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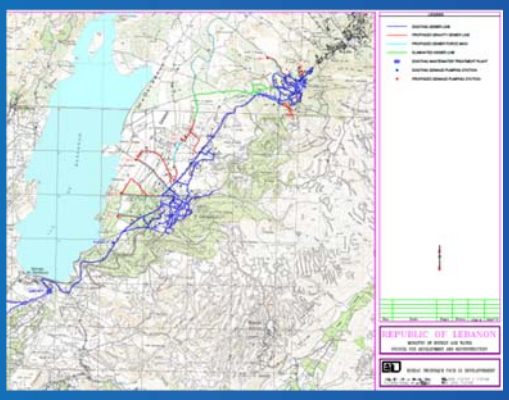

THE COUNCIL FOR DEVELOPMENT AND RECONSTRUCTION (CDR)

EXTENSION OF WASTEWATER COLLECTION NETWORKS DRAINED TOWARD EL MARJ AND AITANIT WASTEWATER TREATMENT PLANTS

AITANIT WASTEWATER SYSTEM

ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN (ESMP)

May 7, 2018

ELARD LEBANON			
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LIST OF ACRONYMS

a.s.l.	Above sea level
BTD	Bureau Technique pour le Développement
BTEX	Benzene, Toluene, Ethyl-benzene and Xylene
BWE	Bekaa Water Establishment
CDR	Council for Development and Reconstruction
CEMP	Construction Environmental Management Plan
CoM	Council of Ministers
DGA	Directorate General of Antiquities
DI	Ductile Iron
EC	Expropriation Commission
EDL	Electricité du Liban
ELARD	Earth Link and Advanced Resources Development
EMP	Environmental Monitoring Report
ESMP	Environmental and Social Management Plan
GoL	Government of Lebanon
HAP	Hazardous Air Pollutants
HSE	Health Safety and Environment
IBA	Important Bird Area
IEE	Initial Environmental Examination
IPA	Important Plant Area
IUCN	International Union for Conservation of Nature
LAP	Land Acquisition Plan
LARI	Lebanese Agricultural Research Institute
LRA	Litani River Authority
MoC	Ministry of Culture
MoE	Ministry of Environment
MoEW	Ministry of Energy and Water
MoIM	Ministry of Interior and Municipalities
MoPH	Ministry of Public Health
MTBE	Methyl Tertiary Butyl Ether
NSEQ	National Standards for Environmental Quality
ODS	Ozone Depleting Substances
OP	Operational Policy
PAP	Project Affected People
PPE	Personal Protective Equipment

PS	Pumping Station
ToR	Terms of Reference
UNDP	United Nations Development Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNFCCC	United Nations Framework Convention on Climate Change
uPVC	un-Plasticized Polyvinyl chloride
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
WB	World Bank
WHO	World Health Organization
WWTP	Wastewater Treatment Plant

EXECUTIVE SUMMARY

I. Introduction

Earth Link and Advanced Resources Development s.a.l. (ELARD) was awarded by the Council for Development and Reconstruction (CDR) (the "Implementing Agency") the development of an Environmental and Social Management Plan (ESMP) for the construction of sewage extension networks for Baaloul and Qaraoun that will connect to Aitanit Wastewater Treatment Plant (WWTP). These make up the Aitanit Wastewater System. This ESMP is prepared for the Aitanit Wastewater System to identify and assess possible impacts resulting from the Project and to propose measures to minimize the significance of negative impacts and maximize the benefits of positive ones. This document was prepared based on the requirements stipulated in the Terms of Reference, Activity I on Environmental and Social Management Plan – ESMP.

II. Regulatory and Institutional Framework

The ESMP report first refers to national legislation and international conventions ratified by Lebanon and relevant to the project. Various governmental institutions play a role in the permitting and supervision of the Project. These include the Council for Development and Reconstruction (CDR), Ministry of Public Works and Transport (MoPWT), Ministry of Environment (MoE), Ministry of Energy and Water (MoEW), Ministry of Interior and Municipalities (MoIM), in addition to the Bekaa Water Establishment (BWE). At a local level, the municipalities of Baaloul and Qaraoun and the Lake Union of Municipalities are primary stakeholders.

III. Project Description

The proposed Aitanit Wastewater System includes the construction of 13.2 km of additional/extension sewer lines (gravity lines and force mains) and six (6) pumping stations in Baaloul and Qaraoun on state-owned lands, in addition to lateral sewer lines. The additional sewer lines will be constructed within the public domain along the existing roads Right-of-Way.

IV. Description of the Environment

The proposed Project extends within the villages of Baaloul and Qaraoun, in the Caza of West Bekaa, in the Bekaa Governorate of Lebanon. The additional/extension sewer lines will be constructed within the public domain along the existing roads Right-of-Way. As for the proposed six (6) pumping stations in Baaloul and Qaraoun, these are located on state-owned lands, over which the Government of Lebanon (GoL) and Litani River Authority (LRA) have propriety rights.

Average temperature recorded in the study area between January 2015 and December 2015 varies between -2.2°C in January and 36.1°C in August. The maximum wind speed reported ranged between 2 m/sec in November and 3.6 m/sec in April with a prevailing Southwesterly wind. The average yearly precipitation in the project area ranges between 800 and 1,000 mm/year.

The literature review revealed a lack of ambient air quality data for the Project area. Since the Project area is rural and the Project is located in the villages of Qaraoun and Baaloul in proximity to residential areas, the main potential sources of ambient air pollution include the presence of solid waste open dumps (especially when waste is open burned), agricultural activities involving the use of pesticides, traffic (knowing that the study area is not congested), and private power generators.

The literature review revealed a lack of noise data for the Project area. No background noise measurements were taken during the conducted field investigations (as per the contractual agreement).

No world heritage sites, biosphere reserves, protected areas or areas of high ecological value are located in the vicinity or in proximity of the sites. However, an area of special concern, the Qaraoun Lake classified as an Important Bird Area, is in proximity of the sites. Most of the sites have no or low ecological value in respect to floral biodiversity except for two sites (Pumping station 2 and Pumping station 6) which have medium ecological value due to presence of native trees or a large number of trees.

Uncovered prehistorical occupation and archaeological features are present in the area. In 1999, the mosaic floor of a Byzantine church was incidentally found in Lala by a resident. Heavy Neolithic sites were identified both in Lala and in Qaraoun. As for the byzantine period, the mosaic floor found in Lala asserts of the presence of an occupation in the vicinity during that period.

The Project site is located at an elevation between 900 m asl and 1,400 m asl. Several small springs are found within the study area, one located in Qaraoun village and two adjacent to Baaloul village. Public wells are available in the project area; three are located in Qaraoun village, one in Baaloul village. 37 private wells are reportedly located in the study area with depths varying between 80 and 320 m. The depth to groundwater is expected to be between 60 and 175 m BG, and the general groundwater flow direction in the area is towards the south and southeast.

The village of Baaloul extends over an area of 12 km^2, housing around 360 residences for a population estimated to be around 600 permanent residents, 1,000 seasonal residents, and 1,100 registered Syrian displaced persons. Qaraoun extends over an area of 27.8 km^2, has around 1,200 housing units, and a population estimated to be around 4,500 permanent residents, 1,200 seasonal residents, and around 5,000 registered Syrian displaced persons. Baaloul has one public middle school while Qaraoun has four schools. Several commercial activities are present in the area including farming and light industries. There are no hospitals or dispensaries located in Baaloul. Qaraoun, on the other hand, has no hospitals but two dispensaries and a total of 10 clinics. The main source of service water for Baaloul is springs and Artesian Wells, while Qaraoun village rely solely on Artesian Wells. Both villages are not fully serviced by the existing wastewater network mainly because of the recent residential expansions that took place after the network design and construction. Similar to many rural areas, both Baaloul and Qaraoun villages collect their municipal solid waste and dispose of them in designated dumpsites, since no sanitary landfill is present. However, the UNDP has initiated a project in Qaraoun and 4 other municipalities aiming at the development of

waste management plans for these villages, promotion of sorting at the source, the possible construction of a sorting facility in Qaraoun, together with composting of organic waste and landfilling of inerts in the newly constructed solid waste management facility of Job Jannine.

V. Environmental Impact Assessment

Environmental impact assessment was carried out to identify the main potential impacts that could arise from the construction and operation of Aitanit Wastewater System in the villages of Baaloul and Qaraoun, analyzes these impacts, and assesses their significance so that any potentially significant impact can be properly mitigated.

An in-depth screening of the potential environmental and socio-economic impacts was conducted to identify the negative and positive impacts. Mitigation measures were later proposed for all the identified impacts shown in the tables below.

Table 1 Construction Phase Environmental Management Plan

Source of Impact	Project Activities	Evaluation of Impact								Mitigation Measures	Residual Impacts	Institutional Responsibility	Cost Estimation
		N	M	E	T	D	R	L	S				
Emissions													
Air Emissions	Combustion and exhaust emissions	M	L	M	C	R	M	H	M	• Ensure that the contractor uses well designed, maintained, and operated equipment/vehicles. Precautionary control measures for emissions reduction could include proper engine fuel mixtures, regularly serviced exhaust emission systems, suitable engine tuning, and use of low sulfur content diesel (whenever available); • Use environmentally friendly equipment whenever possible (machinery with higher fuel efficiency or equipped with air pollution control devices to minimize exhaust emissions); • Keep a record of maintenance for all vehicles on site; • Report monthly fuel consumption records; • Avoid unnecessary idling of vehicles and equipment engines; and • Ensure that an effective Maintenance Plan and Schedule is in place for the generator	Medium	**Implementation:** Contractor **Supervision:** EHS Officer, project proponent, MoE	No separate costs estimation - Included in Contractor's scope of works and fees. Part of construction costs.
	Dust emissions	M	L	M	C	R	M	H	M	• Set physical barriers at the site boundaries; • Water-down work areas; • Schedule deliveries of raw materials efficiently; • Clean and wash tires before trucks departure from site; • Cover incoming and outgoing trucks; • Limit vehicles speed onsite to 20 km/h; • Maintain stockpiles (if any) at minimum heights and ensure that they are covered; • Surround the construction areas with scaffolding nets to control debris & dust from spreading beyond the construction site; and • Inform sensitive receptors of the construction works especially for dusty activities.	Medium	**Implementation:** Contractor **Supervision:** EHS Officer, project proponent, MoE	No separate costs estimation - Included in Contractor's scope of works and fees. Part of construction costs.
Noise	Site preparation, construction activities and operation of on-site generator, equipment and vehicles	N/D	M	L	M	C	R	H	M	• Fit all machinery, generator and vehicles with exhaust silencers where possible; • Place the generator on rubber pads and in a soundproof enclosure; • Ensure proper maintenance of machinery, vehicles and the generator (maintenance schedule should be in place); • Avoid idling and switch off engines when not in use; • Place noisy equipment away from sensitive receptors, behind stockpiles or other barriers to provide acoustic barriers; • Control the speed of vehicle movement on site and in the surrounding area; • Plan deliveries to and from the site properly; • Respect scheduled working hours (7:00 am- 6:00pm) and avoid night-time work; • Avoid construction works on Sundays and public holidays; • Inform staff and workers onsite on the impact of noise and the regulatory requirements; • Provide workers with noise protection equipment and enforce their use; • Conduct regular noise monitoring to ensure that noise emissions are compliant with national standards (Decision 52/1); and • Notify the residents of the plans and expected duration prior to initiating the works.	Medium	**Implementation:** Contractor **Supervision:** EHS Officer, project proponent, MoE	A generator's soundproof enclosure: 1,000 USD and above (depending on generator) Noise PPEs: Washable and reusable ear plugs: 1.5 USD or Ear Muffs: 28 USD. Noise monitoring: $300/ day.

Source of Impact	Project Activities	Evaluation of Impact								Mitigation Measures	Residual Impacts	Institutional Responsibility	Cost Estimation
		N	M	E	T	D	R	L	S				
Soil and Ground Water Resources	Accidental Spills of Fuel, Oil and Chemicals	N/D	H	G	L	C	I	M	H	• Any type of chemical, oil, fuels and lubricants must be stored and handled within containment facilities (e.g. bunded areas, leak proof trays) designed to prevent the release of spills/leaks to the soil and groundwater environment; • Maintenance schedule should be in place as part of the inspection procedures of all equipment/generators/machinery for risk minimization; • Maintenance of machines and equipment should take place off-site or onsite in a contained area with impermeable concrete pavement and drainage for vehicle washing and maintenance; • Oil spill response kits should be available wherever oils are being used/stored; • Promote awareness among workers on how to handle oil/lubricants; • Train workers how to clean up small scale spills; • Promote good housekeeping practices during construction; • Ensure drip trays are present when re-fuelling; • Prepare a Spill Emergency Plan specific for the project; and • In case of spill: ✓ Immediately report to the company representative in case of any spill; ✓ Stop the source of spill (close valve, seal pipe, seal hole or as appropriate); ✓ Check for hazards, flammable matters on site; ✓ Clean the spill by removing affected top soil layer by trained employees (they should be wearing appropriate PPE); ✓ Treat the removed soil as hazardous waste; ✓ Adopt as much as possible dry cleaning techniques to decrease resulting wastewater, and to avoid flushing of spills to deeper soil layers.	Low	**Implementation:** Contractor **Supervision:** EHS Officer, project proponent, MoE	No separate costs estimation - Included in Contractor's scope of works and fees. Part of construction costs.
	Poor Waste Management	N/D	H	L	L	C	I	M	M	• Segregate at source domestic waste, construction waste that can be reused, construction waste to be disposed of, etc.; • Sort excavation waste resulting from construction activities; • Reuse part of the excavation waste in backfilling; and dispose of the rest (if any) in a permitted construction and demolition waste dump designated by the Municipality of Beirut in agreement with the MoE; • Schedule the works for the dry season if possible; • Progressively carry out rehabilitation of disturbed areas following completion of work in each area (rehabilitation will include reinstatement of soil, surface leveling, re-vegetation and mulching where applicable); • Ensure that standards of "good housekeeping" are maintained (i.e., avoid littering, prevent storage of combustible waste for more than 24 hours to prevent attraction of pests and flies); and • Stockpiles shall be covered and contained.	Low	**Implementation:** Contractor **Supervision:** EHS Officer, project proponent, MoE	No separate costs estimation - Included in Contractor's scope of works and fees. Part of construction costs.
	Inadequate Storage and Disposal of Wastewater	N/D	M	L	M	C	R	M	M	• Make sure all connection are inspected and are not leaking Regular inspection of septic/ holding tanks (if any) and connections to the wastewater sewage network; • Obtain a permit from the Municipality of the relevant Water Establishment to transport and discharge the wastewater and sludge in authorized sites; and • Vehicle washing shall be only in contained maintenance areas offsite or onsite with impermeable concrete pavement and proper drainage.	Low	**Implementation:** Contractor **Supervision:** EHS Officer, project proponent, MoE	No separate costs estimation - Included in Contractor's scope of works and fees. Part of construction costs.
Depletion of Resources													
Soil and Ground Water Resources	Temporary or permanent change in topography, soil erosion and collapse from grading, trenching, or excavation	N/I	H	L	L	C	I	H	H	• Ensure international standards (i.e. ASTM Soil Compaction Standards) are met during any remaining excavation works, compaction and grading activities, in order to minimize expected disturbance during the construction phase; • Manage fixed routes for equipment movement and avoid multiple routes; and • Re-use excavated/cut materials as general fill where considered suitable.	Medium	**Implementation:** Contractor **Supervision:** EHS Officer, project proponent, MoE	No separate costs estimation - Included in Contractor's scope of works and fees. Part of construction costs.

Source of Impact	Project Activities	Evaluation of Impact								Mitigation Measures	Residual Impacts	Institutional Responsibility	Cost Estimation
		N	M	E	T	D	R	L	S				
	Dewatering Activities	N/I	L	L	M	C	R	M	M	• Testing of dewatered water should be performed prior to reuse or disposal so that contaminated water will be treated as hazardous waste; • Water produced from dewatering, if not contaminated, could be used for dust suppression if needed or could be discharge as storm water; however it must be settled and filtered from sediments before; • Where groundwater quality is deemed not suitable for use, water should be stored in temporary holding tanks before being removed by a licensed contractor; and • Coordinate with the Beirut Municipality on the proper way for the disposal of the dewatered water. Especially that high conductivity values are expected due to the proximity to the sea.	Low	**Implementation:** Contractor **Supervision:** EHS Officer, project proponent, MoE	No separate costs estimation - Included in Contractor's scope of works and fees. Part of construction costs.
Biological Resources	Construction activities, accidental spills and inadequate disposal of solid waste and wastewater	N/D	L	L	S	C	I	L	L	• Store and handle chemicals and oils within contained areas (e.g. bunded areas, leak proof trays) to prevent spills/leaks to the soil and groundwater; • Onsite maintenance of equipment should take place in a contained area with impermeable concrete pavement; • Provide oil spill response kits wherever oils are being used/stored; • Ensure transporting fuel to the construction in appropriate vehicles and containers, i.e. fuel tankers and sealed drums and provide drip trays when re-fueling; • Reuse the excavated material in backfilling (to the extent possible) and dispose of the rest (if any) in a permitted construction and demolition waste dump in coordination with the Municipality and in agreement with the MoE; and • Proper storage of construction material and their prompt disposal to prevent them from being washed away during rainfall.	Low	**Implementation:** Contractor **Supervision:** EHS Officer, project proponent, MoE	No separate costs estimation - Included in Contractor's scope of works and fees. Part of construction costs.
Water Resources	Water consumption for construction activities and domestic use	N/D	M	L	S	C	R	H	M	• Adopt a water saving plan during the construction phase and limit the amount of water used for domestic purposes.	Medium	**Implementation:** Contractor **Supervision:** EHS Officer, project proponent, MoE	No separate costs estimation - Included in Contractor's scope of works and fees. Part of construction costs.
Energy Resources	Energy consumption during construction activities	N/D	M	L	M	C	R	H	M	• Use equipment with higher fuel efficiency; • Report and monitor monthly fuel and energy consumption records to keep track of consumption levels and identify overuse; • Avoid unnecessary idling of vehicles and equipment engines; and • Ensure that an effective Maintenance Plan and Schedule is in place for the generator and equipment.	Medium	**Implementation:** Contractor **Supervision:** EHS Officer, project proponent, MoE	No separate costs estimation - Included in Contractor's scope of works and fees. Part of construction costs.
Other Impacts													
Traffic	Increase in traffic during construction	N/D	M	L	M	C	R	H	M	• Schedule activities properly (avoid peak hours for transportation and materials delivery; • Inform the nearby community of road blockages and duration when applicable, and provide clear signage and rerouting instructions; • Coordinate with municipal police in case of need for road closure and rerouting to be able to carry out specific construction activities.	Low	**Implementation:** Contractor **Supervision:** EHS Officer, project proponent, MoE	No separate costs estimation - Included in Contractor's scope of works and fees. Part of construction costs.
Socio-economic	Creation of new job opportunities	P/D	H	G	L	C	R	H	B	-	-	-	-
	Disturbances from noise and dust generation	N/D	M	L	S	C	R	H	M	Implement the proposed dust and noise emissions' mitigation measures (mentioned in sections 5.4.2 and 5.5.2)	Medium	**Implementation:** Contractor **Supervision:** EHS Officer, project proponent, MoE	A generator's soundproof enclosure: 1,000 USD and above (depending on generator) Noise PPEs: Washable and reusable ear plugs: 1.5 USD or Ear Muffs: 28 USD. Noise monitoring: $300/ day.

Source of Impact	Project Activities	Evaluation of Impact								Mitigation Measures	Residual Impacts	Institutional Responsibility	Cost Estimation
		N	M	E	T	D	R	L	S				
	Increased pressure on infrastructure	N/D	M	L	S	C	R	H	M	• All construction workers and personnel shall be responsible for ensuring that standards of "good housekeeping" are maintained. This will include: ✓ Clear all rubbish and work associated debris; ✓ Sort domestic and general waste into combustible (paper, food, cardboard, and wood) and non-combustible waste (metals, glass, rubble) streams at source by means of suitably labeled containers for safe collection, segregation and handling of all waste streams generated; and ✓ Avoid storage of combustible waste for more than 24 hours to prevent attraction of pests and flies. • Sort and collect hazardous wastes separately from domestic waste. All hazardous waste bags should be properly labeled so as to prevent occupational health hazards; • Compile details of hazardous wastes, including type, amount and disposal method, to track final destinations and identify opportunities for improvement; and • Transport excavation and construction wastes in covered/closed trucks.	Medium	**Implementation:** Contractor **Supervision:** EHS Officer, project proponent, MoE	No separate costs estimation - Included in Contractor's scope of works and fees. Part of construction costs.
Health and Safety Hazards	Potential risks to general health and safety of the workers, nearby residents and pedestrians	N/D	M	L	M	C	R	M	M	• Surround the construction areas with scaffolding nets; • Provide sufficient lighting; • Make sure ground/floor openings are fenced or covered; • Keep machinery and vehicles passages clear; • Implement speed limits for trucks arriving to and leaving the site; • Provide workers with the appropriate PPE (goggles, dust masks, helmets, hearing protection equipment, proper clothing, safety boots, etc…) and enforce their use; • Maintain the PPE (cleaning when dirty and replacement when damaged or worn out); • Ensure the availability of adequate loading and unloading space; • Prohibit smoking and littering; • Ensure adequate portable fire-fighting equipment is available and regularly maintained; • Provide an emergency action plan and fire hazard inspection procedures; • Ensure that an easily accessible first-aid station is provided on-site; • Post adequate signs at visible locations throughout the construction area indicating type of operation, potential risks, and appropriate medical/emergency action response; • Perform staff training about the fundamentals of occupational health and safety procedures, and about handling hazardous material containers and related wastes; • Implement the required air emissions and noise mitigation measures listed in sections 5.4.2 and 5.5.2 respectively.	Low	**Implementation:** Contractor **Supervision:** EHS Officer, project proponent, MoE	PPEs Prices/ person: Overall ~12 USD Boots ~100 USD Helmet ~ 5 USD PVC Gloves ~2 USD Welding Gloves ~ 4USD Goggles ~ 3 USD Mask ~8 USD Reusable ear plugs1.5 USD Ear Muffs 28 USD First Aid Kit (for 100 workers) ~200 USD

Table 2 Operation Phase Environmental Management Plan

Source of Impact	Project Activities	Evaluation of Impact								Mitigation Measures	Residual Impacts	Institutional Responsibility	Cost Estimation
		N	M	E	T	D	R	L	S				
Emissions													
Air Emissions	Combustion and exhaust emissions	N/D	M	L	L	O	R	H	M	• Promote awareness against idling through signboards; • Promote carpooling and use of public transport for employees; • Ensure that restaurants and shops use energy-saving systems for lighting, water heating, etc. (through incentives or contractual agreements); • Install high quality, power-saving electrical equipment and appliances; • Annual monitoring of GHG emissions and report to MoE as per Decision 99/1 of 2013; • Ensure that the specifications of the generators are in line with national standards (Decision 8/1 dated 2001) in terms of air pollutant emissions through regular monitoring; • Regular maintenance of the generators; • Ensure that effective generator stack heights are in place and in line with national standards (Decision 8/1 dated 2001). The formula for determining the stack height is: H= h + 0.2 √KVA Where ✓ H = Total stack height in meters ✓ h = Height of neighboring building in meters (within 50 m radius) ✓ KVA= Total generator capacity of the set in kVA = kW, i.e. the total capacity which is determined by the maximum fuel (energy) input	Medium	Operator	No separate costs estimation - Included in Operator's scope of works and fees
	Odor Emissions from onsite WWTP and from kitchens	N/D	L	L	L	O	R	H	M	• Install an effective and efficient indoor ventilation system inside the kitchens; • Ensure adequate height of the restaurant/ kitchen stack(s) to ensure dispersion of emissions; • Install the WWTP in an isolated, well-insulated area in one of the basement levels; • Monitor the WWTP effluent regularly to ensure compliance with the national standards (MoE Decision 3/1 dated 2005); • Conduct ozonation/ add iron salts or Potassium Permanganate to the influent to control odor generation from the WWTP; • Provide adequate ventilation pipes with a Carbon filter for the lifting station, the aeration and sludge holding tanks of the WWTP to control odors. The ventilation pipes must be extended above the highest point of the building by three (3) meters; • Ensure that a regular maintenance schedule for the WWTP is in place; • Ensure that sludge is transported as needed in tight bowser tanks to the nearest WWTP treating sludge to control the emission of odors; and • Minimize the emptying time of the sludge holding tank to the shortest period possible.	Low	Operator	No separate costs estimation - Included in Operator's scope of works and fees
Noise	Noise from generators	N/D	M	L	L	O	R	L	M	• Fit the generators with exhaust silencers; • Place the generators on rubber pads and in a soundproof enclosure; • Locate the generators in a designated room to further reduce noise emissions; • Ensure that a regular maintenance schedule is in place for the generators; • Conduct regular noise monitoring to ensure that noise emissions are compliant with national standards (Decision 52/1).	Low	Operator	No separate costs estimation - Included in Operator's scope of works and fees
	Noise from Traffic	N/D	M	L	L	O	R	L	L	-	-	-	-

Source of Impact	Project Activities	Evaluation of Impact								Mitigation Measures	Residual Impacts	Institutional Responsibility	Cost Estimation
		N	M	E	T	D	R	L	S				
Soil and Ground Water Resources	Accidental Spills of Fuel, Oil and Chemicals	N/D	M	L	L	O	R	M	M	• No storage tank should be used for the storage of fuel, oil or chemicals unless its material and construction are compatible with the type of materials to be stored and storage conditions (e.g. pressure and temperature); • Drip trays should be installed underneath equipment such as diesel generators, transformers to contain leakage and when using chemicals • Keep records of all fuel, oil, chemicals, and diesel; • Reduce the frequency of refuelling activity by filling the tanks to the maximal capacity during each refuelling operation; • Ensure that the maintenance schedule and checklist already prepared is being efficiently used; • Check tank levels prior to delivery to prevent overfilling through side glass or manually by dipstick logs; • Have a Spill Response Plan in place. • Ensuring a supply of suitable absorbent materials is available at re-fuelling points for use in dealing with minor spills. If a leak or spill occurs during loading or offloading operations, the operations will be stopped and the spill will be contained, cleaned up and collected based on the Spill Response Plan; and • Ensure that personnel assigned to handle chemicals/oil/fuel are well aware of the requirements. They should be trained prior to commencing their duties.	Low	Operator	No separate costs estimation - Included in Operator's scope of works and fees
	Inadequate Storage and Disposal of Solid Waste and Wastewater	N/D	M	L	L	O	R	L	L	• Provide low toxic or environment-friendly (biodegradable) detergents for washing and general cleaning purposes; • Install an oil/grease trap for the kitchen's sinks wastewater before the treatment process; • Promote Waste Segregation awareness within the complex; • Regularly inspect waste bins within the complex and those to be collected by the waste contractor, and coordinate with the Municipality for replacement of any broken or defective containers; • Regularly inspect garbage rooms; and • Ensure that standards of "good housekeeping" are maintained at all times.	Low	Operator	No separate costs estimation - Included in Operator's scope of works and fees
	Sludge Generation	N/D	H	L	L	O	R	M	M	• Use water-tight tankers for the transportation of sludge; • Use impermeable flooring underneath the sludge holding tank with a drain to contain any potential spill/ overflow and prevent soil and ground water contamination; • Construct a soak away pit lined with rock, into which any overflow from the WWTP in case of failure can be discharged and slowly percolate into the ground; and • Establish an agreement with the nearest WWTP treating sludge to dispose off the sludge generated, with the Municipality of Beirut and the MoE's approval.	Low	Operator	No separate costs estimation - Included in Operator's scope of works and fees
Depletion of Resources													
Biological Resources	Normal operation	P/D	M	L	L	O	R	H	B	-	-	-	-
Water Resources	Water consumption for operation activities, irrigation, and domestic use	N/D	M	L	L	O	R	H	M	• Obtain the exploitation permit (if not available) for the use of groundwater from the existing private well; • Conduct a detailed hydrogeological study to properly assess the effect of the extra use of groundwater within the study area; • Install low flow plumbing fixtures; • When cleaning use automatic systems to reduce water consumption; • Use efficient irrigation systems for green spaces (i.e., drip irrigation); • Perform regular inspections and maintenance of faucets and pipes; and • Monitor water consumption by depending on water meters to detect leaks and identify overuse.	Medium	Operator	No separate costs estimation - Included in Operator's scope of works and fees

Source of Impact	Project Activities	Evaluation of Impact								Mitigation Measures	Residual Impacts	Institutional Responsibility	Cost Estimation
		N	M	E	T	D	R	L	S				
Energy Resources	Energy consumption during construction activities	N/D	M	L	M	O	R	H	M	• Perform regular inspections and maintenance of equipment; • Report and monitor monthly fuel and energy consumption records to keep track of consumption levels and identify overuse; • Maximize the use of daylighting; • Upgrade machines/equipment and generators to more energy efficient technology when rehabilitation or upgrade is considered for the purpose of reducing consumption; and • Switch off all machines/ equipment or any other energy consuming appliances when not in use.	Medium	Operator	No separate costs estimation - Included in Operator's scope of works and fees
Other Impacts													
Traffic	Increase in traffic during operation	N/D	M	L	M	O	R	M	M	• Implement a traffic light system synchronized between intersections in order to improve the level of service in the area; • Traffic circulation signs should be respected and violations should be prohibited at all times; and • Change the direction of Ibtihage Kadoura Street towards the West to help the traffic from the Complex to be evacuated quickly with less impact on the surrounding network.	Medium	Operator	No separate costs estimation - Included in Operator's scope of works and fees
Socio-economic	Increased load on existing infrastructure (solid waste and wastewater generation, traffic, and energy)	N/D	M	L	L	O	R	M	M	• Regular inspection and maintenance of water networks, WWTP, machines and generators etc.; • Use efficient irrigation systems for green spaces (i.e., drip irrigation); and • Keep records of fuel and energy consumption.	Low	Operator	No separate costs estimation - Included in Operator's scope of works and fees
	Socio-economic development of the area (new of restaurants and offices, and new job opportunities)	P/I	H	L	L	O	R	H	B	-	-	-	-
	Visual amenity	P/D	M	L	L	O	R	H	B	-	-	-	-
Health and Safety Hazards	Potential risks to general health and safety of the employees and visitors	N/D	M	L	L	O	R	L	L	• Regularly inspect the stacks in the storage areas to identify any damage and determine any necessary remedial action to be taken; • Clean any spills promptly; • Store and handle chemicals (if any) as directed by their material safety data sheets and use the required PPEs; • Conduct regular training for employees about health and safety requirements; • Implement necessary security measures (CCTV, security patrol, speeding limits in the parking, etc.); • Ensure an appropriate firefighting system (portable and automatic) is installed; • Regular maintenance of all systems (firefighting, WWTP, mechanical, electrical, etc.); and • Implement the required air emissions and noise mitigation measures listed in sections 5.5.2 5.4.2 and 5.5.3 respectively.	Low	Operator	No separate costs estimation - Included in Operator's scope of works and fees

1. INTRODUCTION

1.1 GENERAL OVERVIEW

Earth Link and Advanced Resources Development s.a.l. (ELARD) was awarded by the Council for Development and Reconstruction (CDR) (the "Implementing Agency") the development of an Environmental and Social Management Plan (ESMP) and Land Acquisition Plan (LAP) for the construction of sewage extension networks for 13 villages:

- Bouerij, Chtaura, El Mraijet, Jdita, Jlala, Makse, Taalabaya, Taanayel, Wadi Ed Delem, Zebdol and Saouiri that will connect to El Marj Wastewater Treatment Plant (WWTP). These make up the El Marj Wastewater System; and

- Baaloul and Qaraoun that will connect to Aitanit Wastewater Treatment Plant (WWTP). These make up the Aitanit Wastewater System, in addition to the villages of Machghara and Aitanit (not covered by the scope of the LAP and ESMP studies).

This ESMP is prepared for the Aitanit Wastewater System to identify and assess possible impacts resulting from the Project and to propose measures to minimize the significance of negative impacts and maximize the benefits of positive ones. This document was prepared based on the requirements stipulated in the Terms of Reference, Activity I on Environmental and Social Management Plan – ESMP.

1.2 OBJECTIVES OF THE ESMP

The ESMP is an important decision-making tool to ensure that the environmental impacts of the Project are identified and evaluated prior to its commencement and that appropriate control measures are implemented in a timely manner.

The objectives of this ESMP study are to:

- Identify applicable Lebanese legislations, policies, standards as well as international agreements and treaties relevant to the Project;
- Provide a detailed description of the Project activities;
- Describe the environmental baseline conditions of the Study Area likely to be affected by the proposed Project activities;
- Identify the nature and extent of any significant potential environmental and social impacts be they positive (beneficial) or negative (adverse), temporary or permanent;
- Propose appropriate mitigation measures to minimize the significance of the identified impacts;
- Develop an appropriate monitoring plan to ensure the implementation of the proposed mitigation measures during construction and operation; and
- Conduct and report on public consultation.

1.3 STRUCTURE OF THE ESMP

The ESMP report consists of the following sections:

- Introduction;
- Institutional and Regulatory Framework;
- Project Description;
- Environmental Baseline Study;
- Environmental and Social Impact Assessment;
- Public Participation;
- Environmental and Social Management Plan;
- References; and
- Appendices.

1.4 PROJECT PROPONENTS

1.4.1 The World Bank (WB)

The World Bank (WB) is providing financial assistance to the project through the CDR. The WB responsibilities, in the context of this Project, are to:

- Provide technical support to the CDR and other relevant stakeholders as required to ensure a reasonable implementation of the Banks' safeguards; and
- Supervise the implementation of the Bank's environment and social safeguards through the implementation of the ESMP described in this document.

1.4.2 The Council for Development and Reconstruction (CDR)

The CDR is the implementing agency on behalf of the Government of Lebanon which has received financing from the WB toward the cost of the Lake Qaraoun Pollution Prevention Project, which the Project – subject of this study – falls under.

By that, the CDR is leading the execution of the Project and provides procurement, engineering and supervision services. The CDR shall ensure that the recommendations of this ESMP study for Aitanit Wastewater System are included in the Terms of Reference (TOR) of the contractors executing the construction activities.

1.4.3 Engineering Consultant

Bureau Technique pour le Développment (BTD) has been assigned by the CDR to provide engineering services to this Project and to prepare detailed engineering, Bill-of-Quantities and tender documents for the implementation of the Aitanit Wastewater System. BTD shall integrate the recommendations of the ESMP study into the detailed design, where the ESMP shall become an integral part of the tender documents.

1.4.4 ESMP Practitioner

ELARD has been assigned by the CDR to act as the environmental and social safeguard consultant for this Project. ELARD has prepared this ESMP in close coordination with the Implementing Agency and other stakeholders.

1.5 BACKGROUND INFORMATION

1.5.1 Project Location

The Project is located in the villages of Baaloul and Qaraoun in the West Bekaa Caza, Bekaa Governorate of Lebanon. The Project location is shown in Figure 1-1.

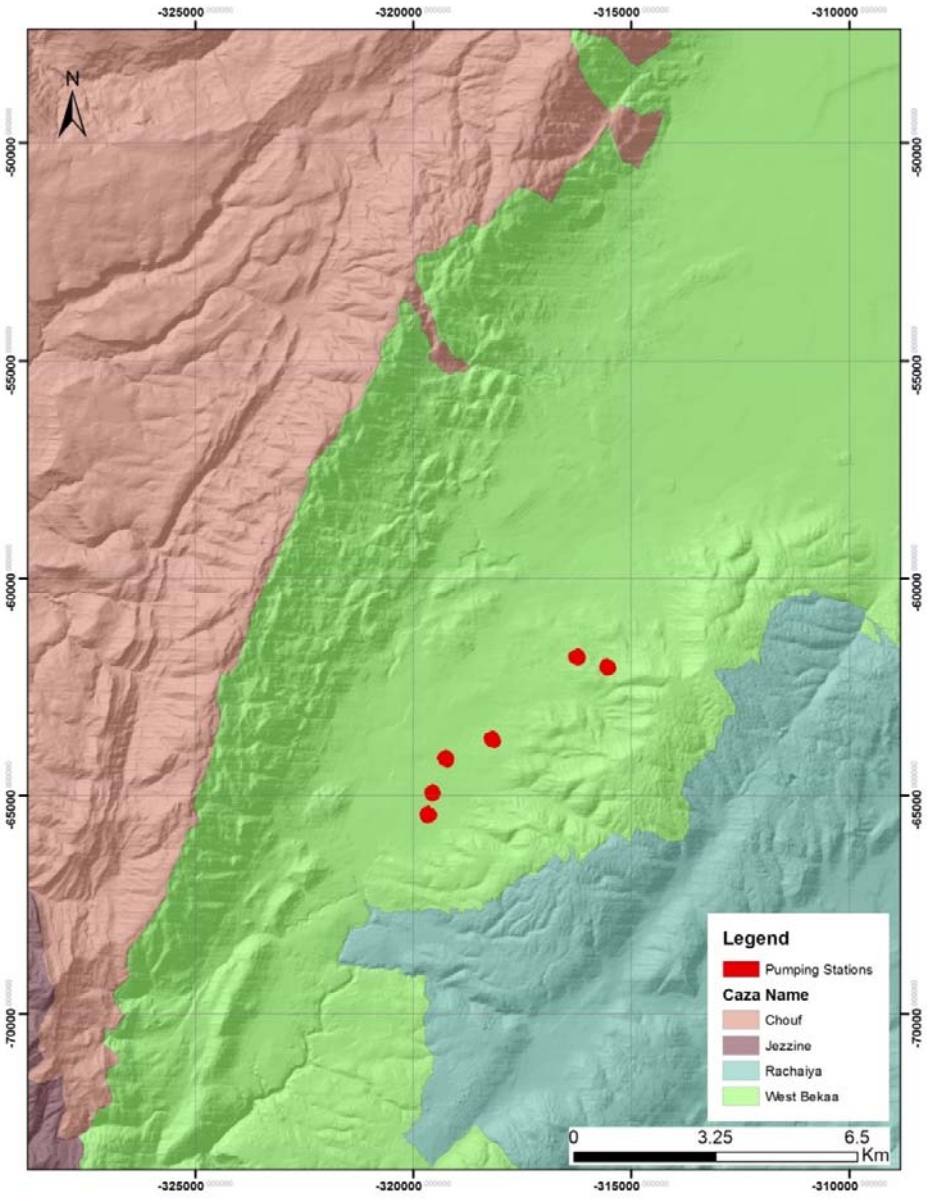


Figure 1-1 Project Location General Overview

1.5.2 Project Need and Objectives

One of the main components of The Lake Qaraoun Pollution Prevention Project is to improve the collection of domestic sewage through the construction of new networks, rehabilitating part of the old ones, and the establishment of new pumping stations where topographically needed.

This includes, among others, the construction of a sewage network and pumping stations in 13 villages in Zahleh and West Bekaa Cazas divided into two main systems:

- El Marj Wastewater System: includes Bouerij, Chtaura, El Mraijet, Jdita, Jlala, Makse, Taalabaya, Taanayel, Wadi Ed Delem, Zebdol and Saouiri connected to El Marj WWTP; and
- Aitanit Wastewater System (subject of this report) includes the villages of Baaloul and Qaraoun connected to Aitanit WWTP. The latter services a total of four villages, two of which are not addressed in this ESMP report, which are Machghara and Aitanit.

2. LEGAL AND INSTITUTIONAL FRAMEWORK

2.1 INTRODUCTION

This section presents an overview of public and private institutional stakeholders relevant to the Project, as well as applicable legislation, policies, standards and international treaties and agreements setting the regulatory environmental requirements associated with the Project.

The objective is to ensure compliance not only with Lebanese environmental laws and regulations, but also with the World Bank Safeguards Policies as well as relevant international agreements of which Lebanon is signatory, and to observe non-statutory corporate standards and good practice guidance.

2.2 INSTITUTIONAL FRAMEWORK RELEVANT TO THE ESMP STUDY

Various governmental institutions play a role in the permitting and supervision of the Project. These include the Council for Development and Reconstruction (CDR), Ministry of Public Works and Transport (MoPWT), Ministry of Environment (MoE), Ministry of Energy and Water (MoEW), Ministry of Interior and Municipalities (MoIM), in addition to the Bekaa Water Establishment (BWE).

At a local level, the municipalities of Baaloul and Qaraoun and the Lake Union of Municipalities are primary stakeholders in part of the Aitanit Wastewater System addressed in this ESMP report. The role of the different institutions with a particular focus on environmental protection is summarized in Table 2-1.

Table 2-1 Public Administrations Concerned with the Protection of the Environment

Public Administration	Prerogatives
Council for Development and Reconstruction (CDR)	The CDR will lead the execution of the project components and designate competent parties to implement them. The CDR will also supervise the implementation of the Environmental and Social Management Plan (ESMP) and will make sure that the recommendations are included in the Terms of Reference (TOR) of the contractors executing the construction activities. The CDR will be also responsible for the needed land acquisition procedures for the execution Aitanit System. In addition to that, the CDR will prepare the necessary reports to be submitted to the World Bank.
Ministry of Environment (MoE)	MoE is the national competent authority responsible for the protection of the environment in Lebanon. MoE is responsible for reviewing the ESMP report for the Project and for issuing the conditions for approval of the Project. Upon approval of the ESMP, MoE is responsible to enforce and supervise the implementation of the Environmental and Social Management Plan (ESMP).

