Government of Lebanon

Capital Investment Program

- C E D R E -

Conférence Economique pour le Développement par les Reformes avec les Entreprises

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Capital Investment Programme

Report

INTRODUCTION

Since the start of the Syrian crisis, economic growth in Lebanon has slowed down sharply and the number of people living in Lebanon has increased sharply, with an estimated 1.5 million displaced Syrians entering Lebanon during 2011-2017.

Despite the major reconstruction of Lebanon's infrastructure that took place subsequent to the end of the 15-year conflict in 1990, with low levels of public investments after 2000, due in part to fiscal and debt limitations and delays in project implementation, Lebanon's infrastructure still had significant gaps in various infrastructure sectors when the Syrian crisis evolved. The Syrian crisis placed increased pressure on Lebanon's infrastructure, leading to deterioration of existing infrastructure, in particular in transport, and a widening of the gaps, in particular in the electricity sector.

A sharp expansion of investments in Lebanon's infrastructure is key to and a recovery of economic growth in the medium term, with increased private sector productivity, and the creation of employment opportunities in the short term.

The short-term priority is the completion of projects for which for which external financing has already been secured. These are not part of the Capital Investment Programme (CIP). The CIP is a key pillar of the Government's vision for stabilization and development against the background of the Syrian crisis and the effects this has had on Lebanon. It comprises new projects for infrastructure investment that will eliminate the gaps that exists between the demand and need for infrastructure services, in all sectors, and the supply, and reduce the cost to the economy of the lack of adequate infrastructure. The CIP is limited to projects in the physical infrastructure sectors for which funding from external lenders and donors or private investors are sought. The adoption of the Public Private Partnership Law in 2017 provides the legal framework for private sector investments in infrastructure.

The projects in the CIP were selected in compliance with the sectors' strategies, aimed at bridging the gaps and meeting the sustainable development goals, particularly ensuring decent work and economic growth, reducing inequality, ensuring clean water and sanitation, affordable and clean energy, building resilient infrastructure and promoting sustainable industrialization and innovation, making cities inclusive, safe, resilient, and sustainable.

Projects were prioritized based on their readiness for implementation and their expected positive impacts to provide adequate basic services to households, enable sustainable urban development, and improve social security, stability and wellbeing. In the sector reports, scores of 1 to 3 are indicated with respect to readiness for implementation (availability of tender documents, environmental impact assessment and feasibility studies, or the time required to finalize them), and with respect to impact, scores of 1 to 3 are indicated to the degree to which existing investments are capitalized upon, socio-economic impacts and mitigation of the impacts of the Syrian crisis. The combined scores indicate the priority score, with 6 being the highest. The priority score is the main determinant for whether the projects form part of the first, second and third phases of the CIP. Concurrently with the prioritization as per the above, the indications of needs and demands received from the various regions, municipalities and villages were assessed and incorporated in the CIP where justified. These exclude projects that could be funded outside the framework of the CIP.

The CIP will be adjusted as necessary in the course of its implementation to reflect evolving priorities and the outcomes of detailed appraisals and financial viability analysis, and environmental and social impact assessments.

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1 CONTEXT AND FRAMEWORK

1.1 Project Rationale

Since the start of the Syrian crisis economic growth in Lebanon has slowed down sharply, the number of people living in Lebanon has increased sharply, with an estimated 1.5 million displaced Syrians entering Lebanon during 2011-2017, poverty and unemployment among Lebanese has increased and the majority of Syrian displaced do not have employment opportunities.

Despite the major reconstruction of Lebanon's infrastructure that took place subsequent to the end of the 15-year conflict in 1990, with low levels of public investments after 2000, due in part to fiscal and debt limitations and delays in project implementation, Lebanon's infrastructure still had significant gaps in various infrastructure sectors when the Syrian crisis evolved. The crisis placed increased pressure on Lebanon's infrastructure, leading to deterioration of existing infrastructure, in particular in transport, and a widening of the gaps, in particular in the electricity sector. The current state of Lebanon's infrastructure is a major constraint to providing basic services to the population and achieving higher levels of private sector led economic growth.

A recovery of economic growth in the medium term, with increased private sector productivity, and creation of employment opportunities in the short term are critically dependent on a sharp expansion of investments in infrastructure, initially through an acceleration of implementation of existing projects, and subsequently through implementation of the projects contained in the CIP.

1.2 Project Context and Objectives

A plethora of studies acknowledge the important role of infrastructure in both supporting and driving economic growth, and notably in meeting key development targets, such as poverty alleviation and reduction of income inequalities. Strong infrastructure is a key driver of economic growth as it allows countries to expand their productive capacity and competitiveness, rendering them more attractive to businesses. Equally, investments in infrastructure allow for more equitable access to the labour market and increase labour productivity, which in turn stimulates economic growth. Investments in infrastructure, therefore, have a number of indirect and multiplier effects, and can provide a valuable stimulus to economies.

Lebanon's performance in terms of infrastructure continues to remain poor. Weaknesses in infrastructure are consistently cited as issues constraining the business and investment environment. Limited improvements in infrastructure are, therefore, constraining Lebanon's competitiveness to businesses, and unless addressed, will take their toll on economic performance moving forward. More specifically, the uneven distribution of social and physical infrastructure in Lebanon is a key factor restraining economic opportunities and improvements in quality of life. In this context, a Capital Investment Programme was formulated to (i) meet the needs of an expanded population and economy; (ii) generate meaningful employment opportunities for a large and growing youth population and for displaced persons; and (iii) stimulate long-term and sustainable economic growth.

Projects were selected in compliance with the sectors' strategies, aiming at bridging the gaps and meeting the sustainable development goals (SDGs), particularly ending poverty, ensuring decent work and economic growth, reducing inequality within and among nations, clean water and sanitation, affordable and clean energy, quality education and healthcare, building resilient infrastructure and promoting sustainable industrialization and innovation.

The projects have been assessed against a number of factors including their readiness for implementation, their impact on Lebanese and displaced communities, and their alignment/ compatibility with national and international development targets.

The following main physical infrastructure sectors are covered by the CIP:

- Transport
- Water and Irrigation
- Wastewater
- Electricity
- Telecom
- Solid waste
- Cultural Heritage
- Infrastructure Networks for Industrial Areas

1.3 Methodology

The present Capital Investment Programme (CIP) is intended as a first step towards the aggregation and categorisation of projects across the various sectors to address shortages in infrastructure and service provision. Concerned ministries and CDR were contacted to confirm their visions, sectors' strategies and list of on-going and planned projects. Coordinated efforts were then aligned to come up with a reasonable investment plan. It is the culmination of efforts in which:

1. Ongoing, planned and proposed projects within the various governmental ministries, CDR, previous national plans (including the 2004 Schéma d'Aménagement du Territoire Libanais – SDATL) were collected;

2. Meetings with various stakeholders were held to discuss their priorities/ objectives, and to gather up-to-date information on the status of current projects, their pipelines etc.;

3. Projects were structured in 3 implementation cycles (indicatively 2018-2021; 2022-2025; 2026-2030), with projects allocated across the 3 cycles in line with their "Priority Score". This was then reduced to 2 cycles of 4 years each.

Prioritisation Process:

All projects are assessed in terms of their readiness for implementation (status) and impact.

- **Status**: a score from 1 to 3 is allocated depending on the availability of tender documents, environmental impact assessment and feasibility studies - or the period required to finalize them; the higher the score the higher the implementation readiness the project is.

- **Impact**: the score from 1 to 3 is correlated to the degree to which existing investments are capitalized upon, socio-economic impacts and mitigation of the impacts of the Syrian crisis; the higher the score the highest the impact of the project is.

The scores of the above are added to calculate for each project the "Priority Score" ranging from 2 to 6. This, in turn, is used to select in which of the 3 defined implementation cycles the project should be initiated.

Concurrently with the above exercise, a Technical Committee established by the Prime Minister's Office, reviewed and collected from the Mohafazats, Municipalities and villages their needs, demands and concerns. These were listed, assessed and categorised based on the following 3 categories:

- Projects aligned with the sector strategy and already included or could be integrated into the sector development projects

- Projects of socio-economic importance at the local level that could be funded outside of the CIP

- Plans that do not fall within the above 2 categories but could be self-funded.

The following technical sections present the assessment of the above mentioned infrastructure networks and projects. Each section is organized, in as far as applicable, in the following structure:

- Introduction; presenting the sector general importance to the socio-economic context
- Background and Current Conditions;

- Impact of the Syrian Crisis;
- Existing Programme and Strategies, including the on-going development contracts, whether funded or a fund is secured and the project is being initiated; the list does not include the projects whose funding are currently being negotiated;
- Development vision of the sector, as established by the concerned ministry or administration; and
- The Capital Investment Programme.

2 TRANSPORT

2.1 Introduction and Methodology

2.1.1 *Objectives*

This paper presents the Capital investment programme for the transport sector in Lebanon to support the Republic's development vision for the 2030 horizon. It starts with an overview of the Transport Infrastructure context and its importance in bridging gaps between different Lebanese areas. The role of Transport in stimulating economic performance and growth is also stated; this is associated with eliminating infrastructure constraints for people and businesses, optimizing the movement of people and goods and consequently trade, generating employment, and attracting new investments. The principal objectives of this paper are to:

- Summarise the existing situation in the transport sector and, in particular, the specific sub-sector modes road, rail, air and maritime
- Examine the current impact of the influx of displaced Syrians on the transport sector
- Review the importance of Lebanon's Transport Infrastructure with respect to its trade balances
- Review past proposals for the sector
- Identify gaps within the sector physical infrastructure
- Derive a set of selection criteria to deliver a programme of priority projects to address the constraints and development issues facing the sector while also taking into consideration the impacts of the Syrian crisis
- Provide an analysis of the economic, social, and transport based need for all identified projects within the Capital Investment Programme
- Establish the programme/projects list that will feed in the Capital Investment Programme for Stabilization and Development in Lebanon at the Strategic Level
- Present the bottom up approach employed by the government and its respective agents in incorporating the demands of Municipalities, Governorates, and Ministries into the Capital Investment Programme
- Examine the Institutional needs and context of the Lebanese transport sector in terms of capacities

2.1.2 *Context*

Since the preparation of the 2006-2009 Development Programme, some progress has been made in enhancing and improving the sector but this has not been in line with the general development of the country, particularly a growing population and national economy. The growth in the Lebanese economy between 2000 and 2015 was at around 88% in real GDP terms. This additional economic activity and production was coupled with a population increase of nearly 500,000 between 2006 and 2016 in addition to an influx of 1.5 million displaced Syrians since 2011. This growth led to an increase in demand for services, which were not met with sufficient investments in transport infrastructure. This translated into shortfalls in transport service provision among other sectors, noting the vital role that transport infrastructure plays in providing access to services for businesses and individuals. This lack of adequate capital investment in transport Infrastructure has hindered the establishment of a sustainable nationwide economic development policy and dampened efforts to create meaningful employment opportunities for a large and growing youth population.

Furthermore, the quality of transport infrastructure is not equally distributed among different Lebanese areas, with border and rural areas suffering the most. The Syrian crisis has worsened and highlighted the condition of the already strained infrastructure within these areas. Hence, upgrades and expansions to these infrastructure network have become quintessential in stimulating economic growth and lifting these vulnerable groups out of poverty.

This report examines the current context and condition of Lebanon's transport infrastructure network and identifies gaps in service provision, which need to be addressed, in addition to economic opportunities that can be tapped through capital investment in transport Infrastructure. It then presents the Capital Investment Programme, while assessing the different projects within it against a number of factors, including their readiness for implementation, their impact on vulnerable Lebanese and Syrian communities, and their alignment/compatibility with national and international development targets.

2.1.3 *Methodology*

The Method of Analysis employed in this study can be categorized into two main phases in addition to a supplementary examination of the institutional context of the sector. These phases are as follows:

A. Phase 1:

I. Review of Existing Development Programme, Policies, and Literature on the current status of the Lebanese Transport Sector
II. Assessment of the current conditions of the transport sector including the impact of the Syrian Crisis
III. Setting development goals and objectives in addition to proposed investment/development cycles. This involves extensive stakeholder consultations
IV. Analysis of Ongoing and Proposed Projects in addition to pledged financing schemes within the government portfolio of projects.
V. Organizing, Grouping, and Prioritizing Projects based on development goals. Availability of financing, and various other factors
VI. Developing a Capital Investment Programme based on this prioritization

B. Phase 2:

I. Analysing Municipality and Governorates Requirements and Demands for transport project development, maintenance, and rehabilitation
II. Integrate these requirements/projects into the existing transport sector development strategies and sort them accordingly while coordinating with the relevant ministries
III. Incorporate applicable projects into the Capital Investment Programme under the suitable investment/development cycle
IV. Identify projects which will require other sources of funding and/or local funding
V. Update Capital Investment Programme and Issue a Lebanon 2030 National Vision and Context Report

C. Analysis of the Institutional Context and Considerations required to enable the implementation of the CIP

D. Examining possible financing schemes and modes for private sector participation.

2.2 Background and Current Conditions

2.2.1 *The Role of Infrastructure*

Infrastructure is an encompassing term that refers to a multitude of essential services – including water and wastewater, energy, transport, health and education. Together, they constitute one of the most fundamental pillars of any country, and a plethora of studies acknowledge the role of infrastructure in both supporting and driving economic growth, and notably in meeting key development targets, such as poverty alleviation and reduction of income inequalities. As cited by the World Bank:

> *"Investment in high-quality, sustainable infrastructure can provide basic services to households; lead to productive gains for industry; provide market access for agriculture; enable sustainable urban development; open corridors of trade for poor and landlocked countries to the global economy; and help progress towards a more climate-smart world."*

Transport Infrastructure, along with the associated sector, exists to provide support to the growth of the overall national economic and social objectives. The aims of transport operations and infrastructure

provision are to ensure that the sector is effective, affordable and sustainable. The outputs of the sector must facilitate industry and commercial needs, including internal and external trade, and must also facilitate the ease of movement for inhabitants, for leisure, work, and trade.

The relationship between transport infrastructure, economic growth and population growth is strongly intertwined and reciprocal. A growing population and economy lead to increased demand for transport infrastructure. However, strong transport infrastructure is also a key driver of economic growth as it allows countries to expand their productive capacity and competitiveness, rendering them more attractive to businesses. Equally, investments in infrastructure allow for more equitable access to major urban conglomerations and subsequently the labour market and increase labour productivity which in turn stimulates economic growth. Investments in transport infrastructure, therefore, have a number of indirect and multiplier effects, and can provide a valuable stimulus to economies; continued investment in infrastructure to expand and upgrade capacity is critical to enabling and unlocking a virtuous cycle of growth and development.

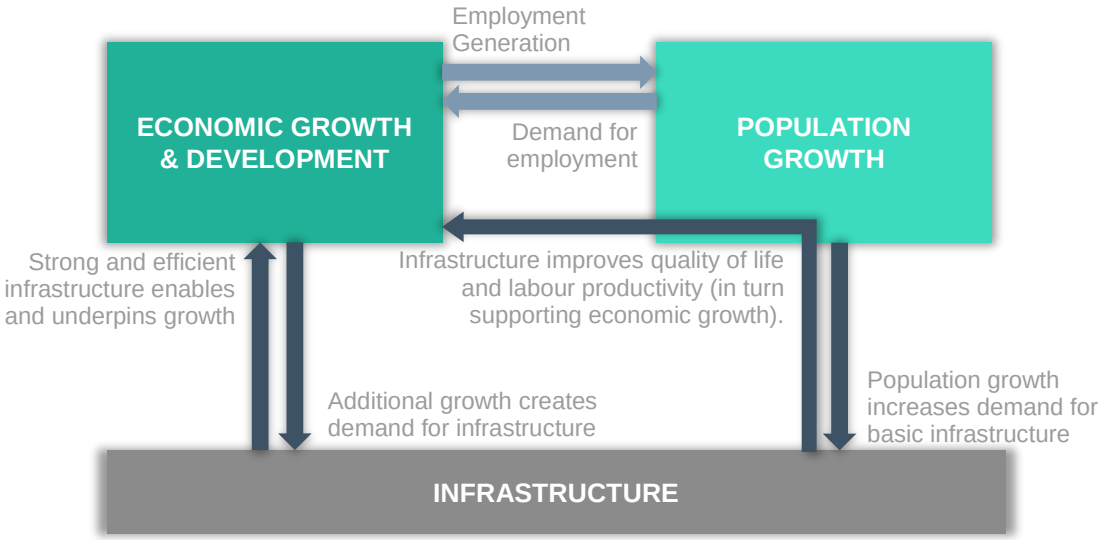

Figure 2-1: Infrastructure and the Economy

2.2.2 *Transport Infrastructure and the Lebanese Economy*

The services provided by transport facilities and infrastructure are not an end in themselves. Rather, they are a means to a series of wider ends, which may be any combination of political, economic, military or social. The Lebanese economy is itself heavily service oriented with over 78% of GDP generated from services in 2015. Commerce, tourism and financial services in particular, are the largest contributors- followed by healthcare and higher education.

