

EXECUTIVE SUMMARY

Earth Link and Advanced Resources Development s.a.l. (ELARD) (the "ESIA Consultant"), in cooperation with Egis International, was appointed by the Council for Development and Reconstruction (CDR) (the "Project Proponent") to conduct an Environmental and Social Impact Assessment (ESIA) and Resettlement Action Plan (RAP) for the Bus Rapid Transit (BRT) system between Tabarja and Beirut and feeders buses services (the "Project").

The objective of the Project is to improve transport connectivity and mobility on the coastal corridor located to the North of Beirut. This objective will be achieved through:

- (i) the construction of a new Bus Rapid Transit (BRT) System between Tabarja and Beirut and within Beirut,
- (ii) the establishment of feeder bus services to the trunk BRT line, and
- (iii) the establishment of appropriate institutional arrangements for the management, operation and maintenance of the new mass transit system.

The World Bank (WB) prepared the "Pre-feasibility Report for a Bus Rapid Transit System for Greater Beirut" and will be appraising the Project for funding based on the outcomes of the Feasibility Study and Environmental and Social Impact Assessment. When the Project is approved for implementation, the CDR will be responsible for its construction while the operation will be under the jurisdiction of the Railways and Public Transport Authority (RPTA).

Implementation of a Bus Rapid Transit (BRT) System has been identified as one of the potential investments to improve mobility and traffic circulation along the three (3) main entrances to Beirut: Northern, Southern and Eastern entrances. In the first phase, the proposed Project addresses the Northern Entrance. The remaining two (2) entrances will be studied at later stages.

Project Description

The Project is thus the implementation of a BRT System for the Northern Corridor of Greater Beirut linking Beirut to Tabarja. In addition, the BRT corridor will continue into the city of Beirut in an Outer Ring and an Inner Ring.

A BRT System is a bus-based mass transit system with large transport capacities and has the following elements:

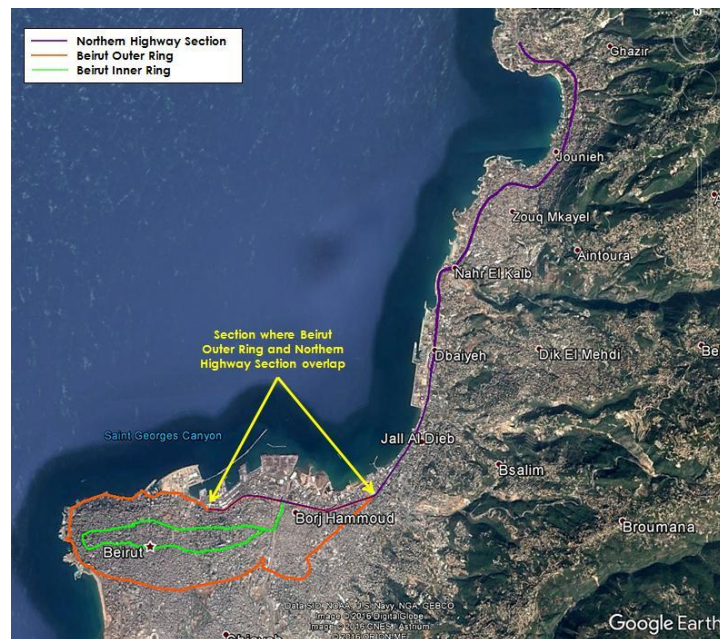
- Alignment in the center of the road with physical separation of the dedicated lane from mixed traffic;
- Stations with off-board fare collection;
- Station platforms level with the bus floor and multiple bus doors for entry; and
- Bus priority at intersections.

The section along the Northern Highway runs from Tabarja to Beirut (Charles Helou) with a length of 24 km and has 28 stations in the median with separating distance of 850 m, connected to either side of the highway by pedestrian bridges, with stairs and elevators.

The Beirut Outer Ring with a length of 18 km follows the Mirna Chalouhi Boulevard - Emile Edde - Jisr El Wati - Corniche Al Mazraa - Corniche Al Baher - Charles Helou - Nahr Al Mot. There will be 21 stations, 700 m apart, and road-level pedestrian crossings.

The Beirut Inner Ring with a length of 16 km stays within the administrative boundaries of the city of Beirut. It passes through the following streets and avenues: Independence, Charles Malek, General Fouad Chehab, Spears, Omar Bin Abdel Aziz, Bani Maarouf, and Algeria. There will be 19 stops on the right hand side of the road, 570 m apart.

The overall BRT alignment is shown in the figure below.



Overall BRT Alignment

Along with the BRT service, feeder bus services with specific itineraries are going to be provided to serve as transit, from and to the BRT stations.

The feeder bus lines are based on the “20 bus lines” project prepared by the Ministry of Public Works and Transport (MoPWT). The total service fleet will comprise around 850-900 buses operating on about 20 complementary bus routes outside the main BRT trunk lines.



Feeder Bus Network

The third component of the Project is institutional strengthening which includes:

- The delineation of the arrangements for the management, operation and maintenance of the new BRT System; and

- The preparation of required studies to concession BRT operations to a private operator under the supervision of the RPTA.

Public Consultation

The BRT System has primarily a general public interest for commuters. Its implementation aims at enhancing public transport thereby easing traffic flows, reducing air pollutants emissions, reducing travel time, and improving road safety conditions. As part of the ESIA Study, a "Stakeholder Engagement and Consultation Plan" was developed to lay out the roadmap on how the ESIA Consultant will facilitate capturing the opinions of stakeholders.

Three (3) main approaches were adopted to inform people about the Project throughout the ESIA study to solicit their opinions:

1. Key Stakeholder Meetings and Interviews,
2. Two Public Consultation Meetings at the Scoping and Draft ESIA Study stages, and
3. Focus Group Meetings.

The most striking and relevant outcomes from the meetings, interviews, public hearings and focus group meetings are summarized as follows:

- 1- On Project Design: While a reliable and efficient mass transit system is a must, especially that the current system does not meet the expectations of the population on various levels, removing one lane to be dedicated to a busway might lead to more congestion. Furthermore, integration of the BRT bus with the feeder bus network, and P&R facilities is a necessity to create a functioning, integrated system of public transport.
- 2- On Environmental Matters: There is a need to have clean, low-emission buses that attract the demand of passenger car users to a sufficient level so that they switch from using private vehicles to using the bus.
- 3- On Social Matters: The current private operators of the common transport system will face competition from the new BRT system – in terms of road space and service provision. Construction of the BRT bus corridors is anticipated to create disruption and heavy congestion along already-saturated roads that have a poor level of service. The project design elements must cater for the needs of all persons: students, women, young adults, professionals, persons with disabilities, the elderly, and should be affordable.
- 4- On Institutional Matters: Lack of enforcement of the traffic law, illegal parking, traffic rules violations by all road users might be an impediment to achieving the project objectives. Furthermore, there is a general mistrust that the state institutions will succeed in creating and maintaining an operating system of mass transit.

Policy, Legal and Administrative Framework

The key institutions spearheading the Project are the CDR, MoPWT and RPTA in terms of design, construction, operation and maintenance. Key stakeholders who have a prominent role in supporting the implementation and ensuring the Project is implemented and operated in line with the rules and regulations are the MoIM through the TMO, the MoE and the MoC,

since site preparations will be required. The municipalities are pivotal stakeholders in the implementation, especially for the feeder bus network.

The applicable legislation is the responsibility of all stakeholders and actors to implement, starting with the Traffic Law No. 243/2012, Environmental Protection Law No. 444/2002, Law No. 37/2008 on Cultural Heritage, Law No. 58/1991 on Expropriation, Decree No. 8442/2002 and its amendment Decree No. 3054/2016 on Fuel Standards, and Law No. 220/2000 on the rights of persons with disabilities.

Provided that the Project will be financed through loans from the World Bank, and given the nature of the project that is classed as Category A, two safeguard policies apply, namely OP 4.01 Environmental Assessment and OP 4.12 Involuntary Resettlement.

Environmental and Social Baseline

Environmental and socio-economic aspects considered in this ESIA are as follows:

- Physical environment: emissions and air quality, noise, soil and geological setting.
- Landscape and biological environment;
- Socio-economic environment;
- Transport network and traffic; and
- Cultural heritage assets.

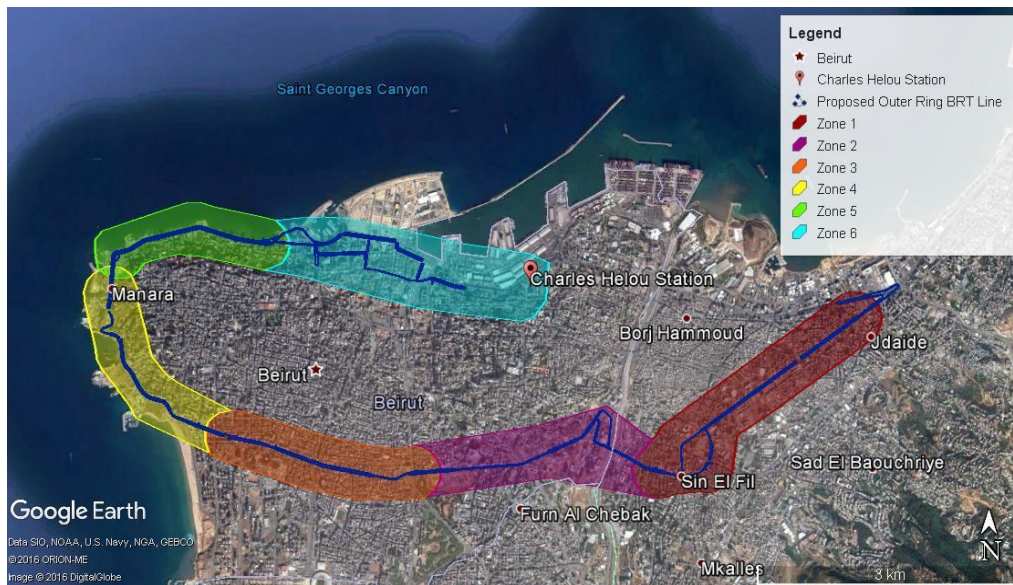
The baseline conditions were analyzed based on 1) a desk study and 2) baseline field investigations. The results of the field and desk surveys were documented in maps, photographs and text describing the existing state of the environment prior to the proposed operation of the BRT System components.