Public Administration	Prerogatives
Ministry of Energy and Water (MoEW)/Bekaa Water Establishment (BWE)	The MoEW, through the Bekaa Water and Wastewater Establishment (BWE), is responsible for wastewater and potable water management. The MoEW will be responsible for approving the design of wastewater networks, and other matters related to water resources management. The BWE will monitor the implementation of the ESMP for the project activities during the operation phase.
Ministry of Interior and Municipalities (MoIM)	MoIM manages the affairs of Municipalities and Unions of Municipalities, stops all kinds of infractions and violations, and oversees local authorities' affairs and operations.
Ministry of Public Works and Transportation (MoPWT)	According to Decree 13379/1998, the Directorate General of Roads and Buildings of the MoPWT is responsible for the inspection of sewage networks. Moreover, public roads fall under the MoPWT authority. Consequently, it is important to coordinate with the MoPWT when implementing the project.
Litani River Authority (LRA)	LRA has overall responsibility for the management of the Litani River and the Qaraoun lake. It shall oversee the implementation of this project which contributes to the protection of the quality of the River and the Qaraoun Lake.
Baaloul and Qaraoun Municipalities	The Municipalities will supervise the implementation of the ESMP and particularly the ESMP recommendations related to the activities of the current Project during its operation. The Municipalities are responsible to manage complaints from local residents and may be involved if complaints are received during Project implementation.

2.3 RELEVANT LEBANESE REGULATIONS AND STANDARDS

2.3.1 Overview of the Legal Framework in Lebanon

The Lebanese Constitution represents the strongest legislative text in Lebanon and when in contradiction with the Constitution, a proposed legislation(s) cannot be issued. International treaties/agreements ratified by Lebanon have the second priority in the Lebanese legislative framework. The legal structure in Lebanon is shown in Figure 2-1.

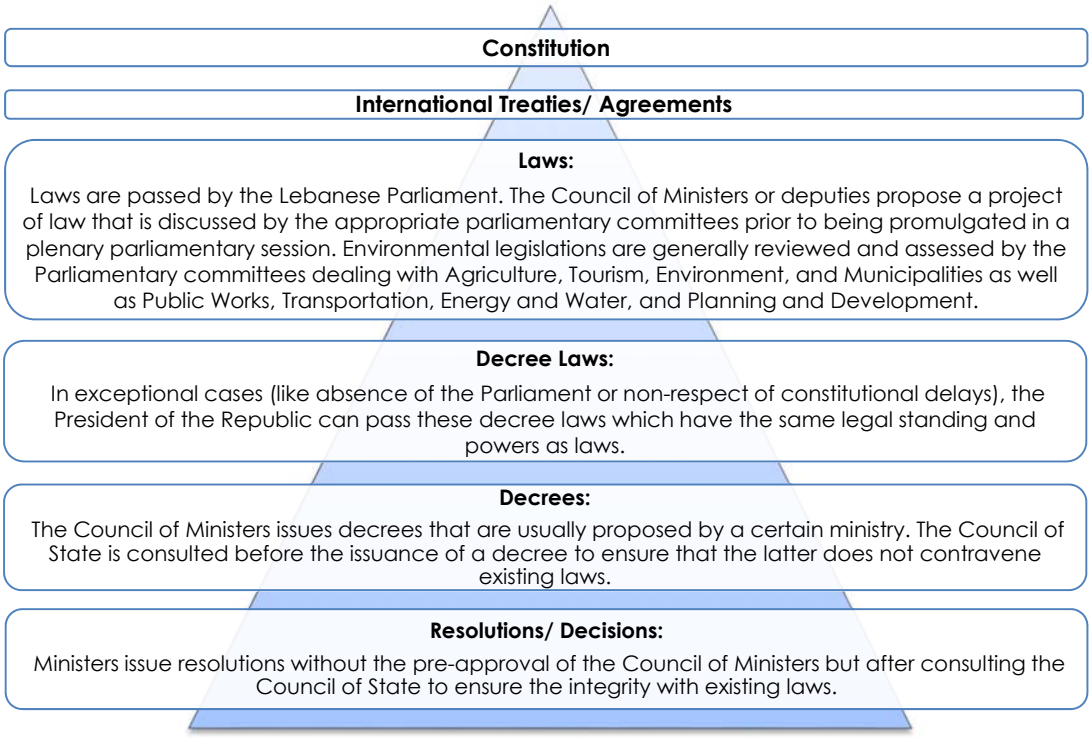


Figure 2-1 Hierarchy of Legislation in Lebanon

2.3.2 Synopsis of the Legislative Framework for Environmental Protection

Table 2-2 presents an overview of the main environmental legislations found in Lebanon dealing with environmental permitting, the management of water resources, public maritime domain, solid waste, wastewater, as well as air quality.

Table 2-2 Summary of Relevant Environmental Legislations

Law / Decree	Year	Reference Entity	Relevant Provisions
Decree 3989	2016	CoM	Designation of an Environmental Police Department within the Ministry of Environment to regulate environmental crimes and enforce penalties; and specification of their organization and mandates.
Decree 3058	2016	CoM	Integration of immovable heritage to private and public buildings and properties.
Decree 3057	2016	CoM	Defines and regulates the procedures followed by the DGA for the preventive and rescue excavations.
Circular 6/1	2015	MoE	Defining EIA and IEE review fees and bank guarantees.
Environmental Prosecutor Draft Law	2012	CoM	Establishing an Environmental Prosecutor.
Decree 8157	2012	CoM	Establishing the National Council for the Environment and specifying its mandates and organization.
Decree 8633	2012	CoM	Sets the EIA Procedures. It is under the Framework of the Environmental Law. It stipulates the EIA procedures and regulations related to all development Projects that have a potential impact on the environment.
Decree 8213	2012	CoM	Strategic Environmental Assessment of Policies, Plans and Programs in the public sector.
Decree 2275	2009	CoM	Application Decree on the organization and mandates of the MoE, its divisions and departments.
Law 37	2008	Parliament	Defines and regulates the protection and management of cultural properties.
Law 690	2005	Parliament	Law on the Organization of the Ministry of Environment. The Law gives the Ministry of Environment the prerogative to set the standards and norms for the protection of coastal zone, river beds and different water resources taking into account the protection of the environment and the conservation of its natural resources.
Decision 3/1	2005	MoE	Environmental Guidelines for the establishment and operation of small-scale wastewater treatment plants.
Law 646	2004	Parliament	Construction Law – Amendment of the Decree-law 148/83.
Law 444	2002	Parliament	Sets the framework for environmental protection. Provides the principles and rules for protecting different environmental matrices (air, water, soil…) from pollution with wastewater, hazardous wastes, chemicals, and noise, etc.; and specifies the penalties for violating environmental laws. • Section 1 (Basic Principles and General Provision) • Section 2 (Organization of Environmental Protection), paragraph 4 (Environmental Monitoring Mechanisms) • Section 3 (Environmental Information System and Participation in Environmental Management and Protection) • Section 4 (Environmental Impact Assessment)

Law / Decree	Year	Reference Entity	Relevant Provisions
			• Section 5 (Environmental Protection) • Section 6 (Responsibilities and Sanctions)
Decision 8/1	2001	MoE	National Standards for Environmental Quality (NSEQ) • Provides standards for stack emission levels and air pollutants emissions discharge limits from generators. Appendix 1 (ELVs)- Tables 1 to 3) and Appendix 2-9 (minimum stack height for generators) • Provides ELVs for wastewater discharged into different receiving media (sewerage system, surface water, sea).
Ministerial decree	1998	MoC	Prohibits the illicit trafficking of cultural artifacts
Law 623	1997	Parliament	Implementing penalties for vandalism of water, telephone and electricity infrastructure
Decision 52/1	1996	MoE	Specifying the National Standards for Environmental Quality (NSEQ) and the Environmental Limit Values (ELVs) for air, water, and noise: • Section 10 (Noise Standards) • Section 14 (Ambient Air Quality standards)
Law 58	1991	Parliament	Expropriation law which was modified later on by the Law enacted on 12/08/2006.
Law 21	1990	Parliament	Ratification of the UNESCO convention for the protection of antiquities.
Law 64/88	1988	Parliament	Environmental protection against hazardous waste that could harm air, water, biodiversity, soil, and people; states fines for activities that result in pollution and hazards to the environment and public health. • Table 1 (specifies hazardous substances and non-hazardous waste).
Decree-Law 69	1983	CoM	Decree-law on urban planning.
Decree-Law 68	1983	CoM	Organizing drilling to extend lines of public services in roads. تنظيم أشغال الحفر لمد خطوط الخدمات العامة في الطرق وبراحتها
Law 118	1977	Parliament	• Article 74: License for digging roads to extend public water pipes • Article 51: Regulate traffic and public transport
Decree 8735	1974	CoM	Protection against pollution from solid and liquid waste (prohibiting the digging of wells for the disposal of raw sewage, banning sewage infiltration from septic tanks and the use of untreated sewage for the irrigation of vegetables and some fruit trees), and assigning solid waste management to municipalities.
Law 973/74	1974	Parliament	Relating to solid waste pollution; followed by application Decree No. 8735.

Law / Decree	Year	Reference Entity	Relevant Provisions
Decision 225	1934	MoC	Establishes a system for penalizing violations related to laws on ancient monuments and ruins and historical buildings.
Law 166/LR	1933	Parliament	Sets "the regulation of ancient monuments".
Decree 2761	1933	CoM	Provides guidelines related to Wastewater Management and Disposal; related to the pollution caused by the discharge of liquid waste, emphasizes the prohibition of direct or indirect wastewater discharges and waste disposal into water streams.
Decree law 16 L	1932	CoM	Mandates the establishment of buffer zones for the protection of all surface and groundwater resources from any type of activity/potential source of pollution. Requirements for buffering are found in Decision 320/26.
Decision 320	1926	MoE	Related to the protection and use of water bodies belonging to the public domain.

2.3.3 EIA Decree and Project Relevance to Environmental Protection Law

The EIA Decree No. 8633/2012 sets specifications and criteria for environmental standards and requirements, principles, and measures necessary to assess the environmental impact of development projects. The EIA Decree addresses the objectives of the regulation, definitions, as well as various stages of the national EIA process such as screening, scoping, implementation, and review of the EIA report, in addition to the period of validity, and the appeal process. The EIA Decree also lists all the activities for which an EIA study or permit conditions are mandatory, and those that require an IEE (refer to Appendices 1, 2 and 3 of the EIA Decree). The main steps of the EIA Implementation Process in Lebanon are summarized in Figure 2-2 as described in Appendix 9 of the EIA Decree.

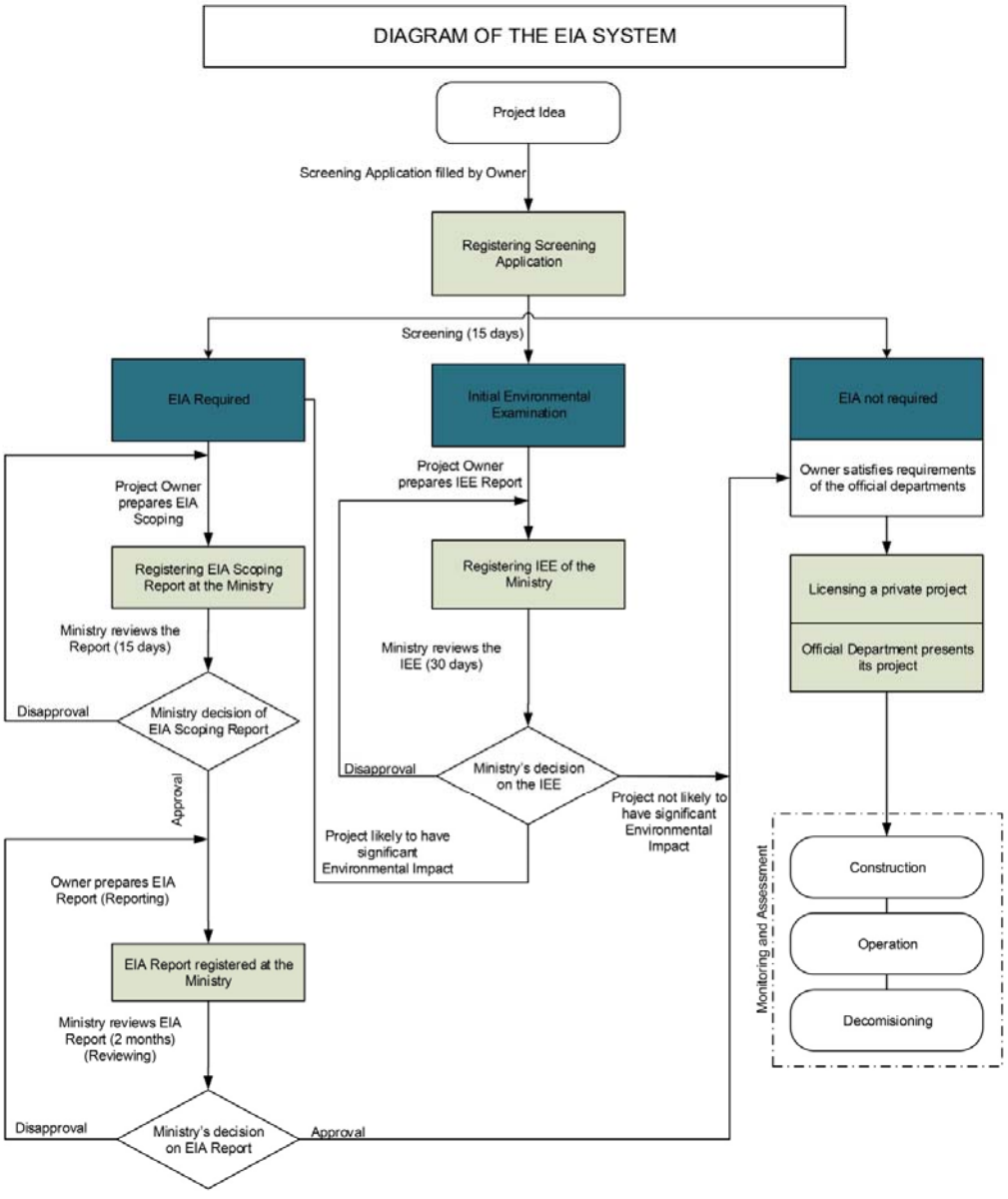


Figure 2-2 Schematic Diagram of the IEE Licensing Procedure

2.3.4 Relevant National Environmental Standards

The main legislative texts that stipulate environmental standards in Lebanon are listed in Table 2-3. National emission and discharge standards were established by MoE in Decision 52/1 dated 1996 and later updated and complemented in the Ministerial Decision 8/1 dated 2001. The relevant national standards are detailed in Appendix D and grouped into the following:

- Ambient Air Quality and Stack Emissions
- Noise
- Wastewater Discharges and Treated Effluent Reuse.

Table 2-3 Relevant National Environmental Standards

Relevant Standards*		
Ministerial Decision No. 52/1, MoE	29/7/1996	National Standards for Environmental Quality and Environmental Limit Values for Air, Noise, Water and Soil
Ministerial Decision No. 8/1, MoE	30/1/2001	Updates/complements Decision No. 52/1 by developing National Standards for Environmental Quality (NSEQ) related to air pollutants and liquid waste emitted from classified establishments and wastewater treatment plants into receiving water bodies for both new and existing facilities.

2.4 INTERNATIONAL AGREEMENTS AND TREATIES

Lebanon has ratified 50 International Conventions (48 actually in force). Those treaties and conventions, which are most relevant to the proposed Project activities, are listed in Table 2-4.

Table 2-4 Ratified or Signed International Agreements Relevant to the Project

Agreement	Objective	Relevance to Project
Convention on Biological Diversity, Rio de Janeiro - 1992 Ratified by Lebanon in 1994	1. To conserve biological diversity; 2. To use biological diversity in a sustainable way; and 3. To share the benefits of biological diversity fairly and equitably.	Protection and conservation of biodiversity during construction and operation activities
Convention to Combat Desertification - 1994 Ratified by Lebanon in 1994	To combat desertification	Control land clearance and Project footprint size
The Framework Convention on Climate Change, or Global Warming Convention (UNFCCC)– 1992 Ratified by Lebanon in 1994	To achieve stabilization of greenhouse gas concentrations in the atmosphere in order to prevent dangerous anthropogenic interference with climate system	Reduce greenhouse gas emissions from construction and operation activities
The Kyoto Protocol – 1997 Ratified by Lebanon on 13/11/2006	To reduce greenhouse gas emissions in an effort to prevent anthropogenic climate change	
Paris Agreement - Paris Climate Conference	To limit the increase in the global average temperature well below	

Agreement	Objective	Relevance to Project
(COP21), part of the UNFCC - 2015. Agreement Entered into force on October 2016. Signed by Lebanon in 2016. Not yet Ratified	2 °C and to raise efforts to limit the temperature increase to 1.5 °C; To foster climate resiliency and developments with low greenhouse gas emissions; To provide support for developing countries (financial and technological support) in their adaptation efforts.	
Vienna Convention for the Protection of the Ozone Layer – 1985 Montreal Protocol on Ozone-Depleting Substances - 1987 and its amendments Ratified by Lebanon between 1993 and 1999	To protect human health and the environment from any activity that modifies the ozone layer Adopt measures to control human activities found to have adverse impact on the ozone layer	Regulate the use of ODS (ozone depleting substances) during all phases of the Project
International Labour Convention No. 139, 120 and 136 Lebanon has ratified 50 International Labor Conventions (48 actually in force)	Prevent vocational risks ensuing from cancer causing materials and tools Deals with sanitation in offices Protect workers against the risks of intoxication ensuing from benzene	Protect workers' health and ensure proper sanitation and hygiene for base camps, work environment and offices
Convention on the Means of Prohibiting and Preventing the Illicit Import, Export and Transfer of Ownership of Cultural Property; Paris, 14 November 1970 Ratified by Lebanon in 1992	To find means to protect cultural heritage from the dangers of illicit export and transfer of ownership	Protection of any potential cultural properties and natural heritage found in the project sites
Convention concerning the Protection of the World Cultural and Natural Heritage; Paris, 16 November 1972 Ratified by Lebanon in 1983	To identify, protect, conserve, present and transmit the cultural and natural heritage to future generations	

3. PROJECT DESCRIPTION

This section describes the proposed Project and its different components to a level of detail commensurate with the available data at this stage of design. The term Project refers to the proposed Aitanit Wastewater System, namely in the villages of Baaloul and Qaraoun – subject of this ESMP report.

3.1 EXISTING WASTEWATER MANAGEMENT SYSTEMS

Currently around 10.3 km of gravity sewer lines exist in Baaloul and serve most of the village. All the wastewater is conveyed by gravity to Qaraoun, which is conveyed, in turn, to the Aitanit WWTP. At present, no sewage pumping stations exist in Baaloul.

Around 16.5 km of gravity sewer lines exist in Qaraoun and mainly serve the upper part of the village, above the main road. At present, one sewage pumping station exists, in addition to a sewer force main of around 1 km. This pumping station pumps wastewater conveyed from Qaraoun, together with that of Baaloul, to the Aitanit WWTP.

The Aitanit WWTP is located within the cadastral area of the village of Aitanit at approximately 400 m south of the Qaraoun Dam on the Litani River. The WWTP commenced operation in 2009 and was designed to operate on an average flow of 5,000 m^3/day and on a peak flow of 7,000 m^3/day; however, it is working under capacity treating only 1,500 m^3 to 2,500 m^3 of wastewater per day. The treated effluent is being discharged into the Litani River.

The WWTP consists of the following units achieving biological (secondary) treatment by trickling filters followed by disinfection:

- One inflow reception and pumping station equipped with one static screen, two duty and one standby submersible pumps;
- Two mechanically-operated fine screens where large solids are retained and collected manually to garbage bags (Figure 3-1);
- A septic haulers receiving station equipped with two screens and two pumps;
- Three primary clarifiers (Figure 3-2);
- Primary sludge pumping station with two duty submersible pumps;
- Trickling filters pumping station with two duty and two standby submersible pumps;
- Two trickling filters (Figure 3-3);
- Three final clarifiers;
- Secondary sludge pumping station:
  - Excess sludge: one duty and one standby submersible pump; and
  - Recirculating sludge: three duty pumps and one standby submersible pump.
- Two chlorine contact basins: two parallel basins (one for future operation);
- Four anaerobic digesters to reduce the organics content in the sludge to 50%; the sludge is therefore stabilized and partially thickened; and
- Sludge drying ponds; 6 units with a surface of 1,200 m^2 each. Those are utilized to dry the sludge to a solids content of more than 30% (Figure 3-4).

Figure 3-1 Fine Screening Unit

Figure 3-2 Sludge Settling Pond

Figure 3-3 Two Trickling Filter Basins

Figure 3-4 Sludge Drying Beds

3.2 PROPOSED WASTEWATER MANAGEMENT SYSTEMS

The proposed Aitanit Wastewater System includes the construction of 13.2 km of additional/extension sewer lines (gravity lines and force mains) and six (6) pumping stations in Baaloul and Qaraoun on state-owned lands, in addition to lateral sewer lines. The additional sewer lines will be constructed within the public domain along the existing roads Right-of-Way. The following sections present the proposed wastewater management systems specific to each of Baaloul and Qaraoun localities.

3.2.1 Construction Works in Baaloul

Construction works in the village of Baaloul will comprise of:

- A total length of 3.2 km of un-Plasticized Polyvinyl Chloride (uPVC) sewer lines of 200 mm in diameter as gravity sewer lines, and Ductile Iron (DI) lines of 80 mm in diameter as sewer force mains, in addition to lateral sewers to connect the newly-served population to the network. Around 100 household will be serviced by the proposed additional sewer lines. Alignment of the proposed additional sewer lines in the village of Baaloul is shown in the Master Plan, Appendix A of this report.
- Two (2) sewage pumping stations described in Table 3-1. The locations of these proposed pumping stations in the village of Baaloul are presented in Appendix B of this report.

3.2.2 Construction Works in Qaraoun

Construction works in the village of Qaraoun will comprise of:

- A total length of 10 km of uPVC sewer lines of 200 mm in diameter as gravity sewer lines, and DI 80–150 mm in diameter as sewer force mains, in addition to lateral sewers to connect the newly-served population to the network. A total of 240 housing units will be serviced by the additional sewer lines in Qaraoun. Alignment of the proposed

additional sewer lines in the village of Qaraoun is shown in the Master Plan, Appendix A of this report.

- Construction of four (4) sewage pumping stations, described in Table 3-1. The establishment of two pumping stations requires the construction of access roads branching from an existing road. The locations of these proposed pumping stations in the village of Qaraoun are presented in Appendix C of this report.

Table 3-1 Characteristics of the Proposed Pumping Stations

Plot Number	Pumping Station (PS) Number	Pumping Unit (Count)	Design Flow Rate (l/s)	Auxiliary Systems
Baaloul				
/2587/	PS-1	Duty Pump (1) Standby Pump (1) Future Pump (1)	3.5	Standby Generator Fuel storage tank
/2283/	PS-2	Duty Pump (1) Standby Pump (1) Future Pump (1)	3.5	Standby Generator Fuel storage tank
Qaraoun				
/7365/	PS-3	Duty Pump (1) Standby Pump (1) Future Pump (1)	3.83	Standby Generator Fuel storage tank
/2966/	PS-4	Duty Pump (1) Standby Pump (1) Future Pump (1)	12.38	Standby Generator Fuel storage tank
/3627/	PS-5	Duty Pump (1) Standby Pump (1) Future Pump (1)	6.28	Standby Generator Fuel storage tank
/4243/	PS-6	Duty Pump (1) Standby Pump (1) Future Pump (1)	3.5	Standby Generator Fuel storage tank

The locations of the proposed sewer lines and the pumping stations are shown in Figure 3-5.

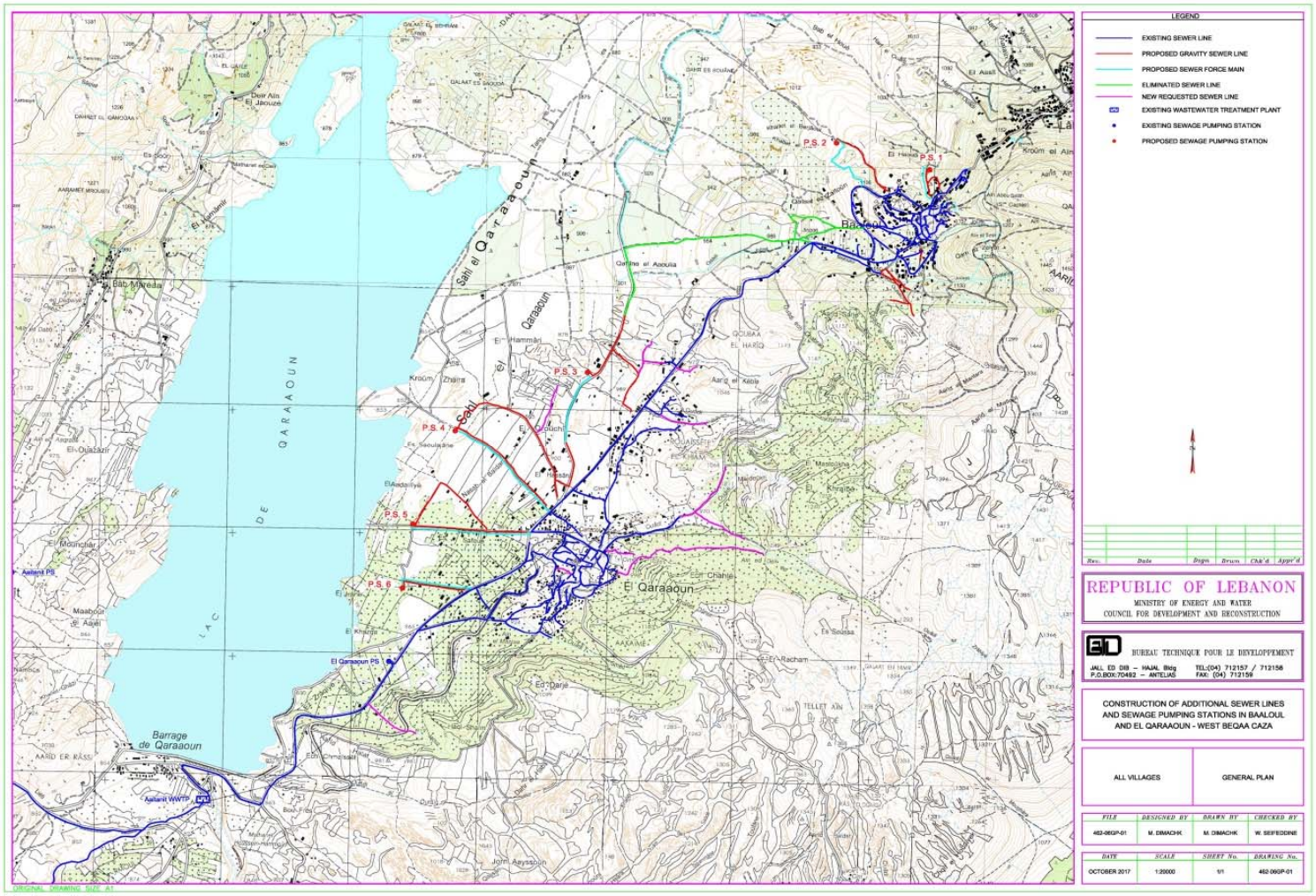


Figure 3-5 Map Showing the Proposed Sewer Lines

3.3 CONSTRUCTION PHASE

3.3.1 Main Construction Activities

Activities involved in the site preparation and construction works of the proposed additional sewer lines and pumping stations in Baaloul and Qaraoun are:

- Site clearance
- Excavation
- Backfilling
- Pipe works
- Concrete works
- Plastering
- Waterproofing
- Metal works
- Testing and commissioning
- Road reinstatement.

3.3.2 Main Construction-related Materials

The main construction-related materials associated with the construction of the proposed additional sewer lines and those for the pumping stations in Baaloul and Qaraoun are listed in Table 3-2 and Table 3-3, respectively. These have been extracted from the Bill-of-Quantities prepared by the Engineering Consultant.

Table 3-2 Main Construction-related Materials Associated with the Sewer Lines Construction Activities

Construction-related Materials Associated with Activities	Quantity (Unit of measurement)
Sand or gravel bedding and surrounds	12,803 m*
Reinforced concrete bedding and surrounds	435 m*
Concrete manholes	249 units
Manhole covers and frames	235 units
Manhole neck extensions	14 units
Concrete works	22 m^3
Cutting, breaking-out and removal of concrete pavement or staircases for sewers	410 m^3
Reinstatement of paved roads including base, sub-base and wearing courses	13,220 m^3
Reinstatement of concrete pavement or staircases	410 m^3

* As per BoQ, materials provided in linear meters and not quantities or volumes

Table 3-3 Main Construction-related Materials Associated with the Pumping Stations Construction Activities

Construction-related Materials Associated with Activities	Quantity (Unit of measurement)
Excavated material	875 m^3
Backfill material	745 m^3
Blinding and mass concrete	67 m^3
Reinforced concrete	490 m^3
Cyclopean concrete	80 m^3
Steel reinforcement for buildings	58 tonnes

Sourcing of raw materials will be from duly permitted sites; these have not yet been defined and will be defined once the contractor is selected.

3.3.3 Construction Schedule of Main Activities

The duration of construction activities for the proposed Project in Baaloul and Qaraoun is detailed in Table 3-4.

Table 3-4 Proposed Construction Schedule for the Installation of Additional Sewage Networks and Construction of Pumping Stations

Activity	Duration (months)
Mobilization, materials delivery to site	1
Excavation, sand bedding, pipe laying, hydro-testing, backfilling, and reinstatement	3
Installation of additional sewer networks and construction of pumping stations	10
Testing and commissioning	2
Total Period	**16**

3.3.4 Construction Equipment

Equipment and machinery employed at a typical construction site where the proposed works are executed are presented in Table 3-5 below. Nevertheless, the count of equipment and machinery to be used is not available at this stage. The awarded Contractor shall provide this at a later stage.

Table 3-5 List of Construction Equipment and Machinery

Equipment/Machinery
Air compressor
Asphalt spreader/paver
Backhoe loader
Bench Saw
Bulldozer
Circular Saw

Equipment/Machinery
Compressor
Concrete mixer truck
Drill
Dump truck
Excavator Truck (Poclain)
Fuel tanker
Grinder
Ground excavation dozer
Hole Cutter
Jack hammer
Leveling ground grader
Mobile Concrete pump
Mobile Crane
Pick Up
Plate compactor
Pneumatic breaker (Breaking hard ground)
Rock Breaker (Jack Hammer)
Roller compactor
Shovel Truck
Water tanker
Welding machine

3.3.5 Power Supply and Energy Consumption

For each construction site, the needed electricity will be supplied by Electricité Du Liban (EDL), if possible and private generators as needed. Details regarding the capacity of the generators, fuel consumption for the generators, equipment and machinery, and construction site fuel storage tanks are not available at this stage.

3.3.6 Water Supply

Water during construction will be needed for concrete batching activities, hydro-testing, compaction, dust suppression, and daily domestic use of workers. Water tankers will supply water from providers in the area. Water will be stored in plastic tanks onsite. Water consumption quantities are not available at this stage and will be estimated by the selected Contractor at a later stage.

3.3.7 Wastewater Generation

Wastewater generated during the construction phase will consist mainly of hydro-test water (for the hydraulic testing of pipes), concrete washout water, and domestic wastewater (onsite temporary housings, toilets, lavatories, etc.). Wastewater will be either collected and discharged at the nearest existing manhole connected to the sewage network, or collected

into an onsite temporary septic tank that will be regularly emptied by service providers in the area.

3.3.8 Solid Waste Management

Domestic-like solid waste generated during this phase will be disposed of along with the municipal solid waste stream generated in the Project area, collected by the municipalities of Baaloul and Qaraoun.

Construction and demolition waste that cannot be reused onsite will be appropriately disposed of at a location approved by the involved municipalities and MoE. Hazardous wastes (oil, grease, bitumen, chemicals, etc.) will be stored and disposed in coordination with the concerned municipalities and the MoE. No waste will be left on-site after the completion of construction works, and onsite waste burning will be prohibited.

3.3.9 Manpower, Transportation, and Security

The number of workers needed varies depending on the construction activities. The average manpower forecast required for the execution of works is not available at this stage. There is still a lack of data on the location of the labor camp – if any – at this design stage.

Transportation of construction materials and wastes, and laborers, will be carried out by the awarded Contractor in conformance with the applicable laws and regulations related to road and public safety.

Construction sites will be secured from public access and trespassing by proper fencing and delineation of sites, installation of warning boards, and appointment of onsite guards.

3.4 OPERATION PHASE

During the operation phase, operation and maintenance teams of the BWE will carry out day-to-day activities of the wastewater network and pumping stations.

3.4.1 Power Supply and Energy Efficiency Measures

For the operation phase, power will be needed for the operation of the pumping stations. Each station will be equipped with an EDL transformer and a standby power generator and a fuel storage tank. The standby generator, with its connecting cables and accessories, will be installed in a designated room on a concrete pad, inside sound-proof canopy. No provisions were presented in the design of the proposed pumping stations in terms of energy efficiency measures.

Details regarding the capacity of the transformers, generators and fuel tanks for each proposed pumping station are shown in Table 3-6.

Table 3-6 Capacity of the Transformers, Generators, and Fuel Tanks for each Pumping Station

Station	PS-1	PS-2	PS-3	PS-4	PS-5	PS-6
EDL Transformer (kVA)	100	160	100	160	100	100

Station	PS-1	PS-2	PS-3	PS-4	PS-5	PS-6
Standby Power Generator (kVA)	30	135	30	90	60	30
Fuel Storage Tank (L)	1,000	4,000	1,000	4,000	4,000	1,000
Standby Power Generator Tank (L)*	500	500	500	500	500	500

*Equipped in the generator and used as an intermediary tank

3.4.2 Water Supply

During the operation of the wastewater pumping stations, water supply is needed for routine housekeeping activities at the stations premises. An onsite water supply tank should be provisioned for each pumping station.

3.4.3 Wastewater Management

Under the normal operating and maintenance conditions of the sewage networks and pumping stations, no wastewater is expected to be generated. Nevertheless, faulty operation and maintenance practices or sudden malfunctioning in either the sewage collection lines or pumping stations is expected to result in raw wastewater overflows. In particular, malfunctioning or prolonged power outages of pumping stations might result in the septicity of collected raw sewage in the stations wet wells. This might result in the generation of foul odors and bases for vector breeding – if not promptly resolved.

Wastewater overflows at the level of the pumping stations are directed through an emergency overflow/bypass line that diverts raw wastewater usually into the receiving environment. Prolonged malfunctioning resulting in raw wastewater overflows is considered detrimental to the environment and public health. The engineering design of the proposed pumping stations in Baaloul and Qaraoun takes into consideration a wastewater overflow emergency/bypass line for the proposed pumping stations; however, the detailed design is not available at this stage.

3.4.4 Solid Waste Management

Solid wastes will be generated during maintenance works involving the repair of sewer pipelines or malfunctions of the pumping stations. Hazardous wastes generated from the operation and maintenance of sewer lines and pumping stations – mainly wastewater/ sludge residues, will be disposed of in coordination with the concerned municipalities and the MoE.

4. DESCRIPTION OF THE ENVIRONMENT

This section establishes the baseline environmental conditions within the designated Study Area. Aspects considered cover the physical, biological and socioeconomic environment. For this purpose, published documents were reviewed and analyzed in order to define the characteristics of the existing environment and the projected future environment assuming the non-implementation of the Project.

The desk study involved a review of the published literature, reliable Internet sources and available satellite images of the Project Area. Information on the area was verified and supplemented through a quick environmental baseline field investigation. The field survey was in the form of a walk-through along the proposed Study Area.

The results of the field and desk surveys were documented through maps, photographs and text describing the existing state of the environment prior to the construction of the proposed Project.

4.1 PROJECT BOUNDARIES

The proposed Project extends within the villages of Baaloul and Qaraoun, in the Caza of West Bekaa, in the Bekaa Governorate of Lebanon. The additional/extension sewer lines will be constructed within the public domain along the existing roads Right-of-Way. As for the proposed six (6) pumping stations in Baaloul and Qaraoun, these are located on state-owned lands, over which the Government of Lebanon (GoL) and Litani River Authority (LRA) have propriety rights. The locations and coordinates of the pumping stations are shown in Figure 4-1, Figure 4-2 and Table 4-1.

Figure 4-1 Proposed Pumping Station Sites in Baaloul

Figure 4-2 Proposed Pumping Station Sites in Qaraoun

Table 4-1 Geographic Coordinates of Proposed Pumping Stations

Pumping Station	Coordinates
PS-1	N: 33°35'41.88" E: 35°44'33.21"
PS-2	N: 33°35'35.07" E: 35°45'1.22"
PS-3	N: 33°34'38.87" E: 35°43'20.25"
PS-4	N: 33°34'22.94" E: 35°42'39.53"
PS-5	N: 33°33'57.66" E: 35°42'28.67"
PS-6	N: 33°33'40.72" E: 35°42'25.49"

4.2 PHYSICAL ENVIRONMENT

4.2.1 Climate and Meteorology

Climatic and meteorological data for year 2015 were obtained from the Lebanese Agricultural Research Institute (LARI) from the two stations closest to the site: Houch Aammiq and Kherbet Qanafar stations.

4.2.1.1 Temperature

The Study Area is characterized by hot, dry summers and relatively cold, wet winters. Average Minimal and Maximal temperatures recorded between January 2015 and December 2015 are represented in Figure 4-3. Average monthly temperatures ranged between a minimum of -2.2°C in January 2015 and a maximum of 36.1°C in August 2015 in Houch Aammiq station and an average monthly temperatures range between a minimum of 0.1°C in January 2015 and a maximum of 32.9°C in August 2015 in Kherbet Qanafar station.

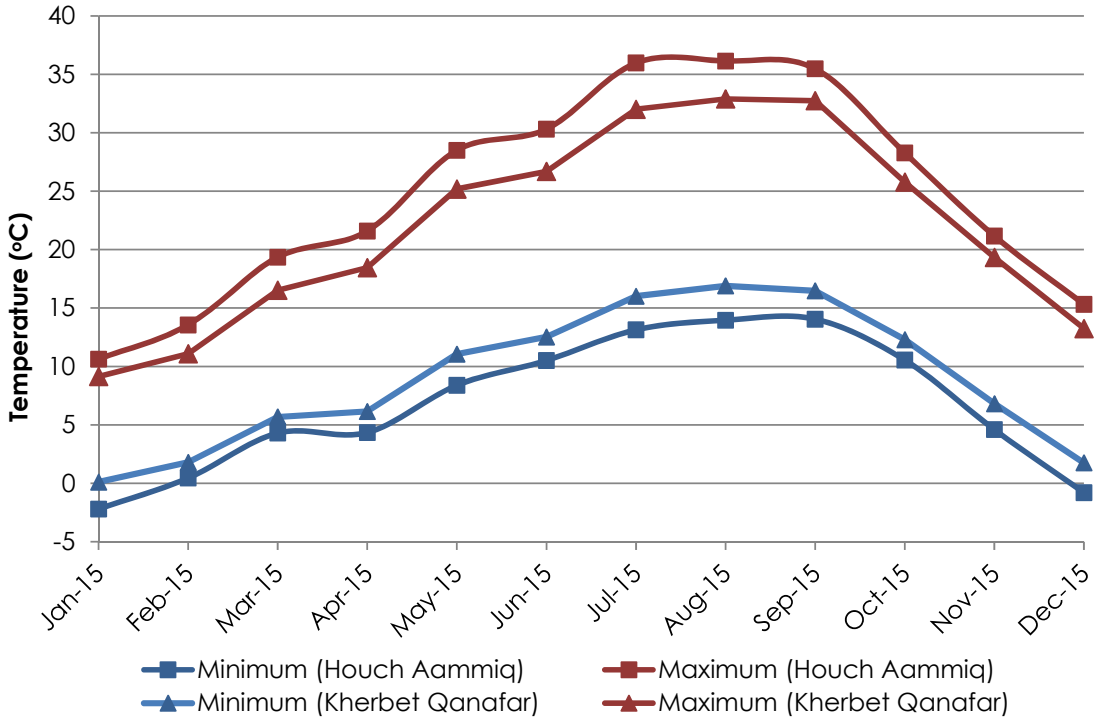


Figure 4-3 Monthly Average Maximum and Minimum Temperatures

4.2.1.2 Precipitation

The monthly precipitation for the area is shown in Figure 4-4. The highest precipitation recordings are observed in January and February in Kherbet Qanafar and during December in Houch Aamiq Station. A rainfall map of the study area is provided in Figure 4-5, showing the average yearly precipitation in the study area ranging between 800 and 1,000 mm/year.