The manufacturing and agricultural sectors however have declined in importance since 2000- though they have remained relatively stable since 2005.

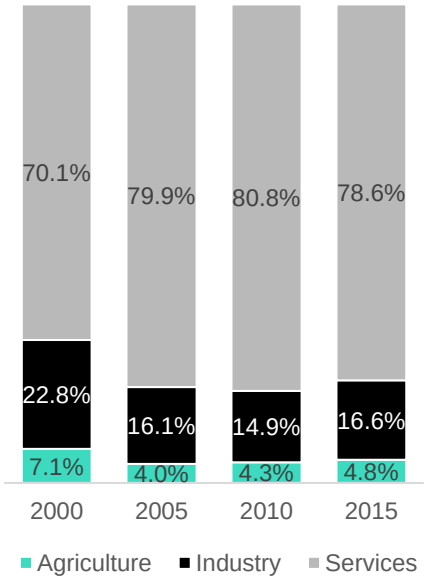

Figure 2-2: GDP by Economic Activity, 2000-2015, Source: World Bank

This makes Lebanon dependent on global flows and renders it sensitive to regional and domestic conflicts, which has been evident in the Macro economic trends since the year 2000, with drops in growth rate during years of conflict, followed by high growth in subsequent years, a result of investment in infrastructure (as part of reconstruction efforts) and the return of investor confidence.

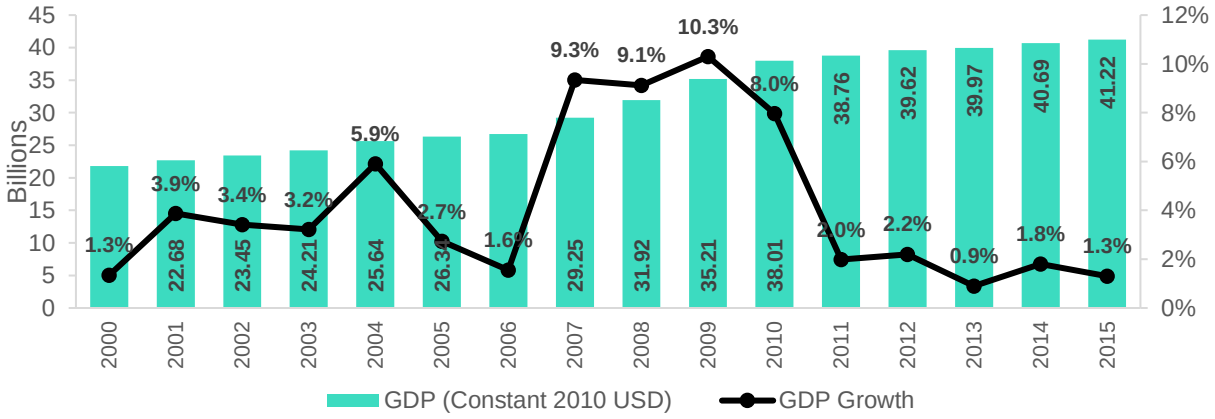

Figure 2-3: GDP per capita (2000-2015), Source World Bank 2016

Investing in Transport Infrastructure means facilitated operations for Lebanon's service sector to meet the growing demand for services. Better Road, Air, and Maritime Transport Infrastructure will allow the people and goods that flow within the Service sector to move faster, cleaner, and smarter allowing the service sector to reach and exceed pre-crisis levels. Furthermore, investing in transport infrastructure can also benefit the underperforming agricultural and manufacturing sectors as the structural composition of the Lebanese economy can be viewed, to a certain extent, as a response/by-product to the country's infrastructure. Transport Infrastructure in addition to water and power are required in production, export, and distribution activities. Supply chains can be optimized and Lebanon's deficiencies in the manufacturing and agricultural sectors can be partially resolved through Capital investment in Transport Infrastructure. A sensitive and tailored Capital investment programme would hence not only strengthen Lebanon's service sector, but also focus on other sectors making the economy less volatile and sensitive to regional threats and risks.

2.2.3 *Capital Investment in Transport Infrastructure*

Transport solutions generally involve the use of funding, often in significant amounts. Decisions on how best to develop, operate and maintain transport facilities and infrastructure, normally treat such expenditure mainly in terms of investment and the economic return available on alternative options for action. Economic appraisal for Transport Infrastructure projects typically involves a cost-benefit analysis to quantify the return on investment and NPV resulting from the implementation of these projects. As stated earlier, the vast majority of road transport infrastructure projects aim to assist overall economic growth than generate income themselves (of course this is different for railway, air, and maritime transport where the economic benefits are coupled with direct revenue generation from these facilities). For all forms of transport, it is important that any economic appraisal that is to take place is to consider the holistic economic and business benefits from implementing these projects in the cost benefit analysis in addition to the overall impact on economic geography. Hence, the value of the return on investment from Transport Infrastructure Projects must take into consideration the following costs and benefits:

- Valuation of travel time savings for business commuters as a result of reduced congestion
- Valuation of travel time savings for cargo
- New markets and capacity for cargo and growth
- Generated Employment and Impacts on Long Term Economic Growth for both construction and operations
- Demand forecast increase and new economic activity (road, air, and maritime transport)
- Impact on economic geography: Greater opportunities for businesses and people in areas with new developments and links
- Impact on economic geography: Greater opportunities and higher quality of service for people and businesses in areas with released capacities on old networks
- Changes in future patterns in land use and real estate value
- Greater access to public and private services for new portions of the population which in turn stimulates economic growth
- Public and Private Sector gains from concession contracts, PFIs, BOTs, and PPPs
- Improvement of Infrastructure which will attract more Foreign Direct Investment (FDIs)
- Construction costs
- Land Expropriation costs
- Operating costs
- Financing costs (interest rates, payback periods, debt/equity ratios...)

The appraisal for the Capital investment programme must understand and portray how much investment would influence national performance both, in terms of overall economic productivity and the geographic allocation of economic activity.

Given the current situation in Lebanon, this approach on its own is likely to be unrealistic since it must now be an aim of the transport sector to assist both overall economic growth and also take into account the consequences of external conflicts which increase the burden on government financial resources. The selected approach must also take into considerations the risks and burdens associated with external conflicts. The Capital Investment programme must also include migratory measures and contingencies and must use these new projects to mitigate the effects of the Syrian displaced individual’s crisis and the government’s financial burdens. This can be achieved through the following strategies:

- Focusing a portion of the Capital investment programme on areas with vulnerable Lebanese and Syrian groups and designing projects that would provide both employment and access to services and economic opportunities
- Aligning the transport infrastructure Capital investment programme with other sectors as to ensure that all economic benefits and opportunities are captured

- Focusing on air, maritime, rail, and trade routes to provide the flow of goods into, out of, and through Syria for humanitarian relief and future reconstruction. These projects will generate revenue through themselves and their associated economic activities (tariffs, concession contracts, etc.)
- Encouraging private sector participation in transport infrastructure financing through PPPs, BOTs, and similar concession agreements to ease the financial burden on the government.
- Adopting a risk based and sensitive approach in selecting projects and prioritizing them across different funding and implementation cycles

Currently, Lebanon's open economy and dependence on global flows is further confirmed by the importance of FDI to GDP. Lebanon scores one of the highest FDI to GDP percentages in the region accounting for 5% in 2015 as compared to 3% in the UAE, 3.4% in Jordan and 1.3 % in Saudi Arabia. It is without doubt that FDI in addition to grants and loans from international monetary institutions will be crucial in financing the Capital Investment Programme. In 2015, around 44 foreign investment projects and foreign partnerships were announced. The services, trade, and retail sectors received the lion's share of these investments and greater diversification is needed into infrastructure. Partnerships with foreign and local players in the private sector would also be beneficial as stated earlier in this section.

2.2.4 *Transport Infrastructure and Sustainable Development Goals*

The significance of transport infrastructure is further highlighted with relation to the United Nations 2030 Sustainable Development Goals. Investments in physical infrastructure can directly contribute to meeting a number of the Goals. These Goals are identified in the table below.

Table 2-1: United Nations Strategic Development Goals

Goal		Role of Transport Infrastructure in Meeting Goals	
		Direct	Indirect
1	End poverty in all its forms everywhere		✓
8	Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all;		✓
9	Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation;	✓	✓
10	Reduce inequality within and among countries;		✓
11	Make cities and human settlements inclusive, safe, resilient and sustainable;		✓

2.2.5 *Quality & Competitiveness of Transport Infrastructure*

In its annual Global Competitiveness Index (CGI) 2016-2017 report, the World Economic Forum ranked Lebanon 101th globally out of 138 countries. Infrastructure is one of the key pillars used in this barometer. The CGI indicates that infrastructure has exhibited little improvement relative to other countries over the last 6 years. Weaknesses in physical infrastructure such as transport are consistently cited as issues constraining the business and investment environment. If not addressed adequately, this will take a toll on economic performance moving forward.

Table 2-2: Lebanon's Infrastructure Ranking, Global Competitiveness Index, Source: World Economic Forum

	2010-2011	2011-2012	2012-2013	2013-2014	2014-2015	2015-2016	2016-2017
2nd pillar: Infrastructure	123	121	127	119	122	116	117
Quality of overall infrastructure	132	135	141	142	140	138	131
Transport infrastructure	97	109	113	101	103	102	
Quality of roads	101	115	115	123	120	119	124
Quality of port infrastructure	55	62	71	64	73	80	80
Quality of air transport infrastructure	36	43	51	53	65	68	82
Available airline seat km/week, million*	69	70	70	73	72	73	71

Lebanon's significant road network of 22,000 Km2 is in an overall poor condition and has not been significantly expanded or improved since the 1960s. Bottlenecks and Traffic Jams are a daily occurrence at entrance points of the greater Beirut area as all north-south traffic passes through Beirut's central streets. There exists no reliable public transportation system, and the underdeveloped roads are unable to accommodate the growing number of vehicles.

Further to the negative economic implications of this condition discussed earlier, this state has resulted in an increased accident rate and financial costs to drivers. Import dues on vehicles can exceed 50% of a vehicles value and, generally, spending on transportation represents about 15 % of household expenditures (which is excessively high compared to other countries in the region).

2.2.6 *Roads*

Around 6,500 km of the Lebanese highway network is classified and, hence, the responsibility of central government (Ministry of Public Works and Transport). The remaining network is the responsibility of municipalities and local authorities. Past surveys carried out indicate that over 80% of the classified network is in fair (mainly) or poor condition. The 2006-2009 Development Programme stated that the MPWT was only spending $40 million annually on road maintenance, whereas it was estimated that $100 million is needed annually to keep the network in good condition. The same study also estimated that it would cost around $1 billion to bring the classified road network up to an acceptable standard. The consequence of an under-funded sector is a network that is declining with a subsequent negative impact on national economic performance.

It is likely that the vehicle fleet consists of more than 1,500,000 vehicles, with growth continuing at around 4% per annum. Evidence indicates that the majority of the fleet is old, poorly maintained and polluting. High import taxes act as a barrier to replenishment of the fleet with new and clean vehicles.

The consequences of a growing vehicle fleet and a deteriorating road network are poor performance, observed through increasing levels of congestion in urban areas, and a lack of mobility within the population. Congestion can be ameliorated through increasing the road network infrastructure, although this is hampered by expensive land expropriation.

One solution to the congestion on the network and the ageing vehicle fleet would be a shift to the use of public transport. Older studies indicated that 68% of motorised trips, in Beirut and Tripoli, were undertaken using private passenger car. The share of public transport was 32%, split by 16% (service and taxi vehicles), 14% (private sector buses) and 2% (OCFTC buses). The larger PT group (service and taxi vehicles) is largely unregulated, which has contributed to an excess of supply over demand. Private sector buses dominate the supply of government sector buses and tend to be favoured because the privately owned vehicles are relatively new and present a better image to the public.

Furthermore, more rural regions with more vulnerable economic groups lack adequate infrastructure, which has been increasingly strained by the influx of displaced Syrians.

2.2.7 *Railways*

No railways currently operate in the Lebanon. Historically, three lines were operated: i) Naquora-Beirut-Tripoli with an extension towards Homs in Syria ii) Beirut-Damascus and iii) Riyaq-Homs. The existing railway infrastructure is now inoperable and many sections of the right-of-way have been built upon.

Rehabilitating this right of way and dedicating it to rail or bus public transport would greatly alleviate the deteriorating conditions and vehicle congestion on the existing road network.

2.2.8 *Airports*

The main airport in the Lebanon is the Beirut Rafic Hariri International Airport, located approximately 9 km south of the capital city Beirut. It is the hub for Lebanon's national flag carrier, Middle East Airlines-Air Liban (MEA) and the Lebanese cargo carrier, Trans Mediterranean Airways (TMA). In addition, the airport is the base of operations for a couple of charter carriers such as Med Airways and Wings of Lebanon and offers facilities for general aviation and executive jets. It houses Beirut military air base. More than 45 world major airlines, that serve more than 60 destinations worldwide, operate from the airport.

The estimated number of passengers that used the airport in 2017 was approximately 8.2 million, an annual increase of 7.48% since the year 2000. It has one passenger terminal building, with overall area of 150,000 square metres, and this is currently operating over its capacity of 6 million. The total area of the airport is around 7 million square metres. The airfield is comprised of three runways. The airport is proposed to have a capacity of 16 million passengers as per its initial forecast and Master Plan.

The airport has a state of the art general aviation terminal building with associated apron and aircraft hangars to accommodate VIP passengers and charter flights.

Two smaller airports also exist in Lebanon. The first is Lebanon's first Air Base in Reyak in the Bekaa valley. The air base contains most of the Lebanese air force's fleet and almost all retired aircrafts. IT also boasts the Lebanese Air Force training school. The second Airport which is currently also a Military Base (although much less active than Reyak) is the Rene Mouawwad Airport in Koleiat in Akkar, North Lebanon. Established in the early 1960's, the airport served as a private airport for an Oil Company that used small IPC planes to transfer its employees between Lebanon and the Arab Countries. In 1966 it was taken over by the Lebanese Military which transformed it into one of the most modernized military bases in the region at the time. In addition to this Military activity, the airport was used for internal passenger flights in the late 80's and early 90's, but has ever since been out of operation with the exception of light military activity.

Plans have been put in place for the airport's expansion and rehabilitation into a modern hub for charter, cargo, and internal flights through a proposal for a feasibility study submitted to the Lebanese Parliament and Cabinet of Ministers. Such a project would help ease the load on RHBIA in addition to the traffic jams on roads between Beirut and Tripoli. Its socio economic importance should also be highlighted as it will generate employment and economic opportunities in the economically vulnerable Governate of Akkar. Koleiat' s strategic location at only 6 km from the Syrian border will also mean that its modernization will allow it to play a vital role in the humanitarian relief and reconstruction effort associated with the Syrian Crisis, and position itself as an important hub in the area.

2.2.9 *Ports*

Virtually all maritime traffic is handled by the ports of Beirut and Tripoli, with the former port being the major handler of imported/exported goods.

Container volumes at the port of Beirut increased at 14.3% pa between 2005 (465 thousand TEU) and 2011 (1.03 MTEU). However, growth has decelerated in more recent years, with growth of 2.4% pa between 1.04 MTEU in 2012 and 1.15 MTEU in 2016. This seems to have been largely caused by a decline in transhipment traffic. About 70% of total domestic cargo weight is handled in containers, and this total has increased at 4.9% pa from 7.2 to 8.7 million tonnes between 2012 and 2016.

The Port of Beirut's development has been highly constrained by the presence of very deep water immediately offshore of the port, which has precluded the development of new outer harbours, and the proximity of the city of Beirut on the landside. Several schemes to re-develop older areas of the port and improve the Container Terminal and Passenger Terminal are underway or in advanced planning including the first phase of the container terminal expansion (increasing container terminal capacity by 450,000 TEU and allowing the terminal to process 1.5 million tons per annum). It is believed that construction is underway, which will be followed by a second phase which is a re-development of the passenger terminal at quay 5 and transforming quays 1 and 2 into a public promenade along with the construction of leisure commercial properties.

The Port of Tripoli is upgrading its container terminal facilities and a concession to invest in and operate the terminal has been awarded to Gulftainer. Most of the terminal investments have either already been completed or are in the process of being completed soon. The costs of the outstanding investments are USD 98 million and will increase the terminal capacity from currently 20,000 TEU to 270,000 TEU per year. Traffic forecasts indicate that terminal turnover will reach capacity by 2023.