Overall Environment and Receptors

For the Northern Highway alignment from Tabarja to Beirut, each station was studied separately. Each of the two Beirut Outer and Inner Rings alignments or corridors was divided into several zones with respect to major avenues/ streets/ areas. In order to define the assessment study area, a walking distance of a 300 m radius buffer area was delineated surrounding each station. Receptors within each zone were identified.

Separate booklets were prepared to compile the findings of the baseline assessment. The descriptions include:

- Physical characteristics of the roads/highway where the BRT buses are planned to pass;
- Detailed GIS and Google Earth maps;
- Photographic records;
- A table providing information about the planned location of each station;
- Environmental, social, cultural and archeological points of interest surrounding the stations;
- General observations; and
- Links with other sites/ towns/ villages/ roads.



Proposed Beirut Outer Ring BRT Line and Assessment Zones



Proposed Beirut Inner Ring BRT Line and Assessment Zones

Traffic

The Project lies in the heavily urbanized and congested area of Greater Beirut. The dense nature of economic activities, housing, commercial, industrial and cultural attract a very large number of commuters on a daily basis.

The AM peak hour traffic volumes on the southbound routes in the Project study area range between 339 on Harissa Highway (feeder service) and 7,024 vehicles entering Beirut at Charles Helou. The PM peak hour traffic volumes on the northbound routes range between 304 on Harissa Highway (feeder service) to 4,797 vehicles on the Jounieh Coastal Highway. Public transport in Greater Beirut is not organized within a comprehensive system and lacks a regulatory approach. Beirut chronically suffers from lack of parking spaces. One of the main reasons that the road network is operating with a bad level of service is the existence of a

significant number of double park and illegal on-street parking spaces reducing the capacity of the road and blocking traffic circulation and even the sidewalks, where some cars park.

Emissions and Air Quality

The transport sector contributes 99% of the total CO emissions load, 62% of the total NO_x load, 4.8% of the total SO₂ load and 63% of the NMVOCs load. Passenger cars have the largest contribution to the emissions, since 85% of the Lebanese fleet consists of passenger cars. The road transport sector accounts for 40% of national consumption of fuel and emits 23% of national GHG emissions, contributed through urbanization, negative externalities of air pollution, traffic congestion and the old fleet of passenger vehicles. Privately-owned passenger cars are also the largest contributor to GHG emissions, with 27% of CO₂, 0.87% of CH₄ and 14.29% of N₂O. The annual increases in the contribution of the transport sector to GHG emissions between 1994 and 2011, on the order of 8%, 6% and 15% for CO₂, CH₄, and N₂O respectively are notable.

In terms of air quality, the ambient concentrations of NO₂, PM₁₀ and PM_{2.5} exceed the WHO and IFC EHS Ambient Air Quality Guidelines in and around Beirut. Hence, the coastal airshed is regarded as degraded. The coastal areas experience high levels of PM₁₀ which are correlated with sea breezes and dust carried over from the African and Arabian deserts. PM_{2.5} which constitutes 61% of PM₁₀ concentrations is related to local emissions from traffic congestion.

Noise

High population density and large fleet size exacerbate the problem of noise pollution. According to a survey of noise levels in the GBA and the perception of people, the results show elevated noise levels above the national standards all around the city. Transportation noise was perceived as the major source of annoyance by majority of the respondents in the urban setting.

Noise measurements were carried out over 15-minute intervals at 25 locations, as part of this study, reflecting daytime noise levels. Noise levels were measured near residential/commercial buildings and proposed bus stations to acquire baseline noise levels for the entire proposed BRT corridors - Northern Highway, Beirut Outer Ring and Beirut Inner Ring. All noise levels approach or exceed the Lebanese standards and the IFC EHS Guidelines, the existing noise levels throughout the project corridor fluctuate between 67 and 81 dB(A) by location, depending on site characteristics such as proximity to major roadways like Charles Helou Highway, and other noise sources, the relative elevation of roadways and receptors.

Geology, Soil, Groundwater and Seismicity

The topography of the area is flat on the coast, where the elevation ranges between 100 and 500 meters from the Mediterranean Sea to the west of the BRT, but becomes mountainous with increasing slopes east of the BRT corridor.

There are eleven (11) geological formations and Quaternary deposits outcropping in the study area. The surface water bodies that are crossed by the proposed BRT Corridor comprise two (2) perennial rivers and three (3) seasonal streams. The major aquifers in the Study Area are the Sannine-Maameltain Limestone formation (C4-C5) and the Miocene

Limestone Formation (mL). Both formations include karstic aquifers with groundwater mostly flowing through fractures and cavities. The general groundwater flow direction is to the west (towards the sea). Almost all the area crossed by the BRT Corridor is characterized by seawater intrusion due to overexploitation of groundwater along the coastal area.

Lebanon is located along the Dead Sea Transform Fault (DSTF) system which has several surface expressions, represented in major faults (Yammouneh, Roum, Hasbaiya, Rachaiya and Serghaya faults) and in uplifts as high mountainous terrain. The activity along the DSTF is evident from the seismic activity record. Recent work categorized the Lebanese section of the DSTF as being a strong seismic activity zone.

Landscape and Biological Environment

While the BRT System lies within a heavily urbanized area, some system components such as the Park and Ride (P&R) facilities will be located on empty plots of land that are vegetated, however non-productive.

No areas of special concern (world heritage sites, wetlands, biosphere reserves, or protected areas) are located in the vicinity of the sites or along the median strips. Neither endangered species, nor critical ecosystems/ habitats were recorded during the field visit. The plants observed at the P&R facilities are mostly weeds and signs of degraded habitats such as *Ricinus communis*, *Chrysanthemum coronarium* and *Notobasis syriaca*.

The existing median strips along the Tabarja-Beirut alignment mainly consist of exotic ornamental plant species such as palm, Washingtonia, eucalyptus, olive trees and others. Those species have no ecological value but have an important positive impact on local air quality and aesthetic value given their presence in congested urban areas.

The median strips along the Beirut Outer Ring mainly consist of exotic ornamental plant species such as palm, Washingtonia trees and other trees, shrubs, and herbs. Those species have no ecological value but have an important positive impact on local air quality in the different areas. Some native coastal plants are observed in the median strip along Corniche Al Baher in Beirut. A highly-regarded vegetated median strip is located on the seaside next to AUB campus in Beirut.

No faunal species or any traces of fauna were observed during the field visit except for pigeons and birds which are adapted to cities. All the sites are situated in urban areas and are not expected to support faunal species.

Socio-economic and Mobility Aspects

According to the latest statistics Lebanon's resident population is estimated to be 5.988 million (2016), of which 75.8% is urban population (2.226 million in the capital city of Beirut in 2015). It is important to mention that this number includes refugees, since due to the latest Syrian war crisis, it is assessed that 1.19 million refugees currently reside in Lebanon (mid-2015). The mass influx of Syrian refugees in Lebanon is one of the main challenges that Lebanon is facing today.

The average annual population growth rate is 6.0% (2010-2015) while the urban annual population growth rate in the same period is 3.2%. In spite of the fact that currently there is a positive trend for population growth, future estimates show decelerating and decreasing pattern of population growth. This suggests that by mid-century Lebanon will possibly have

an aging population, with larger proportion of the decreasing population (-4.1% between 2015-2050) living in urban areas. Based on the latest national survey in 2009, 10.8% of the population live in Beirut, 27% in the suburbs of Beirut and 15.8% in Mount Lebanon. The governorate of Mount Lebanon accounts for the largest share of the population and the governorate of Beirut is ranked 5th in terms of number of inhabitants, however the city of Beirut being the capital is the major economic pole in the country.

The Lebanese population is young, with 44% of residents below 24 years of age. Statistics show that the households in urban areas are relatively small, with 54.7% in Beirut having members between 1 and 3. In 2014, the national GDP was USD 49,631 million; annual growth rate of 2% and per capita income of USD 8,844. The Services sector is the largest contributor to the national GDP i.e. 73.2% of the Gross Value Added, followed by Industry (23.6%) and Agriculture (3.2%). It is also estimated that 73% of the population have access to the Internet, while 71 per 100 people have mobile-cellular subscriptions.

The traffic conditions in Lebanon are known for facing infrastructure challenges, congestion, and deteriorating quality of already mismanaged public transport services.

Public transport modes are available in Lebanon; however, they are characterized by being unreliable and in most cases improperly distributed over the market. The city of Beirut is over-served compared to the demand, resulting in severe competition among operators, while other cities have shortage of public transport services. The available public transport means are not facilitated with the proper infrastructure to make them accessible by the public; ultimately resulting in the utility of -the only reliable option- private vehicles. According to the RPTA, the approximate number of passengers using public transport in 2014 was 1,213,268, based on 19,112 and 18,033 morning trips and evening trips respectively. The infrastructure and facilities such as bus stations, dedicated taxi-spots and proper scheduling of the available systems are almost absent in Lebanon.

Mobility cost in Lebanon is estimated to be around US\$ 50/veh.km or US\$ 42/pass.km. . It is important to note that the road transport sector in Lebanon is one of the largest energy consumers (27.42% of national energy consumption). This reflects the economic burden of the transport sector not just on the public but also on the national economy. Increase in availability of properly managed public transport systems would tackle the three components of mobility cost through the reduction of pollution, less fuel consumption due to less utility of private cars, and reducing ownership costs. The annual household expenditure on transportation is the third largest (13.11% of total expenses) after Housing expenses (28.36%) and Food (20%).

It is estimated that 40% of the total road fatalities are pedestrians killed in traffic accidents, compared to 10% in developed countries. Statistics show that the number of fatalities is about 600 per year or 17 per 100,000 inhabitants. Absence of sidewalks, expansion of roads at the expense of sidewalks and improper sidewalk arrangements and maintenance are the main reasons causing pedestrian accidents.

In 2011, there were 1.446 million vehicles in Lebanon or 330 vehicles/1,000 population making it the third highest in the region after Kuwait (426 vehicles/1,000 population) and Bahrain (347 vehicles/1,000 population).

The age distribution of the vehicles reflects the old nature of the fleet (i.e. 71% older than 10 years). The size of the fleet and the old nature also impact negatively the public transport. Average age of the shared taxis "service taxis" which are privately owned is about 20 years old, and other public transport vehicles being more than 10 years old. All transport modes of private/public buses, minivans, taxis have low occupancy rate of 1.2 passengers for taxis, 6 for vans and 12 for buses; average of 1.7 for passenger vehicles. These conditions result in high energy demand by the transport sector; 3.08 MJ/pass.km or 15.06 GJ/capita.

