby properties.

In case the works imply any temporary closure of the road, traffic will be secured by the project Contractor via alternative routes to reach relevant destinations. Detours and diversions were not included in the design. Therefore, before the execution of rehabilitation works, the Contractor, based on the schedule of works and if needed, will secure the access and traffic movement via other alternative routes and means in coordination with the related Municipality. Accordingly, all detours will be on existing alternative roads (public domain properties) and there is no need to use or rent some land to create the detour.

### **Existing Policies, Legal and Administrative Framework**

This ESMP was conducted in accordance with the World Bank safeguards and the Lebanese laws and regulations. The most important legal documents are listed below:

- Labor Law/1946: The Lebanese Labor Code
- Law No. 335/2001: Pursuant to the International Labor Organization ILO Convention No 128
- Decree 8987/2012 Prohibition of employment of minors under the age of 18 in work that may harm their health, safety or morals
- Decree 3791/2016 Minimum Wage
- Law 444/2002 Framework Law for Environmental Protection
- Decree 8803/2002 and its amendments: Organization of quarries activity, rehabilitation and licensing procedures
- Law 80/2018: Integrated Solid Waste Management
- Decree 11802/2008 Occupational prevention, safety, and health in all enterprises subject to the Code of Labor
- Law 166/1933 amended by Law 37 of 2008: Antiquity Law
- Decree-Law 118/1977 on the Municipal Act Law 37/2008 on the Cultural Policy Law
- Law 243/2012: New Traffic Law
- Legislative Decree 340/1943: Penal Code

Two World Bank safeguards policies apply to Lebanon Roads and Employment Project: OP 4.01 Environmental Assessment and OP 4.12 Involuntary Resettlement. Given that the planned project will mainly focus on the rehabilitation of roads, the work in these areas will be done under OP 4.01.

OP 4.12 was triggered by this project and a Resettlement Policy Framework was accordingly prepared and disclosed on the CDR website (<https://www.cdr.gov.lb/en-US/Studies-and-reports/Roads-and-Employment.aspx>), in the case of Aley and in accordance with site specific

plans, no involuntary resettlement or land acquisition will take place. In other words, there will be no displaced persons by the project activities (this includes locals and Syrian refugees).

## Consultation

Consulting with the main stakeholders (namely Head of union of Municipalities of Aley, Municipal heads (Qamatiyeh, Charoun, Ain el Roummane and Kahale), vice municipal head, Moukhtar (مختار) and representative of other municipalities in addition to local residents represented by local NGOs such as Jamiyat Al Maraa el Wardiya) and ensuring they agree on sensitive issues improves the chances that the project will not be subject to last-minute disputes. This ESMP was publicly consulted through a public participation meeting that was arranged for Aley Caza. The public participation meeting was held at Aley Municipality on Thursday July 16, 2020. The consultation was delivered during the spread of COVID-19, invitations were sent electronically and it was posted prior time of the consultation at the municipality's billboards. The number of attendees was 18 of which 4 were women, whom represented concerned municipalities and local community. During the meeting, attendees were informed about the project objectives, the identified natural, economic, and social resources of importance in the area, the project's possible environmental and social risks, the planned mitigation measures and Grievance Redress Mechanism (GRM).

Municipalities and local authorities were concerned about the selection of roads within the scope of REP. According to them, there are roads that are in greater need for rehabilitation (e.g. Sofar road that needs retaining wall for safety issues). In this context, the consultant explained that the Government prioritized roads in Aley Caza based on municipalities' official requests beside several technical criteria. Secondly, they asked regarding their main role in this project. In this context, the consultant and the representative of CDR explained that the head of each municipality have a main role to inform people about the project and at a later stage, they have a major role in assisting CDR in monitoring any potential violations by the Contractor during the rehabilitation phase. In particular, any violation observed must be reported to CDR. Further, the CDR explained that this ESMP includes a GRM to ensure the management of any project-related complaints. The following GRM link was communicated to the attendees (<http://www.cdr.gov.lb/study/RoadsEmp/RoadsEmp.htm>).

Further, the head of municipalities asked if alternative roads for rehabilitation under the project can be provided. Accordingly, the consultant explained that the project cannot integrate any alternative roads, but they can, however, send their requests in relation to alternative roads to the MoPWT for future projects.

Female attendees were asked separately about their concerns. They were particularly worried about the supervision process. According to them, women must be in the supervision board, as they would best monitor the execution of the ESMP. In this context, CDR ensured to consider employing women during the Project implementation.

As for NGOs Consultation, this ESMP has targeted them according to their position in Lebanon. They consist of two levels as follows: (1) Local: they are specific to each Caza. Their mission is to address different concerns and issues among the local society including social, economic, gender equality, environment, poverty, women empowerment, etc. and (2) International: they cover the whole country and their consultation will be applied to all the ESMPs of the REP. When the crisis in Syria erupted in early 2011, numerous International NGOs responded to the

humanitarian crisis and worked directly with the Syrians in Lebanon by providing aid and responding to their critical situation.

Invited local NGOs include the Druze Women Association and Al Resalah Association, all of which cover Aley area. As for international NGOs, ACTED, ANERA, and DRC were invited. Out of all invited NGOs, only local NGOs attended the consultation meeting. They shared the same concerns of the rest of the public.

### **Baseline assessment**

The environmental and social assessment recorded the existing conditions within the project area including physical, biological, and socioeconomic conditions prior the project implementation and operation. Baseline data and field surveys were conducted to describe the status of the following environmental and socio-economic receptors: air quality, water quality, soil quality, geological conditions, climate and meteorology, natural habitats and biodiversity, land-use/land-cover, acoustic environment, cultural resources, and socio-economic conditions (employment opportunities, labor influx, social tensions, labor induced Sexual Exploitation and Abuse (SEA) Sexual Harassment (SH), occupational health and safety).

The geology of the studied roads was investigated for outcropping formations, subsurface stratigraphy, structure (faults, folds, seismic, etc.), hydrogeology (groundwater and sea water intrusions) and hydrology (surface water). The outcropping lithological formations in and around the study area of Aley roads belong to the Cretaceous geological time period.

In terms of the subsurface, regarding the four roads in Aley, the study revealed that (a) the formations do not host any major water aquifers and (b) the exposed geological layers have both poor permeability and transmissivity lowering the risk of spill infiltration or spread. However, the surrounding area witnesses rich surface water quality, knowing that the roads intersect with Ghadir and Damour rivers with numerous winter channels that lead to the rivers, and in close proximity to two springs.

Air quality is also an essential component in assessing social wellbeing and health status of a community. The study relied on UNDP/MoE project "Air quality assessment in an East Mediterranean country: the case of Lebanon" and showed that the levels of CO, SO<sub>2</sub>, O<sub>3</sub>, NO<sub>2</sub>, and PM10 are within the national limit values (Decision 52/1 dated 1996) confirming that the studied areas for the four roads do not include major air polluting activities.

Regarding natural habitats and biodiversity, given the nature of the project, the direct influence area concerns existing roads. Consequently, a rapid biological assessment has been carried out to draw the ecological profile of the adjacent areas to the concerned roads to assess habitats and species that are at added risk from the proposed project. The assessment showed that Aley R1d does not involve rich ecosystems. Adjacent areas to the assessed roads are already impacted by human activities (e.g. degraded lands, rural settlements, and agricultural areas). However, some segments of Aley R1a, Aley R1b, and Aley R1c are of certain ecological significance (a pine forest was recorded along Aley R1a (short segment in Aazouniyeh), riparian habitats were recorded where Aley R1a intersects with Ghadir River and Aley R1c intersects with Damour River, and maquis ecosystems along Aley R1c in El-Kamatiyeh and Ain-Rommane).

Finally, a socio-economic assessment was conducted in the project area to map the demographic, social, and economic baseline conditions at the level of Aley Caza. A set of social indicators were investigated including Aley's employment and livelihood, the availability of public and private education and health institutions, access to public utility and community services, land use patterns, and impacts of the Syrian crisis.

The population of Aley is 300,800 including 74,900 households and the average household size is 4, whereas, the average household size in Lebanon is 3.8. In addition, 105,500 people from the population of Aley are aged between 0–14 and above 65 years. In Mount Lebanon, 105,000 of the households are headed by a woman. In 2016, 48,392 of Aley's Lebanese population were deprived while 104,746 were above the poverty line (OCHA, 2016). This mean that 48,392 of the Lebanese in Aley were deprived from basic resources essential to meet their fundamental survival and protection needs.

The number of Syrian refugees in Aley is 68,332 and their average households size is 5 compared. 14.6% of the households are headed by a woman and 63.3% of the Syrian refugees in Aley are below the poverty line (UNHCR, UNICEF and WFP, 2018).

Regarding other vulnerable groups such as individuals with specific needs, 31.6%, 10.1%, 33.5%, 12.7% and 4.7% of the households have at least one person with chronic illness, serious medical condition, temporary illness, disability, needing support in daily activities respectively (UNHCR, UNICEF and WFP, 2018). In addition, 87.8% of the Syrian refugees in Aley live in residential buildings. As for Palestinians, refugee camps are not available in Aley.

Finally, the abovementioned data on vulnerable groups is generally for Aley Caza or Mount Lebanon. However, specific data is not available to confirm whether or not these groups of people are within the communities surrounding the roads, knowing that the main focus of the assessment was to identify sensitive receptors (health care facilities, academic institutions and other entities) that might be impacted (obstruction and dust issues) during the execution of the project. Nevertheless, the mitigation measures recommended as part of this ESMP ensure that the communities surrounding the roads in Aley Caza including vulnerable groups, if any, will not be adversely affected.

Regarding health care facilities, Aley district contains different facilities ranging from public and private hospitals and clinics that are mainly small sized medical facilities due to the uneven geographical distribution of hospitals in Lebanon. For instance, El Azouniyeh Hospital is spotted at a distance of 25 m from Aley R1a (El-Azouniyeh – Charoun – Ain Sofar) and Ghaleb Obeid Physio Center 10 m away from Aley R1c section 1 (El-Kamatiyeh – Ain-Rommane – Aley – Bkhichtay).

Further, there are several colleges and universities in Aley district, including: The Lebanese University-Faculty of Economic Science and Business Administrations, Maroun Abboud School, Koumatiyeh Pubic school and Sofar School that are located in close proximity to the roads to be rehabilitated at a distance of less than 10 m.

The economic background of Aley district relies on the industrial and agricultural sectors. According to IDAL (2017), the Mount Lebanon Governorate contains the highest concentration of industrial firms in Lebanon, hosting 58% of the total number Lebanese industrial firms like

agro-food companies and paper and printing companies. The unemployment rate in Aley is 13%, whereas, unemployment rate in Lebanon is 11.4% (CAS, ILO and EU, 2020).

For the cultural heritage sector, all remaining archeological sites in Lebanon are under the protection of the Ministry of Tourism and/or local Municipalities. The archeological sites in Aley Caza namely, Al Akeili Historical Square, Saoufar Archaeological House and Ighmid Heritage House are not located in close proximity to the roads to be rehabilitated.

On average, daily traffic volume is directly affected by the road classification. Higher traffic volume is usually witnessed on primary and international roads, and the volume decreases along secondary and local roads. In the context of Aley roads, Aley R1a, R1b, and R1d are classified secondary roads and Aley R1c is a primary road. As a result, Aley R1c witnesses the highest traffic volume (8,473 vehicles per day) among all Aley roads. Moreover, among the remaining Aley R1a, R1b, and R1d, Aley R1a witnesses the lowest traffic volume (1,168 veh/day), given that it is both secondary and of rural nature. Finally, on average, 90% of the time the roads host passenger cars, and the remaining 10% is divided between motorcycles and 4-tire trucks.

In specific, Aley R1a, Aley R1b and Aley R1c section 1 are surrounded by residential agglomerations, commercial areas, and other nearby sensitive receptors (schools and places of worship) at a distance of less than 10 m that might be affected by the rehabilitation activities. Regarding Aley R1d and R1c section 2, residential units are dispersed around the roads and nearby schools and places of worship weren't noted along Aley R1c (section 2). Finally, Aley R1b, R1c (section 2), R1d are surrounded by agricultural areas and Aley R1b, R1a (small segments) and R1c (sections 1 and 2) are bordered by wooded lands.

### **Impacts Evaluation**

The purpose of this section is to identify and quantify all potential impacts, both adverse and beneficial, of the project on the existing environment during both rehabilitation and operational phases. The assessment studied the impacts of the proposed project on air quality, water quality, soil quality, acoustic environment, visual intrusion, land-use/land- cover and socio-economic impacts.

Regarding the operation phase, the assessment entails the “**Defects Liability Period**’ during which the Contractor is responsible for defect remedy activities.

Given that the project aims to upgrade existing roads, the environmental impacts are expected to include dust raised during rehabilitation, increase in noise pollution derived from construction machinery, degradation of water quality, disruption to traffic movement, potential damages to existing utilities, and disturbance of local biodiversity. During the rehabilitation phase, impacts on air and water quality have been evaluated as direct and irreversible. The rehabilitation phase requires the use of many heavy machinery and equipment which are usually associated with impacts on air quality. Dust and odor emissions are expected to be high during this phase. Moreover, potential impacts on water quality from rehabilitation activities are aligned with accidental spillages and contaminated storm water runoff. The roads intersect with Ghadir and Damour rivers with numerous winter channels that lead to the rivers, and in close proximity to two springs. In terms of subsurface, the rehabilitation work entitled for Aley roads do not pose any risk as encountered formations along the roads do not host any major aquifers and the geological layers have poor permeability.

Finally, in addition to the expected temporary disturbance of the natural ecosystems (noise pollution and potential soil and water contamination), direct destruction of vegetation and population might occur if waste (excavated materials) was discharged directly into the roadside ecosystems. However, given that the concerned roads generally involve paths that are already under anthropogenic influences, the potential impacts of the project on the local biodiversity are expected to be limited to disturbance of the natural ecosystems when roads are surrounded by wooded lands and riparian habitats (Aazouniyeh pine forest along Aley R1a, riparian habitats along Aley R1a and Aley R1c that intersect with Ghadir River and Damour River respectively, and maquis ecosystems along Aley R1c in El-Kamatiyeh and Ain-Rommane), illegal dumping and discharge of wastes in river and streams (namely Ghadir and Damour Rivers) that can lead to direct destruction of local biodiversity and natural habitats (including reproduction sites for amphibians) and finally, dust accumulation on nearby vegetation and cultivated lands (agricultural areas along Aley R1b, R1c section 2, and R1d).

Potential social risks related to this project include (1) potential labor influx (in case the Contractor doesn't recruit labor from the surrounding community) and potential risk of labor-induced SH towards female workers and SEA towards women in the surrounding community; (2) Potential risk of child labor; (3) Poor labor conditions; (4) Dissatisfaction with job allocation and social tensions; (5) Risk of under-participation or underemployment of women; (6) Nuisance and traffic disturbance; and (7) Temporary obstruction of access routes to sensitive receptors which is expected to be high specifically for Aley R1a, Aley R1b (some segments are highly populated and bordered by schools and Mosque) and Aley R1c section 1 (section is surrounded by residential and commercial areas and by schools).

Whereas, the potential positive impacts of the project are to create direct and indirect short-term jobs for Lebanese and Syrians living in the surrounding community and enhance the economic development and livelihood opportunities. In addition, the project will positively impact the commercial shops surrounding the roads in Aley Caza by the rehabilitation activities as workers will potentially buy goods from local shops. Knowing that the rehabilitation activities will not require land take, the community surrounding the roads will not experience economic displacement, for instance, loss of assets or loss of income sources or means of livelihood.

Once roads are rehabilitated, the project is expected to improve drainage systems (less runoff water), road safety conditions, reduce traffic accidents and traffic congestion, and ultimately enhance livelihood opportunities. On the other hand, the main expected environmental impacts on water and soil could result in from maintenance activities during the “**Defects Liability Period**” during which the Contractor is responsible for maintenance activities, if not managed properly.

### **Development of the ESMP**

An ESMP is essential to ensure that the identified impacts are maintained within the allowable levels, unanticipated impacts are mitigated at an early stage, and the expected project benefits are realized. Thus, to mitigate the identified impacts/risks, the prepared ESMP for roads in Aley Caza was prepared before initiating any civil works. The aim of this ESMP is to assist in the systematic and prompt recognition of problems, encouraging effective actions to correct them and ultimately achieve the goal of good environmental and social performance. A sound understanding of environmental and social priorities and policies, properly managing the project,

acknowledging the regulatory requirements and keeping updated operational information are fundamental to ensure the effective and satisfactory environmental and social performance.

A proper management plan was provided for specific concerns regarding the roads in Aley as shown in the conducted environmental and social assessment. The plan includes measures and equipment to control exhaust emissions, dust and odor emissions, and soil manipulation activities during the rehabilitation phase. Moreover, proper measures and guidelines on the control of accidental spills of construction material were provided to prevent soil contamination. Any discharge of wastewater into the winter channels will mainly lead to adverse impacts to the downstream Ghadir and Damour Rivers.

Regarding biodiversity, recommendations are provided to guide the project Contractor in reducing the negative impacts on natural habitats and biodiversity. Mitigation actions suggested in this ESMP included recommendations regarding rehabilitation work and solid waste management in order to avoid degrading the sites or disturbing the local fauna. Despite that the concerned roads are mainly under anthropogenic influences, Contractors must be careful during the rehabilitation work so that the direct impacts (direct destruction) on ecosystems and associated fauna would be minimal. The waste management plan must be adopted to avoid soil and water contamination that could have irreversible impacts on biodiversity. More specifically, rehabilitation debris should not be dumped into the natural habitat (e.g. wooded lands, streams and rivers encountered in Aley Caza along the studied roads).

The social risks of this project can be mitigated through periodic monitoring of labor conditions, specific required clauses within contracts that will be required to protect workers, and the Code of Conduct (CoC) for Gender Based Violence (GBV) issues. This ESMP guides the Contractor (1) to preferably hire local workers, (2) not to hire individuals below the legal working age in accordance with the labor law of Lebanon (3) ensure proper compliance and implementation of the CoC. Similarly, close coordination with the affected municipalities is recommended in relation to road obstruction issues, provision of safety measures, including detours, safety signs and traffic management, especially in the populated areas and where the schools are located. In addition, a robust GRM must be clearly communicated to all project-affected persons during and before project implementation.

Further, the ESMP generated key project indicators to monitor project implementation success. It is designed to guarantee effectiveness in the measurement of major project outcomes and outputs based on measurable indicators. The risk of environmental and social impacts can be monitored (e.g. monitoring of solid waste disposal and wastewater discharge, monitoring of underage labor, and monitoring of workers' behaviors during the rehabilitation work). Project monitoring will be undertaken by the implementing agency (CDR) to ensure the project is being implemented in line with the proposed objectives and is on track to achieve expected results. Project progress reports will be prepared by CDR and submitted to the World Bank for review.

Finally, a multi-layer GRM was established for the concerned roads in Aley Caza. Procedures of GRM were explained during consultation sessions and available at the CDR's website on the following link <http://www.cdr.gov.lb/study/RoadsEmp/RoadsEmp.htm>. It ensures that any complaint is identified and handled properly and within specific timeline.

## **Conclusion**

Assessments showed that the proposed project has potential implications, both adverse and beneficial, on the social and environmental frameworks. In this context, the Contractor shall be committed to putting in place several measures to mitigate the negative environmental and social, safety and health impacts associated with the development cycle of the project adhering to WB social and environmental standards and policies.



## ملخص تنفيذي

### مقدمة

يهدف مشروع الطرق والعمالة في لبنان الممول من البنك الدولي إلى تحسين أحوال الطرق والسلامة المرورية من خلال إعادة تأهيل شبكة الطرق في لبنان، وخاصة في المناطق الريفية الثانية، كما ويهدف إلى خلق فرص عمل للمواطنين اللبنانيين والنازحين السوريين من خلال مشاركة العمالة في أعمال إعادة التأهيل.

سيتم تنفيذ أعمال المشروع ضمن شبكة الطرق الرئيسية الخاضعة لسلطة وزارة الأشغال العامة والنقل. في هذا السياق، سينفذ مجلس الإنماء والإعمار المشروع بالنيابة عن الحكومة / وزارة الأشغال العام والنقل.

تجدر الإشارة إلى أن الأعمال المتوقعة قد تؤدي إلى آثار بيئية واجتماعية سلبية مرافقة لأعمال التنفيذ، وعليه يجب إعداد خطة إدارة بيئية واجتماعية وفقاً لمتطلبات سياسة العمليات في البنك الدولي رقم (OP4.01)، والتي تصنف المشروع على أنه الفئة B وذلك من أجل الحد من التداعيات الممكن حدوثها وتخفيف الآثار السلبية وتطوير الآثار الإيجابية. وبناءً على ذلك، طورت شركة دار الهندسة نزيه طالب وشركاه في هذا التقرير خطة إدارة بيئية واجتماعية مخصصة لتأهيل الطرقات ضمن قضاء عاليه.

إن الهدف من خطة الإدارة البيئية والاجتماعية هو تحديد وتقييم التأثيرات البيئية والاجتماعية المحتملة للمشروع والتباحث مع الأطراف المعنية لإعداد خطة إدارة تتضمن تدابير وسبل التخفيف من المخاطر الاجتماعية والبيئية المتوقعة، كما وتطوير خطة رصد ومراقبة، بالإضافة إلى تحديد المسؤوليات في تفعيل خطة الإدارة البيئية والاجتماعية.

### وصف المشروع

يشمل المشروع الطرق المصنفة في ٢٥ قضاء في جميع أنحاء لبنان بطول إجمالي يصل إلى حوالي ٨٣٥ كم تقريباً، بحيث يوجد طريقتين مقترحة في قضاء عاليه.

تم تطوير خطة الإدارة البيئية والاجتماعية مخصصة لأعمال التأهيل ضمن هذه الطريق في قضاء عاليه بطول إجمالي يصل إلى حوالي ٢٠،٨ كم تقريباً، مقسمة على الشكل التالي:

- طريق عاليه المسمى (R1a): طريق واحد يمتد بطول إجمالي يبلغ 7.2 كم تقريباً. إن الطريق يبدأ عند العزونية ويمر عبر شارون وينتهي في عين سفور.
- طريق عاليه المسمى (R1b): يمتد الطريق بطول إجمالي يبلغ ٧،١ كم، بحيث يبدأ في الخلة ويمر عبر بسوس وعين الرمانة وينتهي في القميحات.
- طريق عاليه المسمى (R1c): يتكون الطريق من قسمين ويمتد بطول إجمالي يبلغ ٥،٣ كم، وهو عبارة عن الأقسام التالية:
  - القسم الأول يبدأ في القميحات ويمر عبر عين الرمانة وعاليه وينتهي في بختشاي.
  - القسم الثاني يبدأ في القميحات وينتهي في عين الرمانة.
- طريق عاليه المسمى (R1d): يمتد الطريق بطول إجمالي يبلغ ١،٢ كم، بحيث يبدأ في القميحات وينتهي في بددون.

تقتصر أعمال تطوير الطرق على الصيانة وبعض أعمال الإنشاء البسيطة، وكذلك على إدارة وتنظيم حركة المرور. في قضاء عاليه، تنتوع أنشطة إعادة التأهيل بين طريق عاليه المسمى R1a وطريق عاليه المسمى R1b وطريق عاليه المسمى R1c وطريق عاليه المسمى R1d؛ نظراً لحالة الحالية للطرق التي تم مسحها.

لذلك فإن الأنشطة التي يتعين القيام بها في قضاء عاليه تشمل أعمال الرصف الإسفلتي (على مثال رصف كامل الطريق عند الحاجة وإزالة الأسفلت القديم)؛ أعمال الإنارة (إعادة تأهيل أعمدة الإضاءة وتوفير أعمدة جديدة عند الحاجة)، وتحسين وتركيب مجاري الصرف الصحي، وبناء الجدران الدعم، وتركيب حواجز الأمان، ووضع العلامات وإشارة المرور. سوف توفر أعمال إعادة التأهيل فرص عمل لحوالي ١٢٨ عاملاً وسوف تتطلب حوالي ١٨ شهراً لإنهاء الأعمال.

لن يتم إغلاق الطرق أو إعاقة السير ضمنها أثناء تنفيذ أنشطة إعادة التأهيل. وسيتم تنفيذ الأعمال على حق الطريق / الممر فقط ولن تستخدم أي مرافق مجاورة قائمة. بالإضافة إلى ذلك، ستحافظ أنشطة إعادة التأهيل على ممر عبور لضمان سهولة الوصول إلى العقارات القريبة.

في حال انطوت الأعمال على أي إغلاق مؤقت للطريق، فسيتم تأمين حركة المرور من قبل مقاول المشروع عبر طرق بديلة للوصول إلى الوجهات ذات الصلة. تجدر الإشارة إلى أن التصميم المعد لا تضمن تحويلات. لذلك، وقبل تنفيذ أعمال إعادة التأهيل، سوف يقوم المقاول إذا لزم الأمر وبناءً على جدول الأعمال بتأمين الوصول وتسهيل حركة المرور عبر طرق ووسائل بديلة أخرى بالتنسيق مع البلديات ذات الصلة. وعليه، ستكون جميع التحويلات إن وجدت على طرق بديلة موجودة (ممتلكات عامة) وليس هناك حاجة لاستخدام أو استئجار بعض الأراضي لإنشاء طرق التقاف.

### الإطر القانونية

سوف يتم تنفيذ خطة الإدارة البيئية والاجتماعية وفقاً لسياسات البنك الدولي وبحسب القوانين والأنظمة اللبنانية، ولا سيما القانون رقم ٢٠٠٢/٤٤٤ (قانون حماية البيئة).

إن مشروع الطرق والعمالة في لبنان يتبع سياستان وقائمتان من سياسات البنك الدولي هما سياسة التقييم البيئي رقم (OP 4.01) وسياسة إعادة التوطين القسري (غير الطوعي) رقم (OP 4.12). وحيث أن المشروع المنوي إنشائه يركز بشكل رئيسي على إعادة تأهيل الطرق موجودة سابقاً، فإنه سوف يتم العمل في إتباع سياسة العمليات المرتبطة بالتقييم البيئي رقم (OP 4.01).

وفقاً لمكونات مشروع التأهيل في قضاء عاليه فإنه لن تتم إعادة التوطين القسري أو إستملاك أراضي. وعليه، فلن يكون هناك أي نازحين و/أو مهجرين بسبب أنشطة المشروع (وهذا يشمل السكان المحليين واللاجئين السوريين) مما لا يتطلب تطبيق سياسة إعادة التوطين القسري (غير الطوعي) رقم (OP 4.12).

### إجتماعات المشاركة العامة

إن الهدف الرئيسي للتشاور مع أصحاب العلاقة المعنيين هو التأكد من مدى موافقتهم على القضايا الحساسة لأجل تحسين فرص عدم تعرض للمشروع وخلق نزاعات تؤدي لتوقفة و/أو إلغائه.

إن الإجتماع هدف إلى التشاور مع أصحاب العلاقة الرئيسيين (رئيس اتحاد بلديات عاليه، رؤساء البلديات (القماطية، شارون، عين الرمان وكحالة)، نائب رئيس البلدية، مختار وممثل البلديات الأخرى بالإضافة إلى السكان المحليين ممثلين بالمنظمات غير الحكومية مثل جمعية المرأة الوردية، كما والتأكد من التوافق على القضايا الحساسة من أجل تحسين فرص عدم تعرض المشروع لنزاعات اللحظة الأخيرة.

تمت عرض خطة الإدارة البيئية والاجتماعية بشكل علني من خلال اجتماع المشاركة العامة الذي تم تنظيمه لقضاء عاليه. وعقد اجتماع المشاركة العامة في بلدية عاليه في يوم الخميس ١٦ تموز ٢٠٢٠، وذلك في فترة انتشار وباء COVID-19، إذ إرسال الدعوات إلكترونياً ونشرها في وقت سابق من الإجتماع على اللوحات الإعلانية للبلدية. بلغ عدد الحاضرين ١٨ منهم ٤ نساء مثلوا البلديات المعنية والمجتمع المحلي.

خلال الاجتماع، تم إبلاغ الحضور بأهداف المشروع والموارد الطبيعية والاقتصادية والاجتماعية التي تم تحديدها على أنها ذا أهمية في المنطقة، كما وتم عرض المخاطر البيئية والاجتماعية المحتملة للمشروع، وتدابير التخفيف المخطط لها وآلية معالجة المظالم (GRM).

أبدت البلديات والسلطات المحلية قلقاً بشأن اختيار الطرق، بحيث أشاروا إلى أنه هناك طرق بحاجة إلى إعادة التأهيل أكثر من الطرق المختارة (مثل طريق صوفر الذي يحتاج إلى جدار حماية لأجل السلامة العامة). وفي هذا السياق أوضح الإستشاري أن الحكومة أعطت الأولوية للطرق في قضاء عاليه بناءً على طلبات البلديات الرسمية إلى جانب عدة معايير فنية. كما وتم السؤال عن دور البلديات الرئيسي في هذا المشروع، قام الإستشاري وممثل مجلس الإنماء والإعمار بالتوضيح بأن رئيس كل بلدية له دور رئيسي في إطلاع الناس على المشروع وفي مرحلة لاحقة، لديهم دور رئيسي في مساعدة مجلس الإنماء والإعمار في مراقبة أي انتهاكات محتملة من قبل المقاول. وعلى وجه الخصوص، يجب إبلاغ مجلس الإنماء والإعمار بأي انتهاك يتم

ملاحظته. كما أوضح مجلس الإنماء والإعمار أن خطة الإدارة البيئية والاجتماعية هذه تتضمن آلية معالجة المظالم لضمان إدارة أي شكاوى متعلقة بالمشروع. وقد تم إرسال رابط آلية معالجة المظالم التالية إلى الحضور (<http://www.cdr.gov.lb/study/RoadsEmp/RoadsEmp.htm>).

بالإضافة، سأل رئيس البلديات عما إذا كان يمكن توفير طرق بديلة لإعادة التأهيل في إطار المشروع، وقد أتت الإجابة من قبل الاستشاري بأن المشروع لا يمكنه دمج أي طرق بديلة، ولكن يمكنهم مع ذلك، إرسال طلباتهم فيما يتعلق بالطرق البديلة إلى وزارة الأشغال العامة والنقل للمشاريع المستقبلية.

قامت السيدات بالسؤال بشكل منفصل عن مخاوفهن، إذ كانوا قلقين بشكل خاص بشأن عملية الإشراف، وضرورة أن يجب أن تكون النساء ممثلة في مجلس الإشراف كونهم يفضلون مراقبة تنفيذ خطة الإدارة البيئية والاجتماعية. وفي هذا السياق، حرص ممثل مجلس الإنماء والإعمار على النظر في توظيف النساء أثناء تنفيذ المشروع.

أما بالنسبة لاستشارات المنظمات غير الحكومية NGOs، فقد استهدفتهم خطة الإدارة البيئية والاجتماعية بحسب موقعهم في لبنان. وهي تتكون من مستويين على النحو التالي: (١) محلي: خاص بكل قضاء. مهمتهم هي معالجة الاهتمامات والقضايا المختلفة بين المجتمع المحلي بما في ذلك الاجتماعية، والاقتصادية، والمساواة بين الجنسين، والبيئة، والفقر، وتمكين المرأة، وما إلى ذلك و (٢) دولي: يغطي البلد بأكمله وسيتم تطبيق استشاراتهم على الجميع خطط الإدارة البيئية والاجتماعية الخاصة بالتقرير. عندما اندلعت الأزمة في سوريا في أوائل عام ٢٠١١، استجابت العديد من المنظمات غير الحكومية الدولية للأزمة الإنسانية وعملت مباشرة مع السوريين في لبنان من خلال تقديم المساعدة والاستجابة لحالتهم الحرجة.

تشمل المنظمات غير الحكومية المحلية المدعوة جمعية المرأة الدرزية وجمعية الرسالة، وجميعها تغطي منطقة عاليه. أما بالنسبة للمنظمات غير الحكومية الدولية، فقد تمت دعوة ACTED و ANERA و DRC. من بين جميع المنظمات غير الحكومية المدعوة، حضرت المنظمات غير الحكومية المحلية فقط، وقد شاركوا ذات مخاوف باقي الجمهور.

### وصف البيئة المحيطة بالمشروع

تمت دراسة البيئة الفيزيائية والكيميائية والبيولوجية والاجتماعية والاقتصادية ضمن منطقة المشروع في الوضع الحالي وقبل تنفيذ المشروع. إذ قام فريق العمل بجمع البيانات الأساسية وإجراء المسح الميداني للعناصر البيئية التالية: جودة الهواء وجودة المياه وجودة التربة والظروف الجيولوجية ووضع المناخ والأرصاء الجوية والموائل الطبيعية والتنوع البيولوجي واستخدام الأراضي / الغطاء الأرضي ونسبة الضوضاء والموارد الثقافية والظروف الاجتماعية الاقتصادية (فرص العمل وتوفر اليد العاملة والمشاكل الاجتماعية والاستغلال و/أو الانتهاك الجنسين الناجمين عن العمل والتحرش الجنسي والصحة والسلامة المهنية).

أظهرت الدراسة أن الوضع الجيولوجي ضمن الطرق المقترحة لناحية الطبقات الصخرية المتكشفة والطبقات الجوفية والتكوينات التكتونية (فوالق، طبقات، الوضع الزلزالي، إلخ)، الهيدروجيولوجيا (المياه الجوفية ومياه البحر) والهيدروجيولوجيا (المياه السطحية والأنهر) أن معظم التكوينات الصخرية البارزة في منطقة الدراسة وحولها لطرقت عاليه إلى العصر الطباشيري الجيولوجي (Cretaceous geological time period).

أما فيما يتعلق بالطبقات الجوفية ضمن الطرق الأربعة في عاليه، فقد كشفت الدراسة أن (أ) التكوينات لا تحتوي على أي خزانات مياه جوفية رئيسية و (ب) الطبقات الجيولوجية المكشوفة ذات نفاذية ضعيفة ونفاذية تقلل من خطر تسرب المياه الملوثة. ومع ذلك، تشهد المنطقة المحيطة جودة مياه سطحية غنية بحيث تتقاطع الطرق مع نهر الغدير والدامور ومع العديد من القنوات الشتوية التي تؤدي إلى النهرين، وعلى مقربة من نبعين.

تعد جودة الهواء أيضاً عنصراً أساسياً في تقييم الرفاهية الاجتماعية والحالة الصحية للمجتمع. وقد اعتمدت الدراسة على مشروع برنامج الأمم المتحدة الإنمائي / وزارة البيئة "تقييم جودة الهواء في بلد شرق البحر الأبيض المتوسط: حالة لبنان" وأظهرت أن مستويات ثاني أكسيد الكربون وثاني أكسيد الكبريت وثاني أكسيد الكبريت وأكسيد النيتروجين وأكسيد النيتروجين و PM10 تقع ضمن قيم الحدود الوطنية (القرار ١/٥٢ بتاريخ ١٩٩٦ م) مؤكداً أن المناطق المدروسة للطرق الأربعة لا تحتوي على أنشطة ملوثة للهواء.

فيما يتعلق بالموائل الطبيعية والتنوع البيولوجي، ونظرًا لطبيعة المشروع، فإن منطقة التأثير المباشر تتعلق بالطرق الحالية. وبالتالي، تم إجراء تقييم بيولوجي سريع لرسم الصورة البيئية للمناطق المجاورة للطرق المعنية لتقييم الموائل والأنواع المعرضة لخطر إضافي من المشروع المقترح. أظهر التقييم أن طريق عاليه R1d لا يشمل النظم البيئية الغنية.

تتأثر المناطق المجاورة للطرق التي تم تقييمها بالأنشطة البشرية (مثل الأراضي المتدهورة والمناطق الريفية والمناطق الزراعية). ومع ذلك، فإن بعض قطاعات طرق عاليه R1a و R1b و R1c لها أهمية بيئية معينة (تم تسجيل غابة صنوبر على طول R1a (جزء قصير في Aazouniyeh)، تم تسجيل موائل على ضفاف النهر حيث يتقاطع طريق عاليه R1a مع نهر الغدير وتقاطع طريق عاليه R1c مع نهر الدامور والنظم البيئية على طول طريق عاليه R1c في القماطية وعين الرمانة).

أخيرًا، تم إجراء تقييم اجتماعي اقتصادي في منطقة المشروع لرسم خريطة للظروف الأساسية الديموغرافية والاجتماعية والاقتصادية على مستوى قضاء عاليه. وتم التحقق في مجموعة من المؤشرات الاجتماعية بما في ذلك التوظيف وسبل العيش في عاليه وتوافر مؤسسات التعليم والصحة العامة والخاصة والوصول إلى المرافق العامة والخدمات المجتمعية وأنماط استخدام الأراضي وتأثيرات الأزمة السورية.

يبلغ عدد سكان عاليه ٣٠٠،٨٠٠ نسمة منهم ٧٤،٩٠٠ أسرة ومتوسط حجم الأسرة موكنة من ٤ أفراد، في حين يبلغ متوسط حجم الأسرة في لبنان ٣،٨ أفراد. بالإضافة إلى ذلك، فإن ١٠٥،٥٠٠ شخص من سكان عاليه تتراوح أعمارهم بين ١٤-٠ وما فوق ٦٥ سنة. في جبل لبنان، ١٠٥،٠٠٠ من الأسر ترأسها امرأة. في عام ٢٠١٦، كان ٤٨،٣٩٢ من سكان عاليه اللبنانيين محرومين بينما كان ١٠٤،٧٤٦ فوق خط الفقر (مكتب تنسيق الشؤون الإنسانية، ٢٠١٦). وهذا يعني أن ٤٨،٣٩٢ لبنانيًا في عاليه حرما من الموارد الأساسية الضرورية لتلبية احتياجاتهم الأساسية للبقاء والحماية.

بلغ عدد اللاجئين السوريين في عاليه ٦٨،٣٣٢ ومعدل حجم أسرهم ٥ أفراد مقارنةً بـ ١٤،٦٪ من الأسر ترأسها امرأة و ٦٣،٣٪ من اللاجئين السوريين في عاليه يعيشون تحت خط الفقر (المفوضية السامية للأمم المتحدة لشؤون اللاجئين، واليونيسف، وبرنامج الأغذية العالمي، ٢٠١٨).

فيما يتعلق بالمجموعات الضعيفة الأخرى مثل الأفراد ذوي الاحتياجات الخاصة تظهر النسب بالتتابع مع الوصف، ٣١،٦٪، ١٠،١٪، ٣٣،٥٪، ١٢،٧٪ و ٤،٧٪ من الأسر لديها شخص واحد على الأقل يعاني من مرض مزمن، حالة طبية خطيرة، مرض مؤقت، إعاقة، يحتاج إلى دعم يومي الأنشطة على التوالي (UNICEF and WFP، UNHCR، 2018). إضافة إلى ذلك، يعيش ٨٧،٨٪ من اللاجئين السوريين في عاليه في مبان سكنية. أما بالنسبة للفلسطينيين، فمخيمات اللاجئين غير متوفرة في عاليه.

أخيرًا، البيانات المذكورة أعلاه عن الفئات الضعيفة هي عمومًا لقضاء عاليه أو جبل لبنان. ومع ذلك، لا تتوفر بيانات محددة لتأكيد ما إذا كانت هذه المجموعات من الأشخاص داخل المجتمعات المحيطة بالطرق أم لا، مع العلم أن التركيز الرئيسي للتقييم كان تحديد المستقبلات الحساسة (مرافق الرعاية الصحية والمؤسسات الأكاديمية والكيانات الأخرى) التي قد تتأثر (مشاكل عدم القدرة بالوصول وإنعاث الغبار) أثناء تنفيذ المشروع. ومع ذلك، فإن تدابير التخفيف المتبع كجزء من خطة الإدارة البيئية والاجتماعية تضمن أن المجتمعات المحيطة بالطرق في قضاء عاليه، بما في ذلك الفئات الضعيفة (إن وجدت) لن تتأثر سلبيًا.

فيما يتعلق بمرافق الرعاية الصحية، تحتوي منطقة عاليه على مرافق مختلفة تتراوح بين المستشفيات والعيادات العامة والخاصة التي تعتبر بشكل أساسي مرافق طبية صغيرة الحجم بسبب التوزيع الجغرافي غير المتكافئ للمستشفيات في لبنان. على سبيل المثال، تم رصد مستشفى العزونية على بعد ٢٥ م من عاليه (العزونية - شارون - عين صوفر) ومركز غالب عبيد للعلاج الطبيعي الذي يبعد مسافة ١٠ أمتار من طريق عاليه R1c قسم ١ (القماطية - عين الرمانة - عاليه - بخشتاي).

علاوة على ذلك، هناك العديد من الكليات والجامعات في قضاء عاليه، بما في ذلك: الجامعة اللبنانية - كلية العلوم الاقتصادية وإدارة الأعمال، مدرسة مارون عبيد، مدرسة قماطية العامة ومدرسة صوفر التي تقع على مقربة من الطرق المراد إعادة تأهيلها بمسافة أقل من ١٠ م.

تعتمد الخلفية الاقتصادية لقضاء عاليه على القطاعات الصناعية والزراعية. وفقًا لإيدال (٢٠١٧)، تضم محافظة جبل لبنان أعلى تركيز للشركات الصناعية في لبنان، بحيث تستضيف ٥٨٪ من إجمالي عدد الشركات الصناعية اللبنانية مثل شركات الأغذية الزراعية وشركات الورق والطباعة. يبلغ معدل البطالة في عاليه ١٣٪، بينما يبلغ معدل البطالة في لبنان ١١،٤٪ (ILO and EU، CAS، 2020).

بالنسبة لقطاع التراث الثقافي ، تخضع جميع المواقع الأثرية المتبقية في لبنان لحماية وزارة السياحة و / أو البلديات المحلية. المواقع الأثرية في قضاء عاليه ، وهي ساحة العكيلي التاريخية ، وبيت صوفر الأثري ، وبيت إغميد التراثي، والتي لا تقع جميعها على مقربة من الطرق المراد إعادة تأهيلها.

بالعموم، يتأثر حجم حركة المرور اليومية بشكل مباشر بتصنيف الطريق. عادة ما يلاحظ ارتفاع حجم حركة المرور على الطرق الرئيسية والدولية وينخفض الحجم على طول الطرق الثانوية والمحلية. في سياق طرق عاليه ، تم تصنيف طريق عاليه R1a و R1b و R1d كطرق ثانوية وطريق عاليه R1c كطريق رئيسي. نتيجة لذلك ، شهد طريق عاليه R1c أعلى كثافة مرورية (٨،٤٧٣ مركبة في اليوم) بين جميع الطرق في عاليه. علاوة على ذلك ، من بين طرق عاليه R1a و R1b و R1d ، تشهد طريق عاليه R1a أقل حجم حركة مرور (١،١٦٨ مركبة / يوم)، نظرًا لأنها ذات طبيعة ثانوية وريفية. أخيرًا ، في المتوسط ، ٩٠٪ من الوقت تستخدم الطرق سيارات الركاب ، والنسبة المتبقية ١٠٪ مقسمة بين الدراجات النارية والشاحنات ذات الإطارات الأربعة.

وبالأخص، طريق عاليه R1a ، طريق عاليه R1b ، طريق عاليه R1c القسم ١ محاطة بتجمعات سكنية ومناطق تجارية ومستقبلات حساسة أخرى قريبة (مدارس ودور عبادة) على مسافة أقل من ١٠ أمتار قد تتأثر بأنشطة إعادة التأهيل . فيما يتعلق بالقسم ٢ من كريفات عاليه R1d و R1c ، فإن الوحدات السكنية تنتشر حول الطرق ولم يتم ملاحظة المدارس وأماكن العبادة المجاورة على طول منطقة طريق عاليه R1c (القسم ٢). أخيرًا ، فإن طرق عاليه R1b و R1c (القسم ٢) و R1d محاطة بمناطق زراعية و Aley R1b و R1a (أجزاء صغيرة) و R1c (القسمان ١ و ٢) تحدها أراضي مشجرة.

### وصف الآثار المحتملة للمشروع

إن الهدف من هذا القسم هو تحديد وتقدير جميع الآثار المحتملة، السلبية والإيجابية للمشروع على الوضع البيئي خلال مرحلتي إعادة التأهيل والتشغيل. ولذلك تم دراسة تقييم آثار المشروع المقترح على جودة الهواء وجودة المياه وجودة التربة وجودة الهواء ونسبة الضوضاء والتلوث النظري واستخدام الأراضي / الغطاء الأرضي والآثار الاجتماعية والاقتصادية.

فيما يتعلق بمرحلة التشغيل ، يستلزم التقييم "فترة الضمان" التي يتحمل خلالها المقاول مسؤولية أنشطة الصيانة.

كون المشروع يهدف بشكل أساسي إلى تحديث الطرق القائمة، فمن المتوقع أن تشمل الآثار البيئية الغبار الناتج أثناء أعمال إعادة التأهيل وزيادة التلوث الضوضائي الناتج عن آلات البناء وتدهور جودة المياه وتعطيل حركة المرور والحركة السياحية والأضرار المحتملة للمرافق القائمة واضطراب التنوع البيولوجي.

وعليه فإنه تم تقييم الآثار خلال مرحلة إعادة التأهيل على نوعية الهواء والماء على أنها مباشرة ولا يمكن عكسها. تتطلب مرحلة إعادة التأهيل استخدام العديد من الآلات والمعدات الثقيلة التي ترتبط عادة بالتأثيرات على جودة الهواء مما يؤدي إلى توقع حدوث انبعاثات للغبار والروائح المزعجة خلال هذه المرحلة. أما الآثار المحتملة على جودة المياه من أنشطة إعادة التأهيل فهي مرتبطة بحدوث تسرب ملوثات عرضية وعند جريان المياه السطحية. تتقاطع الطرق في عاليه مع نهري الغدير والدامور ومع العديد من القنوات الشتوية التي تؤدي إلى النهرين، وعلى مقربة من نبعين. من حيث الجوفية ، لا تشكل أعمال إعادة تأهيل طرق عاليه أي مخاطر حيث أن التكوينات التي تمت مواجهتها على طول الطرق لا تستضيف أي خزانات مياه جوفية رئيسية كما أن الطبقات الجيولوجية ضعيفة النفاذية.

بالإضافة إلى الاضطراب المؤقت المتوقع للنظم البيئية الطبيعية (التلوث الضوضائي واحتمال تلوث التربة والمياه)، قد يحدث تأثير سلبي مباشر على النباتات والسكان إذا تم تصريف النفايات (الحفريات) مباشرة في النظم البيئية على جانب الطريق. إلا أنه، نظرًا لأن الطرق المعنية تتضمن بشكل عام مسارات تخضع لتأثيرات بشرية، فمن المتوقع أن تقتصر التأثيرات المحتملة للمشروع على التنوع البيولوجي المحلي عبر اضطراب النظم البيئية الطبيعية عندما تكون الطرق محاطة بالأراضي المشجرة والموائل النهرية (غابات الصنوبر في العزونية على طول طريق عاليه R1a ، والموائل النهرية على طول عاليه R1a وعاليه R1c التي تتقاطع مع نهري الغدير ونهر الدامور على التوالي ، والنظم البيئية Maquis على طول عاليه R1c في القماطية وعين الرمانه) ، التخلص من النفايات العشوائي في الأنهار ومجاري المياه (وبالتحديد نهري الغدير والدامور) الذي يمكن أن يؤدي إلى تدمير مباشر للتنوع البيولوجي المحلي والموائل الطبيعية (بما في ذلك مواقع تكاثر البرمائيات) وأخيرًا تراكم الغبار على النباتات القريبة والأراضي المزروعة (المناطق الزراعية على طول عاليه R1b ، R1c القسم ٢ ، و R1d).

تشمل المخاطر الاجتماعية المحتملة المتعلقة بالمشروع:

(١) تدفق اليد العاملة (في حالة عدم توظيف المقاول للعمالة من المجتمع المحيط بها) والمخاطر المحتملة تجاه العاملات من النساء في المجتمع المحيط (بسبب قرب السكان والمدارس من الطرق المراد إصلاحها) ؛ (٢) الخطر المحتمل لعمل الأطفال ؛ (٣) ظروف العمل السيئة ؛ (٤) عدم الرضا عن تخصيص الوظائف ؛ (٥) خطر نقص مشاركة المرأة أو قلة تقدير دور النساء ؛ (٦) الإزعاج بشكل عام وإضطراب المرور ؛ (٧) عرقلة مؤقتة لسهولة الوصول إلى المواقع الحساسة، والتي من المتوقع أن تكون مرتفعة خصيصاً في طريق عاليه R1a ، عاليه R1b (بعض القطاعات مكتظة بالسكان وتحدها مدارس ومسجد) وعاليه R1c القسم ١ (القسم محاط بمناطق سكنية وتجارية ومدارس).

أما من الناحية الإيجابية فإنه من المتوقع أن تتمثل في خلق وظائف قصيرة الأجل مباشرة وغير مباشرة للبنانيين والسوريين الذين يعيشون في المجتمع المحيط وتعزيز التنمية الاقتصادية وفرص كسب العيش. بالإضافة إلى ذلك ، سيؤثر المشروع بشكل إيجابي على المحلات التجارية المحيطة بالطرق في قضاء عاليه من خلال أنشطة إعادة التأهيل حيث من المحتمل أن يشتري العمال البضائع من المتاجر المحلية. مع العلم أن أنشطة إعادة التأهيل لن تتطلب إستملاك الأراضي ، فإن المجتمع المحيط بالطرق لن يتعرض للنزوح الاقتصادي عبر فقدان الأملاك أو فقدان مصادر الدخل أو وسائل العيش.

بمجرد إتمام أعمال التأهيل، فإنه من المتوقع أن يؤدي المشروع إلى تحسين ظروف السلامة على الطرق والحد من حوادث المرور وازدحام المرور وفي نهاية المطاف تعزيز فرص كسب العيش. من ناحية أخرى ، يمكن أن تنتج الآثار البيئية المتوقعة الرئيسية على المياه والتربة من أنشطة الصيانة خلال "فترة الضمان" التي يتحمل خلالها المقاول مسؤولية أنشطة الصيانة إذا لم تتم إدارتها بشكل صحيح.

### خطة الإدارة البيئية

تعتبر خطة الإدارة البيئية والاجتماعية ضرورية لضمان الحفاظ على التأثيرات المحددة ضمن المستويات المسموح بها وتخفيف الآثار السلبية غير المتوقعة في مرحلة مبكرة وتحقيق فوائد المشروع المتوقعة. وبالتالي فإنه من أجل التخفيف من الآثار السلبية و/أو المخاطر المحددة، فقد تم إعداد خطة الإدارة البيئية والاجتماعية لطريق عاليه قبل البدء بالشروع في أي أعمال مدانية. إن الهدف من خطة الإدارة البيئية والاجتماعية هو المساعدة في التعرف السريع على المشكلات وتشجيع الإجراءات الفعالة لتصحيحها وتحقيق الهدف من تطبيق الخطة البيئية والاجتماعية في نهاية المطاف. إن الفهم السليم للأولويات والسياسات البيئية وإدارة المشروع بشكل صحيح وتحديد المتطلبات التنظيمية وتحديث المعلومات المتعلقة بفترة التشغيل هي أمور أساسية لضمان الأداء البيئي الفعال والمرضي.

قد تم توفير خطة إدارة مناسبة لمتطلبات محددة ضمن مشروع طرق عاليه الموضحة في التقييم البيئي والاجتماعي الذي تم إجراؤه. تتضمن الخطة تدابير ومعدات للتحكم في انبعاثات العوادم وانبعاثات الغبار والروائح وأنشطة معالجة التربة خلال مرحلة إعادة التأهيل. علاوة على ذلك، تم توفير التدابير التوجيهية المناسبة للسيطرة على التسربات العرضية لمواد البناء لمنع تلوث التربة والمياه الجوفية. إن أي تصريف لمياه الصرف الصحي في قنوات الشتاء سيؤدي بشكل أساسي إلى آثار سلبية على نهري غدير والدامور.

فيما يتعلق بالتنوع البيولوجي ، يتم تقديم التوصيات لتوجيه مقاول المشروع في الحد من الآثار السلبية على الموائل الطبيعية والتنوع البيولوجي. تضمنت إجراءات التخفيف المقترحة في خطة الإدارة البيئية والاجتماعية توصيات بشأن أعمال إعادة التأهيل والجدول الزمنية وإدارة النفايات الصلبة لتجنب تدهور المواقع أو إزعاج الحيوانات المحلية. يجب أن يلتزم المقاولون بالحذر أثناء أعمال إعادة التأهيل حتى تكون الآثار المباشرة على الأنظمة البيئية والحيوانات المرتبطة بها ضئيلة. يجب اعتماد خطة إدارة النفايات لتجنب تلوث التربة والمياه التي يمكن أن يكون لها آثار لا رجعة فيها على التنوع البيولوجي. وبشكل أخص، لا يجب إلقاء بقايا حفريات في الموائل الطبيعية (مثل الجداول المائية والقنوات المائية) في قضاء عاليه على طول الطرق (المؤهلة).

يمكن التخفيف من المخاطر الاجتماعية لهذا المشروع من خلال المراقبة الدورية لظروف العمل والبنود المحددة المطلوبة ضمن العقود لحماية العمالة وتجنب العنف القائم على نوع الجنس . توجد الخطة القواعد السلوكية البيئية والاجتماعية للمقاول على النحو التالي:

(١) الأفضل توظيف عمال محليين ، (٢) عدم توظيف أفراد دون سن العمل القانوني وفقاً لقانون العمل في لبنان (٣) ضمان الامتثال والتنفيذ المناسبين لقواعد السلوك وبالمثل ، يوصى بالتنسيق الوثيق مع البلديات المتضررة فيما يتعلق بقضايا عرقلة

الطرق. بالإضافة إلى ذلك ، يجب إبلاغ آلية معالجة المظالم بوضوح لجميع الأشخاص المتأثرين بالمشروع أثناء تنفيذ المشروع وقبله.

علاوة على ذلك، أنتجت خطة الإدارة البيئية والاجتماعية مؤشرات رئيسية للمشروع لرصد نجاح تنفيذ المشروع وهي مصممة لضمان الفعالية في قياس النتائج الرئيسية للمشروع على أساس مؤشرات قابلة للقياس. يمكن رصد مخاطر الآثار البيئية والاجتماعية (مثل مراقبة التخلص من النفايات الصلبة وتصريف مياه الصرف الصحي ومراقبة العمالة القاصرة ومراقبة سلوكيات العمال أثناء أعمال إعادة التأهيل). ستقوم مجلس الإنماء والإعمار بمراقبة المشروع لضمان تنفيذ الخطة بما يتماشى مع الأهداف المقترحة وأنه يسير على الطريق الصحيح لتحقيق النتائج المتوقعة. كما وسيقوم بإعداد التقارير المرحلية للمشروع وتقديمها إلى البنك الدولي للمراجعة.

وأخيراً ، تم إنشاء آلية معالجة المظالم متعددة البنود للطرق المعنية في قضاء عاليه. بحيث تتضمن تحديد أي شكوى والتعامل معها بشكل صحيح وضمن الجدول الزمني المحدد.

(<http://www.cdr.gov.lb/study/RoadsEmp/RoadsEmp.htm>)

### الخلاصة

أظهرت التقييمات أن للمشروع المقترح آثاراً محتملة، سلبية وإيجابية على حد سواء على كافة الأطر الاجتماعية والبيئية. وعليه، يجب أن يلتزم المخطط بتنفيذ التدابير التخفيفية للآثار السلبية البيئية والاجتماعية والصحية والسلامة العامة والاجتماعية المرتبطة بعمل المشروع مع الالتزام بالمعايير والسياسات الاجتماعية والبيئية للبنك الدولي

## 1. Introduction

### 1.1 Project Background

The Roads and Employment Project (REP) funded by the World Bank (WB) aims to improve the efficiency of road sector expenditures through the prioritization of road works and the improvement of road asset management techniques. The Project Development Objectives (PDOs) are to: (1) improve transport connectivity along select paved road sections; and (2) create short term jobs for Lebanese and Syrians.

The project will have the following components:

- Component 1: Roads Rehabilitation and Maintenance
- Component 2: Improving Road Emergency Response Capacity
- Component 3: Capacity Building and Implementation Support

This ESMP report only deals with the first component of the REP project. This includes the rehabilitation and maintenance of primary, secondary, and tertiary roads, including road safety and spot improvements. The investments under this component will improve transport connectivity and create jobs for Lebanese and Syrians.

A set of criteria were decided upon to objectively select the roads to be rehabilitated. The main criteria are pavement and road safety condition; traffic level; road functional classification; fairness in road distribution between different towns; and finally, potential for job creation and other socioeconomic benefits.

The project covers classified roads in 25 Cazas<sup>1</sup> throughout Lebanon with an expected total length of 835 km and grouped into six lots as follows:

- Lot 1: roads in Cazas of Jbeil, Kesrouane and El Metn
- Lot 2: roads in the Cazas of Aley, Baabda, Chouf and Zahle.
- Lot 3: roads in the Cazas of Bent Jbeil, Hasbaya, Jezzine, Marjaoun, Nabatiye, Rachaya, Saida, Sour and Bekaa West.
- Lot 4: roads in the Cazas of Akkar, Minieh-Danniyeh and Zgharta.
- Lot 5: roads in the Cazas of Batroun, Bcharre, Koura and Tripoli.
- Lot 6: roads in the Cazas of Baalbek and Hermel.

The maintenance and rehabilitation activities include asphalt overlays, drainage works, base and subbase reconstruction on selected sections, slope stabilization works, retaining walls, lighting works, road safety activities (edge safety barriers, marking, signing, etc...) as well as roadside improvements.

Considering that the anticipated civil works will result in environmental and social impacts, an environmental and social management plan (ESMP) shall be prepared under the requirements of

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<sup>1</sup> Caza is a synonym of District: Second largest administrative division below the national level. Each governorate is divided into districts or cazas (REACH, 2015). Lebanon is divided into six administrative regions (called Governorate or Mouhafaza) and 25 sub-regions (called Caza) not including Beirut.



OP4.01, that classifies the project as Category B. Accordingly, Dar Al Handasah Nazih Taleb & Partners will develop an Environmental and Social Management Plan for Lot 1 and Lot 2 as it was assigned by the CDR to prepare all the tender documents needed for the rehabilitation of roads included in these lots under CDR contracts No.20373 and No.20374.

This report is the specific ESMP for Aley Caza (LOT 2) (see Figure 1-1) and is structured as follows:

Executive Summary

Chapter 1 – Introduction;

Chapter 2 – Existing Policies and Regulatory Framework

Chapter 3 – Description of the Proposed Project

Chapter 4 – Description of the Environment and Social Context

Chapter 5 – Potential Environmental and Social Impact

Chapter 6 – Mitigation of Environmental and Social Impacts

Chapter 7 – Environmental and social Management and Monitoring Plan

Chapter 8 – Consultation, Disclosure and GRM

Chapter 9 – Conclusion

References

Annexes

## **1.2 Project Rationale**

According to the World Economic Forum's (WEF) Competitiveness Index 3 Lebanon's infrastructure is the second main restriction to growth and its supply and quality is substantially below various sets of comparator countries. This situation can further threaten the country's delicate political, social, and economic situation. As the influx of Syrian refugees continues to increase, the capacity of the existing and rotting infrastructure will no longer be appropriate to meet the excess demand, and pressing public investments will be needed. In other words, road rehabilitation needs have been heightened by the influx of Syrian refugees, which has substantially increased traffic demand and the utilization of the road network.

More specifically, according to the Global Competitiveness Report of the World Economic Forum (WEF) in year 2018, Lebanon ranks as the 127th for quality of roads out of 140 studied countries, and achieved a very low score of 2.6 out of 7. Moreover, in terms of road connectivity, Lebanon ranked 95 and achieved a poor connectivity score index of 48.7 out of 100 (Schwab, 2017). In terms of road conditions, approximately 95% of the roads are paved but lack proper maintenance. In Lebanon, road traffic injuries are growing to be a public health and developmental concern. Yearly, more than 1,000 people are killed due to road conditions, where one-third of the mortality cases happen to pedestrians, motorcyclists, and other vulnerable groups (Choueiri et al., 2013). Moreover, Lebanon has one of the highest per capita rates of road accidents in the world. The World Health Organization estimated that the total number of road traffic fatalities in 2015 to be 1,088, and their associated economic cost is between 3 percent and 5 percent of GDP (World Bank, 2017).

To deal with increasing road traffic and safety challenges, the Lebanese Government announced the implementation of "Road and Employment Project" which aims to improve transport connectivity and to create direct and indirect jobs for Lebanese and Syrians.

However, infrastructure projects can exert a substantial strain on the environment and natural resources. Sustainable infrastructure designs are the only solution to reduce the built-up pressure and promote the well-being of local communities. With sustainable practices and proper waste management plans enforced, the burden on the environment can be reduced. Sustainable construction can generally be defined and achieved by satisfying the following criteria: increase the lifetime; limit material consumption; use durable materials; and; consider the environmental impact of the construction process (Hoeckman et al, 2012). Similarly, the socio-economic effects of infrastructure projects can be reduced through transparency and fair compensation processes (Morris, 2007). In this context, integrating environmental and social issues and concerns in development plans and strategies would be crucial in the context of Lebanon's commitment to sustainable development. This ESMP prepared for economic decisions and development to go hand in hand with environmental and social protection. Accordingly, the developed ESMP should be viewed as a decision-making instrument for growth and environmental protection and should not be considered as a development restraint.