2.2.10 *Transport and Trade Flows*

With its strategic location on the eastern coast of the Mediterranean Sea, Lebanon's role in the region has been shaped by trade. The country has a free trade system and a competitive market with a commercial, proactive approach. Its imposed tariffs are negligible and one of the lowest among the MENA countries. Over the past 10 years, Lebanon has implemented major trade liberalization strategies making it one of the more open economies in the region according to the World Bank which ranked it 59th out of 125 countries in its latest Trade Tariff Restrictiveness Index (TTRI).

Yet, the regional instability, combined with the economic weakening of the region, have impacted overall trade to and from Lebanon. The halting of the majority of land trade operations to, from, and through Syria has led to this decrease. Furthermore, Lebanon's maritime and air ports have been strained substantially in terms of capacity, as Syria's Airports and major ports are no longer operational in their full capacity. Hence several goods and people destined for Syria are now transiting through Lebanon. This has not, however, served to counter balance the trade deficit as Lebanese exports recorded a decline of USD 1.3 billion since the start of the conflict in Syria in 2011, corresponding to a negative CAGR of 7% despite attempts by the Maritime Lebanese Bridge Programme (M LEB) to counter the impact of the decline in trade activities as a result of borders closure with Syria. This programme seeks to support continuity in the flow of Lebanese products to traditional markets and support exporters in re-routing their exports via sea routes. The aforementioned capacity and quality constraints are the main reason that this programme has not yet fulfilled its goals and this should be one of the key issues addressed by the Capital Investment Programme, particularly in relation to air and maritime port projects and their associated road and rail infrastructure.

2.3 Impact of the Syrian Crisis on the Transport Sector

The Syrian crisis, with resulting displacement of population, has undermined the development of the transport sector for several main reasons, as follows:

- The additional numbers of people moving in and around the country has contributed to increasing congestion, particularly urban areas. This increasing congestion has had particular impact on the land transport sector, with reduced journey times for private car users, public transport passengers and freight vehicles.
- The Lebanon has a high density of population, with constraints to transport network expansion due built-up areas and mountainous terrain dividing the country. The additional displaced population has increased transport flows and this puts pressure on transport infrastructure where there are already capacity constraints. This is particularly the case in the ports sector and in missing links in the highway sector.
- Increased traffic flows contribute towards higher maintenance needs, particularly due to wear and tear on the highway network.

- Deficits in funding have been magnified by this increased use of the network. This is particularly the case for the road network. The road sub-sector is funded by government (national and local) and it is unlikely that the displaced population can finance, through taxation, the additional maintenance works needed.
- The continuing conflict in Syria has diverted some traffic (particularly air and marine traffic) via Lebanon. This makes future transport planning more difficult as, when the conflict terminates, some traffic will revert to original routes and some may remain.

To summarize, the Syrian crisis has amplified all the existing issues and difficulties faced by the transport sector, namely all transport facilities acting at or over capacity. On another hand, the closure of Syrian borders, ports, and airports has generated new demand for Lebanese air and maritime ports to provide goods to Syria for the humanitarian relief effort and future reconstruction process. It is however crucial that the proposed Capital investment programme addresses the needed investments and expansions for these ports and associated road and rail infrastructure needed to realize this potential.

2.4 Existing Program and Strategies

The current programs being implemented are mainly the result of three key studies:

- The « Schéma Directeur d'Aménagement du Territoire Libanais » (SDATL) specifically the Transport Chapter (Land use Master Plan decree approved in 2009)
- 2006-2009 Development Programme
- Comprehensive Sector Policy and Strategy for the Lebanese Land Transport Sector (Draft)

2.4.1 *Land Use Master Plan 2009*

The study, which was conducted in 2002-2003 resulted in a comprehensive multi-sectorial plan for the utilization of land in Lebanon. The Transport sector included general strategies that were meant to guide and foster development programmes. The programs resulting from the Transport sector analysis could be listed as follows:

a) Priority Projects

- Rehabilitation of the road network and the liberation of the railway right-of-way
- Proper management for the transport corridors serving northern and southern entrances of Beirut
- Additional capacity integrated with public transport supply
- Completion of the Beirut – Damascus Highway
- Modernization of Tripoli Port
- Improvement of Tripoli Northern entrance corridor
- Re-establishment of the rail link from Tripoli to the Northern border
- Improvement of the radial links around Nabatiyeh City

b) Protection of Investments
c) Regulation of Public Transport
d) Creation of Organizing Authority for Transport in the central area of Lebanon (Nahr Ibrahim to Nahr El Damour)

2.4.2 *2006-2009 Development Programme*

The main focus was on developing a strategy for the sector with considerable focus on institutional reform, funding issues and priority projects. The key investment projects, for the physical infrastructure, identified were:

- Rehabilitation and extension of the strategic Lebanese road network
- Construction of missing highway links i.e. Coastal Expressway north of Beirut, Beirut Peripherique, A2 Motorway, the Pan Arab Motorway, Tripoli-Northern Border Motorway
- Traffic management measures within Greater Beirut
- Bus stations and terminals in all regions
- Inland port near Beirut and logistics centres in Tripoli, Zahle and Zahrani
- Clearing rail right-of way of encroachments and turning sections into public transport corridors
- Rehabilitation of Tripoli-Syrian border rail link
- Continued development of Beirut port expansion
- Rehabilitation and development of Rafic Hariri Beirut Airport

2.4.3 *Comprehensive Sector Policy and Strategy for the Lebanese Land Transport Sector*

This study, with draft version completed in December 2016, focused on establishing 'a procedure and structure for the sector's and donor's coordination' and was funded by the European Union. As part of the study, a set of physical transport projects were recommended and these are as follows:

- Development of the Greater Beirut bus network, including more environmentally friendly vehicles
- Development of a Bus Rapid Transit network for the Greater Beirut Area
- Rehabilitation and improvement of specific roads
- Development of the strategic highway network i.e. widening of A1; Beirut Peripherique; Eastern Ring Road, Tripoli; Northern Pan Arab Highway (Beddaoui – Aabboudiyeh); Eastern Pan Arab Highway
- Rehabilitation of Tripoli-Syrian border rail link
- Development of logistics centres and dry ports
- Enhancement of land-cross border facilities

2.4.4 *Summary of Proposals*

The above studies are broadly similar in terms of their proposed investment programme, although the later 2016 strategy has greater emphasis on the development of the public transport network. The fact that little progress was made since the 2006-2009 programme indicates some underlying problems with capital investment in the transport sector, particularly in terms of funding of infrastructure improvements.

Nevertheless, funding was obtained for some programs/projects, either from external sources or from the Government. These programs/projects that are categorized as ongoing and committed are listed in the below Table:

Table 2-3: List of Ongoing and Committed Programs/Projects in the Transport Sector

Ref. No.	Category/Programme/Project Group	Contract Value (Million USD)
TO1	Beirut-Damascus Highway (Mdeirej to Masnaa)	350
TO2	Northern Coastal Highway – (Deir Ammar – Abdeh)	22
TO3	Northern Coastal Highway – (Tripoli Eastern Ring Road)	190
TO4	Northern Coastal Highway – (Tripoli Western Ring Road)	72
TO5	Northern Coastal Highway – (Akkar – Phase 1, Bared to Halba)	50
To5a	Akkar Arab Highway – Phase 2	100
TO6	Southern Coastal Highway (with link Sour – Nakoura)	60
TO7	Zahle – Baalbeak Road (link Karak –Ryak)	26
TO8	Rehabilitation and improvement of Roads in various Areas (Projects of the CM Decision 99 year 2014)	150
TO9	Jounieh Highway Improvement (A1)	90
TO10	Lebanon Roads and Employment (WB / COM approved)	200
TO11	Rehabilitation and Development of Tripoli Port	98
TO12	Various Road and Infrastructure Funded Projects (IDB, AFESD)	101
	Total	**1,509**

2.5 Development Vision

A broad comparison between the existing conditions and stated objectives reveals major gaps that need to be filled if those objectives are to be achieved at all. These gaps can be roughly stated as follows:

- Several strategic links are missing in the road network. This has resulted in unbalanced traffic patterns, especially on the major corridors along the coast and on the Beirut-Damascus linkage, which is evidenced by the bottleneck effects on traffic in various locations. Due to these missing links, many investments in road works are still short of providing the full service they were meant to offer.
- It is a common understanding in transport planning that efficient transport, especially in urban areas, cannot be achieved except through mass transport. The prevailing conditions of public transport in Lebanon and lack of a minimum level of service for any mass transport mode is resulting in severe impacts on traffic, safety, environment and society in general. Provision of adequate public transport is an evident high priority in any planning exercise in Lebanon.
- The road network in Lebanon has been subject to many rehabilitation initiatives since the end of the civil war to bring it back to an acceptable condition. These initiatives have had varying levels of success. In any case, the fact remains that many roads are still operating in poor to critical conditions, causing negative impacts on safety and vehicle operating costs. The rehabilitation needs and a proper maintenance strategy for the road network remain essential in preserving the previous investments in road assets.

In general, transport improvement projects should reduce journey times and costs and, in the long-term, contribute to the economic development of the country. This latter benefit could be through transport cost savings, improved productivity, removing bottlenecks or providing missing, or a better utilisation of national assets. In addition to direct benefits, transport improvements can generate indirect benefits, namely:

- Better transport access can result in an increase in land values.
- The opening up of new markets to producers.
- Employment generation opportunities, particularly during the implementation phase.
- Improved access to rural areas and better access to schools, hospitals, etc.

What is desired is an Integrated and efficient transport system able to support a prosperous economy that promotes sustainable growth, enables a healthier life style, provides safe and accessible mobility options, facilitates trades, socially integrates all Lebanese people, preserves the environment, and aids in mitigating the negative impacts of the Syrian Crisis.

For this present study, the following overriding issues must also be addressed before a transport project is selected for a priority programme:

- Does the transport project satisfy national objectives and is it in line with transport policy?
- Does the transport project ameliorate the current socio economic issues prevalent among vulnerable groups while also considering the Syrian displaced crisis?

2.6 Justification for New Capital Investment Programme

The status of the existing transport network in Lebanon, along with the progress of existing programs and strategies, the importance of transport for trade flows, and the impact of the Syrian Crisis provide evident justification for a new Capital investment programme to keep the transport sector competitive, improve the quality of life and work in the country, and allow the Lebanese economy to benefit from a state of the art transport system rather than being strained by it as it is today. The justification revolves around 5 main pillars:

1. Capacity and Impact on economic activity
2. Sustainable development and access to services for vulnerable groups

3. Facilitating Trade and Movement of goods in and out of Lebanon
4. Reintroducing Public Transport to Lebanon
5. Generating Employment

2.6.1 *Capacity and Impact on Economic Activity*

As stipulated in section 2.2, the current condition of the road network in Lebanon Is in need of constant maintenance, rehabilitation, and the establishment of new strategic links. The additional strain placed on the road network due to the Influx of displaced Syrians has amplified this need substantially.

Major urban conglomerations such as the Greater Beirut Area, which are the economic and cultural hubs of the country, are in dire need of road upgrades as hundreds of thousands of daily commuters travel to and from these cities on a daily basis passing through their main roads. Several substantial bottlenecks exist which inflict losses in time and hence costs for people and businesses. Furthermore, the decreased Level of Service within the road network of these cities has a negative impact on the value of land and property, the environment, and the quality of life for their inhabitants. A Capital investment programme focused on establishing new strategic links at the city entrances with bypasses and road upgrades and maintenance within urban roads will have direct cost-time benefits for individuals and businesses and improve the quality of life for the inhabitants of these cities.

Rural areas will also be in need of Capital investments to rehabilitate and maintain their roads, particularly the Akkar and Beqaa Governorates, as they currently host around 60 % of displaced Syrians and have a significant new strain on their road networks noting that the initial condition of these roads was not ideal.

Furthermore, establishing new links between and within areas will have an indirect geographical economic impact by attracting new businesses and investments to these areas along the newly established links, which will benefit land value and economic livelihood of the local population.

2.6.2 *Sustainable Development and Access to services for vulnerable groups*

Lebanon is subject to economic disparity amongst different areas. Data on poverty in Lebanon remains limited. The most recent comprehensive study dates back to 2011 (before the full impact of the Syrian Crisis on Lebanon). At the time, poverty in Lebanon was widespread across the country, with overall poverty in Lebanon estimated at 27%. The Bekaa region and North Lebanon in particular recorded the highest levels of poverty. With the highest concentrations of Displaced Syrians flooding into these regions, an exacerbation in such levels is expected. It is estimated that, in addition to the 1.2 million already living below the poverty line, in the period 2012-2014 an additional 170,000 Lebanese were pushed below the poverty line.

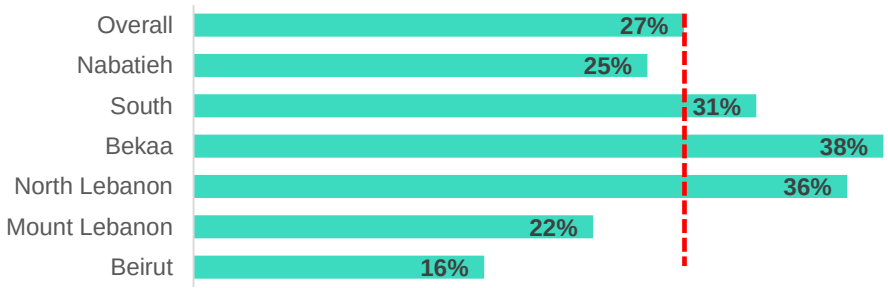

Figure 2-4: Poverty Rates by Region 2011, Source: World Bank, 2016

The majority of displaced Syrians are living in areas already subject to high poverty rates. This situation has deepened the vulnerability of the Lebanese population and heightened tensions between the two communities.

The map below, prepared in cooperation with the Prime Minister's Office, UNICEF and UNHCR, shows the distribution of poor Lebanese and registered Displaced Syrians at cadastral locality level. There are

251 such vulnerable localities (out of the total 1,577 in Lebanon). These cover 87% of registered Displaced Syrians and 67% of deprived Lebanese. This gives an indication regarding the areas that require the most attention in terms of poverty alleviation and infrastructure development.

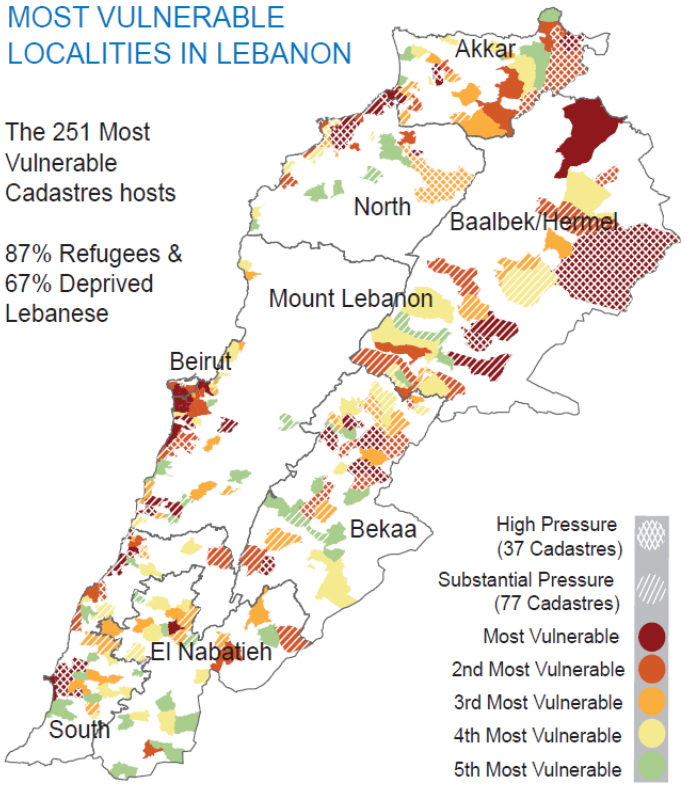

Figure 2-5: Vulnerability Map, Source: Lebanon Crisis Response Plan 2015-2016 (Government of Lebanon and UN)

Improving the quality of life for these vulnerable groups can only be achieved through sustainable development which will require providing new links and accesses to hospitals, schools, government institutions, and access to the Greater Beirut Area and other major cities which are the countries social and economic hub. This would increase job opportunities for the under privileged and help in promoting sustainable development and equity.

2.6.3 *Facilitating Trade and Movement of Goods in and out of Lebanon*

Lebanon's Air and Maritime ports in addition to its major international highways (The Coastal and Beirut-Damascus Highways) have been functioning at capacity since before the onset of the crisis. Furthermore, the closure of the Syrian Border has led to a greater focus on Maritime trade which has placed an even greater strain on the country's ports. Finally, the closure of Syria's air and maritime ports in addition to most of its land borders to international trade, mean that a substantial amount of goods destined for Syria either for the humanitarian relief or the future reconstruction process will inevitably transit through Lebanon. Lebanon is hence in a very strategic position to fill in this market gap and counter balance the trade deficit which was amplified by the Syrian Crisis. This would require upgrades to its major maritime ports such as Beirut and Tripoli, Beirut Rafic Hariri International Airport, and constant rehabilitation and maintenance of its major international routes such as the coastal and Beirut-Damascus Highways. Other notable projects that would satisfy this pillar is the Tripoli Northern Border Freight Railway link in addition to the modernization of the Renee Mouawwad/Koleiat Airport for charter, cargo, and domestic passenger flights as it is situated strategically only 6 Km from the Syrian Border.