Driving patterns and conditions also reflect the efficiency of road transportation. The average speed in GBA is around 18 km/hr and decreases to <10 km/hr in peak traffic conditions.

Currently, there is a functioning, mostly informal mass transit system that consists of private station operators and bus drivers who run one or more buses in the same area of operation of the BRT and its feeder network.

The survey of operators described the routes, fleet sizes, number of roundtrips per day and passengers, along with the fares demanded. A round-up of the surveyed figures shows:

- 1- 1,414 buses that do 3,501 round trips per day, carrying 136,371 passengers per day, and collecting a gross revenue of 234,316,000 million LBP per day (156,211 USD per day)
- 2- 2,935 minivans that do 17,088 round trips per day, carrying 372,539 passengers per day, and collecting a gross revenue of 398,354,000 million LBP per day (265,570 USD per day)

The daily turnover of the current mass transit system in the study area is at least 421,780 USD. A back-of-the-envelope calculation of the annual profits of a bus operator that rents a bus, hires a driver, pays for diesel and pays for a stop in an illegal bus station, and the bus would operate for 27 days per month, can reach at least 11,000 USD/year.

The socio-economic inductive study was conducted via an initial opinion survey, focus group meetings to gauge social perceptions, and interviews with key informants.

The purpose of the initial survey that was conducted during the scoping phase was to collect background information about the current modes of transportation and the public's opinions regarding uptake of public transport in the Project area. A total of 60 questionnaires were filled. The opinion census results showed the willingness of the Lebanese population to use public transport and a rather strong awareness of the benefits of a well-managed public transport system.

Four (4) types of focus groups were identified for the focus group meetings as follows:

- 1- Persons with commercial interests along the BRT routes (northern highway, outer and inner rings) – this branched into two (2) meetings according to geography:
 - a. Meeting conducted at the training center of Beirut and Mount Lebanon Chamber of Commerce, Industry and Agriculture (CCIA-BML) with Beirut commercial establishments; and

- b. Meeting conducted at ELARD offices with Metn and Kessrouane commercial establishments.
- 2- Syndicates and Public Transport Unions (meeting conducted at ELARD offices).
 - 3- General public where persons were selected such that they represent the social fabric from all walks of life – women, men, elderly, students, etc. Three (3) focus group meetings were conducted with the general public:
 - Focus group meeting with Metn public (meeting conducted at the El Saydeh Church parish in Sin El Fil);
 - Focus group meeting with Kessrouane public (meeting conducted at Saydet al-Maounat parish in Haret Sakher); and
 - Focus group meeting with Beirut public (meeting conducted at the Municipality of Beirut).
 - 4- Persons with Disabilities (PwDs) (meeting conducted at Arc-en-ciel Non-Governmental Organization (NGO).

NGOs (representing the civil society), mainly working on the public transport sector were invited to the four (4) types of focus groups listed above. A total of seven (7) focus group meetings were held during the months of February, March, April and May 2017.

Due to low turnout of representatives of public transport syndicates and commercial establishments, specific meetings were requested with representatives who agreed to meet and express their views. A third interview was held with an operator in the Dora station to understand the dynamics of the informal mass transit system.

Land

The BRT Corridor will occupy the road right of way along its trajectory, and hence there is no change in land use along the corridor. Nonetheless, in some areas along the highway in the northern corridor from Nahr el Kalb to Tabarja there is a need to expropriate approximately 235 m² of private lands to accommodate the pedestrian infrastructure of the stations along the sidewalks.

The BRT Corridor in the Outer and Inner Rings is entirely located in the right of way, and no land use change or acquisition needs arises.

The P&R facilities will be placed on publicly-available land which have been assessed to have no productive value. One of the P&R facilities in Kfrayassine has five illegal households with a total of 26 persons and some fruit trees.

The bus depot in Safra and bus terminal in Wata Slem, Tabarja will be located on privately-owned plots 14,000 m² (1 plot) and 6,000 m² (3 plots and part of a fourth plot). The plots have no productive activities or housing. Nonetheless, the depot and terminal locations are non-built areas, and the creation of transport infrastructure that will become a hub for commuters and a whole fleet of buses might change the land use in the area.

Land acquisition procedures and compensation estimates are fully evaluated in a Resettlement Action Plan (RAP) prepared in line with Law No. 58/1991 and World Bank OP 4.12.

Cultural Heritage

Given the richness of the Lebanese territories with archaeological riches and cultural resources, it is important to investigate whether the Project's construction works might adversely affect or unearth archaeological remains with cultural and historical value. The Project's footprint area, available at the time of the study, was shared with the Directorate General of Antiquities (DGA) to advise on potential areas of interest from an archaeological perspective.

The cultural points of interest along the BRT route were highlighted using information from desk research and field surveys to pinpoint the locations of museums, galleries, neighborhoods of cultural value, etc. whose locations might be sought by future system users, and hence the bus route would be used as a means to promote cultural tourism.

Analysis of Alternatives

No Project Alternative

Without the BRT project, the population of almost 2.2 million residing in Greater Beirut and the larger urban population that commute to Beirut from the northern areas will not benefit from a sustainable, efficient, advanced and safer transport system. The urban population which is in continuous growth (87% of total population in 2050) will continue to suffer from traffic congestion, traffic accident risks, and unreliable public transport systems. The dominant transport mode would continue to be the private passenger car, while contributing to overloading the capacity of existing roads, increasing pollution levels and GHG emissions, and increasing the overall cost of mobility.

Without the dedicated BRT corridor, the buses would be stuck in mixed traffic, without dedicated stations for passengers and regulated timetables. Ultimately, it is expected that there would be no improvement in the level of service that a public transport system would provide, with adverse impacts on quality of life and the environment.

Elevated BRT Corridors

BRT corridors running in the median highway can be constructed on separate elevated roads or underground viaducts as an alternative to ground-level structures. Due to the complexity of the underground system and the archaeological potential in Lebanon, only the elevated system is considered as a potential alternative and compared to the current project.

Elevated systems can have relatively high construction costs, due to the additional requirement of raw material and complexity of the engineering, especially in already developed urban settings. Elevated roads are preferred where there are a lot of intersecting roads with the main corridor and the construction area not already developed. No additional lane is gained by having elevated structures since the columns holding the road will be occupying the space, especially in the case of construction at the median section of the road.

Nonetheless, the elevated road option is advocated by the local authorities and municipalities in the Kesserouan area. A feasibility study to evaluate the elevated road option is currently being pursued by the CDR.

Bus Technology Alternatives

Most common buses operate on diesel fuel. Advanced models are equipped with Diesel Particulate Filters (DPF) and Selective Catalytic Reduction (SCR) technology. There are other more advanced technologies that operate on biodiesel, compressed natural gas (CNG), diesel-electric (Hybrid), electricity using overhead electric wires (Trolley) or rechargeable batteries, and Hydrogen (Fuel Cell) to name a few.

Trolley buses are not considered in the comparison, since the capital cost of the buses are high and require a high-cost infrastructure of overhead wires and connecting poles in addition to constant electricity supply, which is a challenge in current circumstances in Lebanon. Other fuels also require some sort of requirements but mainly the supply of fuel. Hybrid, Biodiesel and Diesel (with DPF) require similar facilities to provide the fuel. Natural Gas and Fuel Cell buses need specific storage and supply systems that often increase the capital

cost of these systems. Since natural gas infrastructure is not realized in Lebanon, buses running on natural gas may not be realistic for the short to medium term.

The choice of diesel buses for the BRT System of this Project stems from the examination of available infrastructure and availability of fuel types in the local market. It is recommended to settle for a known and tested bus technology, provided that new buses are procured that run on energy-efficient engines (Euro V or Euro VI), are equipped with DPF and SCR technology to reduce PM and NOx emissions, and use ultra low sulfur diesel in conformity with the national specified standards.

Potential Environmental and Social Impacts

The identification and analysis of impacts consists of appraising the design information submitted by the Project Proponent, in conjunction with the baseline information of the site. A single matrix was developed to summarize the impacts expected during the construction and operation phases. The matrix describes the potential impacts through identifying the sources/activities and the pathways through which these impacts affect receptors (environment/human).

The identified environmental and socio-economic impacts are assessed in terms of their Significance (Low, Moderate or High) based on the Likelihood (Low, Moderate or High) of the impact and its Consequence (Insignificant, Minor, Moderate, Major, Critical and Beneficial). A number of considerations are built into the Impact Consequence Criteria including nature, direction, magnitude, geographical extent, timing, duration and reversibility of the impact as per the MoE Decision No. 261/1/2015.

Sources of Impacts and Potential Impacts during the Design/Pre-Construction Phase

Sources of Impacts during Design/Pre-construction	Potential Environmental and Socio-economic Impacts
<p>Poor integration of the BRT System with current public transit services, other public transport systems to be introduced in the future, or the surrounding environment</p>	<ul style="list-style-type: none"> • Public outcry and frustration from insufficient or disintegrated services that do not meet the long-standing demand for an efficient and reliable public transport system • The current design of stations' separating distances of 850 m on the northern highway, 700 m in the Outer Ring and 500 m in the Inner Ring encourages users within 400 m radius to exercise as they walk to the stations • Poor integration of the infrastructure with the local transit needs and cityscape might lead to poor uptake of the new BRT services, especially if the design of stations, bridges and surrounding infrastructure are not user-friendly for all people, appealing or safe for vulnerable groups such as women, youth, special needs persons and the elderly • Potential visual impact resulting from constructed facilities of the BRT System that do not improve the fabric and aesthetics of the urban space • Non-inclusion or weak integration of the current public transport service providers in the BRT System might create social unrest among operators due to foreseen competition for passengers and road space • If the level of service of BRT feeder buses are sub-standard to the BRT trunk line itself, or if pedestrian infrastructure connecting P&R facilities and stations to neighborhoods and satellite/commuter towns are not upgraded and/or designed to meet the different social needs of users, commuters, especially women, people with special needs or limited mobility, students, the elderly, etc. might be discouraged to undertake journeys in the BRT System • Poor or lack of allocation of sufficient space for commuters who alight from or wish to board other vehicles at stations might lead to tailbacks on the right lanes and reduce the level of service on the road
<p>The reserved width of the BRT-dedicated lane on both sides of median of the northern highway between Charles Helou & Tabarja is 8.3 to 11.8 m</p>	<ul style="list-style-type: none"> • On the medium to long-term, it is anticipated that the BRT System would attract more customers who will make the switch from private vehicles to using the bus, thus contributing to reduced congestion and better level of service along the highway • Decreasing the width of the road which currently witnesses heavy congestion at most times, and not exclusively during peak hours, will lead to public opposition in the short to medium-terms as reduced congestion might only be gradual as private vehicle users switch to using the BRT System
<p>Introduction of the BRT System in the section of the northern highway between Nahr el Kalb and Tabarja requires:</p> <ul style="list-style-type: none"> - Widening of the A1 Highway between Dbayeh and Tabarja to a 3 by 3 lane road 	<ul style="list-style-type: none"> • Widening bridges or constructing new ones are associated with localized impacts on the local environment (debris, construction-related impacts) and the canyons underneath that can however be mitigated, with special attention to the neighboring Roman Bridge • Poor coordination of construction work schedules for A1 Highway widening and BRT-associated construction works along the intersecting sections between Nahr el Kalb & Tabarja would lead to