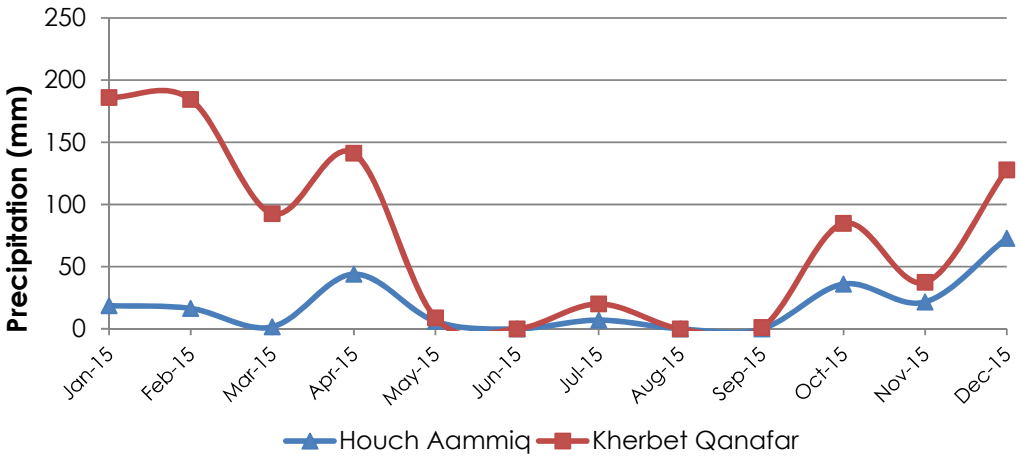


Figure 4-4 Monthly Precipitation at Houch Aammiq and Kherbet Qanafar Station

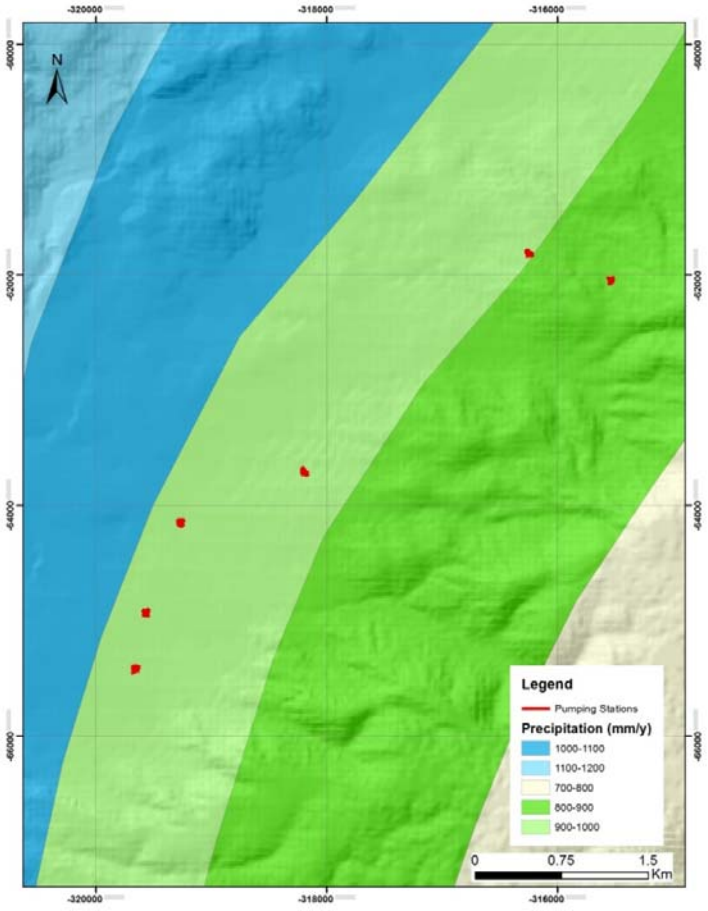


Figure 4-5 Rainfall Map of the Study Area
Source: Plassard, J., 1972

4.2.1.3 Wind

The monthly average and maximum wind speed at Houch Aammiq Station area is shown in Figure 4-6, with a maximum speed varying between 2 m/sec and 3.6 m/sec. The Project area is predominated by the Southwesterly winds most of the year. The wind rose is shown in Figure 4-7.

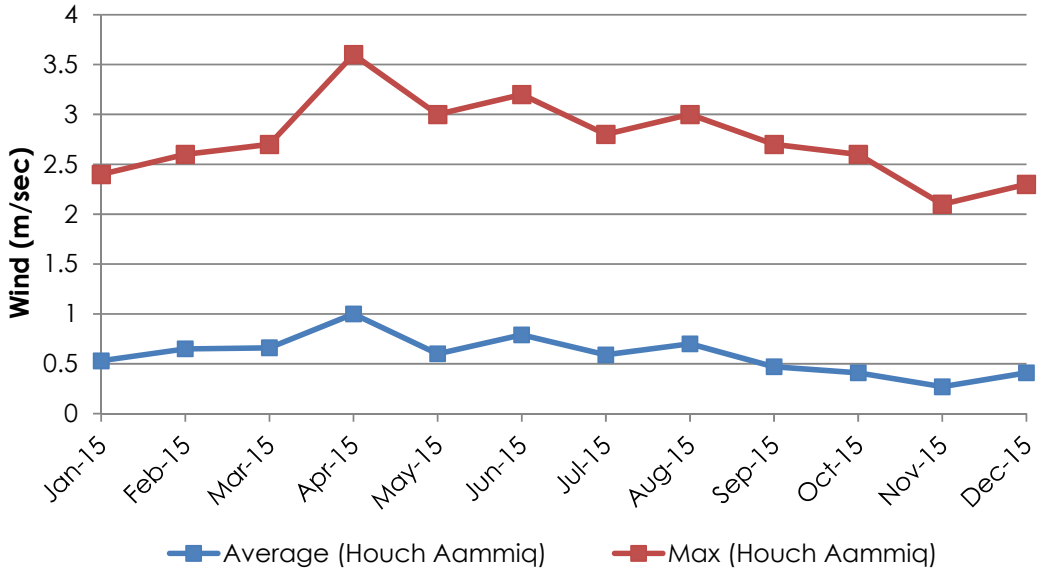


Figure 4-6 Monthly Wind Speed at Houch Aammiq Station

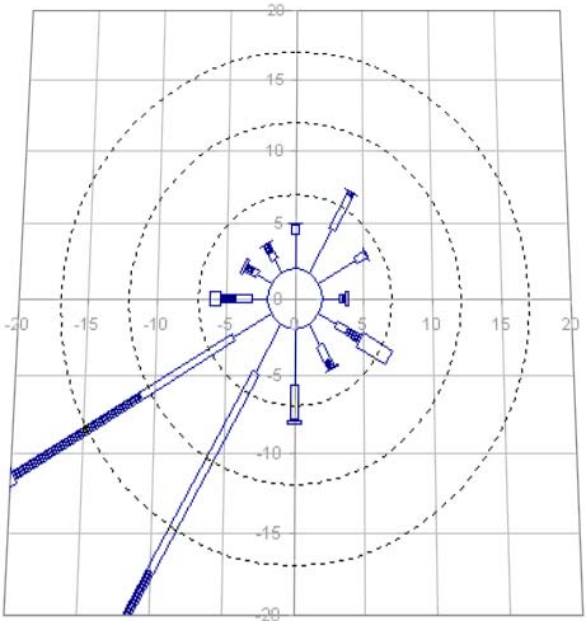


Figure 4-7 Wind Rose for Project Area

4.2.2 Ambient Air Quality

Air pollution is defined as the modification of the natural characteristics of the atmosphere by any chemical, physical or biological contaminant such as Particulate Matter (PM), Carbon Monoxide (CO), Ozone, Nitrogen Dioxide (NO_2) and Sulphur Dioxide (SO_2) (WHO, 2011).

Sources of pressures on ambient air quality in Lebanon can be a result of natural phenomena or anthropogenic activities such as transportation (vehicles), energy production (power plants, private generators and gas stations), industrial manufacturing processes, construction, quarries, fireworks, burning tires, open dumping and wars (MoE/UNDP/ECODIT, 2011). The impact on health from urban air pollution in Lebanon is estimated to cost $145 million/year (0.87% of the GDP) (IPT Energy Center, 2016).

The transportation sector is one of the leading sources of air pollution in the country where private cars are excessively used by the Lebanese population for daily commuting. Fuels and lubricants used in vehicles are a major source of Particulate Matter (PM), Sulphur Dioxide (SO_2), Nitrogen Oxides (NO_x), Carbon Monoxide (CO), and carbonyls emissions (Afif et al., 2009; Kouyoumjian and Saliba, 2006; Moussa et al., 2006; Saliba et al., 2006, 2007). Those air pollutants are identified for the risk they represent through long-term or short-term exposure, for their toxicity, or even for their environmental interference.

The literature review revealed a lack of ambient air quality data for the Project area. Since the Project area is rural and the Project is located in the villages of Qaraoun and Baaloul in proximity to residential areas, the main potential sources of ambient air pollution include the presence of solid waste open dumps (especially when waste is open burned), agricultural activities involving the use of pesticides, traffic (knowing that the study area is not congested), and private power generators.

4.2.3 Noise

The literature review revealed a lack of noise data for the Project area. No background noise measurements were taken during the conducted field investigations (as per the contractual agreement).

4.2.4 Biological Environment

4.2.4.1 Flora and Vegetation Cover

The sites are located in the West Bekaa in the villages of Qaraoun and Baaloul at altitudes ranging between 900 m to 1,400 m a.s.l above sea level (Figure 4-8). The sites are very close to the Qaraoun Lake.

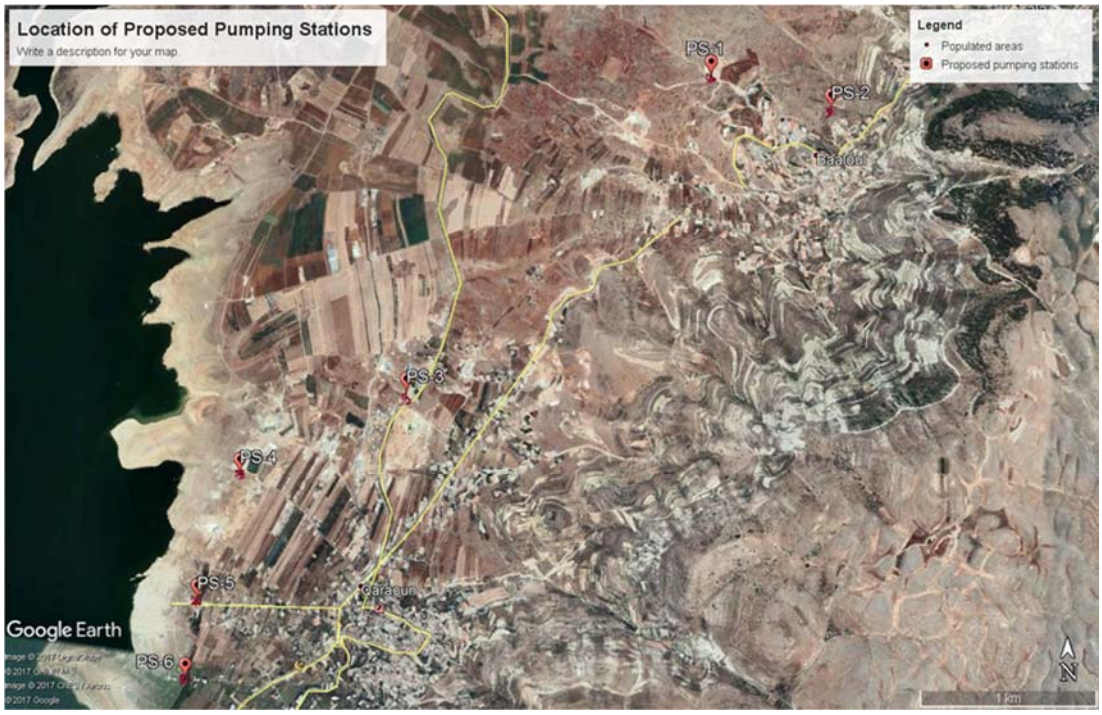


Figure 4-8 Location of Proposed Pumping Stations

No world heritage sites, biosphere reserves, protected areas or areas of high ecological value are located in the vicinity or in proximity of the sites. However, an area of special concern, the Qaraoun Lake classified as an Important Bird Area (IBA), is in proximity of the sites (Figure 4-9).

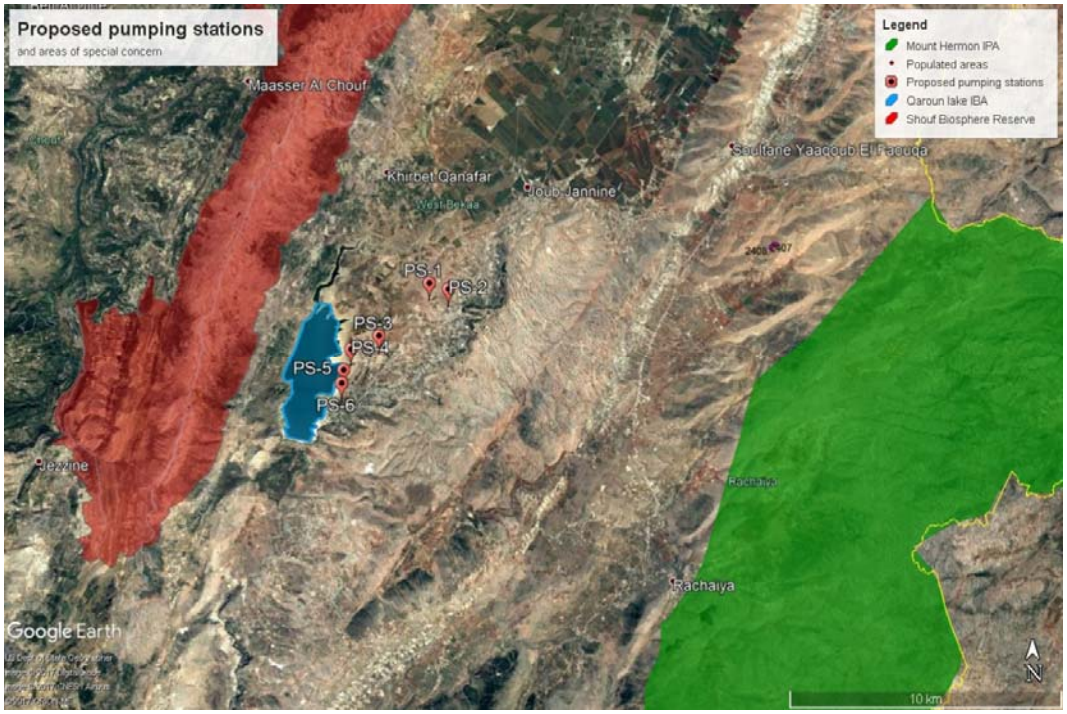


Figure 4-9 Proposed Pumping Stations and Areas of Special Concern

Most of the sites have no or low ecological value in respect to floral biodiversity except for two sites (PS-2 and PS-6) which have medium ecological value due to presence of native trees or a large number of trees (Figure 4-2).

Table 4-2 Habitat, Biodiversity and Ecological Value of Proposed Pumping Stations

Plot number	Site	Habitat	Biodiversity	Ecological value
Baaloul 2587	PS-1	Shrub land	Unproductive olive, apple, pine	Low
Baaloul 2283	PS-2	Shrub land	Olive, walnut, almond (low production)	Medium
Qaraoun 7365-7366	PS-3	Degraded land	One tree	None
Qaraoun 2966	PS-4	Bare land	None	None
Qaraoun 3627	PS-5	Rocky land with planted trees	Fir, cypress, walnut	Low
Qaraoun 643-4243	PS-6	Woodland / garrigue	Vine, almond, pine, prickly cedar	Medium

4.2.4.2 Fauna species

A publication entitled "State of Lebanon's Birds and IBA's" by the MoE and UNDP in 2014 identifies the Qaraoun Lake as an IBA with 110 bird species observed including storks, raptors, pelicans and cranes. Four of the observed bird species are classified as vulnerable or near threatened. Therefore, the proposed sites (especially PS-3 to 6) are expected to support important faunal species including local and migratory birds since they are in very close proximity to the lake (ranging from 0.3 to 1.3 km away from the lake). In addition, other faunal species have been identified surrounding the lake and are expected to be present within these sites too. These include the Spur-thighed (Greek) Tortoise (Vulnerable as per IUCN Red List) and the Chameleon.

However, the lake and its surrounding suffer from water pollution. The report recommends "reducing the amount of refuse and industrial/agricultural/domestic effluent that comes into the lake". Therefore, the project will bring an improvement to the environment of the lake and its surrounding. It will also reduce one of the major threats to the lake and wildlife in and around it.

4.2.5 Archaeology

Occupation in the region of interest is attested since the Middle Paleolithic period, i.e. 600.000 – 45.000 B.P. Surveys were held in the region since the middle of the 20th century.

- Acheulean (400 K B.P.): Ghazzé, Joubb Jannine, Qaraoun and Machghara are sites considered as part of the general comprehension scheme of this period, and are linked with the evolution of mankind with links between Nahr el Kebir in northern Syria and to the South with Egypt.

- Heavy Neolithic sites (7000 – 6500 B.C.): Joub Jannine, Dhour, Moufi, Tahoun Ben Aissa, Amlaq el-Qatih, Lala, Qaraoun I and II and Baidar Chamoute.

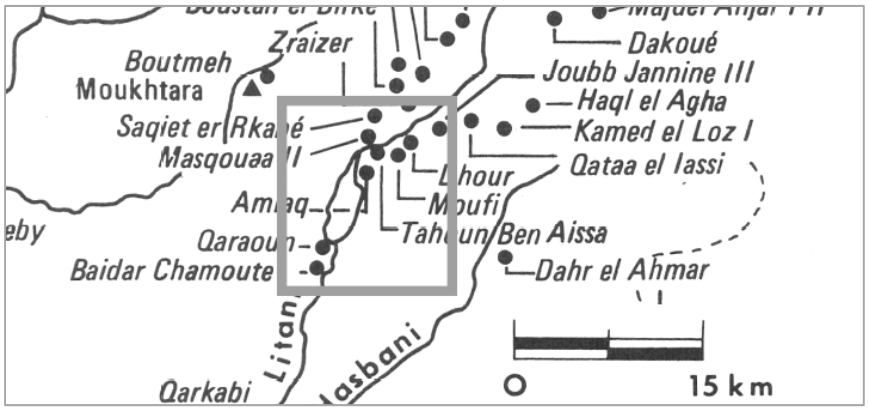


Figure 4-10 Heavy Neolithic sites. [1]

On the other hand, in 1999, the mosaic floor of a Byzantine church was incidentally found in Lala by a resident. A Greek inscription on the mosaic allowed dating the Church to 582 A.D.

Heavy Neolithic sites were identified both in Lala and in Qaraoun:

- Lala's site has unidentified traces of occupation, thus it is difficult to date it.
- Qaraoun I and II are located on both banks of the Litani River. Material of a Lithic industry was found during the surveys: axes, picks, heavy drills, scrapers, etc.

As for the byzantine period, the mosaic floor found in Lala asserts of the presence of an occupation in the vicinity during that period.

4.2.6 Geological and Hydrological Setting

4.2.6.1 Topography and Surface Hydrology

The project site location stretches over the cadastral boundaries of Qaraoun and Baaloul villages shown in Figure 3-5. The project site ranges in elevation from 900 m to 1,400 m a.s.l. Surface hydrology in the project site is represented in several seasonal streams that are surrounding the study area (Figure 4-12). The two major water bodies surrounding the study area are the Litani River and Qaraoun Lake. Both are approximately 3 km west of the Qaraoun village and approximately 5 km west of Baaloul village.

[1] Francis Hours, Olivier Aurenche, Jacques Cauvin et al. *Atlas des sites du Proche-Orient (14000-5700 BP)*. Lyon : Maison de l'Orient et de la Méditerranée Jean Pouilloux, 1994. (Travaux de la Maison de l'Orient méditerranéen, 24).

4.2.6.2 Geology, Hydrogeology and Seismicity

The study area is dominated by the Sannine-Maameltein and Chekka formations. The lithostratigraphic, hydrostratigraphic and structural conditions are described below.

4.2.6.2.1 Lithostratigraphy and Hydrostratighraphy

There are four (4) main geological formations outcropping within the project study area; those are the Quaternary Deposits (Q), the Eocene Limestone (e2b), the Chekka Formation (C6-P-e2a) and the Sannine Maameltein Formation (C4-C5) as shown in Figure 4-11 and Figure 4-12.

4.2.6.2.2 Quaternary Deposits (Q)

The Quaternary Deposits (Q) in the study area is composed of conglomerates with calcareous cement. This formation is outcropping west of the study area. It lies above the Sannine-Maamiltain Formation and is estimated to be around 50-100 m in thickness.

4.2.6.2.3 Eocene Limestone (e2b)

The Eocene Limestone Formation (e2b) in the study area is mainly composed of Breccia and marly limestone. The thickness of this formation is estimated to range between several tens of meters at the peripheries to around 350-400 m towards the core of the Bekaa syncline. This formation is outcropping in the eastern part of the study area.

4.2.6.2.4 Chekka Formation (C6-P-e2a)

The Chekka Formation (C6-P-e2a) in the study area is composed of white chalk and marly chalk. It lies above the Sannine-Maameltein Formation and is estimated to be around 500 m in thickness. Parts of the project network are located in the Chekka Formation that is characterized by its very low permeability.

4.2.6.2.5 Sannine Maameltein Formation (C4-C5)

The Sannine-Maameltein Formation (C4-C5) in the study area is composed of well bedded limestone and dolomitic limestone with occasional calcareous shale intercalation, with alternating sequence of limestone and marly. The C4-C5 formation is highly jointed and karstified with an estimated thickness ranging between 700 to 900 m. Parts of the Project network are located in this Formation that is a karstic aquifer and characterized by a very high permeability.

4.2.6.3 Structural Conditions

The study area is crossed by a minor Fault adjacent to Baaloul village. This fault results in fractures and joints, which generally enhance secondary porosity and act as preferential pathways for groundwater in limestone units. Faults can also form hydraulic barriers to groundwater flow due to juxtaposition of lower permeability rocks against aquifer rocks and/or when low permeability fault rock, such as fine gouge, is formed.

4.2.6.4 Springs

Several small springs are found within the study area, one (1) located in Qaraoun village and two (2) adjacent to Baaloul village (Figure 4-12). These springs emerge from the Chekka Formation.

4.2.6.5 Public and Private Wells

4.2.6.5.1 Public Wells

Five (5) public wells are found within the selected study area (Figure 4-12). Three (3) are located in Qaraoun village, one (1) in Baaloul village and one (1) in Lala village west of the project network. Public wells within the study area have reported depths between 170 and 420 m and they are tapping the Sannine-Mammeltein (C4 – C5) aquifer.

Table 4-3 Public Wells within the Study Area

Well ID /Name	Elevation (masl)	Depth of the well (m)	Aquifer Tapped
BWB001/Qaraoun Well	1,100	375	C4-C5
BWB002/Qaraoun Old Well	950	205	C4-C5
BWB003/Qaraoun 1st Well	950	177	C4-C5
BWB009/Lala New Well	1,200	420	C4-C5
BWB019/Baaloul Well	950	170	C4-C5

4.2.6.5.2 Private Wells

Thirty-seven (37) private wells are reportedly located in the study area with depths varying between 80 and 320 m. These wells are expected to be tapping the Sannine-Maameltein aquifer.

In addition to reported private wells, there are many unreported illegal wells that are expected to be extracting water from the Sannine-Maameltein aquifer.

4.2.6.6 Groundwater Flow Conditions

The depth to groundwater in the Sannine-Maameltein Aquifer is expected to be between 60 and 175 m BG in the study area based on the reported public wells data.

The general groundwater flow direction in the area is towards the south and southeast (Figure 4-12).

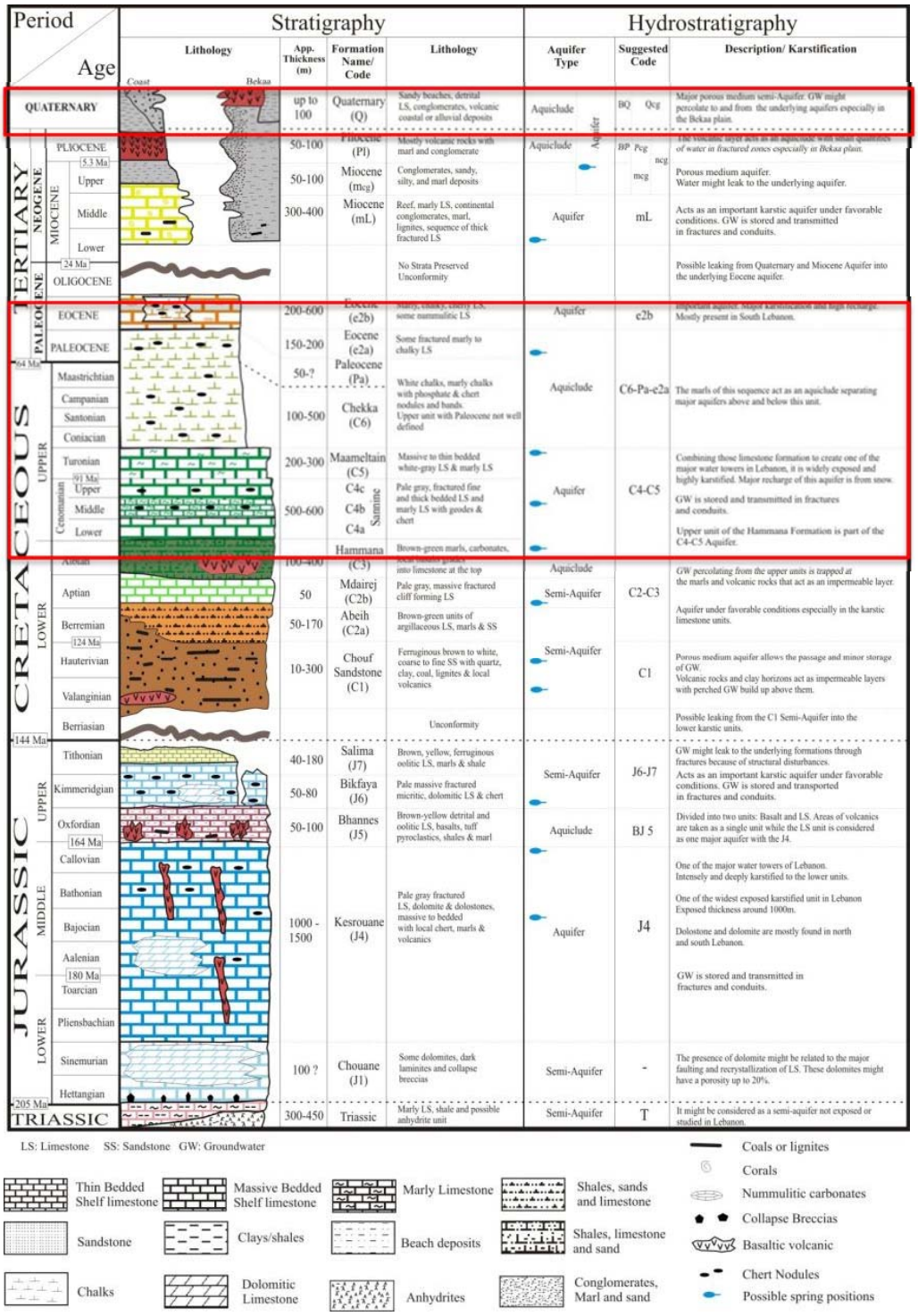


Figure 4-11 Lithostratigraphy and Hydrostratigraphic Units in Lebanon and within the Study Area (Red boxes)

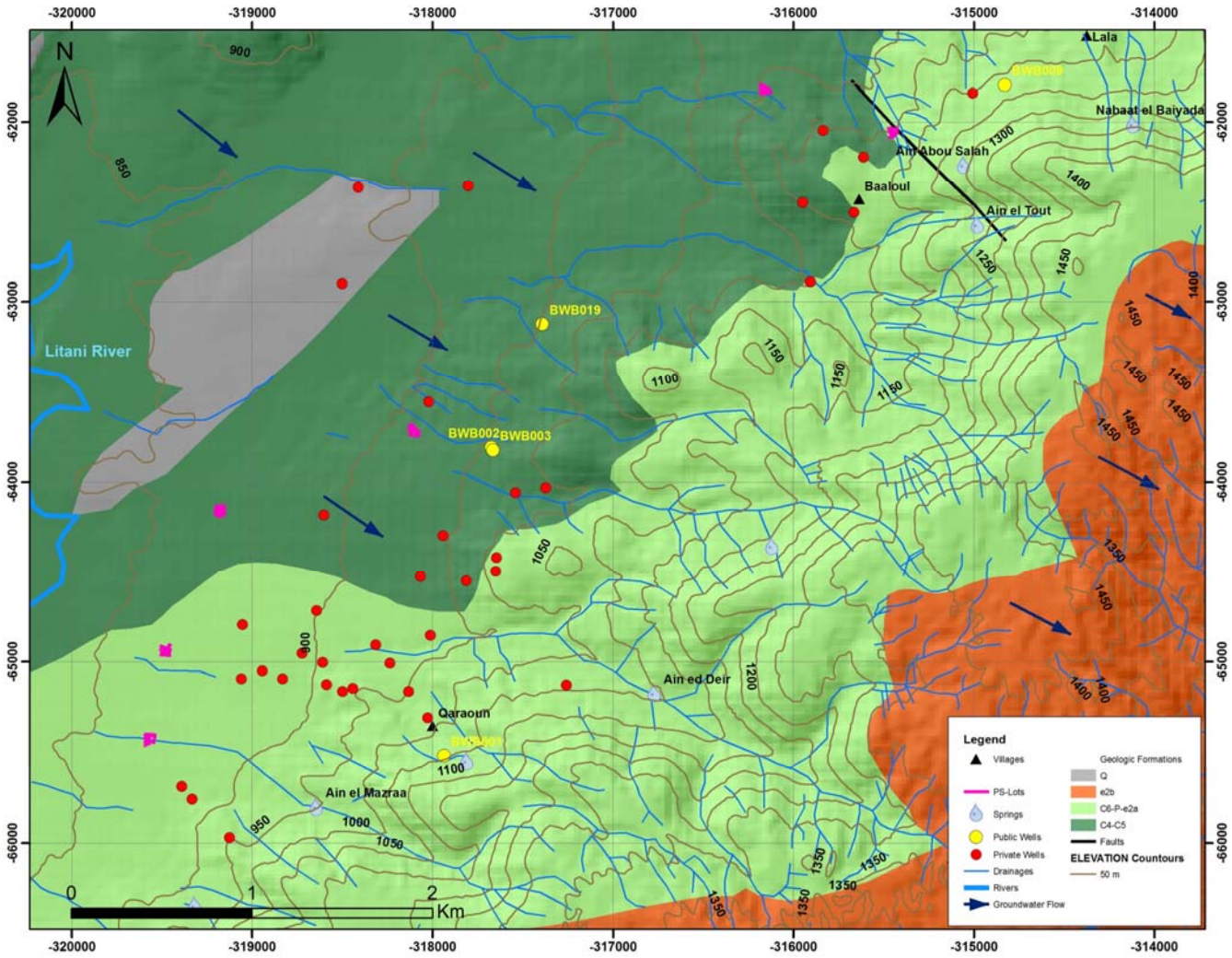


Figure 4-12 Geological and Hydrogeological Map of the Project Site

4.2.6.1 Seismicity

Lebanon is located on the eastern coast of the Mediterranean Sea, along the Dead Sea Transform Fault system. The Dead Sea Transform Fault system in Lebanon has several surface expressions such as major fault lineaments (Yammouneh, Roum, Hasbaya, Rachaya and Serghaya faults) and uplifts resulting in mountainous terrain (Mount Lebanon and Anti Lebanon). The fault system also has an active seismic record. Recent work has categorized the Lebanese section of the Dead Sea Transform Fault as being a strong seismic activity zone (Khair *et al.*, 2000).

No major recent earthquake epicenters were recorded close to the study area but according to the United States Geological Survey (USGS) earthquake hazard program, the most recent earthquake that occurred in Lebanon was on June 29, 2016 at around 19 km WSW of Beirut. This earthquake had a magnitude of 3.7 on the Richter scale and occurred at a depth of 13.8 km below the surface (Figure 4-13).

A historical seismicity map and a seismic hazard map of the region are presented in Figure 4-14 and Figure 4-15 respectively.

The study area is located at about 31 km inland and 5 km east of the Yammouneh fault.

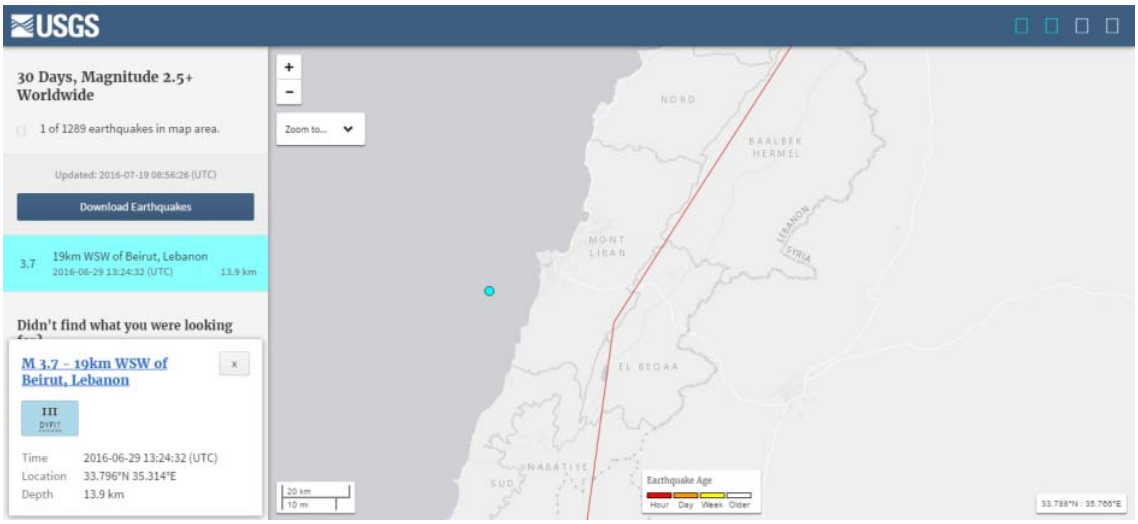


Figure 4-13 Map Showing the Most Recent Earthquake Epicenter in Lebanon

(Source: http://earthquake.usgs.gov/earthquakes/map)

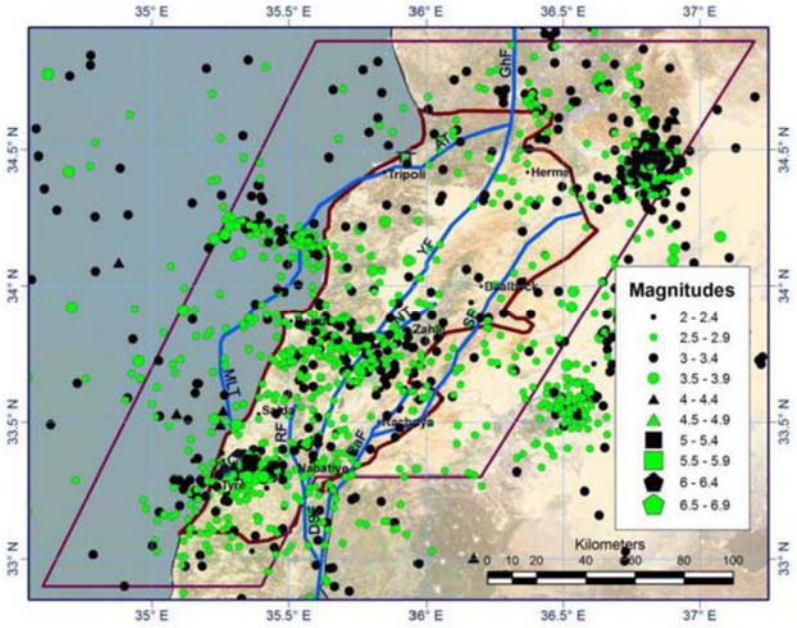


Figure 4-14 Instrumented Earthquake Events in and Around Lebanon between 1998 and 2009 with M ≥ 2

(*Adopted from Huijer* et al.*, 2011)*

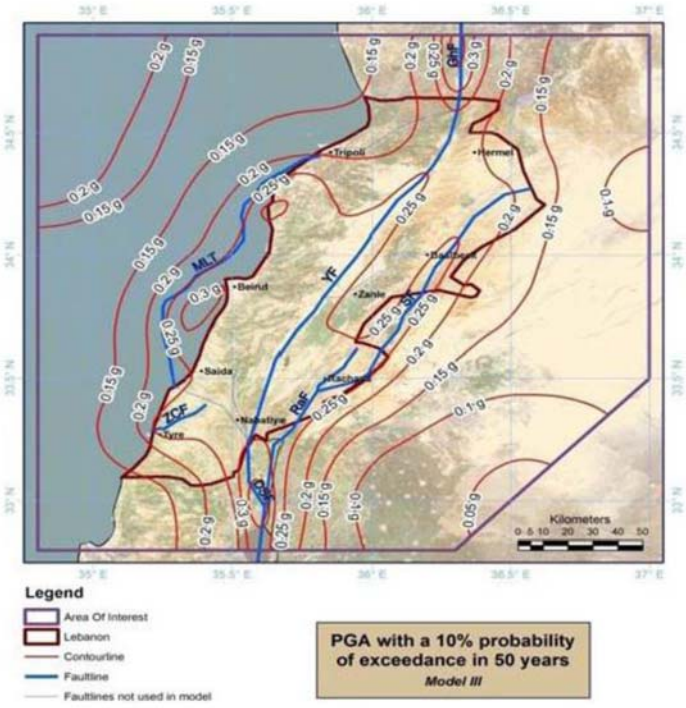


Figure 4-15 Seismic Hazard Map (contouring of Peak Ground Acceleration with a 10% probability of exceedance in 50 years)

(Adopted from Huijer et al., 2011)

4.2.7 Socio-Economic Environment

This section illustrates the Project Area demographic, social and economic characteristics relevant to the Project and their relevance within the local context.

4.2.7.1 Population

The village of Baaloul extends over an area of 12 km^2, housing around 360 residences for a population estimated to be around 600 permanent residents, 1,000 seasonal residents, and 1,100 registered Syrian displaced persons. Qaraoun extends over an area of 27.8 km^2, has around 1,200 housing units, and a population estimated to be around 4,500 permanent residents, 1,200 seasonal residents, and around 5,000 registered Syrian displaced persons.

4.2.7.2 Education and Employment

Baaloul has one (1) public middle school while Qaraoun has four (4) schools.

4.2.7.3 Commercial Establishments

Table 4-4 presents the types of commercial activities in Baaloul and Qaraoun.

Table 4-4 Type of Activities in Baaloul and Qaraoun

Activity	Details
Baaloul	
Farming	4 goat and sheep rearing farms
Gas Stations and Car Repair	2 gas stations, 2 car repair shops, and 1 car blacksmith and paint workshop
Industrial	1 aluminum industry, 3 metal industries, 1 gypsum workshop, and 2 carpentries
Qaraoun	
Farming	3 poultry rearing farms, 6 cattle rearing farms, and 4 goat and sheep rearing farms
Gas Stations and Car Repair	7 gas stations,10 car repair shops, and 2 car blacksmith and paint workshops
Industrial	8 block-cutting facilities, 2 plastic manufacturing industries, 5 concrete blocks production facilities, and 5 carpentries

4.2.7.4 Healthcare Facilities

There are no hospitals or dispensaries located in Baaloul. The closest healthcare provider is located in the neighboring villages of Joub Janine or Sohmor. Qaraoun, on the other hand, has no hospitals but two dispensaries and a total of ten (10) clinics.

4.2.7.5 Water Supply

As per the municipality records, Baaloul village has a spring, two public wells; one of which is under commissioning, and several private wells used to supply the village with water. As for the water needs of the village of Qaraoun, these are supplied by four public wells and several private wells.

4.2.7.6 Wastewater Management

As mentioned earlier in this report, around 10.3 km of gravity sewer lines exist in Baaloul and serve most of the village. Collected wastewater is conveyed by gravity to the village of Qaraoun, which is conveyed, in turn, to the existing Aitanit WWTP.

As for the village of Qaraoun, around 16.5 km of gravity sewer lines exist and mainly serve the upper part of the village. Wastewater from Qaraoun is also conveyed to the Aitanit WWTP for treatment.

Both villages are not fully serviced by the existing wastewater network mainly because of the recent residential expansions that took place after the network design and construction, and of possible deteriorations in parts of the network. Construction of the additional sewer lines is expected to secure full service coverage of wastewater collection and conveyance.