2.6.4 *Reintroducing Public Transport to Lebanon*

Strategic Links, Maintenance, and Rehabilitation will not be sufficient to mitigate congestion and bottlenecks alone, and would require large capital investments with large expropriation costs. Reintroducing public transport via the existing coastal railway ROW for a Bus Rapid Transit System within the Greater Beirut Area would provide an alternative form of transportation, which is accessible to a large portion of the population. Such a system would also allow reclaiming a misused and abused national asset, concession financing which would generate revenue for the government, substantial employment during construction and operation, and easing traffic along the coastline.

2.6.5 *Generation of Employment*

The Capital Investment Program will induce several economic benefits of which Employment is key. For all these projects the size of construction contracts will be large and several skilled and unskilled workers will be provided with employment for the duration of construction with a smaller portion during operations. In a country where unemployment is currently at 6 % for Lebanese citizens with youth unemployment reaching 20 % (figures for displaced Syrians are substantially higher), this investment programme is crucial in terms of alleviating poverty and providing opportunities for vulnerable groups preventing a shift towards crime and extremism.

2.7 Strategic Capital Investment Programme

Based on the sector development vision and identified gaps, the Transport investments identified for inclusion in the Capital Investment Programme should satisfy one or more of the following criteria:

- Complementing missing strategic links in the Lebanese road network
- Improvement to the Public Transport supply and encouraging the shift from private car usage
- Preserving the road assets through proper rehabilitation and maintenance

Each one of the above criteria will, to a greater or lesser extent, reduce the burden on the Lebanese transport network due to lack of proper maintenance, investment, institutional problems, congestion etc.. Especially with the mass influx of displaced Syrians.

Data was collected and analysed from various sources including the Ministries programmes, projects, and requirements in addition to previous studies and development programmes to group and identify 18 programmes in addition to 2 sub-programmes which would compose a Capital Investment Programme that focuses on the three pillars identified above covering land, air, and marine transport.

Each one of these programmes contains several sub projects distributed against different Lebanese Cazas and Governorates based on the social and economic needs for each respective population identified by the relevant ministries and policies in addition to the strategic needs of the nation as a whole.

This Strategic CIP will act as the general framework in which all transport projects with their different development goals, scales, focuses, and geographic outreach can be incorporated into a wider strategic programme with dedicated national funding, commitments, SDGs, agencies, priorities, and implementation cycles.

The list of proposed Transport investments is included in the below Table:

Table 2-4: Transport Capital Investment Projects – Cycles 1 and 2

Ref	Project	Region	Description	Estimated Cost (MUSD)		Status		Impact	Generated Employment	Priority Score	Implementation Cycle
				Investment	Land Expropriation				Million Labour-Days		
TP1	Dbaye - Nahr Ibrahim Motorway (A2) - Phase 1	National	Design and Construction for Development works	247	125	Design partially available	2	3	2.9	5	1
TP2	Beirut Peripherique - Phase 1	National	Design and Construction for Development works	232	254	Design partially available	2	3	2.7	5	1
TP5	Northern Coastal Highway - Akkar	National	Pan Arab Highway - Akkar	150	50	Design available	3	3	1.75	6	1
TP10	Bus Rapid Transit System - Greater Beirut Public Transport Project	National	Design and Construction of dedicated routes and Stations in addition to dedicated Bus Routes within Greater Beirut	500		Feasibility & ESIA available	3	3	5.8	6	1
TP16	Rehabilitation and Development of Beirut Rafic Hariri Airport - Phase 1	National	Design and Construction of Rehabilitation and Development Works- Includes Various works expected for the development goals of BRHIA	500		Design under preparation	2	3	5.8	5	1
TP8/8a	Rehabilitation of classified Roads and Municipal Roads	Multi-Regional	Design and Construction for Road Rehabilitation and Expansion in addition to urban facilities projects within the responsibilities of Municipalities	509[1]		Design available	3	3	5.8	6	1
TP1	Dbaye - Nahr Ibrahim Motorway (A2) - Phase 2	National	Design and Construction for Development works	330	166	Design partially available	2	2	3.8	4	2
TP2	Beirut Peripherique - Phase 2	National	Design and Construction for Development works	310	338	Design partially available	2	2	3.7	4	2
TP4	Northern Coastal Highway - Beirut Entrance	National	Antelias- Nahr Beirut Seaside Highway	180		No design	1	3	2.1	4	2
TP6	Toufiqiyeh- Ras Baalbak- Syrian Border Highway	National	Design and construction of 35 km highway from Toufikia connecting to Ras Baalbek and leading to the Syrian border	110	55	Design under preparation	2	3	1.3	5	1
TP7	Beirut-Damascus Highway Completion	National	Jamhour - Baalchmey & Mdeirej Completion. Providing a safer and faster road from Beirut through Mount Lebanon and Bekaa Valley to connect to Damascus.	400	100	No design	1	3	4.6	4	2
TP9	New and Upgrading of Road Network at multiregional scale	Multi-Regional	Various connections, road rehabilitations and upgrades, parkings, and other infrastructure works	380	50	Design partially available	2	2	4.4	4	2
TP11	Tripoli-Syrian Border Railway	National	Design and Construction Works for Railway Tracks. Includes both phases 1 and 2 of the Tripoli-Syrian Border Railway in addition to a rehabilitation of the seaside Railway track across Lebanon to be used for Public Transport	90	0	Design partially available	2	2	1.0	4	2
TP12	Touristic Port in Jounieh	National	Design and Construction Works for Touristic Port	62		Design available	3	1	0.7	4	2
TP16a	Rehabilitation and Development of Rene Mouawad Airpot in Akkar	National	Design and Construction of Rehabilitation and Development Works to meet development goals of Rene Mouawad Airport	100		No design	1	2	1.1	3	2
TP18	Service road for Coastal Highway – Phase 1	National	Providing safe exit roads for cars and passengers from cities and major town. Service road section 1 from Jounieh to Jbeil, and section 2 from Khalde to Damour	38	68	Design under preparation	2	3	0.4	5	1

[1] 250 MUS$ for the Beirut – North section are under negotiation with the WB.

Ref	Project	Region	Description	Estimated Cost (MUSD)		Status		Impact	Generated Employment	Priority Score	Implementation Cycle
				Investment	Land Expropriation				Million Labour-Days		
TP18	Service road for Coastal Highway – Phase 2	National	Providing safe exit roads for cars and passengers from cities and major town. Service road section 1 from Jounieh to Jbeil, and section 2 from Khalde to Damour	112	202	No design	1	3	1.3	4	2
TP19	Feasibility Studies for Major Projects	National	Conducting technical and financial appraisals for projects not included in CIP	25	-	Studies	2	3	0	5	1
			Total Cycle 1	**2,311**	**552**						
			Total Cycle 2	**1,964**	**856**						
			Total Transport Cycles 1 and 2	**5,683**							

Table 2-5: Transport Future Capital Investment Projects – Cycle 3

Ref.	Project	Region	Description	Estimated Cost (MUSD)		Status		Impact	Generated Employment	Priority Score	Implementation Cycle
				Investment	Land Expropriation				Million Labour-Days		
TP1	Dbaye - Nahr Ibrahim Motorway (A2) - Phase 3	National		247	125	No design	1	2	2.9	3	3
TP2	Beirut Peripherique - Phase 3	National		232	254	No design	1	2	2.7	3	3
TP3	Southern Coastal Highway (Saida Bypass and Sour Link)	National	Completion of a missing 7.5km Link on the Souther Coastal Highway through Saida South Highway Road- Phase 5 Section 2 - 3 km from Bourj Rahhal-Abbasiya in Sour	450	150	Design partially available	1	2	5.2	3	3
TP14	Expansion of Saida Port	National	Design and Construction of Port Extension	60		Design available	1	2	0.7	3	3
TP15	Touristic Port in Sour	National	Design and Construction Works for Touristic Port	30		No design	1	2	0.3	3	3
TP20	Rehabilitation of Tripoli Port-Phase 2	National		150		No design	1	2	1.7	3	3
			Total Transport Cycle 3	**1,169**	**529**						
				1,698							

2.8 CIP Update: Municipalities and Governorates Requirements

2.8.1 *Methodology*

The Capital Investment Programme was prepared at the Strategic Level based on the demands, policies, and portfolios of projects set forth by the different involved ministries and based on the development goals of the transport sector in Lebanon. It covers the main ports (air and maritime) of the Republic in addition to the 6,500 Km of classified roads and major public transport schemes and is reflective of the development vision and strategy for the Sector on the National scale.

The desired development goals cannot however be achieved without incorporating the development schemes that include the full 22,000 Km network which also includes 15,500 Km of unclassified roads which fall under the jurisdiction of the Municipalities and Governorates of the Republic in addition to the minor public transport/ports schemes that cover their areas of jurisdiction. Sustainable development, employment, inequality reduction, public transport, and any socio-economic activity has to consider grassroots projects and employ a form of decentralization in development to ensure financial viability and sustainability of the investment programme and the adequate capture of requirements from the key beneficiaries (the residents and businesses of the various Lebanese towns and cities).

The framework of programmes in the CIP allows the incorporation of future projects and initiatives that serve the same development goals and can benefit from the same funding and mechanisms of certain respective programmes.

For this purpose, a bottom up and organic approach was adopted to identify the needs and requirements of all municipalities, Cazas, and Governorates throughout the republic through a series of meetings and consultations between the Ministerial Committee for development, representatives of the respective ministries and agencies, and the representatives of the respective Municipalities, Cazas and Governorates.

Municipalities, Ministries, Governorates, and Cazas produced their respective requirements in the forms of project lists and official requests. These requests differed according to project type, status, and jurisdiction and where analysed and sorted based on the following criteria:

1. Source of request/document title
2. Governorate
3. Caza
4. Involved Municipalities
5. Project Scope
6. Project Status
7. Project Category/type
8. Classification (in case of roads projects)
9. Investment and Costs
10. Source and availability of funding
11. Jurisdiction of project
12. Required Services
13. Additional remarks and special circumstances

The projects that made up these requests were tabulated based on these criteria.

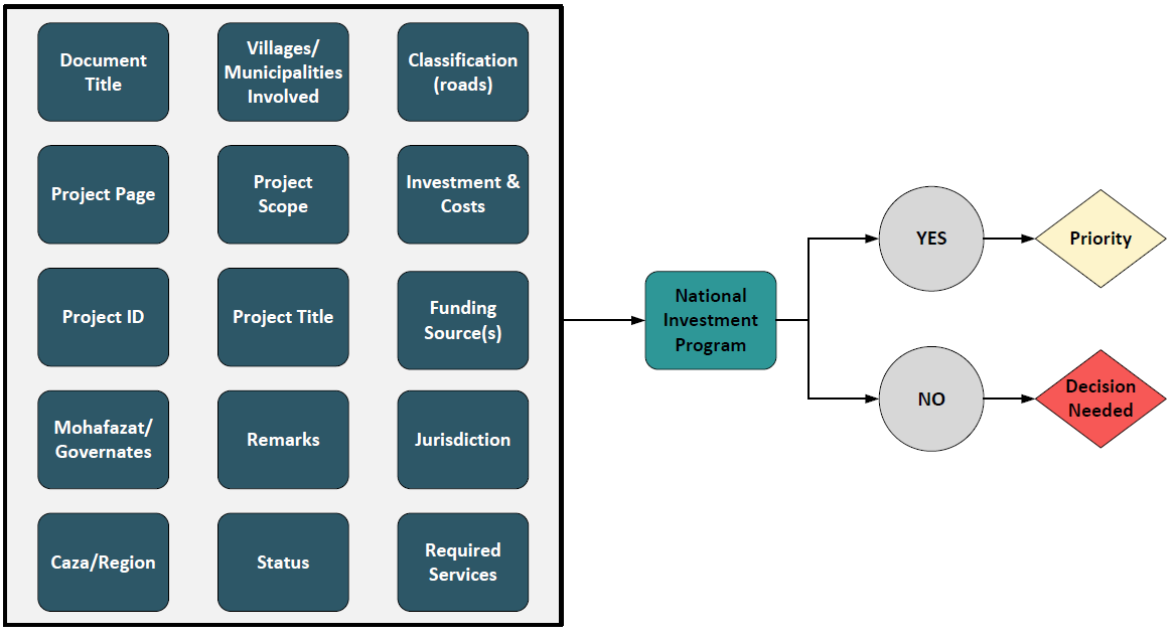

Figure 2-6: Method of Analysis for Municipalities and Governorates Requirements

Next steps included providing missing information, as possible, that fall under the above identified criteria for each project. This includes cost, scope details, status, involved agencies, and any special circumstances. This allowed adequate evaluation and validation of each project to occur based on a Multi Criteria Analysis.

These criteria where used to employ a Multi Criteria analysis through which the following was determined for each project:

1. Potential source/mechanism of funding
2. Inclusion in Capital Investment Programme
3. Implementing Agency/Agency of Jurisdiction
4. Social and Economic Benefit
5. Priority/urgency of implementation

After completing the Multi Criteria Analysis, projects were analysed in the context of the development schemes of the Lebanese government and the strategic Capital Investment Programme. Projects where then grouped according to the following three categories:

1. Projects with a scale, scope, benefits, and required investment that would allow them inclusion within the Strategic Capital Investment Programme. Their priority cycles were determined based on where they fell in the programme, their availability and funding status.
2. Projects with socio-economic benefits that could be funded from sources other than the Capital Investment Programme and/or via dedicated municipality budgets originating from the relevant ministries..

It is important to stress on the fact that this exercise was conducted to add to the development strategy for the Transport Sector under the umbrella of the Capital Investment Programme. The municipal and ministerial requests, that were incorporated, validate this strategy and fill in its inherent gaps. Requests that would cause an offshoot from this strategy were not incorporated.

The goal of this exercise is to issue a comprehensive document outlining the National Vision and context of the transport sector in Lebanon for the year 2030. This would include projects at the strategic level in addition to the requirements of Governorates and municipalities. This vision would include the updated capital investment programme in addition to lists of projects that would require other sources of funding (identified in Scheme2).

2.8.2 *Analysis and Results*

Data was obtained mainly in the form of project lists and minutes of meetings, through the following two sources of information:

1. Meetings with the ministerial committee for development, Governorate, Caza, and Municipal representatives and ministerial representatives. These meetings produced lists of projects and concerns that were coordinated between both the ministries and the elected municipal and governorates representatives. They included both ongoing and proposed projects in the Ministry's and Municipalities short, medium, and long term development plans in addition to key strategic concerns and traffic issues with their associated proposed mitigation measures. In certain instances they also included public transport initiatives and conceptual proposals and requests for studies/design works.
2. Follow up project lists sent by the Ministry of Public Works. These lists included a number of ongoing and proposed projects of varying scales and with dedicated funding from the Ministry's budget for maintenance and rehabilitation and these were considered along with the requests stipulated in the meeting.

These projects were sorted and organized. Information on the capex, source of funding, and project status for a large number of these projects still needs to be collected and finalized in order to validate the analysis.

The following five categories were used to group projects based on their type, goal, and development framework/priority:

1. Road Rehabilitation and Improvement Projects
2. New Links and Roads
3. Ports (both Maritime and Air)
4. Public Transport Projects (Rail, Bus, Pedestrian)
5. Parking Projects

Although the same criteria were used in the MCA for all categories, each category had its own areas of focus and considerations while finalizing the project grouping.

2.8.3 *Road Rehabilitation and Improvement Projects*

By decree of Lebanese law, all road rehabilitation projects fall under the jurisdiction of the Ministry of Public Works and Transport and should as such be funded via the Ministry's allocation of funds to the relevant municipalities, cazas, or governorate (depending on the scale of the project). Other projects such as public transport initiatives and new strategic roads and links require special funding via a dedicated ministerial decree.