Sources of Impacts during Design/Pre-construction	Potential Environmental and Socio-economic Impacts
<ul style="list-style-type: none"> - Widening of Ghazir and Casino du Liban bridges by 4.6 m 	<p>multiple bottlenecks, cause social nuisance and lead to increased noise and air emissions from vehicles idling in standstill traffic</p> <ul style="list-style-type: none"> • Impacts from widening the A1 Highway are manifold and are examined separately in an EIA and Land Acquisition and Resettlement Plan, prepared by the CDR (www.eib.org/attachments/pipeline/20090635_eia_en.pdf). The impacts from the land acquisition due to widening are addressed in the Expropriation decrees for the A1 highway widening. • The land acquisition and resettlement impacts associated with the BRT pedestrian bridges are analysed in the Resettlement Action Plan document, separate to the ESIA Report. Impacts include partial land expropriation of a total of 235 m² for the road widening without any land fragmentation, approx. 14,000 m² for the depot in Safra, and 8,000 m² for the terminal in Tabarja. All affected lands are non-productive. Some fixed assets such as steel containers and planted trees will be removed and compensated accordingly. Five households illegally occupying state-owned land in one of the P&R facilities in Kfaryassine will be displaced, however compensated in accordance with the provisions of Expropriation Law No. 58/1991.
<p>Introduction of the BRT System in the Beirut Outer Ring necessitates that:</p> <ul style="list-style-type: none"> - 1,200 on-street side parking spaces are axed - Due to road layouts, some sections cannot be dedicated – such as in tunnels from Ain el Tineh to Adlieh, Sin el Fil & Dekwaneh, Dbaibo between Ain el Mreisseh & Raouche - 2 m of the coastal sidewalk (Corniche) be removed - Street furniture, signals, stop signs and traffic lights, and road marking be upgraded to accommodate the BRT System with its stations 	<ul style="list-style-type: none"> • Improvements to road infrastructure is anticipated to enhance road safety. However, since regular buses and taxis will continue to operate on the road lanes next to the BRT lane, continuing to allow passenger-driven road habits of hailing taxis and buses to stop at undesignated locations, as well as pedestrians crossing at unmarked locations through inadequate road design to accommodate different uses and demands, might not bring about the foreseen benefit enhanced road safety. Hence road infrastructure upgrades should solve the cumulative impact from chaotic road usage by addressing the road design of all stretches that the BRT buses and their feeders intend to service • On the medium to long-term, and if public parking lots with limited spaces are made available, it is expected that fewer private vehicle journeys are made into the Greater Beirut Area that is served by the BRT and its feeders, leading to higher parking fares, fewer fuel consumption and pollutant and GHG emissions per commuter • Mixed traffic lanes might lead to bottlenecks and discourage the use of the BRT System for some users, due to increase in journey time, and rise in collision risks in mixed traffic sections • On the short-term, the removal of on-street side parking is anticipated to create social dismay and unacceptance from private vehicle owners, local shops' and business owners, and violations of stricter street parking rules are expected to increase. Enforcement of strict no-parking and no-stopping rules with fines should induce on the medium-term a disincentive to drive private cars into the city for routine journeys, and guarantee free flow on the roads adjacent to the BRT lane • Given the high recreational and amenity value of the seafront promenade, narrowing the sidewalk might induce public opposition to reducing the free, open air public space that is

Sources of Impacts during Design/Pre-construction	Potential Environmental and Socio-economic Impacts
<p>Introduction of the BRT System in the Beirut Inner Ring necessitates:</p> <ul style="list-style-type: none"> - Removal of approx. 1,500 on-street parking spaces on the right hand side, to be replaced with a dedicated BRT bus lane - Only one lane in some stretches remains available for through traffic, and in some stretches the bus would move in mixed traffic - Dedicated lanes not to be physically separated from the rest of the road to enable traffic movement from side streets into and out of residential neighbourhoods, which would however cross-over the dedicated bus lane at numerous points 	<p>revered by the city dwellers, and which is a touristic attraction in its own right</p> <ul style="list-style-type: none"> • The Inner Ring route traverses areas in the heart of the city of Beirut with a marked presence of schools, universities, hospitals, government agencies, social welfare organizations esp. for persons with special needs, cultural centers and museums/galleries, entertainment hubs, shopping areas, restaurants, public parks, etc., hence an improved bus service with marked stops, good level of service roads, with safety features, no on-street parking and upgraded pedestrian infrastructure to residential neighborhoods, commercial areas, educational institutions, etc. should be expected to attract students and inter-city commuters on short journeys, and contribute to less traffic congestion during peak hours • Introducing a bus service within the city might result in less trips demanded from shared taxis, within the zones that the bus and its feeder buses would service • Given the nature of the highly-dense and interwoven inner city streets, the maneuverability impacts from having a dedicated bus lane in the Inner Ring are too restrictive for local traffic, and direct access to residences and small businesses on the right-hand side of the road • While medium to long-term impacts from removing on-street parking spaces are positive for calmer circulation of vehicles on the inner city roads, most parking spaces are used by residents who do not have parking spaces allocated in their residential buildings or neighborhoods, hence, unless alternative public/resident parking garages are made available by the Municipality of Beirut by the time that the BRT bus runs, city dwellers on the Inner Ring route would not have sufficient spaces to park their vehicles • Mixed traffic lanes might lead to bottlenecks and discourage the use of the BRT System for some users, due to increase in journey time, and rise in collision risks in mixed traffic sections
<p>Bus fleet and Operability</p>	<ul style="list-style-type: none"> • Bus size, engine, fuel used, and running frequency influence the assessment of air and noise emissions; which based on the selected technology they will be reduced. The expected reduction in private vehicles trips or trips made in passenger cars is also anticipated to influence the net emissions budget. • The size of the bus, its amenities, frequency of running, operating staff, ticketing system, fares, safety provisions for boarding, disembarking and using the buses by all persons will affect acceptability and take-up. Larger buses within the city of Beirut are expected to be refused by the city dwellers. Low-emission, clean and safe buses that operate on fixed schedules and routes are a key feature that are expected to impact social acceptability and participation.

Sources of Impacts and Potential Impacts during the Construction Phase

Sources of Impacts during Construction	Potential Impacts during Construction
Site clearance, grading, excavation and paving activities, which involve mobility of personnel and mobilization/ operation/ demobilization of Powered Mechanical Equipment (PME)	<ul style="list-style-type: none"> • Temporary visual impacts with the presence of equipment, machinery and workers • Increase in air pollution, including Airborne particulates (dust) from soil disturbance • Increase in vibration and sound levels • Soil disturbance and potential impacts on land conditions and groundwater resources (e.g., changes in water drainage, erosion, runoff, sedimentation, grading) • Induced potential secondary development during construction in the surrounding areas • Accidental unearthing/disturbance of archaeological artefacts • No major impacts from construction works are anticipated on species of fauna and flora and their habitats given the primarily urban nature of the project area • Exposure of workers, pedestrians and passengers to potential asphalt odor and hazardous fumes during paving activities
Improper handling and storage of construction materials/raw-material as well as accidents:	<ul style="list-style-type: none"> • If construction works are not properly conducted and managed with safety measures considered, people passing near the construction site could be at risk • Impacts resulting from any dewatering activities • Impact on workers' and pedestrians' safety resulting from improper handling and storage of construction material and construction activities
<ul style="list-style-type: none"> • Traffic accidents • Pipeline and/ or storage tanks fracturing, leakage, as well as explosion and fire hazards • Potential sabotage (risk assessment and emergency response) • Presence of: equipment, materials, soil heaps, and borrow pits, on main existing roads and the highway near commercial and industrial establishments and residential units 	<ul style="list-style-type: none"> • Impact on the public's nuisance, health and safety in the heavily congested and dense corridors of Beirut and the coastal areas in the districts of Metn and Kesseruon
<ul style="list-style-type: none"> • Potential loss of trees and vegetation in the median strip and highway shoulder 	<ul style="list-style-type: none"> • Poor landscape and visual amenity, and less greenery in the local urban environment
Potential use of gensets (combustion of fossil fuel for the operation of the gensets)	<ul style="list-style-type: none"> • Change in ambient air quality
Workers' exposure to noise, dust and occupational	<ul style="list-style-type: none"> • Increased risks of accidents and health problems

Sources of Impacts during Construction	Potential Impacts during Construction
<p>hazards</p> <p>Closing sections of the highway and creating detours to allow construction works and the movement of vehicles to transport people and materials</p>	<ul style="list-style-type: none"> Increased peak and off-peak traffic volumes at bottlenecks that will negatively impact people's daily activities (delays to reach destinations, discomfort, increase in noise levels, etc.) Potential negative impact on businesses (i.e. shops, markets, restaurants, cafes) on the highway resulting from temporary loss of customers or delays
<p>Improper storage of chemicals and generated waste on-site</p> <p>Accidental spillage of chemicals like fuel, lubricants, oils and other chemicals used for construction works and/or operating the equipment and/or generating power</p> <p>Inadequate management (handling and disposal) of solid domestic and construction waste (including empty cement bags, piles of sand and dirt due to excavation, etc.), and generated domestic wastewater</p>	<ul style="list-style-type: none"> No major impacts from construction works are anticipated on species of fauna and flora and their habitats given the primarily urban nature of the project area Chemical and biological contamination of soil and water resources Impact on workers' and pedestrians' safety resulting from improper handling and storage of chemicals and solid waste generated related to construction activities
<p>Asphalt application during the paving phase of the exclusive BRT lane construction</p>	<ul style="list-style-type: none"> Exposure of workers, pedestrians and passengers to potential asphalt odor and hazardous fumes during construction activities
<p>Impacts resulting from poor implementation of a Traffic Management Plan during the construction of the BRT system</p>	<ul style="list-style-type: none"> Since significant part of the project involves construction on existing traffic routes, the successful or poor implementation traffic management plan will have tangible impacts on the existing traffic and the public using this traffic route