4.2.7.7 Solid Waste Management

Similar to many rural areas, both Baaloul and Qaraoun villages collect their municipal solid waste and dispose of them in designated dumpsites, since no sanitary landfill is present. However, an ongoing UNDP project is targeting waste management in Qaraoun and 4 other villages (Lala, Sohmor, Saghbine and Khirbet Qanafar) through the development of waste management plans for these villages, promotion of sorting at the source, the possible construction of a sorting facility in Qaraoun, together with composting of organic waste and landfilling of inerts in the newly constructed solid waste management facility of Job Jannine.

5. ENVIRONMENTAL IMPACT ASSESSMENT

This section identifies the main potential impacts that could arise from the construction and operation of Aitanit Wastewater System in the villages of Baaloul and Qaraoun, analyzes these impacts, and assesses their significance so that any potentially significant impact can be properly mitigated.

Based on previous relevant and similar environmental studies and on concerns identified by the technical experts, the following environmental and socio-economic aspects and impact categories were selected by the study team to be further investigated as part of the ESMP study:

- Impacts on ambient air quality;
- Impacts on noise;
- Impacts on soil and groundwater resources;
- Impacts on biological environment;
- Impacts on traffic;
- Impacts on resource use (water, fuels, energy);
- Impacts on waste generation;
- Impacts on archaeology and cultural heritage;
- Impacts on socio-economy; and
- Impacts on occupational and public health and safety.

Potential impacts are identified and assessed for the construction and operation phases of the Project, based on the methodology described in the following sub-sections.

5.1 IMPACT IDENTIFICATION AND ASSESSMENT METHODOLOGY

5.1.1 Impact Identification

The identification and analysis of impacts consists of appraising the information submitted by the Project Proponent in conjunction with the baseline information of the site. Impacts from similar projects, as cited by literature and as documented by ELARD for other similar projects conducted elsewhere, were also examined so as to identify potentially significant impacts on the environment and surrounding communities. After identifying the Project impacts, the ESMP study evaluates their significance and determines mitigation measures to eliminate/minimize them.

A matrix was developed to summarize all identified potential impacts during the construction and operation phases of the Project (Table 5-1). The matrix describes the potential impacts through identifying the sources/activities and the pathway (media of transportation such as air, water) through which these impacts reach their receptors (environment/human). This report further explains the proposed methods of assessment.

Table 5-1 Impact Identification Matrix for Construction and Operation Phases of the Proposed Project

Environmental Aspect / Activity	Ambient Air Quality	Noise	Soil and Groundwater Resources	Water Resources	Energy Resources	Biological Environment	Traffic	Socio-economy	Health and Safety	Archaeology and Cultural Heritage
Construction Phase										
Operation of machinery, equipment and generators	X	X	X	-	X	X	X	X	X	X
Excavation, trenching, backfilling, and compaction works for pipelines on public roads	X	X	X	X	X	X	X	X	X	X
Site clearance, excavation, backfilling, and compaction works at pumping stations sites	X	X	X	X	X	X	X	X	X	X
Construction, furnishing/equipping, and finishing activities of pumping stations	X	X	X	X	X	X	X	X	X	X
Storage of fuels, chemicals, and stockpiling of construction materials on site	-	-	X	-	-	X	-	-	X	-
Accidental spills (fuels/chemicals) and material wash-off	X	-	X	-	-	X	-	-	X	-
Waste generation and disposal (solid and liquid)	X	-	X	-	-	X	X	X	X	-

Environmental Aspect / Activity	Ambient Air Quality	Noise	Soil and Groundwater Resources	Water Resources	Energy Resources	Biological Environment	Traffic	Socio-economy	Health and Safety	Archaeology and Cultural Heritage
Operation Phase										
Normal operation of sewage network and pumping stations	X	X	X	X	X	X	-	X	X	-
Maintenance of sewage network	X	X	X	-	X	-	-	-	X	-
Maintenance of pumping stations	-	X	X	-	X	-	-	-	X	-
Malfunctioning, accidental downtime of sewage network and/or pumping stations resulting in raw wastewater overflow	X	-	X	-	-	X	-	X	X	-

5.1.2 Environmental Impact Screening and Assessment

Impact screening involves the examination and evaluation of the change inflicted on the baseline environment as a result of construction and operation activities associated with the Project implementation.

The predicted environmental and social impacts will be assigned a level of **significance** (Low, Medium or High) based on the **likelihood** (Low, Moderate or High) of the impact occurrence and the **consequence** (Negligible, Minor, Moderate, Major, Critical, or Beneficial) of that impact. A number of considerations are built into the Impact Consequence Criteria including the nature, direction, magnitude, geographic extent, timing, duration, and reversibility of the impact, as per the MoE Decision 260/1. Some basic questions, which can be used to address the above considerations, are outlined in Table 5-2.

Table 5-2 Questions for Addressing Considerations under Impact Consequence Criteria

Issue	Question	Criterion	
Nature of Impact	What is the nature of the impact?	P: Positive N: Negative	D: Direct I: Indirect
Magnitude of the Impact	The magnitude will be assessed for each impact category separately	L: Low M: Medium H: High	
Extent of the impact (geographical scale of the impact)	Is the extent of the impact localized or confined to a designated area around the project site, or does it extend regionally/ nationally/ globally?	L: Local - Change or effect only within the project site or extends to areas immediately outside G: Global - Regional, national, or international changes or effects.	
Timing of the impact	Is the impact likely to persist for a long or short term?	S: Short term M: Medium term L: Long term	
Duration of the impact	Are the consequences likely to be limited to the construction or operation phase?	C: During construction O: During operation	
Reversibility of the impacted condition (impacted condition can be changed or reversed)	Are the consequences likely to be reversible or irreversible?	R: Reversible I: Irreversible.	

5.1.3 Impact Assessment Criteria

The consequence assessment criteria table to be included under each environmental aspect is illustrated below Table 5-3.

Table 5-3 Consequence Assessment Criteria Template Table

Impact/Source	Nature	Magnitude	Extent	Timing	Duration	Reversibility	Consequence Rating

The consequence rating criteria are ranked into six levels of significance, the last being the beneficial impact, as listed in Table 5-4. The likelihood of the occurrence of the impact is then rated according to the criteria outlined in Table 5-5. Based on the level of significance and likelihood of occurrence, the significant risks (impact severities) are identified.

Table 5-4 Consequence Assessment Rating Criteria

Criteria	Consequence Rating
Nature: Negative Magnitude: High Extent: Global (large area of effect that supports sensitive receptors) Timing: Short, medium or long-term Reversibility: Irreversible	5. Critical
Nature: Negative Magnitude: High Extent: Local (area supports a significant proportion of sensitive receptors) Timing: Short, medium or long term. Reversibility: Reversible or irreversible	4. Major
Nature: Negative Magnitude: Medium Extent: Local (area of effect encompasses an area that supports either a moderate or minor proportion of sensitive receptors) or global Timing: Short, medium or long term Reversibility: Reversible	3. Moderate
Nature: Negative Magnitude: Low Extent: Local (sensitive receptors located in the immediate vicinity of the source or areas immediately outside) Timing: Medium or long-term (1 – 5 years or > 5 years) Reversibility: Reversible	2. Minor
Nature: Negative Magnitude: Low – unlikely to be noticeable Extent: Local (absence or presence of sensitive receptors located in the immediate vicinity of the source) Timing: Short-term Reversibility: Reversible	1. Negligible
Changes that result in a positive impact to an ecosystem, environment or population.	B. Beneficial

Table 5-5 Likelihood Evaluation Criteria and Ranking Impacts

Score	Category	Definition
H=3	High	The impact will occur under normal operational conditions
M=2	Moderate	The impact may occur at some time under normal operating conditions
L=1	Low	The impact is very unlikely to occur under normal operating conditions but may occur in exceptional circumstances

The impact significance level will be assigned according to the Likelihood of Occurrence cross-tabulated with the Consequence Rating Criteria, as shown in Table 5-6.

Table 5-6 Impact Significance Levels

		Consequence Rating					
		Negligible 1	**Minor 2**	**Moderate 3**	**Major 4**	**Critical 5**	**Beneficial B**
Likelihood Rating	**Low (L=1)**	1	2	3	4	5	+
	Moderate (M=2)	2	4	6	8	10	++
	High (H=3)	3	6	9	12	15	+++

Legend

Consequence Rating	**Likelihood**	**Significance**	
1- Negligible	L- Low (1)	+ to +++	Beneficial
2- Minor	M- Moderate (2)	1 to 3	Low
3- Moderate	H- High (3)	4 to 9	Medium
4- Major		10 to 15	High
5- Critical			
B- Beneficial			

5.2 PRE-SCREENING OF POTENTIAL ENVIRONMENTAL IMPACTS AND PATHWAYS

Based on the methodology described above, the various impacts of the project were pre-screened according to the phase of the Project activity as well as the pathway of the impact. The preliminary findings are representative of the potential adverse and beneficial environmental and socio-economic impacts that could result from the Project. The results of the pre-screening process are summarized in Table 5-7.

Table 5-7 Pre-Screened Potential Environmental and Socio-Economic Impacts

Environmental Aspect/Receptor	Phase	Potential Impact
Ambient Air Quality	Construction	• Exhaust emissions from fuel-fired equipment, vehicles and on-site generators • Dust emissions from land clearance, excavation, backfilling, grading, and compaction activities, movement of heavy machinery and vehicles on unpaved roads, and construction activities
	Operation	• Exhaust emissions from fuel-fired on-site power generators equipped for pumping stations • Foul odor emissions from leaking or overflowing of raw wastewater at the level of the network and pumping stations (septicity of wastewater due to aging and stagnancy)
Noise	Construction	• Operation of equipment and on-site generators • Site clearance, excavation, backfilling, grading, and compaction activities • Heavy machinery and vehicle movement for the transportation of labor and materials

Environmental Aspect/Receptor	Phase	Potential Impact
	Operation	• Operation of on-site generators for pumping stations • Operation of pumping stations and maintenance activities
Soil and Groundwater resources	Construction	• Site clearance, trenching, excavation, backfilling, grading, and compaction activities • Accidental spills or leaks of fuel and oil from machinery, generators and vehicles during construction and maintenance • Inadequate solid waste management • Inadequate wastewater management
	Operation	• Accidental spills or leaks of fuel and/or oil from onsite fuel storage and operation and maintenance activities • Potential contamination from wastewater overflows and/or leakages
Biological Environment	Construction	• Site clearance, excavation and construction activities • Elevated noise levels from works and employed machinery and equipment • Traffic • Transportation of construction material and equipment, as well as construction waste • Inadequate disposal of solid wastes and wastewater discharges
	Operation	• Elevated noise levels from the operation of generators and pumping stations • Leakage of wastewater
Traffic	Construction	• Increase in traffic from material/ waste haulage vehicles and machinery onsite and along roads leading to construction sites
	Operation	• Increase in traffic during maintenance works of sewage network and pumping stations
Water Resources	Construction	• Increase in water consumption for construction activities, hydro-testing of sewer lines, and domestic use (site labor)
	Operation	• Water consumption for housekeeping purposes at pumping stations premises
Energy Resources	Construction	• Energy consumption during construction activities (machinery, vehicles, generators)
	Operation	• Energy consumption during pumping stations' operation (generators, electricity)
Waste Generation	Construction	• Construction-related solid and liquid wastes generation
	Operation	• Operation- and maintenance-related solid and liquid wastes generation (generator oils, filters, spare parts, pumping stations spare parts, etc.)
Archaeology and Cultural Heritage	Construction	• Excavation works
	Operation	• None
Socio-economy	Construction	• Creation of new job opportunities • Potential damage to the existing infrastructure • Disturbances from noise and dust generation and traffic • Increased load on existing infrastructure (solid waste and wastewater generation)

Environmental Aspect/Receptor	Phase	Potential Impact
		• Land acquisition
	Operation	• Beneficial Impact on public health and the environment of providing new sewer networks
Occupational and Public Health and Safety	Construction	• Potential risks to general health and safety of the workers, nearby residents and pedestrians
	Operation	• Potential risks to general health and safety of the workers during maintenance activities and to nearby residents from potential failures/ overflow of networks and pumping stations.

5.3 SOURCES OF CUMULATIVE IMPACTS

Potential cumulative sources of impacts within the Project Area include the following:

- Existing traffic and related vehicular ambient air and noise emissions along adjacent roads;
- Air pollutant emissions from existing private power generators and solid waste open dumps in the area;
- Dust and air pollutants emissions from existing nearby construction sites;
- Continuous and cumulative resource use of water and energy from residences, trade, commercial, agricultural, educational, healthcare, and construction activities; and\
- Surface water and groundwater pollution due to point source discharges of untreated sewage, industrial wastewater, agricultural activities, spills from generators' operation and maintenance and from gas stations in the study area, etc.

Whenever applicable, the effect of these potential cumulative impacts on the different receptors will be taken into consideration as part of the subsequent assessment of Project related impacts.

5.4 POTENTIAL IMPACTS ON AMBIENT AIR QUALITY

5.4.1 Sources of Potential Impacts

The primary sources of air pollutants from the various Project activities are listed in Table 5-8.

Table 5-8 Potential Impacts on Ambient Air Quality

Source of Change (Project Activities)	Cumulative Sources of Impact
Construction • Exhaust emissions from fuel-fired equipment, vehicles and on-site generators • Dust emissions from site clearance, land excavation, backfilling, grading and compaction activities, movement of heavy machinery and vehicles on unpaved roads, and other general construction activities	Exhaust emissions from vehicles passing nearby, and existing power generators, uncontrolled MSW disposal and open burning, and nearby construction activities

Source of Change (Project Activities)	Cumulative Sources of Impact
Operation • Exhaust emissions from fuel-fired on-site power generators equipped for pumping stations • Foul odor emissions from leaking or overflowing of raw wastewater at the level of the network and pumping stations (septicity of wastewater due to aging and stagnancy)	

5.4.2 Impacts during Construction

Table 5-9 below provides the rating of potential ambient air quality impacts during the construction phase before and after applying mitigation measures, respectively.

Table 5-9 Consequence Assessment of Ambient Air Quality Impacts during Construction Before and After Applying Mitigation Measures

Impact/Source		Nature	Magnitude	Extent	Timing	Duration	Reversibility	Consequence Rating
Combustion and exhaust emissions	Before Mitigation	N/D	M	L	S	C	R	3. Moderate
	After Mitigation	N/D	L	L	S	C	R	2. Minor
Dust emissions	Before Mitigation	N/D	M	L	S	C	R	3. Moderate
	After Mitigation	N/D	L	L	S	C	R	2. Minor

5.4.2.1 Combustion and Exhaust Emissions

Construction activities will require considerable vehicle and heavy machinery movement, especially during the mobilization stage, which together with the diesel operated construction machinery and on-site generators, will generate exhaust emissions from the employed fuel-fired systems. According to the USEPA (2002), diesel emissions count about 40 hazardous air pollutants (HAP). The main air pollutants most likely to be associated with the emission sources mentioned above include: Oxides of Nitrogen (NO_x), Sulfur Dioxide (SO_2), Carbon Dioxide (CO_2), Carbon Monoxide (CO), and Particulate Matter (PM), all of which lead to adverse respiratory impacts. Carbon monoxide also acts as a poison by reducing the amount of O_2 that can combine with hemoglobin in receptors' bloodstreams.

The main concern is not to completely eliminate exhaust emissions, as it is technically impossible and inevitable during normal operation of machinery and vehicles, but to reduce and control them as much as possible.

The lack of equipment/machinery maintenance, poor fuel quality (ex: high sulfur content), unnecessary idling periods, long operation periods, and absence of exhaust emission control systems will result in the increase of pollutant emissions to ambient air.

Combustion and exhaust emissions associated with site equipment, vehicles and generators operations will be of a **Moderate Consequence (3)** and a **High Likelihood (3)**, resulting in a **Medium Significance (3H=9)** on the overall ambient air quality within the Project Area.

In order to reduce the impact of combustion and exhaust emissions on ambient air, the following mitigation measures are recommended to be adopted and implemented by the awarded Contractor:

- Ensure well designed, maintained, and operated equipment/vehicles. Precautionary control measures for emissions reduction could include proper engine fuel mixtures, regularly serviced exhaust emission systems, suitable engine tuning, and use of low sulfur content diesel, whenever available;
- Use environmentally friendly equipment whenever possible (machinery with higher fuel efficiency or equipped with air pollution control devices to minimize exhaust emissions);
- Keep a record of maintenance for all machinery, vehicles, and generators on site;
- Report and monitor monthly fuel consumption records to keep track of consumption levels and identify overuse;
- Avoid unnecessary idling of vehicles and equipment engines; and
- Ensure that an effective Maintenance Plan and Schedule is in place for employed site machinery, vehicles, and power generators.

By applying the above mitigation measures, the impacts from exhaust and combustion emissions will be reduced to **Minor Consequence (2)** with **High Likelihood (3)**, resulting in a **Medium Significance (2H=6)** on the overall air quality within the Project Area.

5.4.2.2 Dust Emissions

The sources of airborne particulates during the construction phase include the following:

- Site clearance, trenching, excavation, backfilling, grading, and compaction works;
- Handling of construction materials and other general construction activities;
- Operation of heavy machinery, equipment, and power generators; and
- Transportation of site labor and construction materials/wastes from and to the Project location.

Dust emissions would vary on a daily basis depending on the level of activity and the prevailing weather conditions. Under normal meteorological conditions, dust impacts will be limited within several tens to hundred meters from the disturbance area, i.e. construction site. The main environmental and health concerns associated with dust generation include:

- Potential nuisance impacts on nearby stationary receptors (residential, commercial, religious buildings, agricultural lands), and mobile receptors (pedestrians and motorists on nearby streets); and
- Occupational health risks to construction workers from inhaling dust-laden air that might irritate respiratory pathways.

The duration of main earth disturbance activities (i.e., land clearance, excavation, backfilling, grading, and compaction works) is limited to several months overall and the surrounding roads that lead to the sites are not all paved, which increases the potential for dust emissions and is expected to impact the nearby receptors if not mitigated properly.

Dust emissions from construction activities are expected to have a **Moderate Consequence (3)** of a **High Likelihood (3)**. Accordingly, with no mitigation measures in place, dust emissions are likely to have **Medium Significance (3H=9)**.

Minimization of dust dispersion can be accomplished through dust control/suppression measures, including the following:

- Set physical barriers at site boundaries;
- Ensure site roads are kept regularly damped down and compacted to minimize dust emissions;
- Schedule deliveries of raw materials efficiently;
- Wheel-washing of vehicles before departure from construction site;
- Cover incoming and outgoing trucks with proper canopies;
- Limit vehicular speed onsite to 20 km/h;
- Maintain material stockpiles at minimum heights and adequate slopes and ensure that they are covered;
- Surround the construction areas with scaffolding nets to control debris and dust from dispersing beyond the construction sites; and
- Inform sensitive receptors of the scheduled construction works, ahead of time in conjunction with the concerned municipalities, especially for dust-generating activities.

With the above recommendations, the potential impacts from dust generation during construction activities of the additional sewer lines and pumping stations are expected to have **Minor Consequence (2)** and a **Moderate Likelihood (2)** resulting in a **Medium Significance (2M=4).**

5.4.3 Impacts during Operation

Table 5-10 below provides rating of potential ambient air quality impacts during the operation phase before and after applying mitigation measures, respectively.

Table 5-10 Consequence Assessment of Ambient Air Quality Impacts during Operation Before and After Applying Mitigation Measures

Impact/Source		Nature	Magnitude	Extent	Timing	Duration	Reversibility	Consequence Rating
Combustion and exhaust emissions	Before Mitigation	N/D	L	L	L	O	R	2. Minor
	After Mitigation	N/D	L	L	L	O	R	2. Minor
Foul odor emissions from leaking or overflowing of raw and/or aging wastewater	Before Mitigation	N/D	M	L	L	O	R	3. Moderate
	After Mitigation	N/D	L	L	L	O	R	2. Minor

5.4.3.1 Combustion and Exhaust Emissions

The Project operation will result in additional ambient air pollutants and greenhouse gases emissions, particularly at the level of the pumping stations that are equipped with standby power generator; thus, resulting in direct negative environmental impacts on the overall ambient air quality in the area.

Therefore, the impacts of combustion and exhaust emissions are anticipated to be of **Minor Consequence (2)** and **High Likelihood (3)**, giving an overall **Medium Significance (2H=6)** on ambient air quality.

The following mitigation measures are proposed to be adopted and implemented, namely at the level of wastewater pumping stations, by the awarded Operator:

- Ensure proper operating conditions and regular maintenance of the generators as per manufacturer specifications;
- Ensure that the specifications of the generators are in line with national standards (Decision 8/1 dated 2001) through one of the following:
  - Compliance in terms of air pollutant emissions through regular monitoring; or
  - Ensuring that effective generator stack heights are in place. The formula for determining the stack height is:

    $H = h + 0.2 \sqrt{KVA}$

    Where:

    - ✓ H = Total stack height in meters
    - ✓ h = Height of neighboring building in meters (within 50 m radius)
    - ✓ KVA= Total generator capacity of the set in kVA = kW, i.e. the total capacity which is determined by the maximum fuel (energy) input

If the proposed mitigation measures are applied, the impacts on ambient air quality from combustion and exhaust emissions will have **Minor Consequences (2)** and **Moderate Likelihood (2)**, resulting in a **Medium Significance (2M=4).**

5.4.3.2 Foul Odor Emissions

Normal operating and maintenance conditions of pumping stations are not expected to result in considerable odiferous emissions, and every station will be equipped with a fan and a ceiling extract diffuser. Nevertheless, due to improper operating and maintenance practices, or due to sudden or accidental malfunctioning or downtime due to power outages, incoming raw wastewater might overflow while wastewater detained in the stations' wet wells will start to age and result in septic conditions.

The impacts of odor emissions are expected to be of **Moderate Consequence (3)** and **Moderate Likelihood (2)**, resulting in an overall **Medium Significance (3M=6)** on ambient air quality.

To reduce odor emissions, the following can be implemented:

- Ensure proper engineering design of the pumping stations (sizing of wet wells, pump-sets, and provision of a wastewater overflow emergency/bypass line);

- Ensure prompt repair of pumping stations in case of failure to minimize the resulting impact, and prevent power outages to keep the stations operational;
- Provide adequate ventilation with a carbon filter to control odors. The ventilation pipes must be extended above the highest point of the station building by three (3) meters;
- Ensure that a regular inspection and maintenance schedule is in place for the stations; and
- Establish an odor complaint grievance mechanism as a measure to allow implementation of timely and effective actions to minimize impacts from odors on downwind receptors.

With the above mitigation measures in place, odor emissions will be reduced, resulting in **Minor Consequences (2)** and **Low Likelihood (1)**, having **Low Significance (2L=2)** on ambient air quality**.**

5.5 POTENTIAL IMPACTS ON NOISE

5.5.1 Sources of Potential Impacts

The primary sources of noise from the various Project activities are listed in Table 5-11 below.

Table 5-11 Potential Impacts on Noise Levels

Source of Change (Project Activities)	Cumulative Sources of Impact
Construction • Operation of heavy machinery, equipment, vehicles, and on-site generators • Site clearance, trenching, excavation, backfilling, grading, and compaction activities • Heavy machinery and vehicle movement for the transportation of labor, materials and waste **Operation** • Operation of on-site generators for pumping stations • Operation of pumping stations and maintenance activities	Noise from nearby traffic, existing private power generators, and surrounding construction sites

5.5.2 Impacts during Construction

Table 5-12 below provides rating of potential noise impacts during the construction phase before and after applying mitigation measures, respectively.

Table 5-12 Consequence Assessment of Noise Impacts during Construction Before and After Applying Mitigation Measures

Impact/Source		Nature	Magnitude	Extent	Timing	Duration	Reversibility	Consequence Rating
Noise associated with site preparation, construction activities	Before Mitigation	N/D	M	L	M	C	R	3. Moderate

Impact/Source		Nature	Magnitude	Extent	Timing	Duration	Reversibility	Consequence Rating
and operation of on-site generators, heavy machinery, equipment and vehicles	After Mitigation	N/D	L	L	M	C	R	2. Minor

Noise impacts during the construction phase are considered temporary in nature. Potential sources comprise of activities caused by the operation of earth moving heavy machinery and equipment (excavators, bulldozers…) during site preparation, general construction activities, and transportation of equipment, materials, waste, and site labor, and the employment of site power generators. Typical sound level pressures recorded from the equipment anticipated to be used at the construction sites are illustrated in Table 5-13 for indicative purposes.

Table 5-13 Typical Sound Pressure Levels Reported from Construction (BS 5228-1 2009)

Equipment/Machinery	Noise Level (dB(A), LA_{eq} at 10 m)
Air compressor	95
Asphalt spreader/paver	75
Backhoe loader	67
Bench Saw	85
Bulldozer	86
Circular Saw	85
Compressor	65
Concrete mixer truck	80
Concrete Pump	67
Drill	85
Dump truck	79
Excavator Truck (Poclain)	82-83
Fuel tanker	79
Grinder	80
Ground excavation dozer	92
Hole Cutter	85
Jack hammer	90
Leveling ground grader	76-84
Mobile Concrete pump	75-80
Mobile Crane	67-70
Pick Up	78
Plate compactor	63
Pneumatic breaker (Breaking hard ground)	87
Rock Breaker (Jack Hammer)	83
Roller compactor	84

Equipment/Machinery	Noise Level (dB(A), LA_{eq} at 10 m)
Shovel Truck	83-91
Tower Crane	76-77
Water tanker	79
Welding machine	73

Noise levels of a range of 63 to 95 dB(A) are expected close to the main activity areas. Nevertheless, these levels would be reduced as the distance from the point source of noise increases. Noise levels will only affect potential receptors (the closest residences) for a relatively short period of time and intermittently. Noise insulation at a typical residential dwelling can result in 25-35 dB(A) noise reduction (BS 8233: 1999), only in the case where all windows are closed. If a window is left partially open, noise will be reduced by 10-15 dB(A) (BS 8233: 1999). As such, noise will be less audible to the local residents when indoor.

Therefore, noise emissions during the construction phase will have **Moderate consequences (3)** and **High likelihood (3)**, resulting in **Medium Significance (3H=9).**

Mitigation measures to reduce works-associated noise levels include:

- Fit all machinery, equipment, and vehicles with exhaust silencers where possible;
- Ensure proper inspection and maintenance of machinery, vehicles and generators;
- Avoid idling and switch off engines when not in use;
- Place noisy equipment away from sensitive receptors, behind stockpiles to provide acoustic barriers;
- Control speed limits of vehicle movement on site and in the surrounding area;
- Plan deliveries to and from the site during day time hours;
- Respect scheduled working hours (7:00 am- 6:00pm) and avoid night-time work;
- Avoid construction works on Sundays and public holidays;
- Inform site staff and workers on the impact of noise and the applicable regulatory requirements;
- Provide workers with noise protection equipment and enforce their use;
- Conduct regular noise monitoring to ensure that noise emissions are compliant with national standards (Decision 52/1, provided in Appendix D);
- Notify the residents of the plans and expected duration prior to initiating the works, in conjunction with concerned municipalities; and
- Establish a noise complaint grievance mechanism as a measure to allow implementation of timely and effective actions to minimize noise impacts on downwind receptors.

Implementing the aforementioned mitigation measures will result in **Minor Consequences (2)**, of a **High Likelihood (3),** giving **Medium Significance** (**2H=6**).

5.5.3 Impacts during Operation

Table 5-14 below provides rating of potential noise impacts during the operation phase before and after applying mitigation measures, respectively.

Table 5-14 Consequence Assessment of Noise Impacts during Operation Before and After Applying Mitigation Measures

Impact/Source		Nature	Magnitude	Extent	Timing	Duration	Reversibility	Consequence Rating
Noise from standby power generators (at the level of pumping stations)	Before Mitigation	N/D	L	L	L	O	R	2. Minor
	After Mitigation	N/D	L	L	L	O	R	2. Minor
Noise from the normal operation and maintenance of pumping stations and sewage networks	Before Mitigation	N/D	L	L	L	O	R	2. Minor
	After Mitigation	N/D	L	L	L	O	R	1. Negligible

5.5.3.1 Noise from Standby Generators

During the operation stage, standby power generators are likely to generate elevated noise levels, perceptible to nearby receptors. Considering that the generators at each pumping station are enclosed in soundproof canopies, and not at a close proximity to sensitive receptors, noise will not majorly affect visitors, employees and adjacent receptors.

As such, the noise impact from standby power generators operation, at the level of pumping stations, is of **Minor Consequences (2)** and **Moderate Likelihood (2)** of occurrence, resulting in **Medium Significance (2M=4).**

The following additional mitigation measures are proposed to be adopted and implemented by the appointed Operator:

- Fit generators with exhaust silencers;
- Ensure proper operation and a regular maintenance schedule of generators, as per manufacturer specifications; and
- Conduct regular noise monitoring around pumping stations perimeters and at identified sensitive receptors to ensure that noise emissions are compliant with national standards (Decision 52/1).

If the above measures are applied, noise impact from generators will be of **Minor Consequence (2)** and **Low Likelihood (1),** resulting in **Low Significance (2L=2).**

5.5.3.2 *Noise from Normal Operation and Maintenance of Pumping Stations and Sewage Networks*

Noise is expected to arise from the operation of pumping stations and from the usage of equipment during the maintenance period of the stations and the wastewater network.

Noise impact will be of **Minor Consequence (2)** and **Low Likelihood (1)**, resulting in **Low Significance (2L=2).**

The following mitigation measures should be adapted to minimize the impacts:

- Design the pumping stations to have properly noise insulated walls;
- Regular maintenance of the stations pump-sets, as per manufacturer specifications;
- Notify nearby residents of the networks maintenance plans and the expected duration prior to initiating the works, in conjunction with the concerned municipalities;
- Avoid idling of equipment and generators when not in use; and
- Equip all internal combustion engine-driven equipment with intake and exhaust mufflers.

Noise impact will be of **Negligible Consequence (1)** and **Low Likelihood (1)**, resulting in **Low Significance (1L=1).**

5.6 POTENTIAL IMPACTS ON SOIL AND GROUND WATER

5.6.1 *Sources of Potential Impacts*

The primary sources of impacts on soil and groundwater from the various Project activities are listed in below Table 5-15.

Table 5-15 Potential Impacts on Soil and Groundwater

Source of Change (Project Activities)	Cumulative Sources of Impact
Construction • Site clearance, trenching, excavation, backfilling, grading, and compaction activities • Accidental spills or leaks of fuel and oil from machinery, generators and vehicles during construction and maintenance • Inadequate solid waste management • Inadequate wastewater management **Operation** • Accidental spills or leaks of fuel from onsite fuel storage and operation and maintenance activities • Potential contamination of soil and groundwater resources from wastewater overflows and/or leakages	Groundwater pollution due to prolonged disposal of untreated sewage into septic tanks/ cesspools in additional to deteriorated wastewater networks causing leakages of raw sewage, as well as industrial and agricultural sources, spills, etc. in the project surrounding

5.6.2 *Impacts during Construction*

Table 5-37 below provides rating of potential impacts on soil and groundwater during the construction phase before and after applying mitigation measures respectively.

Table 5-16 Consequence Assessment of Soil and Ground Water during Construction Before and After Applying Mitigation Measures

Impact/Source		Nature	Magnitude	Extent	Timing	Duration	Reversibility	Consequence Rating
Temporary or permanent change in topography, soil erosion and collapse from grading, trenching, or excavation works	Before Mitigation	N/I	H	L	L	C	I	4. Major
	After Mitigation	N/I	M	L	L	C	I	3. Moderate
Accidental spills of fuel, oil and chemicals	Before Mitigation	N/D	H	G	L	C	I	5. Critical
	After Mitigation	N/D	L	L	M	C	I	3. Moderate
Inadequate solid waste management	Before Mitigation	N/D	H	L	L	C	R	4. Major
	After Mitigation	N/D	M	L	L	C	R	3. Moderate
Inadequate wastewater management	Before Mitigation	N/D	M	L	M	C	R	3. Moderate
	After Mitigation	N/D	L	L	S	C	R	1. Negligible

5.6.2.1 *Temporary or Permanent Change in Topography, Soil Erosion and Collapse from Grading, Trenching, or Excavation*

Potential impacts from physical disturbance of underlying soils at work sites include physical compaction, erosion, and reduction in porosity and loss of permeability.

Excavation works at proposed pumping station sites and trenching works for the additional sewer lines will result in direct disturbance of soil including localized alteration of the soil profile within the excavation/trench footprint, and soil compaction in the immediate vicinity as a result of vehicle and construction equipment operations.

Soil compaction is also a vital part of the construction process. It is used for support of the building foundation, roadways, walkways, and retaining walls. The compaction process consists of mechanically densifying a soil by pressing the soil particles together into a close state of contact with air being expelled from the soil mass in the process. When soil particles are forced together by compaction, both the number of voids contained in the soil mass and the size of the individual void spaces are reduced. This change in voids has an obvious effect on the movement of water through the soil. One effect is to reduce the permeability, thus reducing the seepage of water.

Given the impact on soil is long-term and irreversible, the impact is classified as having **Major Consequence (4)** and **High Likelihood (3)** of occurrence; this results in a **High Significance (4H=12)**.

Mitigation measures should be adopted by the site Contractor to reduce the significance of potential impacts; these include:

- Ensure international standards (i.e. ASTM Soil Compaction Standards) are met during any excavation works, compaction and grading activities, in order to minimize expected disturbance during the construction phase;
- Manage fixed routes for equipment movement and avoid multiple routes; and
- Re-use excavated/cut materials as general fill where considered suitable.

If the above mitigation measures are taken into consideration, the potential impacts from excavation and soil compaction would be reduced to **Moderate Consequence (3)** rating with **Moderate Likelihood (2)**, as such the significance level will then be a **Medium Significance (3M=6)**.

5.6.2.2 Impacts from Accidental Spills of Fuel, Oil and Chemicals

The major potential sources of accidental spills that might be incurred from the construction of the proposed Project include chemicals, diesel supplies, lubricating oils, among others, as part of routine equipment and generators operations and maintenance during the construction phase.

These spills might contain compounds such as benzene, toluene, ethyl-benzene and xylene (BTEX), or compounds of methyl tertiary butyl ether (MTBE). These aromatic hydrocarbons tend to readily evaporate from surface spills and biodegrade under aerobic and anaerobic conditions given their relatively good solubility and volatility, particularly MTBE and benzene. Spills consisting of BTEX; Poly Aromatic Hydrocarbons (PAHs), chlorinated hydrocarbons (CHs), as well as heavy metals such as Nickel, Copper, Chromium and Zinc persist in the receiving environment, and when mixed with soil, they tend to adhere and accumulate due to their low evaporation and biodegradability.

Since excavation will not be close to the groundwater level that is not shallow within the study area, the groundwater will be at moderate levels of risk in case of any spill.

The impact of potential spills will be long-term, with a **Critical Consequence (5)** and **Low Likelihood (1)** of occurrence, thus resulting in a **Medium Significance (5L=5).**

There are several mitigation measures that should be incorporated during the construction stage to minimize impacts from potential spills and leaks, and even prevent them from occurring. Below is a minimum list of required mitigation measures:

- Good housekeeping practices through handling and storage of chemicals, oil, fuels and lubricants within containment facilities (e.g. bonded areas, leak-proof trays) designed to prevent the release of spills/leaks to the soil and groundwater environment;
- Maintenance schedule should be in place as part of the inspection procedures of all equipment/ generators/ machinery for risk minimization;
- Maintenance of machines and equipment should take place off-site or onsite in a well-contained area with impermeable concrete pavement and drainage for vehicle washing and maintenance;
- Oil spill response kits should be available wherever oils are being used/stored;
- Promote awareness among workers on how to handle oil/lubricants;
- Train workers how to clean up small-scale spills;

- Ensure drip trays are present when re-fuelling;
- Prepare a Spill Emergency Plan specific for the Project; and
- In case of spill:
  - Immediately incident reporting to the concerned authorities;
  - Contain the source of spill (close valve, seal pipe, seal hole or as appropriate);
  - Check for hazardous flammable materials on site;
  - Prompt clean-up of the spill by removing affected top soil layer by trained employees who should be equipped with appropriate tools and Personal Protective Equipment (PPE);
  - Treat and contain the removed soil as hazardous waste; and
  - Adopt, to the extent possible, dry cleaning techniques to decrease resulting wastewater, and to avoid flushing of spills to deeper soil layers.

Once the above is applied, the impacts of leaks/spills will become of **Moderate consequence (3)** and **Low Likelihood (1)** of occurrence; resulting in a **Low Significance** (**3L=3**).

5.6.2.3 Impacts from Inadequate Solid Waste Management

As mentioned in previous sections, construction activities are likely to generate considerable volumes of solid wastes of various types. Inappropriate waste handling and disposal practices may potentially result in soil and groundwater contamination due to leaching and runoffs.

Poor Waste Management will have a **Major consequence (4)** with **Moderate Likelihood (2)** if no mitigation measures are in place, resulting in a **Medium Significance (4M=8).**

The potential impact resulting from poor waste management should be reduced by implementing the following measures:

- Segregate at source domestic-like wastes and construction wastes that can be reused onsite from those that need to be transferred for treatment or disposal;
- Sort excavation waste resulting from construction activities into different types (bulky aggregates, fine aggregates, etc.);
- Reuse part of the excavation waste in backfilling; and dispose of the rest (if any) in an adopted/authorized construction and demolition waste dump;
- Material stockpiles should be of certain heights, slopes and be well covered and contained;
- Schedule the works during dry season, when possible;
- Progressively carry out rehabilitation of disturbed areas following completion of works at all construction sites (rehabilitation will include reinstatement of soil, surface leveling, re-vegetation and mulching, where applicable); and
- Ensure that standards of "good housekeeping" are maintained (i.e., avoid littering, prevent storage of combustible waste for more than 24 hours to prevent attraction of pests and flies).

Once the above are applied, the impact will be reduced to **Moderate Consequence (3)** with **Low likelihood (1)** resulting in a **Low Significance (3L=3).**

5.6.2.4 Impacts from Inadequate Wastewater Management

If inappropriate sanitary facilities for construction site labor are not provided and no strict rules of sanitation are maintained, domestic wastewater may find its way into the underlying soils and eventually, groundwater. If septic tanks used for sanitary facilities are not leak-proof, leakages may result in gradual pollution of groundwater resources given the Project area is found to be partially on a karstic aquifer (C4-C5 geological formation).

Based on the above, the impact from inadequate storage and disposal of wastewater during construction is considered to have a **Moderate consequence** with **High likelihood,** resulting in a **Medium Significance (3M=9)**.

To ensure that no groundwater contamination results from poor wastewater management, the below should be taken into consideration by the awarded Contractor:

- Ensure all connections are inspected and are not leaking through the regular inspection of septic/ holding tanks (if any) and connections to the wastewater sewage network;
- Obtain a permit from the Municipality or the relevant Water Establishment to transport and discharge the domestic wastewater to an operating treatment facility; and
- Restrict vehicle washing to contained maintenance areas offsite or onsite with impermeable concrete pavement and proper drainage.

With the above measures being implemented, the impact will become of **Negligible Consequence (1)** with **Low Likelihood (1),** resulting in a **Low Significance (1L=1).**

5.6.3 Impacts during Operation

Table 5-17 below provides rating of potential impacts on soil and groundwater during the operation phase before and after applying mitigation measures respectively.

Table 5-17 Consequence Assessment of Soil and Groundwater during Operation Before and After Applying Mitigation Measures

Impact/Source		Nature	Magnitude	Extent	Timing	Duration	Reversibility	Consequence Rating
Accidental Spills of Fuel, Oil and Chemicals	Before Mitigation	N/D	H	G	L	O	I	5. Critical
	After Mitigation	N/D	L	L	M	O	R	2. Minor
Potential contamination from wastewater overflows and/or leakages	Before Mitigation	N/D	H	L	M	O	R	4. Major
	After Mitigation	N/D	M	L	M	O	R	3. Moderate

5.6.3.1 *Accidental Spills or Leaks of Fuel from Onsite Fuel Storage and Operation and Maintenance Activities*

The major potential sources of accidental spills include the refueling of diesel supplies and lubricating oils, as part of routine generators operation and maintenance, during the operation phase. Private generators will be located in an allocated area along with the fuel tanks. It is planned to have the fuel tanks in a bunded area.

The likelihood of the impact occurring is classified of a **Critical Consequence (5)** and of **Low Likelihood (1)** resulting in a **Medium Significance (5L=5).**

Accidental spills and leaks should be further minimized if the below is taken into consideration:

- No storage tank should be used for the storage of fuel, oil or chemicals unless its material and construction are compatible with the type of materials to be stored and storage conditions (e.g. pressure and temperature);
- Drip trays should be installed underneath diesel generators and fuel storage tanks to intercept leakages;
- Recordkeeping of all fuel, oil, chemicals, and diesel quantities used onsite;
- Reduce the frequency of refueling activity by filling the tanks to the maximal capacity during each refueling operation;
- Ensure that the maintenance schedule and checklist already prepared is being efficiently used;
- Check tank levels prior to delivery to prevent overfilling through side glass or manually by dipstick logs;
- Establish a Spill Response Plan in place;
- Ensure a supply of suitable absorbent materials is available at re-fueling points for use in dealing with minor spills. If a leak or spill occurs during loading or offloading operations, the operations will be stopped and the spill will be contained, cleaned up and collected based on the Spill Response Plan; and
- Ensure that personnel assigned to handle chemicals/oil/fuel are well aware of the requirements. They should be trained prior to commencing their duties.