These Road rehabilitation, maintenance, and improvement projects also include the construction of new roads which enhance the functionality of an existing network. The Municipal and governorate requested projects included a substantial number of projects falling under this category, as did the Ministry of Public Works and Transport which presented its list of ongoing and proposed projects part of its improvement programme for various municipalities across the Republic. As the Strategic Capital Investment Programme includes dedicated sums and programmes for roads rehabilitation, maintenance, and improvement as part of its three pillars for development, the vast majority of the rehabilitation projects requested by the ministries and municipalities were incorporated into these programmes and hence considered within the CIP. The Capital Investment Programmes considered are the following:

1. TP8: Rehabilitation and Improvement of Roads in Various Lebanese Areas. Dedicated Funding of $309 Million
2. TP8a: Rehabilitation and Improvement of Municipal Roads. Dedicated Funding of $200 Million

The types of works associated with these projects include the following:

- Pavement and grading works
- Expansion (widening)
- Safety Improvements
- Introduction/Removal of separators and/or roundabouts
- Introduction of new roads, links, and/or connections that enhance the operation of the existing particular network
- Construction of retaining walls
- Barriers
- Signing and Marking
- Traffic Signals and general traffic management
- Vehicle Inspection Facilities
- Bridge/overpass maintenance and construction
- Associated legislative, acquisition and administrative works

These Programmes were established to provide funding for all rehabilitation activities for classified (TP8) and unclassified municipal (TP8a) roads based on strategic needs, condition of roads, and the programmes of the ministries and relevant municipalities. Further studies are underway to determine the classification status of the roads within the various projects that would enable categorizing each project under either TP8 or TP8a. Furthermore, it is recommended that for each requested project more accurate information should be provided and determined for capex, required services and project status, in addition to road conditions. The current results are given in Table 2-5 showing the total requested projects by the Ministry of Public Works and Transport and other sources.

The current available funding within TP8 and TP8a should be validated against the capex and other costs associated with these projects as well.

Table 2-6: Number of Roads and Rehabilitation Projects

Project Category	Lebanon Totals*		
Classification	**Total MPWT**	**Total Other**	**Sum Total**
Rehabilitation	1,609	455	2,064
Capital Investment Programme	1,609	454	2,063
TP8- Rehabilitation and Improvement of Roads in Various Lebanese areas	1,609	443	2,052
TP9- Upgrading of Road Network in Greater Beirut Area	0	11	11
Short and Medium Term Projects (Other Funding)	0	1	1

*The values presented in the table are the number of requested projects.

With the data currently available, all but 12 rehabilitation projects were incorporated into the Capital Investment Programme's TP8 Sub-Programme. This included 1,609 mostly small sized projects in terms of capital which were provided from the Ministry of Public Works and Transport's programme in addition to 443 projects of small and medium sizes from a capital perspective which were provided from the consultations and coordinated lists of the Ministries and Municipalities. 11 out of the remaining 12 were incorporated into TP9- Upgrading of Road Network in GBA, which is a master programme with all the major linkages and rehabilitation works within the GBA. One project was considered to be out of the scope of the CIP and was assigned to the Short and Medium Term projects category. That project was the establishment of a vehicle inspection centre in the Koura Caza that would help promote short and medium term socio economic goals and road safety within the Caza.

2.8.4 *New Links/Roads*

This Category includes the construction of new links and roads, which present their own added strategic value rather than merely complementing and/or enhancing the operation of the existing classified network. They can fall into existing programmes with the CIP or require the formulation of their own CIP sub-programme. They include the following project types:

- Missing Strategic links within the existing classified network. This includes mainly the coastal highways and the Beirut Damascus highway in addition to several entrances to major cities.
- Additional major links between areas that offer their own socio economic benefits and work towards the larger strategic development goals of those areas (such as the TP1- Dbaye Nahr Ibrahim A2 Motorway)
- Additional major links that provide new routes and trade flows into Syria that can benefit the humanitarian relief and/or future reconstruction effort
- Major Links that fall under the umbrella of the rehabilitation programme.
- Major Links that should be included in the CIP but would require their own sub-programme as they do not fit under any of the current categories,

Such projects usually require dedicated ministerial decrees in order to request and gather funding.

Projects that fell within the context of existing major schemes within the CIP were grouped along with the corresponding TPs. Other projects, which didn't fit a particular category but belonged within the development context of the CIP were highlighted as well.

Other links with short and medium term social and economic benefits were also selected and grouped together. These projects will require alternative sources of funding, with a selection of them, which need to be subjected to further financial, technical, and economic appraisal before consideration. The current results are given in Table 2-7.

Table 2-7: Number of New Roads/Links

Project Category	Lebanon Totals*		
Classification	**Total MPWT**	**Total Other**	**Sum Total**
New Road/Link	1	87	88
Capital Investment Programme	1	56	57
TP1- Dbayeh Nahr Ibrahim (A2) Motorway	0	1	1
TP5- Northern Coastal Highway	0	1	1
TP7- Beirut Damascus Highway Completion	0	3	3
TP8- Rehabilitation and Improvement of Roads in Various Lebanese areas	1	31	32
TP9- Upgrading of Road Network in Greater Beirut Area	0	17	17
TBD**	0	3	3
Short and Medium Term Projects (Other Funding)	0	31	31

*The values presented in the table are the number of requested projects.

**These projects are already ongoing and were not considered in the Capital Investment Programme.

Of the 88 identified projects, 57 were incorporated into the Capital Investment Programme. These projects included the following:

- All works related to the Dbayeh-Nahr Ibrahim A2 Motorway, as the larger programme is already a quintessential part of the CIP
- All works related to the northern portion of the Coastal Highway, as the larger programme is already a quintessential part of the CIP
- All works related to the Beirut-Damascus Highway, as the larger programme is already a quintessential part of the CIP
- All improvement/rehabilitation projects with substantial capital value and strategic impact. These include construction of new links that serve the purpose of network improvement and fall within the categories of TP8 and TP10

31 projects were assigned short and medium term projects. A number of these projects do have strategic value, but require further economic, financial, and technical appraisal before being rendered feasible and incorporated into the CIP. These included the following key projects:

- The Hammana Tunnel
- The Ainata-Arz Tunnel to link the northern coast with the governorate of Baalbeck-Hermel

2.8.5 *Maritime and Airports*

The existing CIP covers the nation's Main airport in addition to a smaller airport in the Akkar region as well as most of the major commercial and touristic maritime ports along the coast.

Municipality and ministry's requests which fell under any of the existing major CIP schemes were incorporated into those schemes whereas smaller port projects such as various fisherman's ports construction and development activities were categorized as projects with small and medium term social and economic benefits and will require funding from alternative sources. The current results are given in Table 2-8.

Table 2-8: Number of Maritime and Air Ports

Project Category	Lebanon Totals*		
Classification	**Total MPWT**	**Total Other**	**Sum Total**
Port	3	10	13
Capital Investment Programme	1	2	3
TP14- Expansion of Saida Port	0	1	1
TP12-Touristic Port in Jounieh	1	0	1
TP16a-Rehabilitation and Development of Kleyat René Mouawad Airport	0	1	1
Short and Medium Term Projects (Other Funding)	2	8	10

*The values presented in the table are the number of requested projects.

Three projects were included in the Capital Investment Programme. These include the Development of Kleyat Renee Mouawad Airport, the expansion of Saida Port, and the development of a Touristic Port in Jounieh, all of which are strategic projects with existing CIP Sub-Programmes. A total of 10 projects were categorized as Short and Medium Term projects and excluded from the CIP. These included fisherman's ports projects which, despite having added value in terms of locality socio-economic benefits, lack the strategic direction to render them as suitable CIP projects.

2.8.6 *Public Transport Projects*

This category includes any public transport initiative within any ministry portfolio or municipality request. It includes the following:

1. All projects that are part of or add value to the Greater Beirut Public Transport Project/Bus Rapid Transit System. This includes stations, clearing the ROW, rail works, and violations resolutions.
2. All projects for bus stations, bus stops, or bus lanes
3. The Beirut Mono Rail project
4. Any legislation or administrative reform that promotes and enhances the current state of public transport within the country

Projects that fell under the scheme of the GBA BRT project were added to it whereas other projects suitable for the CIP but not falling within this category were highlighted for consideration. As for the other initiatives they were categorized as projects with short and medium term benefits that require other sources of funding. The current results are given in Table 2-9

Table 2-9: Number of Public Transport Projects

Project Category	Lebanon Totals*		
Classification	**Total MPWT**	**Total Other**	**Sum Total**
Public Transport: Rail/Bus/Pedestrian	0	19	19
Capital Investment Programme	0	11	11
TBD	0	3	3
TP10-Greater Beirut Public Transport Project	0	7	7
TP11- Tripoli - Syrian Border Railway	0	1	1
Short and Medium Term Projects (Other Funding)	0	8	8

*The values presented in the table are the number of requested projects.

9 out of the 17 Public Transport Projects requests were incorporated into the CIP with the majority of them (6) being added to the GBA Public Transport Project (BRT) as they were supplementary projects that serve the larger strategy of the BRT or in certain instances sub projects that were mentioned by the municipalities. They include bus stations, bus stops and ROW works.

1 Project was added to the Tripoli-Syrian Border Railway project and it consisted of enabling and clearing works and in certain instances overlaps with the major TP11 programme. Further investigations regarding the structure of the programme and its capex are needed.

3 projects involving public transport outside the context of the GBA were included but still require assignment to a particular sub-programme or possibly the creation of a dedicated one.

2.8.7 *Parking Projects*

This category includes over ground and underground parking structure projects across the country. Current CIP schemed for Beirut and Tripoli include parking projects and requests within these two cities were added to the CIP accordingly as these are the nation's two biggest cities and urban conglomerations with substantial traffic and considerable parking issues and scarcity. As for other parking projects, they were categorized as projects with short and medium term benefits that require other sources of funding. The current results are given in Table 2-10.

Table 2-10: Number of Parking Projects

Project Category	Lebanon Totals*		
Classification	**Total MPWT**	**Total Other**	**Sum Total**
Parking	0	13	13
Capital Investment Programme	0	7	7
TP9- Upgrading of Road Network in Greater Beirut Area	0	7	7
Short and Medium Term Projects (Other Funding)	0	6	6

*The values presented in the table are the number of requested projects.

Parking Projects that fall within the schemes of the upgrading the network in the GBA were categorized under TP9 as this parkings within the capital are scarce and their introduction is crucial to energizing economic and social viability.

Other parking projects in other areas were considered to have smaller value and categorized under Short and Medium Term Projects.

2.8.8 *Summary and Way Forward*

For all the identified projects within all the programmes included both CIP and non CIP projects, various items still need determination and validation within the way forward. This includes the following:

1. Finalizing the classification of all roads into International, Primary, Secondary, Local and Municipal in order to categorize rehabilitation programmes under TP8 and TP8a
2. Evaluating the Condition of roads categorized under TP8/8a in order to validate their inclusion
3. For all projects that were added to CIP sub-programmes, costing, scoping, and phasing exercises should be conducted in order to avoid any overlaps with previous works and set the development and implementation programme for the future
4. For new CIP projects with no existing sub-programme, the possibility of creating new sub programmes should be examined
5. For Short and Medium Term Projects, further financial, economic and technical appraisals should be conducted
6. For all projects CAPEX and OPEX should be finalized and validated
7. For all projects the status of design and construction should be finalized and validated
8. For all projects the adequate source of funding should be determined (whether within the CIP or outside of it)

This is given in more detail for each Category, Scheme, and TP in Table 2-11.

The exact scope of the aforementioned tasks will be determine in subsequent meetings and consultations and based on the information that can be made available.

Table 2-11: Summary and Way Forward

Category	Number of Requested Projects Percentage of projects within CIP or other category	Way Forward
Rehabilitation	**2,064**	• **CAPEX/OPEX validation** • **Status of Project Validation** • **Source of Funding Validation**
Capital Investment Programme	*99.9%*	• *Conducting Classification Exercise to subdivide projects between TP8 and TP8a* • *Evaluating Roads Condition to validate inclusion of all projects in CIP* • *Conduct Cost Estimation exercise to further validate priority*
Short and Medium Term Projects (Other Funding)	*0.1%*	• *Conduct further financial, economic, and technical appraisals* • *Conduct Cost Estimates* • *Determine Source of Funding*
New Road/Link	**88**	• **CAPEX/OPEX validation** • **Status of Project Validation** • **Source of Funding Validation**
Capital Investment Programme	*64.7%*	• *Integrate into appropriate Programmes* • *Identify sub-projects and/or applicable phasing* • *Conduct Classification Exercise* • *Conduct Cost Estimates* • *Examine possibility of assigning new sub programme number* • *Examine possibility of creating dedicated sub programme*
Short and Medium Term Projects (Other Funding)	*35.2%*	• *Conduct further financial, economic, and technical appraisals* • *Conduct Cost Estimates* • *Determine Source of Funding*
Parking	**13**	• **CAPEX/OPEX validation** • **Status of Project Validation** • **Source of Funding Validation**
Capital Investment Programme	*54%*	• *Conduct Cost Estimation to further validate priority*
Short and Medium Term Projects (Other Funding)	*46%*	• *Conduct further financial, economic, and technical appraisals* • *Conduct Cost Estimates* • *Determine Source of Funding*
Port	**13**	• **CAPEX/OPEX validation** • **Status of Project Validation** • **Source of Funding Validation**
Capital Investment Programme	*23%*	• *Integrate into appropriate Programmes* • *Identify sub-projects and/or applicable phasing*
Short and Medium Term Projects (Other Funding)	*77%*	• *Conduct further financial, economic, and technical appraisals* • *Conduct Cost Estimates* • *Determine Source of Funding*
Public Transport: Rail/Bus/Pedestrian	**19**	• **CAPEX/OPEX validation** • **Status of Project Validation** • **Source of Funding Validation**
Capital Investment Programme	*58%*	• *Conduct Cost Estimation exercise to further validate priority* • *Examine possibility of creating dedicated sub programme* • *Integrate into appropriate Programmes* • *Identify sub-projects and/or applicable phasing*
Short and Medium Term Projects (Other Funding)	*42%*	• *Conduct further financial, economic, and technical appraisals* • *Conduct Cost Estimates* • *Determine Source of Funding*
Total Proposed Projects	**2,197**	

Category	Number of Requested Projects Percentage of projects within CIP or other category	Way Forward
Capital Investment Programme	*97 %*	*It is important to note that this percentage is not indicative of the size of the projects or the Capital Investment, merely the project count. In the case of CIP projects, Rehabilitation projects are the most numerous as they consist of several small sized projects from the Ministry lists with capital investments not exceeding $50,000.*
Short and Medium Term Projects (Other Funding)	*3%*	

2.9 Institutional Considerations

To successfully implement the proposed Capital investment programme, the capacities and institutional, legal, and financial framework and personnel required to manage and deliver said programme must be ensured. This can be accomplished through focusing on several areas and disciplines which would allow the creation of political, economic, social, technological, environmental, and legal frameworks and capacities that would enable the Lebanese Transport Sector to effectively deliver the programme. Some key areas that could be considered, include the following:

- Land transport law and regulations
- Training Personnel
- Institutions and Systems for Roads Operation and Maintenance
- Institutions and Systems for Data and Research
- Institutions and Systems for Road Safety
- Development and Enhancement of the Trucking Industry
- Communications and Public Awareness
- Institutions and Systems for Public and Multi Modal Transport
- Standards and Guidelines
- Innovation and Technology Integration
- Trade legislation
- Tariffs, Taxation and Revenue Structures
- Frameworks for alternative and sustainable funding (PPPs, Donors Coordination, etc…)
- Key Indicators to Measure Performance

Previous studies have been conducted and it has been identified that in order to establish an integrated and efficient nationwide transport system supporting a prosperous economy that promotes sustainable growth, enables a healthier life style, provides safe and accessible mobility options, socially integrate all Lebanese people, and preserves the environment, certain institutional capacities need to be in place. In order to achieve these goals the following is needed within the key areas identified above:

1. Functionally integrated legislation
2. Regulations
3. Policies
4. Enforcement Mechanisms
5. Financial structures and frameworks
6. Human resources
7. Technology

A thorough review of the literature in this field has identified various sources in which this aspect has been addressed. A Draft Strategy report titled:" Technical Assistance of the Support Programme for

Infrastructure Sector Strategies and Alternative Financing" prepared by a Hulla & Co./Human Dynamic Consortium as part of the European Union Aid effort has identified the following programmes which are presented in Table 2-12 to promote further capacity assessment and investigation before a thorough institutional capacity building programme is brought forth.

2.10 Possible Schemes for Financing and Private Sector Participation

The purpose of this section is to present the various options and schemes for financing and private sector participation available within the transport sector for both capex and opex intensive projects, in addition to shedding light on the key considerations that need to be examined within the Political, Economic, Social, Technological, Environmental, and Legal contexts in the Republic of Lebanon.

Capital intensive projects such as roads, railways, airports, ports, and large transport systems involve substantial investments that can put a strain on public finance. Due to Lebanon's existing budget deficits, social troubles due to the Syrian crisis, trade deficits, and large public debt, and rapid urbanization and growth, public finances are scarce and are needed for future infrastructure (both physical and social) maintenance and expansion. Furthermore, Lebanon's economic environment is well accustomed to foreign direct investment, privatization, and a GDP, which is generally heavily dependent on the private sector.