### **1.3 Report Objectives**

The main aim of this study is to bring into focus all the environmental and social aspects that could affect directly and indirectly the project area and the society. This study will enable the project developers and the authorities to consider the potential environmental and social consequences, and accordingly ensure that mitigation measures, monitoring plans and contingency strategies are provided to mitigate these identified negative impacts.

This ESMP for Aley Caza was developed in accordance with environmental laws and regulations in Lebanon and WB guidelines to ensure that all environmental and social requirements related to the project are properly implemented by the selected Contractor during the rehabilitation phase of the project and by the concerned municipalities and MoPWT during the operation of the project.

The specific objectives of this ESMP are to:

1. Establish environmental and socio-economic baseline
2. Set the Legal, Institutional, Standards & Policies Frameworks
3. Conduct an inclusive public consultation session that takes into consideration the views of Project Affected People (PAPs) to feed into project design
4. Identify potential social and environmental impacts caused by the project
5. Manage the various environmental and social impacts by specifying several project specific mitigation measures, as stated in the Environmental and Social Management Framework (ESMF) document prepared by CDR;
6. Achieve feasible and applicable mitigation measures during all the project's phases;
7. Provide appropriate compensation for any loss caused by project implementation;
8. Emphasize, improve, and enhance the positive outcomes of the project;
9. Guide on creating short term jobs for communities within a gender workforce equality environment;
10. Identify the responsible authorities and assign roles for different organizations in the efficient implementation of this ESMP.
11. Ensure transparency throughout the project preparation and implementation
12. Implement a robust GRM that is multi-channeled and fully functional and that is clearly communicated to all project affected people.

## **1.4 Methodology**

This ESMP report was prepared by Geoflint s.a.r.l at the request of Dar Al Handasah Nazih Taleb & Partners, as a fulfillment of the environmental and social requirements stated in component 1 (Road Rehabilitation and Maintenance) of the REP project.

The report (1) provides the relevant information regarding the environmental and social baseline conditions prevailing along the chosen roads to be rehabilitated in Aley (Aley R1a, Aley R1b, Aley R1c, and Aley R1d) that are part of Lot 2 and have a total length of 20.8 km, refer to Figure 1-1, (2) discusses the project activities, (3) identifies the possible adverse impacts during both roads rehabilitation and operation, and (4) sets out an ESMP for the four roads within Aley Caza to alleviate or prevent any likely negative social and environmental impacts.

The methods used for data collection and stakeholders' engagement are elaborated in this chapter.

### **1.4.1 Collection of Environmental and Social Baseline information**

Baseline data (environmental and social baseline information) were collected in conjunction with the project design concept and plans to highlight issues and opportunities identified within the site location and to inform the project proponents about any constraints or potential impacts.

Available data was collected from concerned municipalities, literature review, and field survey and side meetings when needed for the social assessment.

Meteorological data, which play a vital role in transport and dispersion of air pollutants, were investigated and collected in shape of a statistical distribution of weather conditions over a period of time. Also, the ambient air quality for the targeted areas was acquired from the Ministry of Environment (MoE) in order to assess the social wellbeing and health status of the communities. In addition, water quality of nearby water resources was investigated in order to accurately assess the potential impacts of the rehabilitation works. The geology, hydrogeology and seismicity of the targeted areas were studied in order to identify any viable water resources and define the level of seismic hazards of the area.

Site visits were conducted for road, social, acoustic environment and natural habitat assessments. Regarding natural habitat assessment, a single field visit was set for each road (given the limited timeframe of this study). The field investigation did not aim for an exhaustive inventory of the biodiversity of the project area but a general overview of present species (mainly flora) and key habitats. This general approach allows the identification of the conservation status of the natural habitats. Walking transects were recognized to obtain an understanding of the vegetation communities in the area and record existing species. Knowing that a single visit is not enough, the study had to consider some species as potentially present and it was difficult to perform a complete faunal survey. Further, Land Use Land Cover (LULC) maps were generated for the concerned areas.

Regarding the social assessment, socio-economic information about the area was obtained from several national sources and studies, as well as from the Ministry of Social Affairs (MoSA), and informal meetings with municipal council members during the field visits. Moreover, sensitive receptor maps were generated for the concerned roads in Aley for a better understanding of the project potential social implications.

#### **1.4.2 Methodology for Stakeholders Engagement**

According to Bourne (2016), every stakeholder and every stakeholder community is unique and has their own distinct set of expectations and perceptions. Engaging with and influencing such diverse parts within a community through a traditional “one-size-fits-all” approach is no longer deemed effective. As a result, an operative communication strategy was set, accounting for the complexity of the people whose support and involvement are vital to project success.

Multiple communication means were used to secure stakeholder involvement. The aim was that project’s stakeholders become aware of the project’s components and results, and that they get prepared to have the needed involvement in the work.

The Stakeholder Circle methodology was used as it provides a flexible approach for defining the stakeholder community, and recognizing the information and communication needed to influence each stakeholder’s prospects and actions.

The five steps to the Stakeholder Circle methodology (Bourne, 2016) were conducted and are listed below.

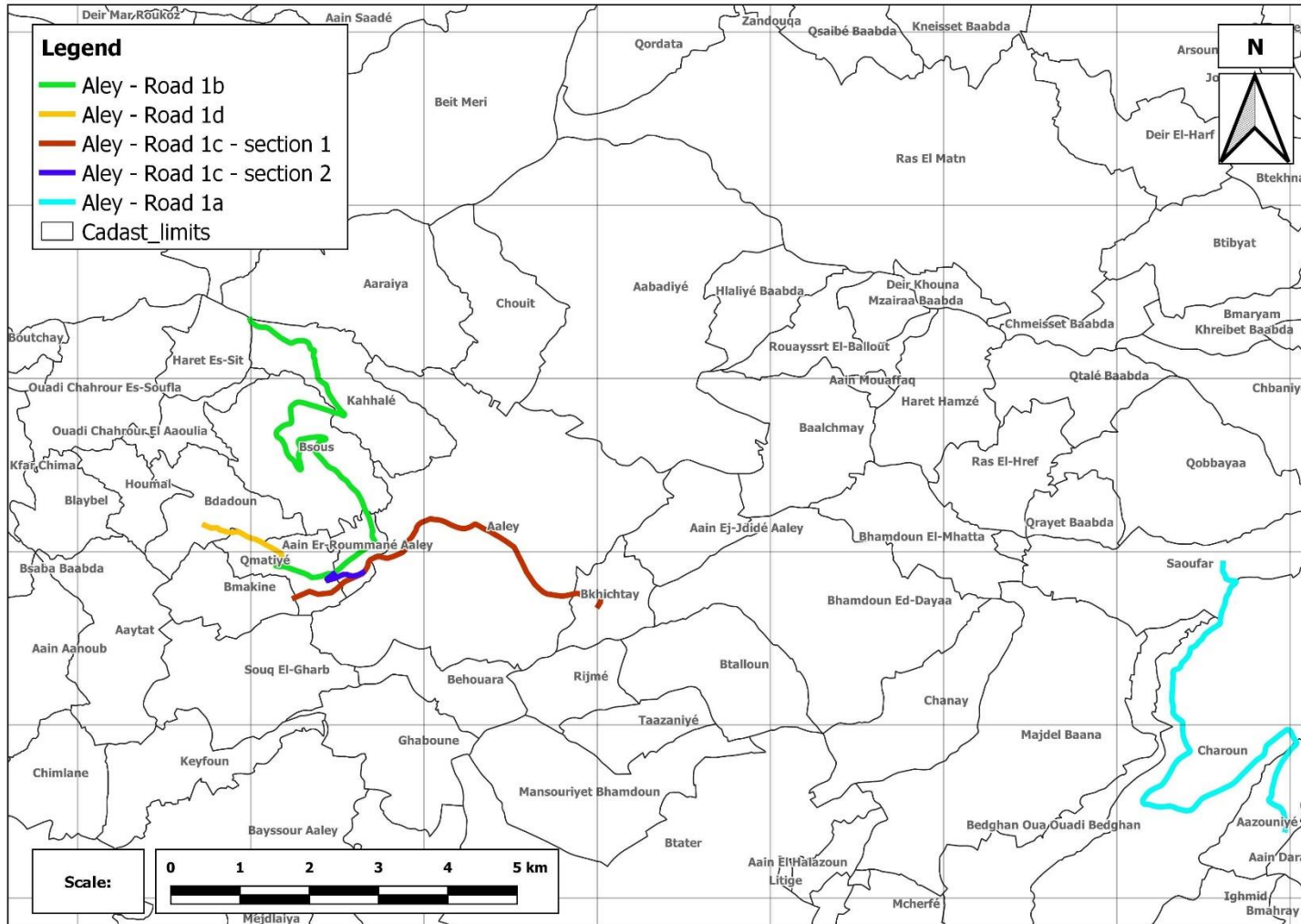
1. Identification of all stakeholders
2. Prioritization to determine who is important
3. Visualization to understand the overall stakeholder community
4. Engagement through effective communications
5. Monitoring the effect of the engagement.

The aim was to understand stakeholders’ needs, identify support from the key positive stakeholders, disseminate Project design and reduce opposition from negative stakeholders.

Subsequently, a directed communication with the identified important stakeholders was conducted. The aim was to make as much information as possible easily accessible. Additional different channels to deliver information were used (this includes formal and informal channels like phone calls and WhatsApp messages).

Emails and direct phone calls to personalize the direct communication with identified stakeholders were adopted.

Figure 1-1 Lot 2– Roads Key Plan Drawing (Aley roads)



Source: Geoflint s.a.r.l. & Dar Al Handasah Nazih Taleb & Partners, 2020

## **2. Existing Policies, Legal and Administrative Framework**

The environmental, economic and social implications of the proposed project must be addressed within the context of applicable legal and policy framework impacting the decision-making process at the national, regional and international levels. More specifically, the ESMP is conducted in accordance with the World Bank Safeguards and national and international laws/regulations that are related to social and environmental impact assessments.

The project must comply with environmental regulations, labor and occupational health and safety laws to avoid adverse impacts on the environment, health and safety of workers and affected communities. More specifically, it must comply with Lebanese Labor laws, International Labor Organization (ILO) Labor standards, applicable collective agreements and international Human rights conventions.

### **2.1 Applicable Legal and Regulatory Framework**

This section detailing the applicable legal provisions aims to provide a review of relevant national and international legal instruments as well as legislation, regulations, and policy documents, which are applicable to the proposed project in the Republic of Lebanon. The following table presents an overview of the main Lebanese environmental legislations dealing with the management of natural resources, solid waste and wastewater as well as air quality and pollution control. Moreover, laws, decisions in relation labors, human rights and biodiversity are elaborated in this section as well.

**Table 2-1 National Applicable Legal Framework**

Relevant Sector	Legislation	Date	Brief Description	Relevance to The Project
<b>Environment</b>	Decree 2761	19/12/1933	Guidelines related to Wastewater Management and Disposal	Wastewater generated by the project activities should be managed and disposed of according to this decree. This decree provides guidelines related to wastewater management and disposal to avoid pollution caused by the discharge of liquid waste illegally into water streams and valleys.
	Decree 8735	23/08/1974	All generated rehabilitation solid wastes are to be properly collected, handled and disposed	Solid wastes generated by project activities should be managed according to guidelines set in this decree.
	Law 558	24/07/1996	Law for the protection of forests	The requirements of the law shall be adhered to for the protection of forests.
	Law 532	24/07/1996	Establishment of Al Shouf Cedars Nature Reserve	Aley R1a road is 3.2 km away from the Nature reserve (Biosphere reserve and IBA).
	MoE Decision 52/1	29/06/1996	Environment quality standards and criteria for air, water and soil pollution. Revised standards for water, air and soil pollution (partly updated in Decision 8/1 dated 30/1/2001).	Decision 52/1 was referenced in the study to specify the National Standards for Environmental Quality and the Environmental Limit Values for Air and Water. The described decision (Annex 12 in decision 52/1) was used for monitoring air emissions.
	MOE Decision no.29	1998	Classification of Damour River as a natural site	Aley R1c intersects with Damour River
	MoE Decision 8/1	30/01/2001	Amendment to part of MoE Decision 52/1 dated 29/6/1996. National Standards for Environmental Quality (NSEQ) that covered air and liquid emissions for all sectors.	This decision will be used to monitor air and water quality during implementation of project activities.
	Law 444	29/07/2002	Environment Protection Law: Fundamental principles and public rules (7 parts, 68 articles), Organization of	It is essential for the proposed project as the protection of the environment is a must throughout all of the steps of the project.

			environmental protection, Environmental information system and participation in the management and protection of the environment, Environmental Impact Assessment, Protection of environmental media, Responsibilities and fines, Other regulations (miscellaneous, institutional).	
	Decree 8803/2002 and its amendments	04/10/2002	Organizes the activity of quarries and crushers, licensing procedures, as well as the operation, management and rehabilitation of quarries.	Ensures the provision of construction material and the disposal of construction waste comply with the decree
	Law 77	13/04/2018	Water Resources Law	Penalizes unauthorized discharges or disposal of any kind of waste in water resources
	Law 78	13/04/2018	Law for the protection of air quality	The requirements of the law shall be adhered to for the management of air emissions from the project
	Law 80	10/10/2018	Integrated Solid Waste Management which sets integrated solid waste management principles and provides guidelines for the management of waste.	Solid waste generated during the project should be managed in accordance with Law 80, which includes limiting quantities generated when possible, as well as properly disposing of any generated waste.
<b>Health and safety</b>				
	Decree 11802	30/01/2004	Occupational health and safety decree	The occupation health and safety conditions during the rehabilitation period should comply with this decree.
<b>Labor Laws</b>	Labor Law	23/09/1946	Labor Law that sets basic labor rights in Lebanon including minimum working age, working and resting hours etc....	It protects employees from any sort of violations dictated in this law
	Law 335	2/8/2001	This law is the ratification of ILO convention No. 182: The agreement required the ratifying country to take immediate and effective measures to prohibit the worst forms of labor and eliminate it and specify the types of work	Does not allow the employment of children and protects them from engaging in any work activities that could harm their health and safety.



			that harm the health, safety or ethical behavior of children and their location.	
	Law 400	5/6/2002	This law is the ratification of ILO convention No. 138: This agreement aims to develop a general instrument on the subject of minimum age for employment to gradually replace the instruments applied in specific economic sectors, aiming to completely eliminate child labor	Minimum age of employment on tasks and works that pose risks or hazards to health and safety
	Decree 8987	29/09/2012	Prohibition of employment of minors under the age of 18 in work that may harm their health, safety or morals	Adhere to the requirements of this decree with regards to employment for this project.
	Decree 3791	30/06/2016	Sets minimum wage for employees and workers	Adhere to the requirements of this decree with regards to wages of employees on this project.
	MOL Decision 29/1	2018	Restricts significant number of jobs to Lebanese only and allows Syrians to occupy jobs that are not restricted to Lebanese, these are mainly covering the construction sector.	Adhere to the requirements of this decree with regards to employment for this project
<b>Traffic</b>	Law 243	22/10/2012	Aims at the elimination of any kind of traffic violations such as: exceeding the speed limit, driving without a license or driving under any substance alternating the normal mental and physical state.	All transportation vehicles utilized during project implementation should abide by the general rules specified in Law 243.
<b>Cultural and Municipal</b>	Decree law 166	7/11/1933	Antiquity law	Defines chance find procedures that should be followed in case antiquities were identified in the project site
	Law 118	30/06/1977	Municipalities Law. It stipulates the role of the Municipalities and Municipalities councils.	Defines the roles of municipalities in the provision of environmental services such as solid waste management, wastewater management, etc.

	Law 37	16/10/2008	Cultural Property focuses on determining the categories of the cultural properties and classifying them in order to protect them as national treasures.	Defines the procedures to be followed to categorize cultural properties.
<b>General</b>	Decree 340	01/03/1943	The text of Article 522 of the Lebanese Penal Code, applies to cases of assault of women, by force, violence, and manipulations which are acts that affect a woman's dignity, physical health, psychological state, and moral integrity.	This law was mentioned as the project may hold risks on women during rehabilitation work.
	Law 58	29/05/1991	Law of properties and expropriation	Despite that no expropriation activities will be done; this law is added because OP 4.12 was triggered by the project
	Law 53	14/09/2017	Abolishment of article 522 of the penal code that exempts a rapist from punishments if he marries a victim	This law was mentioned as the project may hold risks on women during rehabilitation works (influx of workers (men) to the concerned area).

\*Lebanon's legislative body is represented by the Lebanese Parliament that approves and issues Laws. Lebanon's executive body is represented by the Council of Ministers (COM) and is headed by the Presidency of the Council of Ministers. The COM enacts regulations in the form of Decisions (denoted COM Decision Number) and Decrees. Decisions are issued by a specific minister and are limited to the affairs of the ministry that promulgated it. Ministerial Decisions are subject specific.

## 2.2 Institutional Framework

The project works will be executed on the main road network which is under the jurisdiction of the Ministry of Public Works and Transport (MoPWT). MoPWT is in charge of the construction and maintenance of the main road network, consisting of the primary, secondary, and tertiary roads.

In Lebanon, donor-funded road works projects are implemented by CDR upon the request of the Council of Ministers (CoM). Therefore, in the context of REP project, CDR will execute the project on behalf of the government/MoPWT.

The main national institutions that are in relation to this project and their corresponding mandates are presented in the table below.

**Table 2-2 National Institutions in relation to REP project**

Institutions	Roles and Responsibilities
<b>MoPWT</b>	<p>MoPWT is responsible for the management of public roads, and for developing a sustainable strategy for the transportation sector within the urban and rural areas.</p> <ul style="list-style-type: none"> <li>MoPWT will work closely with CDR during project implementation to ensure that important decisions on road (selection priorities, road designs, equipment specifications, and road asset management) are well coordinated.</li> <li>MoPWT will be responsible to manage the rehabilitated roads upon the completion of the project.</li> </ul>
<b>CDR</b>	<p>The Council for Development and Reconstruction is a public institution established through Decree No. 5 dated 31st January 1977. CDR's main responsibilities is to:</p> <ul style="list-style-type: none"> <li>Coordinate with relevant government agencies, particularly MoPWT, regarding roads priorities, technical aspects, and project's requirements.</li> <li>Monitor the project. In particular, every six months CDR must submit to the WB project progress reports summarizing all project aspects and progress achieved in project implementation.</li> </ul>
<b>Municipalities<sup>2</sup></b>	<ul style="list-style-type: none"> <li>Municipalities are responsible for their municipal area. According to Decree 118/1977, municipalities are responsible for supervising projects' implementation in their municipal territories. In this context they were consulted for this project.</li> </ul>
<b>Ministry of Environment (MoE)</b>	<ul style="list-style-type: none"> <li>MoE is responsible for planning and monitoring of environmental issues.</li> <li>MoE is in charge of protecting the environment in general, setting regulations and standards, and advising on implementing projects and programs in a sustainable manner. Accordingly, this ESMP must comply with the Lebanese environmental standards and regulations issued by MoE.</li> </ul>
<b>Ministry of Agriculture (MoA)</b>	<ul style="list-style-type: none"> <li>MoA is responsible for monitoring all activities related to forestry and agriculture. It regulates the introduction of new species in agriculture and livestock, protects, supervises and manages natural resources and provide technical assistance whenever necessary.</li> <li>The REP will not involve the construction of new roads or widening of existing ones (i.e. no tree cutting will occur). However, in the context of building retaining walls, if the Contractor had to cut native trees, the MoA must be consulted. Tree cutting permits are provided by MoA.</li> </ul>
<b>Ministry of Labour (MoL)</b>	<ul style="list-style-type: none"> <li>MoL is responsible for all labour and employment issues. Labour inspection is the responsibility of the Department of Labour Inspection, Prevention and Safety (DLIPS) under the Labour Relations Authority of the MoL.</li> </ul>

<sup>2</sup> Concerned Municipalities in Aley Caza: Aley R1a: El-Azouniyeh, Charoun, and Ain Sofar - Aley R1b: El-Kahale, Bsous, Ain-Rommane, and El-Kamatiyeh – Aley R1c: El-Kamatiyeh, Ain-Rommane, Aley, and Bkhichtay – Aley R1d: El-Kamatiyeh and Bdedoune.

	<ul style="list-style-type: none"> <li>DLIPS supervises the implementation of all laws, regulations, decrees and rules pertaining to the terms and conditions of employment, and the protection of workers in the workplace, including the provisions of international labour Conventions ratified. Labour inspectors ensure the supervision of compliance with regulations regarding conditions of employment and protection of workers including occupational safety and health. This ESMP must be in accordance with labor laws, regulations and conventions.</li> </ul>
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In addition to the national public institutions, the local community represented by the Non-Governmental Organizations (NGOs) were consulted (refer to Table 8-1 and 8-2 in Section 8.1).

## 2.3 Environmental Standards

The National emission levels for effluent discharges, ambient noise, and ambient air quality are provided in this section.

### Wastewater Discharge Targets

The allowable contaminants concentration for wastewater when discharged into the sewage network, sea or surface water are indicated in the MoE decision 8/1 dated 30/1/2001. The table below shows a list of allowable contaminants concentrations.

**Table 2-3 The allowable contaminants concentration for wastewater when discharged into different bodies**

Contaminants	Surface Water	Sewage Network	Sea Water
<b>pH</b>	6 – 9	6 – 9	6 – 9
<b>BOD mg/l</b>	25	125	25
<b>COD mg/l</b>	125	500	125
<b>temperature Co</b>	30	35	35
<b>Total nitrogen mg/l</b>	30	60	30
<b>Total phosphorus mg/l</b>	10	10	10
<b>Oil and grease mg/l</b>	30	50	30
<b>Mercury mg/l</b>	0.05	0.05	0.05
<b>Total suspended solids mg/l</b>	60	600	60
<b>Total coliform bacteria (Most Probable Number/100 ml)</b>	2,000	-	2,000

### Air Emissions Targets

The maximum allowable limits for outdoor air pollutants are specified in Annex 14 of the MoE Decision No. 52/1 dated 1996. The table below shows the list of allowable criteria pollutants concentrations.

**Table 2-4 Maximum allowable limits for outdoor air pollutants**

Pollutants	Maximum Limit ( $\mu\text{g}/\text{m}^3$ )	Exposure duration
Sulphur dioxide ( $\text{SO}_2$ )	350	1 hr
	120	24 hrs
	80	1 yr
Nitrogen dioxide ( $\text{NO}_2$ )	200	1 hr
	150	24 hrs
	100	1 yr
Ozone ( $\text{O}_3$ )	150	1 hr
	100	8 hrs

Carbon monoxide (CO)	30,000	1 hr
	10,000	8 hrs
Total Suspended Particles (TSP)	120	24 hrs
PM <sub>10</sub>	80	24 hrs
Lead (Pb)	1	1 yr
Benzene	5 ppb	1 yr

### Noise Emissions Targets

The expected noise pollution levels should not exceed the values listed in the MoE Decision 52/1 dated 1996. The limite values are presented in the table below.

**Table 2-5 Sound pressure limits according to MoE Decision 52/1, 1996**

Phase	Sound Pressure Level dB(A)
Working Location (less than 8 working hrs.)	90
Working Location (requires good speech hearing)	80

Therefore, the maximum national standard of 90 (dB) for occupational noise exposure limits should not exceed an average duration of 8 hours working days. If the limits are higher than the acceptable limits, then the exposure duration should be reduced as mentioned in the table below.

**Table 2-6 Noise exposure limits**

Sound Pressure Level dB(A)	Exposure Duration (hrs.)
95	4
100	2
105	1
110	0.5
115	0.25

Moreover, the following table indicates the Lebanese noise guidelines in different zones and at different periods of the day.

**Table 2-7 Lebanese noise guidelines for different zones (MoE 52/1, 1996)**

Area classification	Maximum accepted noise level dB(A)		
	Day <sup>1</sup>	Evening <sup>2</sup>	Night <sup>3</sup>
Residential area with few construction sites, activities or on a highway	50 – 60	45 – 55	40 – 50
Urban residential area	45 – 55	40 – 50	35 – 45
Residential suburb	40 – 50	35 – 45	30 – 40
Rural residential, hospital, public garden	35 – 45	30 – 40	25 – 35

(<sup>1</sup>) 7 a.m. to 6 p.m.      (<sup>2</sup>) 6 p.m. to 10 p.m.      (<sup>3</sup>) 10 p.m. to 7 a.m.

## **2.4 World Bank Policies and Guidelines**

### **2.4.1 Safeguard Policies**

In addition to the Lebanese legislation, two safeguards policies apply to Lebanon Road and Employment Project (1) OP 4.01 Environmental Assessment and OP 4.12 and (2) Involuntary Resettlement.

#### OP 4.01 Environmental Assessment.

The ESMP for the selected roads in Aley should comply with the safeguard policy of the World Bank, specifically, the OP/BP 4.01 regarding Environmental Assessment. The OP 4.01 is triggered as the project could have impacts on the environment due to the rehabilitation of roads infrastructures and associated civil works.

Under the requirements of OP4.01, the proposed project is classified as Category B (impacts are localized, short-term, and reversible and have no severe effects on the environment). Simple and low/moderate cost mitigation measures will be sufficient to restore the potential damage or keep it to the lowest possible) since the environmental impacts are expected to be minimal, during the rehabilitation phase, and can be mitigated via an environmental and social management plan.

#### OP 4.12 Involuntary Resettlement.

Despite that OP 4.12 was triggered by this project because minor realignments or other small-scale construction may require land and could impact squatters or encroachers on government-owned lands or otherwise result in the involuntary taking of land, in the case of Aley, the design of roads under study did not implicate land acquisition. No involuntary resettlement or land acquisition will take place. In other words, the project will be implemented primarily within the existing “right of way” there will be no displaced persons by the project activities (this includes local and Syrian refugees). A Resettlement Policy Framework was accordingly prepared and disclosed on the CDR website: <https://www.cdr.gov.lb/CDR/media/CDR/StudiesandReports/Roads%20and%20Employment/RF.pdf>.

#### **2.4.2 Access to Information**

This Policy governs the public accessibility of information in the WB’s possession. The WB allows access to any information in its possession that is not on a list of exceptions. This Policy is based on five principles:

1. Maximizing access to information;
2. Setting out a clear list of exceptions;
3. Safeguarding the deliberative process;
4. Providing clear procedures for making information available; and
5. Recognizing requesters’ right to an appeals process.

#### **2.4.3 Consultations and Disclosure Policy**

Transparency is essential to building and maintaining communal dialogue, and increasing public awareness about the WBG’s development role and mission. It is also critical for enhancing good governance, accountability, and development effectiveness.

Openness promotes engagement with stakeholders, which, in turn, improves the design and implementation of projects and policies, and strengthens development outcomes. In this context, a formal consultation process with the main municipalities took place during the preparation of this ESMP for Aley Caza. It was organized at Aley Municipality on July 16. The main stakeholders, were informed about the project objectives, the identified natural, economic, and social resources of importance in the area, the project’s possible environmental and social risks, the planned mitigation measures and Grievance Redress Mechanism (GRM).

Finally, this ESMP will be disclosed on CDR's and concerned municipalities' website on the following link <https://cdr-lebanon.com/en-US/Studies-and-reports/Roads-and-Employment.aspx>.

#### 2.4.4 Useful Guidelines and Manuals

This ESMP was based on Environment Health and Safety (EHS) Guidelines that are referred to in the WB's Environmental and Social Framework. The EHS Guidelines contain the performance levels and measures that are normally acceptable to the WB Group, and that are generally considered to be achievable.

The management plan must meet as well the

- WBG Environmental, Health and Safety (EHS) Guidelines.
- Disclosure Handbook.
- The World Bank Participation Sourcebook.
- Roads and the Environment. A Handbook. World Bank Technical Paper.
- Doing Better Business through Effective Public Consultation and Disclosure – A good Practice Manual, issued by IFC.
- Good Practice note addressing Gender Based Violence in Investment Project Financing involving Major Civil Works.

#### 2.5 Gap Analysis

The only national Decree 8633 in relation to social and environmental impact assessment does not impose any environmental study for road rehabilitation projects, however, WB guidelines impose conducting an ESMP for such projects.

Moreover, some of the WB's policies and emission limits are more stringent than those of the Lebanese Government. The Lebanese wastewater emission standards are, in general, less strict than WB standards, but stricter for ambient air quality and similar for noise. In this context, the stricter limits will prevail. Refer to the tables below.

**Table 2-8 Comparison of ambient air quality standards between Lebanese and WB standards**

Pollutants	Lebanese Standards		WHO Standards	
	Maximum Limit ( $\mu\text{g}/\text{m}^3$ )	Exposure duration	Maximum Limit ( $\mu\text{g}/\text{m}^3$ )	Exposure duration
Sulfur dioxide (SO <sub>2</sub> )	350	1 hr	500	10 mins
	120	24 hrs	20	24 hrs
	80	1 yr	-	-
Nitrogen dioxide (NO <sub>2</sub> )	200	1 hr	200	1 hr
	150	24 hrs	-	-
	100	1 yr	40	1 yr
Ozone (O <sub>3</sub> )	150	1 hr	-	-
	100	8 hrs	100	8 hrs
Carbon monoxide (CO)	30,000	1 hr	30,000	1 hr

	10,000	8 hrs	10,000	8 hrs
<b>Total Suspended Particles</b>	120	24 hrs	-	-
<b>PM<sub>2.5</sub></b>	-	-	25	24 hrs
	-	-	10	1 yr
<b>PM<sub>10</sub></b>	80	24 hrs	50	24 hrs
<b>Lead (Pb)</b>	1	1 yr	0.5	1 yr
<b>Benzene</b>	5 ppb	1 yr	1.7	1 yr
<b>Benzo[a]Pyrene (BaP)</b>	-	-	0.00012	1 yr
<b>Arsenic (As)</b>	-	-	0.0066	1 yr
<b>Cadmium (Cd)</b>	-	-	0.005	1yr
<b>Nickel (Ni)</b>	-	-	0.025	1 yr

Table 2-9 Comparison of allowable noise level standards between Lebanese and WB standards

region type (receptor)	limit for ambient noise levels dB(A)					
	Day time (7 a.m. - 6 p.m.)		Evening time (6 p.m. - 10 p.m.)		Night time (10 p.m. - 7 a.m.)	
	Lebanese standards	WB standards	Lebanese standards	WB standards	Lebanese standards	WB standards
commercial and administrative area in town centers	55-65	70	50-60	70	45-55	70
residential areas with some construction sites or along a main road	50-60	55	45-55	55	40-50	45
urban residential areas	45-55	-	40-50	-	35-45	-
residential suburbs with slight traffic	40-50	55	35-45	55	30-40	45
industrial area	60-70	70	55-65	70	50-60	70
rural residential areas, public gardens and hospitals	35-45	-	30-40	-	25-35	-

Table 2-10 Comparison of allowable wastewater discharge levels standards between Lebanese and WB standards

Parameters/pollutant	Wastewater Effluent Pollutants Threshold			
	Lebanese requirements			WB requirements
	Surface Water	Sewage Network	Sea Water	



<b>pH</b>	6 – 9	6 – 9	6 – 9	6 – 9
<b>BOD mg/l</b>	25	125	25	30
<b>COD mg/l</b>	125	500	125	125
<b>temperature Co</b>	30	35	35	-
<b>Total nitrogen mg/l</b>	30	60	30	10
<b>Total phosphorus mg/l</b>	10	10	10	2
<b>Oil and grease mg/l</b>	30	50	30	10
<b>Mercury mg/l</b>	0.05	0.05	0.05	0.01
<b>Total suspended solids mg/l</b>	60	600	60	50
<b>Total coliform bacteria (Most Probable Number/100 ml)</b>	2000	-	2000	400

## 2.6 International treaties and conventions

The main international treaties and conventions in relation to REP are listed in Table 2-11 and Table 2-12 below.

**Table 2-11 International Treaties and Conventions in relation to REP.**

Date	Convention/Agreement	Status	Relevance to Project
1992	United Nations Framework Convention on Climate Change.	Covered by Law No. 359 dated 11th August 1994.	This project must control activities that release green-house gases such as emissions from machineries used (most of which rely on fuel) and excavation activities, among others (refer to section 5.3.1.3).
1992	Rio de Janeiro Convention on Biological Diversity.	Covered by Law No. 360 dated 11th August 1994.	This project should abide by this convention to avoid or control activities that may pose a threat on biodiversity at all levels, since improvement of roads sometimes leads, directly or indirectly, to the loss and degradation of natural habitats and biodiversity (refer to section 5.3.1.6).

**Table 2-12 Labors conventions**

ILO Convention	Name	Entry into force	Ratification Date	Description	Relevance to Project
<b>ILO no. 29</b>	<b>Convention Concerning Forced or Compulsory Labor</b>	01/05/1932	25/06/1977	Its object and purpose are to suppress the use of forced labor in all its forms irrespective of the nature of the work or the sector of activity in which it may be performed. With some exceptions such as military service.	This project should abide by this convention to protect employees from being forced into any type of work activity that they do not want to engage in.
<b>ILO no. 105</b>	<b>Abolition of Forced Labor Convention</b>	17/01/1959	25/06/1977	Aims at the elimination of forced labor and cancels certain forms of forced labor still allowed under the Forced Labor Convention of 1930	This project should comply with the guidelines of this convention in order to protect employees from being forced into any type of work activity without their will.
<b>ILO no. 111</b>	<b>Discrimination (Employment and Occupation) Convention</b>	15/06/1960	25/06/1977	Enable legislation which prohibits all discrimination and exclusion on any basis including of race/color, sex, religion, political opinion, national or social origin in employment.	This project should abide by this convention to ensure a healthy environment between the employees and between the employer and employees in the work place by enforcing equality and respect between them.
<b>ILO no. 122</b>	<b>Employment Policy Convention</b>	09/07/1965	25/06/1977	Aim at ensuring that there is freedom of choice of employment and the fullest possible opportunity for each worker to qualify for, and to use his skills and endowments in, a job for which he is well suited, irrespective of race, color, sex, religion, political opinion, national extraction or social origin.	This project should comply with the guidelines of this convention to ensure that employees are given the right opportunities, based on their qualifications, irrespective of their origin, affiliations.
<b>ILO no. 138</b>	<b>Minimum Age Convention for Admission to Employment and Work</b>	19/06/1976	25/06/1977	It stipulates that States should progressively raise the minimum age to a level consistent with the fullest physical and mental development of young people. It establishes 15 as the minimum age for work in general and 18 as the minimum age for hazardous work.	This project should abide by this convention in order to abolish the employment of children below the specified minimum age.

### 3. Description of the Proposed Project

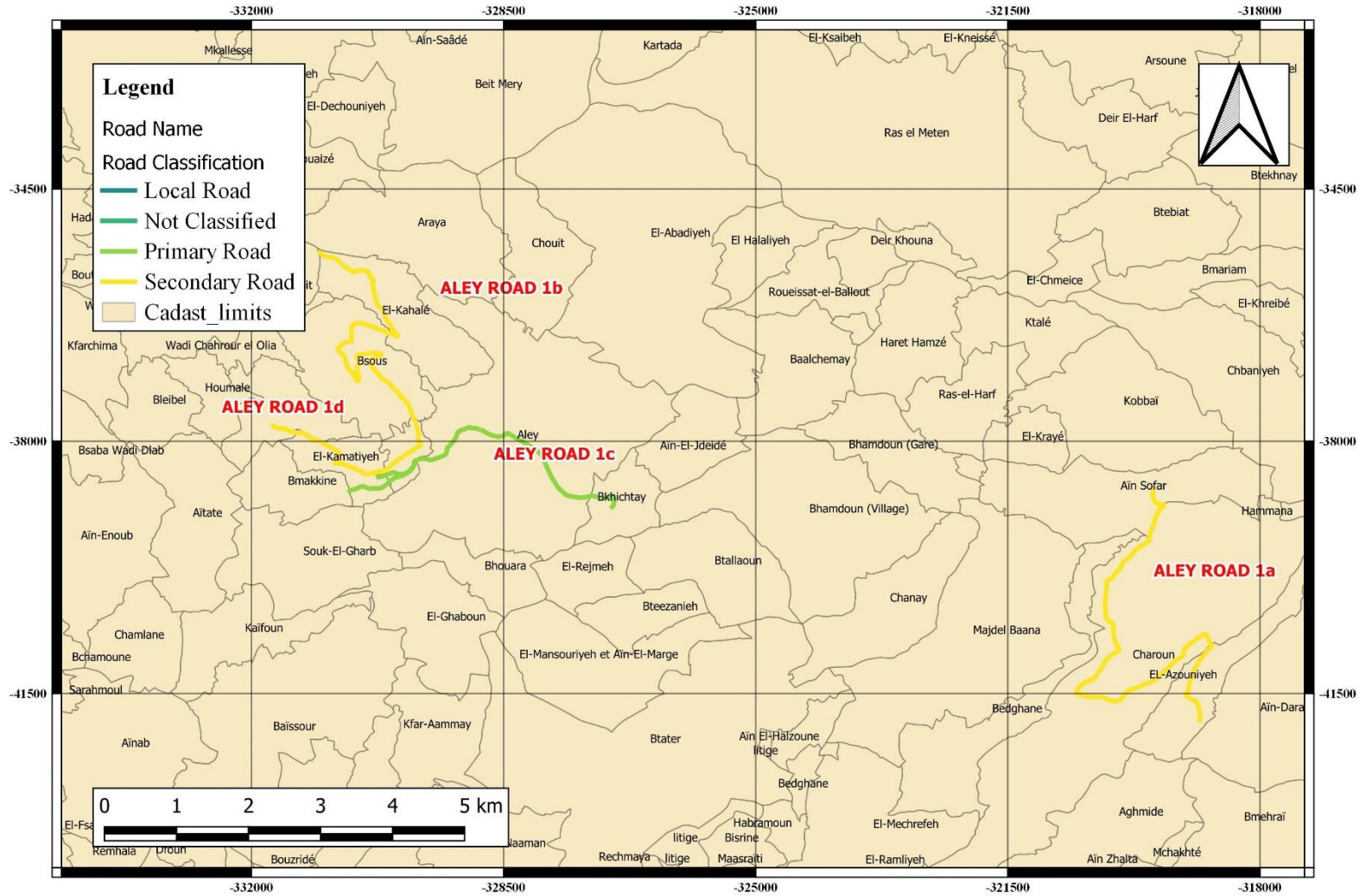
The first element of the REP includes the rehabilitation and maintenance of primary, secondary, and tertiary roads, including road safety and spot improvements.

Four roads with a total length of 20.8 km will be rehabilitated in Aley Caza, the subject of this report (Table 3-1). The land acquisition did not occur during the design of any road under study.

**Table 3-1 Roads to be rehabilitated within Aley Caza (refer to Figure 3-1 for road map classification)**

Caza	Road Code	Section	Cadastral Borders	Length (km)	Road Classification
Aley	1a	One continuous alignment	El-Azouniyeh – Charoun – Ain Sofar	7.2	Secondary
	1b	One continuous alignment	El-Kahale – Bsous – Ain-Rommane – El-Kamatiyeh	7.1	Secondary
	1c	1	El-Kamatiyeh – Ain-Rommane – Aley – Bkhichtay	5.3	Primary
		2	El-Kamatiyeh – Ain-Rommane		
1d	One continuous alignment	El-Kamatiyeh - Bdedoune	1.2	Secondary	

Figure 3-1 Classification of Aley roads



### 3.1 Roads Location and Classification

#### 3.1.1 Aley R1a (El-Azouniyeh – Charoun – Ain Sofar)

Aley R1a is located in Aley Caza and consists a single alignment with a total length of 7.2 km. It starts at El-Azouniyeh, at an elevation of 1,176 m, descends until it reaches its minimum elevation of 1,144 m, then re-ascends as it passes through Charoun where it reaches its maximum elevation of 1,299 m. It then witnesses minor variations in elevation until it ends at Ain Sofar at 1,278 m.

The road is classified as a secondary road that passes through urban and rural areas, where secondary roads have a roadway width varying between 5 m and 8 m, as shown in Table 3-2. Refer to Figure 3-1 for road classification and Figure 3-2 for the road alignment.

**Table 3-2 American Association of State Highway and Transportation Officials AASHTO 2018**

Classification	Width (m)
International Roads	10-14
Local Roads	4-6
Primary Roads	8-10
Primary Roads (highways)	10-14
Secondary Roads	5-8

#### 3.1.2 Aley R1b (El-Kahale – Bsous – Ain-Rommane – El-Kamatiyeh)

Aley R1b is located in Aley Caza and consists of a single alignment with a total length of 7.1 km. It starts at El-Kahale (at 380 m), descends slightly to reach its minimum elevation of 338 m, and then ascends, passing through Bsous and Ain Rommane, until it reaches El-Kamatiyeh at its maximum elevation of 682 m. Finally, it re-descends slightly to end there at 647 m.

The road passes through urban and rural areas and is classified as a secondary road. Refer to Figure 3-1 for the road classification and Figure 3-3 for the road alignment.

#### 3.1.3 Aley R1c (El-Kamatiyeh – Ain-Rommane – Aley – Bkhichtay)

Aley R1c is located in Aley Caza and consists of two sections or alignments that have a combined length of 5.3 km.

- Section 1: starts at El-Kamatiyeh (at 730 m), descends slightly to reach its minimum elevation of 720 m, then slightly varies in elevation as it passes through Ain-Rommane where it starts ascending until it reaches its maximum elevation of 857 m in Aley. After that it re-descends until it ends in Bkhichtay at 777 m.
- Section 2: starts in El-Kamatiyeh (at 683 m) and ascends until it ends in Ain-Rommane at its maximum elevation of 738 m.

The road passes through urban and rural areas along with a commercial street and is classified as a primary road. Refer to Figure 3-1 for the road classification and Figure 3-4 for the road alignment.

#### 3.1.4 Aley R1d (El-Kamatiyeh - Bdedoune)

Aley R1d is located in Aley Caza and consists of a single alignment with a total length of 1.2 km. It starts at El-Kamatiyeh (at 645 m) and descends until it ends at Bdedoune at its minimum elevation of 498 m.

The road passes through rural areas and is classified as a secondary road. Refer to Figure 3-1 for the road classification and Figure 3-5 for the road alignment.

### 3.2 Project Activities

During the execution of rehabilitation activities, roads will not be closed or shutdown. Works will be executed on the road right of way/passageway only and will not use or undermine any existing adjacent facilities. In addition, the rehabilitation activities will maintain a passing corridor within the alignment to grant access to nearby properties.

In case the works imply any temporary closure of the road, traffic will be secured by the project Contractor via alternative routes to reach relevant destinations. Detours and diversions were not included in the design. Therefore, before the execution of rehabilitation works, the Contractor, based on the schedule of works and if needed, will secure the access and traffic movement via other alternative routes and means in coordination with the related Municipality. Accordingly, all detours will be on existing alternative roads (public domain properties) and there is no need to use or rent some land to create the detour.

#### 3.2.1 Aley R1a

The road cross sections and safety conditions assessment are provided in a separate technical report provided by the engineers (Dar Al Handasah Nazih Taleb).

In summary, the sight distance in the horizontal alignment is not respected at some curve locations. Safety barriers, edge curbs, footwalls, and masonry walls are lacking all along the road. The absence of signing and marking all over the road is well noticed. Moreover, the part of the road located between station 5+400 and station 7+000 has a very critical width around 4m. The improvement of this section requires widening the existing road from the cut side; however, the existing project is limited to road rehabilitation, which excludes road widening activities. Drainage rehabilitation is required all throughout the road's length. Lighting improvement, which consists of mostly rehabilitation with some additions, is also required all throughout.

As for pavement conditions, most of the road requires milling and overlay, barring some sections between 1+100 and 3+00 and between 5+400 and 7+200, which require complete pavement reconstruction.

For relevant data regarding this road, refer to Table 3-3 and Figure 3-2.

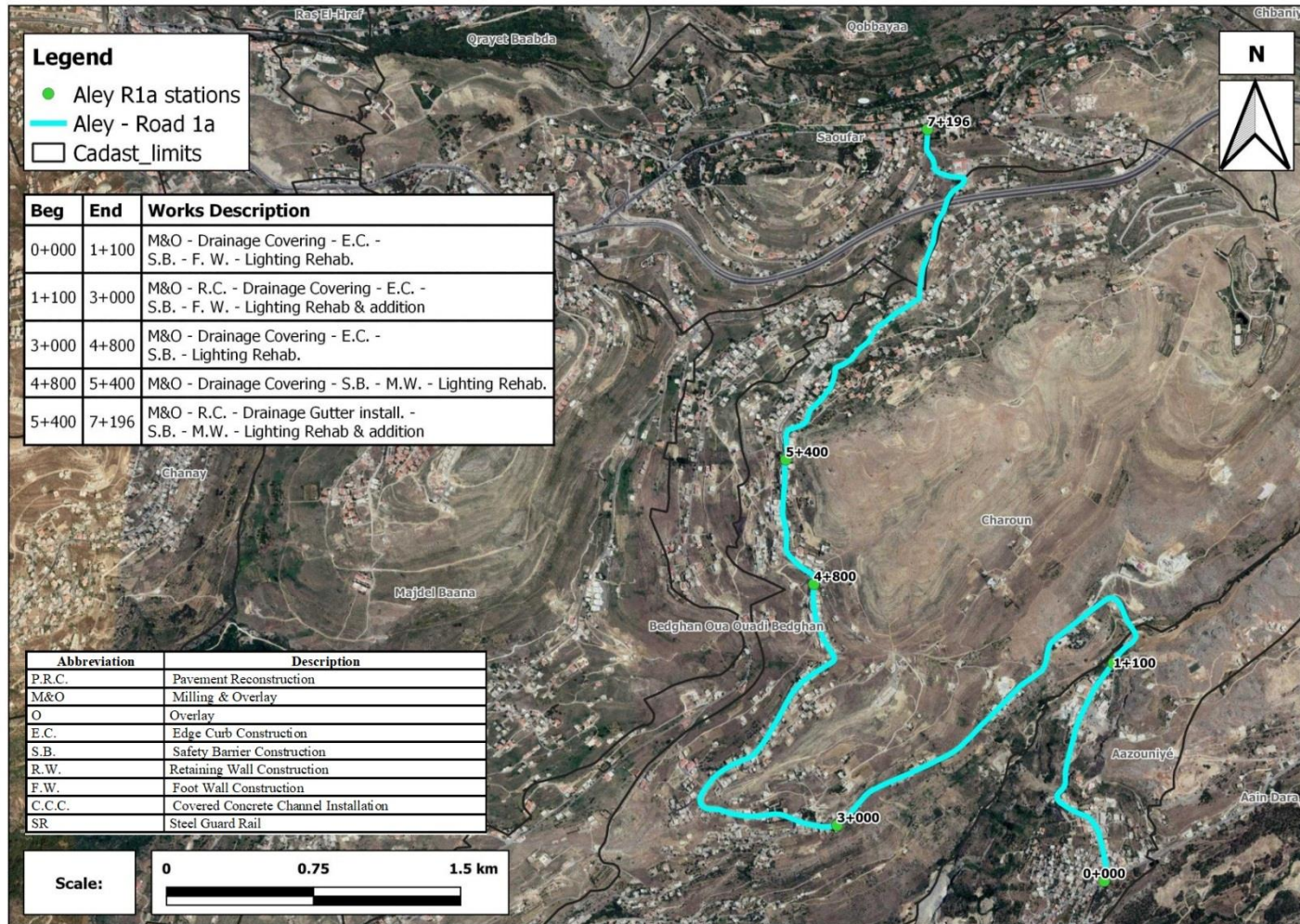
**Table 3-3 Existing road condition survey – Aley R1a**

Beg	End	Cadaster Location	Road Classification	Urban / Rural	Existing Road Width	Single / Dual Carriage way	Travelled Way Width (m)	Cross-Sections Assessment	Pavement Assessment	Road Safety Assessment
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					th (m)					
0+00 0	1+10 0	El- Azounyi eh	Secondary	Urban	6 - 7	Single	6 - 7	Accept able	Milling & Overla y	Safety barriers, footwalls, and edge curbs
1+10 0	3+00 0	Charoun	Secondary	Rural	6 - 6.5	Single	6 - 6.5	Accept able	Milling & Overla y and Recons tructio n	Safety barriers, footwalls, and edge curbs
3+00 0	4+80 0	Charoun	Secondary	Urban	6 - 6.5	Single	6 - 6.5	Critical width at some locatio ns	Milling & Overla y	Safety barriers and edge curbs
4+80 0	5+40 0	Charoun	Secondary	Urban	6 - 7	Single	6 - 7	Critical width 6 m	Milling & Overla y	Safety barriers & masonry walls
5+40 0	7+20 0	Charoun - Ain Sofar	Secondary	Rural	3.8 - 5	Single	3.8 - 5	Critical width less than 4 m at some locatio ns	Milling & Overla y and Recons tructio n	Safety barriers and masonry walls

Source: Dar Al Handasah Nazih Taleb & Partners

**Figure 3-2 Work stations with road rehabilitation activities along Aley R1a alignment**



Source: Geoflint s.a.r.l. & Dar Al Handasah Nazih Taleb & Partners, 2020



### **3.2.2 Aley R1b**

In summary, the sight distance in the horizontal alignment is not respected at some curve locations (mainly at stations 0+550, 3+400 and 3+825). A lack of safety barriers is observed all throughout the road's length. The need to provide at some locations, footwalls, edge curbs, and slope protection is also urgent. The absence of signing and marking all over the road is well noticed. Lighting and drainage rehabilitation are also required all throughout. Moreover, some drainage additions are needed at the first and final 2 km of the road.

As for pavement condition, milling and overlay is required throughout the road's length.

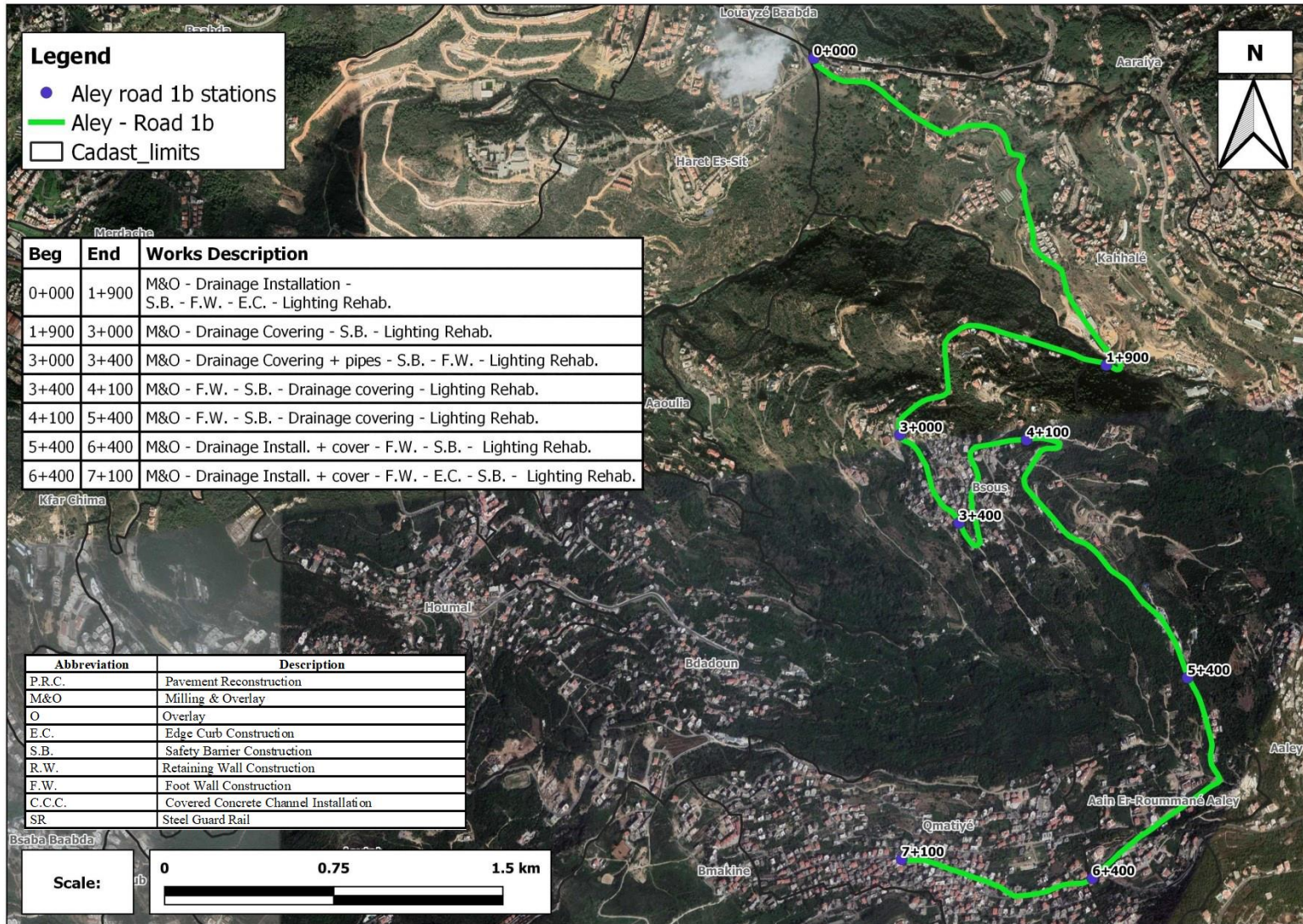
For relevant data regarding this road, refer to Table 3-4 and Figure 3-3.

**Table 3-4 Existing road condition survey – Aley R1b**

Beginning	End	Cadaster Location	Road Classification	Urban / Rural	Existing Road Width (m)	Single / Dual Carriageway	Traveled Way Width (m)	Cross-Sections Assessment	Pavement Assessment	Road Safety Assessment
0+000	1+900	El-Kahale	Secondary	Rural	7.5	Single	≈7.5	Acceptable	Milling Overlay &	Safety barriers, edge curbs, and footwalls
1+900	3+000	Bsous	Secondary	Rural	7 – 8.5	Single	7	Acceptable	Milling Overlay &	Safety barriers
3+000	3+400	Bsous	Secondary	Urban	≈7	Single	7	Acceptable	Milling Overlay &	Safety barriers & footwalls
3+400	4+100	Bsous	Secondary	Urban	≈5.5 – 6	Single	5.5 – 6	Critical width	Milling Overlay &	Safety barriers & footwalls
4+100	5+400	Bsous	Secondary	Urban	≈6.5 – 7.5	Single	6.5	Acceptable	Milling Overlay &	Safety barriers & footwalls
5+400	6+400	Ain-Rommane	Secondary	Urban	≈7	Single	6.5	Acceptable	Milling Overlay &	Safety barriers & footwalls
6+400	7+100	El-Kamatiyeh	Secondary	Urban	5.8 – 7.5	Single	5.8 – 7.5	Critical width at some locations	Milling Overlay &	Safety barriers & footwalls

Source: Dar Al Handasah Nazih Taleb & Partners

Figure 3-3 Work stations with road rehabilitation activities along Aley R1b alignment



Source: Geoflint s.a.r.l. & Dar Al Handasah Nazih Taleb & Partners, 2020

### **3.2.3 Aley R1c**

In summary, a lack of safety barriers is observed throughout most of section 1. The absence of signing and marking all over the road is well noticed. Lighting rehabilitation is required throughout the road's length along with some additions in section 2.

As for pavement conditions, milling and overlay is required throughout the road's length.

For relevant data regarding this road, refer to Table 3-5, Table 3-6, and Figure 3-4.

**Table 3-5 Existing road condition survey – Aley R1c section 1**

Beg	End	Cadaster Location	Road Classification	Urban / Rural	Existing Road Width (m)	Single / Dual Carriageway	Traveled Way Width (m)	Cross-Sections Assessment	Pavement Assessment	Road Safety Assessment
0+000	0+600	El-Kamatiyeh	Primary	Urban	7 – 8	Single	7 – 8	Narrow	Milling & Overlay	Acceptable
0+600	1+200	Ain-Rommane	Primary	Urban	7 – 8	Single	7 – 8	Narrow	Milling & Overlay	Safety barriers and edge curbs
1+200	1+750	Aley	Primary	Urban	14	Single	14	Acceptable	Milling & Overlay	Safety barriers and edge curbs
1+750	2+100	Aley	Primary	Commercial street	7 – 9	Single	7 – 9	Narrow	Milling & Overlay	Acceptable
2+100	2+700	Aley	Primary	Commercial street	7.5 – 10	Single	7.5 – 10	Narrow	Milling & Overlay	Acceptable
2+700	3+100	Aley	Primary	Commercial street	12	Single	12	Acceptable	Milling & Overlay	Safety barriers
3+100	3+800	Aley	Primary	Commercial street	9.5	Single	9.5	Acceptable	Milling & Overlay	Safety barriers
3+800	4+600	Aley – Bkhichtay	Primary	Commercial street	9.5	Single	9.5	Acceptable	Milling & Overlay	Safety barriers

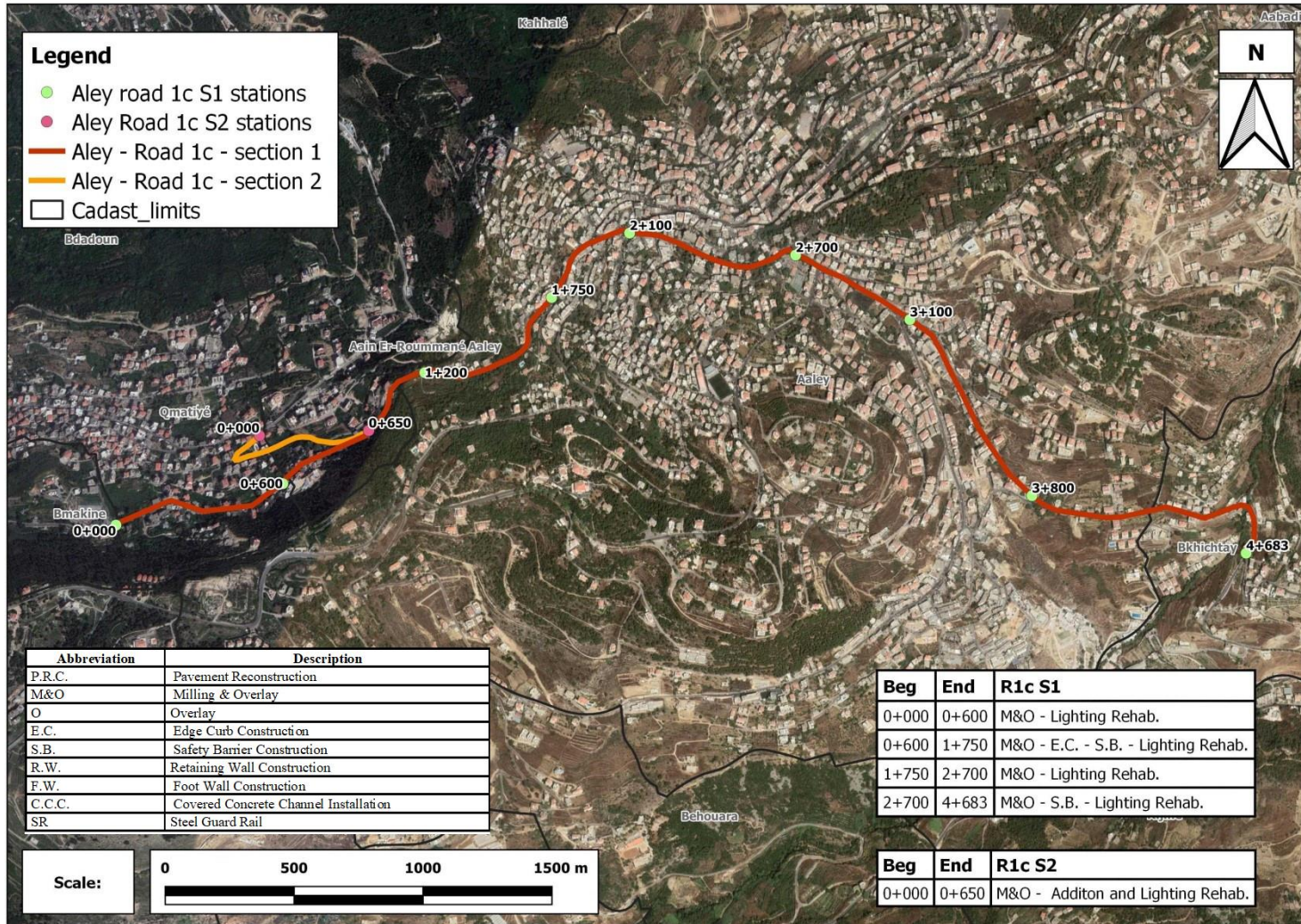
Source: Dar Al Handasah Nazih Taleb & Partners

**Table 3-6 Existing road condition survey – Aley R1c section 2**

Beg	End	Cadaster Location	Road Classification	Urban / Rural	Existing Road Width (m)	Single / Dual Carriageway	Traveled Way Width (m)	Cross-Sections Assessment	Pavement Assessment	Road Safety Assessment
0+000	0+650	El-Kamatiyeh – Ain Rommane	Primary	Urban	11	Single	11	Acceptable	Milling & Overlay	Acceptable

Source: Dar Al Handasah Nazih Taleb & Partners

Figure 3-4 Work stations with road rehabilitation activities along Aley R1c alignments



Source: Geoflint s.a.r.l. & Dar Al Handasah Nazih Taleb & Partners, 2020

### **3.2.4 Aley R1d**

In summary, a lack of safety barriers is observed along the road. The need to widen this road and to provide new retaining walls, footwalls and slope protection is urgent. However, the existing project is limited to road rehabilitation, which excludes road widening activities. The absence of signing and marking all over the road is well noticed. Lighting rehabilitation, along with some additions, is also required all throughout

As for pavement conditions, milling and overlay is required throughout the road's length.