With the proper mitigation measures in place, the impact is characterized as having **Minor Consequence (2)** with **Low Likelihood (1)**, resulting in a **Low Significance (2L=2)**.

5.6.3.2 *Potential Contamination from Wastewater Overflows and/or Leakages*

During the operation phase of the wastewater networks and pumping stations, sudden malfunctioning or downtime are expected to take place. Prolonged power outages and improper operation and maintenance of operating systems might lead to a relatively higher frequency of malfunctions. These all result in possible overflows of raw wastewater and/or leakages from the networks into underlying soils and eventually, groundwater.

Based on the above, the impact from inadequate storage and disposal of wastewater during construction is considered to have a **Major consequence (4)** with **High likelihood (3)**, resulting in a **High Significance (4H=12)**.

Measures should be adopted to eliminate and/or reduce soil, groundwater and indirect impacts on water resources from sudden overflows or leakages of raw wastewater due to technical malfunctions and/or prolonged power outages. These include:

- Ensure proper engineering design of the pumping stations (sizing of wet wells, pump-sets, and provision of a wastewater overflow emergency/bypass line);
- Ensure prompt repair of pumping stations in case of failure to minimize the resulting impact on soil and water resources;
- Proper operation and maintenance procedures for all operating components (networks and pumping stations);
- Continuous monitoring of any signs of leakages or overflows;
- Maintain continuous supply of power (for pumping stations) to prevent possible overflows and downtime; and
- Ensure sewage network manholes are closed with proper lids to prevent blockages from fallen bulky objects.

If proper implementation of the above measures is ensured, the predicted impacts will become a **Moderate Consequence (3)** with a **Moderate Likelihood (2)**, resulting in a **Medium Significance (3M=6)**.

5.7 POTENTIAL IMPACTS ON BIOLOGICAL ENVIRONMENT

5.7.1 Sources of Potential Impacts

The primary sources of impacts on the biological environment from the various Project activities are listed in Table 5-18 below.

Table 5-18 Potential Impacts on the Biological Environment

Source of Change (Project Activities)	Cumulative Sources of Impact
Construction Damage to biological environment from: • Site clearance, excavation and construction activities • Elevated noise levels from works and employed machinery and equipment • Increased traffic • Transportation of building material, equipment and waste • Inadequate disposal of solid waste and wastewater **Operation** Damage to biological environment from: • Elevated noise levels from the operation of generators and pumping stations • Leakage of wastewater	Inadequate disposal of solid waste (open dumps) and untreated wastewater in the surrounding area

5.7.2 Impacts during Construction

Table 5-19 below provides rating of potential impacts on the biological environment during the construction phase before and after applying mitigation measures respectively.

Table 5-19 Consequence Assessment of Impacts on the Biological Environment during Construction Before and After Applying Mitigation Measures

Impact/Source		Nature	Magnitude	Extent	Timing	Duration	Reversibility	Consequence Rating
Excavation and construction activities and associated traffic and waste disposal	Before mitigation	N/D	L	L	M	C	R	2.Minor
	After mitigation	P/D	-	-	-	-	-	Beneficial

Potential negative impacts on biodiversity during plant construction are summarized in Table 5-20.

Table 5-20 Potential Negative Impacts on Biodiversity

Impact	Cause
Loss or destruction of trees and plants	Construction works
Altered abiotic/site factors	Soil compaction, erosion
Mortality of individuals	Destruction of vegetation
Disturbance to wildlife	Construction noise, traffic, or presence of people, and disposal of waste

Based on the description of the biological environment, the anticipated project will not lead to significant negative impacts on biodiversity except for the removal of some trees at the pumping stations sites PS-2 and PS-6, and disturbance to wildlife including birds living or crossing near the Qaraoun Lake. The main construction activities having negative results on biodiversity are earth-moving activities, generation and inadequate disposal of domestic and construction waste material and wastewater effluent discharges.

The potential impact of construction activities on biodiversity is considered to have **Minor Consequence (3)** and **High Likelihood (3)**, resulting in **Medium Significance (2H=6)**.

Recommended mitigation measures to minimize or eliminate construction impacts on biodiversity at the proposed location include:

- Minimize disturbance of natural land by excavating and constructing necessary areas of land only;
- Prohibition of unnecessary cutting or damaging of wild plants and trees, specifically the wild species;

- Since a number of trees will be removed, native trees should be planted in areas surrounding the sites or in landscaped areas within the sites;
- Reforestation of areas surrounding the sites should be executed in cooperation with reforestation organizations;
- Native trees, shrubs and herbs (available at native nursery) to adopt in the landscape plan in order to enhance the visual aspect of the facilities and play a role of reintroduction of native plant species to the area include:
  - *Cedrus Libani*
  - *Juniperus excels*
  - *Juniperus oxycedrus*
  - *Juniperus drupacea*
  - *Pinus pinea*
  - *Acer hermoneum*
  - *Acer syriacum*
  - *Laurus nobilis* (good for hedges)
  - *Ostrya carpinifolia*
  - Quercus calliprinos
  - *Crateagus azarolus* or *monogyna*
  - *Malus trilobata*
  - *Prunus ursine*
  - *Pirus syriaca*
  - *Rosa canina*
  - *Lonicera etrusca* (climber)
  - *Origanum syriacum*
- Avoid construction works during the bird migration seasons;
- Proper disposal of domestic and construction waste at designated sites;
- Enclosing all fine earth materials during transportation to and from the site to prevent spillage and dusting; and
- Proper storage and prompt transportation of construction material to prevent them from being washed away during rainfall or carried by wind.

With these mitigation measures in place, the potential impact of construction activities on biodiversity becomes **Beneficial (+)** with **Moderate Likelihood (2)**, leading to an overall **Beneficial Significance (B++)**.

5.7.3 Impacts during Operation

Table 5-21 below provides rating of potential impacts on the biological environment during the operation phase before and after applying mitigation measures respectively.

Table 5-21 Consequence Assessment of the Biological Environment during Operation Before and After Applying Mitigation Measures

Impact/Source		Nature	Magnitude	Extent	Timing	Duration	Reversibility	Consequence Rating
Normal operation of networks, pumping stations and generators	Before mitigation	N/D	L	L	L	O	R	2. Minor
	After mitigation	P/I	-	-	-	-	-	Beneficial

The main impacts during operation are summarized in Table 5-22.

Table 5-22 Potential Negative Impacts on Biodiversity

Impact	Cause
Increased human intervention	Operation and maintenance works
Air and Soil pollution	Improper disposal of liquid and solid waste
Water pollution	Leakage of wastewater
Disturbance to fauna	Operation noise, traffic, or presence of people
Threat to planted native species	By weeds and invasive species

The potential impact of the proposed project's operation is considered of **Minor Consequence (2)** and **Low Likelihood (1)**, resulting in a **Low Significance (2L=2).**

Recommended mitigation measures to minimize the impacts on biodiversity at the proposed locations include:

- Include native species in the landscape plan;
- Management of landscaping plan to prevent growth of weeds and exotic species, allow propagation and survival of native species and replanting trees to replace the ones that are removed or die;
- Proper management of liquid and solid waste generated by the project;
- Prevention of littering in the area;
- Control hunting within the project area.

With these mitigation measures in place, the potential impact of project operation on biodiversity becomes of **Beneficial Consequence (+)** with **Moderate Likelihood (2),** leading to an overall **Beneficial Significance (B++),** especially at the level of the Litani River and Qaraoun Lake that will be protected from wastewater pollution, thus reducing impacts on their living environment and species.

5.8 POTENTIAL IMPACTS ON TRAFFIC

5.8.1 Sources of Potential Impacts

The primary sources of traffic impacts from the Project activities are listed in Table 5-23.

Table 5-23 Potential Impacts on Traffic

Source of Change (Project Activities)	Cumulative Sources of Impact
Construction Increase in traffic during construction (mainly at the level of sewage networks and pumping stations adjacent to the public roads) for the transport of materials and waste to the sites **Operation** Increase in traffic during maintenance works (mainly at the level of sewage networks and pumping stations adjacent to the public roads)	Existing traffic

5.8.2 Impacts during Construction

Table 5-24 below provides rating of potential traffic impacts during the construction phase before and after applying mitigation measures, respectively.

Table 5-24 Consequence Assessment of Traffic during Construction Before and After Applying Mitigation Measures

Impact/Source		Nature	Magnitude	Extent	Timing	Duration	Reversibility	Consequence Rating
Increase in traffic during construction (mainly at the level of sewage networks and pumping stations adjacent to the public roads)	Before Mitigation	N/D	M	L	M	C	R	3. Moderate
	After Mitigation	N/D	L	L	M	C	R	2. Minor

The construction phase requires the transport of heavy machinery and equipment, construction materials and wastes, in addition to the workforce. Vehicles transporting materials and wastes may need several trips to the construction sites per day, which may increase the traffic volume on the roads leading to these sites, namely during peak hours. Areas in the direct vicinity of the Project construction sites will experience an increase in traffic volume due to the deployment of construction vehicles, transport vehicles and equipment. All roads adjacent to the additional sewer pipelines installation works will be subject to partial or total closure for the duration of the construction period and may cause increased travel times for commuters traveling through the Project area because of lengthy detours or diversions.

The impact on traffic during the construction phase is considered to be of **Moderate Consequence (3)** and **High Likelihood (3)**, resulting in a **Medium Significance (3H=9).**

Recommended mitigation measures to be taken by the awarded Contractor to reduce impacts on traffic include:

- Limit speed on the construction sites to 20 km/h unless otherwise advised, and adopt careful logistical and route planning;
- Position any necessary traffic diversion signs and devices correctly. Signs and devices should be clearly displayed in the Arabic and English languages. Temporary traffic signals and signs should be employed to warn of hazards and provide directions, especially on narrow one-lane roads;
- Coordinate with the concerned municipalities with respect to the planned road blockages, detours or diversion, and the scheduling of the construction works including material delivery, waste transfer, truck movement and other machinery operations in order to limit the disruption to the neighborhood from traffic inconveniences and traffic flow and to minimize noise and dust generation;
- Follow a specific schedule for transport to avoid interference with peak traffic hours and minimize disturbance/delay to commuters at rush hours on the roads leading to the Project construction sites; and
- Fill up all holes and trenches, and level all mounds and heaps of earth, and exposed surface reinstatement, which have been excavated or made in connection with the works immediately upon completion of any part of the works.

Once the above recommendations are in place, the impact will become of **Minor Consequence (2)** and **Moderate Likelihood (1)**, resulting in a **Medium Significance (2M=4)**.

5.8.3 Impacts during Operation

Table 5-25 below provides rating of potential traffic impacts during the operation phase before and after applying mitigation measures, respectively.

Table 5-25 Consequence Assessment of Traffic during Operation Before and After Applying Mitigation Measures

Impact/Source		Nature	Magnitude	Extent	Timing	Duration	Reversibility	Consequence Rating
Increase in traffic during maintenance works (mainly at the level of sewage networks and pumping stations adjacent to the public roads)	Before Mitigation	N/D	L	L	S	O	R	2. Minor
	After Mitigation	N/D	L	L	S	O	R	1. Negligible

During the operation phase, malfunctioning/failures of the pumping stations and sewage networks, in addition to sudden breakages and overflows, are expected. Maintenance

activities, namely at the level of the sewage networks, are likely to generate traffic disturbances from the road blockages and the development of temporary detours and deviations along public roads.

According to the above, the impact on traffic during operation is considered to be of **Minor Consequence (2)** and **Low Likelihood (1)**, resulting in a **Low Significance (3L=3).**

To ensure that the maintenance activities do not lead to road congestion in the areas of works, the following is suggested to be implemented by the awarded Contractor:

- Avoid maintenance works during peak traffic hours;
- Display temporary traffic signals and signs to warn of hazards and provide directions especially on narrow one-lane roads; and
- Coordinate with municipal police in case of need for road closure and rerouting to be able to carry out specific maintenance activities, preferably ahead of time.

With the above measures in place, the impact on traffic during operation will become of **Negligible Consequence (1)** and **Low Likelihood (1)**, resulting in a **Low Significance (1L=1).**

5.9 POTENTIAL IMPACTS ON WATER RESOURCES CONSUMPTION

5.9.1 Sources of Potential Impacts

The primary sources of impacts on water resources from the various Project activities are listed in Table 5-26 below.

Table 5-26 Potential Impacts on Water Resources

Source of Change (Project Activities)	Cumulative Sources of Impact
Construction Water for construction activities and workforce uses **Operation** Water for housekeeping uses at pumping stations	Water consumption from nearby facilities and daily socio-economic activities (residential, commercial, agricultural, industrial, etc.)

5.9.2 Impacts during Construction

Table 5-37Table 5-27 below provides rating of potential impacts on water resources during the construction phase before and after applying mitigation measures, respectively.

Table 5-27 Consequence Assessment on Water Resources Consumption during Construction Before and After Applying Mitigation Measures

Impact/Source		Nature	Magnitude	Extent	Timing	Duration	Reversibility	Consequence Rating
Water for construction activities and domestic use	Before Mitigation	N/D	L	L	S	C	R	1. Negligible
	After Mitigation	N/D	L	L	S	C	R	1. Negligible

In general, water consumption is inevitable at any project site. Generally, water is used for concrete mixing (in case of an onsite mixing), dust suppression using wet techniques, hydro-testing for installed pipelines, and for site labor domestic activities. Particular to concrete mixing, ready-mix concrete will be outsourced from a nearby batching plant and will not take place at the construction sites. Estimations of water demand for construction-related activities are not available at this stage. As for water demand for site workforce, an average of 53 L/capita/d will be needed, assuming no site lodging, compared to the national daily domestic water consumption rate in Lebanon that is around 160 L/capita/d (MoEW, 2010). Nevertheless, as mentioned earlier, there is currently no labor forecast for the construction phase of the proposed Project.

Therefore, the impact on water resources during the construction phase will have **Negligible Consequences (1)** and **High Likelihood (3)**, resulting in a **Low Significance (1H=3).**

To further limit these impacts during construction, the awarded Contractor should adopt a water saving plan during the construction phase and limit the amount of water used for workforce daily uses.

As such, the impact on water resources during the construction phase will have **Negligible Consequence (1)** and **Moderate likelihood (2)**, resulting in a **Low Significance (1M=2).**

5.9.3 Impacts during Operation

As mentioned earlier in Section 3.4.2 above, water supply is needed for routine housekeeping activities at the stations premises during the operation of the wastewater pumping stations. No water consumption is expected to be needed for the operation of the wastewater networks, unless occasionally when needed during maintenance works, namely for hydro-testing of newly-replaced pipelines. Thus, water consumption during operation is negligible.

5.10 POTENTIAL IMPACTS ON ENERGY RESOURCES

5.10.1 Sources of Potential Impacts

The primary sources of impacts on energy resources from the various Project activities are listed in Table 5-28 below.

Table 5-28 Potential Impacts on Energy Resources

Source of Change (Project Activities)	Cumulative Sources of Impact
Construction Energy consumption during construction activities (fuel for generators, equipment and vehicles) **Operation** Energy consumption during operation and maintenance activities (fuel for generators)	Energy consumption from nearby facilities and ongoing daily socio-economic activities (residential, commercial, industrial, etc.)

5.10.2 Impacts during Construction

Table 5-29 below provides rating of potential impacts on energy resources during the construction phase before and after applying mitigation measures respectively.

Table 5-29 Consequence Assessment of Energy Resources Use during Construction Before and After Applying Mitigation Measures

Impact/Source		Nature	Magnitude	Extent	Timing	Duration	Reversibility	Consequence Rating
Energy (fuel) consumption during construction activities	Before Mitigation	N/D	M	L	M	C	R	3. Moderate
	After Mitigation	N/D	L	L	M	C	R	2. Minor

The electricity needed during the construction phase will be supplied by EDL public grid (if possible) and will be backed up by onsite power generators, provided by the Contractor, during grid outages. Fuel-fired generators will be equipped with an onsite temporary fuel storage tank. In addition, fuel will be needed to operate machinery, equipment and vehicles that will be operated during the construction stage. Estimations on energy demand in the form of electricity (if electricity from EDL was supplied) and/or fuel are not available at this stage.

The impact on energy resources during construction is expected to be of **Moderate Consequence (3)** and **High Likelihood (3)**, resulting in a **Medium Significance (3M=9)**.

The awarded Contractor should implement an energy saving plan at each work site that includes:

- Use equipment with higher fuel efficiency
- Adopt a periodic inspection and maintenance schedule for power generators and equipment engines, as per manufacturer specifications, and maintain maintenance logs;
- Report and monitor monthly fuel and energy consumption records to keep track of consumption levels and identify overuse;
- Avoid unnecessary idling of vehicles and equipment engines.

With the above measures in place, the impact on energy resources will become of **Minor Consequence (2)** and **High Likelihood (3)**, resulting in a **Medium Significance (2H=6).**

5.10.3 Impacts during Operation

Table 5-30 below provides rating of potential impacts on energy resources during the operation phase before and after applying mitigation measures, respectively.

Table 5-30 Consequence Assessment of Energy Resources Use during Operation Before and After Applying Mitigation Measures

Impact/Source		Nature	Magnitude	Extent	Timing	Duration	Reversibility	Consequence Rating
Energy consumption during operation	Before Mitigation	N/D	L	L	L	O	R	2. Minor
	After Mitigation	N/D	L	L	L	O	R	2. Minor

The electricity needed for the operation of the pumping stations will be supplied by EDL and will be backed up by private generators during the operation phase.

The impact on energy resources during operation is considered to be of **Minor Consequence (2)**, with **High Likelihood (3)**, resulting in a **Medium Significance (2H=6).**

To reduce impacts on energy resources, the following mitigation measures can be applied:

- Adopt a periodic maintenance schedule of power generators, as per manufacturer specifications, and maintain maintenance logs;
- Perform regular inspections and maintenance of pumping stations and generators;
- Report and monitor monthly fuel and energy consumption records to keep track of consumption levels and identify overuse;
- Upgrade machines/equipment and generators to more energy efficient technology when rehabilitation or upgrade is considered for the purpose of reducing consumption – consider the installation of solar PV panels for the operation of pumping stations; and
- Switch off all machines/ equipment or any other energy consuming appliances when not in use.

The impact on energy resources during operation following the implementation of mitigation measures is considered to be of **Minor Consequence (2)** and **Moderate Likelihood (2)**, resulting in a **Medium Significance (2M=4).**

5.11 POTENTIAL IMPACTS ON WASTE GENERATION

5.11.1 Sources of Potential Impacts

The primary sources of impacts of waste generation from the various Project activities are listed in Table 5-31 below.

Table 5-31 Potential Impacts from Waste Generation

Source of Change (Project Activities)	Cumulative Sources of Impact
Construction Construction-related solid and liquid wastes generation **Operation** Operation- and maintenance-related solid and liquid wastes generation	Inadequate solid waste and wastewater management in the Project area

5.11.2 Impacts during Construction

Table 5-32 below provides rating of potential impacts of waste generation during the construction phase before and after applying mitigation measures respectively.

Table 5-32 Consequence Assessment of Waste Generation during Construction Before and After Applying Mitigation Measures

Impact/Source		Nature	Magnitude	Extent	Timing	Duration	Reversibility	Consequence Rating
Construction-related solid and liquid wastes generation	Before Mitigation	N/D	M	L	M	C	R	3. Moderate
	After Mitigation	N/D	L	L	M	C	R	2. Minor

Potential sources of solid and liquid wastes during construction are:

- Construction waste and spoil;
- Surplus materials;
- Machinery, generator and vehicle mechanical spare parts;
- Empty containers;
- Domestic-like solid waste;
- Domestic-like wastewater from site laborers;
- Hydro-test water; and
- Concrete wash-off (cleaning of ready-mix concrete trucks).

As described previously in sections 3.3.7 and 3.3.8, wastewater will be either collected and discharged at the nearest existing manhole connected to the sewage network, or collected into an onsite temporary septic tank that will be regularly emptied by service providers in the area, while every solid waste stream will be collected and handled separately.

The impact on waste generation during construction is considered to be of **Moderate Consequence (3),** with **High Likelihood (3)**, resulting in a **Medium Significance (3H=9).**

The potential impacts could be minimized by the following mitigation measures:

- All construction workers and personnel should be responsible for ensuring that standards of "good housekeeping" are maintained. This will include:
  - Clear all rubbish and work associated debris;
  - Sort domestic and general waste into combustible (paper, food, cardboard, and wood) and non-combustible waste (metals, glass, rubble) streams at source by means of suitably labeled containers for safe collection, segregation and handling of all waste streams generated; and
  - Avoid storage of combustible waste for more than 24 hours to prevent attraction of pests and flies.

- Regularly inspect garbage bins;
- Sort and collect hazardous wastes separately from domestic waste. All hazardous waste bags should be properly labeled and stored so as to prevent occupational health hazards;
- Compile log sheets of hazardous wastes, including type, amount and disposal method, to track final destinations and identify opportunities for improvement;
- Transport excavation and construction wastes in covered/closed trucks;
- Regularly inspect and maintain septic tanks (if any) to detect and prevent leaks;
- Ensure that the quality of the hydro-test water is compliant with decision 8/1 for the discharge of wastewater into sewage network or surface water bodies; and
- Collect the concrete wash water in a designated tank and allow for water to evaporate and the concrete to harden to dispose it off with construction waste.

With the suggested mitigation measures, the impact on waste generation during construction is considered to become of **Minor Consequence (2),** with **High Likelihood (3)**, resulting in a **Medium Significance (2H=6).**

5.11.3 Impacts during Operation

Table 5-33 below provides rating of potential impacts of waste generation during the operation phase before and after applying mitigation measures respectively.

Table 5-33 Consequence Assessment of Waste Generation during Operation Before and After Applying Mitigation Measures

Impact/Source		Nature	Magnitude	Extent	Timing	Duration	Reversibility	Consequence Rating
Operation-and maintenance-related solid and liquid wastes generation	Before Mitigation	N/D	M	L	L	O	R	3. Moderate
	After Mitigation	N/D	L	L	L	O	R	2. Minor

Potential sources of solid and liquid wastes during construction are:

- Solid wastes from the maintenance of networks and pumping stations;
- Screenings from the cleaning of pumping stations wells; and
- Minimal wastewater from housekeeping practices for the pumping stations.

The impact on waste generation during operation is considered to be of **Moderate Consequence (3),** with **Moderate Likelihood (2)**, resulting in a **Medium Significance (3M=6).**

To reduce the impact of waste generation, the following mitigation measures should be implemented:

- Implement the measures suggested in section 5.6.3.1 during maintenance activities;
- Collect the screenings generated from cleaning the wells of the pumping stations and dispose them in a designated dump in coordination and approval of MoE; and
- Provide low toxic or environment-friendly (biodegradable) detergents for general cleaning purposes.

After implementing the suggested mitigation measures, the impact on waste generation during operation is considered to become of **Minor Consequence (2)** and **Moderate Likelihood (2)**, resulting in a **Medium Significance (2M=4).**

5.12 POTENTIAL IMPACTS ON ARCHAEOLOGY

5.12.1 Sources of Potential Impacts

The primary sources of impacts on archaeology from the various Project activities are listed in Table 5-34 below.

Table 5-34 Potential Impacts on Archaeology

Source of Change (Project Activities)	Cumulative Sources of Impact
Construction Excavation works. **Operation** None	• Uncovered archaeological features in the area. • Unearthed Prehistorical occupation evidence

5.12.2 Impacts during Construction

Table 5-35 below provides rating of potential impacts on archaeology during the construction phase before and after applying mitigation measures respectively.

Table 5-35 Consequence Assessment of Archaeology during Construction Before and After Applying Mitigation Measures

Impact/Source		Nature	Magnitude	Extent	Timing	Duration	Reversibility	Consequence Rating
Potential damage to undiscovered archaeological features during excavation	Before Mitigation	N/D	H	L	M	C	I	4. Major
	After Mitigation	N/D	L	L	M	C	I	2. Minor

The main potential impacts to uncovered Prehistorical occupation and archaeological features will be through potential physical disturbance. Those impacts are considered to be permanent and irreversible.

Assuming no mitigation measures are taken, the impact will have a **Major Consequence (4)** and **High Likelihood (3)** of occurrence, resulting in **High Significance (4H=12)**.

The different components of the Project being located in an area where before present occupation has been identified and that is of a high interest, and since archaeological features of other periods, especially the Byzantine one, might be encountered, it is highly recommended to apply the below mitigation measures in order to reduce impacts on prehistory, archaeology and culture:

- Coordinate with DGA for a survey to be conducted prior to the initiation of works, allowing to identify any possible prehistorical and archaeological remains on the different locations of the Project; and
- Ensure that all crew members and site engineers are made aware of the laws and regulations related to archaeological findings and are capable of identifying any if encountered.

If any material were to be found during the survey, DGA is the only authority to determine the required operations and to give the approval to commence construction works.

During construction, excavation and/or leveling works, the following measures should be applied if any chance finding were to occur:

- Stop construction activities;
- Secure the site to prevent any damage or loss of removable objects;
- Notify the responsible foreman/archaeologist who in turn should notify the DGA (within less than 24 hours);
- DGA will evaluate the find and determine the needed measures to protect it; and
- Construction works could resume only when permission is given from the DGA after the decision concerning the safeguard of the heritage is fully executed.

With proper implementation of mitigation, the impact on archaeology and culture will be reduced to **Minor Consequence (2)** and **Moderate Likelihood (2)** of occurrence, resulting in **Medium Significance (2M=4)**.

5.12.3 Impacts during Operation

No potential impacts on archaeology are anticipated during the project's operation phase.

5.13 POTENTIAL IMPACTS ON SOCIO-ECONOMY

5.13.1 Sources of Potential Impacts

The primary sources of potential impacts on the socio-economic conditions within the Project area from the various Project activities are listed in Table 5-36 below.

Table 5-36 Potential Impacts on Socio-Economy

Source of Change (Project Activities)	Cumulative Sources of Impact
Construction • Creation of new job opportunities • Potential damage to the existing infrastructure • Disturbances from noise and dust generation and traffic • Increased pressure on existing infrastructure (solid waste and wastewater management facilities) **Operation** • Improvement of overall socioeconomic and environmental conditions of serviced communities and receiving environment from containment of wastewater for ultimate treatment prior to discharge into the environment	• Existing socio-economic activities • Existing pressure on solid waste and wastewater infrastructure

5.13.2 Impacts during Construction

Table 5-37 below provides rating of potential socio-economic impacts during the construction phase before and after applying mitigation measures respectively.

Table 5-37 Consequence Assessment of Socio-Economic Impacts during Construction Before and After Applying Mitigation Measures

Impact/Source		Nature	Magnitude	Extent	Timing	Duration	Reversibility	Consequence Rating
Creation of new job opportunities	Before Mitigation	P/D	H	G	M	C	-	Beneficial
	After Mitigation	-	-	-	-	-	-	-
Damage to the existing infrastructure	Before Mitigation	N/D	H	L	S	C	R	4. Major
	After Mitigation	N/D	M	L	S	C	R	3. Moderate
Disturbances from noise and dust generation and traffic	Before Mitigation	N/D	M	L	S	C	R	3. Moderate
	After Mitigation	N/D	L	L	S	C	R	1. Negligible
Increased pressure on existing infrastructure (solid waste and wastewater management facilities)	Before Mitigation	N/D	M	L	S	C	R	3. Moderate
	After Mitigation	N/D	L	L	S	C	R	1. Negligible

5.13.2.1 Creation of New Job Opportunities

The construction phase will lead to the creation of temporary job opportunities and an increase in the purchase of construction materials and services, resulting in beneficial socio-economic impacts in the region.

As a result, the project will have a positive socio-economic impact having a **Beneficial Consequence (+)** with **High Likelihood (3)**, leading to an overall **Beneficial Significance (B+++).**

5.13.2.2 Damage to the Existing Infrastructure

The network pipelines will be installed along the roads and connected to existing wastewater networks. Potential damage might take place to underlying water supply pipelines, electricity power cables, and telecommunication lines during excavation and trenching works, namely due to faulty construction site practices or lack of coordination with relevant authorities prior to the initiation of works regarding the existence of infrastructure.

With no mitigation measures in place, the impact on existing infrastructure is of **Major Consequence (4),** with **Moderate Likelihood (2)**, resulting in **Medium Significance (4M=8).**

Mitigation measures that should be implemented include:

- Trial pits should be executed along the network route to locate the existing infrastructure components;
- Sewer lines should be installed at least[2] 3 meters horizontally from and 0.3 meters lower than existing water main lines;
- Where the separation requirements cannot be met due to topography, inadequate right-of-way easements, or conflicts with other provisions of these regulations, lesser separation is permissible if:
  - The water main and the sewer are located as far apart as feasible within the conditions listed above;
  - The water main and the sewer are not installed within the same trench; and
  - The sewer line is appropriately constructed to prevent contamination of the water in the main by sewer leakage.
- No water main lines should pass through or come into contact with a sewer manhole.

With the above-listed mitigation measures in place, the potential impact on existing infrastructure is of **Moderate Consequence (3),** with **Low Likelihood (1)**, resulting in a **Low Significance (3L=3).**

5.13.2.3 Disturbances from Noise and Dust Generation

As previously noted in sections 5.4.2, 5.5.2, and 5.8.2 above, dust emissions, elevated noise levels, and traffic generated during construction can cause nuisance to the nearby receptors and commuters.

Therefore, disturbances from noise and dust generation and traffic during the construction phase will have **Moderate consequences (3)** and **High likelihood (3)**, resulting in **Medium Significance (3H=9).**

Nevertheless, if the proposed mitigation measures for dust and noise emissions and traffic impacts are properly implemented, the significance of this impact will be reduced.

Upon implementation of proposed mitigation measures, the impact will become of **Negligible Consequence (1)** and **Moderate Likelihood (2),** resulting in an overall **Low Significance** (**1M=2**).

[2]Separation distances specified should be measured from the nearest outside edges of the facilities.

5.13.2.4 *Increased Pressure on the Existing Infrastructure (Solid Waste and Wastewater Management Facilities)*

Excavated material and construction waste that is not recyclable or reusable will be disposed of in permitted dumps in coordination with the Municipality. Domestic-like solid waste generated by construction workers will be disposed of in the nearest curbside waste barrels to be collected by contractors appointed by the Municipality. Wastewater will be collected in temporary septic tanks, which will be emptied as needed, in a location approved by the Municipality.

The increase in pressure on the existing infrastructure during construction is considered to have a **Moderate Consequence (3)** of **High Likelihood (3),** resulting in a **Medium Significance** (**3H=9**).

In order to mitigate the above mentioned impacts, the Project implementing agency – CDR- should ensure the compliance of the awarded Contractor with the proposed waste management plan (refer to Section 5.11.2 above).

Upon implementation of proposed mitigation measures, the impact will become of **Negligible Consequences (1)** and a **Moderate Likelihood (2),** resulting in an overall **Low Significance** (**1M=2**).

5.13.3 *Impacts during Operation*

Table 5-38 below provides rating of potential impacts on the prevailing socio-economic conditions during the operation phase before and after applying mitigation measures, respectively.

Table 5-38 Consequence Assessment of Socio-Economic Impacts during Operation Before and After Applying Mitigation Measures

Impact/Source		Nature	Magnitude	Extent	Timing	Duration	Reversibility	Consequence Rating
Improvement of overall socioeconomic and environmental conditions of serviced communities and receiving environment from containment of wastewater	Before Mitigation	P/I	H	L	L	O	-	Beneficial
	After Mitigation	-	-	-	-	-	-	-

With reference to the Project needs and objectives presented in section 1.5.2 above, the implementation of the Project will result in an overall positive impact on the area through the construction of new additional sewer lines and wastewater pumping stations, as per of the overall Aitanit Wastewater System.

The project is expected to have a **Beneficial Consequence (+)** with **High Likelihood (3),** leading to an overall **Beneficial Significance (B+++).**

5.14 POTENTIAL IMPACTS ON OCCUPATIONAL AND PUBLIC HEALTH AND SAFETY

5.14.1 Sources of Potential Impacts

The primary sources of occupational and public health impacts from the various Project activities are listed in Table 5-39 below.

Table 5-39 Potential Impacts on Occupational and Public Health

Source of Change (Project Activities)	Cumulative Sources of Impact
Construction • Potential risks to general health and safety of the sites' workers, nearby residents, commuters, and pedestrians **Operation** • Potential occupational health and safety risks to operation and maintenance workers and to nearby receptors, pedestrians, and commuters during maintenance works or from sudden overflows or leakages • Improved public health conditions from the proper management of wastewater	Public health conditions associated with the mismanagement of wastewater

5.14.2 Impacts during Construction

Table 5-40 below provides rating of occupational and public health impacts during the construction phase before and after applying mitigation measures respectively.

Table 5-40 Consequence Assessment of Occupational and Public Health Impacts during Construction Before and After Applying Mitigation Measures

Impact/Source		Nature	Magnitude	Extent	Timing	Duration	Reversibility	Consequence Rating
Potential risks to general health and safety of the sites' workers, nearby residents, commuters, and pedestrians	Before Mitigation	N/D	M	L	M	C	R	3. Moderate
	After Mitigation	N/D	L	L	M	C	R	2. Minor

Working on a construction project entails several health and safety risks that need to be addressed ahead of commencing the construction works. The main sources of health and safety risks include physical injuries and exposure to dust and noise. According to the World Health Organization (WHO), prolonged or excessive exposure to noise can cause hearing impairment; similarly, exposure to dust will have respiratory impacts.

The impact on occupational and public health and safety during construction is considered to have a **Moderate Consequence (3)** and a **Moderate Likelihood (2),** resulting in a **Medium Significance** (**3M=6**).

In order to further ensure that workers' and potential site visitors'/ pedestrians' health and safety are not affected, it is recommended to:

- Surround the construction areas with scaffolding nets;
- Provide sufficient lighting;
- Prohibit keeping trenches unnecessarily open and install barriers to avoid falling and tripping;
- Fence off all construction sites to prevent unauthorized access;
- Keep machinery and vehicles passages clear;
- Implement a speed limit of 20 km/h for vehicles arriving to and leaving the construction sites;
- Provide workers with the appropriate PPE (goggles, dust masks, helmets, hearing protection equipment, proper clothing, safety boots, etc.) and enforce their use;
- Maintain the PPE (cleaning when dirty and replacement when damaged or worn out);
- Ensure the availability of adequate loading and unloading space;
- Prohibit smoking and littering;
- Ensure that an easily accessible first-aid station is provided on-site;
- Post adequate signs at visible locations throughout the construction area indicating type of operation, potential risks, and appropriate medical/emergency action response;
- Perform staff training about the fundamentals of occupational health and safety procedures, and about handling hazardous material containers and related wastes; and
- Implement the required air emissions and noise mitigation measures listed in sections 5.5.2 and 5.4.2 respectively.

After implementing the above mentioned mitigation measures, the impact on occupational and public health and safety is considered to become of a **Minor Consequence (2)** and a **Low Likelihood (1)** of occurrence, resulting in a **Low Significance** (**2L=2**).

5.14.3 Impacts during Operation

Table 5-41 below provides rating of occupational and public health impacts during the operation phase before and after applying mitigation measures respectively.

Table 5-41 Consequence Assessment of Occupational and Public Health Impacts during Operation Before and After Applying Mitigation Measures

Impact/Source		Nature	Magnitude	Extent	Timing	Duration	Reversibility	Consequence Rating
Potential health and safety risks to operation and maintenance workers and nearby receptors, pedestrians, and commuters from maintenance works or from sudden overflows or leakages	Before Mitigation	N/D	M	L	S	O	R	3. Moderate
	After Mitigation	N/D	L	L	S	O	R	1. Negligible

Impact/Source		Nature	Magnitude	Extent	Timing	Duration	Reversibility	Consequence Rating
Improved public health conditions from the proper management of wastewater	Before Mitigation	P/I	H	L	L	O	-	Beneficial
	After Mitigation	-	-	-	-	-	-	-

5.14.3.1 *Potential Health and Safety Risks to Workers and Nearby Receptors, Pedestrians, and Commuters from Maintenance Works or from Sudden Overflows or Leakages*

During the operation phase, malfunctions of the pumping stations or damage to the pipelines are possible. The workers in charge of the maintenance of the stations and the networks will be exposed to odors, hazards and potential injuries.

The impact on occupational and public health and safety during operation is of a **Moderate Consequence (3)** and a **Low Likelihood (1),** resulting in a **Low Significance** (**3L=3**).

The awarded Contractor should implement the following site occupational health and safety measures at each work site that includes:

- Provide workers with the appropriate PPE (goggles, dust masks, helmets, hearing protection equipment, proper clothing, safety boots, etc.) and enforce their use;
- Post adequate signs at visible locations throughout the maintenance area indicating type of operation, potential risks, and appropriate medical/emergency action response;
- Prohibit keeping trenches unnecessarily open and install barriers to avoid falling and tripping;
- Fence all maintenance sites to prevent unauthorized access;
- Store and handle chemicals (if any) as directed by their material safety data sheets and use the required PPEs;
- Conduct regular training for workers about health and safety requirements; and
- Implement the required ambient air emissions and noise mitigation measures above listed in sections 5.4.3 and 5.5.3 respectively.

After implementing the above mentioned mitigation measures, the impact on occupational and public health and safety is considered to become of a **Negligible Consequence (1)** and a **Low Likelihood (1)** of occurrence**,** resulting in a **Low Significance** (**1L=1**).

5.14.3.2 *Improved Public Health Conditions from the Proper Management of Wastewater*

Proper implementation of the Project and sound operation and maintenance practices of its various components are expected to promote improvement in the public health conditions of communities potentially affected by the prevailing unsanitary management of wastewater.

The Project is expected to have a **Beneficial Consequence (+)** with **High Likelihood (3),** leading to an overall **Beneficial Significance (B+++).**

5.15 SUMMARY OF ENVIRONMENTAL IMPACTS BEFORE AND AFTER IMPLEMENTATION OF MITIGATION MEASURES

A summary of environmental impacts before and after implementation of mitigation measures is provided in Table 5-42 and Table 5-43.

Table 5-42 Impact Summary before Mitigation

Activity / Source of the impact	Receptors									
	Ambient Air Quality	Noise	Soil and Ground Water Resources	Biological Environment	Traffic	Water Resources	Energy Resources	Archaeology	Socio-economy	Occupational and Public Health and Safety
Construction Phase										
Site clearance, excavation, backfilling, and construction activities	9	9	12	6	9	3	9	12	9	6
Operation of equipment and generators	9	9					9		9	6
Accidental spills (fuels/chemicals) and material wash-off			5							
Waste Generation									9	
Inadequate Solid Waste Management			8						9	
Inadequate Wastewater Management			9						9	
Job creation									+++	
Operation Phase										
Operation of pumping stations and networks	6	4		2			6		+++	+++
Malfunctioning, accidental downtime of sewage network and/or pumping stations resulting in raw wastewater overflow	6		12						6	3
Maintenance activities		2	5		3				6	

Table 5-43 Impact Summary after Mitigation

ctivity / Source of the impact	Receptors									
	Ambient Air Quality	Noise	Soil and Ground Water Resources	Biological Environment	Traffic	Water Resources	Energy Resources	Archaeology	Socio-economy	Occupational and Public Health and Safety
Construction Phase										
Site clearance, excavation, backfilling, and construction activities	4	6	4	++	4	2	6	4	2	2
Operation of equipment and generators	6	6					6		2	2
Accidental spills (fuels/chemicals) and material wash-off			3							
Waste Generation									6	
Inadequate Solid Waste Management			3						2	
Inadequate Wastewater Management			1						2	
Job creation									+++	
Operation Phase										
Operation of pumping stations and networks	4	2		++			4		+++	+++
Malfunctioning, accidental downtime of sewage network and/or pumping stations resulting in raw wastewater overflow	2		6						4	1
Maintenance activities		1	2		1				4	

6. PUBLIC CONSULTATION

According to existing laws and regulations, international conventions and good practice, including the World Bank's Operational Policy OP 4.01, the public has the right to be properly and timely informed about any type of project that can cause an impact on the environment. In this context, a public announcement (Appendix E) stamped and signed by the concerned Municipalities was posted at Baaloul and Qaraoun Municipalities.

A consultation meeting was held on December 18, 2017 in the quarters of Qaraoun municipality to discuss the findings of the ESMP. Photos from the meeting at the Qaraoun Municipality are provided in Figure 6-1. The consultation presentation is provided in Appendix G.