2.10.1 *PPP Modes*

The Capital Investment Programme for Transport requires a minimum of 8.65 Billion USD in investment throughout the three identified cycles. This number might grow with the addition of the municipality and ministerial requested projects explained in section 8 and the possible institutional reforms needed which were explained in section 9. Transport Projects offer several forms of PPPs/Private financing and procurement models which could be implemented. These include the following:

1. Management Contracts
2. Management Contracts with Rehabilitation/Expansion (Minimum Capex)
3. Lease Contracts: Management and Maintenance only
4. Build-Lease-Transfer/Build-Own-Transfer: Capex involved
5. Build Lease Transfer: Capex and Operations
6. Area Concessions: Design, Finance, Construct, Manage, Maintain
7. Design-Build-Operate: Design, Construct, Manage, Maintain
8. Build-operate-transfer (BOT)/Design-Build-Finance-Operate-Transfer (DBFOT)
9. Build-operate-transfer Annuity

These Public-private partnerships can increase the access to transport services for the citizens and the economy at a reduced strain to public finances. Availability of transport services will be increased and efficiency will rise as well.

For the different modes of private sector evaluation, this section will examine the following:

- Private sector expertise, experience, and efficiency offered
- Asset Ownership and during contract
- PPP typical duration
- Capital Investment Focus and Responsibility
- Private Partner Revenue, Risk, and Compensation Terms
- Features and relevance
- CIP projects that fit the particular mode

This Analysis is given in Table 2-12.

Table 2-12: List of Possible Projects within an Institutional Context as Identified in the Relevant Literature

Project	Target	Impact
Awareness Campaign for sustainable mobility	To motivate users to use the public transport system	Improve system performance and facilitate cohabitation between different transport modes
Improvement of Transport Legislation and Regulations	• Establishment of Land Transport Authority in order to improve control and management of transportation sector • Restructuring of Public Transport Authorities • Development and enhancement of rules and regulations of Land and multi modal transport activities • Promote Balanced development and better integration of different modes of transport • Applying specific laws and regulations on public areas to organize and clarify the use of each zone	• Improve urban mobility • Ensure transport accessibility to disadvantaged areas and reduction of negative impacts • Organizing the functionality of the transport sector
Reactivation of the Toads Maintenance Management System	• To Improve the general performance of the road network through an optimization of maintenance and rehabilitation activities	• Increase Road Safety Conditions • Improve quality of roads • Improve the efficiency of the maintenance and rehabilitation programmes
Creation of Sustainable Funding Mechanisms and Legislation	• Creation of the legal and administrative framework for such mechanisms • Establishment of a donors coordination group • Promotion of Public Private Partnership frameworks	• Sourcing the needed funding for implementing the programme without straining the government financially
Development and Enhancement of the Trucking Industry	• Improvement of Lebanese fleet characteristics and market share • Market regulation	• Enhancement of Fleet
National Observatory for Mobility and Road Safety	• Develop proposals for a national road safety strategy • Develop expertise and build up scientific and professional knowledge in security • Provide easy access to independent road safety research and information	• Safe mobility and transport
Public Transport Regulations and Authority	• Establish a national public transport authority for future public transport schemes	• Institutionalizing Public Transport
Transport Training Institute	• Education, rehabilitation and training • Continuous trainings to improve the skills of maintenance, organization, control and management • Ensure the quality of research infrastructures and validity of scientific output	• Institution for expertise, education, rehabilitation, and training
National and International Transport Data Centre	• Create a system to receive, collect, and store all data information, and studies • Scientific Analysis and Methodical processing • Assist transportation planners and decision makers • Provide easily reliable and accessible information	• Provision of key indicators to support transportation planners and decision makers

Table 2-13: Characteristics of PPP Modes and Applicability to CIP

Modes/Features	Asset Ownership During Contract	PPP Duration	Capital Investment Focus and Responsibility	Private Partner Revenue Risk and Compensation Terms	Private Partners Roles	Features and Relevance	Applicable CIP Projects
Management Contract	Public	Short-medium (3-5 years)	Not the focus Public	Low (Pre-determined fee, possibly with performance incentives)	Management of all aspects of operation and maintenance	This involves contracting to the private sector most or all of the operations and maintenance of a public facility or service. Although the ultimate obligation of service provision remains with the public authority, the day-to-day management control is vested with the private sector. Usually the private sector is not required to make capital investments	TP8/8a-Rehabilitation and Improvement of Roads in various Lebanese areas.
Management Contract (with rehabilitation/ expansion)	Public	Medium – long	Limited Focus Brownfield (Rehabilitation / expansion) Private	Medium (Tariff / Revenue share)	Minimum Capex, Management, Maintenance	This is similar to management contracts but include limited investments for rehabilitation or expansion of the facility.	TP8/8a-Rehabilitation and Improvement of Roads in various Lebanese areas. Particularly New Roads and Links within the Rehab. Programme
Lease	Public	Medium (e.g., 10-15yrs)	Not the focus Public	High Revenue from Operations	Management and maintenance	e.g. Leasing of retail outlets at railway stations	All Airport and Railway Projects.
Build Lease Transfer (BLT) or Build-Own-Lease-Transfer (BOLT)	Private (Leased to the government)	Medium (e.g. 10-15yrs)	Greenfield Private	Low-medium Pre-set lease from the government.	Capex	Involves building a facility, leasing it to the Govt. and transferring the facility after recovery of investment. Primarily taken up for railway projects	All Airport and Railway Projects. Vehicle Inspection Service-Mecanique
Build-Transfer-Lease (BTL)	Public	Medium (e.g., 10-15yrs)	Greenfield Private	High Revenue from User Charges	Capex and Operations	Involves building an asset, transferring it to the Govt, and leasing it back. Here	All Airport and Railway Projects.

Modes/Features	Asset Ownership During Contract	PPP Duration	Capital Investment Focus and Responsibility	Private Partner Revenue Risk and Compensation Terms	Private Partners Roles	Features and Relevance	Applicable CIP Projects
						the private sector delivers the service and collects user charges.	Vehicle Inspection Service-Mecanique Major Highways and Expressways
Area Concessions	Public	Long (e.g. 20-30 yrs)	Brownfield/ Expansions Private	High Tariff revenue	Design, finance, construct, manage, maintain	Herein the private sector (concessionaire) is responsible for the full delivery of services in a specified area, including operation, maintenance, collection, management, and construction and rehabilitation of the system. Importantly, the operator is now responsible for all capital investment while the assets are publicly owned even during the concession period. The public sector's role shifts from being the service provider to regulating the price and quality of service.	Major Highways and Expressways All Airport, and Railway Projects Ports
Design-build-operate (DBO)	Public	Short-medium (e.g. 3-5 yrs)	Greenfield Public	Medium-High Tariff revenue	Design, construct, manage, maintain	Typically financing obligation is not retained by the public sector.	Suitable for Short and Medium Term Projects not including rehabilitation projects
Build-operate-transfer (BOT)/ Design-Build-Finance-Operate-Transfer (DBFOT)	Public	Long (e.g. 20-30 yrs)	Greenfield Private	High Tariff revenue	Design, finance, construct, manage, maintain	BOT Concession	All Airport and Railway Projects. Vehicle Inspection Service-Mecanique Major Highways and Expressways

Modes/Features	Asset Ownership During Contract	PPP Duration	Capital Investment Focus and Responsibility	Private Partner Revenue Risk and Compensation Terms	Private Partners Roles	Features and Relevance	Applicable CIP Projects
							Ports
Build-operate-transfer (BOT) Annuity	Public	Long (e.g. 20-30 yrs)	Greenfield Private	Low Annuity revenue / unitary charge	Design, finance, construct, manage, maintain	This has been adopted for highway projects in the past. More recently, it is the preferred approach for socially relevant projects where revenue potential is limited.	Major Highways and Expressways
Build-own-operate-transfer (BOOT) or DBOOT	Private	Long (e.g. 20-30 yrs)	Greenfield Private	High Tariff revenue	Design, construct, own, manage, maintain, transfer	Greenfield minor port concessions.	All Airport and Railway Projects Ports
Build-own-operate (BOO)	Private	Perpetual	Greenfield Private	High Tariff revenue	Design, finance, construct, own, manage, maintain	Under this structure the asset ownership is with the private sector and the service / facility provision responsibility is also with the private sector.	All Airport and Railway Projects. Vehicle Inspection Service-Mecanique Major Highways and Expressways Ports

Of each project type, a rigorous analysis needs to be performed to determine its suitability for PPPs under a particular mode, but Table 2-13 puts these projects in the context of PPP suitability and sets the framework for further analysis that will be required in subsequent phases.

2.10.2 *Characteristics, Risks and Considerations*

The PPP mode for roads sector projects is affected by the following major characteristics of the sector:

- Ownership of land for roads is usually public in most nations. Private ownership legal schemes should be established
- The private sector roles can cover a broad spectrum from design and finance through construction, operation, revenue collection and management of the facility.
- Roads projects that do not involve major capital investment (ie, are O&M only) are typically carried out as performance-based maintenance contracts
- Capital projects are of two types: new build (Greenfield) or expansion or addition to existing roads (Brownfield)
- Capital projects are typically carried out as BOTs
- BOT contracts have a long duration to match the lifetime of the assets created
- An important defining feature of a roads BOT is the revenue type. This can be:
    - user charges collected by the contractor (toll),
    - an annuity paid by the public partner, or
    - an indirect user charge that is paid by the public sector rather than being collected from users (shadow toll).

Several aspects of the Public Sector Environment in Lebanon should be assessed in order to identify what reforms and legislations are necessary to enable effective PPP establishment and implementation in the Transport Sector. These areas include the following:

1. Legal Limitations: Identification of any laws or other legal restrictions in Lebanon that limit PPPs.
2. Policy Support: Identification and/or establishment of a policy for private participation in the transport sector in Lebanon.
3. Political Support: High level political champions
4. Community support
5. Public Sector Capacity and Experience: Identification of PP focal points with advisory powers, sponsoring agencies with PPP procurement capabilities, sponsoring agencies with management and regulatory capabilities, sponsoring agencies with previous experiences in PPPs
6. Enabling infrastructure for shared PPPs between multiple jurisdictions
7. Availability of Public Sector Funding Assistance for PPPs: This includes viability gap funding, grant schemes, and multi-lateral agencies funding guarantees.
8. Private Sector Capability, Appetite, and Previous Experiences
9. Land Availability and Acquisition
10. Environmental Impacts
11. Social Impacts
12. Impacts on Labour and employment
13. Main Revenue Sources and Charges: Shadow tolls, traffic risk, determination of charges/tolls etc..
14. Project size, value, bundling of construction and operation, and output specification
15. Time Constraints

2.11 **Category IV Projects-**

2.11.1 *Background*

Requests were recieved from the various stakeholders to include new roads and railway at the national scale. These requests were categorized as follows before implementation:

- Revisions to timeframes of implementation, scope of work, and/or cost estimates of certain projects within the CIP to reflect developmental needs and priorities in different governorates. This included shifting capital investments from one cycle to another as appropriate
- Proposal of new projects that had not been considered in the CIP. These projects require feasibility studies before implementation and such studies will be planned accordingly
- Proposal of new projects with short and medium term strategic and socio economic value that are outside the scope of the CIP (mainly for technical and cost issues). These projects will also be subject to technical and financial appraisals. The cost of these studies is included in the CIP, whereby implementation, if found feasible, may be considered in futre CIP updates.

2.11.2 *General Comments on the CIP and Proposed Next Steps*

The general shared comments form the consultations on the Transport Programme/Projects are summairzed below:

- Comparison should be made with ongoing and completed projects since 1992
- Focus of next steps should be to ensure political buy in on all projects
- Prioritization should be revisited in certain instances due to developmental needs within each governorate within the context of balanced and sustainable nationwide develpments
- Public Sector participation in the funding should be evaluated against budgetary balances and constraints
- Timeframe should be set for institutional considerations and reform (Refernce to section 2.10)
- Next steps should include a deeper examination of sources and mechanisms of funding for the programme
- Operations and Maintenance costs for projects need to be calculated
- Next Steps should include further examination of private sector participation

2.11.3 *Proposed Feasibility Studies for Projects not Included in CIP*

Various projects were brought forward by the stakeholders which have a socio-economic developmental potential but need to be scrutinized further via technical and economic feasibility studies and design development before they can be incorporated into the CIP or allocated other suitable sources of funding. Several of these projects were discussed in the previous CIP update upon the discussions with the ministries and municipalities. They are listed below:

- Design and Construciton of an Elevated Road at Beirut's southern entrance
- National Railway Network (Excluding the Tripoli-Syrian Border link which is already in the CIP)
- Associated road networks for Elissar developments
- Associated road networks for Lenor developments
- Nakoura Port
- Zahrani Port
- The Hammana Tunnel
- The Ainata-Arz Tunnel to link the northern coast with the governorate of Baalbeck-Hermel
- Phase 2 of Tripoli Port Expansion
- Temporary truck road between Beirut and Bekaa
- Road between Tripoli and the Donnieh Caza
- Touristic Port in Sour
- Various Rehabilitation and Improvement works across all 8 governorates. This consists of several projects that need to be evaluated against existing CIP rehabilitation and improvement projects before incorporating into the CIP or other sources of funding.

Various other requests by the stakeholders were studied against the CIP and found to be included within the scope of its projects. This included several segments along the pan arab and coastal highways.

3 WATER AND IRRIGATION

3.1 Introduction

In the 1970s, nearly 100% of the Lebanese population had access to public water services. This has changed drastically since the civil unrest period. The mobilized water resources and capacities of the networks were no more adequate to meet the demands. The Government of Lebanon launched since the 1990s a long-overdue rehabilitation and upgrading of the existing water infrastructure networks; reservoirs and pump stations have been rehabilitated, additional storage reservoirs have been constructed, transmission lines have been either replaced or rehabilitated, and networks have been extended or replaced in areas that were experiencing substantial losses. Yet, limited additional water resources were mobilized and increase in demand and shortages were growing at a faster rate than the rehabilitation and expansion works.

3.2 Background and Current Conditions

The rehabilitation programme implemented to date has not secured yet an adequate water resources management system. Water supply is still being rationed due to shortages of water resources, power failures and excessive power bills for the operation of the pump stations; adequate additional water resources have not been mobilized to date, and surface and ground water resources are heavily polluted due to current wastewater discharge practices. These conditions were intensified due to the additional resources required to meet the demands of and treat the wastewater generated by the 1.5 million displaced Syrians. The UNICEF – WHO, 2016 report revealed that only 36% of the total population are benefitting from safely managed drinking water services.

The Ministry of Energy and Water issued in 2010 the National Water Sector Strategy (NWSS), putting on track the surface water resources management plan, specifically the construction of the dams to meet water shortages, which entailes a concurrent scheme for the protection of the mobilized water resources from illegal and polluting wastewater discharge practices.

The NWSS of 2010 included assessment of the domestic, industrial, and irrigation water demands and projected the demands for 5 years intervals up to the year 2035. The 2010 demands were estimated at 1,473 MCM of which 505 MCM are domestic, 810 MCM are irrigation, 152 MCM are industrial, and 6 MCM are touristic demands. The available public resources provide only 60% of the total demand. The intention was, in addition to increasing the resources, to reduce the losses and un-accounted for water by 10-15% in the first 10 years. Since then old networks are being replaced but at a slower rate than planned; however no records are available to report the improvements and the Syrian crisis necessitated diverting the efforts towards meeting additional demands estimated at 61 MCM/year.

The four Water Establishments (WEs), North Lebanon, Beirut and Mount Lebanon, Bekaa, and South Lebanon, are responsible for the operation and maintenance of the water and wastewater systems. The development of the water resources, i.e, the dams for the mobilisation and development of surface water resources, is the responsibility of the Ministry of Energy and Water (MoEW). The WEs require capacity buildings to be able to properly manage, supervise and take over the upgraded and expanded networks as well as their operation and maintenance.

3.3 Impact of the Syrian Crisis on the Water and Irrigation Sector

The Syrian Crisis has resulted in the displacement of 1.5 million (LCRP 2015) Syrians into Lebanon, the Country whose population is estimated at about 4.5 million (NWSS 2010, number including displaced Syrians at the time). In other words, within a couple of years only, the population on the Lebanese territory increased by 25-30%, unevenly distributed over the various regions, with the highest concentrations in North of Lebanon and the Bekaa, close to the Lebanese-Syrian borders.

Such unanticipated multiplication of the population would have entailed significant impacts on countries with developed infrastructure and water sector; the impacts on Lebanon who is already suffering from a shortage in almost all its infrastructure sectors have evidently been much more severe, and specifically on the water/wastewater sectors. The water supply demands and the generated wastewater flows have been accentuated at the time the government did not have adequate resources to timely and adequately plan and implement considerable improvement on the relevant infrastructure.