For relevant data regarding this road, refer to Table 3-7 and Figure 3-5.

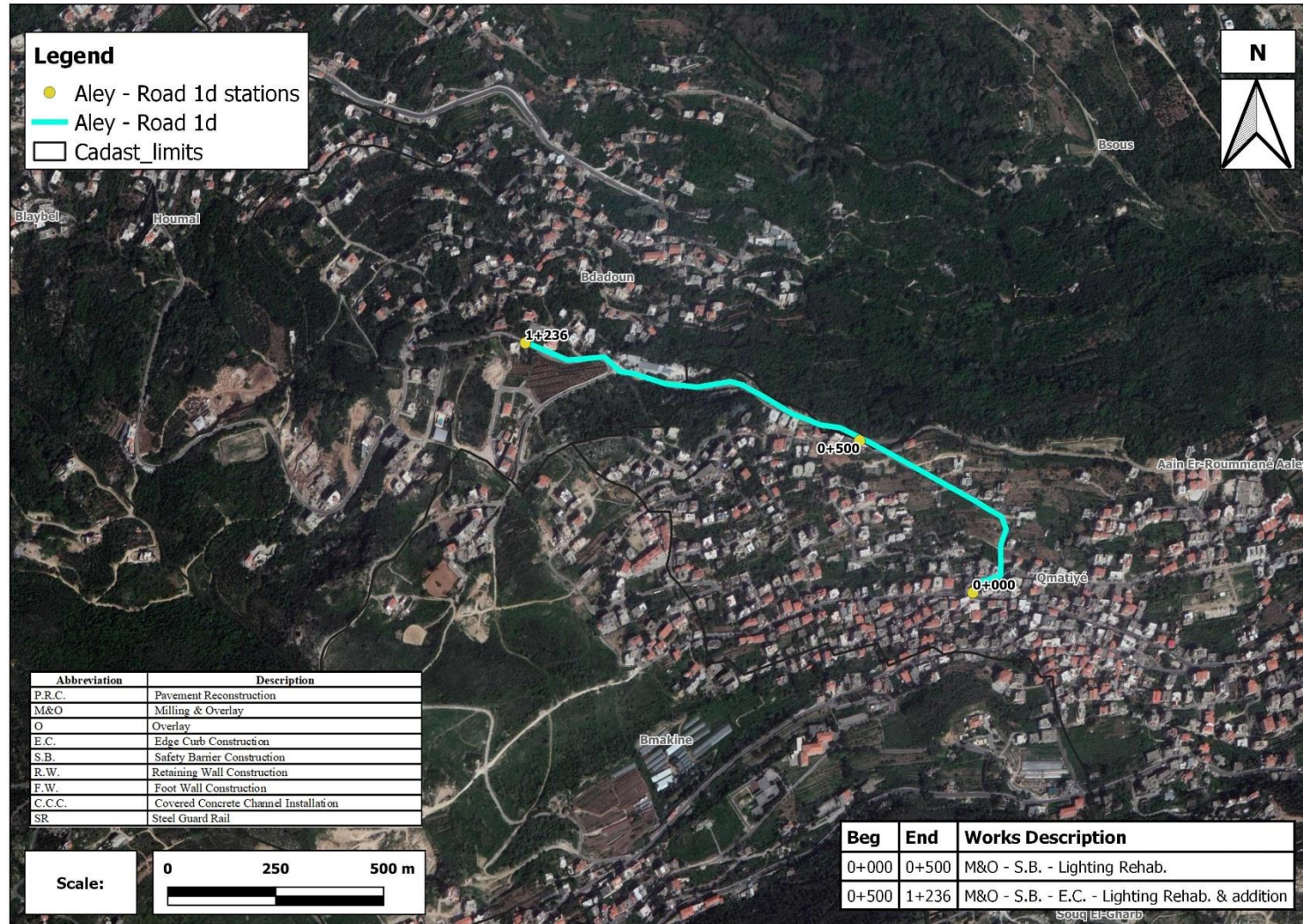
**Table 3-7 Existing road condition survey – Aley R1d**

Beg	End	Cadaster Location	Road Classification	Urban / Rural	Existing Road Width (m)	Single / Dual Carriageway	Traveled Way Width (m)	Cross-Sections Assessment	Pavement Assessment	Road Safety Assessment
0+000	0+500	El-Kamatiyeh	Secondary	Rural	3	Single	3	Very critical width	Milling & Overlay	Safety barriers
0+500	1+236	Bdedoune	Secondary	Rural	3	Single	3	Very critical width	Milling & Overlay	Safety barriers

Source: Dar Al Handasah Nazih Taleb & Partners



Figure 3-5 Work stations with road rehabilitation activities along Aley R1d alignment



Source: Geoflint s.a.r.l. & Dar Al Handasah Nazih Taleb & Partners, 2020

### 3.3 Contractor's Equipment and Materials

The contractor's equipment needed for the rehabilitation activities are presented in Table 3-8. The quantities of raw materials to be used during the rehabilitation phase are presented in Table 3-9).

**Table 3-8 Contractor's equipment to be used**

Contractor's Equipment	
Description	No
Excavator	3
Shovel	3
Bob cat	4
Pick-up	4
Truck	5
Water tank	4
Steel roller	3
Conc. transit mixer	3
Asphalt cutter	4
4x4 Vehicles	4
Vehicles	5
Plate compactor	5
Asphalt Paver	1
Jack Hammer	3

**Table 3-9 Quantities of main materials to be used during the whole period of the rehabilitation works**

Material	Unit	Quantity
Sub-base and base Course	m <sup>3</sup>	14,571
Bituminous Material	m <sup>3</sup>	24,904
Reinforced Concrete	m <sup>3</sup>	5,797
Clearing and Grubbing	m <sup>2</sup>	14,309
Lighting Columns	Number	27
Lighting Brackets	Number	36

### 3.4 Site Rehabilitation Staffing

It is estimated that rehabilitation works for Aley roads will require a total of 18 months (with 12 months defects liability period subsequent to end of works). Moreover, around 128 workers will be involved in rehabilitation activities. These workers must be hired preferably from the surrounding local communities (including Syrian laborers that reside in the concerned project areas) (Table 3-10)

**Table 3-10 Contractor's Personnel**

Contractor's Personnel	
Project Manager	1
Civil Engineer	4
Surveyor	4
Foreman	4
Watchman	4
Skilled labor	20
Labor	55
Steel fixer	6

Carpenter	6
Operator	20
Office boy	4
Total	128

### 3.5 Site Facilities & Infrastructure

The Project site will not include any facilities on-site including site offices for Engineers and for the Contractor, laborers camps, lodging on site, containers, power generators and repair garages.

During the work implementation, the Contractor will have to rent a flat located in the Project area to serve as a Project Offices. These offices will be used by the Contractor Engineers, technical skilled workers and Supervising Consultants. The flat will be equipped with toilet, kitchen (including drinking water and appliances), lockers and other supplies needed for the daily administrative activities. It might also serve as a meeting point for all Project workers at the start and end of their shifts.

The work implementation will also require unskilled workers (laborers) needed to perform earthworks on-site. The Contractor will be encouraged to hire laborers from the local community living in the Project area. However, in case required labors are not available in the area, there may be potential labour influx, although this will be kept to a minimum to the extent possible to encourage local hires. During working hours, laborers will be entitled with a one-hour break on-site. Usually, every laborer brings from home his own food and drinking water. The on-site rest point will be decided by the Contractor at the time of works.

The Contractor will have to service the on-site with portable cabin toilet. The porta cabin will be mobile and its placement depends on the length of the work zone. Accordingly, the Contractor will have to move it based on the progress of rehabilitation works. The Contractor should link the porta cabin toilet to the existing wastewater network. In case the network is not available within the work zone, the Contractor will need to link it to a polyethylene storage tank and the Supervising Consultant shall inspect it on a regular basis and ensure the application of proper mitigation measures.

For vehicles and equipment, the Contractor will have to rent a land within the Project area. This land should be fenced and used for parking purpose only. The Contractor shall not perform any repair on site and is obliged to execute vehicles and equipment maintenance in a repair shop preferably located within the Project area.

## 4. Description of the Environment and Social Context

The environmental and social baseline assessment is a key component in any ESMP study. This assessment will grant an initial assessment of all existing phenomena and conditions in the study area and within the area of influence before the implementation of the project. The aim is to identify key environmental and social issues/impacts that need to be mitigated and monitored during project implementation.

### 4.1 Physical Environment

#### 4.1.1 Topography

Roads under consideration are Aley R1a (El-Azouniyeh – Charoun – Ain Sofar), R1b (El-Kahale – Bsous – Ain-Rommane – El-Kamatiyeh), R1c (El-Kamatiyeh – Ain-Rommane – Aley – Bkhichtay), and R1d (El-Kamatiyeh – Bdedoune) located in Aley Caza. The variation in mean sea level elevations of the vertical alignments are shown in Table 4-1 and the elevation contour lines are shown successively in Figure A until Figure E (in Annex 1).

**Table 4-1 Mean sea level elevations of Aley roads**

Road	Cadastral area name		Altitude approximate range (m)	Mean Elevation (m)
Aley R1a	One continuous alignment	El-Azouniyeh – Charoun – Ain Sofar	1,144 – 1,299	1,231
Aley R1b	One continuous alignment	El-Kahale – Bsous – Ain-Rommane – El-Kamatiyeh	338 - 682	489
Aley R1c	Section 1	El-Kamatiyeh – Ain-Rommane – Aley – Bkhichtay	720 – 857	794
	Section 2	El-Kamatiyeh – Ain-Rommane		
Aley R1d	One continuous alignment	El-Kamatiyeh - Bdedoune	498 – 645	558

#### 4.1.2 Geology

The geology of the studied roads was investigated for outcropping formations, subsurface stratigraphy, structure (faults, folds, seismic, etc.), hydrogeology (groundwater and sea water intrusions) and hydrology (surface water).

The outcropping lithological formations in and around the study area of Aley roads belong to the Cretaceous geological time period (refer to Figure F until Figure J shown successively in Annex 1)

##### (1)Aley R1a

This road crosses formations C1, C2a, and C2b.

##### (2)Aley R1b

This road crosses formations C1, C2a, C2b, C3, and C4.

### (3)Aley R1c

This road crosses formations C1, C2b, and C3.

### (4)Aley R1d

This road falls only on formation C2b.

All of the above-mentioned formations are described in detail in Table 4-2.

**Table 4-2 Geological outcrops exposed along Aley caza roads**

Geology	Name	Description
C <sub>1</sub>	Chouf Sandstone (Grés de Base), Neocomian-Barremian	Varicoloured, cross bedded Sandstone with inter-beds of shale; contains heavy minerals; color depends upon percentage of hematite and presence of volcanics giving purplish colour; Sand is sometimes white; contains coal seams and traces of brittle amber. This formation can reach 300 meter in thickness.
C <sub>2a1</sub>	Abey Formation, Lower Aptian	Clastic: mixture of clay, sand and calcareous material in varying proportions forming clay, sandy clay, marl, marly limestone etc. The calcareous material may be slightly to moderately indurated. Where marl prevails, its fresh color is bluish, weathering to creamish brown. This formation can reach 125 meter in thickness.
C <sub>2a2</sub>	Mdeirej Limestone, Lower Aptian	Karstic, massive marine depositional environment Limestone forming a prominent cliff, which often used as a marker bed. Transition with the Abey Formation consists of three layers of green clay intercalating limestone. This formation is outcropping to the East of the site and it can reach 45 meter in thickness.
C <sub>2b</sub>	Hammana Formation, Upper Aptian	Marl intercalated with marly Limestone with thick layers of Sand on top; layers of ferro-oolitic limestone sometimes overlies the sand. This formation can reach 20 meter in thickness
C <sub>3</sub>	Hammana Formation, Albian	Green Marl (containing glauconite) intercalated with thick layers of marly Limestone forming cliffs 3 - 4 m in height; may contain some thin sand layers in the lower part of the formation. This formation can reach 150 meter in thickness.
C <sub>4</sub>	Sannine Limestone, of Cenomanian age	(C <sub>4</sub> ); this unit is divided into three subunits: <b>C<sub>4a</sub></b> : Dolomitic Limestone, within this formation, geodes of different sizes filled or voided can be recorded. Thickness of this unit is about 300 meters. <b>C<sub>4b</sub></b> : Bluish marl and shale containing crystals of quartz, chert nodules and bands form. Thickness of this unit is about 100 meters. <b>C<sub>4c</sub></b> : Limestone and dolomitic limestone white to brown in color. Limestone is highly karstified. Thickness of this unit is about 300 meters.

Source: Dubertret, (1945)

#### 4.1.3 Hydrogeology

Geological units can be defined as aquifer or aquiclude in terms of storing and transmitting water, and these types depend on the geological environment in which they occur.

An aquifer can be a subsurface rock or sediment unit that is porous and permeable, high enough that it stores and transmits useful quantities of water. Aquifers are divided into the following categories:

- Confined: overlain by an impermeable rock unit,
- Unconfined: that is not overlain by an -impermeable rock unit, where the water in this aquifer is under atmospheric pressure and is recharged by precipitation that falls on the land surface directly above the aquifer,
- or Semi-confined: partially confined, or overlain, by gravel, sand, silt or soil layers of low permeability through which recharge and discharge can still occur.

Aquiclude is a geological formation which, although porous and capable of absorbing water, does not permit its movement at rates sufficient to furnish an appreciable supply for a well or spring. Alternatively, it could be an impermeable body of rock or stratum of sediment that acts as a barrier to the flow of groundwater.

The study area is characterized by the presence of aquifer, aquiclude and open semi-aquifers within the various formations:

- Aquifers in the area are Sannine Limestone (C<sub>4</sub>) and Mdeirej Limestone, Lower Aptian (C<sub>2a2</sub>). The limestone formation forms a main part to the study area and is the most important karstic system in the study area characterized by a significant amount of groundwater flowing in channels, faults and fractures. These fractures include solution joints, solution pits, lapiaz, grooves and sinkholes. Cavities in the rocks are often filled with calcite and cave deposits.
- Aquicludes formations along the area are the Hammana Formation, Albian (C<sub>3</sub>). These deposits constitute an aquiclude due to the presence of marls and marlstones with low hydraulic conductivity. However, low to medium discharge springs are present in this formation.
- Semi-Aquifers in the area are the Chouf Sandstone (C<sub>1</sub>), Abey Formation, Lower Aptian (C<sub>2a1</sub>) and Hammana Formation, and Upper Aptian (C<sub>2b</sub>), which are composed of sand, with very high permeability, and clay, with low permeability are present within these deposits. In relation to permeability and porosity, there are no important fractures or joints within these formations, that is why they are classified as a semi-aquifer.

### **(1)Aley R1a**

The road encounters several winter drainage channels that discharge into the neighboring Damour River (~300m downstream to the south), as shown in Figure K in Annex 1. In addition, the road is in close proximity to two springs (Ain El Baradi and Ain El Hzabel) at work stations (1+100 and 5+400) respectively.

Finally, the road falls on a cretaceous non-aquiferous formation (refer to geology class 10 and 16 in Table 4-3) that exhibits both low permeability and transmissivity with absence of a water table.

In this context, any discharge of untreated solid waste or wastewater onto open ground is unlikely to infiltrate to the subsurface, however, it is highly likely to be carried by the surface channels and into the Damour river, possibly negatively impacting its water quality; especially in the winter season.

## **(2)Aley R1b, R1c, and R1d**

The following roads encounter a number of surface winter drainage channels (refer to Figure L, Figure M, Figure N and Figure O in Annex 1) that discharge downstream into Ghadir river (West of Aley R1b) and Damour river (South of Aley R1c section 1). Moreover, Aley R1b crosses Ghadir river at station 2+600 and Aley R1c S1 crosses Damour river at station 4+683 right before the end of the road.

Similar to Aley R1a, in terms of hydro-stratigraphy, the roads fall mostly on a cretaceous non-aquiferous formation, with a geology class 10 and 16 (refer to Figure L, Figure M, Figure N and Figure O in Annex 1 and Table 4-3). The system exhibits low to very low transmissivity values, meaning that they do not allow water to flow horizontally in the subsurface. Moreover, water tables of this formation are local to discontinuous and groundwater flow is rare and at irregular intervals. Therefore, discharge of wastewater to the open ground is not likely to infiltrate the subsurface.

However, given that the roads intersect with two main rivers and drainage channels, it is prohibited to dump any solid waste or wastewater into these channels or valleys, as this will increase contamination of Ghadir and Damour rivers.

### ***Summary***

In terms of the subsurface, all of the works entitled for Aley roads do not pose any risk, given that 1) the formations do not host any major water aquifers and 2) the exposed geological layers have both poor permeability and transmissivity lowering the risk of spill infiltration or spread. However, the surrounding area witnesses rich surface water quality, knowing that the roads intersect with 1) Ghadir and Damour rivers, 2) with numerous winter channels that lead to the rivers, and 3) in close proximity to two springs. In this context, any accidental spillages to open ground shall be controlled to avoid adverse impacts on perennial river water quality.

**Table 4-3 Legend of the hydrogeology maps shown successively in Figure K until Figure O (in Annex 1)**

Geology Class	Groundwater Sheets		Lithology	Age	Flows of the sources I/sec.	Probable instantaneous flows of the works I/sec.	Permeability	Transmissivity m <sup>2</sup> /sec
			Facies					
2	IN KARSTIC FORMATIONS Wide and rich watertable		Limestone regularly bedding Thickness: 800 to 1,000 m.	Cretaceous Cenomanian-Turonian	<100      100- 1000      >1000	>100	High	$10^{-2} \leq T \leq 1$ Generally high
7	IN POROUS FORMATIONS	Water Table extended	Coarse conglomerate torrential - marly conglomerates Thickness: 500 to 600 m.	NEOGENE Miocene and Pliocene (continental facies)	<100      OR DISCHARGED DISPERSED DIFFUSE	<30	Medium	<10 <sup>-3</sup> Poor or changing
10		Local or discontinuous water table	Sandstone Thickness : 150 to 250 m.	Cretaceous	<10	<10	Low	$10^{-5} \leq T \leq 10^{-4}$ Poor with weak
16	AREAS GENERALLY WITHOUT WATER TABLE OR A VERY LOCAL WATER TABLE		Alternations of clay-sandy, limestone beds and marl Thickness: 300 to 400 m.	Cretaceous Aptian-Albian	<5 (Intermittent sources)	<5	Very Low	Weak with very weak



Road (Aley)	Geology Class				
	2	7	10	12	16
<b>R1a</b>			<b>x</b>		<b>x</b>
<b>R1b</b>			<b>x</b>		<b>x</b>
<b>R1c</b>					<b>x</b>
<b>R1d</b>					<b>x</b>

*The roads lie on the following geology classes*

#### **4.1.4 Climate and Meteorology**

The climate and meteorological parameters play a vital role in transport and dispersion of pollutants in the atmosphere. Thus, the collection and analysis of meteorological information, including primarily precipitation, ambient temperature, wind direction and speed, are essential data for adequately assessing environmental impacts. The most significant meteorological parameters that influence the direct environmental impacts at the proposed project are: wind due to its ability to carry dust and odors to nearby communities; and precipitation due to its ability to enhance the infiltration of accidental spills and contaminated rehabilitation wastewater within the area depending on site operation procedures. Meteorological data are obtained either from the closest available stations and whenever not available satellite data are used and referenced in the text.

##### **(1)Aley R1a**

###### *Precipitation rates*

Precipitation in the summer season between the month of June and September are negligible (~ 9 mm) along the road (Figure R in Annex 1). The highest precipitation is recorded in February with an average value of ~204 mm and the total annual precipitation is approximately 1,002 mm.

###### *Temperature (Land Surface)*

The hottest month in the area is August (29 °C) and coldest month is January (1.3 °C). Fluctuations in the temperature values are shown in Figure S in Annex 1.

##### **(2)Aley R1b, R1c, and R1d**

###### *Precipitation Rates*

Precipitation in the summer season between the month of June and September are negligible (~5.7 mm) along the road (Figure P in Annex 1). The highest precipitation is recorded in January with an average value of 171 mm and the total annual precipitation is 817 mm.

###### *Temperature (Land Surface)*

The hottest month in the area is August (31.1 °C) and coldest month is January (8.7 °C). Fluctuations in the temperature values are shown in Figure Q in Annex 1.

###### *Wind Records*

This report will use freely publicly available modelled or prognostic data provided by meteoblue. Meteoblue is a prognostic climate model that has more than 220 million data points and a resolution of 30 arc seconds, with a spatial resolution of maximum 30 km, and has been collecting climate data from the year 1982 until 2012 (30-year period).

In this context, with reference to Figure T in Annex 1, dominant wind in the area blows from the West, with speeds varying between 0 km/h and 19 km/h.

#### 4.1.5 Air quality and Noise

##### Air Quality

Air quality is an essential component in assessing social wellbeing and health status of a community. Developing baseline information will help in comparing the impacts of the project relative to the existing conditions. Ambient air quality data was gathered from the UNDP project “Air quality assessment in an East Mediterranean country: the case of Lebanon” which is based at the Ministry of Environment. The UNDP/MoE monitors the criteria pollutants: Particulate Matter (PM), Ozone (O<sub>3</sub>), Carbon monoxide (CO), Nitrogen dioxide (NO<sub>2</sub>), Sulfur dioxide (SO<sub>2</sub>) which are recognized by national and international organizations as good indicators of anthropogenic emissions.

**Figure 4-1 Air quality cells for Aley R1a falling in cells 2 and 3**

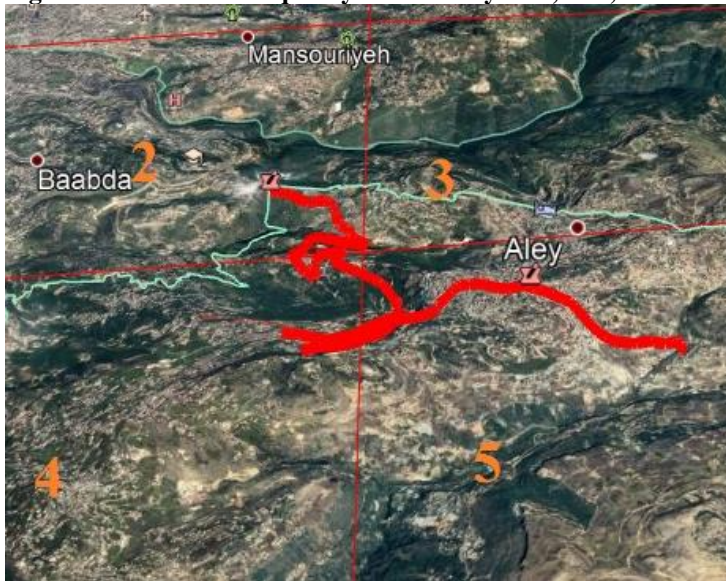


Source: MoE, 2019

**Table 4-4 Ambient air quality in  $\mu\text{g}/\text{m}^3$  for Aley R1a**

Cell ID	NO <sub>2</sub>	O <sub>3</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	SO <sub>2</sub>	CO
2	41.456	66.260	23.413	21.000	21.824	1045.055
3	33.735	71.052	20.922	18.658	17.551	650.774
Lebanese Ambient Air Quality standards, Decision 52/1	100	100	80	-	80	10,000
NAAQS, EPA	107.6	147.7	150	35	84.6	11,070
Exposure Duration	1 year	8 hours	24 hours	24 hours	1 year	8 hours

**Figure 4-2 Ambient air quality cells of Aley R1b, R1c, and R1d alignments**



Source: MoE, 2019

**Table 4-5 Ambient air quality in  $\mu\text{g}/\text{m}^3$  for Aley R1b, R1c, and R1d falling in cells 2,3,4, and 5.**

Cell ID	NO <sub>2</sub>	O <sub>3</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	SO <sub>2</sub>	CO
2	70.062	47.365	38.849	35.275	49.647	1367.356
3	56.213	56.183	29.742	26.801	35.557	1240.378
4	44.053	64.838	29.130	26.098	30.762	757.822
5	39.869	67.761	26.851	24.200	26.218	758.467
Lebanese Ambient Air Quality standards, Decision 52/1	100	100	80	-	80	10,000
NAAQS, EPA	107.6	147.7	150	35	84.6	11,070
Exposure Duration	1 year	8 hours	24 hours	24 hours	1 year	8 hours

Concentrations of chosen criteria pollutants presented in Table 4-4 and Table 4-5 show that ambient air quality concentrations along Aley roads are compliant with the national guidelines (Decision 52/1) and the international USEPA National Ambient Air Quality Standards (NAAQS) standards.

### Noise

Noise levels were measured at each of the road sections using a handheld decibel meter. The meter used is of type Nady DSM-1X Specs having an accuracy of  $\pm 1.4$  dB with a frequency range of 31.5 to 8,000 Hz.

Measurements were taken by Dar Al Handasah Nazih Taleb during their first field survey visit of the roads.

### *Aley R1a*

Results are reported in Table A (in Annex 1), showing minimum, equivalent continuous A-weighted sound level, maximum, allowable noise level according to Lebanese guidelines, and date and time of acquisition per road work station. Measured sound exposure levels varied from as low as 37.1 decibels (dB) to as high as 78.2 (dB), where the equivalent continuous noise level ( $L_{eq}$ ) varied between 51.3 (dB) and 58.5 (dB) along the whole road section. The road has an average  $L_{eq}$  of 54.7 (dB).

A study done in 2004 aimed at comparing magnitudes of different sound pressure values (dB) with the noise generated from an ordinary conversation (refer to Table E in Annex 1). In this context, on average, a person walking along Aley R1a will experience an average sound magnitude of 55(dB), which is less than the sound pressure generated by an ordinary conversation.

### *Aley R1b*

Similar to the above, measured sound exposure levels (Table B in Annex 1) varied from as low as 35.7 decibels (dB) to as high as 84.5 (dB), where the equivalent continuous noise level ( $L_{eq}$ ) has an average of 64.3. (dB).

Similarly, with reference to Table E (in Annex 1), a person walking along Aley R1b will experience a sound magnitude of 64 (dB), which is approximately equivalent to the sound generated by an ordinary conversation.

### *Aley R1c*

Similar to the above, measured sound exposure levels (Table C in Annex 1) varied from as low as 45 decibels (dB) to as high as 80 (dB), where the equivalent continuous noise level ( $L_{eq}$ ) has an average of 65 (dB).

Similarly, with reference to Table E (in Annex 1), a person walking along Aley R1c will experience a sound magnitude of 65 (dB), which is approximately equivalent to the sound generated by an ordinary conversation.

### *Aley R1d*

Similar to the above, measured sound exposure levels (Table D in Annex 1) varied from as low as 37 decibels (dB) to as high as 62 (dB), where the equivalent continuous noise level ( $L_{eq}$ ) has an average of 50 (dB).

Similarly, with reference to Table E (in Annex 1), a person walking along Aley R1d will experience a sound magnitude of 50 (dB), which is half as loud as the sound generated by an ordinary conversation.

## **4.2 Biological Environment and Land use/Land Cover**

In the context of this ESMP for the road rehabilitation project in Aley Caza, the direct influence area concerns existing roads. Consequently, a rapid biological assessment has been carried out to draw the ecological profile of the adjacent areas to the concerned roads, assess key habitats and flora diversity to identify those species endangered or IUCN-listed that are at added risk from the proposed project. This will serve the management plan and the mitigation measures that will be taken in order to reduce the project's potential impact on the local environment.

The assessment was based on field surveys and generated Land use/Land Cover (LULC) maps for each studied road.

#### **4.2.1 Field Survey**

##### *Dates, Methodology, and Limitations*

Given the limited timeframe of this study, a single field visit was set for each road (not necessarily during the best period for field visits due to time limitations). The field investigation did not aim for an exhaustive inventory of the biodiversity of the project area but a general overview of present species (mainly flora) and habitats. This general approach allows the identification of the conservation status of the natural habitats.

Moreover, LULC maps were generated for each road and compiled with site visits observations with respect to adjacent key habitats to the concerned roads.

Walking transects were recognized to obtain an understanding of the vegetation communities in the area and record existing species. Knowing that a single visit is not enough, the study had to consider some species as potentially present. Moreover, it was difficult to perform a complete faunal survey. Thus, information on fauna does not only include the encountered species during the field visit, but also potential species were considered in this assessment (fauna listing is only provided for roads that involve rich habitats). The potentiality of presence of a species was based on: (a) the occurrence of the species habitat; (b) observations of the species near the study area; (c) the fact that the study area is in the distribution range of the species; and (d) related scientific papers.

#### **4.2.2 Evaluation Criteria**

Various regulatory and scientific criteria allow organizing in a hierarchy the importance of habitats and species observed in a given area. These criteria include the endemism, rarity, the ecological importance (key species, specialized species, etc.); the biological status (migratory species, breeding species, etc.); and the biological susceptibility.

There is no list of protected species in Lebanon. The protected species are therefore considered based on international conventions for which Lebanon is part of and the IUCN Middle East red list. In this assessment, the ecological value of species was based on their local ecological importance (distribution of species and degree of endemism (Tohmé and Tohmé, 2014) and IUCN classification).

#### **4.2.3 Results**

### 4.2.3.1 Aley R1a (El-Azouniyeh – Charoun – Ain Sofar)

#### **Project settlement**

Aley R1a is located in Aley Caza and consists a single alignment with a total length of 7.2 km. It starts at El-Azouniyeh, at an elevation of 1,176 m, descends until it reaches its minimum elevation of 1,144 m, then re-ascends as it passes through Charoun where it reaches its maximum elevation of 1,299 m.

The road is settled at an altitude ranging between 1,144 and 1,299 m, thus the studied area covers the ‘Supra-Mediterranean’ zones. According to CORINE classification, the Supra-Mediterranean zone ranges from 1,000 to 1,500. The altitudinal range plays an important role in plant composition (Abi Saleh, 1996).

#### **Natural Habitats**

The studied road involves a path that is already under anthropogenic influences. The main encountered habitats that are adjacent to Aley R1a are primarily artificial areas, agricultural areas (agricultural terraces and fruit orchards) at the beginning of the road, grasslands and small segments of wooded lands (namely the pine forest in Aazouniyeh and some stands of cultivated pine trees bordering the road) as per field visit and the LULC map provided by the National Center for Scientific Research. Refer to Figure U (in Annex 1).

The road encounters several winter drainage channels that discharge into the neighboring Damour River (~300m downstream to the south). In addition, the road is in close proximity to two springs (Ain El Baradi and Ain El Hzabel) at work stations (1+100 and 5+400) respectively. These habitats need special care.

Finally, Ramlieh valley (an IBA site) is 600 m south west of Aley R1a. The ecological links of the project area with this protected site and associated fauna (mainly migratory birds that rest in Ramlieh valley) could be of some significance. Therefore, rehabilitation activities must not take place during the migration period. This will avoid disturbing passenger birds.

**Table 4-6 Main Habitats encountered along Aley R1a**

Habitats types in LULC Map	Field visit observation
Agricultural areas	Agricultural terraces Cultivated trees
Wooded lands	Umbrella pine forests
Grasslands	Scrublands and degraded grasslands
Artificial areas	Residential areas and small shops

#### **Flora**

At the beginning of the road, agricultural terraces were recorded along Aley R1a (Figure 4-3). Second, a *Pinus pinea* “forest” (clear pines) that is accompanied with other tree species such as *Quercus calliprinos*, *Quercus infectoria*, and *Cercis siliquastrum* was recoded bordering Aley R1a in Aazouniyeh (Figure 4-4) Moreover, some clusters of Calabrian pine (*Pinus brutia*) trees and prickly Juniper (*Juniperus oxycedrus*) in the understory were recorded in El-

Azouniyeh. Lower herbaceous species encountered are *Cyclamen persicum*, *Inula visoca*, *Lupinus digitatus*, *Romulea ramiflora*, and *Anemone coronaria*. The lower strata include mostly degraded woodlands and scrublands and is covered by *Cistus creticus* and *Sarcopoterium spinosum*.

In other words, the pine forest is not maintained, the lower layer forms a second layer of trees and woody vegetation (e.g. *Quercus spp.*). When combined with heavy grazing pressure and agriculture, the understory of pine woodlands can be almost bare. Moreover, sand quarry present on site has led to felling of trees, removal of soil, damaged landscape and landslides (refer to Figure 4-5).

At the middle of the studied road, the concerned natural habitat is disturbed and degraded into sub-optimal state (Figure 4-6) due to human activities. The main recorded vegetation include the Spiny burnet (*Poterium spinosum*). Whereas, at the end of the road, human settlements, fruit orchard degraded grasslands (Figure 4-7), and cultivated trees border Aley R1a.



**Figure 4-3 Agricultural terraces bordering Aley R1a**



**Figure 4-4 Pine forest bordering Aley R1a**



**Figure 4-5 Aazouniyeh Pine forest (sand quarry)**



**Figure 4-6 Degraded ecosystem**



**Figure 4-7 Degraded grasslands**



## **Fauna**

Regarding the local fauna, only one lizard was recorded at the project site: *Laudakia stellio stellio* (Hardun) near the pine forest in Aazouniyeh, this species is very common in Lebanon, widespread in Lebanon, Syria, Palestine, Egypt, Jordan, Iraq, Turkey and lives in woodlands inhabitant, breed on land in spring and occurs from sea up to 2000 m of altitude.

Birds believed potential in the studied habitat include the Song Thrush (*Tudrus philomelos*), very common passage migrant. This species is considered of least concern by IUCN red list and Lesser Whitethroats, (*Sylvia curruca*). Although the needles and wood of pine trees is resinous and much less edible than oak trees, pine forests however, are home to specific resident

and breeding birds. Amongst them are Masked Shrikes (*Lanius nubicus*) and Great Tits (*Parus major*). Moreover, the encountered woodlands and orchards in Aazouniyeh possibility hold good breeding site of many of the expected species of these habitats. However, quarrying and hunting appear to be the main problems in the area. This induces disturbance of the local wildlife and killing of migratory bird species. Therefore, it is assumed that birds preferably breed in the Chouf Biosphere Reserve and rest in the Ramlieh valley.

Finally, the species of mammals of ecological interest believed potential in this habitat (Tohme et al, 1985, 1999) include the Stone martin (*Martes foina syriaca*), European Hedgehog (*Erinaceus europaeus concolor*), European badger (*Meles meles*), and the Caucasian Squirrel (*Sciurus anomalus*). All these species are rare and threatened at the local level.

### **Situation of Aley R1a Regarding Protected Areas**

Al Chouf Cedars Nature Reserve (established in 1996) is 3.2.km m east of the studied road (500 m from the transition zone) and Ramlieh valley (an IBA site) is 600 m south west of the road (refer to Figure Z).

Covering an area of 15, 647 ha hectares ranging between 900 and 2,000 meters, the reserve is the largest of Lebanon nature reserves. Al-Chouf Cedar Nature Reserve stretches from Dahr Al-Baidar in the north to Niha Mountain in the south. Covered with oak forests on its northeastern slopes and juniper and oak forests on its southeastern slopes, the reserve is known for its three cedar forests of Maasser Al-Chouf, Barouk and Ain Zhalta, Bmohary. Home to 32 mammals and 31 species of reptile and amphibians, and with about 520 species of plants, Al Chouf Cedars Nature Reserve was declared a UNESCO biosphere reserve in 2005. Also, located on the important intercontinental migratory route for birds, the reserve was nominated an Important Bird Area (IBA) by Birdlife International (over 275 bird species including threatened species recorded in the reserve justifies the site's proposal as an IBA under category A1 (State of Lebanon's birds and IBAs, 2014)).

Sited in the Chouf, the Ramlieh valley ranges south of the towns of Saoufar and Bhamdoun. It is a valley, with gently sloping sides, nevertheless with certain vertical cliffs at the higher elevations on both sides of the valley. The river Safa runs through the valley that is mainly covered by coniferous woodland (dominated by pine trees), which is substituted by terraced orchards towards the head of the valley. The sides of the valley are conquered by bare vegetation, with signs of heavy grazing. Finally, there are some quarries as well on the edges of the site. According to Serhal et al (State of Lebanon's birds and IBAs, 2014), the main value of the site is as a bottle-neck site for soaring bird migration (including White pelicans), although the woodlands and orchards hold suitable breeding populations of many of the likely species of these habitats. There are four biome-restricted species for which breeding is assumed at the Ramlieh. These are Sardinian Warbler, Masked Shrike, and Black-eared Wheatear from the Mediterranean biome, and Western Rock Nuthatch, from the Irano-Turanian biome.

#### **4.2.3.2 Aley R1b (El-Kahale – Bsous – Ain-Rommane – El-Kamatiyeh)**

### **Project settlement**

Aley R1b is located in Aley Caza and consists of a single alignment with a total length of 7.1 km. It starts at El-Kahale (at 380 m), descends slightly to reach its minimum elevation of 338 m, and then ascends, passing through Bsous and Ain Rommane, until it reaches El-Kamatiyeh at its maximum elevation of 682 m. Finally, it re-descends slightly to end there at 647 m.

The road is settled at an altitude ranging between 338 and 682 m, thus according to CORINE classification the studied area covers the ‘Thermo-Mediterranean and Eu-Mediterranean’ zones. The altitudinal range plays an important role in plant composition (Abi Saleh, 1996).

### **Natural Habitats and Associated Flora**

The main encountered habitats that are adjacent to Aley R1b are primarily artificial areas, agricultural areas, wooded lands, and grasslands as per field visit and the LULC map provided by the National Center for Scientific Research. Refer to Figure V (in Annex 1)

The studied road involves a path that is already under anthropogenic influences. The road covers different habitats including residential and commercial areas, industrial areas, stone pine forest, woodland and scrublands (namely oak woodlots), riparian habitats, and olive groves.

More specifically, agricultural terraces, wooded lands, grasslands and artificial areas were recorded from station 0+000 to station 1+900. Wooded lands consist of oak valleys (*Quercus calliprinos*), *Pinus brutia* intermixed with *Quercus calliprinos* where the industrial site lies (bordering Aley R1b, Figure 4-9), and riparian thickets as the road involves several winter channels that discharge downstream into Ghadir river (West of Aley R1b). Further, when the road crosses with Ghadir river (at station 2+600) riparian vegetations were recorded along the road (Figure 4-10). Riparian thickets include species such as *Salix spp.*, *Juglan regia*, *Celtis australis* and shrubby vegetation including *Rubus hedycarpus*. Riparian habitats assist in climate regulation, watershed purification, flood and erosion control, and natural hazard minimization.

On the road edges, the main species recorded are *Arundo donax* (perennial cane dominant along the studied road, Figure 4-8), *Ceratonia siliqua*, *Calicotome villosa*, *Capparis spinosa canescen*, and *Ficus carica*. Finally, the rest of road is mainly bordered by carob trees, agricultural terraces (Figure 4-11), cultivated trees (e.g. umbrella pine trees and olive groves), guarrigue vegetation, and residential areas.

**Table 4-7 Main Habitats encountered along Aley R1b**

<b>Habitats types in LULC Map</b>	<b>Field visit observation</b>
Agricultural areas	Agricultural terraces Cultivated trees namely umbrella pine trees Agricultural polytunnels
Wooded lands	Oak woodland Clear pines intermixed with oak trees Guarrigue vegetation Riparian thickets (Ghadir River at station 2+600)
Grasslands	Scrublands and grasslands Meadows near water channels
Artificial areas	Residential and industrial areas

**Table 4-8 List of main species recorded along Aley R1b**

Species	Habitat	Distribution (Tohmé)
<i>Quercus calliprinos</i>	Woodlands and rocky hill slopes	EMR *
<i>Celtis australis</i>	Roadsides and near rivers	Mediterranean
<i>Pinus brutia</i>	Varied soils, Forests	EMR
<i>Pinus pinea</i>	Sandstone	Mediterranean
<i>Juglans regia</i>	Calcareous ground	Common
<i>Rubus hedycarpus</i>	Wet Soil common	Common

\* Eastern Mediterranean Region (EMR)

**Figure 4-8 Adjacent habitat to Aley R1b (dominant *Arundo donax*)**



**Figure 4-9 Oak and Pine wooded land (Industrial area)**



**Figure 4-10 Riparian habitat (Ghadir River)**



**Figure 4-11 Agricultural terraces bordering Aley R1b**



#### 4.2.3.3 Aley R1c (El-Kamatiyeh – Ain-Rommane – Aley – Bkhichtay)

##### **Project settlement**

Aley R1c is located in Aley Caza and consists of two sections or alignments that have a combined length of 5.3 km.

The road covers the Eu-Mediterranean zone as it is settled between 683 and 857m.

- Section 1: starts at El-Kamatiyeh passes through Ain-Rommane where it starts ascending until it reaches its maximum elevation of 857 m in Aley. After that it redescends until it ends in Bkhichtay at 777 m.

- Section 2: starts in El-Kamatiyeh at 683 m and ascends until it ends in Ain-Rommane at its maximum elevation of 738 m.

### **Natural Habitats and Associated Flora**

The main encountered habitats that are adjacent to Aley R1c are primarily artificial areas, agricultural areas, grasslands and wooded lands as per field visit and the LULC map provided by the National Center for Scientific Research. Refer to Figure W and Figure X (in Annex 1).

The studied road involves a path that is already under anthropogenic influences. The road is mainly bordered by human settlements (namely in Aley) and degraded lands. However, some limited segments of the road are bordered by areas of ecological significance. More specifically, at the beginning of the road (section 1) in Ain-Rommane (between stations 0+640 and 1+200) and in section 2 in El-Kamatiyeh maquis ecosystems were recorded, dominated by Kermes Oak (*Quercus calliprinos*), Palestine pistachio (*Pistacia palestina*), Hermon maple (*Acer hermoneum*), Oriental strawberry-tree (*Arbutus andrachne*), and dwarf shrubs mainly viscous inula (*Inula viscoa*). Also, coniferous woodland dominated by Umbrella pine (*Pinus pinea*) was recorded behind the adjacent ecosystem to the road. Further when the road crosses Damour River (at station 4+683) and also when the studied road is close to Ain es Sayde and Ain-Rommane (between stations 0+000 and 1+200), riparian thickets were recorded including *Salix spp*, *Juglan regia*, *Celtis australis* and shrubby vegetation namely *Rubus hedycarpus*.

**Table 4-9 Main Habitats encountered along Aley R1c**

Habitats types in LULC Map	Field visit observation
Wooded lands	Maquis ecosystems Riparian thickets
Agricultural areas	Fallow lands Cultivated trees
Grasslands	Scrublands and grasslands used for agriculture and forage
Artificial areas	Residential areas

**Figure 4-12 Wooded land bordering Aley R1c (section1)**



**Figure 4-13 Wooded land bordering Aley R1c (section2)**



#### **4.2.3.4 Aley R1d (El -Kamatiyeh – Bdedoune)**

## **Project settlement**

Aley R1d is located in Aley Caza and consists of a single alignment with a total length of 1.2 km. It starts at El-Kamatiyeh (at 645 m) and descends until it ends at Bdedoune at its minimum elevation of 498 m. According to CORINE Classification, the road covers the Eu-Mediterranean zone.

## **Natural Habitats**

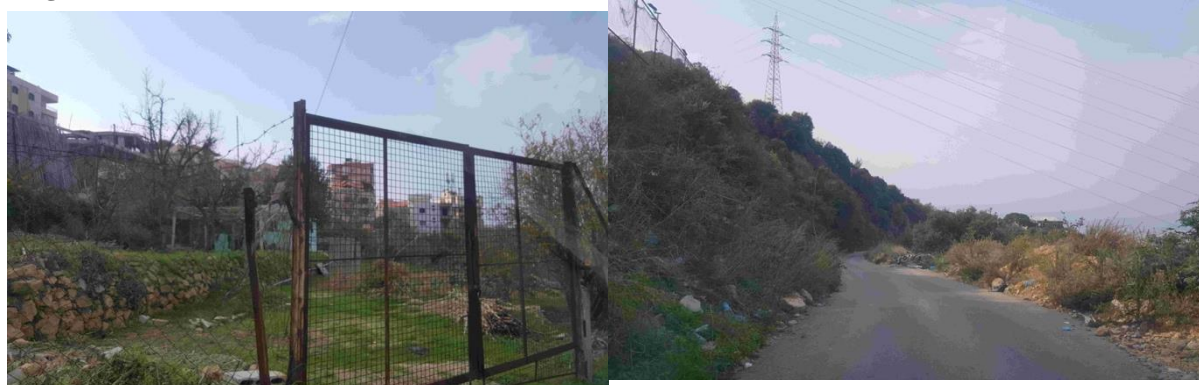
The studied road involves a path that is already under anthropogenic influences. The main encountered habitats that are adjacent to Aley R1d are primarily artificial areas and small segments of degraded woodlands as per field visit and the LULC map provided by the National Center for Scientific Research. Refer to Figure Y (in Annex 1).

The studied area does not involve habitats of ecological significance. Thus, no listing of flora and fauna will be provided for habitats adjacent to Aley R1d.

**Table 4-10 Main Habitats encountered along Aley R1d**

Habitats types in LULC Map	Field visit observation
Wooded lands	Scrublands and degraded maquis
Artificial areas	Residential (rural settlements) Agricultural areas (olive groves and fruit orchards)

**Figure 4-14 Fruit Orchards and Rural settlements      Figure 4-15 Degraded lands**



### **4.2.4 Summary of Results**

In summary, all the studied roads in Aley are mainly bordered by human settlements, agricultural areas and degraded lands. Only limited segments of the roads are considered of a certain criticality (i.e. segments of high ecological significance). More specifically, particular biotopes (riparian habitats) were noted when roads and river intersect. Further some segments of the roads are surrounded by Pine forests and oak maquis.

Regarding Aley R1a, a *Pinus pinea* “forest” (clear pines) that is accompanied with other tree species such as *Quercus calliprinos*, *Quercus infectoria*, and *Cercis siliquastrum* was recorded

bordering a small segment of Aley R1a in Aazouniyeh. Moreover, Ramlieh valley (an IBA site) is 600 m south west of Aley R1a.

Similarly, some segments of Aley R1b are surrounded by oak valleys (*Quercus calliprinos*), a patch of *Pinus brutia* intermixed with *Quercus calliprinos*, and riparian thickets as the road involves several winter channels and intersects with Ghadir River (at station 2+600). Regarding Aley R1c, the road is mainly bordered by human settlements (namely in Aley) and degraded lands. However, some limited segments of the road are bordered by areas of ecological significance. More specifically, at the beginning of the road (section 1) in Ain-Rommane (between stations 0+640 and 1+200) and in section 2 in El-Kamatiyeh maquis ecosystems were recorded. Further, when the road crosses Damour River (at station 4+683, Damour River is classified as a natural site based on MOE Decision no.29 of 1998), riparian thickets were recorded including *Salix spp*, *Juglan regia*, *Celtis australis* and shrubby vegetation namely *Rubus hedycarpus*. Finally, Aley R1d does not involve any adjacent rich natural habitat. Adjacent ecosystems to the concerned road are comprised of human settlements, agricultural terraces and degraded ecosystems with low vegetation cover (garrigues vegetation mainly characterized by dwarf shrubs).

Riparian habitats are known to be excellent refuge for birds, reptiles, and overall amphibians. These habitats assist in climate regulation, watershed purification, flood and erosion control, and natural hazard minimization. Whereas, forests offer diverse sets of habitats for plants, animals and micro-organisms, and harbor the majority of the world's terrestrial species (CBD, 2004). However, in Lebanon, forests are chiefly threatened by uncontrolled hunting in addition to animals grazing and quarries (such as the encountered clear pine forest in Aazouniyeh bordering Aley R1a). Nevertheless, maquis or shrub-lands, remain critically rich ecosystems throughout the country. Due to their density and difficulty of access, they constitute a dynamic hideout for numerous reptiles, mammals, and birds. Therefore, it is important to protect all the remaining maquis throughout the country.

Any contamination of riparian habitats and wooded lands due to rehabilitation works can have severe irreversible impacts on the local biodiversity.

### **4.3 Socio-Economic Condition**

This section describes the social and economic conditions of Aley Caza where Aley R1a (El-Azouniyeh – Charoun – Ain Sofar), R1b (El-Kahale – Bsous – Ain-Rommane – El-Kamatiyeh), R1c (El-Kamatiyeh – Ain-Rommane – Aley – Bkhichtay), and R1d (El-Kamatiyeh – Bdedoune) will be rehabilitated.

#### **4.3.1 Summary of Relevant Caza Background**

##### **Demographical Aspect**

According to the Labor Force and Household Conditions Survey 2018-2019, the population of Aley is 300,800, out of which 70% are Lebanese and 30% are non-Lebanese (CAS, ILO and EU, 2020). Aley has 74,900 households and the average household size is 4, whereas, the average household size in Lebanon is 3.8. In addition, 105,500 people from the population of Aley are aged between 0–14 and above 65 years (CAS, ILO and EU, 2020).

With regards to other Lebanese vulnerable groups, there is no updated information on Female Headed Households (FHH), elderly or disabled in Aley. Data on FHH in Mount Lebanon is only available which indicates that 105,000 of the households are headed by a woman and 458,000 are headed by a man (CAS, ILO and EU, 2020). Further, in 2016, 48,392 of Aley's Lebanese population were deprived while 104,746 were above the poverty line (OCHA, 2016). This means that 48,392 of the Lebanese in Aley were deprived from basic resources essential to meet their fundamental survival and protection needs.

### Syrian Refugees

The number of Syrian refugees in Aley is 68,332 (UNHCR, UNICEF and WFP, 2017) and the average household size of Syrians in Aley is 5 (UNHCR, UNICEF and WFP, 2018). 14.6% of the households are headed by a woman and 63.3% of the Syrian refugees in Aley are below the poverty line (UNHCR, UNICEF and WFP, 2018).

Regarding other vulnerable groups such as individuals with specific needs, 31.6%, 10.1%, 33.5%, 12.7% and 4.7% of the households have at least one person with chronic illness, serious medical condition, temporary illness, disability, needing support in daily activities respectively (UNHCR, UNICEF and WFP, 2018).

Moreover, Syrian refugees are generally spread out through different areas of the community (there are no camps in the study area). 87.8% of the Syrian refugees in Aley live in residential buildings, 10.3% in non-residential (factory, farm, construction site, warehouse and others) and 1.9% in non-permanent structures (prefabricated units) (UNHCR, UNICEF and WFP, 2018).

With respect to Palestinian refugees, there are no Palestinian gathering within Aley Caza.

Finally, the abovementioned data on vulnerable groups is generally for Aley Caza or Mount Lebanon. However, specific data is not available to confirm whether or not these groups of people are within the communities surrounding the roads, knowing that the main focus of the assessment was to identify sensitive receptors (health care facilities, academic institutions and other entities) that might be impacted (obstruction and dust issues) during the execution of the project. Nevertheless, the mitigation measures recommended as part of this ESMP ensure that the communities surrounding the roads in Aley Caza including vulnerable groups, if any, will not be adversely affected.

### **Infrastructure**

Due to a decrease in the average precipitation level over the past 30 years and the 20 % increase in the overall population of Mount Lebanon in the past two years, the area continues to suffer from scarcity in water supply and inadequate water quality and sanitation services (Global Communities, 2013).

The roads in Aley are narrow, damaged and lack proper safety measures, hence increasing the risk of accidents. Such deteriorating roads also hinder the easy access to the rural peripheries by limiting the mobility of the general population. Moreover, the absence of sufficient



rainwater collection canals leads to often blocked roads during severe weather, mainly during the winter.

## **Electricity**

In Lebanon, electricity is supplied through Electricité du Liban (EDL), an autonomous state-owned entity under the jurisdiction of the Ministry of Energy and Water (MoEW). But just like the rest of the country, the region witnesses frequent power outages and weak electricity supply. In addition, some of the distribution networks lack proper repairs and maintenance. As a result, a proper street lighting is absent in some parts of the Caza.

## **Health Services**

Regarding health care facilities, Aley district contains different facilities ranging from public and private hospitals, and private clinics. However, due to the uneven geographical distribution of hospitals in Lebanon, Aley caza mainly comprises small sized hospitals/medical facilities. According to the Ministry of Public Health (MoPH, 2019), Aley contains 6 private hospitals, one public hospital, and 11 primary healthcare centers. For instance, El Azouniyeh Hospital is spotted at a distance of 25 m from Aley R1a (El-Azouniyeh – Charoun – Ain Sofar) and Ghaleb Obeid Physio Center 10 m away from Aley R1c section 1 (El-Kamatiyeh – Ain-Rommane – Aley – Bkhichtay).

## **Education**

The average years of education in Aley is 11.3 and the enrollment rate is 39.5 (CAS). Aley has 36 public schools and 41 private schools (CRDP, 2016). Moreover, there are several colleges and universities in Aley district, including: the Lebanese University-Faculty of Economic Science and Business Administrations, Maroun Abboud School, Koumatiyeh Public school and Sofar School that are located near the roads to be rehabilitated (refer to

Table 4-11 in Annex 1).

## **Economic Background**

Similar to most of the Districts in Mount Lebanon, Aley's economy relies mainly on the industrial and agricultural sectors. This is expected as, according to IDAL (2017), the Mount Lebanon Governorate contains the highest concentration of industrial firms in Lebanon, hosting 58% of the total number Lebanese industrial firms. The majority of these firms are agro-food companies (17.93%), accounting for 34% of the total number of agro-food companies in Lebanon. This sector is followed by paper and printing companies, accounting for 13.15% of industrial firms of Mount Lebanon. In fact, Aley hosts 4.7 % of the total number of industries in Lebanon (MOI/UNIDO/ALI, 2010). Mount Lebanon is also an important agricultural zone, albeit with lower shares of cultivated land than in regions such as the Bekaa, due to its rough landscape.

Moreover, the unemployment rate in Aley is 13%, whereas, unemployment rate in Lebanon is 11.4% (CAS, ILO and EU, 2020).

## **Archeology and Cultural Heritage**

All areas in Lebanon harbor the prints of former civilizations and important historical and cultural periods of history. Unfortunately, most of these assets have either been deserted, remain unknown or even vanished. All remaining sites are under the protection of the Ministry of Tourism and/or local Municipalities. The archeological sites in Aley Caza namely, Al Akeili Historical Square, Saoufar Archaeological House and Ighmid Heritage House are not located in close proximity to the roads to be rehabilitated.

#### **4.3.2 Road Sensitive Receptors**

Sensitive receptors were collected during the field visits and previous surveys for similar projects. The data was analyzed using ArcGIS. Categories considered as sensitive receptors during road rehabilitation are schools, churches, hospitals, mosques, closest residential buildings, and other archeological features (refer to Figure AA, Figure BB, Figure CC, Figure DD and Figure EE in Annex 1).

The main sensitive receptors encountered along Aley roads are presented as follows:

**Aley R1a** (refer to Figure AA in Annex 1 and Figure 4-16)

- Residential and commercial areas (urban settlements) and a small segment of the road is bordered by a pine forest that is partially degraded due to quarrying activities (in El-Azouniyeh) between stations [0+000 - 1+100].
- Degraded grasslands and dispersed residential areas (rural settlements) from station 1+000 to station 3+000.
- Residential areas, fallow lands between stations [3+000 - 7+196] and cultivated trees bordering the road at the end.
- The highly affected sensitive receptors along the road are Sofar School and Charoun Municipality that are 10 m away.

**Aley R1b** (refer to Figure BB in Annex 1 and Figure 4-17 until Figure 4-22)

- Agricultural areas, wooded lands, grasslands and artificial areas such as residents, hotels, restaurants, fuel stations and industries from station 0+000 to station 1+900.
- Wooded land, agricultural areas and few dispersed residential areas (rural settlements) from station 1+900 to station 3+000.
- Residential areas and wooded lands from station 3+400 to station 6+400 in addition to small industrial area prior to station 5+400.
- Residential agglomerations and commercial shops between stations [3+000 - 3+400] and [6+400 - 7+100].
- The highly affected sensitive receptors are El Komatiyeh Mosque (2 m away) and El Komatiyeh School (3 m away) at the end segment of the R1b towards station 7+100.

**Aley R1c section 1** (refer to Figure CC in Annex 1, Figure 4-23 and Figure 4-24)

- Dispersed residential units, commercial areas and wooded lands from station 0+000 to station 1+750

- Residential agglomerations, dense commercial areas and retail shops from station 1+750 to station 3+800. The nearest sensitive receptors along this segment, other than the residential areas and retail shops are the Lebanese University (5 m away), Maroun Abboud School (6 m away) and Ghaleb Obeid Physio Center (7 m away).
- Residential areas and fallow lands from station 3+800 to station 4+683.

**Aley R1c section 2** (refer to Figure DD in Annex 1 and Figure 4-25)

- The road is surrounded by residential areas, agricultural and wooded lands.
- The road is not surrounded by other sensitive receptors such as schools and places of worship.

**Aley R1d** (refer to Figure EE in Annex 1 and Figure 4-26)

- Residential areas from station 0+00 to station 0+500.
- Degraded land, agricultural terraces and few residential areas from station 0+500 to station 1+236

*Aley R1a*

**Figure 4-16 Residential areas and shops**



*Aley R1b*

**Figure 4-17 Gardens One 282 residential unit**



**Figure 4-18 Paint shop**



**Figure 4-19 Shops along the road**



**Figure 4-20 Fuel station along the road**



**Figure 4-21 Al Koumatiyeh Mosque along the road**



**Figure 4-22 Shops and residential areas**



*Aley 1c section 1*

**Figure 4-23 Church along the road**



**Figure 4-24 Fuel station**



*Aley R1c section 2*

**Figure 4-25 Residential areas**



*Aley R1d*

**Figure 4-26 Residential areas**



Table 4-11 summarizes the nearby schools and places of worship surrounding the studied roads along with their respective distances.

**Table 4-11 Relevant sensitive receptors encountered along and near roads in Aley Caza**

Name	Distance (m)
<b>Aley R1a (El-Azouniyeh – Charoun – Ain Sofar)</b>	
Sofar School	10
Charoun Municipality	10
Al Sharif Shrine	15

El-Azouniyeh Hospital	25
<b>Aley R1b (El-Kahale – Bsous – Ain-Rommane – El-Kamatiyeh)</b>	
Al Koumatiyeh Mosque	2
Koumatiyeh Pubic school	3
Bsous Church	40
Saint Antoine Church	70
St. Elie Church	112
<b>Aley R1c section 1 (El-Kamatiyeh – Ain-Rommane – Aley – Bkhichtay)</b>	
Lebanese University (Faculty of Economics & Business Administration)	5
Maroun Aboud school	6
Ghaleb Obeid Physio Center	7
Tawjeh Wa Tarbiya - School	10
Maronite Church	15
Saraya Aley	15
Lady of Niah Church for the Roman Catholic	62
Saints Coeurs Aley	90
National Hospital	112
<b>Aley R1d (El-Kamatiyeh – Bdedoune)</b>	
Al Koumatiyeh Mosque	2

### 4.3.3 Traffic Survey

For the purpose of road rehabilitation; which requires pavement analysis and design, a traffic survey was conducted by Dar Al Handasah Nazih Taleb & Partners. The survey focused on the gathering of baseline data for the existing road conditions, and the Average Daily Traffic (ADT) was the main parameter collected. In addition, the types of vehicles maneuvering the four roads were also examined.

The data collection program consists of automatic classified counts with wide range of traffic count conditions and road characteristics. All long road segments (more than 10 km) required more than one count station one at the beginning and at the end as well an intermediate location where this road link intersects with a higher rank road (example: Secondary intersecting with Primary) while for short road segments one classified count is carried out at the middle of the road link, which is defined as follow:

- For Primary roads, a link is defined as the road section between two consecutive intersections with primary or secondary roads.
- For Secondary roads, a link is defined as the road section between two consecutive intersections with primary, secondary, or tertiary roads.

The distribution of the ATC Stations throughout Aley caza are shown in Figure FF (in Annex 1).

#### *Aley R1a*

Two ATC stations were installed along Aley R1a in order to determine level of traffic. The ADT counts showed a minimum of 236, a maximum of 2,181, and an average of 1,168 vehicles per day (refer to Table F in Annex 1). Moreover, the type and classification of vehicles were determined, where it was revealed that a passenger car was the main vehicle type (92 %) maneuvering the road, followed by a four-tire truck (3 %) (refer to Table G in Annex 1).