Figure 6-1 Images from the Consultation Meeting

Around 36 participants representing the following affiliations attended the meeting; the list of participants is available in Appendix F:

- CDR
- Municipalities (Baaloul and Qaraoun)
- MoPH
- The Litani River Authority
- DGA (MoC)
- Bureau Technique pour le Développement (BTD)
- Islamic Charitable Society
- Muslim Scout
- Civil Society
- Al Waleed Trading and Contracting Establishment

In general, the attendees welcomed the Project and acknowledged its positive impacts on the environment as a whole. Below is a summary of the main issues of concern raised during the public participation meeting, summarized in Table 6-1.

Table 6-1 Concerns Raised during the Public Consultation Meeting

Comment/Question	Answer
The construction of additional networks and pumping stations is very essential for the area; however, their operation and regular maintenance are the main issues. The municipalities do not have the required skills or the financial resources to handle the operation and maintenance of such projects; however, they are obliged to fix any damage when the operator of the project does not, even though BWE collects money for O&M of wastewater infrastructure.	• BWE is the operator of the project and responsible for the regular maintenance of the networks and pumping stations. • Regular coordination between the concerned municipalities and BWE should be conducted to ensure proper operation and maintenance of the system. Municipalities are responsible for ensuring the proper arrangements to achieve this (e.g., subcontracting by BWE to the private sector).
The project should take into consideration future increase in population and wastewater generation when estimating the required diameter of wastewater pipes.	The design of the project takes into consideration the increase of wastewater generation for 25 years.
The plots for PS-5 and PS-6 in Baaloul are locations where people go for a walk and they are potential plots for implementing an Environmental Center project. Potential wastewater overflow and odor and noise generation can negatively affect the project.	• Regular maintenance of the pumping stations will be conducted to avoid any disturbances to regular visitors of the site. • Design of the structures and stations and their textural finishes will be selected to be easily integrated and compatible with the surrounding areas.
Baaloul village needs the addition of around 10 km networks and another pumping station.	The project design is taking into consideration the addition of more networks.
The existing pipelines are old and incapable of accommodating the current wastewater quantities and thus, will not be able to accommodate for the additional quantities with the extension of the networks.	According to the design, the networks will be able to accommodate for the additional wastewater quantities.
DGA: the DGA needs to be informed of the plots numbers and the depth of excavation prior to the initiation of works. An official letter should be addressed to DGA by CDR in this respect, and DGA should conduct initial investigations on site, followed by supervision of works during the works.	CDR will ensure proper coordination with DGA at early stages of the project.

7. ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

This section presents the proposed Environmental and Social Management Plan (ESMP) for the Project. The ESMP will highlight the main impacts and control measures that were identified in the Environmental Impact Assessment section, particularly:

- Mitigation measures to be implemented during the construction and operation phases;
- References to control guidelines and standards;
- Responsibilities for the implementation of the plan;
- Verification, monitoring and training requirements; and
- Record keeping and documentation requirements.

The overall objectives of the ESMP are to:

1) Ensure the Project's compliance with Lebanese legislation;
2) Provide a basis to carry out monitoring activities and compliance inspection programs; and
3) Support the Contractors and relevant stakeholders in the implementation of mitigation and monitoring plans.

The ESMP may be subject to updates and modifications throughout the Project lifetime.

7.1 ENVIRONMENTAL MANAGEMENT PLAN

This section comprises a priority list of the most important measures that the project proponent should adopt to ensure a practical, cost-effective and appropriate approach to impact mitigation.

Proposed mitigation measures for construction and operation impacts are summarized in Table 7-1 and Table 7-2.

Table 7-1 Construction Phase Environmental and Management Plan

Source of Impact	Project Activities	Evaluation of Impact								Mitigation Measures	Residual Impacts	Institutional Responsibility	Cost Estimation
		N	M	E	T	D	R	L	S				
Emissions													
Air Emissions	Combustion and exhaust emissions	N/D	M	L	S	C	R	H	M	• Ensure well designed, maintained, and operated equipment/vehicles. Precautionary control measures for emissions reduction could include proper engine fuel mixtures, regularly serviced exhaust emission systems, suitable engine tuning, and use of low sulfur content diesel, whenever available; • Use environmentally friendly equipment whenever possible (machinery with higher fuel efficiency or equipped with air pollution control devices to minimize exhaust emissions); • Keep a record of maintenance for all machinery, vehicles, and generators on site; • Report and monitor monthly fuel consumption records to keep track of consumption levels and identify overuse; • Avoid unnecessary idling of vehicles and equipment engines; and • Ensure that an effective Maintenance Plan and Schedule is in place for employed site machinery, vehicles, and power generators.	Medium	Implementation: Contractor Supervision: CDR	Part of construction activities cost
	Dust emissions	N/D	M	L	S	C	R	H	M	• Set physical barriers at site boundaries; • Ensure site roads are kept regularly damped down and compacted to minimize dust emissions; • Schedule deliveries of raw materials efficiently; • Wheel-washing of vehicles before departure from construction site; • Cover incoming and outgoing trucks with proper canopies; • Limit vehicular speed onsite to 20 km/h; • Maintain material stockpiles at minimum heights and adequate slopes and ensure that they are covered; • Surround the construction areas with scaffolding nets to control debris and dust from dispersing beyond the construction sites; and • Inform sensitive receptors of the scheduled construction works, ahead of time in conjunction with the concerned municipalities, especially for dust-generating activities.	Medium	Implementation: Contractor Supervision: CDR	Part of construction activities cost
Noise	Noise associated with site preparation, construction activities and operation of on-site generators, heavy machinery, equipment and vehicles	N/D	M	L	M	C	R	H	M	• Fit all machinery, equipment, and vehicles with exhaust silencers where possible; • Ensure proper inspection and maintenance of machinery, vehicles and generators; • Avoid idling and switch off engines when not in use; • Place noisy equipment away from sensitive receptors, behind stockpiles to provide acoustic barriers; • Control speed limits of vehicle movement on site and in the surrounding area; • Plan deliveries to and from the site during day time hours; • Respect scheduled working hours (7:00 am- 6:00pm) and avoid night-time work; • Avoid construction works on Sundays and public holidays; • Inform site staff and workers on the impact of noise and the applicable regulatory requirements; • Provide workers with noise protection equipment and enforce their use; • Conduct regular noise monitoring to ensure that noise emissions are compliant with national standards (Decision 52/1, provided in Appendix D); • Notify the residents of the plans and expected duration prior to initiating the works, in conjunction with concerned municipalities; and • Establish a noise complaint grievance mechanism as a measure to allow implementation of timely and effective actions to minimize noise impacts on downwind receptors.	Medium	Implementation: Contractor Supervision: CDR	• Noise PPEs: Washable and reusable ear plugs: ~1.5 USD/piece or Ear Muffs: ~28 USD/piece • Noise monitoring: 400 USD/Event
Soil and Ground Water Resources	Temporary or permanent change in topography, soil erosion and collapse from grading, trenching, or excavation works	N/I	H	L	L	C	I	H	H	• Ensure international standards (i.e. ASTM Soil Compaction Standards) are met during any excavation works, compaction and grading activities, in order to minimize expected disturbance during the construction phase; • Manage fixed routes for equipment movement and avoid multiple routes; and • Re-use excavated/cut materials as general fill where considered suitable.	Medium	Implementation: Contractor Supervision: CDR	Part of construction activities cost

Source of Impact	Project Activities	Evaluation of Impact								Mitigation Measures	Residual Impacts	Institutional Responsibility	Cost Estimation
		N	M	E	T	D	R	L	S				
	Accidental spills of fuel, oil and chemicals	N/D	H	G	L	C	I	L	M	• Good housekeeping practices through handling and storage of chemicals, oil, fuels and lubricants within containment facilities (e.g. bonded areas, leak-proof trays) designed to prevent the release of spills/leaks to the soil and groundwater environment; • Maintenance schedule should be in place as part of the inspection procedures of all equipment/ generators/ machinery for risk minimization; • Maintenance of machines and equipment should take place off-site or onsite in a well-contained area with impermeable concrete pavement and drainage for vehicle washing and maintenance; • Oil spill response kits should be available wherever oils are being used/stored; • Promote awareness among workers on how to handle oil/lubricants; • Train workers how to clean up small-scale spills; • Ensure drip trays are present when re-fuelling; • Prepare a Spill Emergency Plan specific for the Project; and • In case of spill: - Immediately incident reporting to the concerned authorities; - Contain the source of spill (close valve, seal pipe, seal hole or as appropriate); - Check for hazardous flammable materials on site; - Prompt clean-up of the spill by removing affected top soil layer by trained employees who should be equipped with appropriate tools and Personal Protective Equipment (PPE); - Treat and contain the removed soil as hazardous waste; and - Adopt, to the extent possible, dry cleaning techniques to decrease resulting wastewater, and to avoid flushing of spills to deeper soil layers.	Low	Implementation: Contractor Supervision: CDR	Oil spill response: 80 USD Drip trays: 65 USD
	Inadequate solid waste management	N/D	H	L	L	C	R	M	M	• Segregate at source domestic-like wastes and construction wastes that can be reused onsite from those that need to be transferred for treatment or disposal; • Sort excavation waste resulting from construction activities into different types (bulky aggregates, fine aggregates, etc.); • Reuse part of the excavation waste in backfilling; and dispose of the rest (if any) in an adopted/authorized construction and demolition waste dump; • Material stockpiles should be of certain heights, slopes and be well covered and contained; • Schedule the works during dry season, when possible; • Progressively carry out rehabilitation of disturbed areas following completion of works at all construction sites (rehabilitation will include reinstatement of soil, surface leveling, re-vegetation and mulching, where applicable); and • Ensure that standards of "good housekeeping" are maintained (i.e., avoid littering, prevent storage of combustible waste for more than 24 hours to prevent attraction of pests and flies).	Low	Implementation: Contractor Supervision: CDR	Part of construction activities cost
	Inadequate wastewater management	N/D	M	L	M	C	R	H	M	• Ensure all connections are inspected and are not leaking through the regular inspection of septic/ holding tanks (if any) and connections to the wastewater sewage network; • Obtain a permit from the Municipality or the relevant Water Establishment to transport and discharge the domestic wastewater to an operating treatment facility; and • Restrict vehicle washing to contained maintenance areas offsite or onsite with impermeable concrete pavement and proper drainage.	Low	Implementation: Contractor Supervision: CDR	Part of construction activities cost

Source of Impact	Project Activities	Evaluation of Impact								Mitigation Measures	Residual Impacts	Institutional Responsibility	Cost Estimation
		N	M	E	T	D	R	L	S				
Waste Generation	Construction-related solid and liquid wastes generation	N/D	M	L	M	C	R	H	M	• All construction workers and personnel should be responsible for ensuring that standards of "good housekeeping" are maintained. This will include: - Clear all rubbish and work associated debris; - Sort domestic and general waste into combustible (paper, food, cardboard, and wood) and non-combustible waste (metals, glass, rubble) streams at source by means of suitably labeled containers for safe collection, segregation and handling of all waste streams generated; and - Avoid storage of combustible waste for more than 24 hours to prevent attraction of pests and flies. • Regularly inspect garbage bins; • Sort and collect hazardous wastes separately from domestic waste. All hazardous waste bags should be properly labeled and stored so as to prevent occupational health hazards; • Compile log sheets of hazardous wastes, including type, amount and disposal method, to track final destinations and identify opportunities for improvement; • Transport excavation and construction wastes in covered/closed trucks; • Regularly inspect and maintain septic tanks (if any) to detect and prevent leaks; • Ensure that the quality of the hydro-test water is compliant with decision 8/1 for the discharge of wastewater into sewage network or surface water bodies; and • Collect the concrete wash water in a designated tank and allow for water to evaporate and the concrete to harden to dispose it off with construction waste.	Medium	Implementation: Contractor Supervision: CDR	Part of construction activities cost
Depletion of Resources													
Biological Resources	Excavation and construction activities	N/D	L	L	M	C	R	H	M	• Minimize disturbance of natural land by excavating and constructing necessary areas of land only; • Prohibition of unnecessary cutting or damaging of wild plants and trees, specifically the wild species; • Since a number of trees will be removed, native trees should be planted in areas surrounding the sites or in landscaped areas within the sites; • Reforestation of areas surrounding the sites should be executed in cooperation with reforestation organizations; • Native trees, shrubs and herbs (available at native nursery) to adopt in the landscape plan in order to enhance the visual aspect of the facilities and play a role of reintroduction of native plant species to the area include: - Cedrus Libani - Juniperus excels - Juniperus oxycedrus - Juniperus drupacea - Pinus pinea - Acer hermoneum - Acer syriacum - Laurus nobilis (good for hedges) - Ostrya carpinifolia - Quercus calliprinos - Crateagus azarolus or monogyna - Malus trilobata - Prunus ursine - Pirus syriaca - Rosa canina - Lonicera etrusca (climber) - Origanum syriacum • Avoid construction works during the bird migration seasons; • Proper disposal of domestic and construction waste at designated sites; • Enclosing all fine earth materials during transportation to and from the site to prevent spillage and dusting; and • Proper storage and prompt transportation of construction material to prevent them from being washed away during rainfall or carried by wind.	Beneficial	Implementation: Contractor Supervision: CDR	Part of construction activities cost

Source of Impact	Project Activities	Evaluation of Impact								Mitigation Measures	Residual Impacts	Institutional Responsibility	Cost Estimation
		N	M	E	T	D	R	L	S				
Water Resources	Water for construction activities and domestic use	N/D	L	L	S	C	R	H	L	• Adopt a water saving plan during the construction phase and limit the amount of water used for workforce daily uses.	Low	Implementation: Contractor Supervision: CDR	Part of construction activities cost
Energy Resources	Energy consumption during construction activities	N/D	M	L	M	C	R	M	M	• Use equipment with higher fuel efficiency • Adopt a periodic inspection and maintenance schedule for power generators and equipment engines, as per manufacturer specifications, and maintain maintenance logs; • Report and monitor monthly fuel and energy consumption records to keep track of consumption levels and identify overuse; • Avoid unnecessary idling of vehicles and equipment engines.	Medium	Implementation: Contractor Supervision: CDR	Part of construction activities cost
Other Impacts													
Traffic	Increase in traffic during construction	N/D	M	L	M	C	R	H	M	• Limit speed on the construction sites to 20 km/h unless otherwise advised, and adopt careful logistical and route planning; • Position any necessary traffic diversion signs and devices correctly. Signs and devices should be clearly displayed in the Arabic and English languages. Temporary traffic signals and signs should be employed to warn of hazards and provide directions, especially on narrow one-lane roads; • Coordinate with the concerned municipalities with respect to the planned road blockages, detours or diversion, and the scheduling of the construction works including material delivery, waste transfer, truck movement and other machinery operations in order to limit the disruption to the neighborhood from traffic inconveniences and traffic flow and to minimize noise and dust generation; • Follow a specific schedule for transport to avoid interference with peak traffic hours and minimize disturbance/delay to commuters at rush hours on the roads leading to the Project construction sites; and • Fill up all holes and trenches, and level all mounds and heaps of earth, and exposed surface reinstatement, which have been excavated or made in connection with the works immediately upon completion of any part of the works.	Medium	Implementation: Contractor Supervision: CDR	Part of construction activities cost
Archaeology	Potential damage to undiscovered archaeological features during excavation	N/D	H	L	M	C	I	H	H	• Coordinate with DGA for a survey to be conducted prior to the initiation of works, allowing to identify any possible prehistorical and archaeological remains on the different locations of the Project; and • Ensure that all crew members and site engineers are made aware of the laws and regulations related to archaeological findings and are capable of identifying any if encountered. • If any material were to be found during the survey, DGA is the only authority to determine the required operations and to give the approval to commence construction works. • During construction, excavation and/or leveling works, the following measures should be applied if any chance finding were to occur: - Stop construction activities; - Secure the site to prevent any damage or loss of removable objects; - Notify the responsible foreman/archaeologist who in turn should notify the DGA (within less than 24 hours); - DGA will evaluate the find and determine the needed measures to protect it; and - Construction works could resume only when permission is given from the DGA after the decision concerning the safeguard of the heritage is fully executed.	Medium	Implementation: Contractor Supervision: CDR, DGA	Part of construction activities cost
Socio-economic	Creation of new job opportunities	P/D	H	G	M	C	-	H	B	-	-	-	-

Source of Impact	Project Activities	Evaluation of Impact								Mitigation Measures	Residual Impacts	Institutional Responsibility	Cost Estimation
		N	M	E	T	D	R	L	S				
	Damage to the existing infrastructure	N/D	H	L	S	C	R	M	M	• Trial pits should be executed along the network route to locate the existing infrastructure components; • Sewer lines should be installed at least[3] 3 meters horizontally from and 0.3 meters lower than existing water main lines; • Where the separation requirements cannot be met due to topography, inadequate right-of-way easements, or conflicts with other provisions of these regulations, lesser separation is permissible if: - The water main and the sewer are located as far apart as feasible within the conditions listed above; - The water main and the sewer are not installed within the same trench; and - The sewer line is appropriately constructed to prevent contamination of the water in the main by sewer leakage. • No water main lines should pass through or come into contact with a sewer manhole.	Low	Implementation: Contractor Supervision: CDR	Part of construction activities cost
	Disturbances from noise and dust generation and traffic	N/D	M	L	S	C	R	H	M	• Properly implement the mitigation measures proposed for dust and noise emissions and traffic.	Low	Implementation: Contractor Supervision: CDR	Part of construction activities cost
	Increased pressure on existing infrastructure	N/D	M	L	S	C	R	H	M	• The Project implementing agency – CDR - will ensure the compliance of the awarded Contractor with the proposed waste management plan (refer to Section 5.11.2 above.	Low	Implementation: Contractor Supervision: CDR	Part of construction activities cost
Health and Safety Hazards	Potential risks to general health and safety of the sites' workers, nearby residents, commuters, and pedestrians	N/D	M	L	M	C	R	M	M	• Surround the construction areas with scaffolding nets; • Provide sufficient lighting; • Prohibit keeping trenches unnecessarily open and install barriers to avoid falling and tripping; • Fence off all construction sites to prevent unauthorized access; • Keep machinery and vehicles passages clear; • Implement a speed limit of 20 km/h for vehicles arriving to and leaving the construction sites; • Provide workers with the appropriate PPE (goggles, dust masks, helmets, hearing protection equipment, proper clothing, safety boots, etc.) and enforce their use; • Maintain the PPE (cleaning when dirty and replacement when damaged or worn out); • Ensure the availability of adequate loading and unloading space; • Prohibit smoking and littering; • Ensure that an easily accessible first-aid station is provided on-site; • Post adequate signs at visible locations throughout the construction area indicating type of operation, potential risks, and appropriate medical/emergency action response; • Perform staff training about the fundamentals of occupational health and safety procedures, and about handling hazardous material containers and related wastes; and • Implement the required air emissions and noise mitigation measures listed in sections 5.5.2 and 5.4.2 respectively.	Low	Implementation: Contractor Supervision: CDR	PPEs Prices/ person: Overall ~12 USD Boots ~100 USD Helmet ~ 5 USD PVC Gloves ~2 USD Welding Gloves ~ 4USD Goggles ~ 3 USD Mask ~8 USD Reusable ear plugs ~1.5 USD Ear Muffs ~28 USD First Aid Kit (for 100 workers) ~200 USD

[3]Separation distances specified should be measured from the nearest outside edges of the facilities.

Table 7-2 Operation Phase Environmental and Social Management Plan

Source of Impact	Project Activities	Evaluation of Impact								Mitigation Measures	Residual Impacts	Institutional Responsibility	Cost Estimation
		N	M	E	T	D	R	L	S				
Emissions													
Air Emissions	Combustion and exhaust emissions	N/D	L	L	L	O	R	H	M	• Ensure proper operating conditions and regular maintenance of the generators as per manufacturer specifications; • Ensure that the specifications of the generators are in line with national standards (Decision 8/1 dated 2001) through one of the following: - Compliance in terms of air pollutant emissions through regular monitoring; or - Ensuring that effective generator stack heights are in place. The formula for determining the stack height is: $H = h + 0.2\sqrt{KVA}$ Where: ✓ H = Total stack height in meters ✓ h = Height of neighboring building in meters (within 50 m radius) ✓ KVA= Total generator capacity of the set in kVA = kW, i.e. the total capacity which is determined by the maximum fuel (energy) input	Medium	BWE and concerned Municipalities	Generators emissions: 500 USD/Event
	Foul odor emissions	N/D	M	L	L	O	R	M	M	• Ensure proper engineering design of the pumping stations (sizing of wet wells, pump-sets, and provision of a wastewater overflow emergency/bypass line); • Ensure prompt repair of pumping stations in case of failure to minimize the resulting impact on soil and water resources; • Provide adequate ventilation with a carbon filter to control odors. The ventilation pipes must be extended above the highest point of the station building by three (3) meters; • Ensure that a regular inspection and maintenance schedule is in place for the stations; and • Establish an odor complaint grievance mechanism as a measure to allow implementation of timely and effective actions to minimize impacts from odors on downwind receptors.	Low	BWE and concerned Municipalities	Activated carbon filter: 2,000 USD
Noise	Noise from standby power generators	N/D	L	L	L	O	R	M	M	• Fit generators with exhaust silencers; • Ensure proper operation and a regular maintenance schedule of generators, as per manufacturer specifications; and • Conduct regular noise monitoring around pumping stations perimeters and at identified sensitive receptors to ensure that noise emissions are compliant with national standards (Decision 52/1).	Low	BWE and concerned Municipalities	Part of operations activities cost
	Noise from the normal operation and maintenance activities	N/D	L	L	L	O	R	L	L	• Design the pumping stations to have properly noise insulated walls; • Regular maintenance of the stations pump-sets, as per manufacturer specifications; • Notify nearby residents of the networks maintenance plans and the expected duration prior to initiating the works, in conjunction with the concerned municipalities; • Avoid idling of equipment and generators when not in use; and • Equip all internal combustion engine-driven equipment with intake and exhaust mufflers.	Low	BWE and concerned Municipalities	Part of operations activities cost

Source of Impact	Project Activities	Evaluation of Impact								Mitigation Measures	Residual Impacts	Institutional Responsibility	Cost Estimation
		N	M	E	T	D	R	L	S				
Soil and Ground Water Resources	Accidental Spills of Fuel, Oil and Chemicals	N/D	H	G	L	O	I	L	M	• No storage tank should be used for the storage of fuel, oil or chemicals unless its material and construction are compatible with the type of materials to be stored and storage conditions (e.g. pressure and temperature); • Drip trays should be installed underneath diesel generators and fuel storage tanks to intercept leakages; • Recordkeeping of all fuel, oil, chemicals, and diesel quantities used onsite; • Reduce the frequency of refueling activity by filling the tanks to the maximal capacity during each refueling operation; • Ensure that the maintenance schedule and checklist already prepared is being efficiently used; • Check tank levels prior to delivery to prevent overfilling through side glass or manually by dipstick logs; • Establish a Spill Response Plan in place; • Ensure a supply of suitable absorbent materials is available at re-fueling points for use in dealing with minor spills. If a leak or spill occurs during loading or offloading operations, the operations will be stopped and the spill will be contained, cleaned up and collected based on the Spill Response Plan; and • Ensure that personnel assigned to handle chemicals/oil/fuel are well aware of the requirements. They should be trained prior to commencing their duties.	Low	BWE and concerned Municipalities	Oil spill response: 80 USD Drip trays: 65 USD
	Potential contamination from wastewater overflows and/or leakages	N/D	H	L	M	O	R	H	H	• Ensure proper engineering design of the pumping stations (sizing of wet wells, pump-sets, and provision of a wastewater overflow emergency/bypass line); • Ensure prompt repair of pumping stations in case of failure to minimize the resulting impact on soil and water resources; • Proper operation and maintenance procedures for all operating components (networks and pumping stations); • Continuous monitoring of any signs of leakages or overflows; • Maintain continuous supply of power (for pumping stations) to prevent possible overflows and downtime; and • Ensure sewage network manholes are closed with proper lids to prevent blockages from fallen bulky objects.	Medium	BWE and concerned Municipalities	Part of operations activities cost
Waste Generation	Operation-and maintenance-related solid and liquid wastes generation	N/D	M	L	L	O	R	M	M	• Implement the measures suggested in section 5.6.3.1 during maintenance activities; • Collect the screenings generated from cleaning the wells of the pumping stations and dispose them in a designated dump in coordination and approval of MoE; and • Provide low toxic or environment-friendly (biodegradable) detergents for general cleaning purposes.	Medium	BWE and concerned Municipalities	Part of operations activities cost
Depletion of Resources													
Biological Resources	Normal operation	N/D	L	L	L	O	R	L	L	• Include native species in the landscape plan; • Management of landscaping plan to prevent growth of weeds and exotic species, allow propagation and survival of native species and replanting trees to replace the ones that are removed or die; • Proper management of liquid and solid waste generated by the project; • Prevention of littering in the area; • Control hunting within the project area.	Beneficial	BWE and concerned Municipalities	Part of operations activities cost

Source of Impact	Project Activities	Evaluation of Impact								Mitigation Measures	Residual Impacts	Institutional Responsibility	Cost Estimation
		N	M	E	T	D	R	L	S				
Energy Resources	Energy consumption during operation	N/D	L	L	L	O	R	H	M	• Adopt a periodic maintenance schedule of power generators, as per manufacturer specifications, and maintain maintenance logs; • Perform regular inspections and maintenance of pumping stations and generators; • Report and monitor monthly fuel and energy consumption records to keep track of consumption levels and identify overuse; • Upgrade machines/equipment and generators to more energy efficient technology when rehabilitation or upgrade is considered for the purpose of reducing consumption – consider the installation of solar PV panels for the operation of pumping stations; and • Switch off all machines/ equipment or any other energy consuming appliances when not in use.	Medium	BWE and concerned Municipalities	Part of operations activities cost
Other Impacts													
Traffic	Increase in traffic during maintenance works	N/D	L	L	S	O	R	L	L	• Avoid maintenance works during peak traffic hours; • Display temporary traffic signals and signs to warn of hazards and provide directions especially on narrow one-lane roads; and • Coordinate with municipal police in case of need for road closure and rerouting to be able to carry out specific maintenance activities, preferably ahead of time.	Low	BWE and concerned Municipalities	Part of operations activities cost
Socio-economic	Improvement of overall socioeconomic and environmental conditions of serviced communities and receiving environment from containment of wastewater	P/I	H	L	L	O	-	H	B	-	-	-	-
Health and Safety Hazards	Potential health and safety risks to operation and maintenance workers and nearby receptors, pedestrians, and commuters from maintenance works or from sudden overflows or leakages	N/D	M	L	S	O	R	L	L	• Provide workers with the appropriate PPE (goggles, dust masks, helmets, hearing protection equipment, proper clothing, safety boots, etc.) and enforce their use; • Post adequate signs at visible locations throughout the maintenance area indicating type of operation, potential risks, and appropriate medical/emergency action response; • Prohibit keeping trenches unnecessarily open and install barriers to avoid falling and tripping; • Fence all maintenance sites to prevent unauthorized access; • Store and handle chemicals (if any) as directed by their material safety data sheets and use the required PPEs; • Conduct regular training for workers about health and safety requirements; and • Implement the required ambient air emissions and noise mitigation measures above listed in sections 5.4.3 and 5.5.3 respectively.	Low	BWE and concerned Municipalities	PPEs Prices/ person: Overall ~12 USD Boots ~100 USD Helmet ~ 5 USD PVC Gloves ~2 USD Welding Gloves ~ 4USD Goggles ~ 3 USD Mask ~8 USD Reusable ear plugs ~1.5 USD Ear Muffs ~28 USD First Aid Kit (for 100 workers) ~200 USD
	Improved public health conditions from the proper management of wastewater	P/I	H	L	L	O	-	H	B	-	-	-	-

7.2 IMPLEMENTATION OF THE ESMP

Implementation of the ESMP requires a clear distribution of roles among concerned stakeholders, as well as an environmental monitoring plan to verify the effectiveness of mitigation measures, a capacity building plan and a well-defined auditing and reporting scheme.

7.2.1 Roles and Responsibilities

Roles and responsibilities of different institutions involved in the construction and operation of the project with respect to the implementation of the ESMP are summarized in Table 7-3.

Table 7-3 ESMP Implementation Plan

Institution/Body	Roles and Responsibilities
CDR	• Overall responsibility over the EMP Implementation during construction • As part of the project bi annual progress report; a section will be dedicated to report on the implementation of the ESMP.
MoE	• Reviews and approves CEMP prepared by contractor • Ultimately approve EMP implementation reports • Conduct site audits as needed to check implementation of ESMP during construction and operation phases of the project
MoEW/BWE	• Overall responsibility over the EMP Implementation during operation
Litani River Authority	• General oversight of implementation and operation of the project
World Bank	• Review and approval of ESMP implementation reports
Contractor	• Prepare a Construction Environmental Management Plan (CEMP) that details how the Contractor shall implement the provisions of the CEMP • Provide a field HSE officer to ensure implementation of the CEMP • Immediately report to the site HSE Officer in case of accidents, spills or other events which have health, safety or environmental implications (and to MoE and/ or MoPH as applicable) in case of serious accidents, spills or other events). • In case of incidents, the contractor should fill an incident records form, including how the incident is planned to be addressed.
Supervision consultant(s)	• Review CEMP prepared by Contractor; • Review and approve Contractor's ESMP implementation reports; • Supervise the Contractor's implementation of CEMP; • Prepare a checklist to be used to supervise Contractor's works; • Coordinate with CDR to ensure appropriate reporting of ESMP implementation; • Identify training needs of concerned parties to ensure ESMP and monitoring plan requirements are well-understood and can be implemented.
Municipalities	• Follow up on the ESMP implementation during construction and operation phases

7.2.2 Capacity Building Needs

7.2.2.1 Training Needs during Site Preparation Phase

In order to ensure a proper and effective implementation of the ESMP, it is particularly important to undertake a training program for the contractors that will be in charge of the works regarding its preparation and implementation. Training sessions for the contractors should be conducted prior to the commencement of the construction works and should focus on the following topics:

- General environmental and health awareness for all employees;
- ESMP study key findings and recommendations;
- Implementation of the proposed ESMP;
- Air pollution control;
- Control of leakages;
- Wastewater management;
- Water consumption;
- Solid waste management;
- Hazardous waste management;
- Oil spill management plan;
- Occupational health and safety issues; and
- Emergency plan.

7.2.2.2 Training Needs during Operation Phase

It is recommended to train the maintenance workers on the following:

- Training to ensure that the ESMP is well-understood;
- Efficient energy, impacts from generators and water use;
- Occupational health and safety;
- Noise and air pollution;
- Pumping stations and wastewater networks inspection and maintenance; and
- Emergency plan.

7.2.3 Record Keeping and Reporting

All data collected as part of the ESMP should be well recorded and documented as part of the Environmental Monitoring Report (EMP) submitted to the MoE on an annual basis. Within the EMP report, all data should be presented and analyzed to eventually evaluate the performance of the pumping stations and networks and the effectiveness of the mitigation measures put in place. The EMP report gives all concerned parties a clear picture of the projects' activities and its environmental performance.

7.3 ENVIRONMENTAL MONITORING PLAN

Compliance monitoring should be conducted to ensure the environmental soundness of the project. It should be the responsibility of the designated site HSE Officer during the Construction phase, and the BWE and Municipalities during the operation phase. The proposed monitoring plan for the project is summarized in Table 7-4.

Table 7-4 Environmental Monitoring Plan during Project Construction and Operation

Phase	Impact	Parameters to Monitor	Frequency	Monitoring Location	Number of Samples/Monitoring Points	Standards/Guidelines National/International	Institutional Responsibility	MoE Ref.
Construction	**Emissions**							
	Air Pollutants	• Recorded respiratory health problems among workers • Color of fumes from equipment and construction generators • Emissions of Generators' and construction equipment	• Workers' respiratory problems: monthly • Color of fumes from equipment and generators: weekly • Generators' and equipment's emissions: before starting construction works and monthly afterward	• Workers' respiratory problems: workers' health records • Color of fumes from equipment and generators: stacks • Generators' and equipment's emissions: stacks	• • Generators and equipment stacks for color of fumes • Emissions at generators and equipment stacks for air emissions, and ambient air quality at nearest receptors	• MoE Decision 8/1, dated 2001 (National Standards for Environmental Quality (NSEQ)- Appendix 2-9 for stack emissions • MoE Decision 52/1 – Section 14 for ambient air quality (at receptors)	Site HSE officer	Construction Manager/ Contractors
	Noise	L_{eq}, L_{max}, L_{min}, L_{90} dB(A)	• Three times daily during grading and excavation • Once daily during concrete pouring and pipes laying	Near sensitive receptors	Depending on number of receptors	MoE Decision No. 52/1 (Section 10 (Noise Standards)	Site HSE officer	Construction Manager/ Contractors
	Wastewater Generation	Leakages	Weekly	Networks and septic tanks (labor camp)	Visual inspection	Decree No. 2761of 1933 (Provides guidelines related to wastewater management and disposal; related to the pollution caused by the discharge of liquid waste, emphasizes the prohibition of direct or indirect wastewater discharges and waste disposal into water streams)	Site HSE officer	Construction Manager/ Contractors
	Solid Waste Generation	• Waste types • Waste generation rates (kg or tons/day) • Waste reused • Waste transported for offsite reuse/recycling • Waste disposed of • Method and location of disposal	Daily	Construction site (waste storage)	Daily records	Law No. 973 dated 1974 (Related to solid waste pollution; followed by the application of Decree No. 8735)	Site HSE officer	Construction Manager/ Contractors
	Depletion of Resources							
	Energy Resources	Fuel bills and fuel quantities consumption follow up	• Daily records • Monthly report	Construction site	Fuel and electricity bills	-	Contractor	Construction Manager/ Contractors
	Water Resources	Water consumption (m^3/day) (install water meters to calculate volume consumed per week if applicable)	• Daily records • Monthly report	Construction site	Water bills	-	Contractor	Construction Manager/ Contractors
	Other Impacts							
	Socio-economic	Number/ percentage of local workers	Before and during commencement of construction works (monthly)	-	Employee records	-	Contractor	Contractors
	Health and Safety Hazards	• Proper PPE use • Good housekeeping practices • Number, type and cause of accidents and injuries	Continuous	Construction site	Accidents records	National Decree No. 11802 dated 2004 (Organizing prevention, public safety and occupational health in all institutions, as per the Labor Law)	Site HSE Officer	Contractors

Phase	Impact	Parameters to Monitor	Frequency	Monitoring Location	Number of Samples/Monitoring Points	Standards/Guidelines National/International	Institutional Responsibility	MoE Ref.
	Archaeology	Monuments found during the works	Daily	Construction site	Visual inspection	National Decree No. 3057 dated 2016 which defines and regulates the procedures followed by the DGA for preventive and rescue excavations.	Workers, Site HSE Officer, and Contractor	Contractors
Operation	**Emissions**							
	Air Emissions (Generators' stack emissions)	Stack height, SO_2 , NO_2, CO, PM_{10}	Bi-annually	Generators' stacks	Six (1 sample at each stack)	MoE Decision 8/1, dated 2001 – Appendix 2-9 (National Standards for Environmental Quality (NSEQ))	Operator	Operator
	Noise	L_{eq}, L_{max}, L_{min}, L_{90} dB(A)	Bi-annually	1 m next to generators	1 sample next to each generator and near sensitive receptors	MoE Decision No. 52/1 (Section 10 (Noise Standards)	Operator	Operator
	Wastewater Generation	Leakages and overflow	Weekly	Networks and pumping stations	Visual inspection	Decree No. 2761of 1933 (Provides guidelines related to wastewater management and disposal; related to the pollution caused by the discharge of liquid waste, emphasizes the prohibition of direct or indirect wastewater discharges and waste disposal into water streams)	Operator	Operator
	Solid Waste Generation	• Waste types, sorted, reused and their quantities • Waste generation rates (kg or tons/day) • Waste transported for offsite reuse/recycling • Waste disposed of • Method of disposal	During maintenance activities	Maintenance locations	Records of waste generation and management	Law No. 973 dated 1974 (Related to solid waste pollution; followed by the application of Decree No. 8735) MoE Memo 8/1 (2015) on ISWM.	Operator	Operator
	Accidental Releases from fuel tanks	Visual inspection of spills and leaks	When refueling	Fuel tanks	Records of refueling and spills	Law No. 64/1988 (Environmental protection against hazardous waste that could harm air, water, biodiversity, soil, and people; states fines for activities that result in pollution and hazards to the environment and public health)	Operator	Operator
	Depletion of Resources							
	Energy Resources	Fuel and electricity bills and fuel quantities consumption follow up	Monthly	Pumping Stations	Monthly records	-	Operator	Operator
	Water Resources	Water consumption (m^3/month) (install water Meters) Inspection and maintenance of water fixtures	Monthly (consumption) Weekly (fixtures inspection)	Pumping Stations	Monthly records	-	Operator	Operator
	Other Impacts							
	Public health and safety	Number and cause of accidents during maintenance works	During maintenance activities	Maintenance locations	Accidents records	National Decree No. 11802 dated 2004 (Organizing prevention, public safety and occupational health in all institutions, as per the Labor Law)	Operator	Operator

8. REFERENCES

CDR. (2014). Greater Beirut Water Supply Augmentation Project Environmental and Social Impact Assessment, Resettlement Action Plan.

ELARD. (2015). Environmental and Social Safeguard Studies for Lake Qaraoun Pollution Prevention Project-Expansion of Zahle Sewage Networks. Initial Environmental Examination & Environmental Management Plan.

ELARD. (2014). Environmental and Social Safeguard Studies for Lake Qaraoun Pollution Prevention Project. Activity I-Environmental and Social Management Framework.

Francis Hours, Olivier Aurenche, Jacques Cauvin et al. (1994). Atlas des sites du Proche-Orient (14000-5700 BP). Lyon : Maison de l'Orient et de la Méditerranée Jean Pouilloux, 1994. pp. 1-522. (Travaux de la Maison de l'Orient méditerranéen, 24).

Lorraine Copeland and Peter J. Wescombe. (1965). Inventory of Stone Age sites in Lebanon I, MélUSJ 41, 1965. Pp. 30-175.

Lorraine Copeland and Peter J. Wescombe. (1966). Inventory of Stone Age sites in Lebanon II, MélUSJ 42, 1966. Pp.30-175.

Lorraine Copeland and Corine Yazbeck. Inventory of Stone Age sites in Lebanon III, MélUSJ 55, 1997-1998. Pp. 121-325.

Morshed Dandache. (1999). Byzantine church unearthed, The Daily Star, Apr. 15, 1999.

Daniel Del Castillo. (2000). Buried treasure and the perils of renovation, The Daily Star, Apr. 9, 2000.

IPT Energy Center. (2016). Road Transport Sector and Air Pollution: Case of Lebanon 2016. [online] Available at: http://www.iptgroup.com.lb/Library/Assets/Road%20Transport%20Sector%20and%20Air%20Pollution-%20Case%20of%20Lebanon%202016-011954.pdf [Accessed 19 Dec. 2017].

MoE and UNDP. (2014). State of Lebanon's Birds and IBA's.

Law No. 58. (1991). Lebanese Expropriation Law dated 29/05/1991, amended on 8/12/2006.

World Bank Operational Policy 4.01, Environmental Assessment, dated January 1999.