Sources of Impacts and Potential Impacts during the Operation Phase

Sources of Impacts during Operation	Potential Impacts during Operation
<p>Operation and maintenance of the BRT System</p>	<ul style="list-style-type: none"> • Enhancement of mobility for domestic and international tourists and highlighting of touristic and cultural heritage features along the bus route, which leads to the promotion of landmarks, museums and heritage assets • Enhancement in mobility, road infrastructure and furniture: signage, road markings, signals, crossings • Local small business development around bus stations to serve commuters • Local public transport development around bus stations to further serve commuters (e.g. taxis) • Socio-economic growth in the areas that have access to the BRT system through direct/indirect employment opportunities, increase in land value and attraction of development investments • Short-term to medium-term potential decrease in traffic flow and speeds, and therefore increased congestion due to fewer lanes available for vehicular traffic, in the transition period until commuters switch to using the BRT System and become regular users • Traffic creation at P&R facilities and at bus stations if passages and side road infrastructure within localities are not upgraded • Short-term to medium-term potential increase in fuel demand due to the additional buses added to the fleet in the transition period until commuters switch to using the BRT System and stop using their cars • Resource consumption for the operation of the buses and maintenance activities • Potential soil contamination from accidental spills during maintenance and fueling activities (e.g. fuel, lubricant or oil used for the maintenance) • Increase in noise levels especially during nighttime bus traffic • Hazardous and non-hazardous waste generation from maintenance activities • Solid Waste generation by passengers and operating personnel at stations and P&R facilities
<p>Switching to BRT System from other modes of transportation (reduction of number of vehicles)</p>	<ul style="list-style-type: none"> • Potential reduction in GHG emissions • Potential reduction in emissions of air pollutants (CO, NOx, PM₁₀, SO₂) and GHGs • Organization of the public transport sector would lead to reduction in traffic incidents thus road fatalities and injuries are reduced • Time and monetary savings for users switching from use of private vehicles to the BRT running on a dedicated lane, with set time schedule and intelligent transportation system

Sources of Impacts during Operation	Potential Impacts during Operation
	<ul style="list-style-type: none"> • Higher rates of physical activity for BRT users due to longer walking distances which results in health benefits for BRT users • Reduction in number of passengers using the current buses, thus reduction in passenger turnover and reduced incomes to current bus drivers due to passengers switching to the new BRT System
Provision of well-lit stations staffed with security personnel, security cameras on buses and in stations/P&R facilities, and pedestrian-scale lighting around stations	<ul style="list-style-type: none"> • Creation of a safer environment in the areas served by BRT System • Better road and community safety due to both safer commuting and reduced exposure to road-traffic pollution

Given that the Project is at the feasibility stage and the System components will be subject to detailed design, it is imperative that the environmental and socio-economic mitigation and monitoring measures be revisited through site-specific ESIA (with ESMPs). The site-specific ESIA for the System components, i.e. BRT Corridors, Feeder Buses, P&R facilities, Depot and Terminal, reflect the final design and provide an update of the assessments and conclusions of this ESIA where needed (including baseline, assessment and mitigation measures) to address any gaps that could arise from the detailed design. The site-specific ESIA should include:

- a. **Livelihood Restoration Plan (LRP):** Inclusive of a detailed socio-economic baseline of affected bus operators and businesses subject to temporary disruption with detailed measures to mitigate risks and impacts arrived at through consultation with the PAPs.
- b. **Physical Cultural Resources (PCR) management plan:** a detailed plan should be prepared as part of the site-specific ESIA to meet OP 4.11 requirements, in close coordination and consultation with the Directorate General of Antiquities, once the exact physical footprint and excavation depths for all affected plots are determined.
- c. **Ambient air quality monitoring program:** Empirical primary data needs to be collected on ambient air quality immediately before and throughout BRT System operation, in order to gauge the anticipated positive environmental benefit.

Environmental and Social Management Plan for the Design/Pre-Construction Phase

Source of Impact	Project Activities	Mitigation Measures
<p>T.D.1. Impacts resulting from road closures, bottlenecks due to road works to construct the BRT</p>	<p>Design of Project implementation & construction</p>	<p>T. D.1 mitigations include:</p> <ul style="list-style-type: none"> a. For the northern highway, the construction of the Périphérique, A2 and the implementation of the A1 Highway widening project are crucial to reduce the impact of the BRT construction, which will require the closure of at least one lane of the existing network. b. The bidders for the Construction Tender should be required to submit a Traffic Management Plan for the construction, and the quality of the TMP should be one of the criteria to be considered in the selection process of the contractor. The TMP should be shared with stakeholders and relevant authorities to inform communities when necessary and prevent additional disturbance to already congested traffic flow. The TMP should include the following considerations: <ul style="list-style-type: none"> i. Ensure the diversion to alternate routes wherever possible will minimize traffic jams and bottlenecks and minimize traffic related accidents; ii. Lane availability and minimization of traffic flows past the works site; iii. Acceptable working hours and constraints, avoiding peak hours or public holidays whenever applicable; iv. Agreement with local authorities on time scale for works and traffic delay requirements; v. Identify road closures and prioritize order; vi. Co-ordination with other planned road works; vii. Establishment of incident management system for the entire duration of the works depending on the location. c. The proposed Construction Management Plan of the selected contractor should show a compact construction phase as much as possible, and night shifts should be included in the construction program. d. For the Outer and Inner Ring BRT lines, providing off-street parking to replace on-street parking is very important before the construction work. However, the time between the completion of these parking spaces and the beginning of the BRT implementation should not exceed one month in each area for residents and the workers not to get used to the high parking availability.
<p>ACH.D.1 Potential damage to uncovered archaeological features during excavation</p>	<p>Design of Project implementation & construction</p>	<p>ACH.D.1. The Directorate General of Antiquities (DGA) should be notified of the exact locations where site works will occur and should be involved in the decision-making process during the planning phase of the project (Article 19, Law 166/LR of 1933), impacts on uncovered archaeological features will be reduced. This will allow to:</p> <ul style="list-style-type: none"> a. Institute the necessary measures that need to be considered in order to alleviate and mitigate any negative impacts on cultural heritage and archaeology; b. Identify sensitive areas prior to starting groundworks, and when possible relocate project components;

Source of Impact	Project Activities	Mitigation Measures
		<ul style="list-style-type: none"> c. Guarantee the application of the necessary measures for each project component and location; d. Take into account the possible delays due to archaeological excavation and add them to the BRT construction schedule; e. Determine the needed budgets to conduct any needed archaeological excavation works, studies and publications; f. Set the technical specifications and the tendering procedure.
SE.D.1 Impact on other secondary public transport systems	Design of Project implementation & construction	SE.D.1 The preliminary assessment of the project already considered the wider Land Transport Sector Strategy that has been recently developed by the Ministry of Public Works and Transport (MoPWT). Thus reducing the chances for any conflict with future public transport developments
SE.D.2 Impact on city aesthetics caused by pedestrian bridges, bus stations, depots, terminals and pedestrian traffic	Design of Project implementation & construction	<p>SE.D.2. Mitigation measures to improve visual amenity include:</p> <ul style="list-style-type: none"> a. Preserving and maintaining the landscaping of the entire system and promoting tree planting and homogenous visual design (signs, street lights, sidewalks, etc.) with the city design; b. Ensure all future advertisement plans have a protocol and are integrated at different facilities and installed on buses without causing disturbance to commuters; c. Develop a contemporary architectural design for all different components of the project while considering cultural values and the general aesthetics of the GBA.
SE.D.3 Land use, land acquisition and resettlement impacts	Design of Project implementation	<p>SE.D.3 Mitigation measures to adequately prepare for change in land use, land acquisition and resettlement impacts include:</p> <ul style="list-style-type: none"> a. Evaluation of land acquisition procedures and compensation estimates in a Resettlement Action Plan (RAP) prepared in line with Law No. 58/1991 and World Bank OP 4.12 b. Assessing the impacts from the anticipated change in land use in the bus depot and terminal areas through a separate SEA study.
SE.D.4 Improper system design that does not accommodate persons with special needs and disabilities	Design of Project implementation	SE.D.4 The design of the BRT system both in terms of infrastructure and bus fleet should be in accordance to Law No. 220/2000 and its application Decree No. 7184/2011; relevant articles and design details are discussed in Section 3.2.1.2.9
SE.D.5 Inflexible system design that does not allow future expansion of the system to cover other areas	Design of Project implementation	<p>SE.D.5 The current design of the system serves the areas with high demand should also consider:</p> <ul style="list-style-type: none"> a. facilitating the integration of the system with existing bus networks that links Tripoli (north), Chtaura (east) and Saida (south); b. facilitating the expansion of the system in terms of road networks with potential demand increase in the future;

Source of Impact	Project Activities	Mitigation Measures
		<ul style="list-style-type: none">c. facilitating the integration with other long term public transport plans (e.g. the railway project);d. operation of the P&R facilities that would help commuters to use their private vehicles to reach to the closest point to the BRT system and continue their journey towards Beirut.