### *Aley R1b*

Two ATC stations were installed along Aley R1b in order to determine level of traffic. The ADT counts showed a minimum of 3,379, a maximum of 5,824, and an average of 4,666 vehicles per day (refer to Table F in Annex 1). Moreover, the type and classification of vehicles were determined, where it was revealed that a passenger car was the main vehicle type (92 %) maneuvering the road, followed by a motorcycle (3 %) (refer to Table G in Annex 1).

### *Aley R1c*

One ATC station was installed along Aley R1c in order to determine level of traffic. The ADT counts showed a minimum of 8,277, a maximum of 8,668, and an average of 8,473 vehicles per day (refer to Table F in Annex 1). Moreover, the type and classification of vehicles were determined, where it was revealed that a passenger car was the main vehicle type (89 %) maneuvering the road, followed by a four-tire truck (4 %) (refer to Table G in Annex 1).

### *Aley R1d*

One ATC station was installed along Aley R1d in order to determine level of traffic. The ADT counts showed a minimum of 2,193, a maximum of 2,703, and an average of 2,448 vehicles per day (refer to Table F in Annex 1). Moreover, the type and classification of vehicles were determined, where it was revealed that a passenger car was the main vehicle type (91 %) maneuvering the road, followed by a motorcycle (4 %) (refer to Table G in Annex 1).

### ***Summary of results***

On average, daily traffic volume is directly affected by the road classification. Higher traffic volume is usually witnessed on primary and international roads, and the volume decreases along secondary and local roads. In the context of Aley roads, Aley R1a, R1b, and R1d are classified secondary roads and Aley R1c is a primary road. As a result, Aley R1c witnesses the highest traffic volume (8,473 vehicles per day) among all Aley roads. Moreover, among the remaining Aley R1a, R1b, and R1d, Aley R1a witnesses the lowest traffic volume (1,168 veh/day), given that it is both secondary and of rural nature. Finally, on average, 90% of the time the roads host passenger cars, and the remaining 10% is divided between motorcycles and 4-tire trucks.

## 5. Potential Environmental and Social Impacts

The expected social and environmental impacts were assessed during both the rehabilitation and operation phases of the project (refer to impact assessment methodology in Annex 2). Regarding the operation phase, this assessment entails the “**Defects Liability Period**” during which the Contractor is responsible for maintenance activities.

Regarding the social assessment, potential beneficiaries of the project and the adversely affected groups, including Lebanese and Syrians involved in the project and/or living in the surrounding communities of Aley R1a (El-Azouniyeh – Charoun – Ain Sofar), R1b (El-Kahale – Bsous – Ain-Rommane – El-Kamatiyeh), R1c (El-Kamatiyeh – Ain-Rommane – Aley – Bkhichtay), and R1d (El-Kamatiyeh – Bdedoune) were considered in this assessment.

Moreover, during the site visits to Aley roads, refugee camps of vulnerable groups such as Syrians were not observed. As such, impacts on socio economic conditions of vulnerable groups (poor households, elderly and Syrian refugees) were assessed as part of the impacts on the surrounding residential areas, at the project area, displaced Syrians are not living in specific camps, and thus are considered as part of the local communities of Aley. Moreover, it is important to mention that rehabilitation and maintenance works in Aley Caza will not require land acquisition, therefore, vulnerable groups (poor households, elderly and Syrian refugees) along the roads to be rehabilitated in Aley Caza will not be resettled.

### 5.1 Potential Positive Impacts during Rehabilitation

#### 5.1.1 Potential Positive Social Impacts

Positive socio-economic impacts, during rehabilitation, is creating direct and indirect short-term jobs for Lebanese and Syrians living in the community around the selected roads. In turn, local economic development and livelihood opportunities will be enhanced. Direct job opportunities at the selected road rehabilitation sites will be offered to poor communities and vulnerable groups (low skilled Lebanese and Syrians) in order to enhance their socio-economic conditions. The roads rehabilitation project will also create indirect jobs for low skilled Lebanese and Syrians in supporting industries and services (such as production of construction materials at local shops and factories, transportation of materials, maintenance of equipment).

In addition, the project will positively impact the commercial and retail shops surrounding the roads in Aley Caza by the rehabilitation activities as workers may potentially buy goods from local shops. Knowing that the rehabilitation activities will not require land take, the community surrounding the roads will not experience economic displacement, for instance, loss of assets or loss of income sources or means of livelihood.

Moreover, the road rehabilitation project will also enhance the local economic development of the surrounding community in the following three cases:

- Knowing that the Contractor will not perform vehicle and equipment repair onsite, preferably maintenance activities will be done in repair shops surrounding the selected roads in Aley.
- The Contractor will rent a fenced land in the surrounding area of the selected Aley roads



- The Contractor might rent an apartment for the low skilled workers (in case hiring of low skilled workers from the surrounding community is not possible) from the nearby community.

Further, Lebanese and Syrian workers' skills and experience in road rehabilitation and maintenance will be strengthened, as a result of the learning and training programs of the job onsite.

## **5.2 Potential Negative Impacts during Rehabilitation**

### **5.2.1 Potential Negative Environmental Impacts**

Negative impacts that may derive from the project rehabilitation phase are namely adverse impacts on the local environment. This section elaborates the potential impacts on each environmental component.

#### **5.2.1.1 Impacts on Water Quality**

The outcropping lithological formations in and around the study area of Aley roads belong to the Cretaceous geological time period

In terms of the subsurface, all of the works entitled for Aley roads do not pose any risk, given that 1) the formations do not host any major water aquifers and 2) the exposed geological layers have both poor permeability and transmissivity lowering the risk of spill infiltration or spread. In this context, any discharge of untreated solid waste or wastewater onto open ground is unlikely to infiltrate to the subsurface.

However, the surrounding area witnesses rich surface water quality. For instance, Aley R1a encounters several winter drainage channels that discharge into the neighboring Damour River and the road is in close proximity to two springs (Ain El Baradi and Ain El Hzabel) at work stations (1+100 and 5+400) respectively. Aley R1b, R1c, and R1d encounter a number of surface winter drainage channels that discharge downstream into Ghadir river (West of Aley R1b) and Damour river (South of Aley R1c section 1). Moreover, Aley R1b crosses Ghadir river at station 2+600 and Aley R1c S1 crosses Damour river at station 4+683 right before the end of the road. In this context, any source of contamination (from the porta cabin toilet or chemical substances) will adversely impact the surrounding streams and Rivers. Therefore, mismanagement of wastewater and disposal of rehabilitation waste is prohibited at these highly sensitive locations.

The major impacts on groundwater and surrounding streams and rivers during the rehabilitation works can be associated with the following activities:

- During installation of concrete barriers, on-site concrete pouring may leach and get deposited in nearby streams that discharge into downstream Ghadir and Damour Rivers (shown in Figure K, Figure L, Figure M, Figure N and Figure O in Annex 1).
- During paving of road, any accidental deposition of toxic asphalt substances into nearby streams can cause pollution of surface water since Aley R1b crosses Ghadir River and Aley R1c S1 crosses Damour River.

- During installation of road markings, spillage of chemical paint substances can also pollute open channel watercourses.
- Excavations, drilling, and milling produce substantial amounts of dust and scattered pavement materials. Dust can enter water courses when it is mixed and directed by rain or it can be deposited naturally. This can cause cloudiness and increased water turbidity.
- The porta cabin toilet is a source of wastewater generation. Improper management of the generated waste will pollute nearby surface water bodies and streams since most of the roads in Aley Caza encounter several winter drainage channels that discharge into the neighboring Damour and Ghadir River. Thus, proper management practices should be implemented to avoid contamination of surface and groundwater resources.
- Contaminated storm-water runoff along with sediment transport from the rehabilitation site into the surrounding streams is possible. Storm water runoff or a direct point source discharge can transport pollutants, deposits and residues as well as eroded materials from the site into the receiving environment. Storm water may carry with it the following:
  - Spilled fuels
  - Slurry from pavement milling, drillings, and excavations for drainage ditches
  - Suspended particles, such as sand, slits, bentonite, cements
  - Solid waste, such as plastic, paper, bottles, wood

All of the aforementioned discharges can significantly impact water quality in the area. Proper management modalities would be crucial in order to reduce and prevent contamination of water resources surrounding the roads to be rehabilitated in Aley Caza.

Accordingly, the impacts on water quality are assessed as: direct, moderate, local, short-term, irreversible, of high likelihood of occurrence and of medium significance.

#### 5.2.1.2 Impacts on Soil Quality

##### *Excavation*

Excavation of soil to install new drainage ditches will result in disturbance of soil structure and thus may cause an increase in soil erosion and release of sediments. This will permanently change the structure of the soil and surface geology.

##### *Mismanagement of Solid Waste and Wastewater*

Rehabilitation activities, specifically pavement reconstruction will result in the generation of solid waste; mainly rehabilitation waste such as old asphalt layers, crushed sub base aggregates, etc...Improper management of the waste generated from the rehabilitation works and direct disposal of the domestic-like solid waste (mainly plastic, paper, bottles...) and the direct discharge of wastewater (from the portable toilet) generated by the engineers and workers onsite will significantly impact soil quality.

##### *Accidental Leakages*

Accidental spills of bituminous materials with construction runoff and storm water might result in soil quality deterioration.

Accordingly, the impacts on soil quality are assessed as: direct, moderate, local, short-term, irreversible, of high likelihood of occurrence and of medium significance.

### 5.2.1.3 Impacts on Air Quality

#### *Exhaust emissions*

Impacts on air quality during the rehabilitation works include exhaust emissions of CO, CO<sub>2</sub>, NO<sub>x</sub>, and SO<sub>2</sub> due to increased traffic flow, combustion of diesel for the movement of vehicles/machinery. Construction vehicles involved in pavement works include but are not limited to:

- Excavators (emission factors presented in (Table 5-1)
- Vehicles transporting workers to/from site (i.e. buses, mini-vans, cars).
- Delivery vehicles (i.e. aggregate delivery trucks, and light delivery vehicles)

Combustion and vehicle exhaust gases constitute a complex mixture of organic and inorganic substances such as: PM<sub>10</sub>, NO<sub>2</sub>, SO<sub>2</sub> Toluene, Xylenes, and Ozone. These combustion sources are likely to be extremely difficult to quantify due to the unpredicted operational needs throughout the rehabilitation process.

**Table 5-1 Emission factors for construction equipment (Ahn, Pan, et.al, 2010)**

Equipment	HC (g/hr)	CO (g/hr)	NO <sub>x</sub> (g/hr)	PM (g/hr)	CO <sub>2</sub> (g/hr)
<b>Bulldozer</b>	130.09	270.01	806.53	5.56	55.13
<b>Dumper</b>	100.53	272.45	962.29	8.78	83.44
<b>Excavator</b>	56.78	128.26	385.64	2.94	28.84
<b>Grader</b>	75.52	200.45	655.43	5.86	56.48
<b>All equipment</b>	18.34	63.00	105.96	0.367	6.72

#### *Dust emissions*

Dust is an almost inevitable consequence of roadwork. Gravel and crushed gravel and hard rock aggregates always contain a proportion of fines, and if the material is dry, a fairly heavy dust cloud can be raised when it is mobilized.

The following activities associated with the rehabilitation phase are anticipated to lead to the generation of dust:

- Excavation and leveling works
- Movement of raw materials transporting vehicles on unpaved surfaces
- Unloading of raw materials
- Open storage of raw materials
- Disturbances to material stockpiles by local winds and material handling, which is of great significance depending on the road location.
- Wind blow during transportation of materials by vehicles and specifically when transporting on unpaved roads.

Dust emissions from each of the sources described above will be largely dictated by the wind conditions in the area. Emission of large quantities of fugitive dust may adversely impact air quality, construction workers and surrounding communities.

Nearby receptors such as churches, schools and residential buildings (shown in Figure AA, Figure BB, Figure CC, Figure DD and Figure EE in Annex 1) to be disturbed by the generated fugitive emissions are presented in section 4.3.2. The assessment showed that the highly urbanized roads to be affected by the generated air emissions are the road segments between stations [0+000 - 1+100] and [3+000 - 7+196] of Aley R1a, [3+000 - 3+400] and [6+400 - 7+100] of Aley R1b. In addition, the road segment between stations [1+750 - 3+800] of Aley R1c section 1 is densely bordered by commercial areas, retail shops and residential units. In this context, the sensitive locations that will be adversely affected by the generated dust emissions are Sofar School (10 m away) and Charoun Municipality (10 m away) along Aley R1a, El Komatiyeh Mosque (2 m away) along Aley R1b and R1d, El Komatiyeh School (3 m away) along Aley R1b, Lebanese University (5 m away), Maroun Abboud School (6 m away) and Ghaleb Obeid Physio Center (7 m away) along Aley R1c section 1.

Further, Agricultural areas along Aley R1b, R1c section 2, R1d in addition to the wooded lands along Aley R1b, R1a (small segments) and R1c (sections 1 and 2) will be highly affected by the generated fugitive emissions.

#### *Odor emission*

Odors from asphalt fumes can cause unpleasant smells to the surrounding. Sensitive receptors such as churches and schools near the roads at a distance of less than 10 m (Table 4-11) can be highly affected.

*Accordingly, the impacts on air quality can be assessed as: direct, high, local, medium-term, irreversible, of high likelihood of occurrence and of high significance.*

#### **5.2.1.4 Impacts on Acoustic Environment**

A significant increase in noise is expected during pavement reconstruction along the road sections. Rehabilitation activities may create a problem of noise and vibration generated by construction equipment, truck traffic, and other similar sources. Noise will be mainly generated while mobilizing equipment for the transportation, excavation of land, and raw material transportation.

The road rehabilitation noise and vibration levels highly depend on the type of the equipment/heavy machinery, magnitude and duration of the rehabilitation activities. The main sources of noise are heavy machinery such as, excavators, bob cat, steel roller, pick-up, dump trucks, etc... Noise generating activities, such as pavement milling and drilling, can cause unpleasant noise levels and disrupt teaching activities at nearby schools. The potential impact depends on the magnitude and duration of rehabilitation-related activities. Works such as road markings, signing, etc..., do not generate high noise levels and do not disturb the surrounding environment.

Nearby receptors such as churches, schools and residential buildings (shown in Figure AA, Figure BB, Figure CC, Figure DD and Figure EE in Annex 1) to be disturbed by the generated noise are presented in section 4.3.2. For instance, residential agglomerations and commercial areas along the road segments between stations [0+000 - 1+100] and [3+000 - 7+196] of Aley R1a, [3+000 - 3+400] and [6+400 - 7+100] of Aley R1b, [1+750 - 3+800] of Aley R1c section 1 will be adversely impacted by the noise emissions of the rehabilitation works. In specific, the sensitive receptors that are at a distance of 10 m or less namely, Sofar School and Charoun Municipality along Aley R1a, El Komatiyeh Mosque along Aley R1b and R1d, El Komatiyeh School along Aley R1b, Lebanese University, Maroun Abboud School and Ghaleb Obeid Physio Center along Aley R1c section 1 will be highly impacted by the noise emissions.

Other residential units that might be disturbed by the high noise levels are dispersed around the road segments between stations [1+000 - 3+000] of Aley R1a, [1+900 - 3+000] of Aley R1b, around Aley R1d and R1c section 2.

Therefore, high noise levels should be minimized to avoid nuisance of the surrounding residents and minimize the health effects of vibration and high noise levels on the construction workers.

Accordingly, the impacts on the acoustic environment are assessed as: direct, moderate, local, short-term, reversible, of high likelihood of occurrence and of moderate significance.

#### **5.2.1.5 Impacts on Visual Intrusion**

Visual impacts relate to changes in available views of the landscape, and the effect of those changes on the surrounding environment. Visual intrusion during road rehabilitation works is unlikely to be significant. The road already exists and no major excavation works will be taking place to block a natural scenery view. Impacts on visual intrusion are of very low significance.

Accordingly, the impacts on visual intrusion are assessed as: direct, low, local, short-term, reversible, of low likelihood of occurrence and of negligible significance

#### **5.2.1.6 Impacts on Biodiversity**

Given that the project aims to upgrade existing roads by improving drainage, slopes, embankments, traffic signs, shoulders, and other structures; strengthening pavements; and completing resurfacing (i.e. no widening of roads will take place), expected impacts on natural habitats are potential spillages of wastes, dust raised, and increase in noise, light, and traffic movement during rehabilitation work.

In particular, direct effects on wildlife include the generation of emissions and disturbances such as noise, dust, and pollutants in the soil and vegetation (Rajvanshi *et al.* 2001). In fact, it was shown that dust particles reduce the pigmentation in plant leaves (affect photosynthesis and growth rate of plants) and dust fall on open lands reduces their fertility (Supe et al, 2013). Similarly, noise from construction equipment influences animal behavior, altering activity patterns, and causing stress, loss of reproductive success, and physiological disturbance. Normally, some animals may vacate the area, while, others may get used to the noise (responses may vary among species). Further, wastewater discharge and illegal dumping of solid waste into the roadside scrublands and riparian habitats can severely affect the local fauna and flora and eventually lead to population destruction. In addition, given that lighting poles will be

rehabilitated when needed, additional lighting might affect local fauna in sensitive habitats.

Finally, during rehabilitation, there is an increase in traffic movement; this can induce increased roadkills (i.e. mortality due to vehicular collisions). Animals that are attracted to roads or that need to cross them are more vulnerable.

However, given that the concerned roads generally involve paths that are already under anthropogenic influences, the potential impacts of the project on the local biodiversity are expected to be limited to disturbance of the natural ecosystems when roads are surrounded by wooded lands and riparian habitats (a pine forest was recorded along Aley R1a (short segment in Aazouniyeh), riparian habitats were recorded where Aley R1a intersects with Ghadir River (at station 2+600) and Aley R1c intersects with Damour River (at station 4+683) and encounters Ain es Sayde and Ain-Rommane (between stations 0+000 and 1+200) and maquis ecosystems along Aley R1c in El-Kamatiyeh and Ain-Rommane), illegal dumping and discharge of wastes in river and streams that can lead to direct destruction of local biodiversity and natural habitats (including reproduction sites for amphibians).and finally, dust accumulation on nearby vegetation and cultivated lands (agricultural areas along Aley R1b, R1c section 2, and R1d).

Riparian habitats are known to be excellent refuge for birds, reptiles, and overall amphibians. The project should not affect further the concerned aquatic and riparian communities (remaining adapted species) and the surrounding vegetation and animal communities (birds of passage or resident amphibians and reptiles) that could be of ecological significance. Moreover, the project should not further contaminate Ghadir and Damour rivers. According to studies conducted by AUB University between 2005 and 2009, these rivers are affected by the anthropogenic activities and their water quality has deteriorated due to several factors, including uncontrolled discharges of industrial and domestic wastewater, and uncontrolled surface-water allocation.

Finally, Ramlieh valley (an IBA site) is 600 m south west of the road. The ecological links of the project area with this protected site and associated fauna (mainly migratory birds) could be of some significance. Birds believed potential in the studied habitat include the Woodcock (*Scolopax rusticola*), a woodland species, large number of species arrive from mid-October onwards, winterer in most woodlands with preference to Al Chouf Cedar; the Song Thrush (*Turdus philomelos*), very common passage migrant in early October-late November and mid-February-early April; and the Chukar Partridge, common resident breeder in Lebanon and recorded in most Lebanese mountains (All these species are categorized as being of least concern in the IUCN list of threatened species). Therefore, rehabilitation activities must not take place during the migration period. This will avoid disturbing passenger birds.

Accordingly, the impacts on biodiversity are assessed as: direct, moderate, local, short-term, irreversible, of medium likelihood of occurrence and of medium significance

### **5.2.1.7 Impacts on Existing Infrastructure**

The road rehabilitation works might have adverse impacts on the existing infrastructure including underground cables, sewage network, and water network existing under the road pavement. Random digging and milling of deteriorated road pavement, without previous

investigation of possible existence of underground appliances, may interfere with any existing infrastructure; that is possibly serving nearby surrounding residential and agricultural areas. Damage of existing infrastructure, for instance wastewater infrastructure or water networks, can cause several undesirable impacts such as cutting off water supply for irrigation, generation of bad smells, and attraction of water borne diseases and vectors due contaminated water accumulation.

Several measures must be taken to alleviate traffic in the area. This includes dividing the roads into segments in a way not to block the whole route.

Accordingly, impacts on existing infrastructure are assessed as direct, moderate, local, short-term, reversible, of medium likelihood of occurrence, and of low significance

### **5.2.1.8 Impacts on Resource Consumption**

#### *Freshwater Demand*

During the rehabilitation phase, water will be supplied by tankers, if needed. Freshwater will be mainly used for dust suppression of the temporary stockpiles onsite.

Worker camps will not be installed since the Contractor will employ low skilled Syrians and Lebanese from the surrounding communities of Aley R1a, R1b, R1c and R1d. As a result, the unskilled workers will get their food and water supply from their homes. In addition, the nearby office will provide water for the Contractor's engineers, technical/skilled labor, and the supervising consultants. Consequently, water resources will not be required for domestic purposes.

Water consumption varies and it cannot be estimated as it highly depends on the rehabilitation activities, working days per year and other factors. Rehabilitation activities will consume moderate volumes of water; it will only be for a relatively short finite period.

#### *Energy Demand*

During the rehabilitation phase, required works will require the use of several heavy equipment/machinery that highly consume energy in the form of fossil fuel, leading to the depletion of fossil fuel resources. However, the rehabilitation phase will be of short-term.

#### *Raw Materials Demand*

During the rehabilitation phase, required works will require the use of raw material (refer to Table 3-9), leading to depletion of natural resources such as aggregates from unsustainable quarries.

Accordingly, the impacts on resource consumption are assessed as: direct, moderate, local, short-term, irreversible, of high likelihood of occurrence and of medium significance.

### 5.2.1.9 Impacts on Public and Workers Health and Safety

#### (1) Occupational Health and Safety

Occupational hazards during the rehabilitation works are associated with working in all weather conditions, handling heavy machinery and other sophisticated rehabilitation equipment and long hours of work. In addition, continuous exposure to environmental emissions resulting from the rehabilitation activities can induce health problems. Moreover, a badly planned site can increase the risk of accidents and injuries from falls of materials and collisions between workers and machinery or equipment. Finally, prevention and protective measures should be introduced according to priorities. The potential types of occupational hazards that might occur during the rehabilitation works of the roads include the following:

##### *Physical hazards*

Physical hazards are potential accidents or injuries or illnesses that occur due to repetitive exposure to mechanical action or work activity (WBG, 2007). Forms of physical hazards are but not limited to the following:

Slips, Trips and Falls: Slips, trips and falls have been identified as being the most hazardous feature of survey sites. Occasionally, as a survey progresses, increasing numbers of people crossing these areas results in gradually worsening conditions.

Unplanned Trenching: Vibration may be caused from heavy equipment or from street traffic. Moving heavy equipment may include bulldozers, backhoes, loaders, and/or dump trucks. Equipment and materials may collapse trench walls if operated or stored too close to the trench edge. Water and temperature changes can pose a serious threat to excavations and trenches. Sources of water on job sites include surface water, the level of the water table, moisture content, rain, and cities with existing utilities in the right-of-way.

Environment Hazard: those types of hazards are due to environmental factors like the weather, sun and similar factors and they may lead to the following:

- Hypothermia and Hyperthermia due to sun exposure or sudden temperature change
- Hypotension and Hypertension due to lack of nutrients and medical history
- Dehydration lost due to lack of fluids and excess loss of body water through urine, tears, stool and sweat. An individual can sweat an average of 1.1 liters / hour when exposed to sun.
- Fire caused by accident or ignited by outsiders that will lead to external and internal burns.
- Bites and stings from the wilderness and most common are bees and snakes.

Noise: Extended exposure to excessive noise levels can cause noise-induced hearing loss specifically noise levels above 85 (dB) can cause hearing loss.

Vibrations: Earthwork activities and material loading / unloading activities generate levels of vibrations. Exposure to high level of vibrations for a significant duration will affect workers' health such as carpal tunnel syndrome and permanent damage to the nerves. Whole-body



vibration can occur from operating large mobile equipment such as drillers, air hammers, pile drivers, tractors, graders, excavators and many more. Hand-arm vibration can result from using hand-held equipment such as drills, hammers and disc grinders. Hand-arm vibration may cause carpal tunnel syndrome, a disease that affects the fingers and hands.

### Vehicle Hazards

Vehicles transporting personnel and equipment to the study area are subject to vehicle hazards (transport impacts, road accidents, vehicle crashes). Vehicle crashes can be divided into the following types:

- Frontal and rear impact
- Rotational impact
- Rollover

### *Chemical Hazards*

Chemical hazards occur due to exposure to toxic, corrosive, sensitizing or oxidative substances. During rehabilitation activities, employees are mainly at risk of being exposed to asphalt fumes from pavement works among other solvents. Exposure to asphalt fumes is linked to acute effects such as headache, fatigue, reduced appetite, breathing problems, and skin irritation (Norseth et al, 1991).

### *Ergonomic Hazard*

Ergonomic factors, such as repetitive motion, overexertion, and manual handling lead to occupational injuries such as strains, low back pain, fatigue and others. According to Sang et al (2007), there has been, for years, an increase in rates of work-related musculoskeletal disorders in highway construction specifically and the construction industry in general. Common causes are manual material handling and awkward postures, especially when lifting.

## **(2) Public Health and Safety**

Most of the potential impacts on public health and safety comprise of those described in the previous sections. For instance, the impacts on water quality and availability, air quality soil quality, etc... all have consequences on human health. Nonetheless, some potential impacts, which were not yet discussed, are addressed in this section. First, during the rehabilitation activities, risk of road traffic accidents might increase in between vehicles, pedestrians and vehicles, specifically in highly populated areas surrounded by residential buildings and schools. Second, the proximity of the roads to communities and the open access to rehabilitation sites consist of a potential risk to the public, namely the risk of injuries as a consequence of falls or contact with heavy equipment. This might occur in case of unauthorized or accidental entry of residents into areas where the rehabilitation activities are taking place. This risk, however, is commonly encountered in cases of road rehabilitation projects and will be addressed through a standard set of best practices. This includes the usage of proper signage and barriers, in addition to flagmen and temporary traffic signs when necessary (refer to section 6.1.8)

Accordingly, impacts on health and safety are assessed as: negative, moderate, local, short-term, irreversible, of high likelihood of occurrence and of medium significance

## **5.2.2 Potential Negative Social Impacts during Rehabilitation**

Generally, during the rehabilitation activities, adverse impacts on socio-economic conditions are associated with nuisance, traffic disturbance, potential labor influx and increase in GBV risks mainly Sexual Exploitation and Abuse (SEA) and Sexual Harassment (SH), potential child labor, social tensions, inappropriate labor conditions and obstruction of temporary access routes to sensitive receptors and others. Therefore, the potential impacts on socio-economic conditions of laborers onsite and the residents of the surrounding communities of Aley R1a (El-Azouniyeh – Charoun – Ain Sofar), R1b (El-Kahale – Bsous – Ain-Rommane – El-Kamatiyeh), R1c (El-Kamatiyeh – Ain-Rommane – Aley – Bkhichtay), and R1d (El-Kamatiyeh – Bdedoune) are presented below.

These expected adverse impacts of the project on socio-economic conditions will be temporary in nature, however, implementing appropriate measures to mitigate these impacts is the core responsibility of the Contractor.

### **5.2.2.1 Impacts on Socio-Economic Conditions of Surrounding Communities**

#### **(1) Traffic Disturbance and Nuisance**

Roads under study will not be closed or shutdown, access and traffic will be secured via other alternative routes and means. This would be the case if the Contractor will be obliged to temporarily close the road. As mentioned before, the location of these detours will be specified by the contractor during the rehabilitation phase. However, all detours (if needed) will be on existing alternative roads (public domain properties).

During the rehabilitation works of Aley roads potential socioeconomic impacts include, nuisance and traffic disturbance from the rehabilitation activities onsite and from traffic disturbance. As a result of rehabilitation works, the road width might become narrower and might experience a delay in traffic. The most significant sources of noise and traffic are heavy machinery and the movement of transport vehicles into and from the rehabilitation site, leading to increase in commuting time and inconvenience to roads users.

#### **(2) Potential Labor Influx and Labor Induced SEA**

Potential labor influx will increase the risk of labor induced SEA towards women in the surrounding communities. SEA is defined as “any actual or attempted abuse of a position of vulnerability, differential power, or trust, for sexual purposes, including, but not limited to, profiting monetarily, socially or politically from the sexual exploitation of another” (World Bank, 2018). Sexual abuse is further defined as “the actual or threatened physical intrusion of a sexual nature, whether by force or under unequal or coercive conditions” (World Bank, 2018). In this context, project beneficiaries or members of project-affected communities may experience SEA (World Bank, 2018).

Knowing that the project is expected to employ low skilled Syrians and Lebanese already living in the community around the selected roads for rehabilitation, large labor influx of outsiders into the communities might not occur. However, since some segments of the roads to be rehabilitated in Aley Caza are narrow and in close proximity to residences, schools and other sensitive receptors (refer to 4.3.2), the potential risk for SEA is moderate. Further, if the Contractor doesn't recruit low skilled labor from the nearby communities, the risk of SEA towards women in the community will be high. In order to avoid this risk, recommended mitigation measures (section 6.3) must be implemented.

### **(3) Obstruction of Access Routes to Sensitive Receptors**

During the rehabilitation phase, the access to the road sensitive receptors might be affected due to change of accessibility, the possible detours and diversions (if needed by the Contractor), the nuisance from the presence of excavation activities and heavy machinery. Impacts on sensitive receptors might include temporary obstruction of access routes to residential units, schools, places of worship and hospitals (refer to Figure AA, Figure BB, Figure CC, Figure DD and Figure EE in Annex 1), as presented in section 4.3.2. The assessment showed that the most urbanized roads to be affected by the temporary obstruction of sensitive receptors are the road segments between stations [0+000 - 1+100] and [3+000 - 7+196] of Aley R1a, [3+000 - 3+400] and [6+400 - 7+100] of Aley R1b, [1+750 - 3+800] of Aley R1c section 1 (densely bordered by commercial areas, retails shops and residential units). In addition, the dispersed residential units (between stations [1+000 - 3+000] of Aley R1a, [1+900 - 3+000] of Aley R1b and around Aley R1d) bordering the road in rural areas will be affected by the rehabilitation works. Kindly refer to sensitive receptors maps Figure AA until Figure EE in Annex 1 and photos (Figure 4-16 until Figure 4-26) in section 4.3.2.

In specific, the sensitive receptors that are at a distance of less than 10 m (refer to Figure CC in Annex 1) namely, Sofar School (10 m away) and Charoun Municipality (10 m away) along Aley R1a, El Komatiyeh Mosque (2 m away) along Aley R1b and R1d, and El Komatiyeh School (3 m away) along Aley R1b, Lebanese University (5 m away), Maroun Abboud School (6 m away) and Ghaleb Obeid Physio Center (7 m away) along Aley R1c section 1 will be highly impacted by the temporary obstruction of routes. In this context coordination with relevant municipalities and schools and external GRM will be conducted before the commencement of work.

This impact will be limited for the duration of works on that section of the road. In addition, there are no expected physical impacts on these sensitive receptors, as the works are limited to the road corridor only and therefore there will be no encroachments on any private property.

#### **5.2.2.2 Impacts on Socio-Economic Conditions of Labor**

##### **(1) Labor Induced SH**

The employment of both men and women in REP project might increase the risk of SH towards female employees at the workplace. SH is defined as "Unwelcome sexual advances, requests for sexual favors, and other unwanted verbal or physical conduct of a sexual nature occurring between personnel/staff working on the project" (World Bank, 2018).

## **(2) Child Labor**

The immense needs of vulnerable communities may result in underage workers making themselves available for work. This could result in the employment of child laborers. Employment of underage laborers is a violation of the Lebanese Labor Law dated 1946. Given the type of planned rehabilitation works, children can get injured in the workplace. In this context, employers are subject to the youth employment provisions under the Lebanese Labor Law.

## **(3) Inadequate Labor Conditions**

The project can result in poor labor conditions in the case of the violation of labor law. The project beneficiaries, Lebanese and Syrian communities, might not have work permissions or contractual protections with Contractors and their wages are to be set by the market. While Contractors should follow local labor laws, in Lebanon, monitoring of whether local labor laws are followed is not always performed. Therefore, large and vulnerable population of beneficiaries may be at risk of working for wages that are less than those recognized by the law and may be forced into accords that are not consistent with the law (e.g. work schedules or rest periods).

## **(4) Social tensions and conflict over job-sharing and dissatisfaction with allocation of project-generated jobs.**

The project is expected provide job opportunities for both Syrians and Lebanese in host communities. Syrians already tend to work in construction activities. potential perceptions that project employment ratios favor Syrian communities might further worsen the social tensions between the two groups.

## **(5) Risk of under-participation or underemployment or discrimination of women**

The risk of under-participation or underemployment or discrimination of women in the context of REP project will be high, if the Contractor doesn't set specific percentage of women employment to benefit from the project. Moreover, women's engagement in construction works is not common and also not encouraged, according to Lebanon's social and cultural norms.

## **5.3 Potential Positive Impacts during Operation**

### **5.3.1 Potential Positive Environmental Impacts**

The potential positive environmental impacts of the project are associated with enhanced road conditions.

First, improved drainage helps in decreasing contaminated storm water run-off and consequently helps limit the impact on the streams surrounding Aley R1a, R1b, R1c and R1d. Further, slope stabilization activities will result in a positive impact as it decreases the chances of soil erosion. Improved drainage decreases likelihood of run-off water to reach and contaminate nearby soil. As a result, the project is expected to have a positive impact on soil quality during operation. Finally, the proposed rehabilitation works will result in less

congestion and delays. Moreover, it is predicted that the project will increase the average speed per vehicle and reduce travel time which would typically improve the overall air quality through potential reduction in CO<sub>2</sub> emissions.

### **5.3.2 Potential Positive Social Impacts**

The social benefits of the rehabilitation works, during operation, include transport connectivity and easier access to rural, peri-urban and urban areas. Additionally, the rehabilitated roads will result in potential reduction in traffic congestion, reduced travel time and transport cost. The improvement in the safety conditions of the roads (due to improved drainage and lighting, additional safety barriers, fixing appropriate speed limit and slope protection measures). Moreover, employment opportunities will be offered for a short period of time, knowing that the Contractor will be responsible for the routine maintenance of the roads, during the one year of Defects Liability Period (post rehabilitation phase).

## **5.4 Potential Negative Impacts during Operation**

The negative impacts assessment, during the operation phase, mainly focuses on the maintenance activities that might be required during the Defects Liability Period (one-year period). However, it is important to mention that the Contractor might not perform any maintenance activities, if not necessary.

### **5.4.1 Potential Negative Environmental Impacts**

#### **5.4.1.1 Impacts on Water and Soil Quality**

Potential impacts on water quality should be considered due to the particularity of the project area, knowing that most of the roads in Aley Caza encounter several winter drainage channels that discharge into the neighboring Damour and Ghadir Rivers. Spills of chemicals and pollutants during maintenance activities can affect soil and water quality, if such activities are not managed properly.

Moreover, contaminated storm-water runoff along with sediment transport from the maintenance site into the surrounding streams is possible. Storm water runoff or a direct point source discharge can transport pollutants, deposits and residues as well as eroded materials from the site into the receiving environment. Storm water may carry with it the following:

- Spilled fuels
- Slurry from pavement milling, drillings, and excavations for drainage ditches
- Suspended particles, such as sand, slits, bentonite, cements
- Solid waste, such as plastic, paper, bottles, wood

All of the aforementioned discharges can significantly impact water quality and storm water drainage channels in the area. Proper management modalities would be crucial in order to reduce and prevent contamination of water resources surrounding the maintenance sites in Aley Caza.

Accordingly, impacts on water and soil quality are assessed as: direct, moderate, long-term, local, irreversible, of medium likelihood of occurrence, and of medium significance

#### 5.4.1.2 Impacts on Air Quality and Odor Emission

During the operation phase of the project, impacts on air quality are associated with maintenance activities and movement of vehicles. This includes dust and exhaust emissions. The extent of the impact will depend on type and duration of required maintenance activities.

Moreover, the main expected vehicle emissions are (World Bank, 1997):

- Nitrogen oxides (NO<sub>x</sub>) which is a by-product of fuel combustion in combustion chambers, under conditions of extreme heat and pressure,
- Hydrocarbons (HC) which are produced due to the incomplete combustion of fuel and its evaporation. The emissions of hydrocarbons are strongly correlated with the type of fuel used. The most notorious HC produced are benzene and ethylene.
- Carbon monoxide (CO) which is the result of incomplete combustion in engines
- Sulfur dioxides (SO<sub>x</sub>) emissions which are directly linked to the sulfur content of the fuel.

Accordingly, impacts on air quality are assessed as: direct, moderate, short-term, local, and irreversible, of medium likelihood of occurrence and of medium significance

#### 5.4.1.3 Impacts on Acoustic Environment

The operational phase is expected to be associated with increased noise levels during maintenance activities. Noise is mainly associated with four main sources: a) vehicles noise, b) friction between vehicles and the road surface, c) driver behavior, and d) maintenance activities (Table 5-2) (World Bank, 1997).

**Table 5-2 Sources of acoustic pollution during road operation**

Noise Source	Impacts
Vehicle noise	Transportation vehicles generally produce noise from the engine, transmission, suspension, braking, and stop-and go traffic conditions. The noise levels are expected to increase with the poor maintenance of vehicles accessing the road.
Road noise	Contact between tires and pavement significantly contributes to overall traffic noise. The level depends on the type and condition of tires and pavement. The frictional noise increases with higher speed and during sudden braking.
Driver behaviour	Vehicles' horns, loud music, shouting, sudden braking or accelerating contributes to traffic noise.
Road maintenance	Periodically, road maintenance is generally required. Such activities will utilize heavy machinery which will contribute to noise pollution.

The exposure to increased noise levels can affect the welfare of local residents, both physiologically and psychologically. Noise exposure is considered a source of annoyance which might result in increased stress levels and health impacts. It can cause auditory fatigue, temporary and permanent lessening of hearing ability and sleep disorders (World Bank, 1997).

Accordingly, impacts on acoustic environment are assessed as: direct, moderate, short-term, local, and reversible, of high likelihood of occurrence and of medium significance

#### **5.4.1.4 Impacts on Biodiversity**

During the operation phase of the project, in general, the impacts on biodiversity are expected to be very limited as no additional roads will be built. On the contrary, rehabilitation of existing roads will probably improve the conditions of adjacent lands and plant communities as the impacts of vehicle-generated dust from roads with poor pavement condition will be reduced.

The main expected impacts during operation on the local ecosystem include (1) the potential sedimentation of heavy metals due to surface runoff (Batool et al, 2012) if drainage systems were not fixed; (2) the potential spills during maintenance activities, and (3) the increase in light pollution levels, when roads are equipped with additional light (the project will involve rehabilitation and addition of lighting poles along Aley R1a, and Aley R1c (stations adjacent to wooded lands) and rehabilitation to lighting poles for Aley R1c (refer to Figure 3-2, Figure 3-3 and Figure 3-4).

Accordingly, impacts on biodiversity are assessed as: direct, moderate, local, long-term, irreversible, of high likelihood of occurrence, and of medium significance

#### **5.4.1.5 Impacts on Energy Consumption**

Energy consumption is expected to be high during the operation phase of the project due to additional lightings. Moreover, maintenance works will require the use of several heavy equipment/machinery that highly consume energy in the form of fossil fuel, leading to the depletion of fossil fuel resources.

Accordingly, impacts on energy consumption were assessed as: direct, low, short-term, local, reversible, of moderate likelihood of occurrence and of medium significance.

#### **5.4.1.6 Impacts on Public and Workers Health and Safety**

During the operation phase of the project, occupational health hazards can be attributed to maintenance-related accidents. Proper supervision and the implementation of adequate safety measures will limit the occurrence of accidents from maintenance activities. Any maintenance works and their potential impacts are expected to be similar in nature to those of this project's rehabilitation phase (disturbance of traffic and road accidents).

Accordingly, impacts on health and safety are assessed as: direct, moderate, local, short-term, reversible, of medium likelihood of occurrence and of medium significance

### **5.5 Summary of Potential Environmental Impacts**

#### Rehabilitation phase

During the rehabilitation phase of the project, the impact on water and air quality are expected to be of medium and high significance respectively.

**Table 5-3 Summary of potential negative environmental impacts during rehabilitation**

Environmental Receptor	Impact														Significance	
	Accidental leakages of concrete pouring, toxic asphalt	Excavations, milling and drillings	Contaminated storm water runoff	Domestic-like solid waste (plastic, paper, bottles and others)	Waste such as old asphalt layers, crushed sub base aggregates	Vehicles transporting workers	Delivery vehicles	Unloading and open storage of raw materials	Odors from asphalt fumes	Mobilization and use of are heavy machinery	Changes in available views of the landscape	Exposure to environmental emissions	Road traffic accidents	Handling heavy machinery		Physical, chemical, biological and ergonomic hazards
Water Quality	x	x	x	x												
Soil Quality	x	x	x	x	x											
Air Quality		x				x	x	x	x							
Acoustic Environment		x				x	x			x						
Biodiversity	x	x	x	x	x						x					
Visual Amenity											x					
Existing Infrastructure		x														
Resources Consumption										x						
Health and Safety												x	x	x	x	

Operation phase

Summary of negative environmental impacts during the operation phase are presented in Table 5-4.



**Table 5-4 Summary of potential negative environmental impacts during operation**

Environmental Receptor	Impact						Significance
	Accidental spills of chemicals and pollutants	Dust and exhaust emissions	Use of vehicles heavy equipment and machinery	Accidents from Handling of heavy machinery	Disturbance of traffic and road accidents	Light and noise pollution	
Water and Soil Quality	x						
Air Quality		x	x				
Acoustic Environment			x				
Biodiversity	x	x				x	
Resources Consumption			x				
Health and Safety				x	x		

Significance	
High	
Medium	
Low	
Negligible	

During the operation phase of the project, the main environmental positive impacts are presented in Table 5-5.

**Table 5-5 Summary of positive environmental impacts during operation**

Environmental Component	Positive Impacts
Water quality	Decreased contaminated storm-water runoff due to the improved drainage
Soil quality	Decreased chances of soil erosion due to slope stabilization
Air quality	Improvement in the overall air quality through potential reduction in CO <sub>2</sub> emissions, as a result of increased the average speed per vehicle and reduced travel time

## 5.6 Summary of Potential Social Impacts

### Rehabilitation Phase

Summary of expected positive and negative social impacts of the project during its rehabilitation are presented in Table 5-6.

**Table 5-6 Summary of potential positive and negative social impacts during rehabilitation**

<b>Potential Positive Social Impacts</b>
<ul style="list-style-type: none"> <li>• Creating direct and indirect short-term jobs for Lebanese and Syrians living in the surrounding community</li> <li>• Enhancing economic development and livelihood opportunities</li> <li>• Strengthening Lebanese and Syrian workers' skills and experience in road rehabilitation and maintenance</li> </ul>
<b>Potential Negative Social Impacts</b>
<ul style="list-style-type: none"> <li>• Potential Labor influx (in case the Contractor doesn't recruit labor from the surrounding community) and potential risk of labor induced SH towards female workers and SEA towards women in the surrounding community and all other forms of GBV</li> <li>• Potential risk of child labor</li> <li>• Poor labor conditions</li> <li>• Dissatisfaction with job allocation and social tensions</li> <li>• Risk of under-participation or underemployment of women</li> <li>• Nuisance and traffic disturbance</li> <li>• Temporary obstruction of access routes to sensitive receptors</li> </ul>

### Operation Phase

Summary of expected positive social impacts of the project during its operation are presented in and Table 5-7.

**Table 5-7 Summary of potential positive social impacts during operation**

<b>Potential Positive Social Impacts</b>
<ul style="list-style-type: none"> <li>• Enhanced transport connectivity</li> <li>• Potential reduction in traffic congestion, reduced travel time and transport cost</li> <li>• Economic savings from the reduced cost of road crash injuries and fatalities</li> <li>• Short-term employment opportunities for routine maintenance (during the first year of operation), however this can be associated with potential SEA/SH in case of Potential Labour influx</li> </ul>

## 6. Mitigation of Environmental and Social Impacts

### 6.1 Environmental Mitigation Measures during Rehabilitation

As part of the ESMP, mitigation refers to the set of measures taken to eliminate, reduce, or remedy potential undesirable effects resulting from the rehabilitation of the proposed project.

Generally, mitigation measures are to be considered in all the developmental stages of the project. Mitigation is a description of the measures visualized in order to avoid, reduce and where practicable remedy significant adverse impacts. In this context, this section lists the recommended mitigation measures to be implemented during the rehabilitation of the concerned roads in Aley, namely Aley R1a (El-Azouniyeh – Charoun – Ain Sofar), R1b (El-Kahale – Bsous – Ain-Rommane – El-Kamatiyeh), R1c (El-Kamatiyeh – Ain-Rommane – Aley – Bkhichtay), and R1d (El-Kamatiyeh – Bdedoune)

#### 6.1.1 Water and Soil Quality

Impacts on water and soil quality were assessed as: direct, high, local, short-term, irreversible, of high likelihood of occurrence and of medium significance. Thus, the proposed mitigation measures include:

##### *Control of Soil Manipulation Activities*

- Installation of retaining walls before starting with drainage ditch excavations to block soil erosion
- Excavations for drainage channels should be carried out in complete precision
- Placement of geotextile silt traps as appropriate, especially in areas close to water bodies, knowing that Aley R1a, R1b, and R1c are in close proximity to nearby streams that discharge into Damour and Ghadir Rivers.

##### *Control of Accidental Spills*

- All refueling and maintenance operations shall take place off-site, vehicles should be fueled up before arriving to the road section
- A spill response plan shall be in place and all workers should be trained on its implementation.

##### *Management of Solid Waste and Wastewater*

- Good site practices including the effective disposal of all wastes generated on-site should be adopted.
- The generated waste onsite should be properly segregated at source into recyclables and organic waste in appropriately labelled waste bins. Sorting at source of domestic and general waste should be implemented.
- Sufficient waste disposal points must be provided and regular collection for disposal must take place near the road.
- Adequate bins for collection and storage of waste materials should be provided.

- Prevent the overflowing of the waste containers.
- Wastewater shall not be discharged onto the open ground or into any water body. In case the porta cabin toilet is not close enough to the existing network to be linked directly to it, the porta cabin toilet will be linked to a polyethylene storage tank. If so, the following should be done:
  - A specialized Contractor will be selected to periodically collect (pump out) the wastewater from the polyethylene tank.
  - The supervising consultant should inspect it regularly to check for any leakages and to ensure that the generated wastewater is properly collected before it's full.
- Domestic-like waste shall be removed daily from the site.
- Excavated soil should be stored and transported offsite to a nearest licensed/controlled dumpsite due to possible heavy metal contamination.
- Any excavated unsuitable material should be removed from site within 24 hours. Reuse of contaminated soil material is prohibited and random disposal of this material in open abandoned areas is never allowed.

#### *Control of Storm-water Runoff*

- In case of temporary storage of excavated materials, accidental contamination or spills of the removed soil should be avoided to limit contamination of storm water runoff and in turn the surrounding streams.
- Any stockpiled construction material should be covered with an impermeable layer to avoid contamination of storm-water runoff.

#### **6.1.2 Air Quality**

Impacts on air quality were assessed as: direct, high, local, medium-term, irreversible, of high likelihood of occurrence and of high significance. Thus, the proposed mitigation measures include:

#### *Control of Exhaust Emissions*

- Ensuring maintenance of all construction equipment regularly, at least once a month.
- Machinery and equipment should be equipped with air pollution control equipment that should be monitored regularly to ensure its effective operation.
- Avoiding idling time of machinery.
- Ensuring regular maintenance of vehicles.

#### *Control of Dust Emissions*

- Using dust-suppression methods to reduce emission of particulate matter into the surroundings.
- Prohibit dust-generating activities during excessively windy periods.
- Prohibit burning of generated waste material.
- Covering raw materials stockpiles with plastic impermeable layers, when raw materials are not in use.
- Avoid excessive vehicular movement on unpaved roads.

- Vehicle maximum speed limit in work zones should be decreased to 25 km/hr.
- Trucks hauling raw materials into the rehabilitation site should be covered properly with tarpaulins.
- All trucks and vehicles exiting the rehabilitation site should be dust-free.
- Stockpiles of fine material such as topsoil material, aggregates etc. shall be protected from wind.
- In case of asphalt milling, spray water on exposed surfaces during dry periods especially near schools, hospitals, rural communities, agricultural areas, etc...
- Maintaining stockpiles at minimum heights
- Contractors shall regularly inspect stockpiles, exposed work areas and rehabilitation work practices.
- Spills or leakages are effectively recorded and reported to the adequate management entity, along with immediate clean-up.
- Daily cleaning of streets and pathways in vicinity of rehabilitation site that are affected by soil and dust

#### *Control of Odor Emissions*

- Transport trucks, specifically trucks transporting asphalt, are to be tightly covered at all hauling times to reduce as much as possible release of unpleasant odors.

#### **6.1.3 Acoustic Environment**

Impacts on acoustic environment were assessed as: direct, moderate, local, short-term, reversible, of high likelihood of occurrence and of medium significance. Thus, the proposed mitigation measures include:

During the road bypass rehabilitation works, excessive noise emissions can be reduced by adopting the following measures:

- Applying an appropriate schedule to avoid any works that may cause noise and vibration, specifically during 8 am to 4 pm. Any nighttime activities should be done using noise reducing means or low-noise technologies.
- Using vehicles and equipment that meet national standards for noise and vibration.
- Regular maintenance of the machinery, equipment and vehicle should be carried out to prevent excessive noise.
- Publishing and registering allowed working time of construction machines with local authorities and ensuring strict compliance with set times.
- Restricting the use of noisy machines and/or adopting noise-reducing means (silencers) for construction machines, especially near sensitive areas.

#### **6.1.4 Biodiversity**

Impacts on the biodiversity were assessed as: direct, moderate, local, medium-term, irreversible, of medium likelihood of occurrence and of medium significance. Thus, the proposed mitigation measures are:

Induced negative impacts of road projects on biodiversity can be minimized by taking special care when passing through rich or critical natural ecosystems (wooded lands, riparian habitats...etc.).

- A waste management plan must be adopted to avoid contaminating the soil and water and hence affecting the local biota;
- Workers should be instructed to protect flora and fauna when feasible as well as their habitats;
- Washing of vehicles and machinery should be done offsite and away from particular biotopes (wooded lands and riparian ecosystems namely along Aley R1a, R1b and R1c)
- Solid waste, rehabilitation debris should not be dumped into the natural habitats that are adjacent to the roads (namely the pine forest in Aazouniyeh, the maquis ecosystems along Aley R1c, and the riparian habitats where Aley R1b intersects with Ghadir River and Aley R1c intersects with Damour River);
- Restricting the use of noisy machines and/or adopting noise-reducing means (silencers) for rehabilitation machines.
- Water spraying must be done frequently in order to avoid dust accumulation on adjacent vegetation (agricultural terraces along Aley R1b, R1c section 2, R1d)
- Green lights are recommended near wooded lands (if additional lighting is deemed necessary during the rehabilitation phase, if available in the market)
- Road cross-section must be fixed during the rehabilitation phase to reduce the impact on biodiversity, for example, by flattening side slopes. This makes crossing easier for animals that find roads a physical barrier (WB). Also, providing longer sight lines for drivers is recommended as it can reduce collisions with animals by allowing more reaction time.
- Rehabilitation activities for Aley R1a can be avoided during the two migration seasons for birds (generally, early-September late May, mid Mars-early May) in order to prevent disturbing passenger birds.

#### **6.1.5 Existing Infrastructure**

The impacts on the existing infrastructure were assessed as direct, moderate, local, short-term, reversible, of medium likelihood of occurrence, and of low significance. Following are the mitigation measures:

- Prepare procedures for rapid notification to the concerned Municipality or public entity and assistance with re-instatement, in the event of any disruption of public utilities.
- Splitting works into the road segments will be done to ensure quick progression through road while causing minimal disruption to traffic.

#### **6.1.6 Visual Amenity**

The impacts on visual intrusion were assessed as of negligible significance. Thus, the proposed mitigation measures are:

- Covering of temporary stockpiled excavations on the side of the road
- Ensuring that the light source is the minimum intensity for the required purpose;
- Ensuring that lights are turned off by timer or manually when they are not needed;

- Ensuring that fittings are chosen that direct light accurately to where it is needed;
- Ensuring that the type of light chosen is the least likely to cause light pollution;

### **6.1.7 Resources Consumption**

Impacts on resources consumption were assessed as: direct, high, moderate, short-term, irreversible, of high likelihood of occurrence and of medium significance. Thus, the proposed mitigation measures include:

#### *Energy Demand Control*

- Ensuring that equipment that are not in use are turned off.
- Conducting regular maintenance and efficient operation of machinery.
- Vehicles should not be allowed to remain idle for long periods.
- Recording monthly fuel consumption.

#### *Raw Material Demand Control*

In the context of the project, the Contractor must acquire the required raw materials from a licensed quarry.

### **6.1.8 Health and Safety**

#### **6.1.8.1. Occupational Health and Safety (OHS)**

Impacts on health and safety were assessed as: negative, moderate, local, short-term, irreversible, of high likelihood of occurrence and of medium significance.

According to WBG (2007), preventive and protective measures should be introduced according to the following order of priority:

- Elimination through eradicating the activity or source of risk from the work process, such as by substituting a hazardous chemical by a safer chemical.
- Control through adopting engineering controls at the source of impact, such as by acoustic insulation.
- Minimization through designing safe work systems and administrative or institutional control measures, such as by job rotation or training safe work procedures.
- Limitation through providing, using, and maintaining appropriate PPE in conjunction with training, such as by using masks and gloves.

Specific measures according to WBG (2007) to limit impacts due to the open nature of rehabilitation sites and their proximity to the community include:

- Measures to prevent unauthorized access to dangerous areas should be in place
- Openings should be sealed by gates or removable chains
- Fall prevention and protection measures should be implemented, such as the installation of guardrails with mid-rails and toe boards at the edge of any fall hazard area

- Signage should be in accordance with international standards and be well known to, and easily understood by workers, visitors and the general public as appropriate
- Marking all energized electrical devices and lines with warning signs
- Establishing rights-of-way, site speed limits, vehicle inspection requirements, operating rules and procedures, and control of traffic patterns or direction

### *Training of Personnel*

Training is an essential component of safety and health management since workers who perform tasks without adequate training can cause themselves or others serious injuries or even death. Therefore, the following trainings should be implemented (Muiruri & Mulinge, 2014):

- Ensure that all workers are given proper site-specific instructions on occupational health and safety prior to commencing work.
- The Occupational Health and Safety training should consist of hazard awareness and control measures.
- The training should ensure proper usage of personal protective equipment (PPE).
- The trainees should acquire knowledge of emergency procedures and preventive actions.
- There should also be job-specific health and safety training.
- Additional training should be provided if risks change.
- Refresher training should be provided periodically, if skills are not frequently used.

### *Noise Emissions*

According to WBG (2007), the following should be implemented:

- Employees should not be exposed to a noise level greater than 85 dB (A) for a duration of more than 8 hours per day without hearing protection.
- Another way of protection can be achieved through limiting the duration of noise exposure. For instance, for every 3 dB (A) increase in sound levels, the allowed exposure period should be reduced by 50 percent.
- Periodic medical hearing checks should be performed on employees who are exposed to high noise levels.

### *Health and Safety Signs*

Examples of signs that must be present at the rehabilitation site include but are not limited to the following (DOLIDAR, 2017):

- Wear safety helmets and reflective jackets
- Permit to work areas
- Falling Hazard, Use safety belt
- Watch for moving equipment
- Wear safety footwear
- Wear hearing protection
- Wear eye protection



- First aid
- Danger of electricity
- No smoking
- Work in progress
- Stop and go

### *First Aid and Injuries*

The availability of first aid kits and the adoption of the following recommendations is essential in order to respond quickly and efficiently to any accident or injury:

- At least one laborer per each group of workers onsite should be appointed to respond to emergency cases, on condition that adequate first aid training is provided.
- One employee for every 25 employees on site should be trained in first aid. The assigned personnel should be provided with appropriate identification, including a red hard hat with a white "red cross" symbol and an identification badge (CDR, 2007).
- All workers onsite should know where the first aid facilities are located and how to adequately use first aid kits.
- A full list of nearby hospitals, medical centers and emergency contact numbers should be provided to workers onsite.
- All injuries or accidents at the rehabilitation site should be reported immediately and the Contractor should maintain and keep a record of accidents or illnesses.
- Designing machines to eliminate trap hazards and ensuring that extremities are kept out of harm's way under normal operating conditions.
- Turning off or disconnecting machinery with exposed moving parts.
- Marking all energized electrical devices and lines with warning signs.
- Checking all electrical cords, cables and hand power tools for frayed and exposed cords and following manufacture recommendations for maximum permitted operational voltage.
- Protecting power cords and extensions from physical damages like traffic and environmental factors like getting wet from rain.
- Use mechanical assists to eliminate or reduce exertions required to lift heavy material, hold tools and work objects.

### *Personal Protective Equipment (PPE)*

Proper use of PPEs is essential to limit the occurrence of occupational hazards. Accordingly, the following should be implemented (DOLIDAR, 2017):

- An adequate supply of suitable personnel protective equipment (PPE) such as hard hats, safety boots, reflective jackets, and others should be maintained.
- The PPEs (specifically hard hat and reflective jacket) provided to managers and safety officers should have a different color than the PPEs of the rehabilitation workers onsite.
- Ensure that workers wear PPEs all the time during working hours.
- Workers must be trained on the proper and effective use of personal protective equipment.

- Workers should be aware of the potential risks that they might encounter, in case of not wearing their PPEs.
- Where there is a risk of injury from falling objects, safety helmets must be provided, and worn by the workers.
- Adequate eye protection should be provided and worn whenever there is a possibility of eye injuries.
- When working in an area or with machines that have high noise levels, hearing protection must be worn.
- Gloves must be provided to the workers and the type of the gloves must be appropriate to the type of work being executed.
- Respiratory protection appropriate to a given working activity should be provided to the workers who are exposed to respiratory hazards.

The following PPE should be used when handling and working with asphalt (NIOSH, 2003):

- Wearing thermally insulated gloves to keep asphalt from burning or irritating the skin.
- Wearing long-sleeve shirts and long pants without cuffs and keeping the sleeves rolled down and close to the collar.
- Wearing Steel-toed safety shoes.
- Wearing a face shield, not just safety glasses.

The following mitigation measures should be adopted by labor when handling and working with asphalt (NIOSH, 2003):

- Never stick your head in an asphalt tank or mixing container.
- Never lean over a kettle. Stay upwind from asphalt if possible.
- Enclosing mixing and stirring operations.
- Stop what you're doing if you notice symptoms. Ask your foreman for advice.
- Keep asphalt off your skin and out of your eyes.
- If you do get asphalt in your eyes, flush with water for 15 minutes.
- Eating, drinking and smoking are prohibited during any asphalt activity.

#### **6.1.8.2.Public Health and Safety (PHS)**

##### **Site Layout and Planning**

- Designing carefully the rehabilitation site in order to avoid or reduce accidents due to trips, slips, and collisions (General layouts are set in Annex 3).
- Providing roads within the zones being rehabilitated with speed limits signs of 25 km/hr to decrease risks of collisions and accidents.
- Restricting access to the zones of unfinished works and providing guards to control entrances and exits.
- No work activities are to be conducted without the presence of barriers, temporary traffic lights, and flagmen if necessary, which are required to warn the public of the existing rehabilitation site and its activities.

##### **Traffic Diversion**

Exact locations and distances of detours are to be set by the Contractor. These points are set according to work progress, location and traffic. As such, general precautionary measures are provided to be considered when selecting the detour. It is important to note that the project will not use or rent land for the purpose of diversions.

Moreover, illustrated detour signage should be displayed around the site as necessary. In addition, the approximate location of signs is shown on the drawings (Annex 3). Exact locations are to be determined on site upon engineer's approval.

- The contractor must make informed route choices, thereby avoiding areas with a high risk of erosion or slope instability, or which are particularly sensitive of fuel spills, and to contamination, where feasible.
- The Contractor has to ensure access diversions for traffic at each stage of work and to provide all necessary requirements to facilitate the continuity of traffic circulation.
- Prior to any works, the Contractor shall submit to the engineer a detailed method statement showing and describing the following:
  - The division of the works into phases and sections
  - The various traffic diversions related to each phase of the works.
  - The temporary diversion of the different services and utilities (avoid continuous disturbance).
- Adequate warning signs and security of the site, namely through barriers, should be provided during non-working hours.
- Where the pavement crosses service entrances (houses or shops) which are higher or lower than the pavement edge level, the Contractor has to construct concrete steps as directed by the engineer on site. Steps are constructed wherever the difference in elevation between the entrance and pavement levels are more than 250 mm.
- In case where the pavement edge limit crosses a parking or a pedestrian footpath, a depressed sidewalk curb shall be applied as shown on drawings (Annex 3) and directed by the engineer.