9. APPENDICES

APPENDIX A-MASTER PLAN

LEGEND

- EXISTING SEWER LINE
- PROPOSED GRAVITY SEWER LINE
- PROPOSED SEWER FORCE MAIN
- ELIMINATED SEWER LINE
- EXISTING WASTEWATER TREATMENT PLANT
- EXISTING SEWAGE PUMPING STATION
- PROPOSED SEWAGE PUMPING STATION

N

Rev.	Date	Dsgn	Drwn	Chk'd	Appr'd

REPUBLIC OF LEBANON

MINISTRY OF ENERGY AND WATER

COUNCIL FOR DEVELOPMENT AND RECONSTRUCTION

BUREAU TECHNIQUE POUR LE DEVELOPPEMENT

JALL ED DIB – HAJAL Bldg
P.O.BOX:70492 – ANTELIAS

TEL:(04) 712157 / 712158
FAX: (04) 712159

CONSTRUCTION OF ADDITIONAL SEWER LINES AND SEWAGE PUMPING STATIONS IN BAALOUL AND EL QARAAOUN - WEST BEQAA CAZA

ALL VILLAGES

GENERAL PLAN

FILE	DESIGNED BY	DRAWN BY	CHECKED BY
462-06GP-01	R. YAACOUB	R. YAACOUB	R. YAACOUB

DATE	SCALE	SHEET No.	DRAWING No.
APRIL 2017	1:20000	1/1	462-06GP-01

ORIGINAL DRAWING SIZE A1

APPENDIX B-BAALOUL PLOTS

الجمهورية اللبنانية
المديرية العامة للشؤون العقارية

افادة عقارية

IZOGHBI

امانة السجل العقاري في زحلة

رقم الطلب : ١٨٠٦

بناء على الطلب المقدم من : طارق الرفاعي بتاريخ ١٥-١١-٢٠١٦

و لدى مراجعة قيود السجل العقاري اعطيت هذه الإفادة الشاملة

العقار : ٢٥٨٧ المنطقة العقارية : بعلول المحلة : خلة الشيخ

النوع الشرعي للعقار: اميري مساحة العقار/القسم (م٢) : ٣١٥

المرجع في السجل اليومي		محتويات و وصف العقار و الحقوق العينية و الوقوعات
الرقم	التاريخ	
		وصف العقار : ارض بعل صخرية غير مستعملة.
١٤١	١٩٦٢-٠٣-٠١	دعوى-حكم-قرار : تدعي بلدية بعلول ان هذا العقار وسواه متروك مرفق ويعود حق استعمالها واستثمارها والانتفاع بها لمصلحتها ولمصلحة اهالي بعلول بملف ٢٦

المرجع في السجل اليومي		الملكية - التصرف		الحصة
الرقم	التاريخ	نوع الحق خلاصة العقود	اسماء المالكين	سهم
		اساس الملكية (ملكية، تصرف، قرار قاضي) : بموجب قرار القاضي الصادر بتاريخ ٢٦ / ٧ / ١٩٦١.	الجمهورية اللبنانية (اميري)	٢٤٠٠

NOV 2016

استوفي الرسم بموجب لصق تمغة على الطلب

هذا ما تم تسجيله على الصحيفة العقارية حتى تاريخه أعلاه

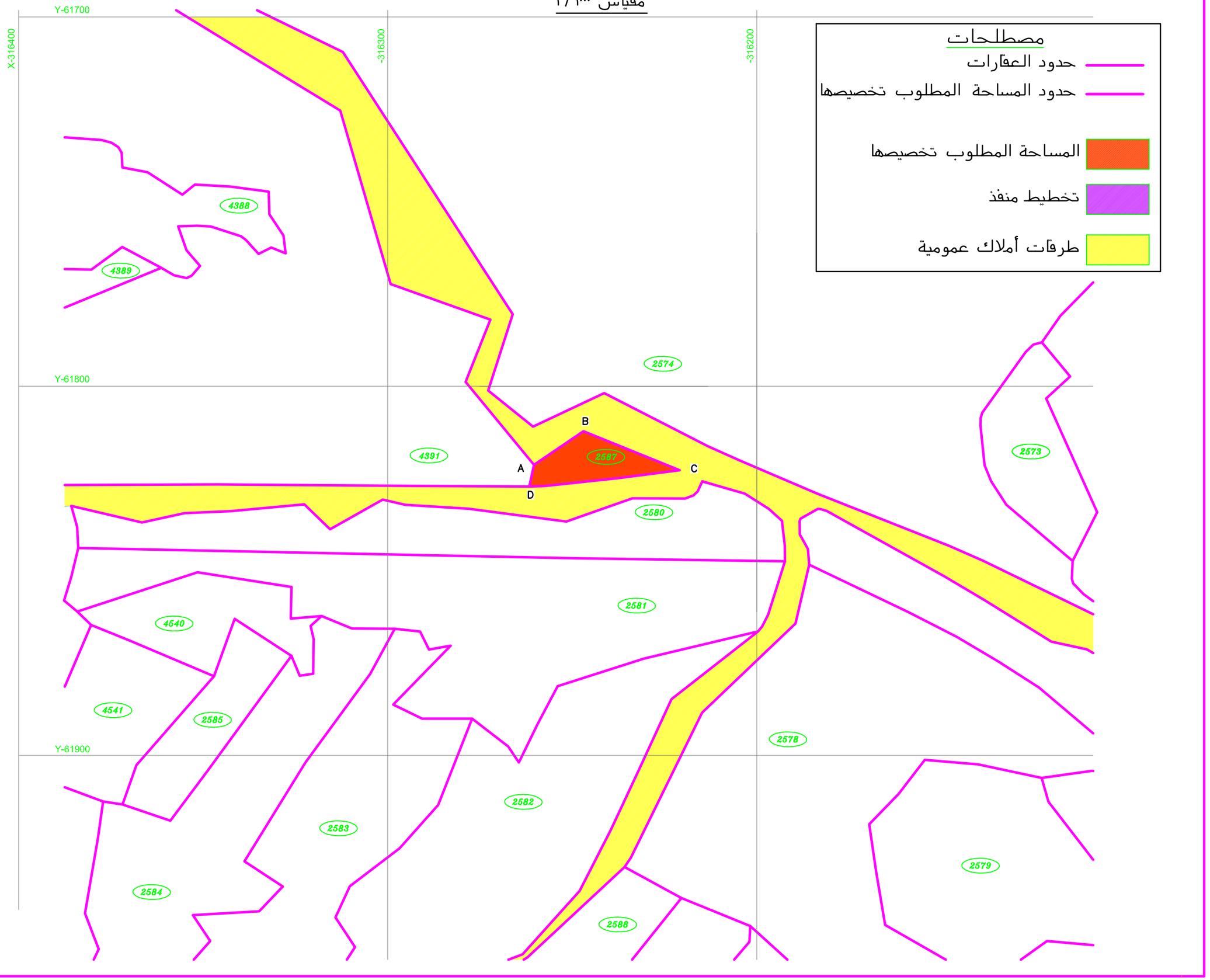
زحلة في ١٥-١١-٢٠١٦

امين السجل العقاري

١٥-١١-٢٠١٦ ٠٩:١٦:٠٩

الموقع المقترح لمحطة ضخ مياه الصرف الصحي في بعلول P.S. 1

مقياس ١/١٠٠٠



الجمهورية اللبنانية
المديرية العامة للشؤون العقارية

افادة عقارية

IZOGHBI

امانة السجل العقاري في زحلة

رقم الطلب : ١٥٢٥

بناء على الطلب المقدم من : قاسم دله

بتاريخ ٠١-١١-٢٠١٦

و لدى مراجعة قيود السجل العقاري اعطيت هذه الإفادة الشاملة

العقار : ٢٢٨٣ المنطقة العقارية : بعلول

المحلة : وادي الحجلية

النوع الشرعي للعقار: اميري

مساحة العقار/القسم (م٢) : ١٢٧٠

محتويات و وصف العقار و الحقوق العينية و الوقوعات

المرجع في السجل اليومي	
الرقم	التاريخ
	وصف العقار : ارض بعل صخرية غير مستعملة.
١٤١	٠١-٠٣-١٩٦٢ دعوى-حكم-قرار : تدعي بلدية بعلول ان هذا العقار وسواه متروك مرفق ويعود حق استعمالها واستثمارها والانتفاع بها لمصلحتها ولمصلحة اهالي بعلول بملف ٢٦

الملكية - التصرف

المرجع في السجل اليومي			الحصة
الرقم	التاريخ	نوع الحق خلاصة العقود	اسماء المالكين	سهم
		اساس الملكية (ملكية، تصرف، قرار قاضي) : بموجب قرار القاضي الصادر بتاريخ ٢٦ - ٧ - ١٩٦١.	الجمهورية اللبنانية (اميري)	٢٤٠٠

استوفي الرسم بموجب لصق تمغة على الطلب

زحلة في ٠١-١١-٢٠١٦

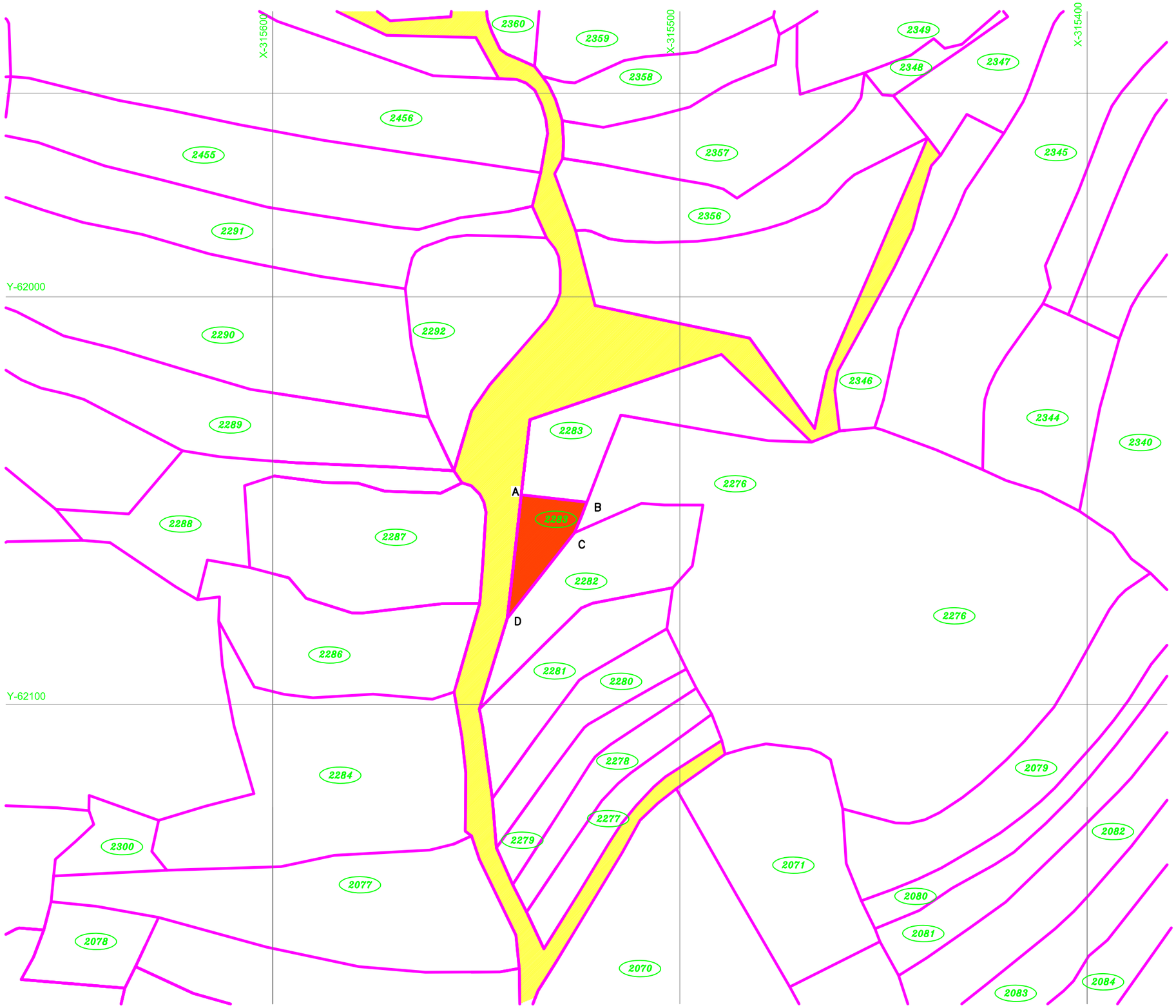
هذا ما تم تسجيله على الصحيفة العقارية حتى تاريخه أعلاه

امين السجل العقاري

٠١-١١-٢٠١٦ ٠٩:٥٥:٥٦

الموقع المقترح لمحطة ضخ مياه الصرف الصحي في بعلول P.S. 2

مقياس ١/١٠٠٠



APPENDIX C-QARAOUN PLOTS

الجمهورية اللبنانية
المديرية العامة للشؤون العقارية

افادة عقارية

SGEADOUN

امانة السجل العقاري في زحلة

رقم الطلب : ٢٥٠٩

بناء على الطلب المقدم من : قاسم دله

بتاريخ ٢٠١٦-١١-٠١

و لدى مراجعة قيود السجل العقاري اعطيت هذه الإفادة الشاملة

العقار : ٧٣٦٥ المنطقة العقارية : القرعون المحلة : قلاع لودي

النوع الشرعي للعقار: اميري مساحة العقار/القسم (م٢) : ١١١٢

المرجع في السجل اليومي		محتويات و وصف العقار و الحقوق العينية و الوقوعات
الرقم	التاريخ	
		وصف العقار : ارض سليخ بعل تزرع حبوب دونت المساحة بتاريخ ١٦ نيسان ٢٠٠٢. نوع العقار : أرض غير مبنية.

المرجع في السجل اليومي		الملكية - التصرف		الحصة
الرقم	التاريخ	نوع الحق خلاصة العقود	اسماء المالكين	سهم
٤٣٧	١٩٧٣-٠٧-٠٤	اخرى (تصحيح، حق مختلف) ووضع يد : تسجيل: بالمرسوم ٤٤٣٥ تاريخ ٣٠ / ١١ / ٩٧٢ وقرار وضع اليد رقم ٢٣ / ١ تاريخ ٢٢ / ٥ / ٩٧٣ بملف ١٨١٥.	الدولة اللبنانية - المصلحة الوطنية لنهر الليطاني (اميري)	٢٤٠٠

٢٠١٦

استوفي الرسم بموجب لصق تمغة على الطلب

زحلة في ٢٠١٦-١١-٠١

هذا ما تم تسجيله على الصحيفة العقارية حتى تاريخه أعلاه

امين السجل العقاري

٢٠١٦-١١-٠١ ٠٩:٥٨:٠١

الجمهورية اللبنانية
المديرية العامة للشؤون العقارية

افادة عقارية

SGEADOUN

امانة السجل العقاري في زحلة

رقم الطلب : ٢٧٧٤

بناء على الطلب المقدم من : طارق الرفاعي

بتاريخ ١٤-١١-٢٠١٦

و لدى مراجعة قيود السجل العقاري اعطيت هذه الإفادة الشاملة

العقار : ٧٣٦٦ المنطقة العقارية : القرعون المحلة : قلاع لودي

النوع الشرعي للعقار: اميري مساحة العقار/القسم (م٢) : ١٤٦٥

المرجع في السجل اليومي		محتويات و وصف العقار و الحقوق العينية و الوقوعات
الرقم	التاريخ	
		وصف العقار : ارض سليخ بعل تزرع حبوب دونت المساحة بتاريخ ١٦ نيسان ٢٠٠٢. نوع العقار : أرض غير مبنية.

المرجع في السجل اليومي		الملكية - التصرف		الحصة
الرقم	التاريخ	نوع الحق خلاصة العقود	اسماء المالكين	سهم
٤٣٧	١٩٧٣-٠٧-٠٤	اخرى (تصحيح، حق مختلف) ووضع يد : تسجيل: بالمرسوم ٤٤٣٥ تاريخ ٣٠ / ١١ / ٩٧٢ وقرار وضع اليد رقم ٢٣ / ١ تاريخ ٢٢ / ٥ / ٩٧٣ بملف ١٨١٥.	الدولة اللبنانية - المصلحة الوطنية لنهر الليطاني (اميري)	٢٤٠٠

استوفي الرسم بموجب لصق تمغة على الطلب

زحلة في ١٤-١١-٢٠١٦

هذا ما تم تسجيله على الصحيفة العقارية حتى تاريخه أعلاه

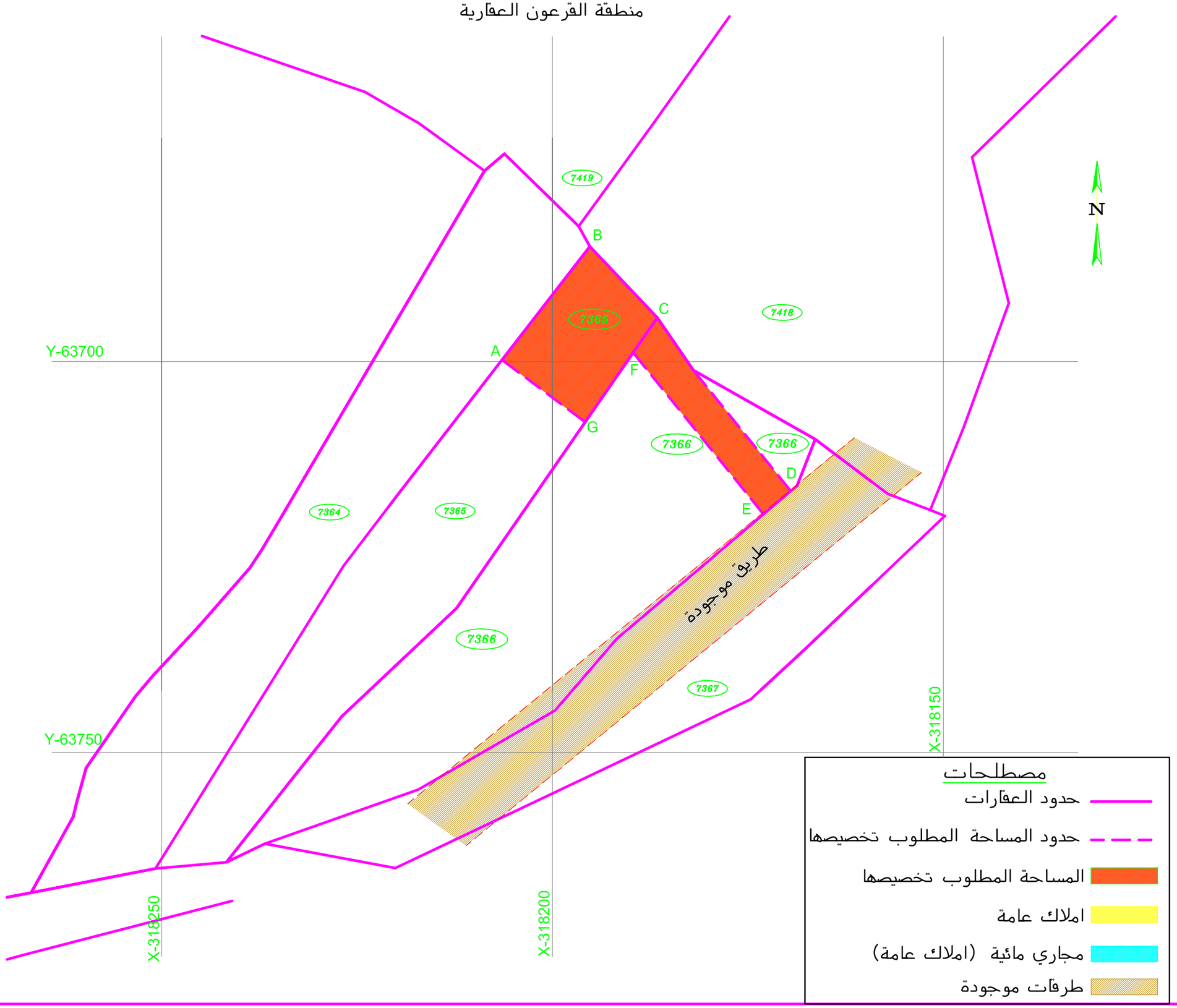
امين السجل العقاري

١٤-١١-٢٠١٦ ٠٩:٠٦:٢١

الموقع المقترح لمحطة ضخ مياه الصرف الصحي في القرعون P.S. 1

مقياس ١/٥٠٠

منطقة القرعون العقارية



مصطلحات

- حدود العقارات
- حدود المساحة المطلوب تخصيصها
- المساحة المطلوب تخصيصها
- املاك عامة
- مجاري مائية (املاك عامة)
- طرقات موجودة

الجمهورية اللبنانية

المديرية العامة للشؤون العقارية

افادة عقارية

SGEADOUN

امانة السجل العقاري في زحلة

رقم الطلب : ٢٥٠٩

بناء على الطلب المقدم من : قاسم دله

بتاريخ ٠١-١١-٢٠١٦

و لدى مراجعة قيود السجل العقاري اعطيت هذه الإفادة الشاملة

العقار : ٢٩٦٦ المنطقة العقارية : القرعون

المحلة : الحصيان

النوع الشرعي للعقار: اميري

مساحة العقار/القسم (م٢) : ٥٤٩٥

المرجع في السجل اليومي		محتويات و وصف العقار و الحقوق العينية و الوقوعات
الرقم	التاريخ	
		وصف العقار : ارض بعل سليخ تزرع حبوب دونت المساحة بتاريخ ٢٦ آذار ٢٠٠٢. نوع العقار : أرض غير مبنية.
		دفعت رسوم الانتقال عن حصة امينة احمد جمعه كرام الدين بالايصال ٢٥١ / ٢٥٣ في ١١ / ١ / ٩٦٦ بملفه

المرجع في السجل اليومي		الملكية - التصرف		الحصة
الرقم	التاريخ	نوع الحق خلاصة العقود	اسماء المالكين	سهم
٥٢٠	٢٠-٠٥-١٩٦٦	استملاك ووضع يد : استملاك بالمرسوم ١٦١٢٩ وقرار وضع اليد رقم ١ / ١١٧ تاريخ ١٣ / ٤ / ٩٦٦ بملف ٢٩٥٧.	الدولة اللبنانية - المصلحة الوطنية لنهر الليطاني (اميري)	٢٤٠٠

استوفي الرسم بموجب لصق تمغة على الطلب

زحلة في ٠١-١١-٢٠١٦

هذا ما تم تسجيله على الصحيفة العقارية حتى تاريخه أعلاه

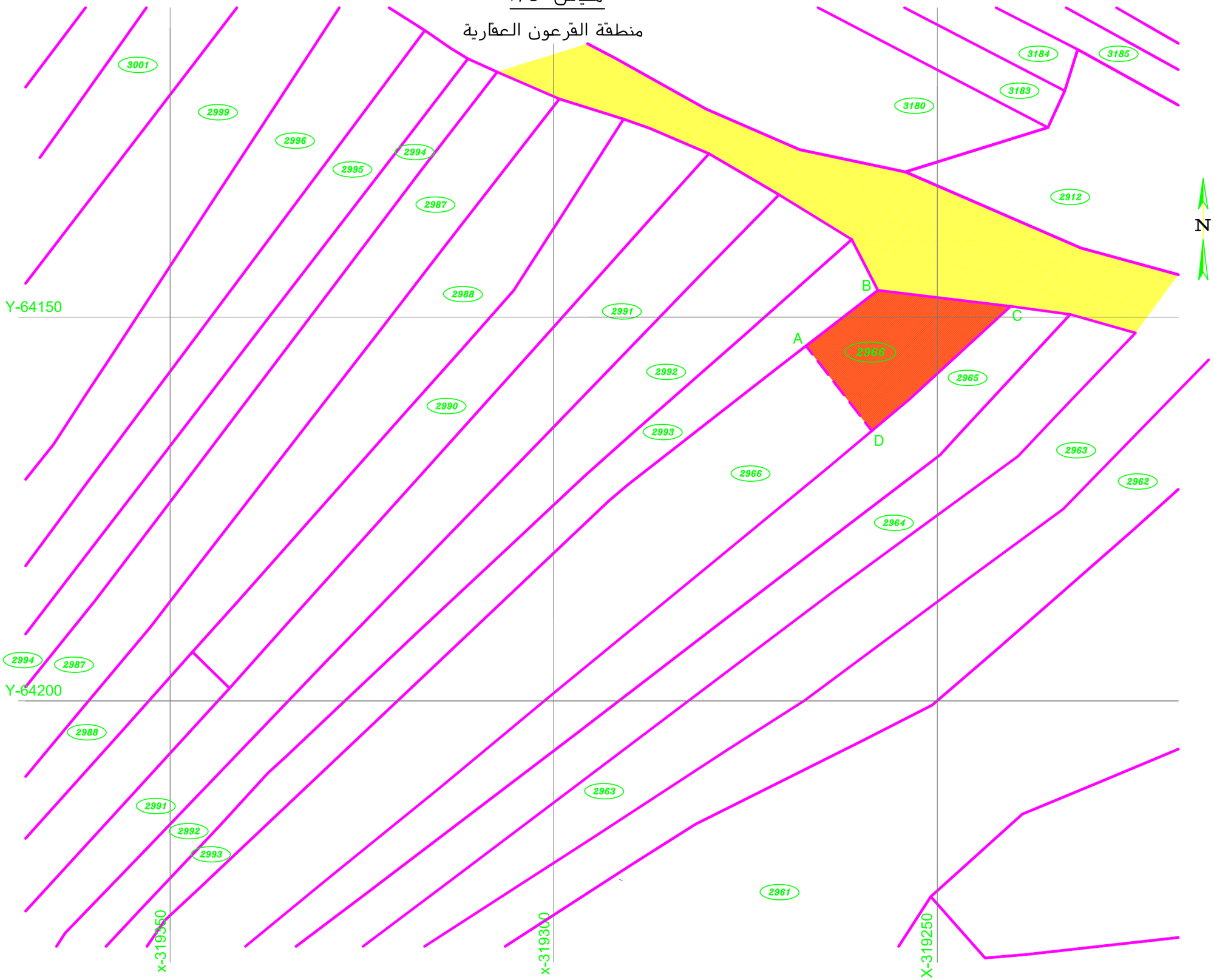
امين السجل العقاري

٠١-١١-٢٠١٦ ٠٩:٥٧:٥٤

الموقع المقترح لمحطة ضخ مياه الصرف الصحي في القرعون P.S. 2

مقياس ١/٥٠٠

منطقة القرعون العقارية



الجمهورية اللبنانية
المديرية العامة للشؤون العقارية

افادة عقارية

SGEADOUN

امانة السجل العقاري في زحلة

رقم الطلب : ٢٥٠٩

بناء على الطلب المقدم من : قاسم دله

بتاريخ ٠١-١١-٢٠١٦

و لدى مراجعة قيود السجل العقاري اعطيت هذه الإفادة **الشاملة**

العقار : ٣٦٢٧ المنطقة العقارية : **القرعون** المحلة : **البياض**

النوع الشرعي للعقار: اميري مساحة العقار/القسم (م٢) : ٧١٢

المرجع في السجل اليومي		محتويات و وصف العقار و الحقوق العينية و الوقوعات
الرقم	التاريخ	
		وصف العقار : ارض بعل سليخ تزرع حبوب دونت المساحة بتاريخ ٦ - نيسان ٢٠٠٢. نوع العقار : أرض غير مبنية.

المرجع في السجل اليومي		الملكية - التصرف		الحصة
الرقم	التاريخ	نوع الحق خلاصة العقود	اسماء المالكين	سهم
٥١٤	١٨-٠٥-١٩٦٦	استملاك ووضع يد : استملاك بالمرسوم ١٦١٢٩ وقرار وضع اليد رقم ١٠٩ / ١ تاريخ ٢٩ / ٣ / ٩٦٦ بملف ٣٥٩٥.	الدولة اللبنانية - المصلحة الوطنية لنهر الليطاني (اميري)	٢٤٠٠

استوفي الرسم بموجب لصق تمغة على الطلب

زحلة في ٠١-١١-٢٠١٦

هذا ما تم تسجيله على الصحيفة العقارية حتى تاريخه أعلاه

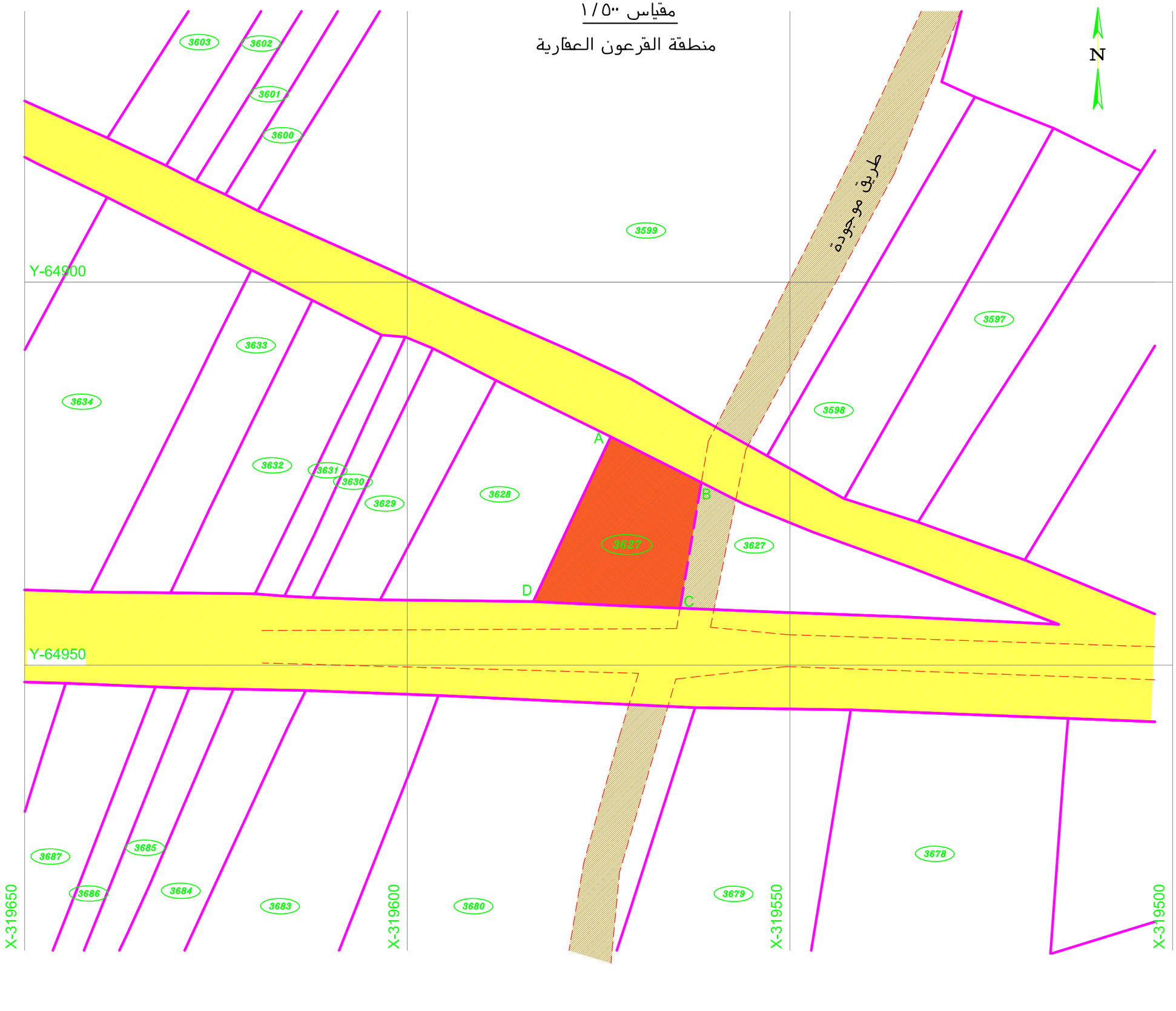
امين السجل العقاري

٠١-١١-٢٠١٦ ٠٩:٥٧:٥٦

الموقع المقترح لمحطة ضخ مياه الصرف الصحي في القرعون P.S. 3

مقياس ١/٥٠٠

منطقة القرعون العقارية



الجمهورية اللبنانية

المديرية العامة للشؤون العقارية

افادة عقارية

SGEADOUN

امانة السجل العقاري في زحلة

رقم الطلب : ٢٥٠٩

بناء على الطلب المقدم من : قاسم دله

بتاريخ ٠١-١١-٢٠١٦

و لدى مراجعة قيود السجل العقاري اعطيت هذه الإفادة **الشاملة**

العقار : **٤٢٤٣** المنطقة العقارية : **القرعون** المحلة : **الزراقيه**

النوع الشرعي للعقار: اميري مساحة العقار/القسم (م٢) : **٣٠٤٠**

المرجع في السجل اليومي		محتويات و وصف العقار و الحقوق العينية و الوقوعات
الرقم	التاريخ	
		وصف العقار : ارض بعل سليخ تزرع حبوب دونت المساحة بتاريخ ٩ - نيسان ٢٠٠٢. نوع العقار : أرض غير مبنية.
٧٧	١٨-٠٢-١٩٦٩	دفعت رسوم الانتقال بالعقد بملف ٤١٤

المرجع في السجل اليومي		الملكية - التصرف		الحصة
الرقم	التاريخ	نوع الحق خلاصة العقود	اسماء المالكين	سهم
٦٢٣	١٨-٠٦-١٩٦٦	استملاك ووضع يد : استملاك بالمرسوم ١٦١٢٩ وقرار وضع اليد رقم ١٤٣ / ١ تاريخ ١٥ / ٥ / ٩٦٦ بملف ٦٤٣.	الدولة اللبنانية - المصلحة الوطنية لنهر الليطاني (اميري)	٢٤٠٠

استوفي الرسم بموجب لصق تمغة على الطلب

زحلة في ٠١-١١-٢٠١٦

هذا ما تم تسجيله على الصحيفة العقارية حتى تاريخه أعلاه

امين السجل العقاري

٠١-١١-٢٠١٦ ٠٩:٥٧:٥٨

الجمهورية اللبنانية
المديرية العامة للشؤون العقارية

افادة عقارية

SGEADOUN

امانة السجل العقاري في زحلة

رقم الطلب : ٢٥٠٩

بناء على الطلب المقدم من : قاسم دله

بتاريخ ٢٠١٦-١١-٠١

و لدى مراجعة قيود السجل العقاري اعطيت هذه الإفادة الشاملة

العقار : ٦٤٣ المنطقة العقارية : القرعون المحلة : الزراقية

النوع الشرعي للعقار: اميري مساحة العقار/القسم (م٢) : ١١٣٤

المرجع في السجل اليومي		محتويات و وصف العقار و الحقوق العينية و الوقوعات
الرقم	التاريخ	
		وصف العقار : ارض بعل قسم مغروس كرم عنب وقسم سليخ ضمنه ثلاث شجرات لوز دونت المساحة بتاريخ ٢٢ / ٣ / ٢٠٠٢. نوع العقار : أرض غير مبنية.

المرجع في السجل اليومي		الملكية - التصرف		الحصة
الرقم	التاريخ	نوع الحق خلاصة العقود	اسماء المالكين	سهم
٦٢٣	١٨-٠٦-١٩٦٦	استملاك ووضع يد : استملاك بالمرسوم ١٦١٢٩ وقرار وضع اليد رقم ١٤٣ / ١ تاريخ ١٧ / ٥ / ٩٦٦ بملفه.	الدولة اللبنانية - المصلحة الوطنية لنهر الليطاني (اميري)	٢٤٠٠

٢٠١٦

استوفي الرسم بموجب لصق تمغة على الطلب

زحلة في ٢٠١٦-١١-٠١

هذا ما تم تسجيله على الصحيفة العقارية حتى تاريخه أعلاه

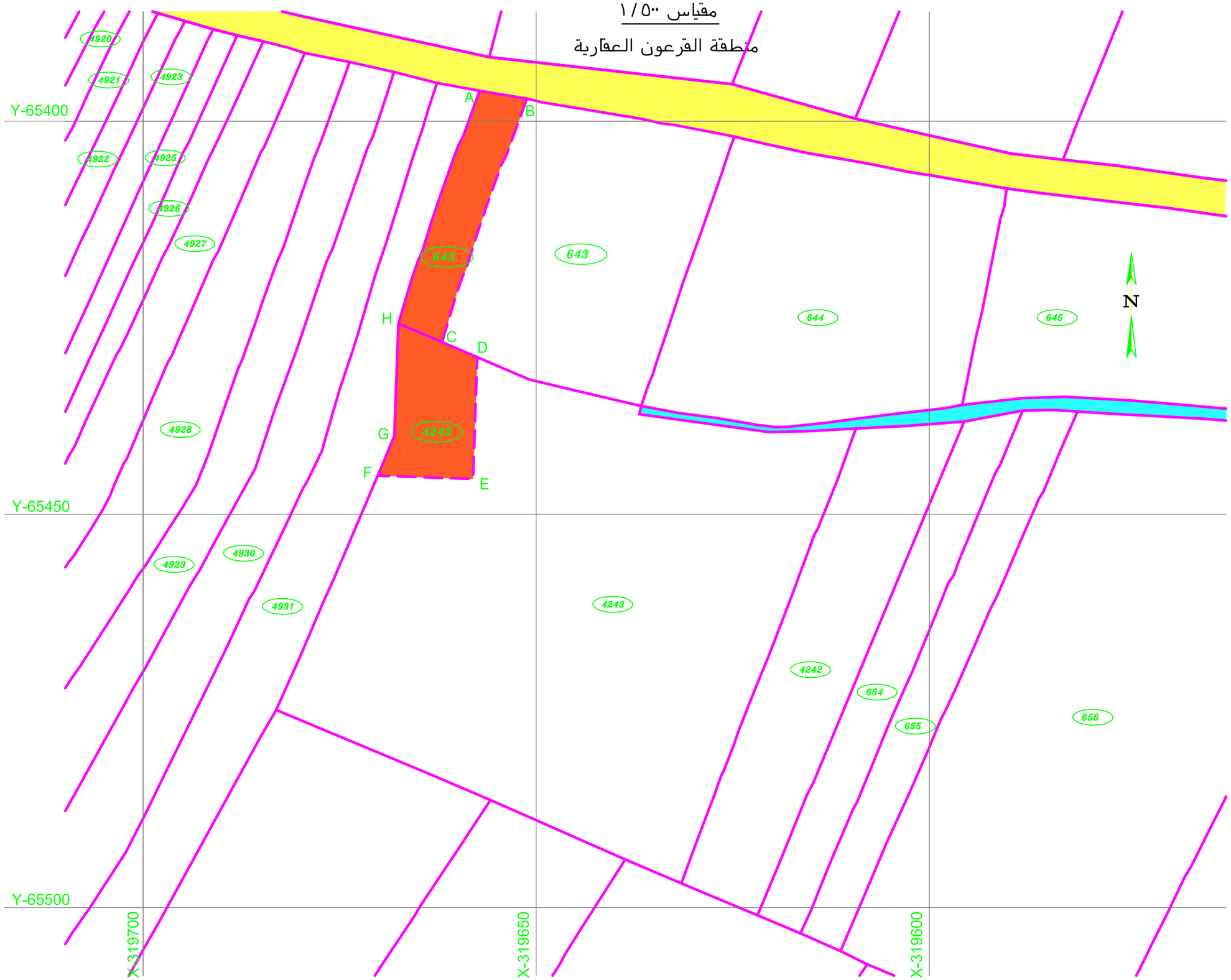
امين السجل العقاري

٢٠١٦-١١-٠١ ٠٩:٥٧:٥١

الموقع المقترح لمحطة ضخ مياه الصرف الصحي في القرعون P.S. 4

مقياس ١/٥٠٠

منطقة القرعون العقارية



APPENDIX D-RELEVANT NATIONAL ENVIRONMENTAL STANDARDS

Ambient Air Quality and Stack Emissions

The maximum allowable limits of atmospheric ambient air pollutants (Decision 52/1) are shown in Table D 1.

Table D 1 Maximum Allowable Limits for Ambient Air Pollutants (MoE Decision 52/1)

Pollutant	Maximum Allowable Concentration (in µg/m³)	Averaging Period
Sulfur Dioxide (SO_2)	350	1 hour
	120	24 hours
	80	1 year
Nitrogen Dioxide (NO_2)	200	1 hour
	150	24 hours
	100	1 year
Ozone (O_3)	150	1 hour
	100	8 hours
Carbon Monoxide (CO)	30,000	1 hour
	10,000	8 hours
Total Suspended Particulate (TSP)	120	24 hours
Particulate Matter (PM-10)	80	24 hours
Lead	1.0	1 year
Benzene	5 ppb	1 year

In addition to the above-mentioned, Decision 8/1 gives specific regulations for stack emissions. The Environmental Limit Values (ELV) for power generators operated with fuel having a thermal capacity greater than 0.5 MW are presented in Table D 2.

Table D 2 Maximum Limits for Power Generation Emissions (MoE Decision 8/1)

Parameter	ELV for New Facilities	ELV for Existing Facilities	Remark
O_2 correction	5%	5%	
Dust (mg/m³)	20 150 250	20 150 250	Using soot filter Diesel fuel Other fuel
CO (mg/m³)	800	1,500	
NO_x (calculated to NO_2) (mg/m³) <3MW/ > 3MW thermal capacity	4,000 / 2,000	6,000	

Parameter	ELV for New Facilities	ELV for Existing Facilities	Remark
SO_x (calculated to SO_2) (mg/m^3) If diesel fuel (European standard) If other type of fuel	- To be determined in later stages	- To be determined in later stages	

According to the Decision 8/1, a minimum stack height has to be kept for the release of exhaust gases in order to ensure the dispersion of pollutants. This method can be used instead of applying the ELVs for generators. This means that an operator of a plant can choose whether he meets the ELVs on one hand or installs a capacity correlated stack height on the other hand to fulfill the demands related to the necessary dilution of the emissions.

The formula required is:

$$H = h + 0.2\sqrt{kVA}$$

Where

H = Total stack height in meters

h = Height of neighboring building in meters

kVA = Total generator capacity of the set in kVA = kW, i.e. the total capacity which is determined by the maximum fuel (energy) input

Noise

The National Maximum allowable noise level and the permissible occupational Noise Exposure standards according to Decision 52/1 are presented in Table D 3 and Table D 4, respectively.

Table D 3 Permissible Ambient Noise Levels in Selected Regions

Region Type	Limit for Noise Level dB(A)		
	Day Time (7 a.m. - 6 p.m.)	Evening Time (6 p.m. - 10 p.m.)	Night Time (10 p.m. - 7a.m.)
Rural residential areas	35 – 45	30 – 40	25 – 35

Table D 4 National Occupational Noise Exposure Standards in Work Areas

Duration per Day (hrs)	Sound Level dB(A)
8	90
4	95
2	100
1	105
½	110
¼	115

Wastewater Discharges

New standards for discharge into receiving water bodies are presented in Decision no. 8/1, to update similar standards set by Decision 52/1 (Table D 5).