Environmental and Social Management Plan for the Construction Phase

Source of Impact	Project Activities	Mitigation Measures
T.C.1. Increased traffic due to creation of detours during construction	During various construction activities that require traffic management	<p>T.C.1 Besides the strict implementation of the measures T.D.1.a & T.D.1.b,</p> <ol style="list-style-type: none"> Management measures should include that any total closure of a road has to be published 2 weeks ahead, and information panels should be placed on the concerned road 1 month in advance. Those closures should be during off peak hours and at night if possible; adequate information signs should be placed 1 km before the closed road or as required on the surrounding road network if it is in the city. The possible detours should be mentioned on the information signs. Full cooperation of the Construction contractor with the Internal Security Forces and Traffic police Transfer services using water taxis, ferries from sea ports should be considered
AQ.C.1. Airborne particles (dust) from soil disturbance	Construction works (excavation, grading, movement of trucks, etc.)	<p>AQ.C.1/AQ.C.2. Control measures for dust emissions:</p> <ol style="list-style-type: none"> Water for any earth moving close to the construction site to prevent visible dust emissions; Using water in excavation works and milling (removal) of existing asphalt to suppress dust propagation; Continuous application of water of disturbed surfaces that cannot be stabilized; Water unpaved roads that is used for vehicular traffic and limit vehicle speed limits; If water is not available segregation barriers (easily erectable boards 2.5m) should be applied to separate the construction works from sensitive receptors; specifically, at the median construction sites, the bus depots, P&R facilities; Minimize large stockpiles of soil and excavation material, and whenever necessary enclose with side barriers and/or cover when not in use; Soil and construction material that are susceptible to dust formation should only be transported in securely covered trucks. <p>AQ.C.2/A.C.3. Control measures for vehicular and equipment emissions:</p> <ol style="list-style-type: none"> Periodically check and conduct maintenance of the construction machinery and vehicles; Regularly check engine oil and use engines/machinery/equipment with good efficiency and fuel combustion characteristics; Use of catalytic converters and good quality fuels (Low Sulphur); Stack height of generators should be at least 3 meters above ground; Ensure availability of trained technicians and operators on site Air quality monitoring at the project site during construction activities; Conduct paving activities during off-peak hours to minimize exposure of receptors to odors, and use advanced application methods and machinery with built in exhausts;
AQ.C.2. Fugitive emissions during construction works and odors from paving activities	Construction works (earth works, paving, piling, machinery, etc.)	<ol style="list-style-type: none"> Use of catalytic converters and good quality fuels (Low Sulphur); Stack height of generators should be at least 3 meters above ground; Ensure availability of trained technicians and operators on site Air quality monitoring at the project site during construction activities; Conduct paving activities during off-peak hours to minimize exposure of receptors to odors, and use advanced application methods and machinery with built in exhausts;

Source of Impact	Project Activities	Mitigation Measures
AQ.C.3. Impacts on air quality from generators	Mobile diesel generators	h. Ensure the usage of Personal Protective Equipment (PPEs) (hard hat, gloves, masks, safety glasses, etc.).
N.C.1 Increase in vibration and noise levels from general construction activities, and movement of construction vehicles	Heavy machinery and generators operation Transport of raw material, construction waste, workers, and traffic congestion resulting from detours and construction activities	<p>N.C.1. Control measures for noise and vibration propagation:</p> <ul style="list-style-type: none"> a. Preparation of noise control plan by the contractor depending on the location prior to the commission of activities to take the proper measures based on site characteristics and distance from receptors; b. Install noise barriers where necessary, especially at the median section where there is continuous traffic and movement of potential receptors; c. Ensure periodic monitoring of noise levels during peak construction activities to ensure noise levels are not increased more than 3 dBA; d. Impose speed limits on construction vehicles; e. Using horns should be prohibited by construction vehicles and trucks on the access roads and on construction sites; f. Utility of efficient equipment and less-noisy design alternatives, and ensure maintenance and repair of machinery and equipment; g. Construction works should be limited in time, and based on the location only work during daytime, and restrict use of noise equipment and apply sequential operation schedule to reduce continuous noise generation; h. Whenever possible enclose noisy equipment and generators to reduce noise levels; i. Consultation with sensitive receptors (hospitals, hotels, schools, etc.) and notification during peak construction activities; take maximum noise reduction measures nearby sensitive receptors. j. Restrict noise-generating construction activities to the allowable hours of construction as identified by local jurisdictions where feasible. Construction is generally allowed to start at 7:00 a.m., Monday through Friday. Construction activities should end by 6:00 p.m., Monday through Friday, in most of the communities around the project area. No construction activities should occur on Sundays or holidays. If work is necessary outside of these hours, local jurisdictions shall require the contractor to implement a construction noise monitoring program and, if feasible, provide additional mitigation as necessary (in the form of noise control blankets or other temporary noise barriers, etc.) for affected receptors. k. Limit pile driving to daytime hours only. l. Equip all internal combustion engine driven equipment with intake and exhaust mufflers that are in good condition and appropriate for the equipment. m. Prohibit unnecessary idling of internal combustion engines within 30 meters of residences. n. Locate stationary noise generating equipment as far as possible from sensitive receptors.

Source of Impact	Project Activities	Mitigation Measures
		<ul style="list-style-type: none"> o. Utilize "quiet" air compressors and other "quiet" equipment where such technology exists. p. Avoid staging of construction equipment within 65 meters of residences and locate all stationary noise-generating construction equipment, such as air compressors, portable power generators, or self-powered lighting systems as far practical from noise sensitive receptors. q. The contractor shall prepare a detailed construction plan identifying the schedule for major noise-generating construction activities and distribute this plan to adjacent noise-sensitive receptors. The construction plan should also list the construction noise reduction measures identified in this study.
<p>SWR.C.1. Site Clearance and demolition activities</p>	<p>Beginning of construction activities and clearance of sites</p>	<p>SWR.C.1. Construction and activities will include excavation works and soil compaction in the immediate vicinity as a result of vehicle and construction equipment operations. However, since most of the BRT path is already along an existing highway in an urbanized area then no valuable soil loss and/or topographic / hydrologic adverse impacts are expected along the project path. Construction will require sourcing of raw materials including aggregates some of which will be sourced from local quarries. Such demand for aggregate materials have a cumulative effect on the adverse impacts resulting from quarries involving geology hydrology and groundwater.</p> <p>The following mitigation measures shall be respected:</p> <ul style="list-style-type: none"> a. Cover and contain stockpiles to protect them from being carried away by wind and runoff water; b. Source aggregate materials from quarries operated by companies with high Environment, Health and Safety Management standards, with quarry rehabilitation plans in place, and with a reputable history of implementing such rehabilitation plans.
<p>SWR.C.2. Accidental spills or leaks of fuel, oil and other chemicals</p>	<p>During various construction phases (grading, paving, installation and building of structures, etc.)</p>	<p>SWR.C.2. Mitigation measures to minimize any potential spills and leaks:</p> <ul style="list-style-type: none"> a. Store and handle any type of chemical, oil, fuels and lubricants within contained facilities (e.g. bunded areas, leak proof trays) designed to prevent the release of spills/leaks to the soil and groundwater environment; b. Put in place a maintenance schedule as part of the inspection procedures of all equipment/generators/machinery for risk minimization; c. Maintain machines and equipment off-site or onsite in a contained area with impermeable concrete pavement and drainage for vehicle washing and maintenance; d. Oil spill response kits should be available wherever oils are being used/stored; e. Promote awareness among workers on how to handle oil/lubricants; f. Train workers how to clean up small scale spills; g. Promote good housekeeping practices during construction; h. Ensure drip trays are present when re-fueling; i. Prepare a Spill Emergency Plan specific for the project; <p>In case of spill:</p>

Source of Impact	Project Activities	Mitigation Measures
		<ul style="list-style-type: none"> j. Immediately report to the company representative in case of any spill; k. Stop the source of spill (close valve, seal pipe, seal hole or as appropriate); l. Check for hazards, flammable matters on site; m. Clean the spill by removing affected top soil layer by trained employees (they should be wearing appropriate PPE); n. Treat the removed soil as hazardous waste; o. Adopt as much as possible dry cleaning techniques to decrease resulting wastewater, and to avoid flushing of spills to deeper soil layers.
SWR.C.3. Inadequate storage and disposal of solid wastes	During various construction phases, mainly during clearance and demolition of existing structures	<p>SWR.C.3. The potential impact resulting from Poor Waste Management should be reduced by implementing the following measures:</p> <ul style="list-style-type: none"> a. Segregate at source domestic waste, construction waste that can be reused, construction waste to be disposed of, etc. b. Sort excavation waste resulting from construction activities; c. 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 respective Municipality in agreement with the MoE; d. Schedule the works for the dry season if possible; e. 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); f. Ensure that standards of "good housekeeping" are maintained (i.e., avoiding littering, preventing storage of combustible waste for more than 24 hours to prevent attraction of pests and flies). g. Stockpiles shall be covered and contained to avoid them being transported by wind and rain.
SWR.C.4. Inadequate storage and disposal of wastewater generated	Operation of equipment, machinery and workers on site	<p>SWR.C.4. To ensure that no groundwater contamination results from poor wastewater management, the below should be taken into consideration:</p> <ul style="list-style-type: none"> a. Provide fully impermeable septic/ holding tanks; b. Empty septic/ holding tanks according to an adequate frequency ensuring they are never full; c. Regular inspection of septic/ holding tanks; d. Obtain a permit from the Municipality to transport and discharge the wastewater and sludge in authorized sites; e. Vehicle washing shall be only in contained maintenance areas offsite or onsite with impermeable concrete pavement and proper drainage.
SWR.C.5. Potential dewatering activities	During various construction activities	<p>SWR.C.5. Impacts from dewatering shall be alleviated by adopting the following measures:</p> <ul style="list-style-type: none"> a. Testing of dewatered water should be performed prior to reuse or disposal to ensure the lack of