### *Noise Emissions*

- Noise levels should be maintained within the national permissible limits (presented in Table 2-4) and limited to working hours as allowed by obtained permits.
- Transportation of rehabilitation material during regular working hours should be minimized, when possible.

## **6.2 Environmental Mitigation Measures during Operation**

### **6.2.1 Water and Soil Quality**

The impacts of the project on water and soil quality were assessed as: direct, moderate, long-term, local, and irreversible, of medium likelihood of occurrence and of moderate significance. Therefore, the proposed mitigation measures include the following:

- All refueling and maintenance operations shall take place off-site, vehicles should be fueled up before arriving to the road section

- A spill response plan shall be in place and all workers should be trained on its implementation.
- Provision of adequate bins for collection and storage of waste material including litterbins and waste skips
- Preventing the overfilling of the waste containers placed on the road

Also, regarding the control of Storm-water Runoff in the case of maintenance and cleaning activities, it is recommended to maintain the cleaning of the storm water channels especially before the start of the rainy season and continually collect solid waste in order to prevent the blockage of the drainage system.

### **6.2.2 Air Quality**

The impacts on the air quality were assessed as: direct, moderate, short-term, local, and irreversible, of medium likelihood of occurrence and of medium significance. Therefore, the proposed mitigation measures include the following:

- Ensuring maintenance of all construction equipment regularly, at least once a month.
- Machinery and equipment should be equipped with air pollution control equipment that should be monitored regularly to ensure its effective operation.
- Avoiding idling time of machinery.
- Using dust-suppression methods to reduce emission of particulate matter into the surroundings.
- Prohibit dust-generating activities during excessively windy periods.
- Vehicle maximum speed limit in work zones should be decreased to 25 km/hr.

### **6.2.3 Acoustic Environment**

The impacts on the acoustic environment were assessed as: direct, moderate, short-term, local, and reversible, of high likelihood of occurrence and of medium significance. Therefore, the main proposed mitigation measure includes applying an appropriate schedule for maintenance activities to avoid any works that may cause noise and vibration, specifically during 8 am to 4 pm. Any nighttime activities should be done using noise reducing means or low-noise technologies.

### **6.2.4 Biodiversity**

Impacts were assessed as direct, moderate, local, long-term, irreversible, of high likelihood of occurrence, and of medium significance. In this context, mitigation measures include:

During the operation of the project, maintenance activities must be conducted properly in order to avoid spillages and natural habitats contamination (i.e. wooded lands along Aley R1a (Aazouniyeh pine forest) and maquis ecosystems along Aley R1c in El-Kamatiyeh and Ain-Rommane), riparian habitats along Aley R1a that intersects with Ghadir river (at station 2+600) and Aley R1c that interests with Damour River (at station 4+683)) and encounters Ain es Sayde and Ain-Rommane (between stations 0+000 and 1+200). Moreover, given that light pollution will increase as lighting poles will be fixed, however, if green<sup>3</sup> lights are to be used (if available in the market), the local fauna will be less disturbed.

Finally, road cross-section must be fixed during the rehabilitation phase to reduce the impact on biodiversity when roads are operational, for example, by flattening side slopes. This makes crossing easier for animals that find roads a physical barrier (WB). Also, providing longer sight lines for drivers is recommended as it can reduce collisions with animals by allowing more reaction time.

### **6.2.5 Energy Consumption**

The impacts on energy consumption were assessed as: direct, low, short-term, local, reversible, of moderate likelihood of occurrence, and of medium significance. Therefore, in order to reduce energy consumption, the following should be applied:

- Equipment should be turned off when not in use.
- Vehicles should not be allowed to remain idle for long periods.
- Recording monthly fuel consumption.

### **6.2.6 Public and Workers Health and Safety**

The impacts on health and safety are assessed as: direct, low, local, short-term, reversible, of medium likelihood of occurrence and of medium significance. Thus, in order to reduce the impacts on health and safety, the following mitigation measures should be applied:

- Ensure that during maintenance all employees utilize appropriate personal protective equipment (e.g. hard hats, steel toe boots, respirators) and are well trained on occupational health and safety.
- Ensure public safety by informing local citizens of the maintenance activities to be performed provided through the use of media, public announcements, and signage.

## **6.3 Social Mitigation measures during rehabilitation**

### **6.3.1 Mitigation Measures on Socio-Economic Conditions of Surrounding Communities**

#### **(1) Traffic Disturbance and Nuisance**

In order to reduce the impact of traffic disturbance and nuisance on the surrounding communities, the following measures should be implemented:

- Full coordination with the Municipality before and during the rehabilitation to avoid/minimize any potential impact
- Adequate warning, signing, delineation and channeling at least 500 m down and up-gradient from the rehabilitation site must be provided by the project proponents.
- Movement of delivery vehicles outside the site should be restricted to off-peak traffic hours.
- Speed limitation signs should be installed at the access points.
- Full road closures won't be done as all closures will be of partial nature; detours will comprise of merely temporary diversions. In this context, the Contractor has to prepare rehabilitation methods and program of work taking into consideration safety and non-stop traffic along the road (refer to Annex 3).

- Commencement works should not be allowed prior to placing all the required temporary signs, traffic lights, flagmen, etc... wherever and whenever required. Typical signs used are those that indicate the presence of a diversion ahead, the end of diversion, in addition to signs indicating there are works ahead, among others.
- Clear communication with all PAPs and a robust GRM that is streamlined and fully functional are essential before commencement of work in order to mitigate traffic nuisance
- The Contractor has to ensure access diversions for traffic at each stage of work and to provide all necessary requirements to facilitate the continuity of traffic circulation.
- Ensure the availability of external GRM

## **(2) Potential Labor Influx and Labor Induced SEA**

Knowing that some of the roads some segments of the roads to be rehabilitated in Aley Caza are narrow and in close proximity to residences, schools and other sensitive receptors, it is important to ensure that labor uphold acceptable behavioral manners when interacting with local communities. Therefore, in order to avoid the risk of SEA incidents towards female inhabitants of the surrounding communities, the following measures are highly recommended:

- Providing workers with the necessary training and awareness raising session on issues regarding SEA, prior to signing the CoC
- Obliging employees to attend an induction training course prior to commencing work on site to ensure they are familiar with the company's commitments to address GBV, in specific, SEA and the project's CoC.
- Repeating training and awareness raising on a regular basis as new staff commence work on the project.
- Informing laborers regarding national laws that prosecute perpetrators of SEA
- Providing CoC in a language understood by the workers who will sign the CoC.
- Ensuring requirements in CoCs are clearly understood by those signing it.
- Ensuring that the sanctions embodied in the CoC are be clearly explained.
- Ensuring that workers at the rehabilitation site sign the Code of Conduct (CoC) (refer to Annex 4) that targets GBV risks, specifically SEA induced by labor influx, and penalizes the perpetrators of SEA.
- Verifying that GRM (refer to section 8.2) is adequately implemented to record complaints from the surrounding communities, to find adequate resolutions and implement corrective actions.
- Ensure the availability of a GRM with multiple channels to initiate a GBV complaint, which ensures confidential reporting with safe and ethical documenting of GBV cases, including SEA and SH.

## **(3) Obstruction of Access Routes to Sensitive Receptors**

In order to minimize the temporary obstruction of access routes to residential units, schools, places of worship and hospitals, the Contractor should ensure adequate and timely communication with the concerned municipalities, schools and dissemination of project-related work schedule with the surrounding community. In other words, the nearby communities including the shops' owners, worship places and schools should be informed of the exact timing

of activities prior to the commencement of works. A robust GRM should be clearly communicated and adequately disseminated as well.

Further, the rehabilitation works should not be performed during peak traffic hours (e.g. works can take place when students are already at school) and during the work hours of the surrounding commercial and retail shops. It is preferable to perform some of the works that are not noisy at night to ensure that access to surrounding schools, commercial and residential areas is not hindered. Also, during rehabilitation of long roads, the Contractor should work on one small segment at a time, to avoid disturbance of the surrounding sensitive receptors for a long period of time and the Contractor should ensure timely completion of the rehabilitation phase.

In addition, passing corridor should be maintained within the alignment to grant access to nearby properties and access to small shops, places of worship and schools should not be blocked by installing wooden boards. Proper installation of sign boards in culturally appropriate languages and written in clear and understandable manner is essential.

### **6.3.2 Mitigation Measures on Socio-Economic Conditions of Labor**

#### **(1) Labor Induced SH**

Although women participation in rehabilitation works is expected to be low, adequate measures should be addressed to avoid the risk for labor induced SH.

Therefore, laborers should be provided with training sessions and awareness campaigns on SH to ensure that they are aware of issues related to women, social norms and the importance of maintaining and respecting gender equality.

The CoC should be enforced to project laborers (in a language understood by all workers). Additionally, the Contractor should ensure that CoC requirements and sanctions to be applied, if breached, are well understood by signatories, prior to signing the CoC. Further, it is important to ensure that a proper GRM is established to address any kind of violations to the signed CoC. In addition, the GRM should include an anonymous channel to ensure confidentiality and protection to GBV survivors reporting incidents.

#### **(2) Child labor**

The project should closely monitor the risk of child labor and should have measures in contracts to ensure that those below the working age are not hired and ensure that labor law of Lebanon is followed. In this context, a labor registry and age verification must be maintained during the whole rehabilitation phase. Also, penalty provisions should be available for hiring child labor.

Additionally, during the employment procedure, the Contractor or sub-Contractor should abide by the Lebanese Labor Law dated 1946.

#### **(3) Inadequate Labor Conditions**

Safety and protection of workers should be ensured within the contracts provided by the Contractor and continuous monitoring is required to maintain adequate labor and contractual

conditions. Further, in order to counter inadequate working circumstances that would make both Syrian and low-skilled Lebanese worker at higher risk of exploitation, appropriate rules and regulations should be implemented in order to ensure the protection of laborers.

Contractors should be forced to abide by the specified Lebanese law determining the minimum wage and minimum working age for children, as per the law, and to comply with, working conditions and hours (as specified in the legal section).

#### **(4) Social tensions and conflict over job-sharing and dissatisfaction with allocation of project-generated jobs.**

Clear criteria for job selection and allocation should be adopted accounting for the ratio of Syrian and Lebanese community workers in Aley Caza and types of positions available. Moreover, it is important to avoid competition between Syrian workforce willing to accept lower wages and skilled Lebanese labor. Hence, the Contractor should ensure a fair allocation of job opportunities, and most importantly non-discrimination and fair treatment (such as equal wages/benefits and working conditions) should be ensured among workers.

Further, the Contractor must comply with Decision 29/1 dated 2018 which restricts significant number of jobs to Lebanese only and allows Syrians to occupy jobs that are not restricted to Lebanese, these are mainly covering the construction sector.

In this context, clear communication with all affected workers and a robust GRM are essential to mitigate the potential risk of social tensions or dissatisfaction among Syrian and Lebanese workers.

#### **(5) Under-participation or underemployment or discrimination of women**

The following measures should be adopted to ensure women employment by the Contractor:

- Setting minimum percentage of women at the employment phase.
- The project should ensure that gender equality is attained when it comes to recruitment, salary levels and others
- Promoting the employment of females in appropriate jobs such as managerial or administrative positions and giving the opportunity to women to decide the suitable operations that they can perform
- Encouraging women through awareness campaigns on the importance of employment in such project in order to enhance their livelihoods.

### **6.4 Social Mitigation Measures during Operation**

Rehabilitation works under REP will lead to positive social impacts due to improvement in road conditions such as lighting. This will increase visibility which will contribute to safer environment for women and reduce the probability of SEA. However, some measures are necessary to ensure that positive impacts are maximized. These measures include the following:

- Ensure that workers during the maintenance phase are trained and well understood prior to signing the CoC that targets GBV risks (mainly SEA and SH) and penalizes the perpetrators of GBV.



- Ensure that streamlined and multi-channeled GRM mechanism is functional to receive any public concerns throughout this phase and to address the received complaints within the set timeframe (specified in section 8.2).

## **7. Environmental and Social Management and Monitoring Plan**

Environmental and social management and monitoring are essential to ensure that the identified impacts are maintained within the allowable levels, unanticipated impacts are mitigated at an early stage, and the expected project benefits are realized. Thus, the main aim is to assist in the systematic and prompt recognition of problems, encouraging effective preventive and mitigation measures and ultimately achieving the goal of good environmental and social performance. A sound understanding of environmental priorities and policies, properly managing the project, acknowledging the regulatory requirements and keeping updated operational information are fundamental to ensure the effective and satisfactory environmental performance.

### **7.1 Institutional Setup and Capacity Building**

The project works will be executed on the main road network which is under the jurisdiction of the MoPWT. In Lebanon, donor-funded road works projects are implemented by CDR upon the request of the Council of Ministers (CoM). Therefore, in the context of REP project, CDR (Road and Transport Department) will execute the project on behalf of the government/MoPWT.

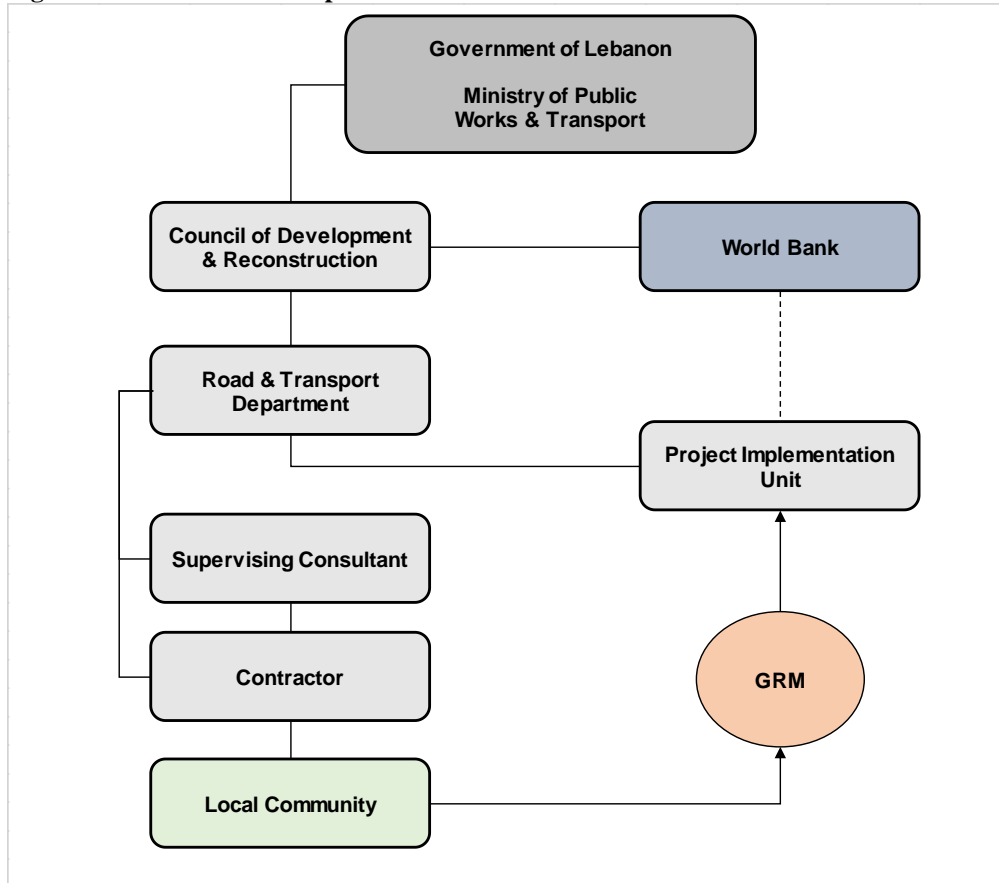
In order to achieve proper environmental management and monitoring, a clear, functional institutional structure was defined (refer to Figure 7-1). During the rehabilitation phase, the Contractor would be the primary actor; ensuring compliance of works with the different items specified in the environmental and social management plan. Accordingly, the Contractor will be supervised by several entities appointed by CDR. CDR will be responsible for constant monitoring of the rehabilitation works through weekly reports (sent by the Contractor) and site visits, ensuring and enforcing mitigation measures.

More specifically, the CDR will develop a Project Implementation Unit (PIU) dedicated to the project, which includes social and environmental specialists to monitor and evaluate the project. Moreover, it will engage a supervising consultant to directly monitor the Contractor. In this context, planning, implementation and supervision of environmental safeguards will thus take place at different stages (a) PIU, (b) Supervising Consultant, and (c) Contractor.

PIU will be responsible for providing the overall plan direction, technical support, appraisal and validation of environmental and social management plans, and monitoring of environmental compliance and progress reporting to the World Bank. The responsibility of implementation and management of environmental/social safeguards by the PIU will be coupled with the assignment of supervising consultant (focal point(s) for environmental and social safeguards) who will be in charge of ensuring sound application of the ESMP. Finally, implementation of the ESMPs will mainly be the Contractors' duty and consequently the Contractor will have to appoint qualified environmental, health and safety consultant and a social development consultant in order to ensure compliance with the ESMPs during the rehabilitation phase of the project.

The main concerned municipalities will be involved in managing and communicating citizens' potential complaints to the CDR (PIU).

**Figure 7-1 Institutional setup**



### 7.1.1 Training

Despite the institutions' previous experiences in implementing similar projects, institutional capacity development would be beneficial to ensure proper implementation and supervision of the suggested mitigation measures and monitoring program. For instance, human resources can be improved through training and regular follow-up.

In order to ensure safeguard procedures, instruments and monitoring needs of the REP are well understood by the Contractor staff, CDR (i.e. the supervising consultant) will provide trainings. These trainings aim to familiarize the Contractor's staff on the following guidelines and instruments:

- i. World Bank's safeguard policies;
- ii. National environmental regulations (the main social and environmental legal texts listed in the legal section of this ESMP);
- iii. Safeguards planning, management and monitoring requirements of the REP as specified in the ESMP;
- iv. GRM

## 7.2 Mitigation Plans

### 7.2.1 Environmental and Social Mitigation Plans

**Table 7-1 Environmental and Social Management Plan in Rehabilitation Phase**

Source of Impact	Project Activities	Proposed Mitigation Measures	Responsibility	Cost Estimation (USD)
Emission				
<b>Air Emissions/Odors</b>	Generation of dusts, exhaust gases, and odors from pavement reconstruction and others activities	<ul style="list-style-type: none"> <li>• Ensuring maintenance of all construction equipment regularly, at least once a month.</li> <li>• Machinery and equipment should be equipped with air pollution control equipment that should be monitored regularly to ensure its effective operation.</li> <li>• Avoiding idling time of machinery.</li> <li>• Ensuring regular maintenance of vehicles.</li> </ul>	Project Contractors / consultant	Included in the rehabilitation Cost
<b>Acoustic Environment</b>	Construction equipment noise and vibrations, earth manipulating activities from pavement milling and drainage excavations	<ul style="list-style-type: none"> <li>• Applying an appropriate schedule for maintenance activities, for instance from 8 am to 4 pm, in order to avoid any works that may cause noise and vibration during nighttime.</li> <li>• Nighttime activities should be done using noise reducing means or low-noise technologies.</li> <li>• Using vehicles and equipment that meet national standards for noise and vibration.</li> <li>• Regular maintenance of the machinery, equipment, and vehicles should be carried out to prevent excessive noise.</li> <li>• Publishing and registering allowed working time of construction machines with local authorities and ensuring strict compliance with set times.</li> <li>• Restricting the use of noisy machines and/or adopting noise-reducing means (silencers) for construction machines, especially near sensitive areas.</li> </ul>	Project Contractors / consultant	Included in the rehabilitation Cost
<b>Solid Waste and Wastewater Generation</b>	Generation of rehabilitation wastes and domestic-like wastes and wastewater	<ul style="list-style-type: none"> <li>• Good site practices including the effective disposal of all wastes generated on-site should be adopted.</li> <li>• The generated waste onsite should be properly segregated at source into recyclables and organic waste in appropriately labelled waste</li> </ul>	Project Contractors / consultant	Included in the rehabilitation Cost

		<p>bins. Sorting at source of domestic and general waste should be implemented.</p> <ul style="list-style-type: none"> <li>• Sufficient waste disposal points must be provided and regular collection for disposal must take place near the road.</li> <li>• Adequate bins for collection and storage of waste material should be provided.</li> <li>• Prevent the overfilling of the waste containers.</li> <li>• Domestic-like waste shall be removed daily from the site and should be collected by either the concerned municipality or the waste collection company (RAMCO).</li> <li>• Excavated soil should be stored and transported offsite to the nearest licensed dumpsite to possible heavy metal contamination.</li> <li>• Any excavated unsuitable material should be removed from site within 24 hours. Reuse of contaminated soil material is prohibited and random disposal of this material in open abandoned areas is never allowed.</li> <li>• In case of linking the porta cabin toilet to a polyethylene storage tank, the following should be done:             <ul style="list-style-type: none"> <li>○ A specialized Contractor should be selected to periodically collect the wastewater from the polyethylene tank.</li> <li>○ The supervising consultant should inspect it regularly to check for any leakages and to ensure that the generated wastewater is properly collected before it's full.</li> </ul> </li> </ul>		
<b>Accidental Releases</b>	Accidental spills of construction materials, and storm water runoff	<p>Control of Accidental Spills</p> <ul style="list-style-type: none"> <li>• All refueling and maintenance operations shall take place off-site, vehicles should be fueled up before arriving to the road section</li> <li>• A spill response plan shall be in place and all workers should be trained on its implementation.</li> </ul> <p>Control of Storm Water Runoff</p> <ul style="list-style-type: none"> <li>• In case of temporary storage of excavated materials, accidental contamination or spills of the removed soil should be avoided to limit contamination of storm water runoff and in turn the surrounding streams.</li> </ul>	Project Contractors / consultant	Included in the rehabilitation Cost

		<ul style="list-style-type: none"> <li>Any stockpiled construction material should be covered with an impermeable layer to avoid contamination of storm water runoff.</li> </ul>		
<b>Soil Manipulation</b>	Soil erosion and sedimentation from drainage or sidewalks excavations	<ul style="list-style-type: none"> <li>Installation of retaining walls before starting with drainage ditch excavations to block soil erosion</li> <li>Excavations for drainage channels should be carried out in complete precision</li> <li>Placement of geotextile silt traps as appropriate, especially in areas close to water bodies, knowing that Aley R1a, R1b, and R1c are in close proximity to nearby streams that discharge into Damour and Ghadir Rivers.</li> </ul>	Project Contractors / consultant	Included in the rehabilitation Cost
<b>Existing Infrastructure</b>	Interference of pavement drilling and milling with infrastructure	<ul style="list-style-type: none"> <li>Prepare procedures for rapid notification to the concerned Municipality or public entity and assistance with re-instatement, in the event of any disruption of public utilities.</li> <li>Splitting works into the road segments will be done to ensure quick progression through road while causing minimal disruption to traffic.</li> </ul>	Project Contractors / consultant	Included in the rehabilitation Cost
<b>Resources Consumption</b>	Increase energy demand	<ul style="list-style-type: none"> <li>Ensuring that equipment that are not in use are turned off.</li> <li>Conducting regular maintenance and efficient operation of machinery.</li> <li>Vehicles should not be allowed to remain idle for long periods.</li> </ul>	Project Contractors / consultant	Included in the rehabilitation Cost
<b>Biological Resources</b>	Changes in natural habitat and biodiversity	<ul style="list-style-type: none"> <li>A waste management plan must be adopted to avoid contaminating the soil and water and hence affecting the local biota;</li> <li>Workers should be instructed to protect flora and fauna when feasible as well as their habitats;</li> <li>Washing of vehicles and machinery should be done offsite and away from particular biotopes (wooded lands and riparian ecosystems namely along Aley R1a, R1b and R1c)</li> <li>Solid waste, rehabilitation debris should not be dumped into the natural habitats that are adjacent to the roads (namely the pine forest in Aazouniyeh, the maquis ecosystems along Aley R1c, and the riparian habitats where Aley R1b intersects with Ghadir River and Aley R1c intersects with Damour River);</li> <li>Restricting the use of noisy machines and/or adopting noise-reducing means (silencers) for rehabilitation machines.</li> <li>Water spraying must be done frequently in order to avoid dust accumulation on adjacent vegetation (agricultural terraces along Aley R1b, R1c section 2, R1d)</li> </ul>	Project Contractors / consultant	Included in the rehabilitation Cost

		<ul style="list-style-type: none"> <li>• Green lights are recommended near wooded lands (if additional lighting is deemed necessary during the rehabilitation phase)</li> <li>• Road cross-section must be fixed during the rehabilitation phase to reduce the impact on biodiversity, for example, by flattening side slopes. This makes crossing easier for animals that find roads a physical barrier (WB). Also, providing longer sight lines for drivers is recommended as it can reduce collisions with animals by allowing more reaction time.</li> <li>• Rehabilitation activities for Aley R1a can be avoided during the two migration seasons for birds (generally, early-September late May, mid Mars-early May) in order to prevent disturbing passenger birds</li> </ul>		
<b>Visual intrusion</b>	Day time and night time rehabilitation works	<ul style="list-style-type: none"> <li>• Covering of temporary stockpiled excavations on the side of the road</li> <li>• Ensuring that the light source is the minimum intensity for the required purpose;</li> <li>• Ensuring that lights are turned off by timer or manually when they are not needed;</li> <li>• Ensuring that fittings are chosen that direct light accurately to where it is needed;</li> <li>• Ensuring that the type of light chosen is the least likely to cause light pollution;</li> </ul>	Project Contractors / consultant	Included in the rehabilitation Cost
<b>Social Risks</b>	<ul style="list-style-type: none"> <li>• Potential labor influx and Labor-induced SH and SEA</li> <li>• Workers tension (Syrian/Lebanese ratio)</li> <li>• Child labor</li> <li>• Inadequate labor conditions</li> <li>• Traffic disturbance</li> <li>• Obstruction of Access Routes to Sensitive Receptors</li> </ul>	<p><b>Socio-Economic Conditions of Surrounding Communities</b></p> <p><u>Traffic Disturbance and Nuisance</u></p> <ul style="list-style-type: none"> <li>• Full coordination with the Municipality before and during the rehabilitation to avoid/minimize any potential impact</li> <li>• Adequate warning, signing, delineation and channeling at least 500 m down and up-gradient from the rehabilitation site must be provided by the project proponents.</li> <li>• Movement of delivery vehicles outside the site should be restricted to off-peak traffic hours.</li> <li>• Speed limitation signs should be installed at the access points.</li> <li>• Full road closures won't be done as all closures will be of partial nature; detours will comprise of merely temporary diversions. In this context, the Contractor has to prepare rehabilitation methods and program of work taking into consideration safety and non-stop traffic</li> </ul>	Project Contractors / consultant	Included in the rehabilitation Cost

		<p>along the road (refer to Annex 3)</p> <ul style="list-style-type: none"> <li>• Commencement of works should not be allowed prior to placing all the required temporary signs, traffic lights, flagmen, etc... wherever and whenever required. Typical signs used are those that indicate the presence of a diversion ahead, the end of diversion, in addition to signs indicating there are works ahead, among others.</li> <li>• The Contractor has to ensure access diversions for traffic at each stage of work and to provide all necessary requirements to facilitate the continuity of traffic circulation.</li> <li>• Ensure the availability of external GRM</li> </ul> <p><u>Potential Labor Influx and Labor Induced SEA</u></p> <ul style="list-style-type: none"> <li>• Providing workers with the necessary training and awareness raising session on issues regarding SEA, prior to signing the CoC</li> <li>• Obliging employees to attend an induction training course prior to commencing work on site to ensure they are familiar with the company's commitments to address GBV, in specific, SEA and the project's CoC.</li> <li>• Repeating training and awareness raising on a regular basis as new staff commence work on the project.</li> <li>• Informing laborers regarding national laws that prosecute perpetrators of SEA</li> <li>• Providing CoC in a language understood by the workers who will sign the CoC.</li> <li>• Ensuring requirements in CoCs are clearly understood by those signing it.</li> <li>• Ensuring that sanctions embodied in the CoC are be clearly explained.</li> <li>• Ensuring that workers at the rehabilitation site sign the Code of Conduct (CoC) (refer to Annex 4) that targets GBV risks, specifically SEA induced by labor influx, and penalizes the perpetrators of SEA.</li> <li>• Verifying that GRM is adequately implemented to record complaints from the surrounding communities, to find adequate resolutions and implement corrective actions.</li> <li>• Ensure the availability of a GRM with multiple channels to initiate a</li> </ul>		
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		<p>GBV complaint, which ensures confidential reporting with safe and ethical documenting of GBV cases, including SEA and SH.</p> <p><u>Obstruction of Access Routes to Sensitive Receptors</u></p> <ul style="list-style-type: none"> <li>• In order to minimize the temporary obstruction of access routes to residential units, schools, places of worship and hospitals, the Contractor should ensure adequate and timely communication with the concerned municipalities and dissemination of project-related work schedule with the surrounding community.</li> <li>• Inform nearby communities including the shops' owners, worship places and the schools ahead of time about rehabilitation date prior to the commencement of works.</li> <li>• The rehabilitation works should not be performed during peak traffic hours (e.g. works can take place when students are already at school) and during the work hours of the surrounding commercial and retail shops.</li> <li>• It is preferable to perform some of the works that are not noisy at night to ensure that access to surrounding schools and residential areas is not hindered.</li> <li>• During rehabilitation of long roads, the Contractor should work on one small segment at a time, to avoid disturbance of the surrounding sensitive receptors for a long period of time.</li> <li>• Maintain a passing corridor within the alignment to grant access to nearby properties</li> <li>• Ensure that access to small shops, worship places and schools is not blocked by installing wooden boards</li> <li>• Proper installation of sign boards in culturally appropriate languages and written in clear and understandable manner</li> <li>• Timely completion of the rehabilitation phase</li> </ul> <p><b>Socio-Economic Conditions of Labor</b></p> <p><u>Labor Induced SH</u></p>		
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		<ul style="list-style-type: none"> <li>• Laborers should be provided with training sessions and awareness campaigns on SH</li> <li>• CoC should be enforced to project laborers (in a language understood by all workers).</li> <li>• The Contractor should ensure that CoC requirements and sanctions to be applied, if breached, are well understood by signatories, prior to signing the CoC.</li> <li>• The Contractor should ensure that a proper GRM with anonymous channel for the sake of confidentiality of the identity of GBV survivors is established to address any kind of violations to the signed CoC.</li> </ul> <p><u>Child Labor</u></p> <ul style="list-style-type: none"> <li>• The project should closely monitor the risk of child labor and should have measures in contracts to ensure that those below the working age are not hired and ensure that labor law of Lebanon is followed.</li> <li>• Labor registry and age verification must be maintained during the whole rehabilitation phase.</li> <li>• Penalty provisions should be available for hiring child labor.</li> <li>• During the employment procedure, the Contractor or sub-Contractor should abide by the Lebanese Law No.0 dated 1946.</li> </ul> <p><u>Inadequate Labor Conditions</u></p> <ul style="list-style-type: none"> <li>• Safety and protection of workers should be ensured within the contracts provided by the Contractor</li> <li>• Continuous monitoring is required to maintain adequate labor conditions.</li> <li>• Appropriate rules and regulations should be implemented in order to ensure the protection of laborers.</li> <li>• Contractors should be forced to abide by the specified Lebanese law determining the minimum wage and minimum working age for children.</li> <li>• Contractor must comply with Decision 29/1 dated 2018 which</li> </ul>		
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		<p>restricts significant number of jobs to Lebanese only and allows Syrians to occupy jobs that are not restricted to Lebanese.</p> <p><u>Social tensions and conflict over job-sharing and dissatisfaction with allocation of project-generated jobs.</u></p> <ul style="list-style-type: none"> <li>• Clear criteria for job selection and allocation should be adopted accounting for the ratio of Syrian and Lebanese community workers in Aley Caza and types of positions available.</li> <li>• It is important to avoid competition between Syrian workforce willing to accept lower wages and skilled Lebanese labor.</li> <li>• The Contractor should ensure a fair allocation of job opportunities, and most importantly non-discrimination and fair treatment should be ensured among workers (such as equal contractual wages/benefits and working conditions) should be also ensured among workers).</li> <li>• Clear communication with all affected workers and a robust GRM that is streamlined and multi-channeled are essential to mitigate the potential risk of social tensions or dissatisfaction among Syrian and Lebanese workers.</li> </ul> <p><u>Under-participation or underemployment or discrimination of women</u></p> <ul style="list-style-type: none"> <li>• Setting minimum percentage of women at the employment phase.</li> <li>• The project should ensure that gender equality is attained when it comes to recruitment, salary levels and others</li> <li>• Promoting the employment of females in appropriate jobs such as managerial or administrative positions and giving the opportunity to women to decide the suitable operations that they can perform</li> <li>• Encouraging women through awareness campaigns on the importance of employment in such project in order to enhance their livelihoods.</li> </ul>		
<b>Occupational Health and Safety Hazards</b>	Rehabilitation activities	<p>Specific measures according to WBG (2007) to limit impacts due to the open nature of rehabilitation sites and their proximity to the community include:</p> <ul style="list-style-type: none"> <li>• Measures to prevent unauthorized access to dangerous areas should be</li> </ul>	Project Contractors / consultant	Included in the rehabilitation Cost

		<p>in place</p> <ul style="list-style-type: none"> <li>• Openings should be sealed by gates or removable chains</li> <li>• Fall prevention and protection measures should be implemented, such as the installation of guardrails with mid-rails and toe boards at the edge of any fall hazard area</li> <li>• Signage should be in accordance with international standards and be well known to, and easily understood by workers, visitors and the general public as appropriate</li> <li>• Marking all energized electrical devices and lines with warning signs</li> <li>• Establishing rights-of-way, site speed limits, vehicle inspection requirements, operating rules and procedures, and control of traffic patterns or direction</li> </ul> <p><i>Training of Personnel</i></p> <p>The following trainings should be implemented (Muiruri &amp; Mulinge, 2014):</p> <ul style="list-style-type: none"> <li>• Ensure that all workers are given proper site-specific instructions on occupational health and safety prior to commencing work.</li> <li>• The Occupational Health and Safety training should consist of hazard awareness and control measures.</li> <li>• The training should ensure proper usage of personal protective equipment (PPE).</li> <li>• The trainees should acquire knowledge of emergency procedures and preventive actions.</li> <li>• Refresher training should be provided periodically, if skills are not frequently used.</li> </ul> <p><i>Noise Emissions</i></p> <p>According to WBG (2007), the following should be implemented:</p> <ul style="list-style-type: none"> <li>• Employees should not be exposed to a noise level greater than 85 dB (A) for a duration of more than 8 hours per day without hearing protection.</li> </ul>		
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		<ul style="list-style-type: none"> <li>• Another way of protection can be achieved through limiting the duration of noise exposure. For instance, for every 3 dB (A) increase in sound levels, the allowed exposure period should be reduced by 50 percent.</li> <li>• Periodic medical hearing checks should be performed on employees who are exposed to high noise levels.</li> </ul> <p><i>Health and Safety Signs</i></p> <p>Examples of signs that must be present at the rehabilitation site include but are not limited to the following (DOLIDAR, 2017):</p> <ul style="list-style-type: none"> <li>• Wear safety helmets and reflective jackets</li> <li>• Permit to work areas</li> <li>• Falling Hazard, Use safety belt</li> <li>• Watch for moving equipment</li> <li>• Wear safety footwear</li> <li>• Wear hearing protection</li> <li>• Wear eye protection</li> <li>• First aid</li> <li>• Danger of electricity</li> <li>• No smoking</li> <li>• Work in progress</li> <li>• Stop and go</li> </ul> <p><i>First Aid and Injuries</i></p> <p>The availability of first aid kits and the adoption of the following recommendations is essential in order to respond quickly and efficiently to any accident or injury:</p> <ul style="list-style-type: none"> <li>• At least one laborer per each group of workers onsite should be appointed to respond to emergency cases, on condition that adequate first aid training is provided.</li> <li>• One employee for every 25 employees on site should be trained in first aid. The assigned personnel should be provided with appropriate</li> </ul>		
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		<p>identification, including a red hard hat with a white "red cross" symbol and an identification badge (CDR, 2007).</p> <ul style="list-style-type: none"> <li>• All workers onsite should know where the first aid facilities are located and how to adequately use first aid kits.</li> <li>• A full list of nearby hospitals, medical centers and emergency contact numbers should be provided to workers onsite.</li> <li>• All injuries or accidents at the rehabilitation site should be reported immediately and the Contractor should maintain and keep a record of accidents or illnesses.</li> <li>• Turning off or disconnecting machinery with exposed moving parts.</li> <li>• Marking all energized electrical devices and lines with warning signs.</li> <li>• Checking all electrical cords, cables and hand power tools for frayed and exposed cords and following manufacture recommendations for maximum permitted operational voltage.</li> <li>• Use mechanical assists to eliminate or reduce exertions required to lift heavy material, hold tools and work objects.</li> </ul> <p><i>Personal Protective Equipment (PPE)</i></p> <p>Proper use of PPEs is essential to limit the occurrence of occupational hazards. Accordingly, the following should be implemented (DOLIDAR, 2017):</p> <ul style="list-style-type: none"> <li>• An adequate supply of suitable personnel protective equipment (PPE) such as hard hats, safety boots, reflective jackets, and others should be maintained.</li> <li>• The PPEs (specifically hard hat and reflective jacket) provided to managers and safety officers should have a different color than the PPEs of the rehabilitation workers onsite.</li> <li>• Ensure that workers wear PPEs all the time during working hours.</li> </ul> <p>The following PPE should be used when handling and working with asphalt (NIOSH, 2003):</p> <ul style="list-style-type: none"> <li>• Wearing thermally-insulated gloves to keep asphalt from burning or irritating the skin.</li> </ul>		
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		<ul style="list-style-type: none"> <li>• Wearing long-sleeve shirts and long pants without cuffs and keeping the sleeves rolled down and close to the collar.</li> <li>• Wearing Steel-toed safety shoes.</li> <li>• Wearing a face shield, not just safety glasses.</li> </ul> <p>The following mitigation measures should be adopted by labor when handling and working with asphalt (NIOSH, 2003):</p> <ul style="list-style-type: none"> <li>• Never stick your head in an asphalt tank or mixing container.</li> <li>• Never lean over a kettle. Stay upwind from asphalt if possible.</li> <li>• Enclosing mixing and stirring operations.</li> <li>• Stop what you're doing if you notice symptoms. Ask your foreman for advice.</li> <li>• Keep asphalt off your skin and out of your eyes.</li> <li>• If you do get asphalt in your eyes, flush with water for 15 minutes.</li> <li>• Eating, drinking and smoking are prohibited during any asphalt activity.</li> </ul>		
<b>Public Health and Safety</b>	Rehabilitation activities	<p><b>Site Layout and Planning</b></p> <ul style="list-style-type: none"> <li>• Designing carefully the rehabilitation site in order to avoid or reduce accidents due to trips, slips, and collisions</li> <li>• Providing roads within the zones being rehabilitated with speed limits signs of 25 km/hr to decrease risks of collisions and accidents.</li> <li>• Restricting access to the zones of unfinished works and providing guards to control entrances and exits.</li> <li>• No work activities are to be conducted without the presence of barriers, temporary traffic lights, and flagmen if necessary, which are required to warn the public of the existing rehabilitation site and its activities</li> </ul> <p><b>Traffic Diversion</b></p> <ul style="list-style-type: none"> <li>• Exact locations and distances of detours are to be set by the Contractor. These points are set according to work progress, location and traffic. As such, general precautionary measures are provided to be considered when selecting the detour. It is important to note that</li> </ul>	Project Contractors / consultant	Included in the rehabilitation Cost

		<p>the project will not use or rent land for the purpose of diversions. Moreover, illustrated detour signage should be displayed around the site as necessary. In addition, the approximate locations of signs are shown on the drawings (Annex 3). Exact locations are to be determined on site upon engineer's approval.</p> <ul style="list-style-type: none"> <li>• The contractor must make informed route choices, thereby avoiding areas with a high risk of erosion or slope instability, or which are particularly sensitive of fuel spills, and to contamination, where feasible.</li> <li>• The Contractor has to ensure access diversions for traffic at each stage of work and to provide all necessary requirements to facilitate the continuity of traffic circulation.</li> <li>• Prior to any works, the Contractor shall submit to the engineer a detailed method statement showing and describing the following:             <ul style="list-style-type: none"> <li>○ The division of the works into phases and sections</li> <li>○ The various traffic diversions related to each phase of the works.</li> <li>○ The temporary diversion of the different services and utilities (avoid continuous disturbance).</li> </ul> </li> <li>• Adequate warning signs and security of the site, namely through barriers, should be provided during non-working hours.</li> <li>• Where the pavement crosses service entrance (houses or shops) which are higher or lower than the pavement edge level, the Contractor has to construct concrete steps as directed by the engineer on site. Steps are constructed wherever the difference in elevation between the entrance and pavement levels are more than 250 mm.</li> <li>• In case where the pavement edge limit crosses a parking or a pedestrian footpath, depressed sidewalk curb shall be applied as shown on drawings (Annex 3) and directed by the engineer.</li> </ul> <p><b>Noise Emissions</b></p> <ul style="list-style-type: none"> <li>• Noise levels should be maintained within the national permissible limits (presented in Table 2-4) and limited to working hours as allowed by obtained permits.</li> </ul>		
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		Transportation of construction material during regular working hours should be minimized, when possible.		
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**Table 7-2 Environmental and Social Management Plan in Operation Phase**

Source of Impact	Project Activities	Mitigation Measures	Residual Impacts	Responsibility	Cost Estimation (USD)
<b>Emission</b>					
<b>Air Emissions</b>	Dust and exhaust emissions	<ul style="list-style-type: none"> <li>• Ensuring maintenance of all construction equipment (e.g. Shovel, steel roller, excavator) regularly, at least once a month.</li> <li>• Machinery and equipment should be equipped with air pollution control equipment that should be monitored regularly to ensure its effective operation.</li> <li>• Avoiding idling time of machinery.</li> <li>• Using dust-suppression methods to reduce emission of particulate matter into the surroundings.</li> <li>• Prohibit dust-generating activities during excessively windy periods.</li> <li>• Vehicle maximum speed limit in work zones should be decreased to 25 km/hr.</li> </ul>	<ul style="list-style-type: none"> <li>• Potential health-related problems</li> <li>• Air quality deterioration</li> </ul>	Project Contractors / consultant	Included in the rehabilitation Cost
<b>Acoustic pollution</b>	Vehicle and equipment noise from maintenance activity	<ul style="list-style-type: none"> <li>• Applying an appropriate schedule for maintenance activities, for instance from 8 am to 4pm, in order to avoid any works that may cause noise and vibration during nighttime</li> <li>• Nighttime activities should be done using noise reducing means or low-noise technologies.</li> </ul>	<ul style="list-style-type: none"> <li>• Health-related problems (i.e. hearing loss, stress, high blood pressure, sleep loss, distraction...)</li> <li>• Wildlife disturbance</li> </ul>	<ul style="list-style-type: none"> <li>• Contractor during the first year</li> <li>• Municipalities and MoPWT after the one-year period</li> </ul>	Secured by responsible party



<p><b>Solid waste and Wastewater Generation</b></p>	<p>Accidental spills and Generated domestic solid waste and wastewater during maintenance</p>	<ul style="list-style-type: none"> <li>• All refueling and maintenance operations shall take place off-site, vehicles should be fueled up before arriving to the road section</li> <li>• A spill response plan shall be in place and all workers should be trained on its implementation.</li> <li>• Provision of adequate bins for collection and storage of waste material including litterbins and waste skips</li> <li>• Preventing the overfilling of the waste containers placed on the road</li> <li>• Proper disposal of any generated wastewater during maintenance activities</li> <li>• Maintain the cleaning of the storm water channels especially before the start of the rainy season and continually remove debris and solid waste in order to prevent the blockage of the drainage system</li> </ul>	<ul style="list-style-type: none"> <li>• Degradation of water and soil quality</li> <li>• Negative implications on public health</li> </ul>	<ul style="list-style-type: none"> <li>• Contractor during the first year</li> <li>• Municipalities and MoPWT after the one-year period</li> </ul>	<p>Secured by responsible party</p>
<p>Depletion of Resources</p>					
<p><b>Biological Resources</b></p>	<p>Light and noise pollution – negative effect on biodiversity (fauna and flora)</p>	<ul style="list-style-type: none"> <li>• When conducting maintenance activities, a waste management plan must be set to avoid contaminating the nearby streams and affecting the local biodiversity. Moreover, restricting the use of noisy machines, especially near sensitive areas (wooded lands along Aley R1a (Aazouniyeh pine forest) and maquis ecosystems along Aley R1c in El-Kamatiyeh and Ain-Rommane), riparian habitats along Aley R1a that intersects with Ghadir river (at station 2+600) and Aley R1c that interests with Damour River (at station 4+683)) and encounters Ain es Sayde and Ain-Rommane (between stations 0+000 and 1+200).</li> <li>• Install silencers to the maintenance machines</li> <li>• Light pollution will increase as lighting poles will be fixed, however, if green lights are to be used, the local fauna will be less disturbed.</li> <li>• Road cross-section must be fixed during the rehabilitation phase to reduce the impact on biodiversity when roads are operational, for example, by flattening side slopes. This makes crossing easier for animals that find roads a physical barrier (WB). Also, providing longer sight lines for drivers is</li> </ul>	<ul style="list-style-type: none"> <li>• Disturbance of the surrounding environment</li> </ul>	<ul style="list-style-type: none"> <li>• Contractor during the first year</li> <li>• Municipalities and MoPWT after the one-year period</li> </ul>	<p>Secured by responsible party</p>

		recommended as it can reduce collisions with animals by allowing more reaction time.			
<b>Resources Consumption</b>	Energy Consumption	<ul style="list-style-type: none"> <li>• Equipment should be turned off when not in use.</li> <li>• Vehicles should not be allowed to remain idle for long periods.</li> <li>• Recording monthly fuel consumption.</li> </ul>	• Exploitation of energy resources	• Project Contractors / consultant	Included in the rehabilitation Cost
<b>Other Impacts</b>					
<b>Health and Safety Hazards</b>	Maintenance related accidents	<ul style="list-style-type: none"> <li>• Ensure that during maintenance all employees utilize appropriate personal protective equipment (e.g. hard hats, steel toe boots, respirators) and are well trained on occupational health and safety.</li> <li>• Ensure public safety by informing local citizens of the maintenance activities to be performed provided through the use of media, public announcements, and signage                             <ul style="list-style-type: none"> <li>• Signage should be in accordance with international standards and be well known to, and easily understood by workers, visitors and the general public as appropriate</li> </ul> </li> <li>• Marking all energized electrical devices and lines with warning signs</li> <li>• Establishing rights-of-way, site speed limits, vehicle inspection requirements, operating rules and procedures, and control of traffic patterns or direction</li> <li>• Ensure that all workers are given proper site-specific instructions on occupational health and safety prior to commencing work.</li> <li>• The Occupational Health and Safety training should consist of hazard awareness and control measures.</li> <li>• The training should ensure proper usage of personal protective equipment (PPE).</li> </ul>	• Health related impacts	<ul style="list-style-type: none"> <li>• Contractor during the first year</li> <li>• Municipalities and MoPWT after the one-year period</li> </ul>	Secured by responsible party

<b>Social</b>	GBV risks and public complaints	<ul style="list-style-type: none"> <li>• Ensure that workers during the maintenance phase sign the CoC that targets GBV risks and penalizes the perpetrators of GBV.</li> <li>• Ensure that GRM mechanism with anonymous nature is functional to receive any public concerns throughout this phase and ensure the confidentiality of the GBV survivors</li> </ul>	<ul style="list-style-type: none"> <li>• Impacts on workers and local community</li> </ul>	<ul style="list-style-type: none"> <li>• Contractor during the first year</li> <li>• Municipalities and MoPWT after the one-year period</li> </ul>	Secured by responsible party
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## 7.3 Monitoring Plan

Environmental and social monitoring is one of the most important parts of an efficient and coherent operation of a project. All environmental and social requirements and restrictions from authorities, project owners and local communities are interlinked and form the primary reference for monitoring and evaluation. In other words, monitoring aims to ensure that all project activities undertaken are environmentally and socially sound, while considering the mitigation measures discussed in the previous section.

It does so by defining a clear set of measurable indicators in an attempt to properly evaluate the project's performance from both an environmental and a social aspect. These indicators, also known as Key Performance Indicators (KPIs), can then be used to assess the project's implementation in a timely manner. Consequently, they assist in the early detection of any deviations from the project's goals. It is important to note that the assessment of all proposed measures is vital to ensure their proper implementation and the optimal operation of the project.

This allows the involved parties to take any corrective measures and limit any unsatisfactory performance if such a case arises. It also allows them to accurately communicate the performance of the project with regulators, the public, or other stakeholders.

Monitoring involves the observation, review, and assessment of onsite activities (including parameters) to ensure adherence to regulatory standards and the suggestions made to lessen negative impacts.

### 7.3.1 Monitoring Plan Implementation

Contractors shall employ qualified environmental and health officers/inspectors responsible for monitoring project activities. Their aim is to ensure that the proposed activities, including the suggested mitigation measures, are properly implemented during the rehabilitation phase. The relevant ministries would also be expected to follow up, if deemed necessary, on the proper implementation and abidance by the relevant laws and regulations.

Monitoring during the operational phase is mainly the responsibility of CDR and any concerned local authorities, namely the relevant municipalities.

The KPIs for this project are listed in Table 7-3.

**Table 7-3 Key performance indicators for the monitoring plan**

Parameter	Standard/Indicator	Phase
Air quality	Lebanese Stack Emission Standards Lebanese Exhaust Emissions Standards for Vehicles	Rehabilitation and post rehabilitation phase
Occupational health and safety	Number of accidents and working days lost Health and Safety Guidelines Compliance with Lebanese Labor Law	
Public safety	Number of accidents involving public safety	
Noise levels	Lebanese Noise Emission Limits for Outdoor Areas	
Soil and water quality	Compliance with Lebanese Standards for the Discharge of wastewater to sewage network/ surface water	

Others	Labor age, labor wage, percentage of women in labor, work injuries, code of conduct trainings, number of grievances (internal and/or external)	
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The monitoring requirements associated with the management strategies which should be implemented during rehabilitation and operation are outlined in Table 7-4 and 7-5

**Table 7-4 Environmental and Social Monitoring Plan in Rehabilitation Phase**

Impact	Parameters to Monitor	Frequency	Monitoring Location	Monitoring Method	Standard/Guidelines National/International	Institutional Follow-up	Approximate Cost (USD/year)
Air Emissions/GHG/Dust	PM2.5-10, SO <sub>x</sub> , NO <sub>x</sub> , O <sub>3</sub> , CO, Total Suspended Particles (TSP)	Testing once during the project life and weekly inspection	<ul style="list-style-type: none"> <li>Construction vehicles exhaust</li> <li>Around rehabilitation site for dust</li> </ul>	<ul style="list-style-type: none"> <li>Single point sampling (at one quarter the diameter across the stack/source)</li> <li>Visual opacity measurement (smoke inspection)</li> </ul>	Particulate Matter (PM <sub>&lt;10</sub> ) 80 µg/m <sup>3</sup>  Sulfur dioxide (SO <sub>2</sub> ) 120 µg/m <sup>3</sup>  Nitrogen dioxide (NO <sub>2</sub> ) 150 µg/m <sup>3</sup>	CDR	500 per test)
Noise	Noise levels (Lmin, Lmax, and Leq)	Monthly during noisy operation	Around the rehabilitation site, especially near loud machinery and major rehabilitation activities	One sample per location (near sensitive receptors)	Refer to Table 2-7	CDR	Included in rehabilitation Cost
WW Generation	pH, Temperature: max, BOD, COD, Sulfate, Fecal Coliform, Total Coliform, Suspended solids, Oil and grease	Before commencement of work and bi-annually	Sediment trap at downstream assigned for contaminated storm water runoff	Two samples at effluent of chosen sediment trap	pH: 6-9 Temperature: max 30 °C BOD: 25 mg/L COD: 125 mg/L Sulfate: 1 mg/L Fecal Coliform: 0 CFU/100ml Total Coliform: 0CFU/100ml at 37 <sup>0</sup> C Suspended solids: 60 mg/L Oil and grease: 50 mg/L	CDR	600

Impact	Parameters to Monitor	Frequency	Monitoring Location	Monitoring Method	Standard/Guidelines National/International	Institutional Follow-up	Approximate Cost (USD/year)
	Domestic-like wastewater	Daily	Polyethylene storage tank (in case porta cabin toilet is not linked to WW network)	Visual inspection	<ul style="list-style-type: none"> <li>Prohibit leaks from tank</li> <li>Prohibit overfilling of tank</li> </ul>	CDR	Included in rehabilitation Cost
Accidental Releases	Number of spills/leaks (of lubricants, oil, fuel, or other chemicals)	Weekly	Around the rehabilitation site, especially near equipment, material, and storage tanks	Visual inspection	N.A.	CDR	Included in rehabilitation Cost
Energy Resources	Fuel consumption rates	Monthly	At fuel storage tanks area	Respective to fuel consumed	N.A.	CDR	Included in rehabilitation Cost
Biological Resources	Ecological audit for particular biotopes	Weekly	Riparian habitats near water channels and streams	Samples and photos per location and GPS point	N.A.	CDR	Included in rehabilitation Cost
GBV	<ul style="list-style-type: none"> <li>Code of conduct trainings</li> <li>Signed forms</li> <li>Dates of training</li> </ul>	Bi-annually	At training locations	Respective to the amounts of trainings conducted	N.A.	CDR	Included in rehabilitation Cost
	GBV-related internal grievances	Monthly	At each rehabilitation zone	Received complaints and GRM records	N.A.	CDR	Included in rehabilitation Cost
OHS	<ul style="list-style-type: none"> <li>Total number of work injuries</li> <li>OHS-related internal grievances</li> </ul>	Continuously	At each rehabilitation zone	Visual inspection Employee records	N.A.	CDR	Included in rehabilitation Cost

Impact	Parameters to Monitor	Frequency	Monitoring Location	Monitoring Method	Standard/Guidelines National/International	Institutional Follow-up	Approximate Cost (USD/year)
	<ul style="list-style-type: none"> <li>OHS-related trainings</li> </ul>						
	<ul style="list-style-type: none"> <li>Visual field inspections</li> <li>Verbal complaints by workers</li> <li>Ensure use of PPE</li> </ul>	Continuously	Around rehabilitation site and used roads	Continuous visual inspection	N.A.	CDR	Included in rehabilitation Cost
Social Tensions and Conflicts over Job-Sharing	<ul style="list-style-type: none"> <li>Number of related grievances</li> <li>Percentage of workers (based on gender, nationality)</li> </ul>	Monthly	<ul style="list-style-type: none"> <li>Around the rehabilitation sites</li> <li>Employee records</li> </ul>	Received complaints and records	N.A.	CDR	-
Obstructing Access to Amenities	Type, location, and duration of amenity to which access was obstructed	Daily	At rehabilitation sites	Visual inspection	N.A.	CDR	Included in rehabilitation Cost
Working conditions	Labor's wages	Monthly	Laborers' contracts	Workers complaints records Labor law verification	N.A.	CDR	-
Child labor	Labor's age	Monthly	Laborers' records/ files	Labor registry and age verification Labor law verification	N.A.	CDR	-



<b>Impact</b>	<b>Parameters to Monitor</b>	<b>Frequency</b>	<b>Monitoring Location</b>	<b>Monitoring Method</b>	<b>Standard/Guidelines National/International</b>	<b>Institutional Follow-up</b>	<b>Approximate Cost (USD/year)</b>
Underemployment of Women	Percentage of female employees in workforce	Bi-annually	Laborers' records/ files	Labor registry	N.A.	CDR	-
Other Grievances	Internal and external grievance reports	Weekly or upon grievance occurrence	At each rehabilitation zone	Complaints records	N.A.	CDR	Included in rehabilitation Cost
Visual intrusion	Dust pollution (opacity)	Daily	At dust generating activities	Several photographs per location + opacity measurement	N.A.	CDR	Included in rehabilitation Cost
Damage to existing infrastructure	Type, size, and number of damaged infrastructure entities	Daily	Around the rehabilitation site.	Visual inspection	N.A.	CDR	-

**Table 7-5 Environmental and Social Monitoring Plan in Operation Phase**

Impacts	Parameters to Monitor	Frequency	Monitoring Location	Monitoring Method	Standard/Guidelines National/International	Approximate Cost (USD/year)
Noise	Noise levels (Lmin, Lmax, and Leq)	Bi-annually or upon complaints	Along the four concerned roads near sensitive receptors and complainers	One sample per location	Refer to Table 2-7	Included in rehabilitation Cost
WW Generation	Leakages, spillages, improper discharges, etc.	Annually	Upon maintenance routine, at wastewater piping system	Visual Inspection	N.A.	Included in rehabilitation Cost
Social Satisfaction	External complaints or grievances  GRM for workers  Documentation of training and raising awareness for SEA/SH and signing of CoC	Bi-annually or upon complaints	Along the four concerned roads	Received complaints and records	N.A.	Included in rehabilitation Cost
Road Safety	Accidents: number, dates, frequency, and causes	Annually	Along the four concerned roads	Visual inspection (of accident logs containing the mentioned data)	N.A.	Included in rehabilitation Cost
Underemployment of Women	Percentage of female employees in workforce	Bi-annually	Laborers' records/ files	Labor registry	N.A.	Included in rehabilitation Cost
Other Grievances	Internal and external grievance reports	Weekly	At rehabilitation site	Complaints records	N.A.	Included in rehabilitation Cost

Impacts	Parameters to Monitor	Frequency	Monitoring Location	Monitoring Method	Standard/Guidelines National/International	Approximate Cost (USD/year)
Working conditions	Labor's wages	Monthly	Laborers' contracts	Workers complaints records Labor law verification	N.A.	Included in rehabilitation Cost
Child labor	Labor's age	Monthly	Laborers' records	Labor registry and age verification Labor law verification	N.A.	Included in rehabilitation Cost

### **7.3.2 Documentation and Reporting**

Monitoring yields lots of data regarding project performance. As a result, proper documentation is necessary for two reasons: first to prepare and send performance reports to the concerned parties and second to analyze the acquired data and implement changes when necessary. In this context, monitoring reports will take place as described below.

- Contractor's Health and Safety officers submit compliance reports to the Environmental Supervision Consultants on a monthly basis.
- The Environmental Supervision Consultants review and approve Contractor reports and submit them to PIU on a monthly basis.
- PIU submits environmental/social progress as part of their quarterly project progress reports to the WB on a quarterly basis.
- In case of severe incidents (e.g. Fatality on-site), immediate reporting within 24 hours to CDR and within 48 hours to the WB must be done.

### **7.3.3 Guidelines for Health and Safety Plan during Rehabilitation**

An effective Occupational Health and Safety Plan, in line with World Bank guidelines, for rehabilitation be submitted by the Contractor and approved by the appointed supervising Consultant prior commencement of works. The plan should include at least the following components:

- Proper signage in and around the sites (local language to be understood by all);
- Fire response and spill response measures;
- Proper storage and signage of materials including Material Safety Data Sheets;
- Safety measures according to type of equipment;
- Train workers on lifting and material handling techniques;
- Plan work site layout to reduce the need for manual transfer of heavy objects,
- Personal safety equipment;
- Medical services which includes first aid kits;
- Mobile sanitary facilities;
- Safe drinking water in accordance with regulations.

In addition, the plan should also incorporate all of the previously mentioned measures stated in section 6.1.8 which address in great detail OHS and PHS measures. All rehabilitation staff should be trained on the Health & Safety Plan and the specific safety measures related to their own activities.

## 8. Consultation, Disclosure and GRM

### 8.1 Public Consultation

Project-affected groups, mainly municipalities such as Head of union of Municipalities of Aley, Municipal heads (Qamatiyeh, Charoun, Ain el Roummane and Kahale), vice municipal head, Moukhtar (مختار) and representative of other municipalities, in addition to local residents represented by local NGOs such as Jamiyat Al Maraa el Wardiya were consulted on the project's environmental and social aspects (list of attendees is attached in Annex 6).

This ESMP was publicly consulted through a public participation meeting that was arranged for Aley Caza. The public participation meeting was held at Aley Municipality on Thursday July 16, 2020. The consultation was delivered during the spread of COVID-19 which has obliged the public to follow health protection measures including social distancing, mask wearing and practicing hand hygiene using alcohol-based hand rub. . Invitations were sent electronically and they were posted prior time of the consultation at the municipality's billboards. The number of attendees was 18 of which 4 were women, whom represent concerned municipalities and local community. During the meeting, attendees were informed about the project objectives, the identified natural, economic, and social resources of importance in the area, the project's possible environmental and social risks, the planned mitigation measures and Grievance Redress Mechanism (GRM).