Table D 5 Maximum Limits for Wastewater Discharge into Receiving Water Bodies

Substance	Maximum Allowable Limits For Receiving Water Bodies	
	Sewerage System	Surface Water
Color	none	none
pH	6-9	6-9
Temperature	35°C	30 °C
BOD (5 day, 20°C)	125 mg/l	25 mg/l
COD (dichromate)	500 mg/l	125 mg/l
Total Phosphorus	10 mg/l	10 mg/l
Total Nitrogen[4]	60 mg/l	30 mg/l
Suspended solids	600 mg/l	60 mg/l
AOX	5	5
Detergents	-	3 mg/l
Coliform Bacteria 370 C in 100 ml[5]	-	2,000
Salmonellae	Absence	Absence
Hydrocarbons	20 mg/l	20 mg/l
Phenol Index	5 mg/l	0.3 mg/l
Oil and grease	50 mg/l	30 mg/l
Total Organic Carbon (TOC)	750 mg/l	75 mg/l
Ammonia (NH_4^+)	-	10 mg/l
Silver (Ag)	0.1 mg/l	0.1mg/l
Aluminum (Al)	10 mg/l	10 mg/l
Arsenic (As)	0.1 mg/l	0.1 mg/l
Barium (Ba)	2 mg/l	2 mg/l

[4] Sum of Kjeldahl-N(organic N + NH3),NO3-N, NO2-N

[5] For discharges in close distance to bathing water, a stricter environmental limit value could be necessary

Substance	Maximum Allowable Limits For Receiving Water Bodies	
	Sewerage System	Surface Water
Cadmium (Cd)	0.2 mg/l	0.2 mg/l
Cobalt (Co)	1 mg/l	0.5 mg/l
Chromium total (Cr)	2 mg/l	2 mg/l
Hexavalent Chromium (Cr^{VI+})	0.2 mg/l	0.2 mg/l
Copper total (Cu)	1 mg/l	0.5 mg/l
Iron total (Fe)	5 mg/l	5 mg/l
Mercury total (Hg)	0.05 mg/l	0.05 mg/l
Manganese (Mn)	1 mg/l	1 mg/l
Nickel total (Ni)	2 mg/l	0.5 mg/l
Lead total (Pb)	1 mg/l	0.5 mg/l
Antimony (Sb)	0.3mg/l	0.3mg/l
Tin total (Sn)	2 mg/l	2 mg/l
Zinc total (Zn)	10 mg/l	5 mg/l
Active (Cl_2)	-	1 mg/l
Cyanides (CN^-)	1 mg/l	0.1mg/l
Fluorides (F)	15 mg/l	25 mg/l
Nitrate (NO_3^-)	-	90 mg/l
Phosphate (PO_4^{3-})	-	5 mg/l
Sulphate (SO_4^{2-})	1,000 mg/l	1,000 mg/l
Sulphide (S^{2-})	1 mg/l	1 mg/l

APPENDIX E-PUBLIC ANNOUNCEMENT

مشروع إمداد خطوط إضافية لشبكات الصرف الصحي وإنشاء محطات ضخ موصولة إلى محطة معالجة مياه الصرف الصحي في بلدة عيتنيت (قضاء البقاع الغربي، محافظة البقاع)

يهدف هذا المشروع الى الإسهام في التحسين المستدام في:

- خدمة الصرف الصحي للتجمّعات غير الموصولة بشبكات الصرف الصحي القائمة في القرى المخدومة؛
- رفع الضرر البيئي الناتج عن الصرف العشوائي للمياه المبتذلة في بحيرة القرعون.

تشمل خدمات الصرف الصحي تصميم وتنفيذ نظم الصرف الصحي المؤلفة من:

أ. شبكات إضافية للصرف الصحي موصولة بالشبكات الرئيسية والفرعية القائمة في بلدتي بعلول والقرعون اللتين تخدمهما محطة معالجة مياه الصرف الصحي في بلدة عيتنيت؛

ب. خطوط ومحطات ضخ مياه الصرف الصحي من بلدتي بعلول والقرعون.

بهدف المشاركة مع المجتمع المحلي والجهات المعنية بالمشروع، سيتم عقد اجتماع مشاركة العامة التشاوري لعرض ومناقشة المعطيات المتعلقة بالخطة البيئية والاجتماعية العائدة لهذا المشروع، الذي كلّف مجلس الإنماء والإعمار شركة الأرض للتنمية المتطورة للموارد ش.م.ل (ELARD S.A.L) مهمّة إعدادها.

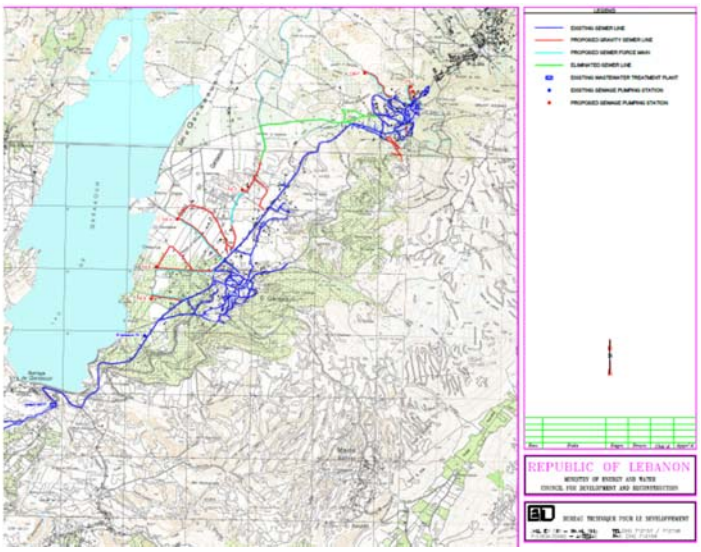
يتناول هذا الاجتماع عرضًا للمشروع ومناقشة الآثار البيئية والاجتماعية المحتملة له والخطة البيئية والاجتماعية المقترحة لتفادي وتقليص حدّة الآثار المحتملة.

مكان الاجتماع: مبنى بلدية القرعون

موعد الاجتماع: نهار الاثنين الواقع في 18 كانون الأول 2017

الساعة: العاشرة صباحاً .10:00 a.m

آملين حضوركم واستمرارية التعاون لكل ما فيه خدمة وصحة وسلامة المواطن والبيئة.



APPENDIX F-LIST OF PARTICIPANTS

اجتماع مشاركة العامّة

مشروع إمداد خطوط إضافية لشبكات الصرف الصحي وإنشاء محطات ضخ موصولة إلى محطة معالجة مياه الصرف الصحي في بلدة عيتنيت

(قضاء البقاع الغربي، محافظة البقاع)

١٨ كانون الأول ٢٠١٧

البريد الالكتروني E-mail	رقم الهاتف Phone number	الجهة Organization	المركز Position	الاسم Name	
	٠٨/٣٢٠٨٧١	البرعون	مدرس	محمد حسين زيب	1
	70/732584	BTD	Civil engineer	محمد دشتي	2
S.baltani@btd-lb.com	71/952 252	BTD	Environmental Engineer	Salam Battani	3
	03799748		محفف بلدية بعلول	سارة درويش	4
wajihsanwich si6	03-655426	رئيس بلدية سلعا - بلدية بعلول		وجيه درويش	5
	03399593	رئيس بلدية سلعا البقاع		علي عاكوم	6
Taha.OMais@Gmail.c	70927501	الكتاب العام	تاجر	طه عيس	7
	03238872	البرعون	متعهد	محمد ابراهيم ياسين	8
	٠٣-٢٠٥٧٩	المجتمع المدني	البرعون	أحمد حاكم ضاع	9
issam.Hamawi@Gmail.com	03942041	وزارة الصحة	مراقب صحي وزارة الصحة	Issam الحموي	10

اجتماع مشاركة العامّة

مشروع إمداد خطوط إضافية لشبكات الصرف الصحي وإنشاء محطات ضخ موصولة إلى محطة معالجة مياه الصرف الصحي في بلدة عيتنيت

(قضاء البقاع الغربي، محافظة البقاع)

١٨ كانون الأول ٢٠١٧

	الاسم Name	المركز Position	الجهة Organization	رقم الهاتف Phone number	البريد الالكتروني E-mail
11	خالد الوليد البيراني	صاحب مؤسسة	مؤسسة الوليد للتجارة والتعهدات	٠٨/٦٣١٢٢٠ ٠٣/٩٤٩٤١٤	birani_k@hotmail.com
12	لميس جمال	أثري	المديرية العامة للآثار وزارة الثقافة	70/837181	lamis.jamal@dga.culture.gov.lb
13	علي شومان	حارس	المديرية العامة للآثار	٠٢/٧١٢٦٢٢	Alishouman@gmil.com
14	عاصم فداوي	رئيس دائرة مجلس الإنماء والإعمار	مجلس الإنماء والإعمار	٠١/٩٨١٤٢١	assemf@cdr.gov.lb
15	شربل بشير	~~مجلس~~ مدير مشروع	مجلس الإنماء والإعمار	٠٢ ٧٢٢١٧٢١	cbechir@cdr.gov.lb
16	[illegible]	د ر		70410525 ~~[illegible]~~	
17	محمد العزنكي	صاحب شركة	كشاف المسلم فوج القرعون	03-889552	moudy180@hotmail.com
18	عدنان عواد	مدرس		03/066201	
19	سالم مريم	مدير شركة	[illegible] الأخضر	70951708	
20	ابو زيد عميص	رئيس جمعية	الجمعية الخيرية الإسلامية في القرعون	03.266 590	

اجتماع مشاركة العامّة

مشروع إمداد خطوط إضافية لشبكات الصرف الصحي وإنشاء محطات ضخ موصولة إلى محطة معالجة مياه الصرف الصحي في بلدة عيتنيت

(قضاء البقاع الغربي، محافظة البقاع)

١٨ كانون الأول ٢٠١٧

	الاسم Name	المركز Position	الجهة Organization	رقم الهاتف Phone number	البريد الالكتروني E-mail
21	محمد يونس	رئيس دائرة	مصلحة الليطاني	03 204 828	myounes@litani.gov.lb
22	وسام شرانق	مصلحة الليطاني	[illegible]	03036724	wissamcharanek@hotmail.com
23	علي ياسين	مختار القرعون		٠٣٥١٨٠٠٤	
24	علي هاشم	رئيس سابق		03399593	
25	[illegible]	طبيب قضاء البقاع الغربي	وزارة الصحة العامة	03287234	
26	جهاد غلول	عضو بلدية	القرعون	٧٠/٦٤٩٣٥٣	
27	جلال ذيب	شرطي بلدية	بلدية القرعون	76/858280	JalalDib27@hotmail.com
28	عبد الكريم الأمين	متقاعد	القرعون	٧٠/٣٦٢٣٤١	
29	سعيد ياسين	عضو بلدية	القرعون	03272735	Lapaz9@hotmail.com
30	م. ابراهيم فرحات	بلدية القرعون	بلدية القرعون	03/904618	

اجتماع مشاركة العامّة

مشروع إمداد خطوط إضافية لشبكات الصرف الصحي وإنشاء محطات ضخ موصولة إلى محطة معالجة مياه الصرف الصحي في بلدة عيتنيت

(قضاء البقاع الغربي، محافظة البقاع)

١٨ كانون الأول ٢٠١٧

البريد الالكتروني E-mail	رقم الهاتف Phone number	الجهة Organization	المركز Position	الاسم Name	
Jumana_Sbara@hotmail.com	03-300581	بلدية القرعون	أمين صندوق	عرجارة	41
	03/269502	القرعون	كاتب	نبيل سرحان	42
	76/66085	القرعون	[illegible]	محمد خالد	43
rzbeidy@elard-group.com	03/333625	ELARD	Project Manager	Rana Zbeidy	44
GChami@elard-group.com	03/464304	ELARD	Assistant Project Manager	Ghid Chami	45
lbacharem@elard-group.com	70/872247	ELARD	Environmental specialist	Lara Bou Charem	46
					47
					48
					49
					50

APPENDIX G-PUBLIC CONSULTATION PRESENTATION

إجتماع مشاركة العامة

مشروع إمداد خطوط إضافية لشبكات الصرف الصحي وإنشاء محطات ضخ موصولة إلى محطة معالجة مياه الصرف الصحي في بلدة عيتنيت (قضاء البقاع الغربي، محافظة البقاع)

نظام عيتنيت لإدارة الصرف الصحي

١٨ كانون الأول ٢٠١٧

البرنامج

- أهداف الجلسة
- غاية خطة الإدارة البيئية والاجتماعية للمشروع المقترح
- لمحة عن المشروع
- الغاية والأهداف المرجوّة من المشروع
- الإطار القانوني والمؤسساتي
- الوضع الحالي لإدارة الصرف الصحي في منطقة المشروع
- وصف تفصيلي للمشروع
- الوضع البيئي الحالي
- تقييم الأثر البيئي والاجتماعي والتدابير التخفيفية
- برنامج الرصد والمراقبة
- أسئلة ومناقشة

أهداف الجلسة

- عرض مختصر للمشروع المقترح وأهدافه
- مناقشة خطة الإدارة البيئية والاجتماعية المقترحة
- مناقشة مخاوف بيئية، إجتماعية أو اقتصادية محتملة لم يتم التطرّق إليها
- الحصول على اقتراحات لمعالجة هذه المخاوف وتخفيفها.

لمحة عن المشروع

- صاحب المشروع: مجلس الإنماء والإعمار
- الجهة المانحة: البنك الدولي The Word Bank
- الشركة الهندسية: شركة BTD
- الاستشاري المسؤول عن دراسة خطة الادارة البيئية والإجتماعية: شركة الأرض للتنمية المتطورة للموارد (ELARD)
- البلديات المعنية مباشرةً بالمشروع: بعلول والقرعون

غاية خطة الإدارة البيئية والاجتماعية للمشروع المقترح

- وصف الآثار البيئية والاجتماعية المحتملة للمشروع وتقييم مدى حدّتها وأهميتها
- وصف التدابير التخفيفية التي يجب تنفيذها لتفادي أو تخفيف الآثار البيئية والاجتماعية السلبية
- ضمان تنفيذ جميع التدابير التخفيفية ومتطلبات الرصد وفق خطة الادارة البيئية والاجتماعية المقترحة خلال مراحل البناء والتشغيل والصيانة
- ضمان حماية البيئة والمناطق المحيطة بها وتطويرها لتلبية احتياجات السكان المحليين وأصحاب المصلحة، وحماية مصالح عامة الشعب.

لمحة عن المشروع

يتضمن المشروع:

- إنشاء 13.2 كم من خطوط الصرف الصحي الإضافية لشبكات الصرف الصحي القائمة على طول الطرق في بلدتي بعلول والقرعون الموصولتين بمحطة عيتنيت لمعالجة الصرف الصحي
- إنشاء 6 محطات ضخ في بعلول والقرعون: 2 منها في بعلول و4 منها في القرعون. تقع المحطات على أراض ملك الحكومة اللبنانية والمصلحة الوطنية لنهر الليطاني

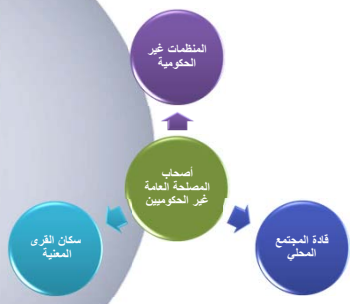
الغاية والأهداف المرجوّة من المشروع

أحد المكونات الرئيسية لمشروع الحد من تلوث بحيرة القرعون هو تحسين عملية جمع مياه الصرف الصحي من خلال إنشاء شبكات جديدة وإعادة تأهيل جزء من الشبكات القديمة وإنشاء محطات ضخ جديدة.

لذلك، يهدف هذا المشروع إلى الإسهام في التحسين المستدام في:

- خدمة الصرف الصحي للتجمّعات غير الموصولة بشبكات الصرف الصحي القائمة في القرى المخدومة
- رفع الضرر البيئي الناتج عن الصرف العشوائي للمياه المبتذلة في بحيرة القرعون.

الإطار القانوني والمؤسساتي



الإطار القانوني والمؤسساتي

رقم القانون / القرار	العنوان
القانون 444/2002	قانون حماية البيئة
قرار وزارة البيئة رقم 8/1 (2001)	تحديد المواصفات والمعايير المتعلقة بملوثات الهواء والنفايات السائلة المتولدة عن المؤسسات المصنفة ومحطات معالجة المياه المبتذلة يكمّل القرار رقم 52/1 (1996)
قرار وزارة البيئة رقم 52/1 (1996)	تحديد المواصفات والنسب الخاصة للحد من تلوث الهواء والمياه والتربة
القانون 58 (1991) المحدّث عام 2006	قانون الاستملاك

الإطار القانوني والمؤسساتي

- تشكل وزارة البيئة السلطة المختصة بمراجعة خطة الإدارة البيئية والاجتماعية وبإعطاء الموافقة عليها قبل الترخيص للمشروع، وبمراقبة تنفيذ الخطة خلال مرحلتي الإنشاء والتشغيل
- المجتمع الأهلي المحلي يشكل جهة أساسية معنيّة بخطة الإدارة البيئية والاجتماعية المقترحة للمشروع

سوف يقوم الاستشاري المسؤول عن خطة الإدارة البيئية والاجتماعية (شركة ELARD) بتوثيق اهتمامات وتوصيات الهيئات الحكومية، الإدارات المحلية، والمجتمع الأهلي في الدراسة واقتراح كيفية معالجتها، وعرضها على أصحاب القرار.

الإطار القانوني والمؤسساتي

الوضع الحالي لإدارة الصرف الصحي في منطقة المشروع

بعلول	القرعون
• 10.3 كم من خطوط الصرف الصحي القائمة • تخدم معظم القرية • لا وجود لمحطات ضخ	• 16.5 كم من خطوط الصرف الصحي القائمة • تخدم الجزء العلوي من القرية، فوق الطريق الرئيسي • توجد محطة ضخ واحدة

يتم نقل مياه الصرف الصحي من بعلول والقرعون إلى محطة معالجة مياه الصرف الصحي في عيتنيت.

الوضع الحالي لإدارة الصرف الصحي في منطقة المشروع: محطة عيتنيت

- بدأ تشغيل محطة معالجة مياه الصرف الصحي في عيتنيت عام 2009
- تم تصميمها للعمل على تدفق بمعدل 5000 متر مكعب في اليوم وعلى تدفق ذروة يصل حتى 7000 متر مكعب في اليوم
- تعمل المحطة حالياً في إطار قدرة معالجة بين 1500 إلى 2500 متر مكعب من المياه المبتذلة يومياً
- يتم تصريف المياه المعالجة في مجرى نهر الليطاني

وصف تفصيلي المشروع: الشبكات الإضافية

الأعمال المقترحة للشبكات الاضافية	
بعلول	القرعون
3.2 كم من خطوط الصرف الصحي لخدمة نحو 100 منزل. خصائصها: - أنابيب ذات قطر 200 مم من الـuPVC كخطوط جاذبية - أنابيب ذات قطر 80 مم من الـ DI كمجاري رئيسية	10 كم من خطوط الصرف الصحي لخدمة نحو 240 منزل. خصائصها: - أنابيب ذات قطر 200 مم من الـuPVC كخطوط جاذبية - أنابيب ذات قطر 80 – 150 مم من الـ DI كمجاري رئيسية - مجاري فرعية

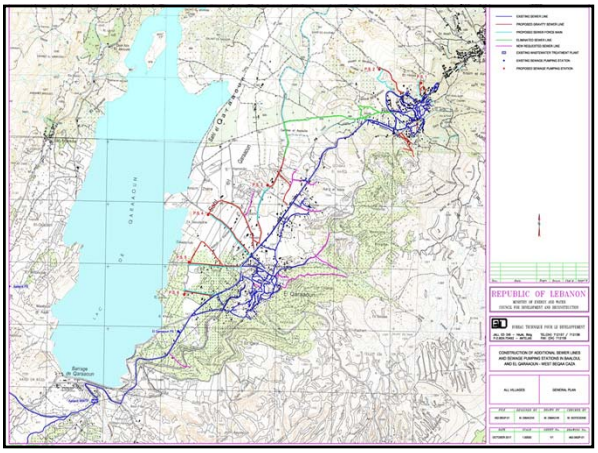
الوضع الحالي لإدارة الصرف الصحي في منطقة المشروع: محطة عيتنيت

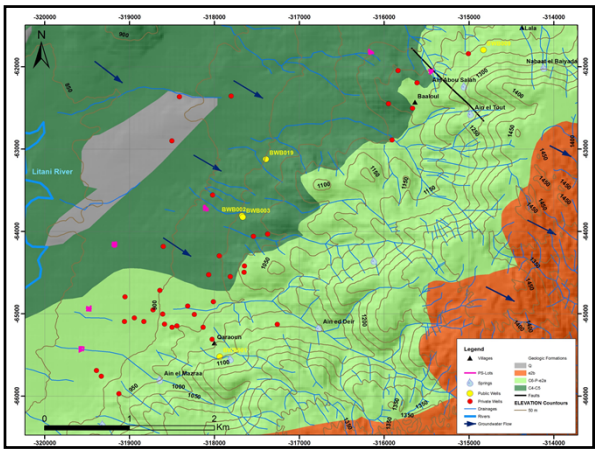
وصف تفصيلي المشروع: محطات الضخ

المحلة	محطة ضخ الصرف الصحي	عدد وحدات الضخ	معدل التدفق	الوحدات التكميلية
بعلول	محطة الضخ-1 PS-1	مضخة عاملة (1) Duty Pump (1) مضخة احتياطية (1) Standby Pump (1) مضخة مستقبلية (1) Future Pump (1)	3.5 (l/s)	مولد كهربائي خزان الوقود
	محطة الضخ-2 PS-2	مضخة عاملة (1) مضخة احتياطية (1) مضخة مستقبلية (1)	3.5 (l/s)	مولد كهربائي خزان الوقود
القرعون	محطة الضخ-3 PS-3	مضخة عاملة (1) مضخة احتياطية (1) مضخة مستقبلية (1)	3.83 (l/s)	مولد كهربائي خزان الوقود
	محطة الضخ-4 PS-4	مضخة عاملة (1) مضخة احتياطية (1) مضخة مستقبلية (1)	12.38 (l/s)	مولد كهربائي خزان الوقود
	محطة الضخ-5 PS-5	مضخة عاملة (1) مضخة احتياطية (1) مضخة مستقبلية (1)	6.28 (l/s)	مولد كهربائي خزان الوقود
	محطة الضخ-6 PS-6	مضخة عاملة (1) مضخة احتياطية (1) مضخة مستقبلية (1)	3.5 (l/s)	مولد كهربائي خزان الوقود

الوضع البيئي الحالي: التقييم البيولوجي

محطة ضخ الصرف الصحي	الموقع المقترح	وجهة استعمال الأرض	القيمة الإيكولوجية
محطة الضخ 1 في بعلول PS-1		شجر الزيتون، التفاح، الصنوبر (غير منتجة)	قيمة إيكولوجية منخفضة
محطة الضخ 2 في بعلول PS-2		شجر الزيتون، التفاح، الصنوبر (قليلة الانتاج)	قيمة إيكولوجية متوسطة





الوضع البيئي الحالي:
التقييم البيولوجي

محطة ضخ الصرف الصحي	الموقع المقترح	وجهة استعمال الأرض	القيمة الإيكولوجية
محطة الضخ 3 في القرعون PS-3		• محطة لقناة مياه الليطاني • بئر ماء	لا قيمة إيكولوجية
محطة الضخ 4 في القرعون PS-4		أرض تحتوي على ردم	لا قيمة إيكولوجية

الوضع البيئي الحالي:
الآثار والإرث الثقافي

- وجود مواقع من العصر الحجري الحديث في بلدتي لالا والقرعون على ضفتي نهر الليطاني في قضاء البقاع الغربي
- أرضية الفسيفساء لكنيسة من الحقبة البيزنطية موجودة في لالا

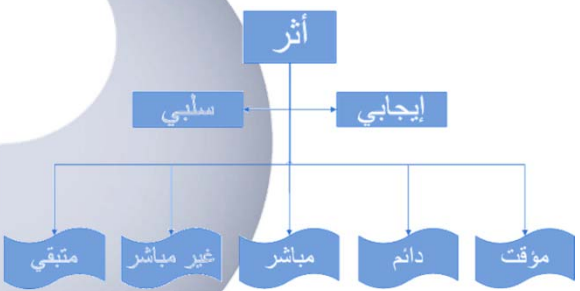
الوضع البيئي الحالي:
التقييم البيولوجي

محطة ضخ الصرف الصحي	الموقع المقترح	وجهة استعمال الأرض	القيمة الإيكولوجية
محطة الضخ 5 في القرعون PS-5		شجر الشربين والسرو والجوز	قيمة إيكولوجية منخفضة
محطة الضخ 6 في القرعون PS-6		شجر الصنوبر والشربين	قيمة إيكولوجية متوسطة

الوضع البيئي الحالي:
الخصائص الجيولوجية والهيدروجيولوجية

- تقع منطقة المشروع على التكوّن الجيولوجي C6-p-e2b: Chekka formation المتّسمة بنفاذية ضئيلة و C4-C5: Sannine-Maamelteinformation ذات نفاذية عالية
- المسطحات المائية الرئيسية المحيطة بمنطقة الدراسة هي نهر الليطاني وبحيرة القرعون. ويقع كل منهما على بعد 3 كم تقريباً غرب بلدة القرعون، وحوالي 5 كم غرب قرية بعلول
- يوجد العديد من الينابيع الصغيرة داخل منطقة الدراسة: واحد في القرعون واثنين قرب بعلول
- يوجد خمسة آبار عامة داخل منطقة الدراسة على عمق يتراوح بين 177 و 420 متراً: ثلاثة في القرعون، واحد في بعلول، وواحد في لالا غرب شبكة المشروع
- تتضمن منطقة الدراسة 37 بئراً خاصاً تتراوح أعماقها بين 80 و320 متراً بالإضافة إلى العديد من الآبار غير المرخص لها

تقييم الأثر البيئي والاجتماعي



نطاق ومنهجية تقييم الآثار المحتملة

احتمالات الحدوث	تقييم الأهمية: مفيدة B	كارثية 5	كبيرة 4	معتدلة 3	بسيطة 2	ضئيلة 1
منخفض L=1	+	5	4	3	2	1
متوسط M=2	++	10	8	6	4	2
مرتفع H=3	+++	15	12	9	6	3

دليل

القبولية	
مفيدة	+ to +++
منخفضة	1 to 3
متوسطة	4 to 9
مرتفعة	10 to 15

إحتمالات الحدوث
(1) منخفض -L
(2) متوسط -M
(3) مرتفع -H

تقييم الأهمية
1- ضئيلة
2- بسيطة
3- معتدلة
4- كبيرة
5- كارثية
B- مفيدة

محاور الآثار البيئية والاجتماعية

نوعية الهواء	مصادر المياه
مستوى الضوضاء	مصادر الطاقة
التربة والمياه الجوفية	الآثار والإرث الثقافي
التنوع البيولوجي	الوضع الاجتماعي والاقتصادي
حركة المرور	السلامة العامة وسلامة العمل

- لكل من هذه المحاور تم تحديد وتقييم الآثار الإيجابية والسلبية المتوقعة خلال مرحلتي البناء والتشغيل للمشروع

تقييم الأثر البيئي والاجتماعي: مرحلة البناء

المكوّن البيئي والاجتماعي	الأثر المحتمل	قبل التدابير	بعد التدابير
نوعية الهواء	الانبعاثات الهوائية من الشاحنات وآليات العمل ومولدات الطاقة	9	6
	الغبار من أعمال الحفر والردم والبناء والتخزين المؤقت والمواد الأولية	9	4
مستوى الضوضاء	الضوضاء الناتجة من عمليات البناء، مولدات الطاقة، حركة السير	9	6
التربة والمياه الجوفية	تجهيز الموقع والتدريج والحفر	12	4
	التسربات العرضية للوقود والزيوت والكيماويات	8	4
	سوء إدارة النفايات	8	3
	سوء التخزين والتخلص من مياه الصرف الصحي	9	3
التنوع البيولوجي	تدهور أو تجزئة أو خسارة الموئل	6	2
حركة المرور	زيادة الضغط على حركة المرور الحالية في المنطقة	9	4
مصادر المياه والطاقة	استهلاك المياه و الطاقة لأعمال البناء	6	4
الآثار والإرث الثقافي	الأضرار المحتملة على الآثار غير المكتشفة أثناء الحفر	12	4
الوضع الاجتماعي والإقتصادي	خلق فرص العمل	+++	
	تلف البنية التحتية القائمة	8	4
	اضطرابات من توليد الضوضاء والغبار	9	4
	زيادة الحمل على البنية التحتية القائمة	6	4
	حيازة الأراضي	3	
السلامة العامة وسلامة العمل	مخاطر أنشطة البناء وتعرض العمال لاحتمال حدوث إصابات	6	2

أهم التدابير التخفيفية خلال مرحلة البناء

المكوّن البيئي أوالاجتماعي	أهم التدابير التخفيفية
نوعية الهواء	• الصيانة المستمرة للآليات والمعدات • استخدام مولدات تتطابق انبعاثاتها مع قرار وزارة البيئة 8/1 (2001) • تغطية جميع الشاحنات الواردة والصادرة من الموقع والمواد الأولية أو التربة • رش المياه للحد من انبعاث الغبار • الجدولة الفعالة للأعمال وإطفاء المعدات والآليات عندما لا يتم استعمالها
مستوى الضوضاء	• تزويد الآليات، المعدات والمولدات بكواتم صوت عند الإمكان • الصيانة المستمرة للآليات والمعدات • الالتزام بأوقات العمل خلال فترة النهار ووضع نظام لتلقي الشكاوى • قياس الضوضاء لضمان توافق الانبعاثات مع القرار 52/1 • إطفاء المعدات والآليات عندما لا يتم استعمالها • إعلام السكان المجاورين عن جدول الأعمال المسببة للضجيج

أهم التدابير التخفيفية خلال مرحلة البناء

المكوّن البيئي أوالاجتماعي	أهم التدابير التخفيفية
التربة والمياه الجوفية	• التقيّد بالمعايير الدولية (للحفر والضغط والتدريج) • تخزين المواد الكيميائية والزيوت والوقود داخل غرفة مغلقة ومخصصة • إعداد خطة طوارئ للتسرب خاصة بالمشروع وتدريب فريق العمل عليها • إعادة تأهيل الأراضي فور الانتهاء من العمل
التنوع البيولوجي	• الحد من اضطراب الأراضي من خلال الحفر والبناء في المواقع اللازمة فقط • حظر القطع أو الإضرار غير الضروري بالنباتات والأشجار البرية • استخدام النباتات والأشجار المحلية في أي خطة تشجير وإعادة تأهيل لأي موقع
حركة المرور	• تحديد مواعيد زمنية لنقل المواد وتسليمها، تجنب ساعات الذروة • التنسيق مع شرطة البلدية في حال إغلاق الطرق وإعادة توجيهها • وضع حد لسرعة حركة الشاحنات في موقع المشروع والمنطقة المحيطة

أهم التدابير التخفيفية خلال مرحلة البناء

المكوّن البيئي أوالاجتماعي	أهم التدابير التخفيفية
مصادر المياه والطاقة	• اعتماد خطة لتخفيف استهلاك المياه خلال مرحلة البناء • مراقبة الاستهلاك الشهري للوقود والطاقة لتتبع الاستهلاك وتحديد الإفراط في الاستخدام • تجنب التشغيل غير الضروري للمركبات ومحركات المعدات
الآثار والإرث الثقافي	• التنسيق مع المديرية العامة للآثار لتحديد المناطق الحساسة قبل البدء بأعمال الحفر والبناء • في حال إيجاد آثار أثناء أعمال الحفر والبناء: ✓ إيقاف الأعمال وإبلاغ المديرية العامة للآثار ✓ المديرية ستضع التدابير اللازمة لتخفيف الآثار السلبية وتتخذ الإجراءات اللازمة ✓ يمكن استئناف أعمال البناء بعد الحصول على إذن من المديرية

أهم التدابير التخفيفية خلال مرحلة البناء

المكوّن البيئي أوالاجتماعي	أهم التدابير التخفيفية
الوضع الاجتماعي والاقتصادي	• خلق فرص عمل للسكان المحليين • تنفيذ التدابير التخفيفية المقترحة للحد من الاضطرابات الناجمة عن الضوضاء وانبعاثات الهواء • المحافظة على البنية التحتية القائمة من خلال تنفيذ الحفر التجريبية على طول مسار الشبكة لتحديد المكونات القائمة • تخفيف الضغط على البنية التحتية القائمة من خلال: ✓ فرز النفايات، وإعادة استخدام ما يمكن إعادة استخدامه. ✓ تخزين النفايات الخطرة في حاويات مخصصة قبل نقلها من قبل فريق المورّد/ الصيانة إلى المكان المتفق عليه.
السلامة العامة وسلامة العمال	• تزويد العمال بمعدات الوقاية الشخصية المناسبة وفرض استخدامها • تسييج مناطق البناء ووضع الحواجز والتنبيهات حول الحفر ومواقع البناء • التأكد من أن العاملين يفهمون ويطبقون متطلبات السلامة في الموقع.

أهم التدابير التخفيفية خلال مرحلة التشغيل

المكوّن البيئي أوالاجتماعي	أهم التدابير التخفيفية
حركة المرور	• تجنب الصيانة أثناء ساعات الذروة • التنسيق مع شرطة البلدية في حال إغلاق الطرق وإعادة توجيهها
مصادر الطاقة	• مراقبة الاستهلاك الشهري للوقود والطاقة لتتبع الاستهلاك وتحديد الإفراط في الاستخدام • تجنب التشغيل غير الضروري للمولدات ومحركات المعدات • تشغيل محطات الضخ على الطاقة الشمسية خلال أيام الصحو
السلامة العامة وسلامة العمال	• تنفيذ التدابير التخفيفية المقترحة للحد من الاضطرابات الناجمة عن الضوضاء وانبعاثات الهواء، وتدريب العمال عليها • تزويد العمال بمعدات الوقاية الشخصية المناسبة وفرض استخدامها • توفر عدة للإسعافات الأولية.

تقييم الأثر البيئي والاجتماعي: مرحلة التشغيل

المكوّن البيئي والاجتماعي	الأثر المحتمل	قبل التدابير	بعد التدابير
نوعية الهواء	الانبعاثات الهوائية من مولدات الطاقة	6	4
	انتشار الروائح الناتجة عن التسرب أو الفائض لمحطات الضخ	6	2
مستوى الضوضاء	الضوضاء الناتجة عن مولدات الطاقة	4	2
	الضوضاء الناجمة عن تشغيل محطات الضخ وأنشطة الصيانة	2	1
التربة والمياه الجوفية	انسكابات عرضية للوقود والنفط والمواد الكيميائية أثناء الصيانة	6	2
	عطل يؤدي الى تسرب مياه الصرف الصحي غير المعالجة	8	3
حركة المرور	زيادة الضغط على حركة المرور خلال عمليات الصيانة	3	2
مصادر المياه والطاقة	استهلاك المياه والطاقة في محطات الضخ	6	3
الوضع الإجتماعي والإقتصادي	تخفيف التلوث الناجم عن التخلص العشوائي من مياه الصرف الصحي	+++	
السلامة العامة وسلامة العمال	مخاطر تعرض عمال الصيانة لاحتمال حدوث اصابات	3	2

برنامج الرصد والمراقبة – مرحلة البناء

المكوّن البيئي أوالاجتماعي	مؤشر الرصد/المراقبة	تواتر المراقبة	نقطة الرصد/المراقبة	عدد العينات / نقاط المراقبة	المسؤولية
نوعية الهواء	الانبعاثات المولدات: ارتفاع الدخون، SO_2، NO_2، CO، PM_{10}	عند أول استخدام للمولدات	على مداخن المولدات	عينة واحدة	مسؤول السلامة العامة للموقع
مستوى الضوضاء	Leq, Lmax, Lmin, L90 dB(A)	يومي	مناطق العمل و قرب المستقبلات الحساسة	تعيين بعد مترين من المولدات والمعدات، والأقرب من وعلى مستقبلات	مسؤول السلامة العامة للموقع
نوعية المياه الجوفية	الخصائص الميكروبيولوجية، الفيزيائية والكيميائية	قبل بدء أعمال البناء وبعدها	الآبار الموجودة في مناطق العمل	عينة واحدة من كل بئر	مسؤول السلامة العامة للموقع
مياه الصرف الصحي	التسربات	أسبوعي	مواقع التخزين	الفحص البصري	مسؤول السلامة العامة للموقع
النفايات الصلبة	الأنواع، الكميات، إعادة الاستخدام، التخزين، والتصريف	يومي	مواقع البناء	السجلات اليومية	مسؤول السلامة العامة للموقع
مصادر الطاقة	استهلاك الوقود	أسبوعي	مواقع البناء	فواتير الوقود والكهرباء	المقاول
موارد المياه	استهلاك المياه	أسبوعي	مواقع البناء	فواتير المياه	المقاول
ازدحام السير	الالتزام بمواعيد نقل المواد وتسليمها الالتزام بالسرعة المسموحة وضع الإشارات اللازمة	يومي	الطرقات المغلقة والطرقات التي تمت إعادة توجيهها	الفحص البصري الشكاوى الواردة إلى البلدية	المقاول
الموارد الأثرية	المعالم الأثرية التي وجدت خلال الأعمال	يومي	موقع البناء	الفحص البصري	مهندس الموقع، المقاول، العمال
مخاطر الصحة والسلامة	استخدام معدات الوقاية الشخصية المناسبة ممارسات جيدة للتدبير المنزلي	يومي	مواقع البناء	الفحص البصري	مسؤول السلامة العامة للموقع

أهم التدابير التخفيفية خلال مرحلة التشغيل

المكوّن البيئي أوالاجتماعي	أهم التدابير التخفيفية
نوعية الهواء	• الصيانة المستمرة للآليات والمعدات • استخدام مولدات تتطابق انبعاثاتها مع قرار وزارة البيئة 8/1 (2001) • ضمان الهندسة والتصميم الصحيح لمحطات الضخ • توفير التهوية الكافية مع فلتر الكربون للسيطرة على الروائح داخل محطات الضخ للصرف الصحي • وجود جدول منتظم للصيانة
مستوى الضوضاء	• الصيانة المستمرة للمضخات والمولدات • قياس الضوضاء لضمان توافق الانبعاثات مع القرار 52/1
التربة والمياه الجوفية	• وضع الزيوت و الشحوم والنفايات الصلبة الناتجة عن الصيانة في مستوعبات خاصة مقفلة و تسليمها للجهات المختصة بإعادة استعمالها أو تكريرها • تجنب القيام بعمليات الصيانة أثناء الأيام الممطرة • صيانة دورية لمحطات الضخ و محطة التكرير في عينتيت • إجراء فحوصات دورية للمياه المكررة في محطة عينتيت

برنامج الرصد والمراقبة – مرحلة التشغيل

المكوّن البيئي أوالاجتماعي	نوع المراقبة	تواتر المراقبة	الموقع	عدد العينات / نقاط المراقبة	المسؤولية
نوعية الهواء	الانبعاثات المولدات: ارتفاع الدخون، SO_2، NO_2، CO، PM_{10}	نصف سنوي	على مداخن المولدات	عينة واحدة	إدارة محطات الضخ
مستوى الضوضاء	Leq, Lmax, Lmin, L90 dB(A)	شهري	بجانب المولدات	عينة واحدة	إدارة محطات الضخ
مياه الصرف الصحي	فحص نظري وهندسي/تقني لأي تسرب أو فيضان للصرف الصحي (للشبكات ومحطات الضخ)	فحص نظري: خلال الكشف الأسبوعي فحص هندسي/تقني: كل ستة أشهر	الشبكات محطات الضخ	الشبكات: فتحات الشبكة (manhole) محطات الضخ: الخط الوارد (inlet) – الخط الموزّد (outlet) – داخل المحطة	إدارة محطة إدارة محطات الضخ والشبكات
النفايات الصلبة	الأنواع، الكميات، إعادة الاستخدام، التخزين، والتصريف	خلال عمليات الصيانة	مواقع الصيانة	السجلات اليومية	إدارة محطات الضخ والشبكات
مصادر الطاقة	استهلاك الوقود	شهري	محطات الضخ	فواتير الوقود والكهرباء	إدارة محطات الضخ
موارد المياه	استهلاك المياه	شهري	محطات الضخ	فواتير المياه	إدارة محطات الضخ
مخاطر الصحة والسلامة	الفحص البصري و تسجيل عدد وسبب الحوادث	مستمر	محطات الضخ ومواقع الصيانة	-	إدارة محطات الضخ

- *Remark: to add for next presentations the institutional setup for ESMP implementation (CDR, BWE, municipalities, MoEW, MoE, etc..)*

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أسئلة ومناقشة

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شكراً لمشاركتكم