Based on the official LCRP 2015 figures of the displaced Syrian population in Lebanon, and the water demand values adopted by the MoEW, the increase in domestic water demand due to the displaced Syrians in Lebanon is estimated at 61 MCM per year. This is accompanied with an increase in wastewater generation by about 50 MCM per year, leading to a total of untreated wastewater of 280 MCM per year at the national level. The Syrian crisis has as such double impact on the sector: it has significantly increased the shortage in supply, and at the same time aggravated the wastewater problem, which constitutes a major contamination problem to the surface and ground water resources used for potable, agriculture and industry.

3.4 Existing Programme and Strategies

The National Water Sector Strategy (NWSS) 2010 prepared by the Ministry of Energy and Water (MoEW), stresses among others, on two main goals:

1- Optimizing the exploitation of the surface water resources to become the main source for water supply and irrigation.
2- Institutional improvement to ensure a better management of the sector to maintain a balance between the demands and the available resources.

The exploitation of the available resources involves the following main components that need to be tackled to achieve the sector's goals:

- Production: the majority of the current water resources production relies on the groundwater which is being extensively extracted and leading to a continuous drop in the water table as the yearly consumption exceeds the recharge. The NWSS calls for a migration as much as possible to the mobilization of the surface water sources that are renewable; hoping to conserve the groundwater as a strategic reserve.
- Transmission and distribution networks should be maintained in good condition to prevent losses and assure continuous supply.
- Conservation and protection of water sources against pollution and specifically biological contamination resulting from shortage in wastewater networks and treatment plants that affects both the surface and ground water sources is essential. Industrial discharges should also be controlled to prevent chemical contamination.

To mobilize the surface water sources, the NWSS identified a list of 40 dams and hill lakes that can store significant volumes of water ranging between 0.3 and 120 MCM and achieving a total static volume of about 670MCM a year that can supply domestic and irrigation demands.

Few of the proposed dams have already been launched (Boqaata, Mseilha, Janneh, Kaysamani, Balaa, El Manzoul ,Yammouneh, Kouashra), Brissa's construction is completed except for lining its reservoir area, Bisri's funding is under preparation, others are considered priority projects but require funding, such as Bared, Qarqaf, Younine and Assi. It is also of utmost importance to initiate the necessary wastewater schemes for the protection of these resources.

Institutional capacity building is essentially required for setting an effective and sustainable management of the Sector, including operation, maintenance, management and conservation of the water resources and infrastructure assets, the reduction/limitation of the losses, and the continuity of the service.

The water sector, which was severely affected by the civil war and its consequences, has been subject to continuous rehabilitation, improvement and expansion. However, the efforts were always unable to

cover the shortage in the water supply. The National Water Sector Strategy (NWSS) 2010, estimated the water supply deficit at about 40% of the total demands.

The efforts of the Ministry of Energy and Water in improving the water sector and reducing the shortage in supply are incessant.

Table 3-1 presents the budget spent by the ministry on upgrading and expansion of water networks during the last five years (2012-2016).

Table 3-1: Ministry's Expenditure on Water Networks

Region	Total MUSD
North Lebanon	70
Mount Lebanon	50
South Lebanon	24
Bekaa	18
Total	**162**

Table 3-2 lists the major on-going and recently completed projects divided into two categories A and B as follows:

A- Expansion and Improvement of Supply
B- Development of resources.

Table 3-2: List of Major on-Going Water Projects

Project	Budget (Musd)
A - Expansion and Improvement of Supply	
Greater Beirut: • Greater Beirut Water Supply Project (Awwaly conveyance project) - Phase 1 - Tunnel and Transmission lines. • Upgrade of water systems in Greater Beirut to enable supply from Awwali project. • Rehabilitation of water supply systems in Greater Beirut. • Construction of Wardaniye Water Treatment Plant to serve Awwali project. • Expansion of Dbaye Water Treatment Plant to increase supply. • Rehabilitation works and construction of new works for Ain el Delbe including pump stations and networks	197 100 50 37 5.1 3
Jbeil: Improvement of water supply system in the caza of Jbeil and construction of waste water networks for the coastal area of Jbeil and associated treatment plant	38
Chouf: Rehabilitation and diversion of transmission line between Safa and Beiteddine, projects for increasing the water sources in Iqlim el Kharroub, and Isolation of Barouk spring	7.3
Akkar: Water **s**upply projects in the villages of south Akkar from Hrar and Qabiit reservoirs (drilling and equipping of water wells, pumping stations, reservoirs, transmission lines and distribution lines) specifically in the villages of Meshmesh, Wata Meshmesh, Bazzal, Danbo, Beit Ayoub, Beit Younes, Qrayat, Bajaa, Shan, Houwaish, Qaiteea, and Continuation of the water supply project for the villages of Borghosh-Hrar region, Kaf et Tineh, and Qabiit and water supply systems consisting of groundwater wells, reservoirs and distribution networks that are under preparation. In addition to improvement of water systems in the villages of Fneideq, Tekrit, Beit Mlat, Bireh, Jouma, and Khirbet Daoud.	83.8
Minieh & Dannieh: Continuation of the water supply project for the villages of Minieh region - Part 1, and rehabilitation an continuation of water systems in Dannieh (Package 1 - Part 1)	17.9

Project	Budget (Musd)
Tripoli: Water supply projects in Qalamoun, Ras-masqa, Anfeh, and Koura regions.	6.3
Zgharta/Ehden: Water supply project in Ehden region and Maydan, and continuation of water networks in Fouwar within Northern Lebanon Water Establishment.	20.2
Bcharre: Rehabilitation of water supply networks in Bcharre region.	11
Koura & Batroun: Rehabilitation of water supply systems in Chekka, Anfeh, Koura coast, and Batroun and Equipping well and construction of potable water pump station for Chebtine village.	10.5
Baalbeck-Hermel: Water supply project for the villages of the caza of Hermel, and additional water supply works in the city of Baalbek and the next villages - 2nd package, additional water sources in Baalback-Hermel, rehabilitation of water treatment plant in Falawi to serve 18 villages from Yamoune spring, and Isolation of Daher el Aalwi spring in Ainata.	29.6
Zahle & West Bekaa: Rehabilitation of water supply systems in West Bekaa and the villages east of Zahle - packages 1, 2 and 3, rehabilitation/improvement of water supply systems in Qoblias, and construction of water supply systems for Dhour Zahle, Twayti, Maalaka, karak, Qaa el Rim, Hzarta and the industrial city.	51.2
Rachaiya & West Bekaa: Rehabilitation of water supply systems in the villages of Rachaiya - part 2 - package 3, transmission line from Arab reservoir to Aarayesh, and Various water supply works in Bkifa, Beit Lahya, Aaiha, El-Haoush.	15.8
Hasbaya: Water Supply Project for Jebel Amel Water Establishment-Phase 3 (construction of reservoirs, transmission and distribution lines from wazzani), Complementary works for the water supply systems of Hebbariye-Hasbaya, drilling and equipping of groundwater well and continuation of water supply network in Chebaa.	30
Marjaayoun & Bint Jbeil: Water Supply Project -Phase 3 (construction of reservoirs, transmission and distribution lines from Taybe treatment plant, wazzani water, and ground water wells in the region). Additional water works in Jebel Amel - caza of Bint Jbeil.	51.2
Nabatiye & Sour: Complementary Water Works project for Southern Lebanon water establishment (Kfaroua, mejdel selm, Debaal, Safad el Batikh, Touline, Chaqra, Borj rahal, Kfardounine, Qraye), and additional water works for Kfarremane/Nabatiye.	15.8
IRRIGATION - Marjaayoun & Bint-Jbeil: Litani conveyor 800 - main and secondary lines.	357.4
B - Development of Resources	
Batroun: • **Mseilha hill lake:** Construction of Mseilha dam and hill lake (12 MCM) for water supply and irrigation • **Balaa hill lake:** Construction of Balaa dam and hill lake (2.2 MCM) for water supply	 59.4 37.3
Greater Beirut and Mount Lebanon: • **Jbeil - Janneh Dam:** Construction of Janneh Dam (90 MCM) for water supply and irrigation. • **Bisri Dam:** Greater Beirut Water Supply Project - Phase 2 - Construction of Bisri Dam (120MCM) including hyropower plant and waste water systems • **Baabda - Kaysamani Dam:** Construction of Kaysamani Dam (1MCM) for water supply • **Metn - Boqaata Dam:** Construction of Beqaata dam and hill lake (12 MCM) for water supply • **Metn - Al Manzoul Hill lake:** Construction of dam and hill lake (0.4MCM) including water treatment plant and transmission line from the lake to reservoirs of Zaarour and Aintoura.	 340 580 25 63.1 15.3
IRRIGATION - Baalbeck - Yamoune hill lake: Construction of Yamoune dam and hill lake (1.5 MCM) for irrigation	14.6
IRRIGATION - Akkar – • **Kouachra hill lake:** Construction of dam and hill lake (0.35 MCM) for irrigation	3.2

3.5 Development Vision

The target of the Ministry of Energy and Water and the Water Establishments includes mobilization of additional water resources to meet the current deficit as well as the initiation of an efficient and appropriately Development Plan to meet the projected future demands.

The Syrian crisis and its consequences call for the consideration of a fast/immediate programme within the Development Plan to attenuate on the short term, the severe impacts of the shortage in water supply on both the vulnerable Lebanese families and displaced Syrians (increased risk of waterborne diseases in addition to intensive contamination of the ground and surface water). This immediate phase will also contribute to meeting the expected increased water demands on the long term.

With the additional domestic water demand of 61 MCM resulting from the Syrian crisis (LCRP 2015 statistics/MoEW demands), the shortage in supply would increase to about 50%.

The climate change, reducing the total annual precipitations, the rainy season and rainfall days, is a major challenge to mobilize the necessary resources to meet the projected demands.

The Capital Investment Programme is divided into 2 categories:

- Category A: this category comprises the projects for extending the Supply through expansion and improvement of the existing systems to increase capacities and coverages to meet the increasing demands. This Category responds in its ultimate phase to the projected future demands but also contributes in its early phases to the short term demands.
- Category B: it consists in providing additional water sources relying mainly on renewable surface sources through construction of dams and hill lakes. This Category targets the projected future demands but will help as well alleviating the short-term demands through the early implementation of projects.

A separate Category includes the projects identified under Lebanese Crisis Response Plan (LCRP) which was launched a couple of years ago to mitigate to the exponential increase of demands induced by the displaced Syrians. It includes expansion of networks and mobilization of additional resources relying on ground water (on temporary basis) to attenuate the urgent additional shortage. However, since limited funds were secured, the projects were earmarked for funding.

The selection and prioritization of the water projects proposed to contribute in developing the sector have been done through the following criteria

- The scale of served population, giving priority to the projects serving larger population number in order to maximize the social and hygienic benefits of the investments
- The density of the displaced Syrians, in an effort to attenuate the impact of the massive increase in population and hence on water demands and hygienic conditions in the hosting areas
- Enhancing the benefit from the CAPEX already invested in the construction of headworks, treatment plants and collection networks.
- The readiness for construction and availability of studies (Feasibility, EIA, Tender Documents).

3.6 Lebanon Crisis Response Plan

Based on the above considerations, a Development Plan is proposed comprising two categories of projects to achieve the following:

Category A: Expansion and Improvement of the existing water supply system:

This Category can be divided into two parts:

- Part 1: this part includes the conveyance systems associated to ongoing or completed dams to enable the exploitation of these dams and hence are considered as complementary investments; they include among others, water treatment facilities, hydropower system, transmission lines, reservoirs and pumping stations.

  Four projects are selected for the first construction cycle to mobilize additional water resources in the North and Mount Lebanon serving directly a population of about 750,000, but affecting a larger population of about 1.5 million.

  One project for the distribution of irrigation water is also selected in this category as the main conveyor of the Litani irrigation Scheme is near completion. This project will irrigate an area of about 14,000 ha, provide large job opportunities, and improve food security, wellbeing and stability.

- Part 2: this part includes the expansion, upgrage and rehabilitation of distribution networks to enhance the water supply and provide access to water sevices to the growing population. Many of these projects fall within the goals of the LCRP, however funds from LCRP were not secured and hence they were reintegrated into the CIP plan. In the regions of North, Bekaa and South, elaborate water master plans are available and include proposals for massive improvement works in the water sector which are required to reach an acceptable level of service. The major part of these works is needed as a first priority, planned for the 2020 to 22 horizon. These projects are also within the LCRP goals; however their costs exceed the LCRP budgets.. Furthermore, as most of the LCRP funds were not secured, they have been listed as cycle 1 CIP projects, and grouped under the relevant Water Establishment.

The mentioned master plans include also continuations and expansions of the first priority projects proposed for later stages; these have been listed as cycles 2 and 3 projects.

Category B: Mobilizing additional water sources:

As previously mentioned, this category relates to the mobilization of additional surface water sources through the construction of dams and hill lakes.

In addition to El Bared Dam in Akkar, serving a population of about 590,000, two projects (Azounieh Dam, Maaser Chouf Dam) are prioritized for mobilizing additional water resources in Mount Lebanon to serve a population of about 300,000, 1 project in Baalback-Hermel which is the continuation of Assi Phase 1 dam, and 1 project in Bekaa/Zahle (Barhashah Dam) due to the significant shortage in the region.

Remaining expropriations for Chabrouh and Besri Dams are also listed in first priority since Chabrouh is completed and Besri about to be launched.

Two projects are selected for the 2nd cycle (Assi Phase 2 Dam, Ibl es Saqi Dam) and 12 others for the 3rd cycle until their construction documents are prepared.

Table 3-3 lists the proposed projects, their description, the estimated investment cost, their readiness for construction and their priorities.

Figure 3-1 shows the geographic distribution of the proposed dams as well as the ongoing or completed ones.

3.7 Municipalities and Governorates Requirements

The Lebanese Government has invited all the Mohafazat and Municipalities to raise their needs in the various sectors including the Water Sector in order to be taken into consideration in the Development Vision. Extensive lists have been received from the municipalities all over the Country including a wide range of requests extending from a minor water connection to the construction of dams. The received lists have been compiled and depending on the type, size, and necessity, the projects have been categorized as follows:

i. Proposed under CIP or covered by other projects proposed under CIP (additional water sources, transmission lines and new distribution networks, regional reservoirs, etc..)
ii. Short and medium term municipal needs (minor storage tanks, collection ponds, irrigation canals, cleaning of water courses, water quality monitoring, minor water connections and rehabilitations, pumps, generators, etc..). These local demands or small-scale projects are categorized as Category “C”; they will be allocated a budget of 200MUSD under proposed CIP project W55 (Short and Medium term municipal needs).

Most of the requests do not refer to a specific project but to the provision or increase of water supply in the regions; the extents and the components of the requested projects are not described and thus correlation has been made in such cases between the goals of the requests/projects and those of CIP projects. The lists include many requests for drilling and equipment of water wells, and others for construction or rehabilitation of local storage tanks. These also have been considered as covered by CIP projects since the latters include similar components and aim to ameliorate the whole water supply systems based on overall master plans.

It is worth noting also that some of the requests are specific for particular municipalities or villages, but others are general at the level of a caza or a union of municipalities. Some others fall within ongoing or under preparation projects as indicated in the tables.

Furthermore, only few projects include cost estimate.

Table 3-5 hereafter summarizes the proposed investments by Cycle and by Governorate. The investments related to Irrigation are given separately.