Municipalities and local authorities were concerned about the selection of roads within the scope of REP. According to them, there are roads that are in greater need for rehabilitation (e.g. Sofar road that needs retaining wall for safety issues). In this context, the consultant explained that the Government prioritized roads in Aley Caza based on municipalities' official requests beside several technical criteria. Secondly, they asked regarding their main role in this project. In this context, the consultant and the representative of CDR explained the head of municipalities have a main role to inform people about the project and at a later stage, they have a major role in assisting CDR in monitoring any potential violations by the Contractor during the rehabilitation phase. In particular, any violation observed must be reported to CDR. Further, the CDR explained that this ESMP includes a GRM to ensure the management of any project-related complaints. This GRM was communicated to the attendees.

Further, the head of municipalities asked if alternative roads for rehabilitation under the project can be provided. Accordingly, the consultant explained that the project cannot integrate any alternative roads, but they can, however, send their requests in relation to alternative roads to the MoPWT for future projects.

Female attendees were asked separately about their concerns. They were particularly worried about the supervision process. According to them, women must be in the supervision board, as they would best monitor the execution of the ESMP. In this context, CDR ensured to consider employing women during project implementation .

As for NGOs Consultation, this ESMP has targeted them according to their position in Lebanon. They consist of two levels as follows: (1) Local: they are specific to each Caza. Their mission is to address different concerns and issues among the local society including social, economic, gender equality, environment, poverty, women empowerment, etc. and (2)

International: they cover the whole country and their consultation will be applied to all the ESMPs of the REP. When the crisis in Syria erupted in early 2011, numerous International NGOs responded to the humanitarian crisis and worked directly with the Syrians in Lebanon by providing aid and responding to their critical situation.

Invited local NGOs include the Druze Women Association and Al Resalah Association, all of which cover Aley area. As for international NGOs, ACTED, ANERA, and DRC were invited. Out of all invited NGOs, only local NGOs attended the consultation meeting. They shared the same concerns of the rest of the public.

More specifically, invitations were sent by the consultant on behalf of CDR to concerned municipalities and NGOs through official letters, emails and direct phone calls. The invitation letter is attached in Annex 6. Invitations were sent to the concerned parties at least one week before the meeting date.

The consultant shared information with local NGOs Table 8-1 represents the name of Concerned NGOs and their field of activity. Those local NGOs may play a role of advocates to reduce projects' social and environmental risks.

**Table 8-1 List of Contacted Local NGOs**

Organization	Contacts	Activities
Druze Women Association	Kamalia Ballan 71463305	Empowering women Charity projects Development projects
The Al Resalah Association	Amal el Rayes 030658382	Social projects and work in Aley Caza

This ESMP consulted International NGOs (see Table 8-2) to inform them about the Project, disseminate it, ask them to circulate its impacts and activities among Syrian and tell them that they can inquire about additional information and/or submit a complaint (if any) by contacting the Grievance Redress Mechanism (GRM) Unit on 01980096 ext:317 or send an Email to [GRM.REP@cdr.gov.lb](mailto:GRM.REP@cdr.gov.lb) or register by hand an official letter at the CDR .

In Aley Caza, the total number of registered Syrian is 59,920 or 26.8 % of its total population (UN OCHA, 2016). They were contacted through the International NGOs to seek their feedback about the Project. Accordingly, this ESMP did not receive any concern about the Project.

**Table 8-2: Consulted International NGOs and their Activities**

NGO Name	Contacts	Intervention Sector(s)	Comments
ANERA Lebanon	Mrs. Dima Zayat Deputy Country Director T: 01382590 (ext: 105) M: 70051813 E: dzayat@aneralebanon.org	<ul style="list-style-type: none"> <li>• Children &amp; Youth</li> <li>• Development</li> <li>• Education</li> <li>• Relief Services</li> <li>• Water sanitation and hygiene</li> </ul>	Mrs. Zayat received the Project information sheet and explained that recently Anera operations in Lebanon have grown substantially to cope with the Syrian crisis. they have six offices throughout Lebanon. She welcomed the idea of the Project and will

			disseminate it across her organization.
ACTED	Mr. Jack French Deputy Country Director T: 01324331 M: 79160375 E: jack.french@acted.org	<ul style="list-style-type: none"> <li>• Development</li> <li>• Infrastructure &amp; Services Rehabilitation</li> <li>• Labor &amp; Livelihoods</li> <li>• Shelter</li> <li>• Water sanitation and hygiene</li> </ul>	Mr. French received the Project information sheet and explained that ACTED is working with Syrian in Beirut and northern districts of Mount Lebanon (Baabda, Metn, Keserwane and Jbeil), as well as in Akkar District. He welcomed the idea of the Project and will disseminate it across his organization.

## 8.2 Grievance Redress Mechanism (GRM)

The project will include a project-wide streamlined and multi-channeled GRM that will register and address grievances and complaints from individuals and households who are affected by the project. Anonymous grievances will be addressed in both GRMs for communities and workers. The maximum anticipated time needed to close a GRM case is 45 days.

### 8.2.1 GRM for Surrounding Communities

The primary purpose of the GRM will be to provide clear and accountable means for project beneficiaries and affected persons to raise concerns of possible tensions and feelings of exclusion and complaints and seek solutions when they believe they have been harmed by the project. As such, the GRM will allow citizens to directly voice concerns or grievances to the implementing agency and ensure that these concerns are responded to and addressed in a timely manner including beneficiary feedback system.

The key objectives of the GRM are:

- Record, categorize and prioritize the grievances;
- Resolve the grievances via consultation with all stakeholders (and notify those stakeholders of the resolutions)
- Relay any unresolved cases to the relevant authority.

The GRM will be accessible to all relevant stakeholders who can use this mechanism to send their suggestions, concerns and complaints related to the project. The complaints, suggestions and concerns can be sent by email, mail, phone (through a hotline), in person and other means such as a grievance compliant logging sheet where grievances are registered in writing and maintained as a database. The phone number, e-mail address, and address for receiving complaints will be disclosed among the population and will be posted at the rehabilitation sites in Aley Caza, before commencement of project implementation. Moreover, the information on how to access the GRM should be available through billboards, CDR website, etc.

The GRM levels of the project are the following (Figure 8-1):

- Level 1: If any person has any complaint, concern or suggestion regarding the project

implementation, he or she can lodge an oral or written grievance through e-mail (GRM.REP@cdr.gov.lb), phone call or text message (01980096 ext:317), or website link (<http://www.cdr.gov.lb/study/RoadsEmp/RoadsEmp.htm>) to the site engineer or manager of the roads to be rehabilitated in Aley Caza. In case an oral complaint is made, it should be written on paper by the receiving unit. The above issue will be resolved within a maximum duration of one week.

- Level 2: If the person is not satisfied with the action of the site manager's Office, he or she can bring the complaint to the attention of the Environmental and Social Specialist of the PIU for the project through e-mail (rstephan@cdr.gov.lb), phone call or text message (01980096 ext:317), or website link (<http://www.cdr.gov.lb/study/RoadsEmp/RoadsEmp.htm>). The issue shall be resolved within a maximum of two weeks.
- Level 3: If the person is not satisfied with the decision of the Environmental and Social Specialist of PIU, he or she can bring the complaint to the attention of the PIU Director's Office through e-mail (elieh@cdr.gov.lb), phone call or text message (01980096 ext:159), or website link (<http://www.cdr.gov.lb/study/RoadsEmp/RoadsEmp.htm>). Once the PIU Director receives the complaint, it needs to be resolved within a maximum of two weeks.

Meanwhile, it is recommended that the aggrieved party is consulted and be informed of the course of action being taken, and when a result may be expected.

Moreover, reporting of the complaints to the PIU should be done regularly. The designated person at each level should report to the PIU on the number and subject of new complaints received, and the status of the already existing complaints, if any. The report should also inform the PIU of complaints that could not be resolved at the lower levels and are being elevated to the PIU Director's attention. The PIU aggregates information received into a status report each quarter, indicating the number and subject of complaints. The quarterly status report also provides up-to-date information on the number and subject of complaints that have been resolved, and the manner in which they have been resolved. This information will be shared with the Bank.

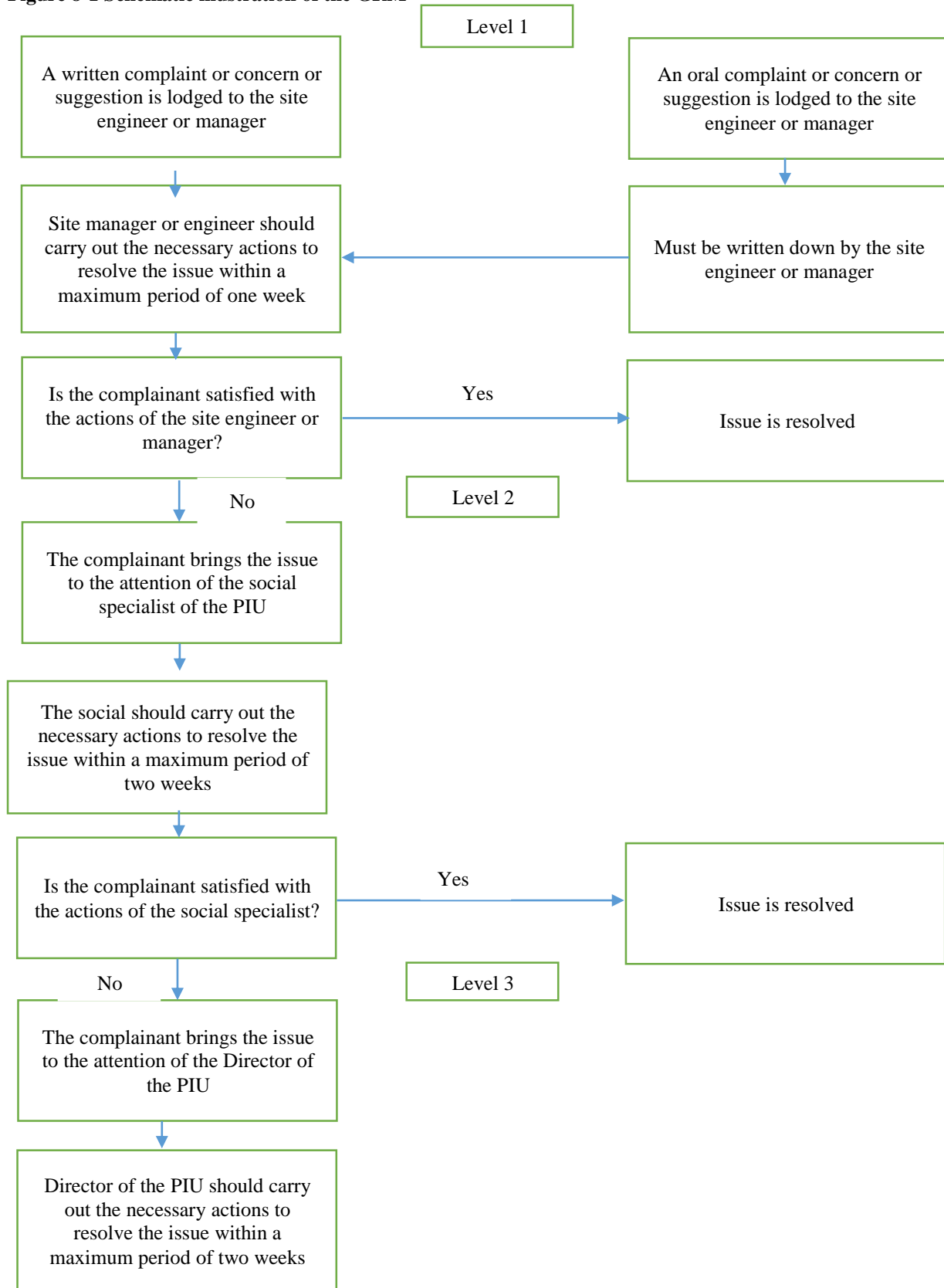
The Complaints Register form (refer to Annex 5) includes the following:

- i) details and nature of the complaint
- ii) the complainant name and their contact details
- iii) date
- iv) Corrective actions taken in response to the complaint.

The GRM does not exclude the formal legal process of the national law. If a grievance remains unresolved following application of the project GRM process, the affected person can initiate legal proceedings in accordance with national law and may have recourse to the Appeals Court as warranted.



**Figure 8-1 Schematic illustration of the GRM**



**8.2.2 GRM for Workers**

Similar to the GRM for surrounding communities, a GRM for internal employees, namely the labors onsite, is also necessary. It aims to allow labors to report any wrongdoings in their favor or important concerns they might have. This internal GRM is similar in nature to the one previously discussed (in terms of accessibility, reporting means, etc...). The only main difference is the contact people for each level. In this context, the first level involves reporting to the health and safety officer of the Contractor and has a duration of one week. The second level involves reporting to the PIU Director and should be resolved within one week. It also follows the Complaints Register form (refer to Annex 5).

## 9. Conclusion

The ESMP identified and assessed the potential environmental and social impacts of REP and consulted relevant stakeholders when preparing the management plan.

In specific, this ESMP report addresses two selected roads for rehabilitation in Aley Caza (Aley R1a, R1c, R1b, and R1d) with a total length of around 20.8 km. The rehabilitation activities include: pavement works, improvement and installation of road surface drainage, construction of retaining walls and installation of safety barriers, marking and signing, and installation and maintenance of lighting poles. The rehabilitation works will involve 128 workers and require a total of 18 months.

Road rehabilitation activities are expected to incur environmental impacts that are similar among both roads. Common environmental impacts include fugitive dust emissions, increase in noise, contamination of water quality, disruption to traffic movement, potential damages to existing utilities, and disturbance of local biodiversity. Once roads are rehabilitated, the project is expected to improve drainage systems (less runoff water), road safety conditions, reduce traffic accidents and traffic congestion, and ultimately enhance livelihood opportunities. On the other hand, the main expected environmental impacts on water and soil could result from maintenance activities if not managed properly within the “**Defects Liability Period**”, during which the Contractor is responsible for maintenance activities.

In this context, the Contractor must implement proper waste and safety plans and all the environmental mitigation measures provided in this ESMP.

A proper management plan was provided for specific concerns regarding the roads in Aley. The plan includes measures to control exhaust emissions, dust and odor emissions, and soil manipulation activities during the rehabilitation phase. Moreover, proper measures and guidelines on the control of accidental spills of construction materials to prevent soil contamination were provided. Regarding biodiversity, although the concerned roads are mainly under anthropogenic influences, Contractors must be careful during the rehabilitation work so that the direct impacts (direct destruction) on ecosystems and associated fauna would be minimal. Waste management plan must be adopted to avoid soil and water contamination that could have irreversible impacts on biodiversity. In other words, rehabilitation debris should not be dumped into the natural habitat (e.g. river, streams and water channels encountered in Aley Caza along the studied roads).

The potential social risks of the project include labor influx, potential risk of labor induced SH towards female workers and SEA towards women in the surrounding community, potential risk of child labor and poor labor conditions, unfair job allocation, underemployment of women, traffic disturbance, and provisional obstruction of access routes to sensitive receptors which is expected to be high for Aley R1a, Aley R1b (some segments are highly populated and bordered by schools and Mosque) and Aley R1c section 1 (section is surrounded by residential and commercial areas and by schools). In this context, the ESMP provided measures to mitigate these risks through periodic monitoring of labor conditions, specific required clauses within contracts that aim to protect workers, and the CoC for GBV issues. In addition, a robust GRM must be clearly communicated to all project-affected persons before and during project implementation.

Moreover, a monitoring plan was set along with defined responsibilities for the operationalization of the ESMP. In other words, the ESMP generated key project environmental and social indicators to monitor project implementation success. It is designed to guarantee effectiveness in the measurement of major project outcomes and outputs based on measurable indicators.

Lastly, a Construction Environmental and Social Management Plan must be prepared once the Contractors are appointed. This CESMP must account as well for the recommendations and guidelines provided within this ESMP to ensure protection of the surrounding environment and the society.

## References

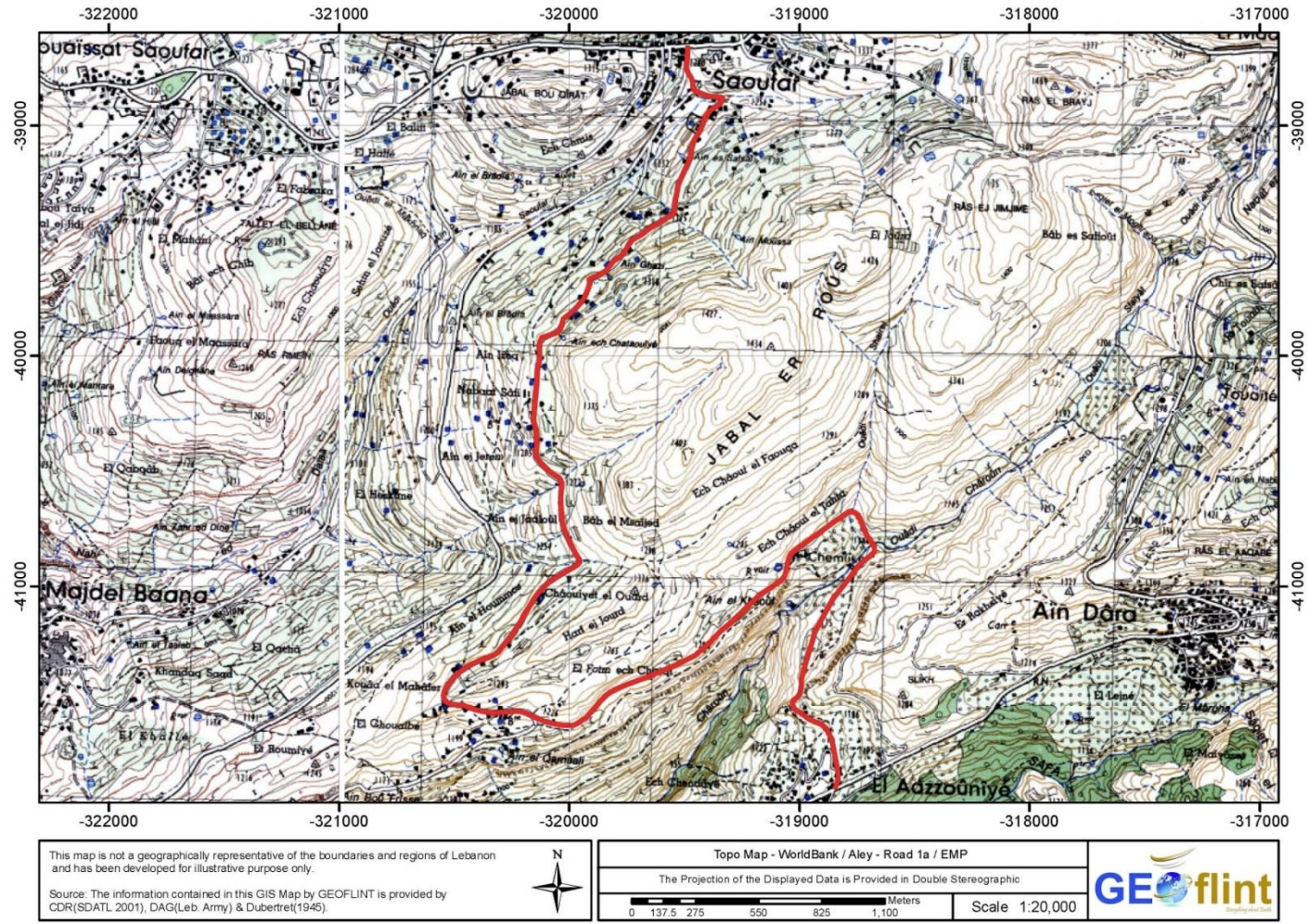
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## **Annex**

### **Annex 1: Figures and Tables Related to Chapter 4**

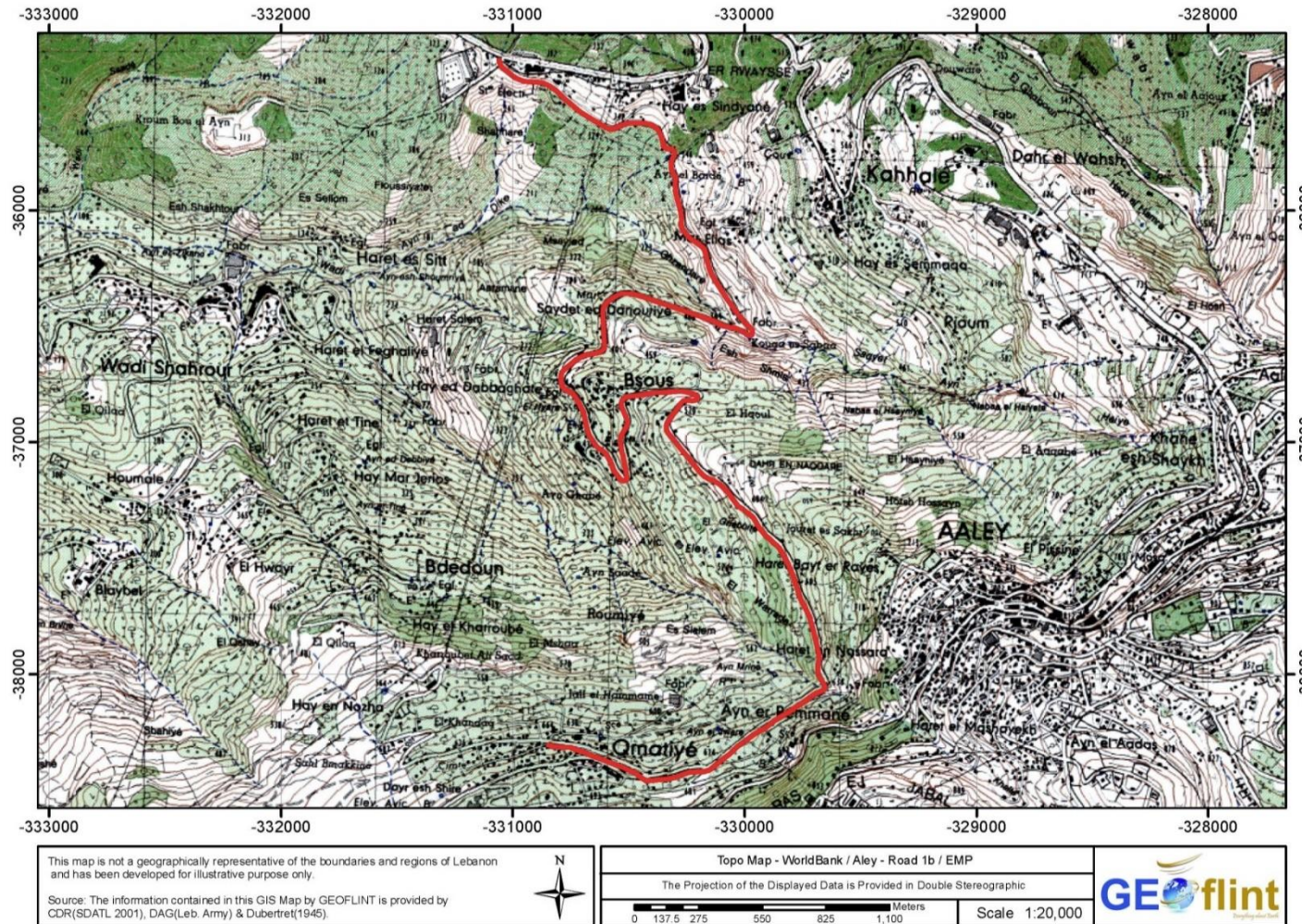
Figure A Elevation contour lines for Aley R1a and its surrounding



Source: CDR, DAG, & Dubertret; processed by Geoflint

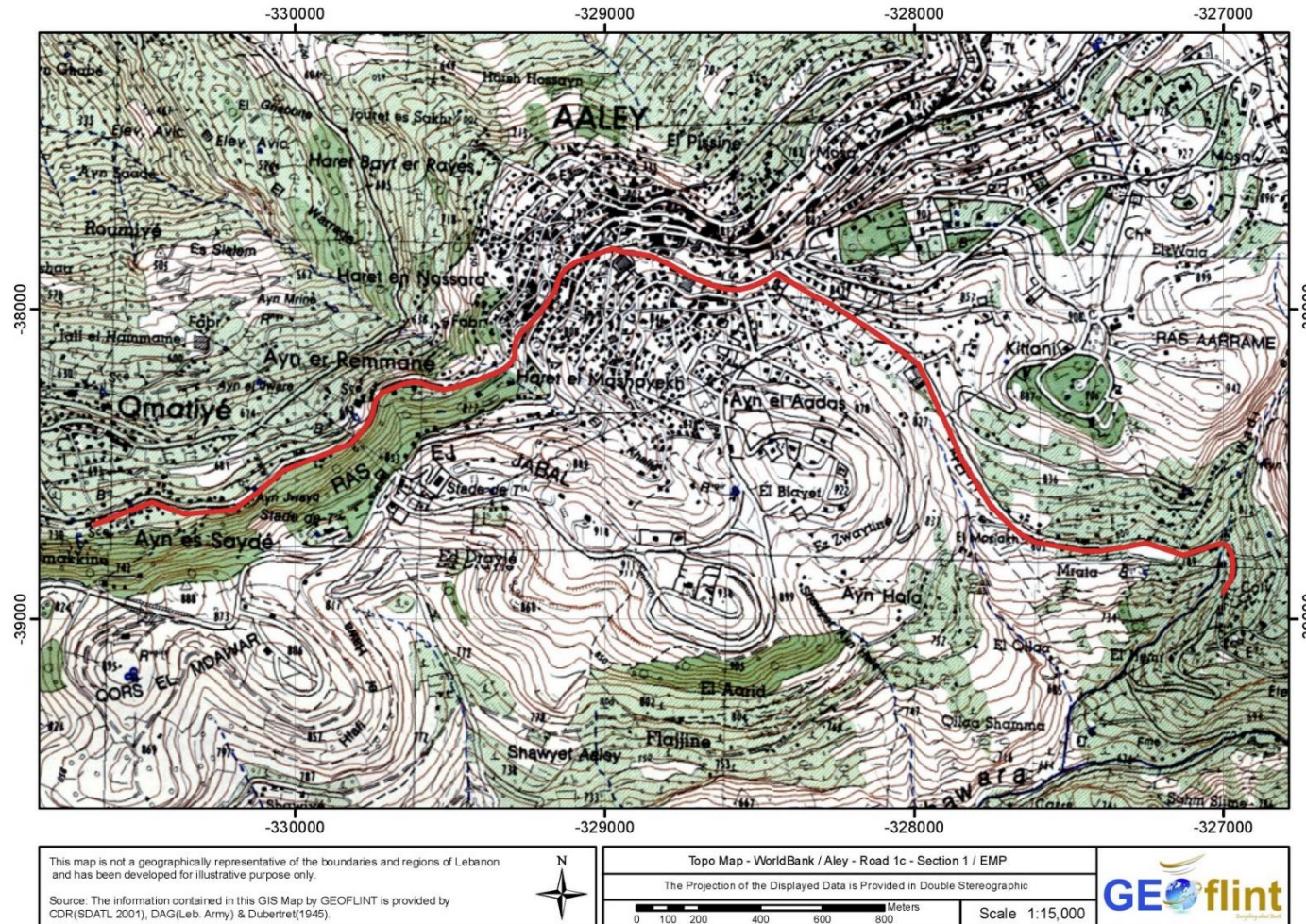


Figure B Elevation contour lines for Aley R1b and its surrounding



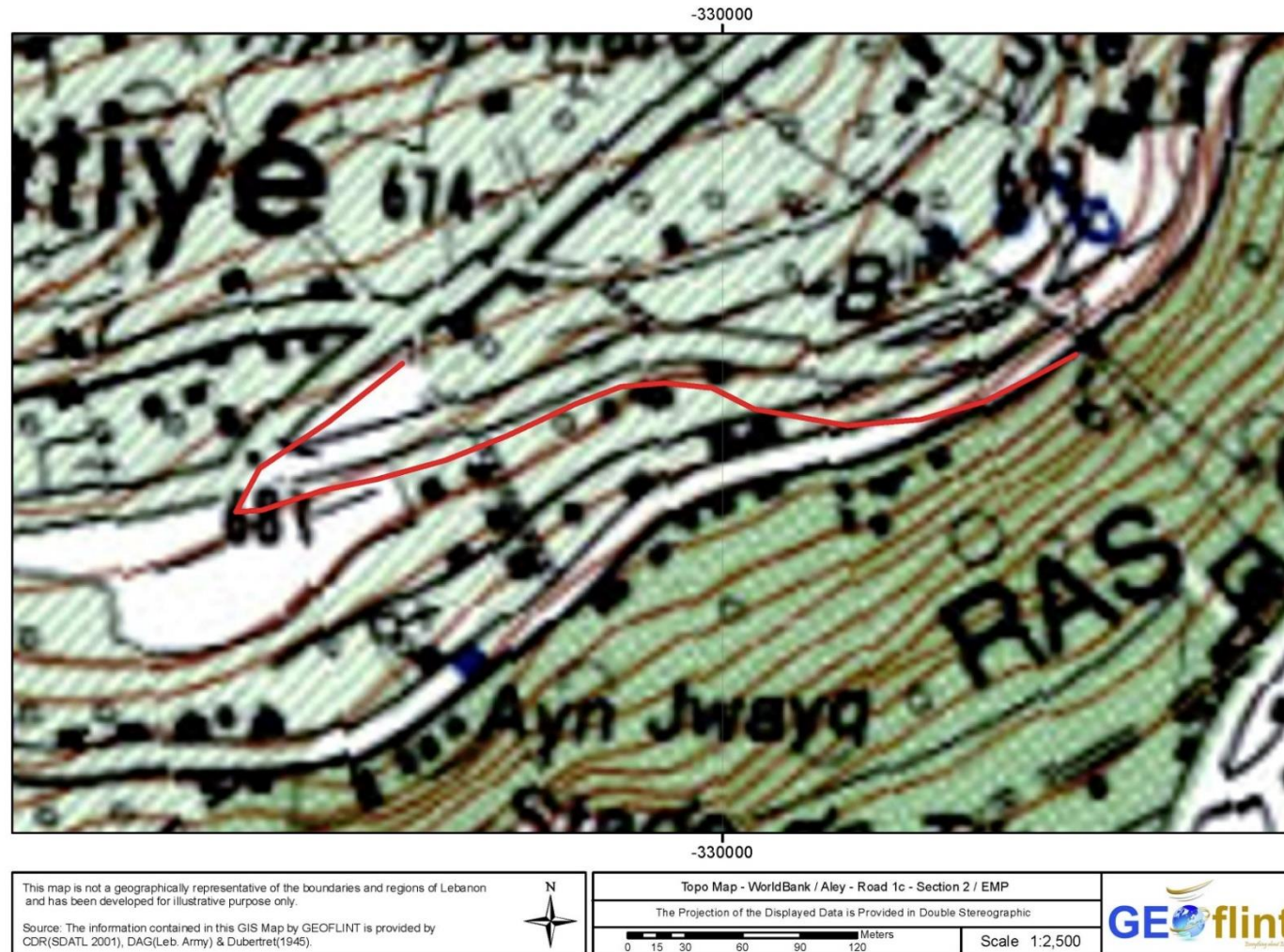
Source: CDR, DAG, & Dubertret; processed by Geoflint

Figure C Elevation contour lines for Aley R1c section 1 and its surrounding



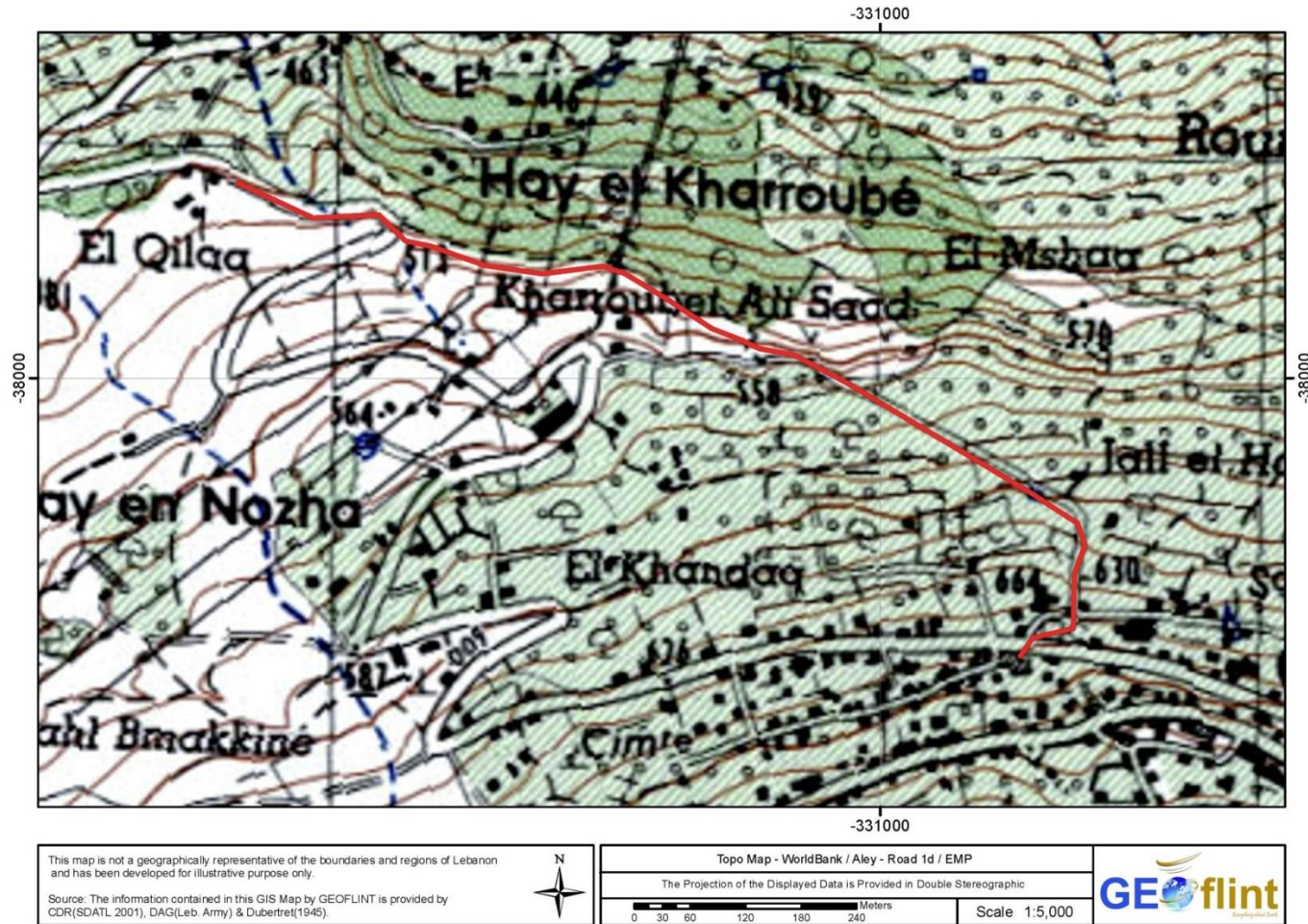
Source: CDR, DAG, & Dubertret; processed by Geoflint

Figure D Elevation contour lines for Aley R1c section 2 and its surrounding



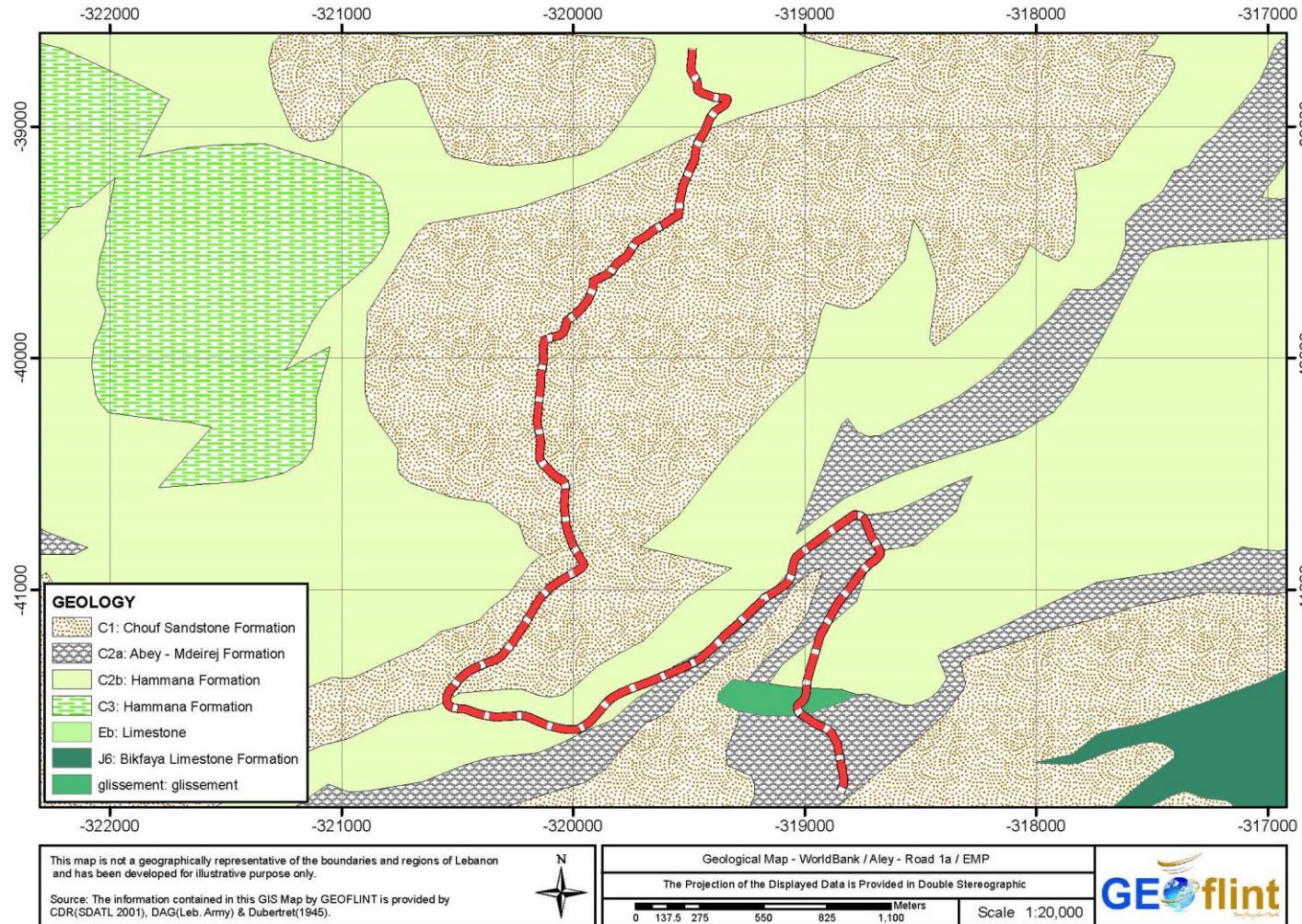
Source: CDR, DAG, & Dubertret; processed by Geoflint

Figure E Elevation contour lines for Aley R1d and its surrounding



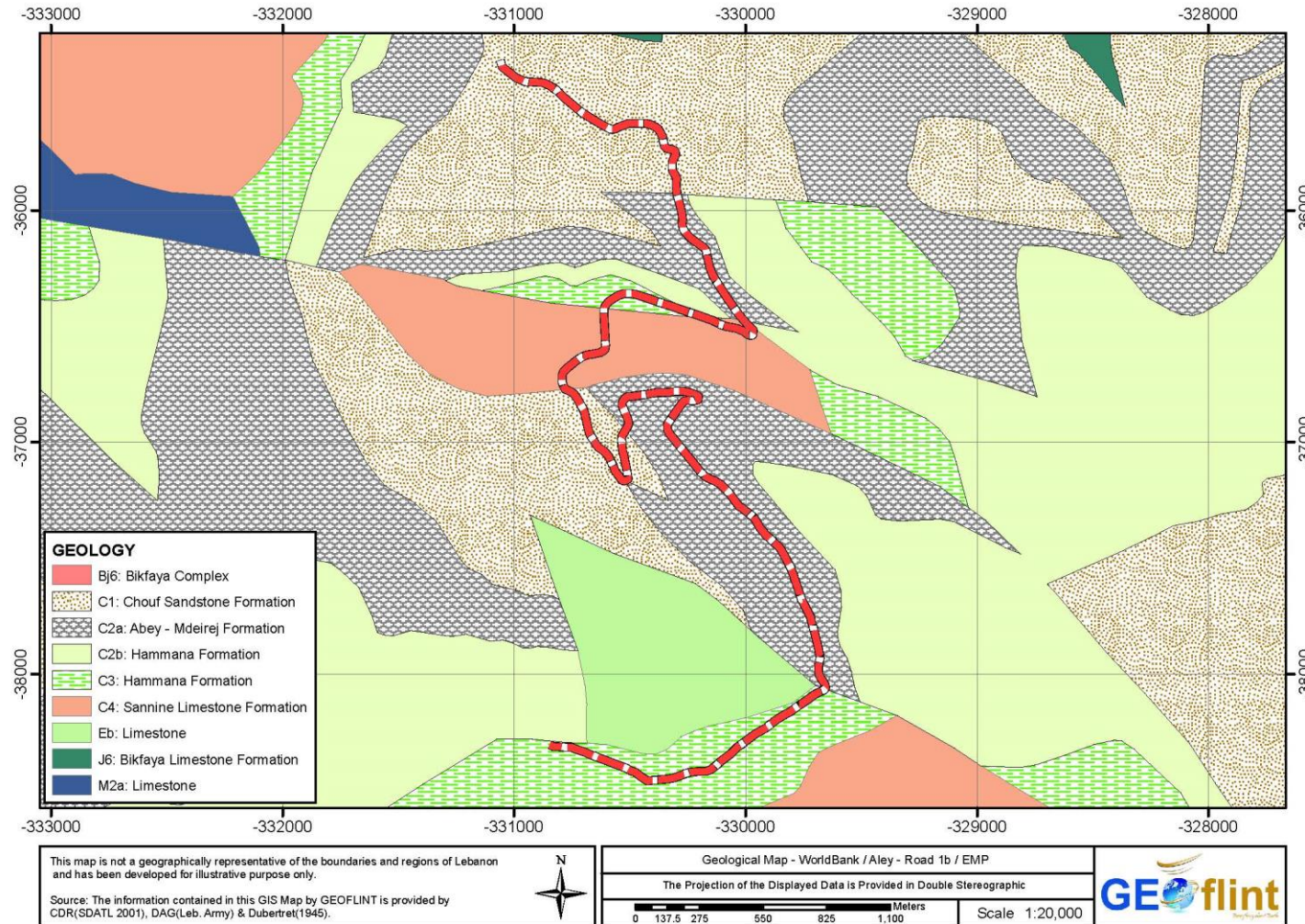
Source: CDR, DAG, & Dubertret; processed by Geoflint

**Figure F General Geological map of Aley R1a and its surrounding (surface outcrops)**



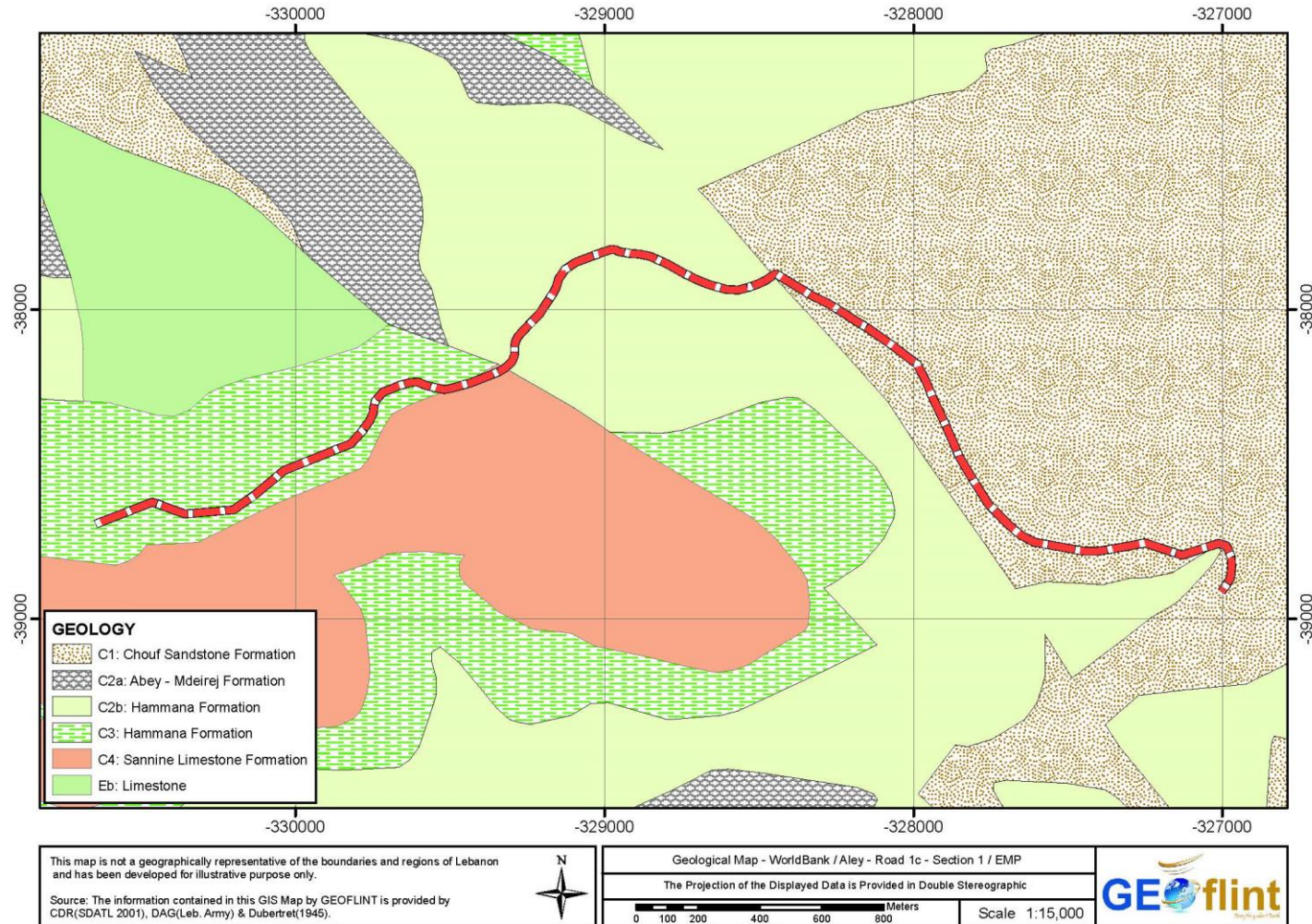
Source: CDR, DAG, & Dubertret; processed by Geoflint

**Figure G General Geological map of Aley R1b and its surrounding (surface outcrops)**



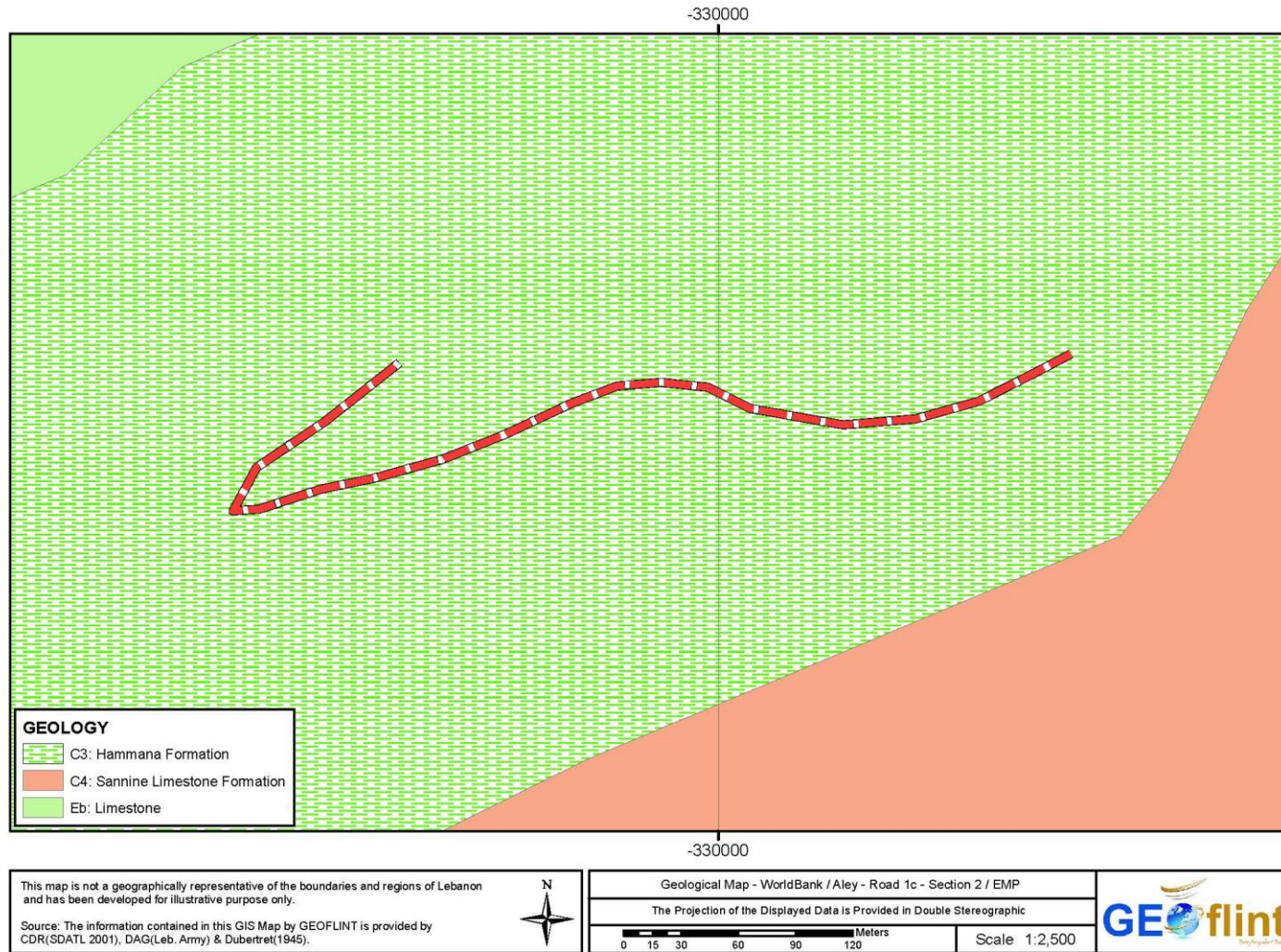
Source: CDR, DAG, & Dubertret; processed by Geoflint

**Figure H General Geological map of Aley R1c section 1 and its surrounding (surface outcrops)**



Source: CDR, DAG, & Dubertret; processed by Geoflint

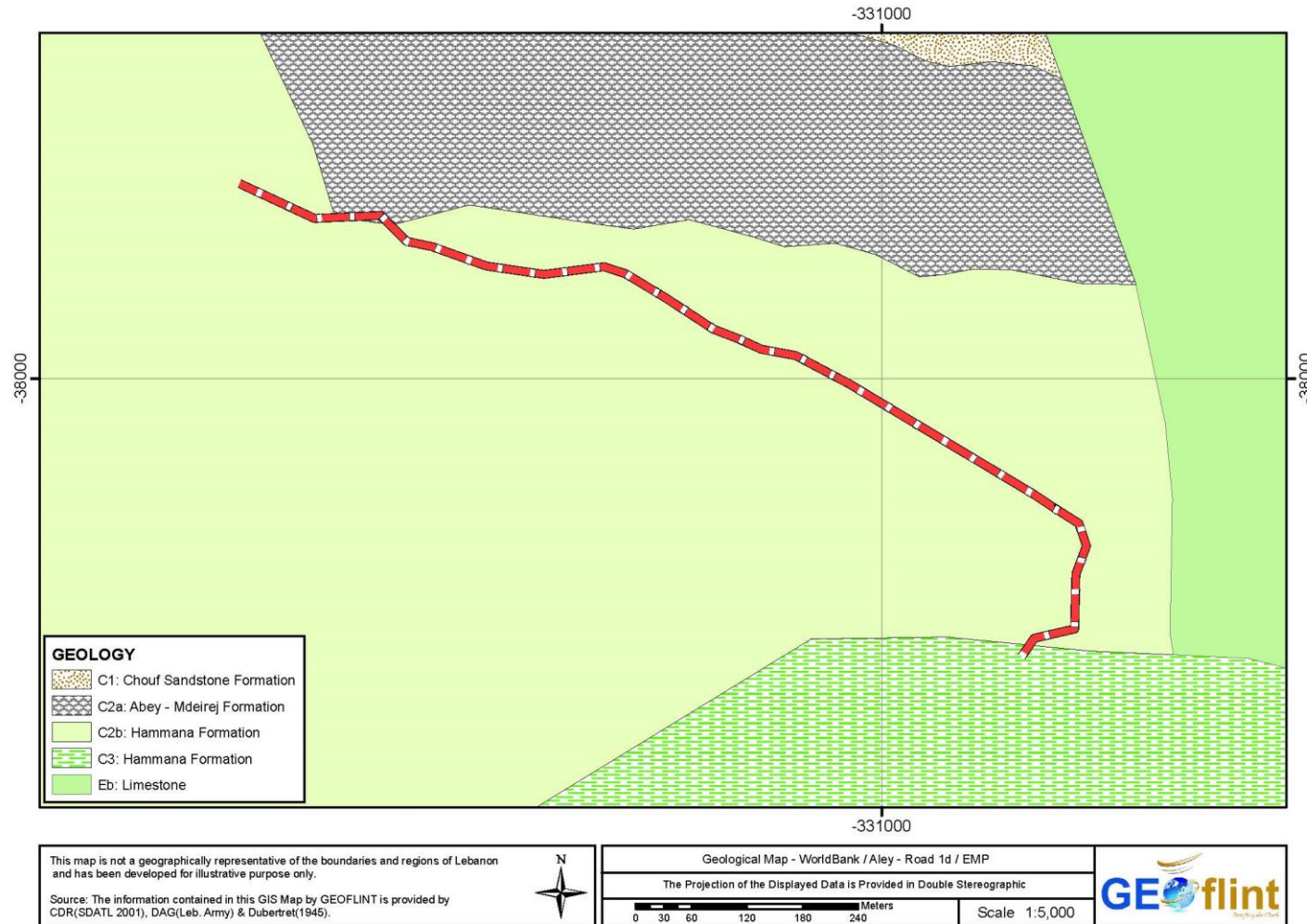
**Figure I General Geological map of Aley R1c section 2 and its surrounding (surface outcrops)**



Source: CDR, DAG, & Dubertret; processed by Geoflint

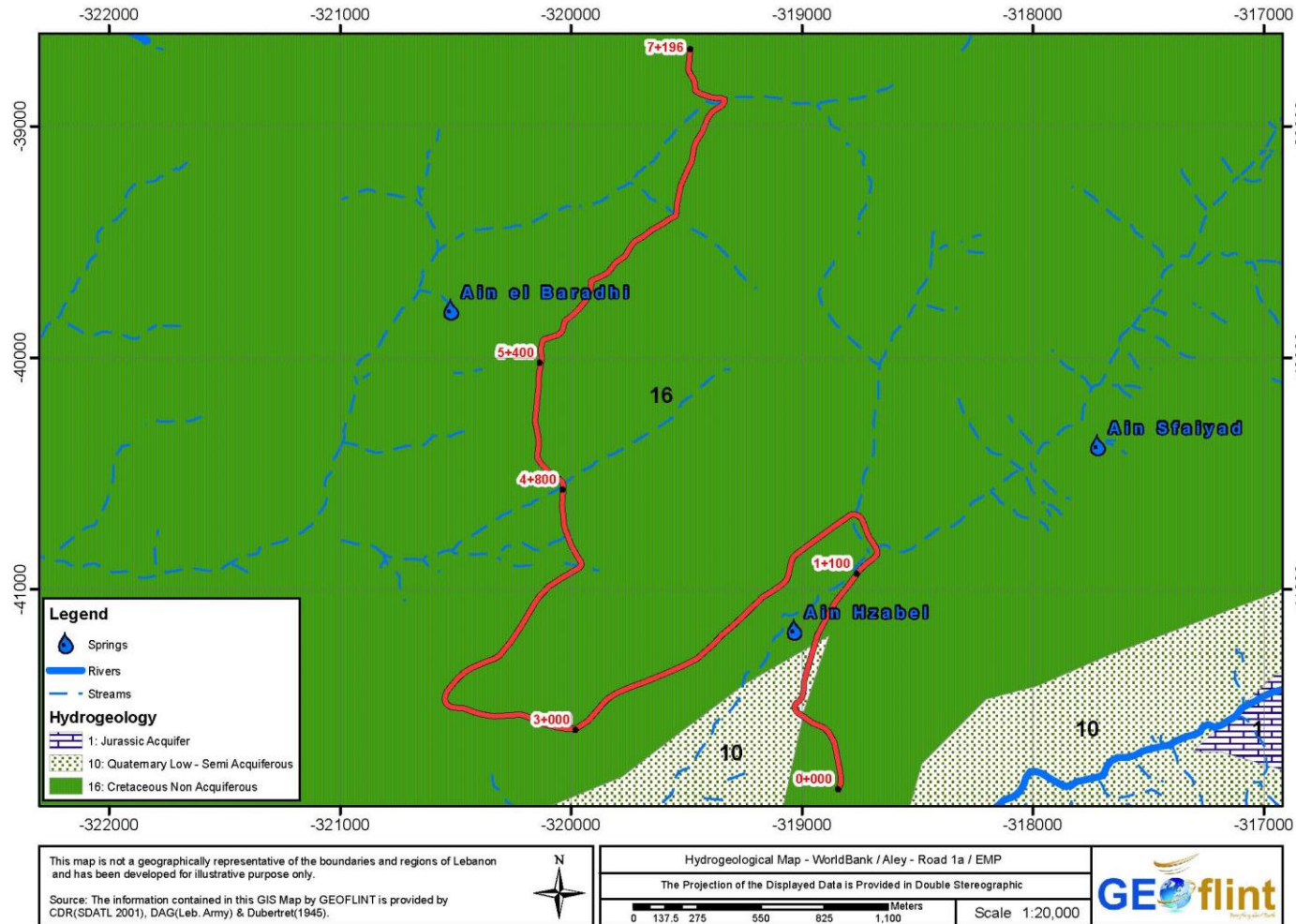


**Figure J General Geological map of Aley R1d and its surrounding (surface outcrops)**



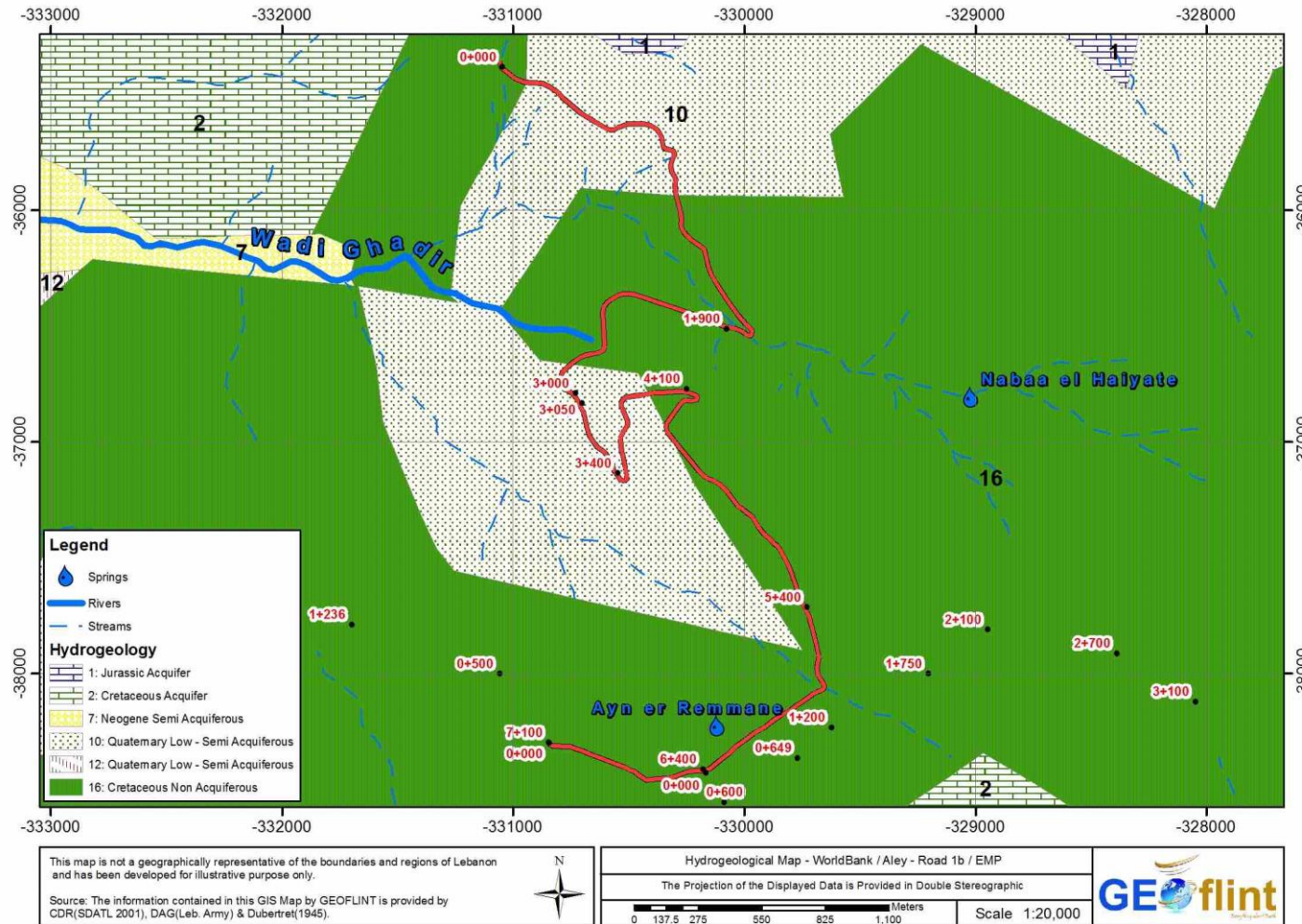
Source: CDR, DAG, & Dubertret; processed by Geoflint