Source of Impact	Project Activities	Mitigation Measures
	that involve excavation and unearthing	<p>petroleum products in it and oil-water separators shall be used as a minimum prior to disposal at municipality and MoE approved disposal locations.</p> <p>b. Water produced from dewatering, if not contaminated with petroleum products, shall be used for dust suppression as needed or can be discharged in the storm water but only after being settled and filtered from sediments and conditional to approval by local municipalities.</p>
ACH.C.1. Accidental unearthing/damage to archaeological findings during excavation	During various construction activities that involve excavation and unearthing	<p>ACH.C.1. By involving the DGA since the planning phase will also be beneficial to the construction phase, if any chance findings were to occur during the construction phase. By applying the following mitigation measures, impacts on archaeology will be reduced:</p> <p>a. Coordinate with the DGA to set a procedure if any chance findings were to occur;</p> <p>b. Stop works immediately;</p> <p>c. Secure the site area;</p> <p>d. Inform the DGA. No actions should be taken prior to the DGA's investigation;</p> <p>e. Construction works can only recommence after permission is given by the DGA.</p>
B.C.1. Impacts on biodiversity during site clearance and excavation of P&R facilities, depot and terminal	Construction works involving excavation and clearance at P&R facilities	<p>B.C.1. Based on the description of the biological environment, the anticipated project will not lead to significant negative impacts on biodiversity. The main construction activities having negative results on biodiversity are earth-moving activities, generation of construction waste material and wastewater effluent discharges. Waste resulting from construction works and any other activity should be disposed of in an allocated disposal site in agreement with the Municipality. Littering in the project area and surrounding areas should be prevented.</p> <p>Recommended mitigation measures to minimize or eliminate construction impacts on biodiversity at the proposed location include:</p> <p>a. Adopt a landscape plan that includes native trees, shrubs and herbs (Listed in APPENDIX L) to enhance the visual aspect of the facility and play a role of reintroduction of native plant species to the areas;</p> <p>b. Include <i>Pancratium maritimum</i> (APPENDIX L) at P&R6 facility landscape plan since it is coastal plant that grows only on sandy beaches;</p> <p>c. Removal of exotic plants species and weeds;</p> <p>d. Management of landscaping plan to prevent growth of weeds and exotic species and allow propagation and survival of native species;</p> <p>e. Proper disposal of domestic and construction waste and of the waste removed from the current dumpsite;</p> <p>f. Enclosing all fine earth materials during transportation to and from the site to prevent spillage and dusting;</p> <p>g. The transportation of lubricants and fuel to the construction site should only be conducted in the appropriate vehicles and containers, i.e. fuel tankers and sealed drums;</p> <p>h. Proper storage and prompt transportation of construction material to prevent them from being washed</p>

Source of Impact	Project Activities	Mitigation Measures
		away during rainfall or carried by wind.
B.C.2. Site clearance and excavation of Beirut-Tabarja trunk-line and station infrastructure	Construction works involving excavation and clearance on Beirut-Tabarja trunk-line and stations	<p>B.C.2. Proposed mitigation measures for the prevention and minimization of impacts from the removal of vegetation at the median section are:</p> <ol style="list-style-type: none"> Adopt a landscape plan at stations where possible that includes native trees, shrubs, herbs (APPENDIX L) and climbers (<i>Lonicera etrusca</i>) which will enhance the visual aspect of the stations and play a role of reintroduction of native plant species to the areas; Removal of the very destructive invasive tree <i>Ailanthus altissima</i> from sides of streets in Jounieh and Kaslik areas and replacing them with native trees (APPENDIX L); Plant a native tree for every tree that is removed. If no place is available on the line or at stations, another place should be found to plant these trees such as sidewalks, abandoned public lands on sides of streets, public gardens;; Remove olive trees planted in the median strips to be relocated in different places or sidewalks as mentioned above; Avoid removal of the very old tree at the intersection of Charles Helou and George Haddad because it is very big and old and no tree will replace it. Proper disposal of domestic and construction waste and of the waste removed from the current dumpsite; Enclosing all fine earth materials during transportation to and from the site to prevent spillage and dusting; The transportation of lubricants and fuel to the construction site should only be conducted in the appropriate vehicles and containers, i.e. fuel tankers and sealed drums; Proper storage and prompt transportation of construction material to prevent them from being washed away during rainfall or carried by wind.
B.C.3. Site clearance and excavation of Beirut Outer ring	Construction works involving excavation and clearance on Beirut Outer ring	<p>B.C.3. Proposed mitigation measures for the prevention and minimization of impacts on vegetation at the median section of the Outer Beirut Ring are:</p> <ol style="list-style-type: none"> Adopt a landscape plan at stations where possible that includes native trees, shrubs, herbs (APPENDIX L) and climbers (<i>convolvulus</i> sp.) which will enhance the visual aspect of the stations and play a role of reintroduction of native plant species to the areas; Plant and allow to propagate <i>Matthiola crassifolia</i>, all <i>Limonium</i> species, <i>Crithmum maritimum</i> and <i>Urginea maritima</i> in public gardens and spaces along the Beirut sea side strip to compensate for the loss of the green areas at stations. <i>Matthiola crassifolia</i> is a native plant species that is endemic to Lebanon and threatened according to the IUCN red list. Its protection and propagation will bring a positive impact for the project on the biodiversity of the area. In addition, there is a need to allow the above mentioned plants to grow along the median strip of the sea side road in Beirut and remove the exotic species gradually;

Source of Impact	Project Activities	Mitigation Measures
		<ul style="list-style-type: none"> c. Plant a native tree for every tree that has to be removed. If no place is available on the line or at stations, another place should be found to plant these trees such as sidewalks, abandoned public lands on sides of streets, public gardens such as the public garden under the cola bridge in Beirut; d. Proper disposal of domestic and construction waste and of the waste removed from the current dumpsite; e. Enclosing all fine earth materials during transportation to and from the site to prevent spillage and dusting; f. The transportation of lubricants and fuel to the construction site should only be conducted in the appropriate vehicles and containers, i.e. fuel tankers and sealed drums; g. Proper storage and prompt transportation of construction material to prevent them from being washed away during rainfall or carried by wind.
B.C.4. Impacts on biodiversity during site clearance and excavation of P&R facility (8), Safra depot and Tabarja terminal	Construction works involving excavation and clearance of Safra depot, P&R (8) and Tabarja terminal	<p>B.C.4. Recommended mitigation measures to minimize or eliminate construction impacts on biodiversity at the proposed location include:</p> <ul style="list-style-type: none"> a. Prohibition of unnecessary cutting or damaging of mentioned native trees within or surrounding the proposed sites; b. If removal of certain trees was necessary, plant a native tree for every tree that has to be removed. If no place is available within the site, another place should be found to plant these trees such as sidewalks, abandoned public lands or public gardens; c. Adopt a landscape plan that includes native trees, shrubs and herbs (APPENDIX L) to enhance the visual aspect of the facility and play a role of reintroduction of native plant species to the areas; d. Removal of invasive, exotic plants species and weeds (e.g. <i>Ailanthus altissima</i>) e. Management of landscaping plan to prevent growth of weeds and exotic species and allow propagation and survival of native species; f. Proper disposal of domestic and construction waste and of the waste removed from the current dumpsite; g. Enclosing all fine earth materials during transportation to and from the site to prevent spillage and dusting; h. The transportation of lubricants and fuel to the construction site should only be conducted in the appropriate vehicles and containers, i.e. fuel tankers and sealed drums; i. Proper storage and prompt transportation of construction material to prevent them from being washed away during rainfall or carried by wind. j. Prevention of littering in the area.
HS.C.1. Impact on	During various	HS.C.1. Mitigation measures of SWR2, SWR3, AQ1 and AQ2 contribute indirectly in reduction of potential

Source of Impact	Project Activities	Mitigation Measures
workers' and pedestrians' safety resulting from improper handling and storage of construction material and construction activities	construction activities that generates waste and requires raw materials	impacts resulting from improper handling and storage of construction materials and construction activities. In addition: <ul style="list-style-type: none"> a. The contractor should have a clear and detailed safety protocol to be applied at all time and accordingly train all workers and staff of safety procedures; b. The contractor should monitor the application of the safety protocol and ensure the safety of workers, the commuters and traffic in the vicinity of the project site;
HS.C.2. Impact on workers' and pedestrians' safety resulting from improper handling and storage of chemicals and waste generated related to construction activities	During various construction activities	HS.C.2. Mitigation measures of SWR2, SWR3, SWR4, AQ1 and AQ2 contribute indirectly in reduction of potential impacts resulting from improper handling and storage of chemicals and waste generated related to construction activities. In addition: <ul style="list-style-type: none"> a. The contractor should have a clear and detailed safety protocol to be applied at all time and accordingly train all workers and staff of safety procedures; b. The contractor should monitor the application of the safety protocol and ensure the safety of workers, the commuters and traffic in the vicinity of the project site; c. Periodic audits should be conducted for on-site waste management practices, waste disposal contractors and disposal facilities at different construction sites.
HS.C.3. Workers exposure to occupational hazards (e.g. noise, air pollution, dust, fire hazards, etc.) and potential for accidents	During various construction activities	HS.C.3 Mitigation measures of AQ1, AQ2, N1, N2, SWR2, SWR3, SWR4 indirectly contribute to mitigating impacts on workers. In addition, there should be detailed safety protocol, and all workers should be trained upon that protocol. The safety should consider: <ul style="list-style-type: none"> a. Installing proper barricades, signs, providing flags, lights and personnel to control the traffic and separate the construction area from potential receptors; b. Movement of trucks, loading and piling construction or excavation material, and building elevated structures; c. Provide PPEs to workers and personnel on construction sites; assure proper signage of all construction areas (zoning areas) and storage location of hazardous material. d. Emergency plans/ evacuation plans in case of injuries and accidents

Source of Impact	Project Activities	Mitigation Measures
SE.C.1. Induce potential secondary development and impact on utility provision during project construction	During various construction activities	<p>SE.C.1. Some of the mitigation actions that can prevent impacts caused on utility services and secondary developments include:</p> <ol style="list-style-type: none"> Surveying and evaluating the utility infrastructure (water pipes, electricity lines, sewerage networks etc.) and the developments surrounding the construction sites (residential buildings, industries, businesses etc.) prior construction planning; Contractors should assess construction locations in advance for potential disruption to services and already executed/planned developments, and identify risks; If temporary disruption is unavoidable, the contractors in collaboration with local authorities should develop a construction plan that would minimize the disruption and communicate the dates and duration to respective stakeholders; Potential receptors surrounding the construction sites should be informed in advance regarding utility shifts and major constructions that might impact their activities; Specific elevated structures such as pedestrian bridges along the BRT line should be studied with utility master plans and construction activities planned accordingly to ensure to existing surroundings and utilities are minimized
SE.C.2. Impacts on visual amenity due to landscape change and new constructions	During various construction activities	<p>SE.C.2 Minor visual impacts are expected from the construction activities and installation of work camps, since most of the construction area is already urban, however certain measures can be taken to minimize impact:</p> <ol style="list-style-type: none"> Proper enclosure or the construction camps at different sites, specifically at the median section, where the erected barriers can include the final design of the BRT system, which would motivate commuters and provide positive advertisement for the BRT system; Plan the movement of equipment and materials during times of least visual impact (e.g. work day start and end) where applicable; Locate piles and topsoil in visually unobtrusive locations where practical; Use existing roads and tracks where applicable instead of creating off-road tracks, and minimize length and width of the created road when necessary; Minimize construction time near sensitive visual receptors; Duration of the construction activities should be optimized to avoid installation of work camps for long periods, and the barriers should be uninstalled in short time following the completion of works/decommissioning; Proper landscaping that promotes tree planting and unified visual design (signs, street lights, sidewalks, etc.)