**Figure K Hydrogeological map of Aley R1a and its surrounding (map showing water potential of the subsurface). Refer to Table 4-3 for description of hydrogeology classes. Work stations are shown along the road alignment.**



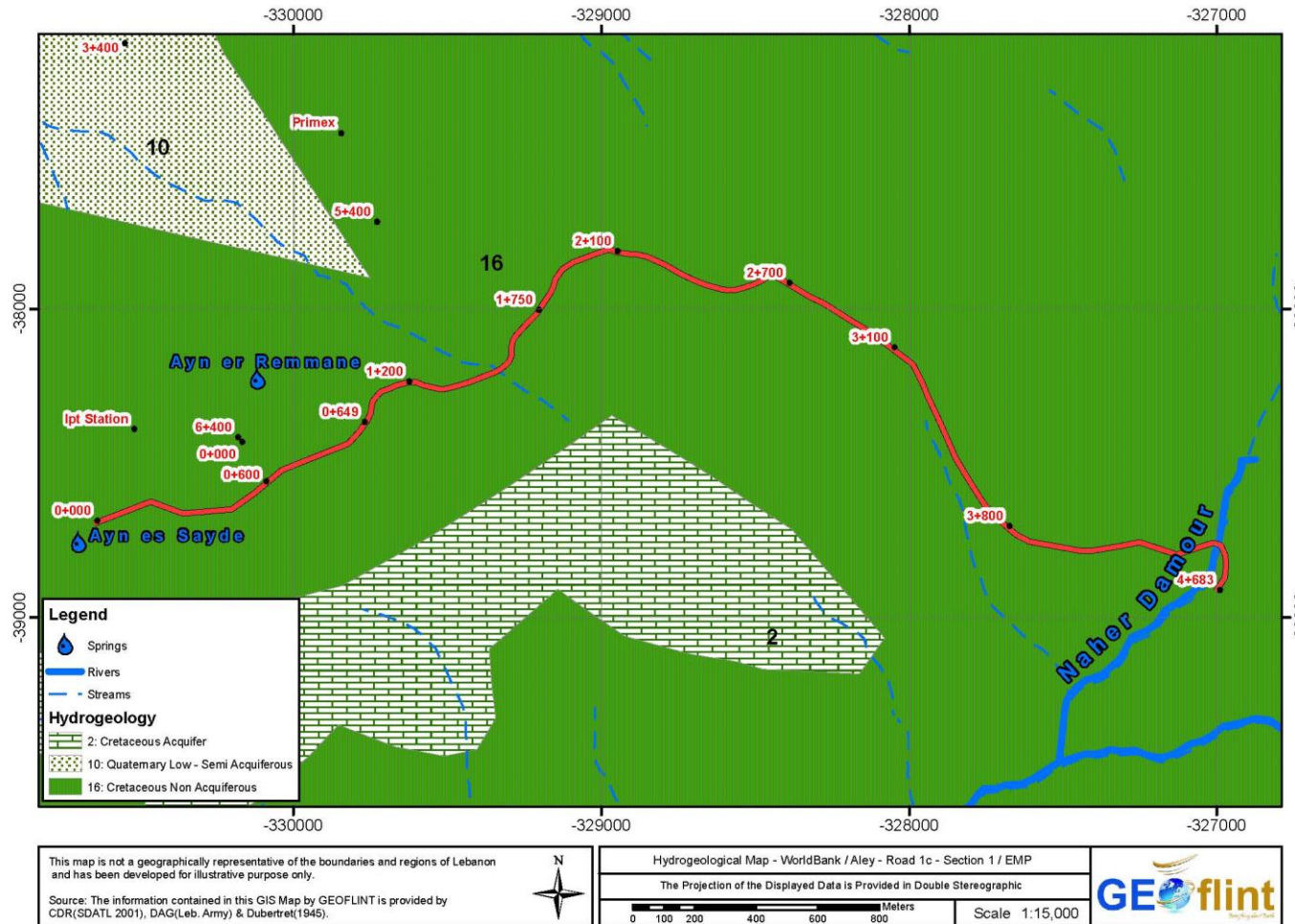
Source: CDR, DAG, & Dubertret; processed by Geoflint

**Figure L Hydrogeological map of Aley R1b and its surrounding (map showing water potential of the subsurface). Refer to Table 4-3 for description of hydrogeology classes. Work stations are shown along the road alignment.**



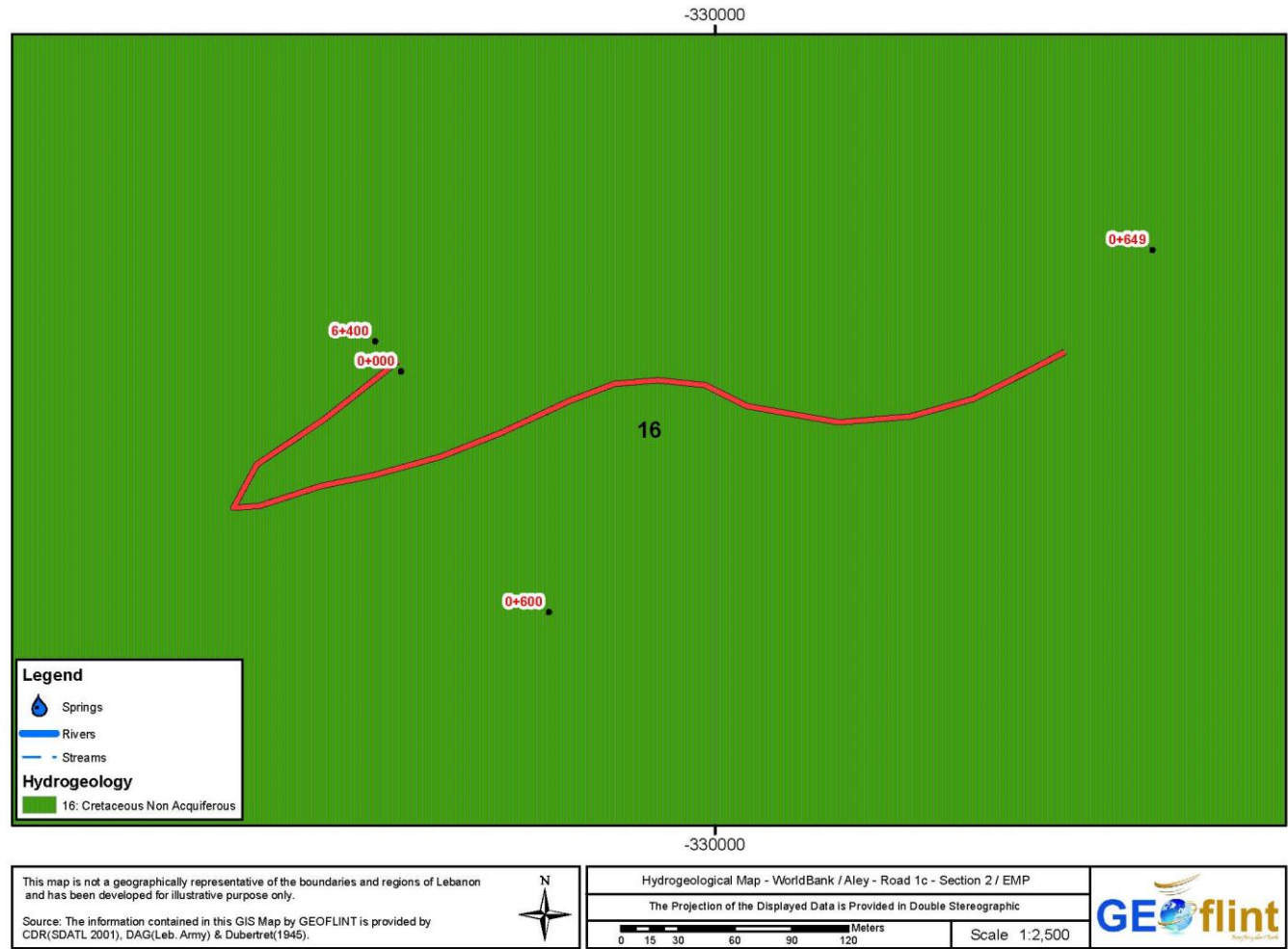
Source: CDR, DAG, & Dubertret; processed by Geoflint

**Figure M Hydrogeological map of Aley R1c section 1 and its surrounding (map showing water potential of the subsurface). Refer to Table 4-3 for description of hydrogeology classes.**



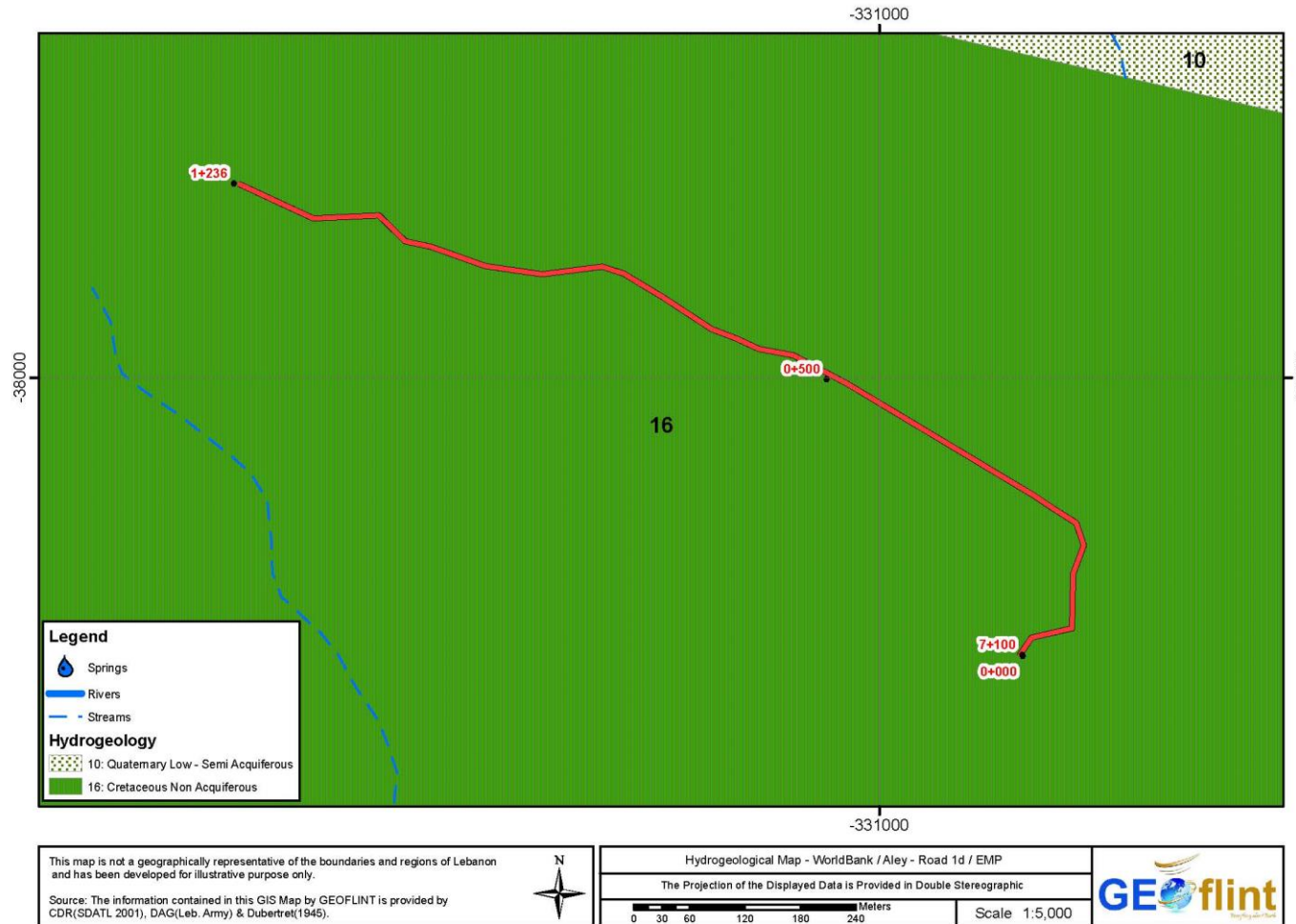
Source: CDR, DAG, & Dubertret; processed by Geoflint

**Figure N Hydrogeological map of Aley R1c section 2 and its surrounding (map showing water potential of the subsurface). Refer to Table 4-3 for description of hydrogeology classes. Work stations are shown along the road alignment.**



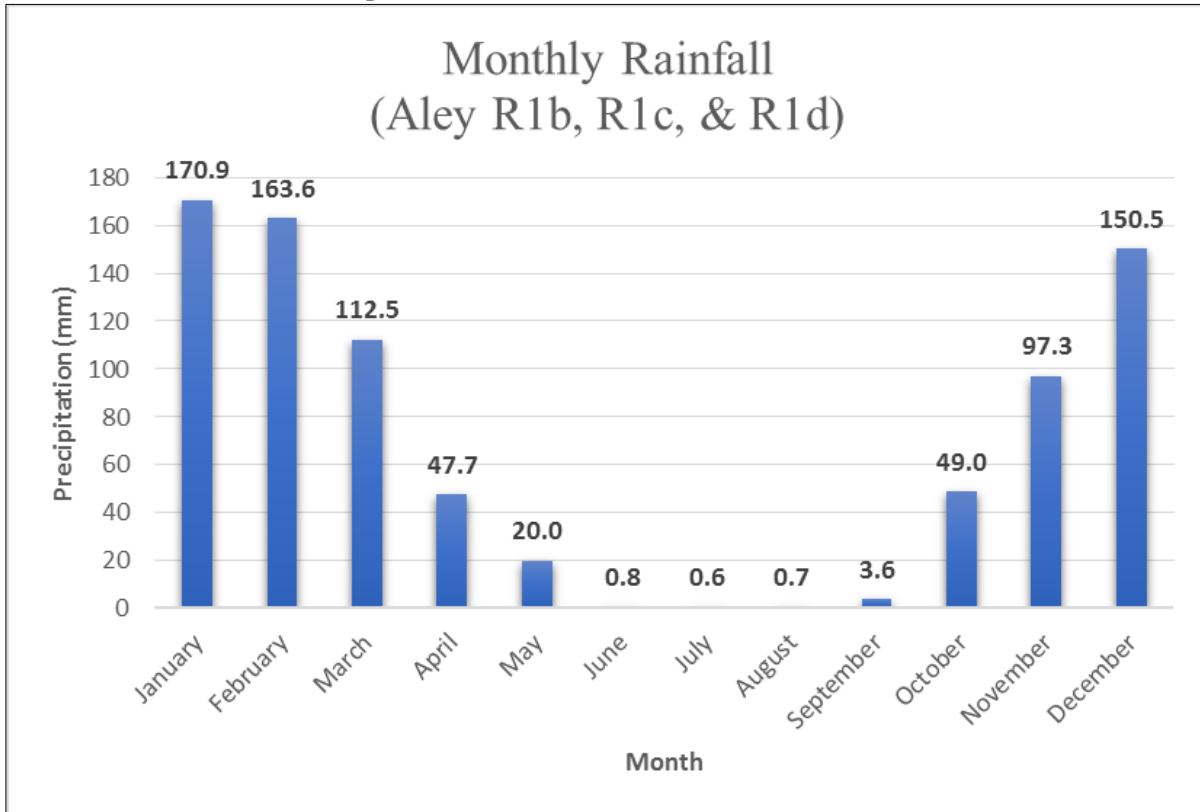
Source: CDR, DAG, & Dubertret; processed by Geoflint

**Figure O Hydrogeological map of Aley R1d and its surrounding (map showing water potential of the subsurface). Refer to Table 4-3 for description of hydrogeology classes.**



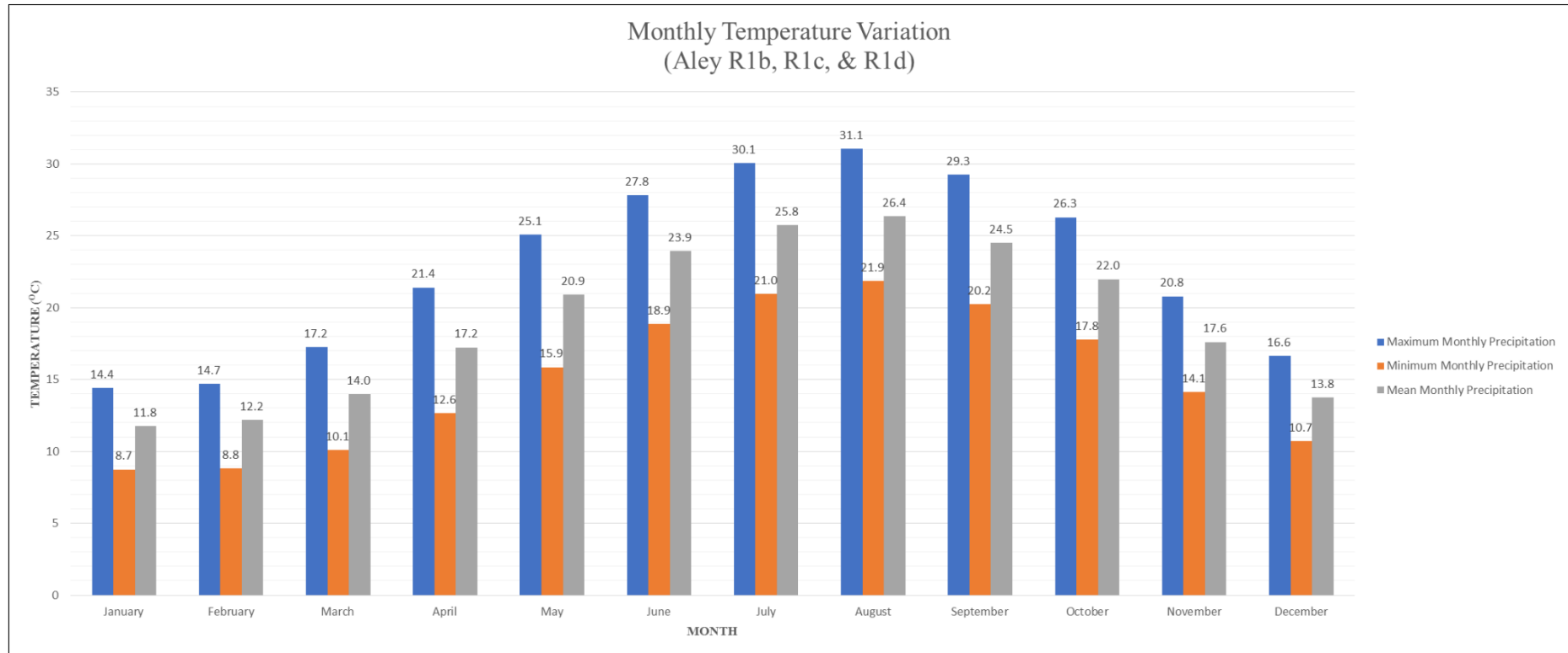
Source: CDR, DAG, & Dubertret; processed by Geoflint

**Figure P Precipitations values along Aley R1b, R1c, and R1d alignments (period extending between 1996-2018) CHIRPS satellite 4.5 km spatial resolution**



Source: CHIRPS satellite

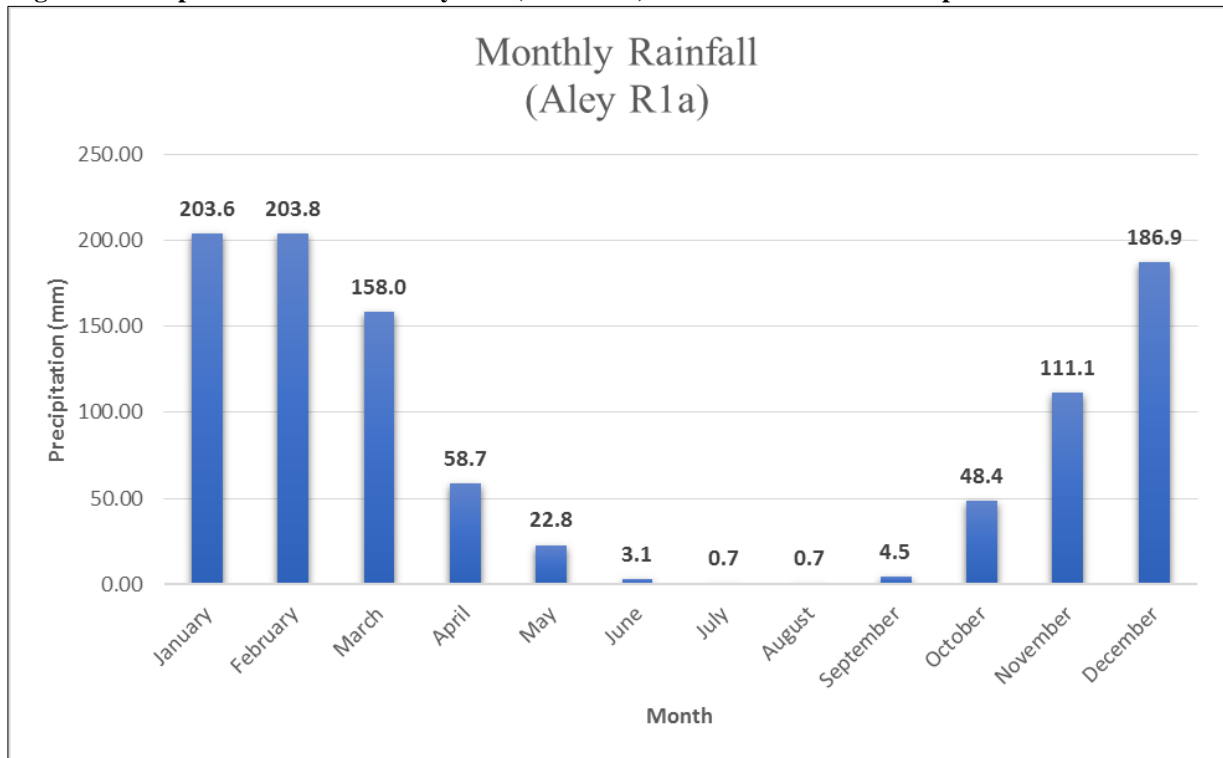
**Figure Q Land surface temperature variation for Aley R1b, R1c, and R1d alignments (period extending between 2000-2018) MODIS satellite 1km spatial resolution**



Source: MODIS satellite

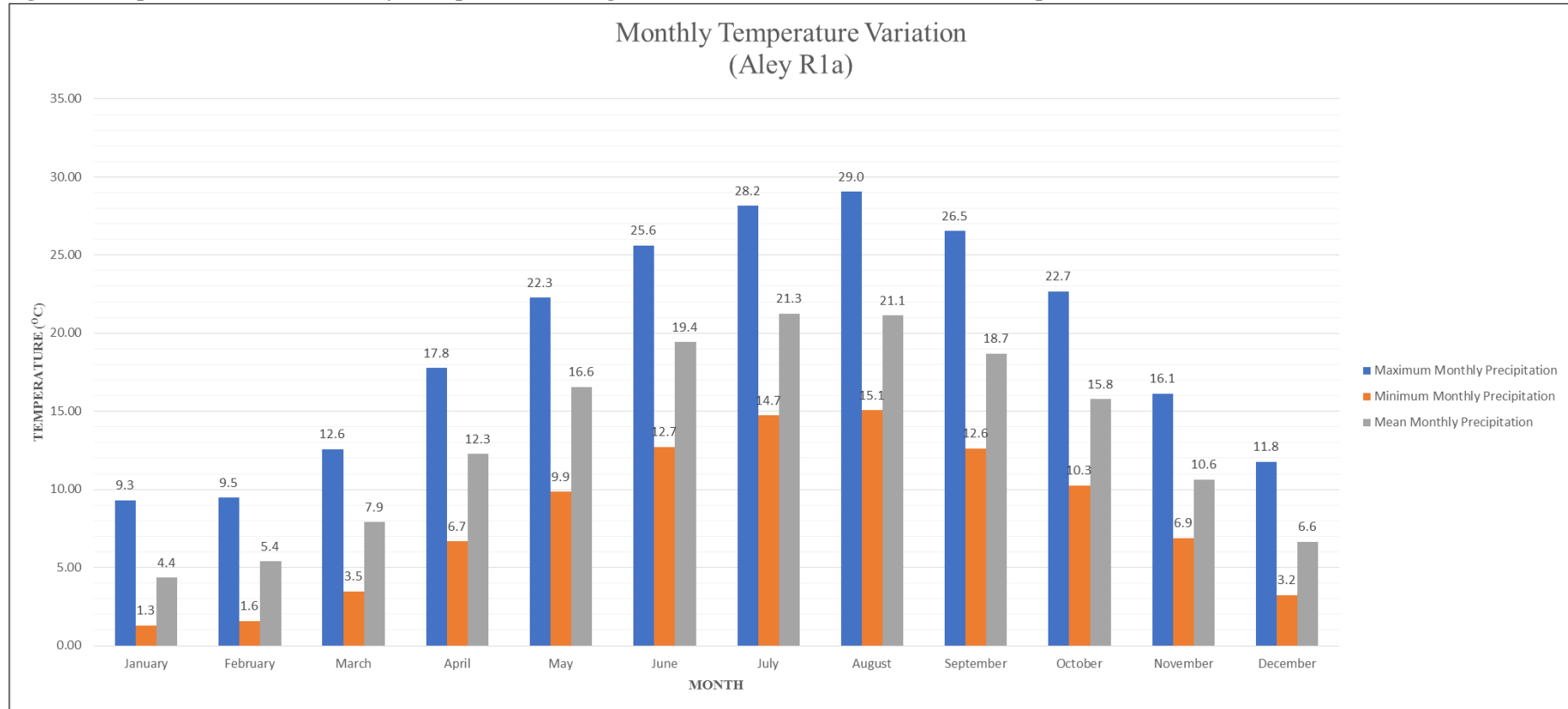


**Figure R Precipitations values for Aley R1a (1996-2018) CHIRPS satellite 4.5km spatial resolution**



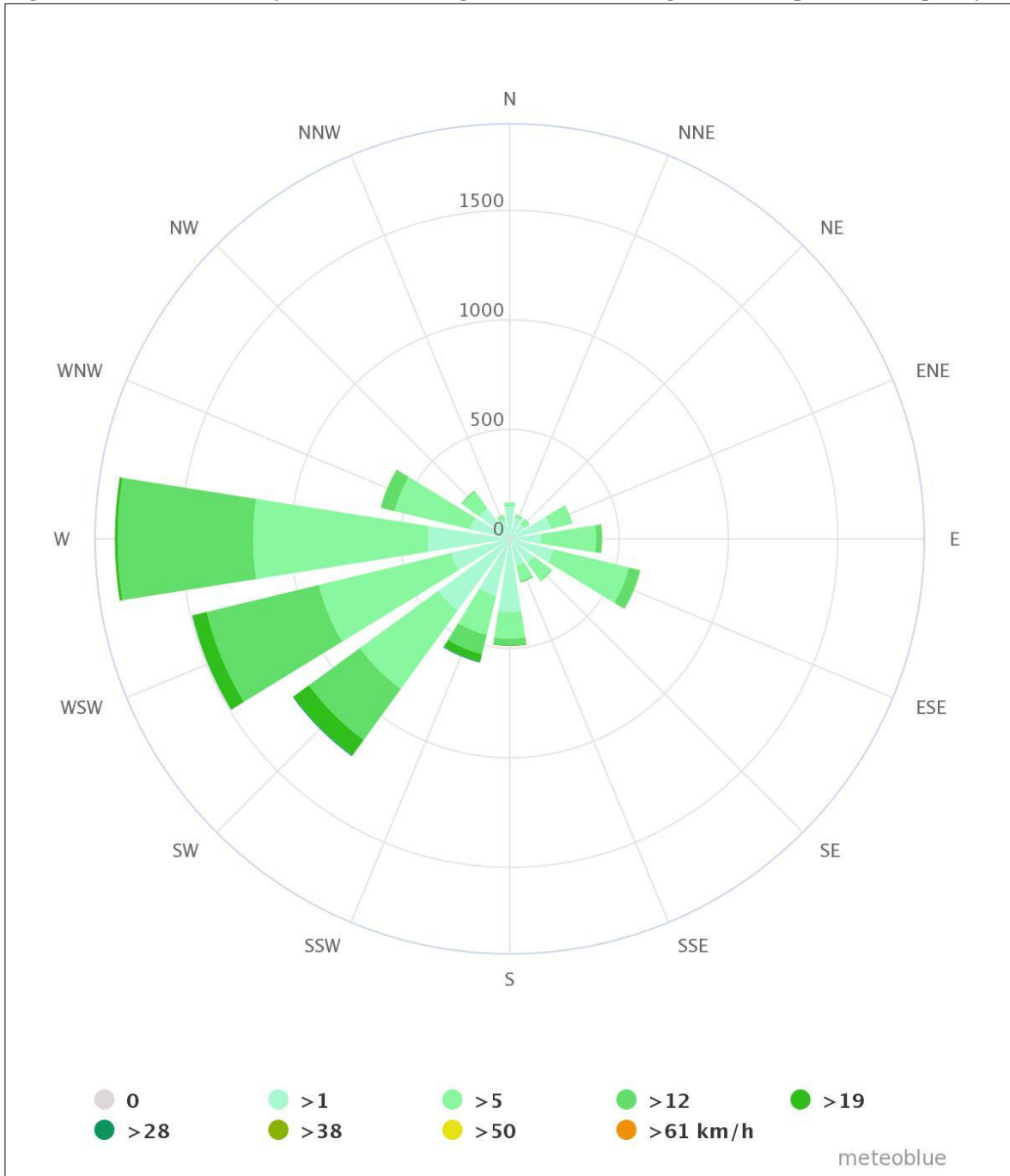
Source: CHIRPS satellite

**Figure S Temperature variation for Aley R1a (period extending between 2000-2018) MODIS satellite 1km spatial resolution**



Source: MODIS satellite

**Figure T Wind rose for Aley caza area showing wind direction along with wind speed and frequency**



W	50
0 : 20 h/year	
>1 : 354 h/year	
>5 : 799 h/year	
>12 : 619 h/year	
>19 : 13 h/year	
>28 : 0 h/year	
>38 : 0 h/year	
>50 : 0 h/year	
>61 km/h: 0 h/year	

Source: Meteoblue prognostic model

**Table A Aley R1a existing acoustic conditions (location of stations shown in Figure 3-2)**

Time	Road Section	Station	Min	Leq (avg)	Max	Allowable Noise Level
			(dB)	(dB)	(dB)	
11:25	Aley R1a	0+000	40.2	57.7	75.1	Refer to Table 2-6
11:31		1+100	38.8	58.5	78.2	
11:38		3+000	37.1	51.3	65.5	
11:48		4+800	42.9	55.4	67.9	
11:56		5+400	42.3	53.3	64.2	
12:07		7+196	38.4	52.0	65.5	

Source: Dar Al Handasah Nazih Taleb & Partners acoustic survey, 2019

**Table B Aley R1b existing acoustic conditions (location of stations shown in Figure 3-3)**

Time	Road Section	Station	Min	Leq (avg)	Max	Allowable Noise Level
			(dB)	(dB)	(dB)	
9:10	Aley R1b	0+000	35.7	53.0	70.2	Refer to Table 2-6
9:20		1+900	46.6	62.2	77.7	
9:30		3+000	43.6	55.8	67.9	
9:33		3+400	55.6	66.6	77.6	
9:41		4+100	59.5	72.0	84.5	
9:51		5+400	57.2	65.5	73.7	
9:58		6+400	54.4	68.4	82.4	
10:08		7+100	58.3	71.3	84.2	

Source: Dar Al Handasah Nazih Taleb & Partners acoustic survey, 2019

**Table C Aley R1c existing acoustic conditions (location of stations shown in Figure 3-4)**

Time	Road Section	Station	Min	Leq (avg)	Max	Allowable Noise Level
			(dB)	(dB)	(dB)	
10:50	Aley R1c S1	0+000	54.9	63.3	71.6	Refer to Table 2-6
10:55		0+600	61.3	70.5	79.7	
11:05		1+750	47.5	62.6	77.6	
11:15		2+700	44.9	59.9	74.8	
11:25		4+683	61.9	71.3	80.7	
10:33	Aley R1c S2	0+000	58.9	63.3	67.7	
10:38		0+650	47.6	64.1	80.6	

Source: Dar Al Handasah Nazih Taleb & Partners acoustic survey, 2019

**Table D Aley R1d existing acoustic conditions (location of stations shown in Figure 3-5)**

Time	Road Section	Station	Min	Leq (avg)	Max	Allowable Noise Level
			(dB)	(dB)	(dB)	
10:10	Aley R1d	0+000	39.9	50.8	61.7	Refer to Table 2-6
10:13		0+500	36.8	48.6	60.3	
10:21		1+236	41.9	51.9	61.8	

Source: Dar Al Handasah Nazih Taleb & Partners acoustic survey, 2019

**Table E Comparing decibel measurements to an ordinary conversation (Trace R&D Center University of Wisconsin-Madison, 2004)**

Sound Environment	Sound Pressure Level (dB)	Approximate loudness with regard to ordinary conversation
Threshold of hearing	0	Don't hear anything
Broadcast studio interior or resulting leaves	10	1/32 <sup>nd</sup> as loud as conversation
Quiet house interior or rural night-time	20	1/16th as loud
Quiet office interior or watch ticking	30	1/8th as loud
Quiet rural area and small theatre	40	1/4th as loud
Quiet suburban area of dishwasher in next room	50	½ as loud
Office interior or ordinary conversation	60	Ordinary conversation
Vacuum cleaner at 10 ft	70	Twice as loud
Passing car at 10ft or garbage disposal at 3ft	80	4 times as loud
Passing bus or truck at 10ft or food blender at 3ft	90	8 times as loud
Passing subway train at 10ft	100	16 times as loud
Nigh club with band playing	110	32 times as loud
Threshold of pain	120	64 times as loud as conversation

Source: Trace R&D Center University of Wisconsin-Madison, 2004

**Figure U LULC map with work stations along Aley R1a alignment**

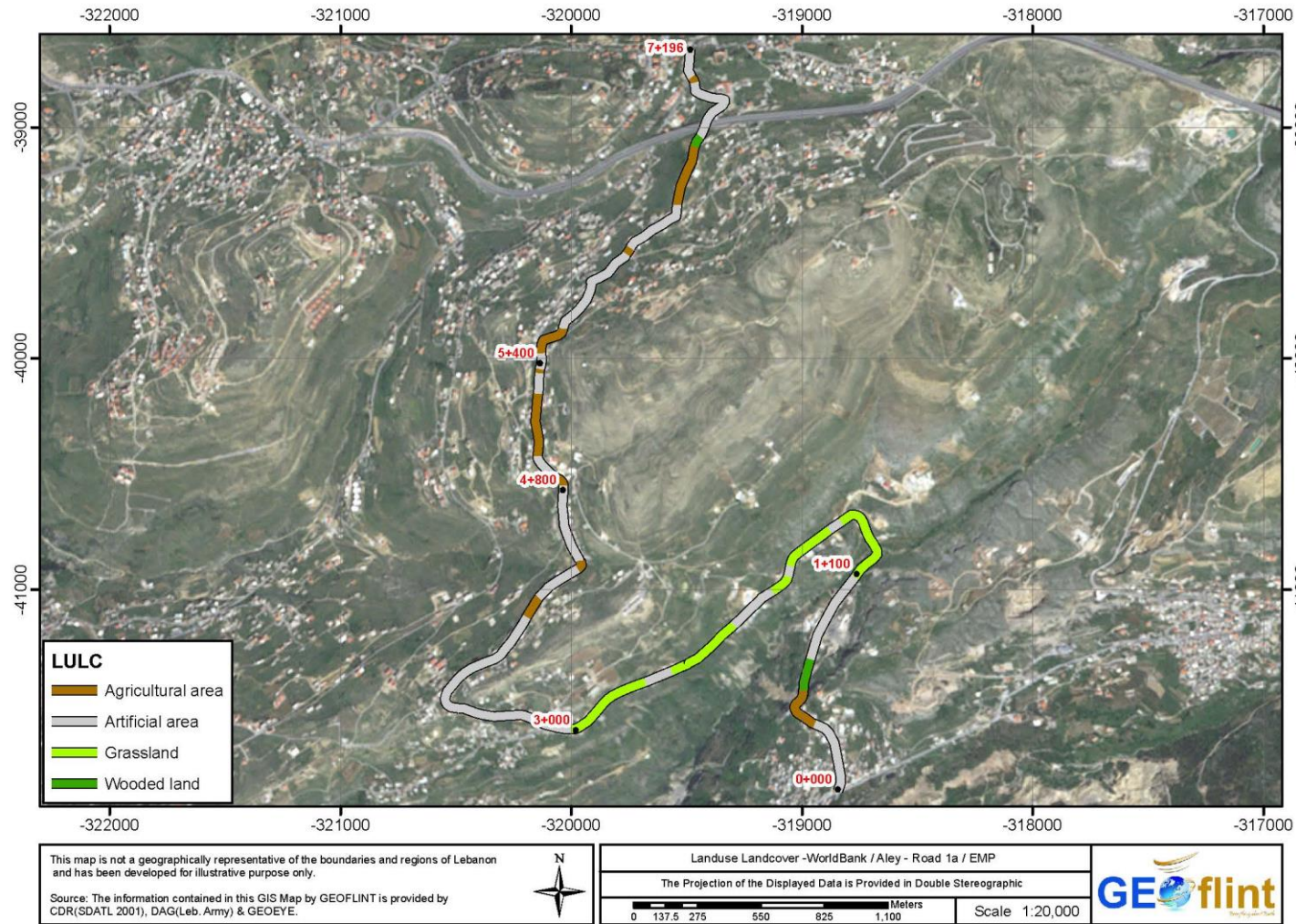


Figure V LULC map with work station along Aley R1b alignment

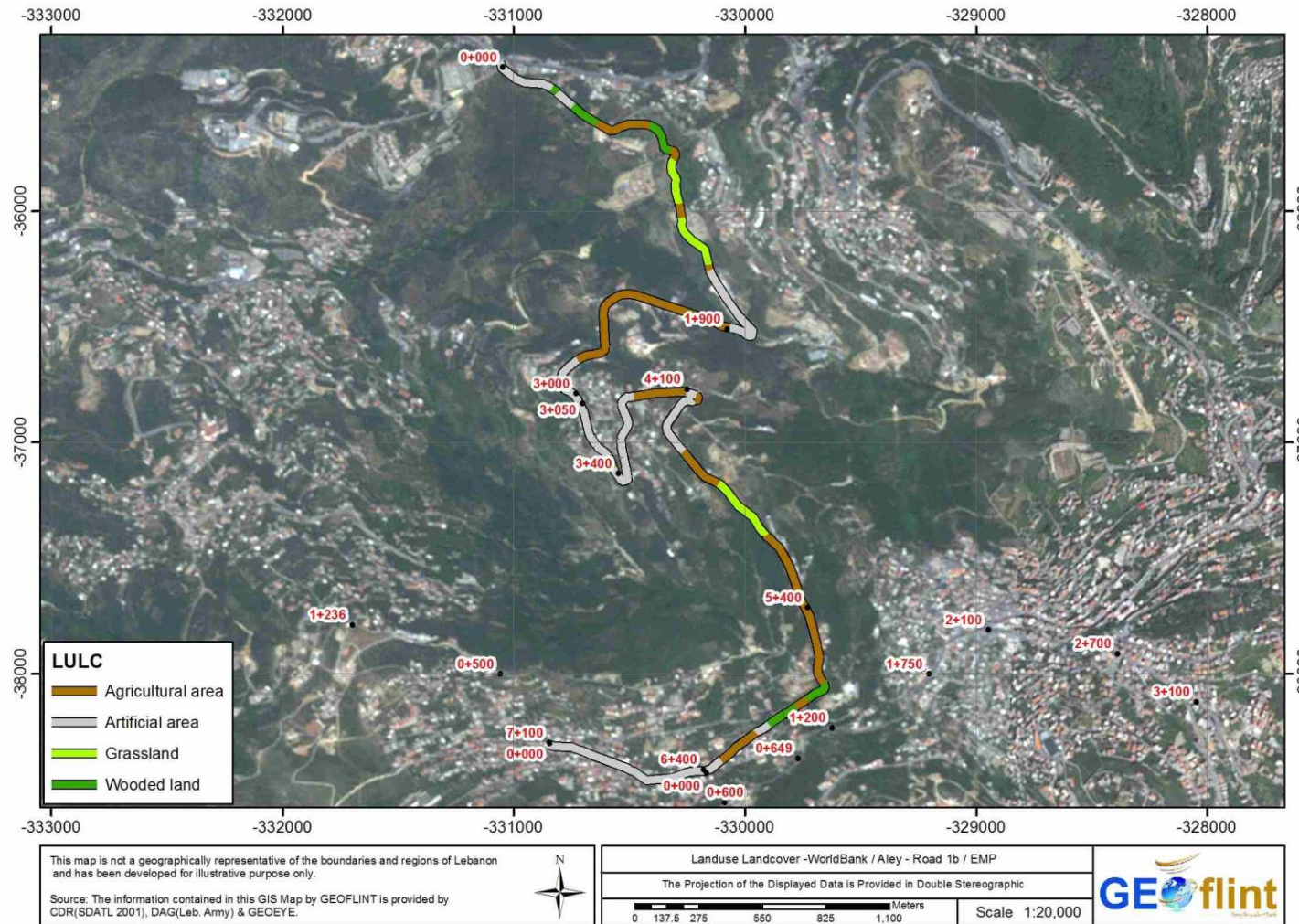
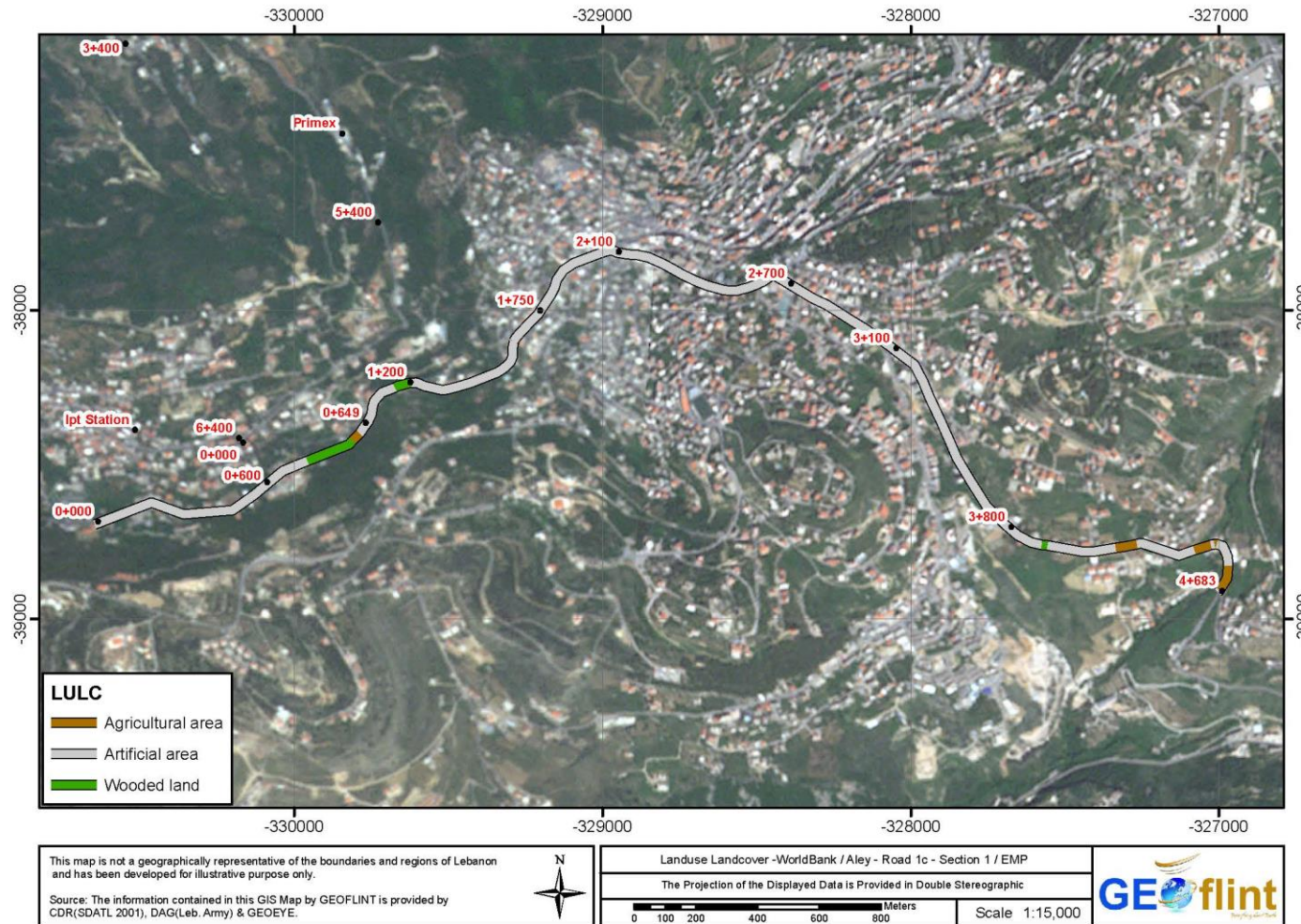


Figure W LULC map with work stations along Aley R1c alignment (section 1)





**Figure X LULC map with work stations along Aley R1c alignment (section 2)**

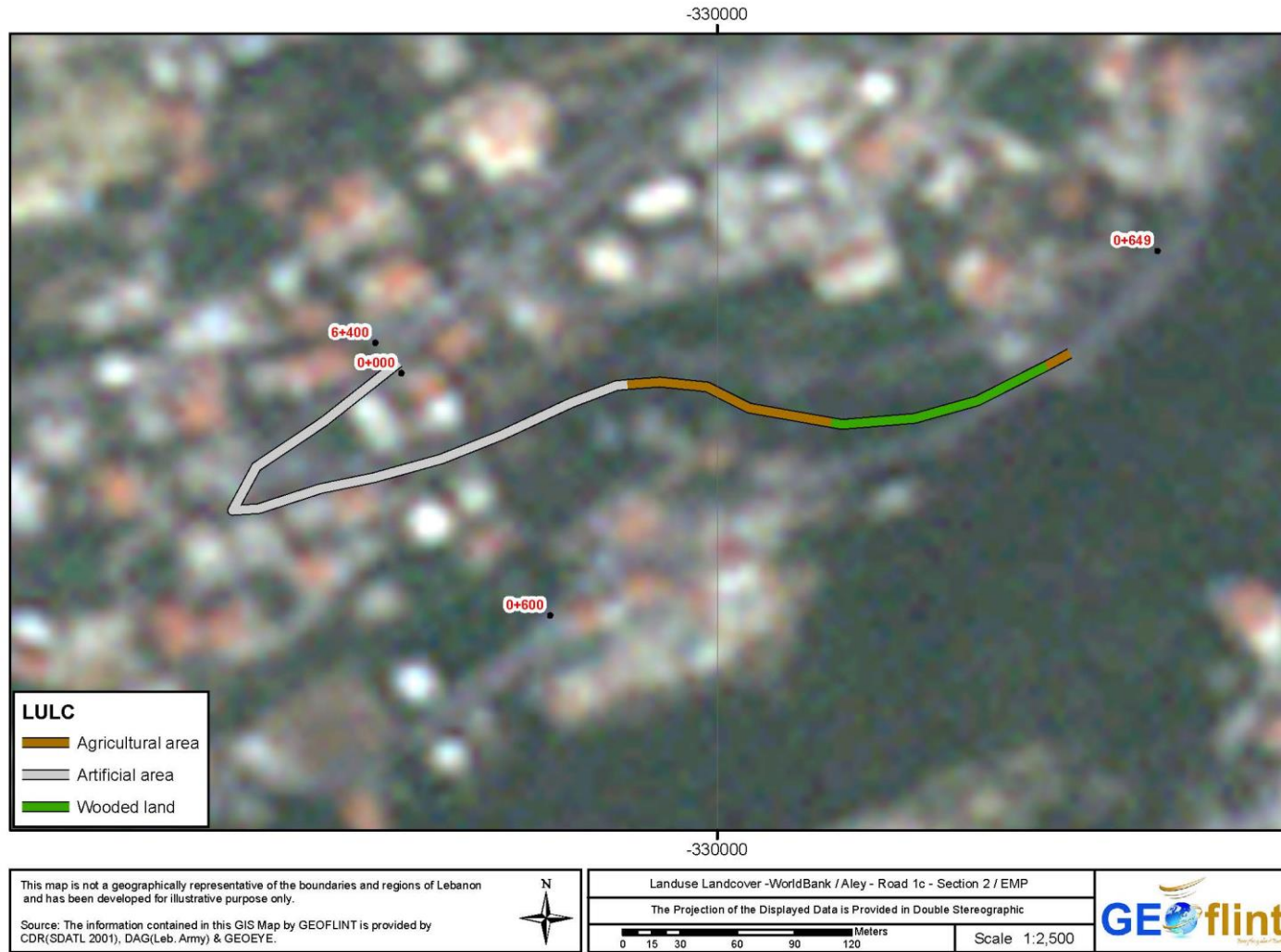


Figure Y LULC map with work stations along Aley R1d alignment



**Figure Z Distances between Aley and Chouf Roads, Chouf Biosphere Reserve, and Ramlieh Valley**

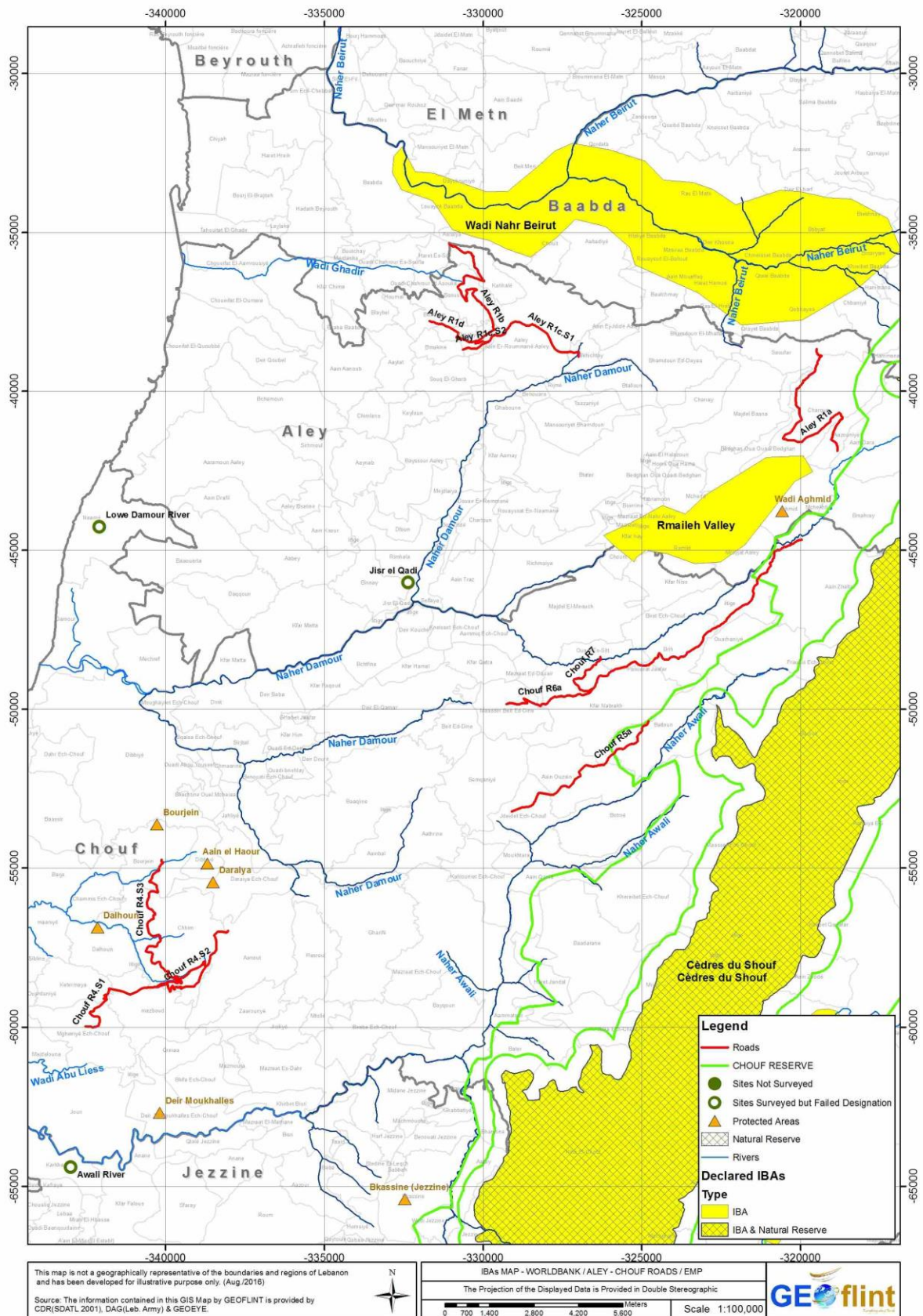
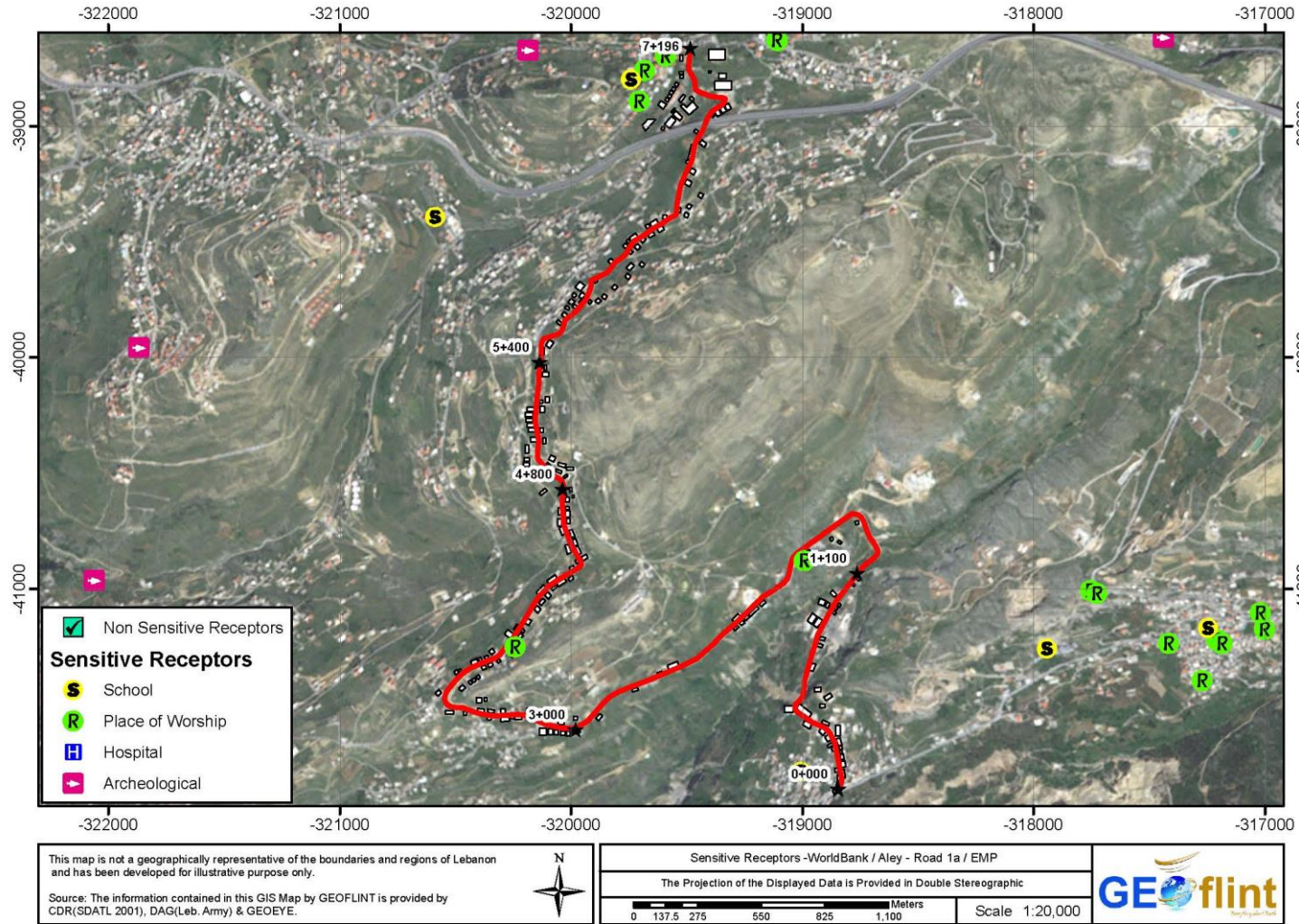
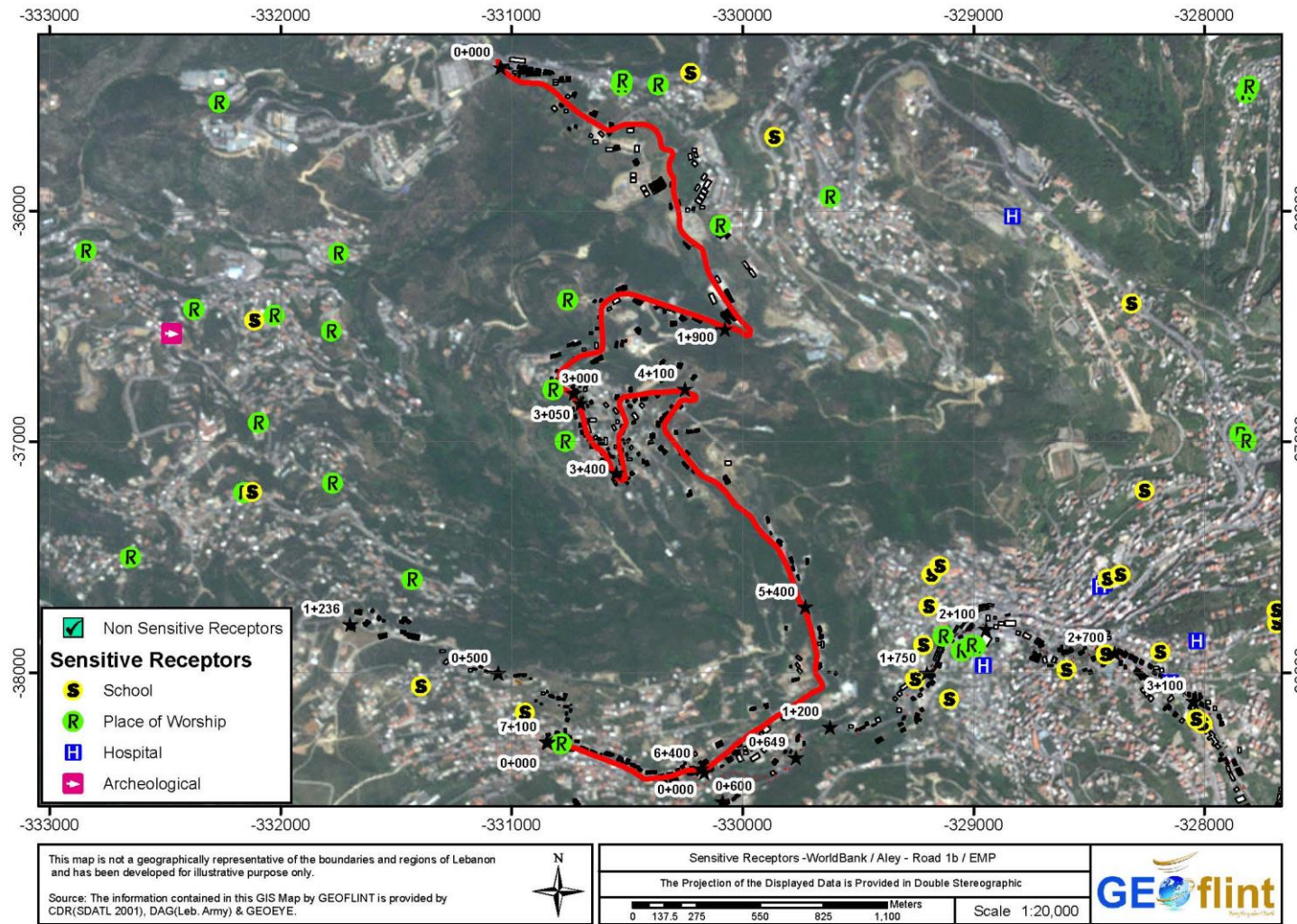


Figure AA Closest sensitive receptors along Aley R1a



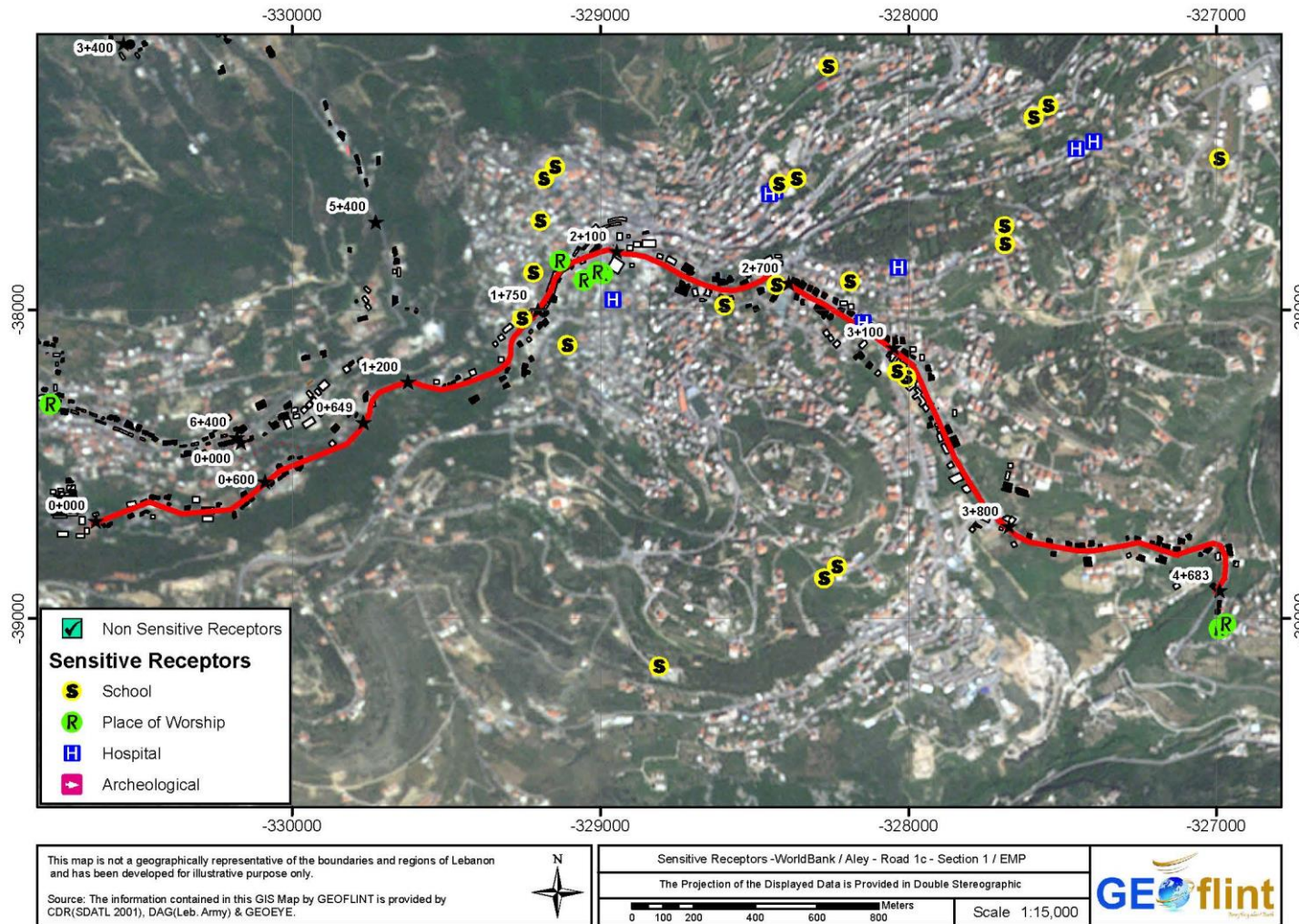
Source: Geoflint s.a.r.l. & Dar Al Handasah Nazih Taleb & Partners, 2020

Figure BB Closest sensitive receptors along Aley R1b



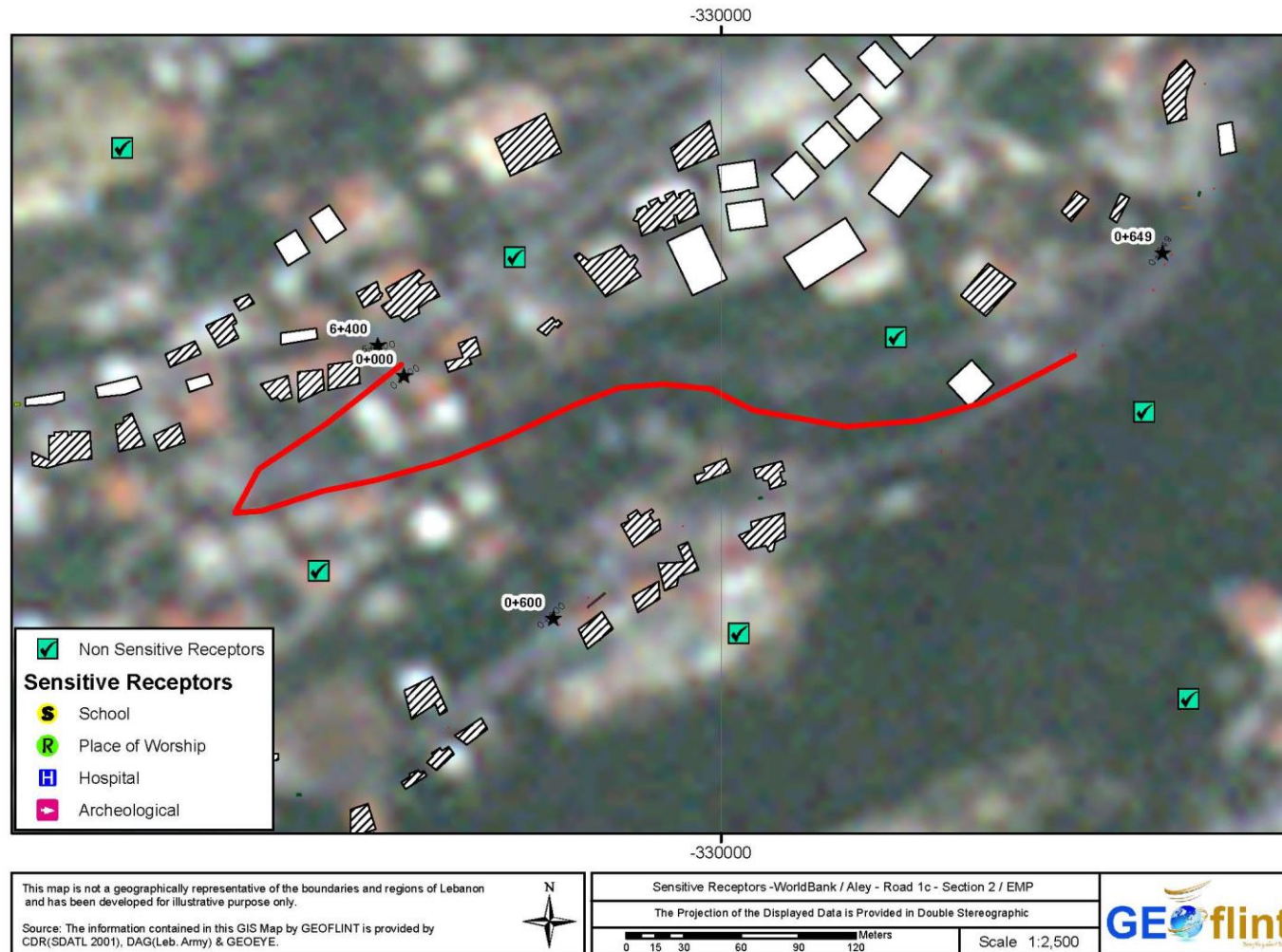
Source: Geoflint s.a.r.l. & Dar Al Handasah Nazih Taleb & Partners, 2020

Figure CC Closest sensitive receptors along Aley R1c (section 1)



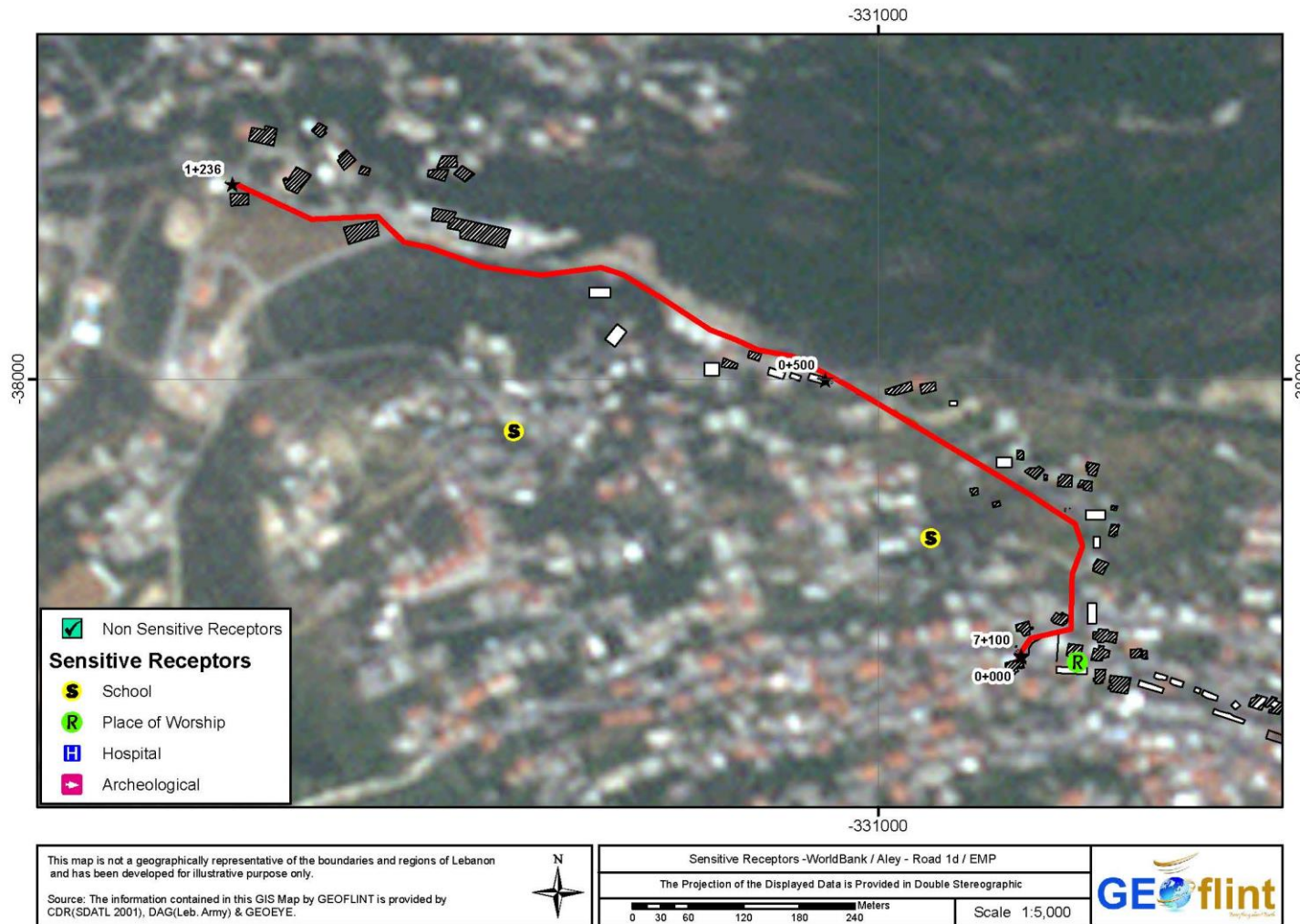
Source: Geoflint s.a.r.l. & Dar Al Handasah Nazih Taleb & Partners, 2020

Figure DD Closest sensitive receptors along Aley R1c (section 2)



Source: Geoflint s.a.r.l. & Dar Al Handasah Nazih Taleb & Partners, 2020

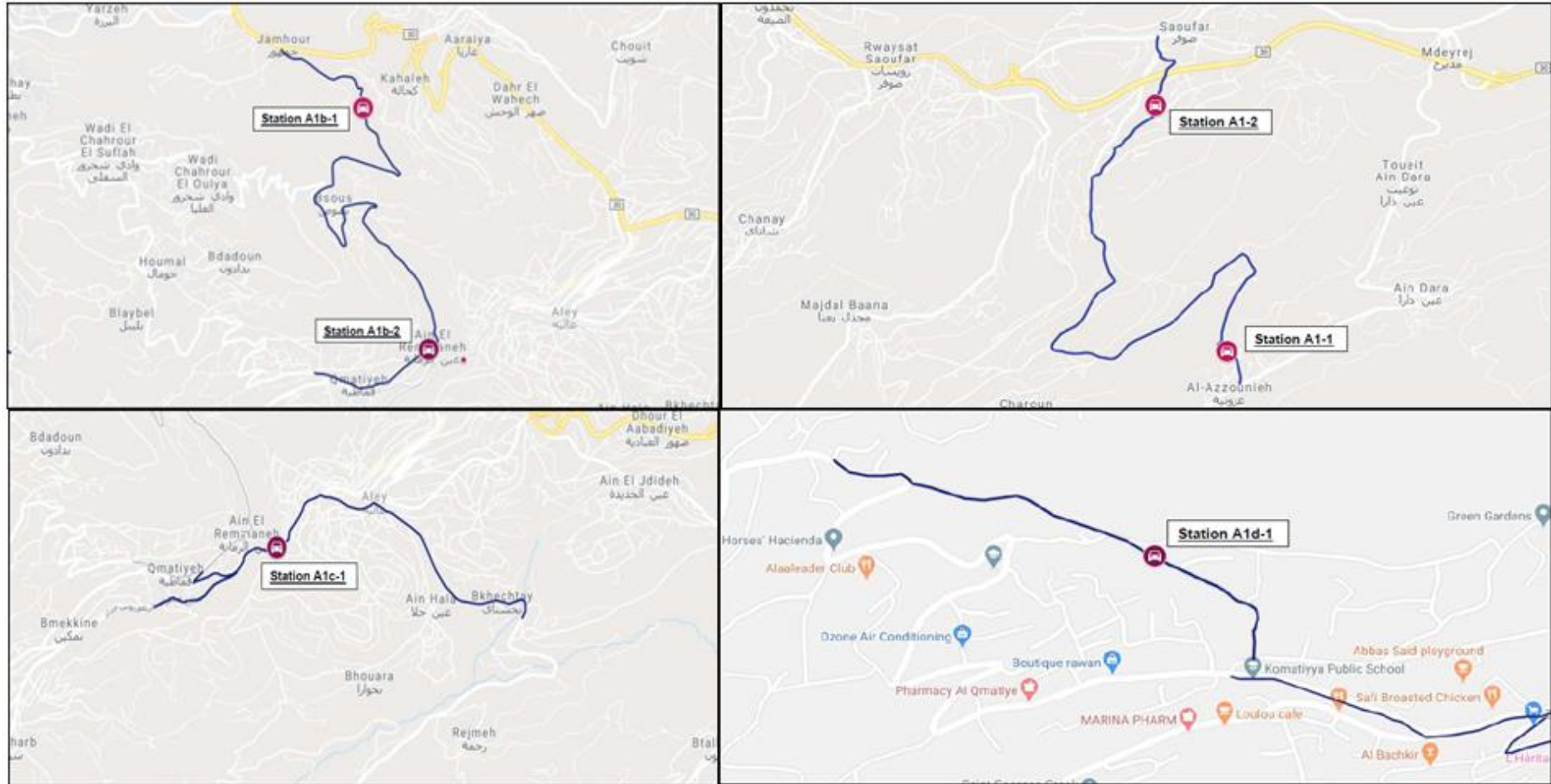
Figure EE Closest sensitive receptors along Aley R1d



Source: Geoflint s.a.r.l. & Dar Al Handasah Nazih Taleb & Partners, 2020



Figure FF Location of ATC stations for Aley roads



Source: Dar Al Handasah Nazih Taleb & Partners, 2020

**Table F ADT values for Aley roads**

Caza	Road	Station	Direction	ADT
				(veh/day)
Aley	R1a	A1a-1	Northbound	2,181
			Southbound	2,002
		A1a-2	Northbound	236
			Southbound	251
	R1b	A1b-1	Northbound	5,295
			Southbound	5,824
		A1b-2	Northbound	3,379
			Southbound	4,166
	R1c	A1c-1	Eastbound	8,277
			Westbound	8,668
	R1d	A1d-1	Eastbound	2,703
			Westbound	2,193

**Table G Type of vehicles passing alignments Aley roads**

Vehicle Class	Type	Percentage (%)			
		Aley R1a	Aley R1b	Aley R1c	Aley R1d
Class 1	Motorcycles	2	3	2	4
Class 2	Passenger Cars	92	92	89	91
Class 3	4-tire trucks	3	2	4	2
Class 4	Buses	0	0	0	0
Class 5	2-axle (6 tire trucks)	2	2	3	2
Class 6	3-axle trucks	0	1	1	1
Class 7	4+ axle trucks	1	0	1	0
Class 8	3-4 axle single-trailer combinations	0	0	0	0
Class 9	5-axle single-trailer combinations	0	0	0	0
Class 10	6+ axle single-trailer combinations	0	0	0	0
Class 11	5- axle multi-trailer combinations	0	0	0	0
Class 12	6- axle multi-trailer combinations	0	0	0	0
Class 13	7+ axle multi-trailer combinations	0	0	0	0

## Annex 2: Assessment Methodology

The assessment followed the Lebanese MoE grading methodology stated in Decree 260/1, dated 2015. The impact grading methodology is explained in this section.

This approach was adopted in order to address the several sources of impacts from the project's rehabilitation and operational phases. The stages of the evaluation process are the following:

1. Identification of project-related activities (sources) and environmental aspects.
2. Identification of potential impacts to the environment (physical, biological, human, cultural).
3. Evaluation and assessment of the related unmitigated impact significance.

Impacts are first classified as shown in the table below:

**Table H Classification of impacts**

Matrix	Classification	Criteria
N (Nature)	<b>P</b> (Positive)	<ul style="list-style-type: none"> <li>• The proposed activity offers benefits for the overall project</li> </ul>
	<b>N</b> (Negative)	<ul style="list-style-type: none"> <li>• Impacts having minimal to major negative influence</li> </ul>
	<b>D</b> (Direct)	<ul style="list-style-type: none"> <li>• Impact arising directly from the project activities</li> </ul>
	<b>I</b> (Indirect)	<ul style="list-style-type: none"> <li>• Impacts arising from activities not directly related to the project development</li> </ul>
M (Magnitude)	<b>L</b> (Low)	<ul style="list-style-type: none"> <li>• High potential to mitigate negative impacts on the physical, biological or human environment to the level of insignificant effects.</li> <li>• Disturbance of degraded areas with little conservation value. Minor changes in species occurrence or variety.</li> <li>• Simple mitigation measures may be needed to minimize impacts</li> </ul>
	<b>M</b> (Moderate)	<ul style="list-style-type: none"> <li>• Medium range (beyond site boundary but restricted to local area).</li> <li>• Medium-term (reversible over time, duration of operational phase).</li> <li>• Potential to mitigate negative impacts on physical, biological or human environment. However, the implementation of mitigation measures may still not prevent some negative effects.</li> <li>• Destruction/Disturbance of areas with potential conservation value. Complete changes in species occurrence or variety.</li> <li>• Mitigation measures will help minimize impacts</li> </ul>
	<b>H</b> (High)	<ul style="list-style-type: none"> <li>• Disturbance to areas of high conservation value. Destruction of rare or endangered species.</li> <li>• Mitigation is required.</li> <li>• Largely irreversible impacts on the physical, biological or human environment.</li> <li>• Has a massive impact on the surrounding livelihood.</li> <li>• Potentially irreparable damage to a site of social and/or cultural importance</li> </ul>

Matrix	Classification	Criteria
<b>E</b> (Extent)	<b>L</b> (Local)	<ul style="list-style-type: none"> <li>Limited to the project area</li> <li>Locally occurring impact within the locality of the proposed project</li> </ul>
	<b>G</b> (Global)	<ul style="list-style-type: none"> <li>Extend beyond the local area</li> <li>National impact affecting resources on a national scale</li> </ul>
<b>T</b> (Timing)	<b>S</b> (Short-term)	<ul style="list-style-type: none"> <li>Activities and their related impacts are characterized by a short duration of effect</li> </ul>
	<b>M</b> (Medium-term)	<ul style="list-style-type: none"> <li>Activities and their related impacts are characterized by a medium duration of effect</li> </ul>
	<b>L</b> (Long-term)	<ul style="list-style-type: none"> <li>Activities and their related impacts are characterized by a long duration of effect</li> </ul>
<b>D</b> (Duration)	<b>C</b> (Construction)	<ul style="list-style-type: none"> <li>Impacts arise during the construction phase of the proposed project</li> </ul>
	<b>O</b> (Operation)	<ul style="list-style-type: none"> <li>Impacts arise during the operational phase of the project</li> </ul>
<b>R</b> (Reversibility)	<b>R</b> (Reversible)	<ul style="list-style-type: none"> <li>Impacts may be reversible, or able to be rehabilitated upon the decommissioning of the proposed project</li> </ul>
	<b>I</b> (Irreversible)	<ul style="list-style-type: none"> <li>Impacts may not be reversible, or able to be rehabilitated upon the decommissioning of the proposed project</li> </ul>
<b>L</b> (Likelihood of occurrence)	<b>L</b> (Low)	<ul style="list-style-type: none"> <li>The classified impact is unlikely to occur under normal operating conditions</li> </ul>
	<b>M</b> (Medium)	<ul style="list-style-type: none"> <li>The classified impact may possibly occur</li> </ul>
	<b>H</b> (High)	<ul style="list-style-type: none"> <li>The classified impact is unlikely to occur under normal operating conditions</li> </ul>
<b>S</b> (Significance)	<b>L</b> (Low)	<ul style="list-style-type: none"> <li>Results in no substantial adverse change to existing environmental conditions</li> </ul>
	<b>M</b> (Medium)	<ul style="list-style-type: none"> <li>Substantial adverse change to existing environmental conditions</li> <li>Can be mitigated to less-than-significant levels by implementation of proposed potentially feasible mitigation measures or by the selection of an environmentally superior project alternative</li> </ul>
	<b>H</b> (High)	<ul style="list-style-type: none"> <li>Substantial adverse change to existing environmental conditions</li> <li>Cannot be fully mitigated by implementation of all feasible mitigation measures</li> </ul>

The environmental significance matrix adopted is based on the well-known “weighted scoring” or “weighing and scoring” method used as a tool in various decision analysis applications. In this method, the following steps takes place:

1. Attributes relevant to the project are chosen
2. Weights or numerical values are assigned to each attribute depending on its importance (values should be based on objective data or expert opinion to exclude subjectivity during the process).
3. Scores are allocated to each option to reflect its status with respect to each attribute

The final result is a single weighted score for each option, which is used to quantify its overall performance/significance. As such, the adopted matrix is designed to allow subjective conclusions to be numerically recorded or quantified, therefore providing at the same time an impact evaluation and quantitative record to revert to in the future:

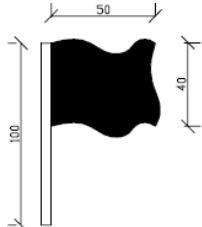
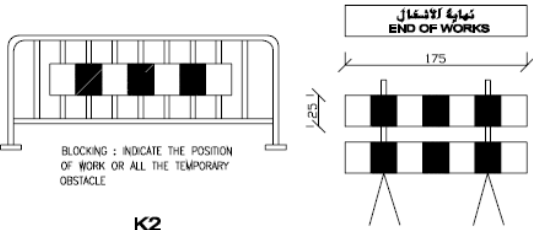

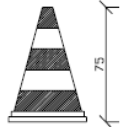
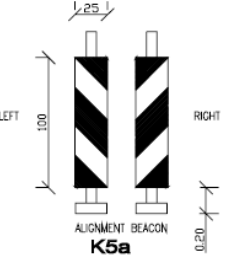
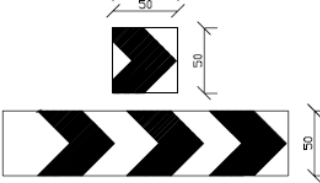
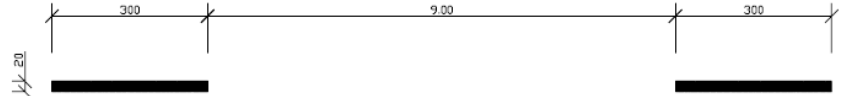
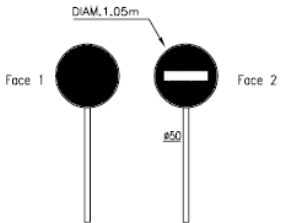
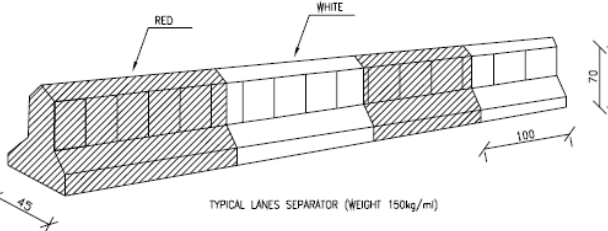
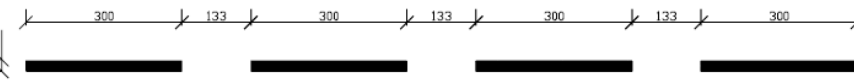
**Table I Significance Impact Matrix**

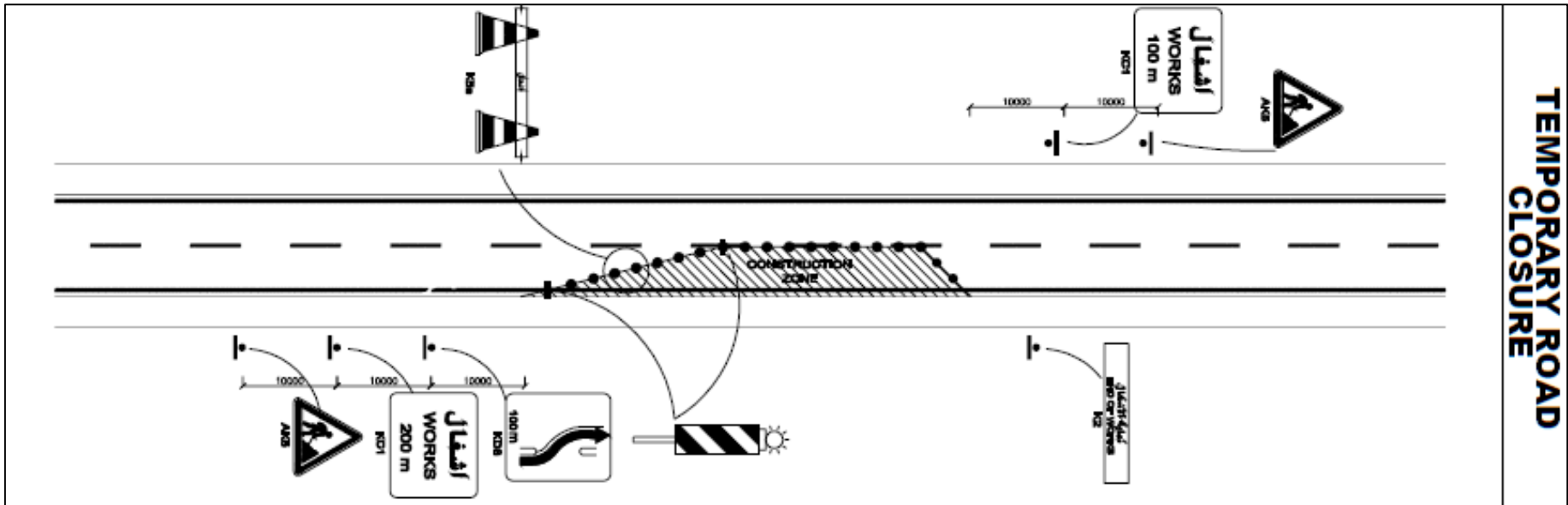
		Magnitude x Extent x Duration								
		1	2	3	4	5	6	7	8	9
Likelihood x Frequency	1	2	4	6	8	10	12	14	16	18
	2	4	6	9	12	15	18	21	24	27
	3	6	8	12	16	20	24	28	32	36
	4	8	10	15	20	25	30	35	40	45
	5	10	12	18	24	30	36	42	48	54
	6	12	18	24	30	36	42	48	54	60

*Yellow: Negligible / Green: Low significance / Blue: Medium significance / Red: High significance*











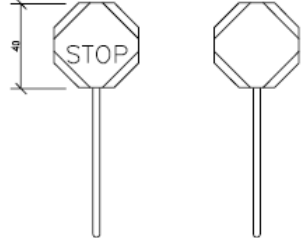
**Annex 3: Road Signs, Markings, Lights, and Barricades to be Used during Rehabilitation Works**

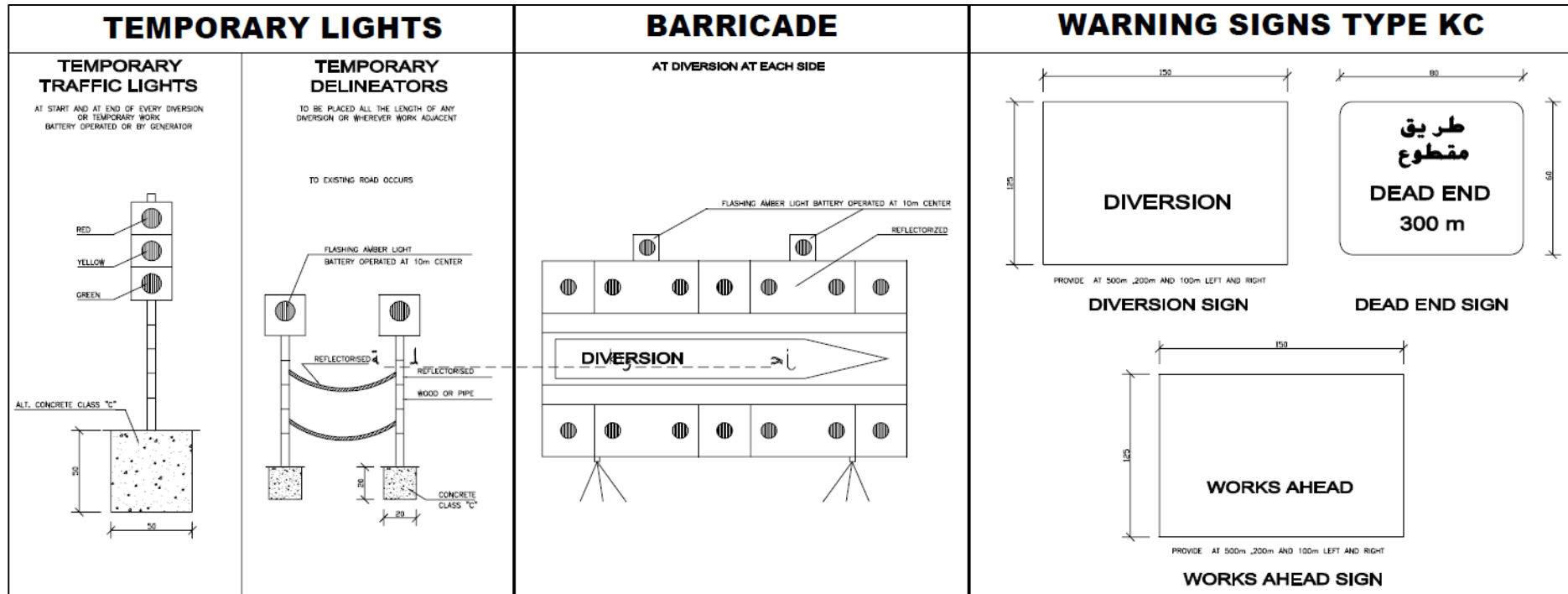
<b>GUIDE SIGNS TYPE KD</b>					<b>REGULATORY SIGNS TYPE B</b>		
<b>SUPPORT IS YELLOW AND SYMBOLS, LETTERS AND LISTEL ARE BLACK</b>					<b>DIAMETER 085m</b>		

<b>SIGNS TYPE K</b>		<b>TEMPORARY MARKING</b>		
 <p>PENNANT <b>K1</b></p>	 <p>تباينة الالوان END OF WORKS</p> <p>BLOCKING : INDICATE THE POSITION OF WORK OR ALL THE TEMPORARY OBSTACLE</p> <p><b>K2</b></p>	<p>THESE LINES ARE YELLOW AND REFLECTORISING.              THEY CAN BE ERASED OR REMOVED WITHOUT ANY RESIDUAL TRACE.</p>  <p>FOR CONTINUOUS EDGE LINE AND FOR SEPARATING THE TRAFFIC IN OPPOSITE DIRECTIONS</p> <p><b>MR2 TEMPORARY</b></p>		
 <p><b>K5a</b></p>	 <p>LEFT RIGHT</p> <p>ALIGNMENT BEACON <b>K5a</b></p>	 <p>BLOCKING : INDICATE THE POSITION OF DIVERSION OR THE TEMPORARY PAVEMENT NARROWING</p> <p><b>K8</b></p>	 <p>FOR SEPARATING THE TRAFFIC IN THE SAME DIRECTION</p> <p><b>TYPE T1</b></p>	
 <p>DIAM. 1.05m</p> <p>Face 1 Face 2</p> <p><b>K10a</b></p>	 <p>RED WHITE</p> <p>TYPICAL LANES SEPARATOR (WEIGHT 150kg/m)</p> <p><b>K16</b></p>		 <p>FOR SEPARATING THE TRAFFIC IN THE SAME DIRECTION</p> <p><b>TYPE T3</b></p>	





<b>WARNING SIGNS TYPE AK</b>	<b>BY FLAGMEN</b>
<p style="text-align: center;">SIDE 0.70 m</p> <div style="display: flex; justify-content: space-around; align-items: flex-start;"> <div style="text-align: center;">   <b>AK2</b> </div> <div style="text-align: center;">   <b>AK3</b> </div> <div style="text-align: center;">   <b>AK4</b> </div> <div style="text-align: center;">   <b>AK5</b> </div> <div style="text-align: center;">   <b>AK3+KM1</b> </div> </div> <div style="display: flex; justify-content: space-around; align-items: flex-start; margin-top: 20px;"> <div style="text-align: center;">   <b>AK14</b> </div> <div style="text-align: center;">   <b>AK17</b> </div> <div style="text-align: center;">   <b>AK22</b> </div> <div style="text-align: center;">   <b>AK14+KM9+KM2</b>  <small>EXAMPLE</small> </div> <div style="text-align: center;">   <b>AK5+KM9</b> </div> </div>	<p style="text-align: center;">STANDARD SIGNS PADDLE</p> <div style="text-align: center; margin-top: 100px;">  </div>



## Annex 4: Code of Conduct

**Table J Contractor Code of Conduct Form**

**Contractor Code of Conduct:**

1. All employees, associates, and representatives commit to treating women, children (under the age of 18), and men with respect, regardless of race; color; language; religion; political or other opinion; national, ethnic or social origin; sexual orientation or gender identity; disability; birth or other status.
2. GBV constitutes acts of gross misconduct and is therefore grounds for sanction, which may include penalties and/or termination of employment. All forms of GBV are unacceptable, regardless of whether they take place on the worksite, the worksite surroundings, or off-site. In addition to the potential sanctions listed above, legal prosecution will be pursued, if appropriate, for any employees, associates, and representatives alleged to have committed GBV.
3. Demeaning, threatening, harassing, abusive, or sexually provocative language and behavior are prohibited among all company employees, associates, and representatives.
4. Sexual favors, making promises or favorable treatment dependent on sexual acts are prohibited.
5. Unless there is the full consent by all parties involved, sexual interactions between the company's employees (at any level) and members of the surrounding communities are prohibited. This includes relationships involving the withholding or promise of any kind of reward.
6. All employees, including volunteers and sub-Contractors are expected to report suspected or actual GBV by a fellow worker, whether in the same company or not. Reports must be made in accordance with GBV allegation procedures.
7. All employees are required to attend an induction training course prior to commencing work on site to ensure they are familiar with the GBV Code of Conduct.
8. All employees must attend a mandatory training course once a month for the duration of the contract starting from the first induction training prior to commencement of work to reinforce the understanding of the institutional GBV Code of Conduct.
9. All employees will be required to sign an individual code of conduct confirming their agreement to support GBV activities.

I do hereby acknowledge that I have read the foregoing GBV Code of Conduct, and on behalf of the company agree to comply with the standards contained therein. I understand my role and responsibilities to prevent and respond to GBV. I understand that any action inconsistent with this Code of Conduct or failure to take action mandated by this Code of Conduct may result in disciplinary action.

Company Name:

Signed by:

Title:

Date:

### Table K Individual Code of Conduct Form

- This individual Code of Conduct should be signed by all employees, from senior managers through the operational staff, and should also be required from any Contractors working with the company.
- I, \_\_\_\_\_, acknowledge that preventing gender-based violence (GBV) is important, and that preventing it is my responsibility. At [Company], GBV activities constitute acts of gross misconduct and are therefore grounds for sanctions, penalties or potential termination of employment. All forms of GBV are unacceptable, be it on the worksite, the worksite surroundings, or in the community. Prosecution of those who commit GBV may be pursued if appropriate.
- I agree that while working on the [Project], I will:
- Consent to a police background check.
- Treat women, children (persons under the age of 18), and men with respect regardless of race; color; language; religion; political or other opinion; national, ethnic or social origin; sexual orientation or gender identity; disability; birth or other status.
- Not use language or behavior towards women, children or men that is inappropriate, harassing, abusive, sexually provocative, demeaning or culturally inappropriate.
- Not request or engage in sexual favors—for instance, making promises or favorable treatment dependent on sexual acts.
- Understand that unless there is the full consent by all parties involved, sexual interactions between the company's employees (at any level) and members of the surrounding communities are prohibited. This includes relationships involving the withholding or promise of monetary or non-monetary reward.
- Attend and actively partake in training courses related to HIV/AIDS and GBV as requested by my employer.
- Report through the grievance redress mechanism or to my manager any suspected or actual GBV by a fellow worker, whether in my company or not, or any breaches of this Code of Conduct.

#### Sanctions

[Company] has established a grievance redress mechanism for receiving, reviewing, and addressing allegations of GBV. If an employee has breached the Code of Conduct, the employer will take disciplinary action which could include:

- Informal warning
- Formal warning
- Additional training
- Loss of up to one week's salary
- Suspension of employment (without payment of salary), for a minimum period of one month up to a maximum of six months
- Termination of employment

In addition to the above, if warranted, [Company] will report the employee to the police as per local legal regulations.

I understand that it is my responsibility to use common sense and avoid actions or behaviors that could be construed as GBV or breach this Code of Conduct. I do hereby acknowledge that I have read the foregoing Code of Conduct, do agree to comply with the standards contained therein and understand my roles and responsibilities to prevent and respond to GBV. I understand that any action inconsistent with this Code of Conduct or failure to take action mandated by this Code of Conduct may result in disciplinary action and may affect my ongoing employment.

Individual Name:

Signed by:

Title:

Date:



## **Annex 6 : Public Consultation**

Note:

Consulting with the main stakeholders and ensuring they agree on sensitive issues improves the chances that the project will not be subject to last-minute dispute.

This ESMP was publicly consulted where a public participation meeting was arranged for Aley Caza. The public participation meeting was held at Aley Municipality on Thursday July 16, 2020. The number of attendees was 18 of which 4 were women. During the meeting, attendees were informed about the project objectives, the identified natural, economic, and social resources of importance in the area, the project's possible environmental and social risks, the planned mitigation measures and Grievance Redress Mechanism (GRM).

Municipalities and local authorities were concerned about the selection of roads within the scope of REP. According to them, there are roads that are in greater need for rehabilitation (e.g. Sofar road that needs retaining wall for safety issues). In this context, the consultant explained that the Government prioritized roads in Aley Caza based on municipalities' official requests beside several technical criteria. Secondly, they asked regarding their main role in this project. In this context, the consultant and the representative of CDR explained the head of municipalities have a main role to inform people about the project and at a later stage, they have a major role in assisting CDR in monitoring any potential violations by the Contractor during the rehabilitation phase. In particular, any violation observed must be reported to CDR. Further, the CDR explained that this ESMP includes a GRM to ensure the management of any project-related complaints. This GRM was communicated to the attendees.

Female attendees were asked separately about their concerns. They were concerned about the monitoring process as well. According to them, women must be in the monitoring board, as they would best monitor the execution of the ESMP.

Finally, municipalities and women were concerned regarding their main role in this project and in monitoring any potential law violations by the Contractor during the rehabilitation phase. In particular, they asked about the procedure of sending their complaints in case the Contractor did not abide by the ESMP guidelines. In this context, the consultant and the representative of CDR explained that the head of municipalities have a main role that is to inform people about the project and at a later stage. Moreover, they have a major role in assisting CDR in monitoring the Contractor during project implementation. Any violation observed must be reported to CDR. Moreover, the representative of CDR explained to the concerned parties that:

- The project will include a GRM that will register and address grievances and complaints from individuals and households who are affected by the project. Any complaints must be reported to CDR.
- Project monitoring and verification will be undertaken by CDR, the implementing agency, to ensure the project is being implemented in line with the proposed objectives (a supervisory consultant will be monitoring the Contractor during the rehabilitation phase ensuring he is abiding by the ESMP). Moreover, it was explained that if the Contractor did not comply with the set social and environmental guidelines, they will face penalties.
- Progress reports will be prepared by CDR to the World Bank for review. Moreover, the

World Bank will ensure continuous implementation support.

- World Bank specialists who are based in Beirut will have regular interaction with CDR. This will allow the Bank to perform continuous monitoring of works.

Invited local NGOs include the Druze Women Association and Al Resalah Association, all of which cover Aley area. As for international NGOs, ACTED, ANERA, and DRC were invited. Out of all invited NGOs, only local NGOs attended the consultation meeting. They shared the same concerns of the rest of the public.

Photos:

**Public Participation meeting for Aley roads**



## Presentation :

## نقاط حوار الجلسة

- المقدمة
- أهداف اللقاء
- الجهات المعنية بالمشروع
- وصف المشروع
- ماذا يتضمن المشروع خلال مرحلة التنفيذ؟
- الآثار البيئية والاجتماعية الإيجابية للمشروع
- الآثار البيئية والاجتماعية السلبية المحتملة للمشروع
- خطة الإدارة البيئية والاجتماعية
- أسئلة ومناقشة عامة



REPUBLIC OF LEBANON  
Ministry of Public Works & Transport  
Directorate General of  
Land & Maritime Transport

مشروع الطرق والعمالة  
في لبنان

## خطة الإدارة البيئية والاجتماعية

## قضاء عاليه

## جلسة مشاركة عامة



DAR AL HANJASAH NAZH TALEB & PARTNERS  
دار الهندسة نزيه طالب وشركاه

## مقدمة

- يخطّط مجلس الانماء والاعمار لتنفيذ مشروع الطرق والعمالة في لبنان عبر تمويل من البنك الدولي
- يشمل المشروع أعمال تأهيل عدة طرق في بلدات من كافة الأضية اللبنانية
- يهدف هذا المشروع إلى تحسين كفاءة قطاع الطرق من خلال تحديد أولويات أعمال الطرق وتحسين تقنيات إدارة شبكة الطرق والسلامة العامة

## مقدمة

- تتمتع شبكة الطرق في لبنان بنطاق وتغطية كافيين بشكل عام
- لكن نسبة كبيرة من تلك الطرق في حالة سيئة وهو الأمر الذي يؤدي إلى إعاقة التنمية المحلية والاقتصادية، خاصة في المناطق الريفية التي تعتبر فيها حالة شبكة الطرق أدنى مستوى من حالة الطرقات على المستوى الوطني ككل



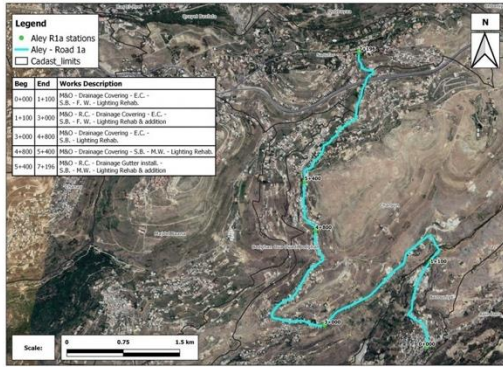
## 2. الجهات المعنية بالمشروع

الصفة	الجهة
ممول المشروع	البنك الدولي
إدارة وتنفيذ	مجلس الانماء والاعمار
استشاري هندسي وشركاه	دار الهندسة نزيه طالب وشركاه
استشاري بيئي	جيوفلنت ش.م.م.

## 1. أهداف اللقاء

- تحقيق الشفافية عبر إعلام الرأي العام بالمشروع لإبداء ملاحظاتهم وذلك وفقاً لسياسة ضمانات البنك الدولي (سياسة تشغيلية رقم 4.01)
- عرض لأهم الآثار البيئية والاجتماعية والتدابير التخفيفية المرتبطة بتنفيذ المشروع
- مناقشة خطة الإدارة البيئية والاجتماعية للمشروع التي تهدف لحماية الصحة البشرية، السلامة العامة والموارد البيئية

## 3. وصف المشروع



Road 1a : 7.2 km

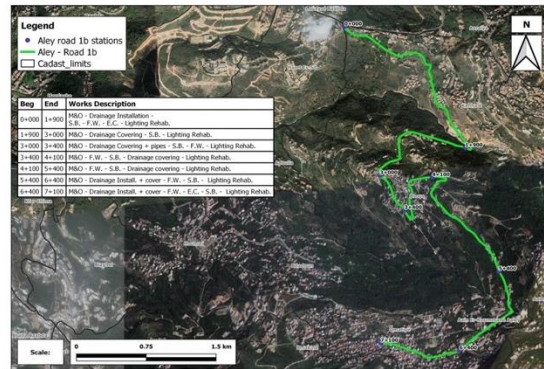
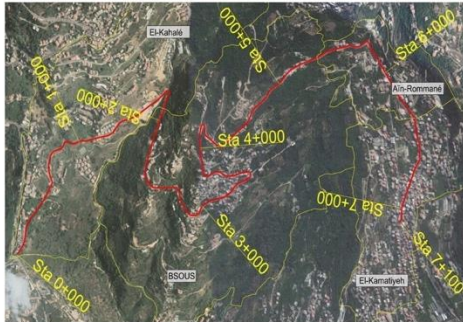
العزونية - شارون - عين صوفر



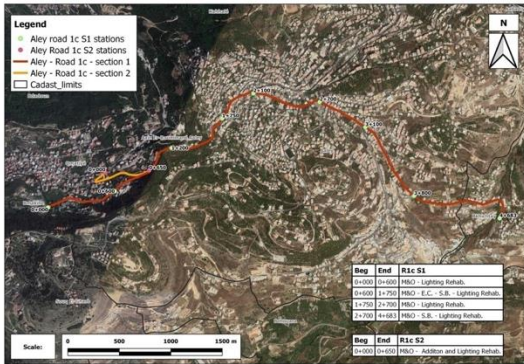
### 3. وصف المشروع

Road 1b: 7.1 km

الكحالة - بسوس - عين الرمانة - قماطية



### 3. وصف المشروع



Road 1C : 5.3 km

القماطية - عين الرمانة - عاليه - بخشتاي



**Section 1:**  
قماطية ، عين الرمانة ، عاليه ، بخشتاي

**Section 2:**  
قماطية ، عين الرمانة

### 3. وصف المشروع

Road 1d: 1.2 km

قماطية - بدادون



Aley R1c section 1



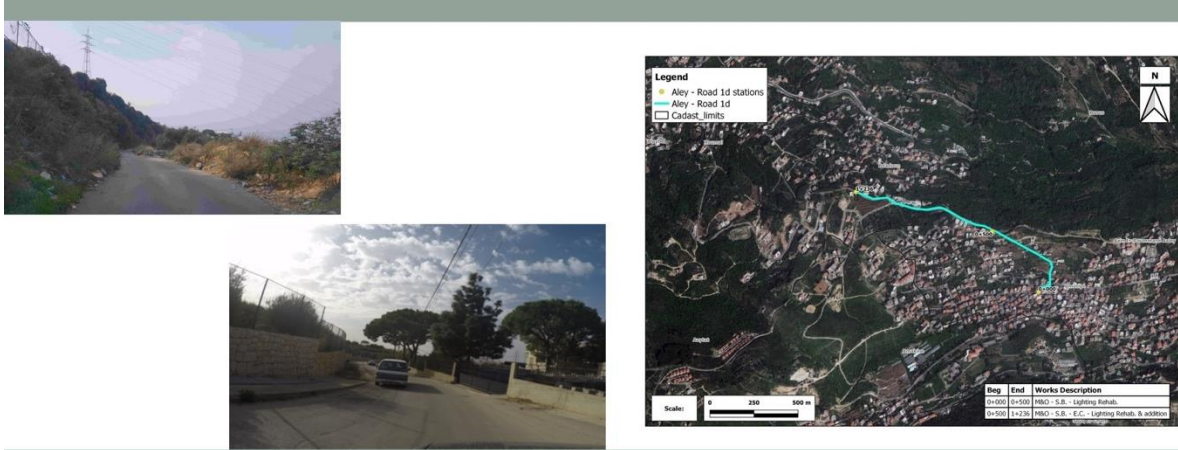
Aley R1c section 1



Aley R1c section 2



Aley R1c section 2



#### 5. الآثار البيئية والاجتماعية الإيجابية للمشروع

مشاريع الطرق:

- تقلل أو تمنع الغبار، وتحسن التصريف، وتقلل العقبات المرورية
- تضمن سلامة الطرق وخاصة القريبة على المدارس والمحلات
- تحد من الحوادث المرورية
- تشجع الناس على الحفاظ على نظافة وأمانة أحيائهم
- ترفع قيمة الأراضي وتزيد الخيارات للأنشطة التجارية على طول الطريق

#### 4. ماذا يتضمن المشروع خلال مرحلة التنفيذ؟

الأنشطة خلال مرحلة التنفيذ:



- استبدال أو تأهيل طبقات الإسفلت بحسب نتائج اختبار من أجل إعادة تأهيل
- إعادة تأهيل شبكة تجميع مياه الأمطار عند الحاجة
- وضع إشارات السير وتخطيط الطرقات
- بناء جدران دعم وحاجز السلامة عند الحاجة



## 6. الآثار البيئية والاجتماعية السلبية المحتملة للمشروع خلال مرحلة التنفيذ

التدابير التخفيفية	الآثار المحتملة على المجتمع
<ul style="list-style-type: none"> <li>التخطيط والتنشغيل السليمين للتحويلات المرورية</li> <li>إعادة تأهيل الطريق بشكل تدريجي</li> <li>وضع علامات سير وأنظمة إضاءة في الأماكن الحساسة لضمان سلامة النقل</li> </ul>	<ul style="list-style-type: none"> <li>تغير في حركة السير</li> </ul>
<ul style="list-style-type: none"> <li>تطوير خطة للتأكد من التزام المقاولين بالمبادئ التوجيهية للصحة والسلامة المهنية</li> <li>توفير المعدات المناسبة للحماية الشخصية</li> <li>توفير التدريب على الصحة والسلامة المهنية للعمال</li> <li>توفير إرشادات السلامة فيما يخص الأضواء والشرايط البرتقالية والبيضاء...</li> </ul>	<ul style="list-style-type: none"> <li>خطر على الصحة والسلامة المهنية والعمامة (في حال حصول اي حادث)</li> </ul>
<ul style="list-style-type: none"> <li>تسريع العمل من خلال الوضع والالتزام بأهداف ومقاييس واضحة لتقييم الأداء ومتابعة سير العمل</li> <li>إعادة تأهيل الطريق بشكل تدريجي</li> </ul>	<ul style="list-style-type: none"> <li>تأثر الحركة التجارية للمؤسسات والمحلات القائمة على جانبي الطريق</li> </ul>
<ul style="list-style-type: none"> <li>حصر الأعمال في ساعة محددة ومصرح عنها سابقاً</li> <li>صيانة دورية للمعدات وتجنب تعطلها</li> <li>الحد من استخدام الأجهزة والمعدات التي تسبب الضوضاء خصوصاً بالقرب من المنشآت الحساسة (المدارس وأماكن الصلاة)</li> </ul>	<ul style="list-style-type: none"> <li>الضوضاء</li> </ul>

## 6. الآثار البيئية والاجتماعية السلبية المحتملة للمشروع خلال مرحلة التنفيذ

التدابير التخفيفية	الآثار المحتملة على البيئة
<ul style="list-style-type: none"> <li>إستخدام آلات ذات انبعاثات منخفضة</li> <li>توجيه مصادر الانبعاثات بعيداً عن المساكن المحيطة</li> <li>رش الطرق بانتظام بالمياه لكافة الغبار</li> <li>تغطية مركبات نقل المواد الأولية والمخلفات من وإلى موقع المشروع</li> <li>تحديد سرعة الشاحنات والمركبات</li> </ul>	<ul style="list-style-type: none"> <li>تلوث الهواء</li> </ul>
<ul style="list-style-type: none"> <li>استخدام حواجز لمنع وصول الترسبات الرملية إلى قنوات المياه</li> <li>تغطية مواد البناء لتجنب غسلها إلى المسطحات المائية</li> <li>تطبيق ممارسات ترشيد المياه من قبل عمال البناء</li> </ul>	<ul style="list-style-type: none"> <li>تلوث المياه</li> </ul>
<ul style="list-style-type: none"> <li>التأكد من صيانة المركبات والمعدات ومن عدم وجود أي تسرب للوقود</li> <li>توفير أطقم في الموقع لمعالجة أي انسكاب عرضي على الفور</li> <li>تعيين مسؤولين عن الممارسات الجيدة في الموقع بما في ذلك العلاج السريع لأي انسكاب عرضي</li> </ul>	<ul style="list-style-type: none"> <li>تلوث التربة</li> </ul>
<ul style="list-style-type: none"> <li>تدريب الموظفين على إدارة النفايات</li> <li>إزالة المخلفات الصلبة من الموقع خلال 24 ساعة، والتخلص منها في مكبات قانونية محددة.</li> </ul>	<ul style="list-style-type: none"> <li>إنشاء المخلفات الصلبة</li> </ul>

## 7. خطة الإدارة البيئية والاجتماعية

**هدف الخطة الإدارة البيئية:** مراقبة المشروع والتأكد من مطابقته مع جميع المعايير البيئية. بعد دراسة الآثار المحتملة للمشروع، تقوم الدراسة باقتراح اساليب تخفيفية لهذه الآثار وسبل لمراقبتها.

### خطة الإدارة البيئية تتضمن:

- مراقبة نوعية المياه
- مراقبة نوعية التربة
- مراقبة نوعية الهواء
- مراقبة نوعية التنوع البيولوجي
- مراقبة الصحة والسلامة العامة
- خطة طوارئ في حال حدوث اي حادث مفاجئ.

## 6. الآثار البيئية والاجتماعية السلبية المحتملة للمشروع خلال مرحلة التشغيل

التدابير التخفيفية	الآثار المحتملة على البيئة
<ul style="list-style-type: none"> <li>استخدام مصادر الإضاءة الصديقة للبيئة بدلاً من الأضواء الصناعية للطرق العامة</li> </ul>	<ul style="list-style-type: none"> <li>اضطراب الأنظمة الإيكولوجية (زيادة مستويات التلوث الضوئي)</li> </ul>
<ul style="list-style-type: none"> <li>إعادة تأهيل شبكة تجمع مياه الأمطار عند الحاجة</li> </ul>	<ul style="list-style-type: none"> <li>زيادة الجريان السطحي (Increased runoff) تسرب محتمل للمعادن الثقيلة</li> </ul>
<ul style="list-style-type: none"> <li>وضع إشارات المرور وتعيين الحد الأقصى لسرعة المركبات</li> </ul>	<ul style="list-style-type: none"> <li>زيادة سرعة السائقين</li> </ul>

## أسئلة ومناقشة عامة

يمكنكم إبداء رأيكم

**شكراً لحضوركم  
ومشاركتكم**

عبر التواصل مع شركة جيوفلنت ش.م.م.

هاتف: 05 954 662 /3/4

فاكس: 05 954 662 Ext. 108

بريد إلكتروني: m.ballouk@geoflnt.com

أو عبر التواصل مع وحدة مشروع الطرق والعمالة في مجلس الإنماء والإعمار

هاتف: +961 1 980 096

بريد إلكتروني: rep.grm@cdr.gov.lb

Invitation letter



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BEIRUT - LEBANON  
website: www.geoflint.com

جيوفلنت ش.م.م.  
خليوي: ٠٠٩٦١٠٣٠٢١٩٠٥٩  
هاتف: ٠٠٩٦١٠٥٠٩٥٤٦٦٢/٣/٤  
فاكس: ١٠٨  
الطابق الأرضي - ماروكوز سنتر - الحازمية  
صندوق بريد: ٤٥ - ١٦٥  
بيروت - لبنان  
شهادة تسجيل شركة رقم: ٢٣٤١٢٦٤

### الموضوع: دعوة لحضور إجتماع مشاركة عامة حول مشروع "الطرق والعمالة"

تحية طيبة وبعد،

بما أن مجلس الإنماء والإعمار يقوم بتمويل من البنك الدولي بتنفيذ مشروع "الطرق والعمالة" لتأهيل طرقات في جميع المحافظات اللبنانية، بإستثناء محافظة بيروت؛

ولما كانت تكلفت شركة دار الهندسة نزيه طالب وشركاه من قبل مجلس الإنماء والإعمار للقيام بالدراسات الهندسية والبيئية المتعلقة بالمشروع والتي بدورها كلّفت شركة جيوفلنت ش.م.م. للإستشارات البيئية بإعداد خطة ادارة بيئية واجتماعية للمشروع المذكور؛

وحيث أنه برزت الضرورة لعقد اجتماعات تشاورية مع الجهات المعنية والعامّة بشؤون البيئة والأمر الإجماعية ذات الصلة بمشاريع الطرق والإستماع إلى آرائهم المتعلقة بالمشروع؛

وبما أن قضاء عاليه يتضمن أربعة طرقات من مجموع الطرقات الملحوظة للتأهيل في هذا المشروع ؛

لذلك

ندعوكم لحضور إجتماع مشاركة للعامّة في تمام الساعة الحادية عشر صباحاً من يوم الخميس الواقع في ١٦ تموز في المركز الثقافي/بلدية عاليه؛ ونتمنى على المواطنين الكرام، إبداء الملاحظات الخطيّة، في حال وجودها، حول المشروع المذكور، وإرسالها إلى شركة جيوفلنت ش.م.م. بواسطة الفاكس على الرقم التالي: ٠٥/٩٥٤٦٦٢ أو إيداعها في المركز الثقافي/بلدية عاليه.

وتفضلوا بقبول فائق الاحترام

مدير شركة جيوفلنت ش.م.م.  
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خليل زين



July 16, 2020

## REP Project – Aley Caza

ESMP-Public Participation  
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July 16, 2020

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**Table M Translated list of attendees**

<b>Name</b>	<b>Representation</b>
Mr. Kamal Meshiya	Head of municipal union of Aley
Engineer Nadime Hamadah	Head of Qamatiyeh Municipality
Mr. Muhanna Sami AlBen	Head of Charoun Municipality
Mr. Fawzi Fawzi Imad	Moukhtar of Azzounieh
Mr. Nidale Shiyeh	Head of works at Sawfar Municipality
Mr. Ghassan Qachouu	Municipality of Bmakine representative
Mr. Georges Ayyash	Municipality of Ain Soufar representative
Mr. Elie Imad	Dar al Handasa representative
Mrs. Rita Estphane	CDR representative
Mr. Khalaf	Head of Ain el Roummaneh Municipality
Mrs. Najwa Jaber	Treasurer of Al Wardiya Women Association
Mrs. Kamiliya Halima	Head of Al Wardiya Women Association
Mr. Samir Hatouri	Vice Head of Municipality of Aley
Dr. Mouna Akel	Board Member of Municipality of Aley
Dr. Hisham Najib	Head of Lebanese University Alumni
Mr. John Bejjani	Head of Kahaleh Municipality
Mrs. Amal Al Rayyes	Representative of Al Risala Association
Lawyer Qaysar Shaker	Head of Bsous Municipality