Environmental and Social Management Plan for the Operation Phase

Source of Impact	Project Activities	Mitigation Measures
T.O.1. Traffic congestion during the execution of the project and the operation	Beginning of operation and passenger shift to BRT system	T.O.1. An important factor in reducing the grace period and the time for transport mode change is the advertisement of the BRT system. Discounted fares and tickets, promotion of Intelligent Transportation Systems (ITS) can be used to attract commuters and facilitate faster shift from use of private cars to using buses
T.O.2. Traffic congestion at P&R facilities and at bus stations if no upgrading of roads and infrastructure takes place	During the operation of the BRT system	T.O.2. Traffic congestion at P&R facilities can be reduced/prevented if rehabilitation of roads is integrated with the BRT project that will ensure serving the demand with the available facilities. Providing facilities (e.g. auxiliary pedestrian platforms connecting P&R facilities to the stations, traffic management corridors and signage, etc.) that would ease pedestrian and traffic flow would contribute to avoiding traffic and faster interchange between commuter modes
SWR.O.1. Fueling and maintenance operation	During relatively deeper excavation works	<p>SWR.O.1 To ensure the minimum contamination of soil and groundwater in case of any spill or leakage, the below shall be implemented:</p> <ol style="list-style-type: none"> a. Promote awareness among workers on how to handle oil/lubricants; b. Promote good housekeeping practices; c. Put in place a maintenance schedule as part of the inspection procedures of all storage tanks and pipes for risk minimization; d. Use standardized fuel spill prevention system for locomotive fueling, including automatic shut-off systems; e. Storage tanks and components shall meet international standards for structural design integrity and operational performance to avoid catastrophic failures during normal operation and during exposure to natural hazards and to prevent fires and explosions; f. Storage tanks shall have appropriate secondary containment, including procedures for the management of containment systems. Appropriate secondary containment should satisfy the following: <ol style="list-style-type: none"> i. Consist of berms, dikes, or walls capable of containing the larger of 110 percent of the largest tank or 25% percent of the combined tank volumes in areas with above-ground tanks with a total storage volume equal or greater than 1,000 liters and will be made of impervious, chemically resistant material; ii. Consider means to prevent contact between incompatible materials in the event of a release;

Source of Impact	Project Activities	Mitigation Measures
		<ul style="list-style-type: none"> g. Transfer of hazardous materials from vehicle tanks to storage in areas with surfaces sufficiently impervious to avoid loss to the environment and sloped to a collection or a containment structure not connected to municipal wastewater/storm water collection system; h. Leak detection may be used in conjunction with secondary containment, particularly in high-risk locations. Leak detection is especially important in situations where secondary containment is not feasible or practicable, such as in long pipe runs, these include: <ul style="list-style-type: none"> i. Use of automatic pressure loss detectors on pressurized or long distance piping; ii. Use of approved or certified integrity testing methods on piping or tank systems, at regular intervals. <p>SW6. In case of underground storage tanks; the following shall be applied:</p> <ul style="list-style-type: none"> i. Assessing local soil corrosion potential, and installing and maintaining rust protection for steel tanks; j. For new installations, installing impermeable liners or structures (e.g., concrete vaults) under and around tanks and lines that direct any leaked product to monitoring ports at the lowest point of the liner or structure; k. Monitoring the surface above any tank for indications of soil movement; l. Reconciling tank contents by measuring the volume in store with the expected volume, given the stored quantity at last stocking, and deliveries to and withdrawals from the store; m. Consider the monitoring groundwater of quality down gradient of underground storage locations, if possible; n. Evaluating the risk of existing underground storage tanks, if any, in newly acquired facilities to determine if upgrades are required or if they should be replaced or abandoned.
<p>SWR.O.2. Hazardous and non-hazardous wastes from maintenance activities</p>	<p>Operation and maintenance of equipment and machinery</p>	<p>SWR.O.2. To ensure the minimum contamination of soil and groundwater from wastes generated from maintenance activities, the below should be taken into consideration:</p> <p>For hazardous material:</p> <ul style="list-style-type: none"> a. Training of operators on release prevention, including drills specific to hazardous materials as part of emergency preparedness response training; b. Use of aqueous detergent cleaning solutions or steam cleaning, or use and recycling of aliphatic cleaning solvents (e.g. 140 solvent); c. Use of water-based paints; <p>For Wastewater:</p> <ul style="list-style-type: none"> d. Use of ultrafiltration to extend the life of washing solutions for aqueous parts or use of alternatives to water cleaning (e.g. dry cleaning by wire brush or bake oven); e. Plumbing connection of floor drains, if any, in maintenance areas to the wastewater collection and treatment system; f. Prevention of discharge of industrial wastes to septic systems, drain fields, dry wells, cesspools, pits, or separate storm drains or sewers. Keep wastewater from service bays out of storm drains by constructing

Source of Impact	Project Activities	Mitigation Measures
		<p>berms or other barriers;</p> <p>g. Depending on the volume of contaminants present in the wastewater, and whether the BRT facility is discharging into a municipal system or directly to surface waters, pretreatment of effluents may be necessary to reduce contaminant concentrations. Pretreatment systems typically consist of oil / water separators, biological and chemical treatment, and activated carbon systems.</p> <p>For Waste Management:</p> <p>h. Understanding potential impacts and risks to soil and water resources associated with the management of any generated hazardous waste;</p> <p>i. Establishing waste management priorities at the outset of activities based on an understanding of potential soil and water resources risks and impacts and considering waste generation and its consequences;</p> <p>j. Establishing a waste management hierarchy that considers prevention, reduction, reuse, recovery, recycling, removal and finally disposal of wastes;</p> <p>k. Apply the proper storage and disposal of wastes.</p>
<p>SWR.O.3 Solid waste generated from passengers at different facilities</p>	<p>Operation and maintenance of equipment and machinery</p>	<p>SWR.O.3 To ensure the minimum contamination of soil and groundwater from general waste at Park and Ride Facilities, the below should be taken into consideration:</p> <p>a. Instituting a solid waste recycling program, depending on the existence of local facilities, with labeled waste containers in the Park and Ride Facilities for metals, glass, paper, and plastics. Food establishments should segregate compostable and other food waste for recycling as agricultural fertilizer and animal feed;</p> <p>b. Passenger bus operators and cleaning contractors should be encouraged to segregate waste in the buses by separating the collection of newspapers / papers, plastic, and metallic containers.</p>
<p>B.O.1. Impacts on biodiversity during regular operation</p>	<p>During operation of the BRT system and utility of different facilities</p>	<p>B.O.1. Recommended mitigation measures to minimize or eliminate the impacts of project operation on biodiversity include:</p> <p>a. Protection of the natural plant species that may grow on sidewalks and median strips along the line such as <i>Matthiola crassifolia</i>, <i>Limonium sp</i>, <i>Crithmum maritimum</i> and <i>Urginea maritima</i>;</p> <p>b. Removal and management of weeds and exotic and invasive species;</p> <p>c. Proper management of liquid and solid waste generated by the project;</p> <p>d. Prevention and control spills of fuel and oil.</p>

Source of Impact	Project Activities	Mitigation Measures
SE.O.1. Impact on livelihood of current bus drivers and public transport operators due to passenger shift to BRT	During the execution of the BRT system and long term operation	<p>SE.O.1. The project has considered options and incentives to encourage local operators to join the new BRT and bus concessions. Such incentives include requiring the new concessionaires to buy or rent a number of existing red plates from the small operators, the recruitment and training of drivers, encouraging local operators to join as shareholders and partners into the new concessions, and allowing operators to continue operations along the new bus and BRT lines according to specifications (schedule, bus requirements...) agreed with the concessionaires and public authorities.</p> <p>Since it is expected that the project will contribute to increasing the overall demand for public transportation in Lebanon, new markets are anticipated to be created and new passengers attracted to the system. This will benefit local operators since not all trips and destinations will be covered by the new system and many new passengers will still need an additional public transportation mode to bring them closer to their final destination. The existing local operators are therefore expected to adjust their operations in accordance with the newly generated demand, resulting in complementary systems.</p>
SE.O.2. Resource consumption for the operation of buses and for maintenance activities	During the operation of the BRT system buses	SE.O.2. Maintenance and fueling of the BRT buses is necessary. There are negligible to minor impacts related to resource consumption, which can be reduced through maintaining the buses in good conditions and ensuring their operation efficiency. This ultimately contributes to less fuel consumption per trip and reduced requirement for major maintenance works
SE.O.3 Frequent bus stops and multiple stations leading to the increase in travel time and discouraging BRT system users	During the operation of the BRT system buses	SE.O.3 The feasibility of the system and the design take into consideration all factors related to passenger demand, size of the fleet, positioning of the stations, the required space, number of stations and the distance between stations to optimize the operation of the system and provide efficient and fast service to the commuters.
SE.O.4 Impact on safety due to lack of monitoring, selection of drivers, etc.	During the operation of the BRT system buses	<p>SE.O.4 To ensure public safety and eliminate commuters' unease, the BRT system should:</p> <ol style="list-style-type: none"> Install CCTV system that monitors all activities at the terminals, stations and P&R facilities in addition to the buses; Secure access to different facilities through installation of barriers and enclosed fences to allow only commuters with the dedicated passes to access the system; Provide security personnel wherever necessary to control the crowd and monitor any suspicious activities; Enforce the operators to develop an eligibility criteria for recruiting the drivers and system operators that

Source of Impact	Project Activities	Mitigation Measures
		<p>are in constant interaction with the commuters, and provide training to ensure efficient and safe operation of the system;</p> <ul style="list-style-type: none"> e. Include evacuation plans at all facilities and emergency preparedness plans; f. Include proper timetables, traffic signs and directions on all buses and stations accommodating all commuters without any discrimination.
<p>SE.O.5 Difficulty in changing the behavior of people to stop using their cars and shift to the BRT system</p>	<p>During the operation of the BRT system buses</p>	<p>SE.O.5 Specifically during the launching of the BRT system and thereafter awareness campaigns should be conducted to encourage people to use the BRT system in addition to incentive schemes. This can be achieved through general media, advertisements, social media, awareness campaigns at different locations tackling various social groups. Proving the efficiency of the system and advertising its advantages play a major role in changing the behavior of the public and encouraging commuters to use the buses instead of their personal vehicles.</p>