Table 3-3: Water and Irrigation Capital Investment Projects – Cycles 1 and 2

Ref	Project	Region	Description	Estimated Cost (MUSD)		Status		Impact		Generated Employment	Priority Score	Implementation Cycle
				Investment	Land Expropriation					Million Labour-Days		
A	**Expansion and Improvement of Supply**											
PART 1: Projects associated with completed or ongoing Dams												
W1	Water supply system for Mseilha Dam.	North/Batroun	Construction of Water Treatment plant, transmission lines, and reservoirs for Mseilha DAM (water supply 6 MCM).	14.5	5	Tender documents available	3	Enable exploitation of Mseilha Dam. Increase the water supply Response to Syrian crisis through generated employment.	3	0.3	6	1
W2	Water supply system for Balaa Lake.	North/Batroun	Construction of Water Treatment plant, transmission lines, and reservoirs for Balaa DAM (water supply 1.5 MCM).	10.5	3	Dam is under construction. Tender documents for the plant and transmission pipe available	3	Enable exploitation of Balaa lake. Increase the water supply	3	0.25	6	1
W3	Hydropower plant for Janneh Dam.	Mount Lebanon/Jbeil	Expansion of the Hydropower plant associated to Janneh DAM (current plan 50MW) to produce additional 100MW (totaling 150MW).	100	-	Dam is under construction. Design required for the plant.	3	Increase power production and reduce deficit in electric power at the national level and specifically for Jbeil and surrounding villages.	2	1.6	5	1
W3A	Transmission line from Janneh Dam to Greater Beirut	Greater Beirut and Mount Lebanon	Construction of a transmission line from Janneh Dam to Beirut region to provide additional water supply	60	-	Dam is under construction. Design required for the transmission pipe	1	Increase water supply for Beirut and Suburbs	2	1.6	3	1
W4	Water treatment plant and water supply system for Beqaata Dam.	Mount Lebanon/Metn	Construction of Water Treatment plant, transmission lines, and reservoirs for Beqaata DAM (water supply 6 MCM).	35	2	Dam is under construction. Design required for the plant and transmission pipe	3	Enable exploitation of Beqaata Dam Increase water supply, reduce deficit and improve hygienic conditions Conserve and recharge groundwater	2	0.35	5	1
W5	IRRIGATION - Litani - Conveyor 800 Phase 2 - Irrigation and Water networks	South/Nabatiye	Construction of distribution networks from the Conveyor 800 system for Irrigation and water supply	300	-	The main conveyor is under construction; expected to be completed by mid 2018. Irrigation networks downstream conveyor are required	2	Allows irrigation of 14,000 ha in the region, increase agricultural production and food security, improve social and economic wellbeing and stabilise population Provides water supply of 20,000m3/day	3	3	5	1
W6	Water supply system for El Bared Dam DAM	North/Akkar	Construction of Water transmission lines and reservoirs from El Bared Dams to the localities served.	20	0.5	Design is required	1	Enable exploitation of El Bared Dam. Response to Syrian crisis through generated employment.	3	0.2	4	2
W6A	Water supply system for Chabrouh Dam	Mount Lebanon	Chabrouh Dam System - Networks required: 60km for Kfardebian, 28km for Faraya, and new networks for other villages.	40	2			Increase exploitation of Chabrouh Dam.	3	0.2	4	1

Ref	Project	Region	Description	Estimated Cost (MUSD)		Status		Impact		Generated Employment	Priority Score	Implementation Cycle
				Investment	Land Expropriation					Million Labour-Days		
PART 2: Expansions, Upgrades and Rehabilitations of Existing Networks												
BEIRUT AND MOUNT LEBANON WATER ESTABLISHMENT												
W7	Water supply system rehabilitation in Beirut area	Greater Beirut	Increasing supply sources, and extension of transmission lines and distribution networks	100	-	-	2	Reduce the extensive water losses in Greater Beirut network and increase water availability at the national scale.	3	1.0	5	1
W8	Water Supply Projects for Mount Lebanon	Mount Lebanon / Metn, Chouf, Aley & Kesrouane	Increasing supply sources, and extension of transmission lines and distribution networks	100	-	-	3	Increase water supply and reduce the significant deficit in Metn.	2	1.0	5	1
W8A	Expropriations for Beirut Storage Tanks	Greater Beirut	Expropriations for Hazmieh and Ashrafieh storage tanks.	-	35	-						1
NORTH WATER ESTABLISHMENT – Cycle 1												
W9	Qobayat Water Supply Systems, Phase 1	Akkar	Completion, expansion and upgrade of Qobayat water supply networks including construction of 60 wells (number may change depending on available safe yield), 2 intake structures on springs, 13 pump stations and upgrade of 7 existing pump stations, 10 reservoirs, and 100km of pipelines.	51	0.5	Detailed Design is required.	2	Reduce the significant shortage in water supply in the Region. Response to Syrian crisis through generated employment.	3	0.2	5	1
W10	Halba Water Supply Systems, Phase 1	Akkar	Expansion and upgrade of Halba water supply networks including construction of 47 wells (number may change depending on available safe yield), 2 intake structures on springs, 1 pump station and upgrade of 8 existing pump stations, 14 reservoirs, 35km of transmission lines and 116km of distribution lines.	92	0.5	Detailed Design is required.	2	Reduce the significant shortage in water supply in the Region. Response to Syrian crisis through generated employment.	3	0.3	5	1
W11	Danniyeh Water Supply Systems, Phase 1	North / Meniyeh-Danniyeh	Expansion and upgrade of Danniyeh water supply networks including construction of 22 wells, 2 intake structures on springs, 8 pump stations and upgrade of 7 existing pump stations, 12 reservoirs and 132km of distribution lines.	27	0.5	Detailed Design is required.	2	Reduce the significant shortage in water supply in the Region. Response to Syrian crisis through generated employment.	3	0.25	5	1

Ref	Project	Region	Description	Estimated Cost (MUSD)		Status		Impact		Generated Employment	Priority Score	Implementation Cycle
				Investment	Land Expropriation					Million Labour-Days		
W12	Minieh Water Supply Systems, Phase 1	North / Meniyeh-Danniyeh	Expansion and upgrade of Minieh water supply networks including construction of 54 wells, 1 intake structure on spring, 2 pump stations, 2 reservoirs and 19km of distribution lines.	12	0.5	Detailed Design is required.	2	Reduce the significant shortage in water supply in the Region. Response to Syrian crisis through generated employment.	3	0.1	5	1
W13	Tripoli Water Supply Systems, Phase 1	North / Tripoli	Expansion and upgrade of Tripoli water supply networks including construction of 8 wells, 1 intake structure on springs, 1 pump station, 2 reservoirs and 4km of transmission lines.	25	0.5	Detailed Design is required.	2	Reduce the shortage in water supply in the Region. Response to Syrian crisis through generated employment.	3	0.15	5	1
W14	Zgharta Water Supply Systems, Phase 1	North / Zgharta	Expansion and upgrade of Zgharta water supply networks including construction of 26 wells, 22 reservoirs and 108km of pipelines.	24	1	Detailed Design is required.	2	Reduce the shortage in water supply in the Region. Response to Syrian crisis through generated employment.	3	0.1	5	1
W15	Bcharre Water Supply Systems, Phase 1	North / Bcharre	Expansion and upgrade of Bcharre water supply networks including construction of 3 intake structures on springs, 50km of distribution lines and 3km of transmission lines.	10	0	Detailed Design is required.	2	Reduce the shortage in water supply in the Region. Response to Syrian crisis through generated employment.	3	0.1	5	1
W16	Koura Water Supply Systems, Phase 1	North / Koura	Expansion and upgrade of Koura water supply networks including construction of 26 wells, 6 pump stations, 13 reservoirs 42km of transmission lines and 120km of distribution lines.	55	0.5	Detailed Design is required.	2	Reduce the shortage in water supply in the Region. Response to Syrian crisis through generated employment.	3	0.15	5	1
W17	Batroun Water Supply Systems, Phase 1	North / Batroun	Expansion and upgrade of Batroun water supply networks including construction of 1 well, 1 pump station, 13 reservoirs, 148km of distribution lines and 4km of transmission lines.	25	0.5	Detailed Design is required.	2	Reduce the shortage in water supply in the Region.Response to Syrian crisis through generated employment.	3	0.25	5	1
NORTH WATER ESTABLISHMENT – Cycle 2												
W9-1	Qobayat Water Supply Systems, Phase 2	Akkar	Expansion and upgrade of Qobayat water supply networks including upgrade of 12 existing pump stations, 11 reservoirs, and 7km of pipelines.	5	0.5	Master plan level; subject to change during phase 1	1	Improve supply to meet demand growth	2	minor	3	2
W10-1	Halba Water Supply Systems, Phase 2	Akkar	Expansion and upgrade of Halba water supply networks including construction of 14 wells, 2 intake structures on springs, upgrade of 14 existing pump stations, 17 reservoirs, 0.6km of transmission lines.	7	0.5	Master plan level; subject to change during phase 1	1	Improve supply to meet demand growth	2	minor	3	2
W11-1	Danniyeh Water Supply Systems, Phase 2	North / Meniyeh-Danniyeh	Expansion and upgrade of Danniyeh water supply networks including construction of 3 wells, 11 reservoirs and 30km of pipelines.	7	0.5	Master plan level; subject to change during phase 1	1	Improve supply to meet demand growth	2	minor	3	2

Ref	Project	Region	Description	Estimated Cost (MUSD)		Status		Impact		Generated Employment	Priority Score	Implementation Cycle
				Investment	Land Expropriation					Million Labour-Days		
W12-1	Minieh Water Supply Systems, Phase 2	North / Meniyeh-Danniyeh	Expansion and upgrade of Minieh water supply networks including construction of 7 wells, 2 reservoirs and upgarde of 1 pump station.	1	0	Master plan level; subject to change during phase 1	1	Improve supply to meet demand growth	2	minor	3	2
W13-1	Tripoli Water Supply Systems, Phase 2	North / Tripoli	Expansion and upgrade of Tripoli water supply networks including construction of 3 wells, 1 reservoir and 1km of transmission lines.	6	0.5	Master plan level; subject to change during phase 1	1	Improve supply to meet demand growth	2	minor	3	2
W14-1	Zgharta Water Supply Systems, Phase 2	North / Zgharta	Expansion and upgrade of Zgharta water supply networks including construction of 30 wells an13 reservoirs.	9	1	Master plan level; subject to change during phase 1	1	Improve supply to meet demand growth	2	0.1	3	2
W15-1	Bcharre Water Supply Systems, Phase 2	North / Bcharre	Expansion and upgrade of Bcharre water supply networks including construction of 6 pump stations, 6 reservoirs and upgrade of 1 existing pump station.	4	0.5	Master plan level; subject to change during phase 1	1	Improve supply to meet demand growth	2	minor	3	2
W16-1	Koura Water Supply Systems, Phase 2	North / Koura	Expansion and upgrade of Koura water supply networks including construction of 10 wells, 1 pump station, 13 reservoirs and upgrade of 1 pump stations.	10	0.5	Master plan level; subject to change during phase 1	1	Improve supply to meet demand growth	2	0.1	3	2
W17-1	Batroun Water Supply Systems, Phase 2	North / Batroun	Expansion and upgrade of Batroun water supply networks including construction of 1 well, 1 pump station and 11 reservoirs.	3	0.5	Master plan level; subject to change during phase 1	1	Improve supply to meet demand growth	2	minor	3	2
BEKAA WATER ESTABLISHMENT – Cycle 1												
W18	Ain El Hawr - Ras El Meil Systems	Baalbek-Hermel / Hermel	Expansion and upgrade of Ain El Hawr (Merjhine), Ras El Meil water supply networks including construction of 21 ground reservoirs, 7 elevated tanks, 2 pump stations, 66km of gravity pipes and 19km of pressure pipes.	18	1	Detailed Design is required.	2	Reduce the shortage in water supply in the Region. Response to Syrian crisis through generated employment.	3	0.1	5	1
W19	Ein El Zarqa	Baalbek-Hermel / Hermel	Expansion and upgrade of Ein El Zarqa water supply networks including construction of 1 pump station and 7km of pipes.	8	1	Detailed Design is required.	2	Reduce the shortage in water supply in the Region. Response to Syrian crisis through generated employment.	3	0.1	5	1
W20	Laboue Water Supply System	Baalbek-Hermel / Baalbek	Expansion and upgrade of Laboue water supply system including construction of 5 ground reservoirs, 2 elevated tanks, 8 pump stations, 47km of gravity pipes and 30km of pressure pipes.	17	0.5	Detailed Design is required.	2	Reduce the shortage in water supply in the Region. Response to Syrian crisis through generated employment.	3	0.1	5	1
W21	Ouyoun Orghosh Water Supply System	Baalbek-Hermel / Baalbek	Expansion and upgrade of Ouyoun Orghosh water supply system including construction of 6 ground reservoirs and 80km of gravity pipes.	9	0.5	Detailed Design is required.	2	Reduce the shortage in water supply in the Region. Response to Syrian crisis through generated employment.	3	minor	5	1

Ref	Project	Region	Description	Estimated Cost (MUSD)		Status		Impact		Generated Employment	Priority Score	Implementation Cycle
				Investment	Land Expropriation					Million Labour-Days		
W22	Younine, Maqne and Nahle water supply systems	Baalbek-Hermel / Baalbek	Expansion and upgrade of Younine, Maqne and Nahle water supply networks including construction of 2 ground reservoirs, 1 well and 20km of pipes.	5	0.5	Detailed Design is required.	2	Reduce the shortage in water supply in the Region. Response to Syrian crisis through generated employment.	3	minor	5	1
W23	Yamoune Water Supply System	Baalbek-Hermel / Baalbek	Expansion and upgrade of Yamoune water supply system including construction of 16 ground reservoirs, 5 elevated tanks, 90km of gravity pipes, 7km of pressure pipes and 4 pump stations.	50	0.5	Detailed Design is required.	2	Reduce the shortage in water supply in the Region. Response to Syrian crisis through generated employment.	3	0.1	5	1
W24	Yahfoufa Water Supply System	Baalbek-Hermel -Bekaa / Baalbek and Zahle	Expansion and upgrade of Yahfoufa water supply networks including construction of 10 ground reservoirs, 1 elevated tank, 1 pump station, 42km of gravity pipes and 1km of pressure pipes.	12	0.5	Detailed Design is required.	2	Reduce the shortage in water supply in the Region. Response to Syrian crisis through generated employment.	3	minor	5	1
W25	Qaa El Rim System	Bekaa / Zahle	Expansion and upgrade of Qaa el Rim water supply system including construction of 11 ground reservoirs, 1 elevated tank, 2 pump stations, 20km of gravity pipes and 7km of pressure pipes.	28	0.5	Detailed Design is required.	2	Reduce the shortage in water supply in the Region. Response to Syrian crisis through generated employment.	3	minor	5	1
W26	Qab Elias, Jdita and Zebdol Water Supply systems	Bekaa / Zahle	Expansion and upgrade of Qab Elias, Jdita and Zebdol water supply networks including construction of 8 ground reservoirs, 2 pump stations, 16km of gravity pipes and 3km of pressure pipes.	9	0.5	Detailed Design is required.	2	Reduce the shortage in water supply in the Region. Response to Syrian crisis through generated employment.	3	0.1	5	1
W27	Aanjar Water Supply System	Bekaa / Zahle	Expansion and upgrade of Aanjar water supply system including construction of 8 ground reservoirs, 1 elevated tank, 2 pump stations, 20km of gravity pipes and 11km of pressure pipes.	24	0.5	Detailed Design is required.	2	Reduce the shortage in water supply in the Region. Response to Syrian crisis through generated employment.	3	minor	5	1
W28	Chamsine Water Supply System	Bekaa / Zahle and West Bekaa	Expansion and upgrade of Chamsine water supply networks including construction of 7 ground reservoirs, 1 pump station, 5km of gravity pipes and 1km of pressure pipes.	6	0.5	Detailed Design is required.	2	Reduce the shortage in water supply in the Region. Response to Syrian crisis through generated employment.	3	minor	5	1
W29	Ain El Zarqa Part1 Water Supply System	Bekaa / West Bekaa	Expansion and upgrade of Ain El Zarqa water supply system Part 1, including construction of 4 ground reservoirs, 1 elevated tank, 1 pump station, 7km of gravity pipes and 2km of pressure pipes.	16	0.5	Detailed Design is required.	2	Reduce the shortage in water supply in the Region. Response to Syrian crisis through generated employment.	3	0.1	5	1

Ref	Project	Region	Description	Estimated Cost (MUSD)		Status		Impact		Generated Employment	Priority Score	Implementation Cycle
				Investment	Land Expropriation					Million Labour-Days		
W30	Ain El Zarqa Part2 Water Supply System	Bekaa / Rachaya	Expansion and upgrade of Ain El Zarqa water supply system Part 2, including construction of 4 ground reservoirs, 2 elevated tanks and 3km of gravity pipes.	6	0.5	Detailed Design is required.	2	Reduce the shortage in water supply in the Region. Response to Syrian crisis through generated employment.	3	minor	5	1
BEKAA WATER ESTABLISHMENT – Cycle 2												
W18-1	Ain El Hawr - Ras El Meil Systems	Baalbek-Hermel / Hermel	Expansion and upgrade of Ain El Hawr (Merjhine), Ras El Meil water supply networks	16	1	Master plan level; subject to change during phase 1	1	Improve supply to meet demand growth	2	0.15	3	2
W19-1	Ein El Zarqa	Baalbek-Hermel / Hermel	Expansion and upgrade of Ein El Zarqa water supply networks	6	1	Master plan level; subject to change during phase 1	1	Improve supply to meet demand growth	2	minor	3	2
W20-1	Laboue Water Supply System	Baalbek-Hermel / Baalbek	Expansion and upgrade of Laboue water supply system	15	0.5	Master plan level; subject to change during phase 1	1	Improve supply to meet demand growth	2	0.15	3	2
W21-1	Ouyoun Orghosh Water Supply System	Baalbek-Hermel / Baalbek	Expansion and upgrade of Ouyoun Orghosh water supply system	9	0.5	Master plan level; subject to change during phase 1	1	Improve supply to meet demand growth	2	0.1	3	2
W22-1	Younine, Maqne and Nahle water supply systems	Baalbek-Hermel / Baalbek	Expansion and upgrade of Younine, Maqne and Nahle water supply networks .	4	0.5	Master plan level; subject to change during phase 1	1	Improve supply to meet demand growth	2	minor	3	2
W23-1	Yamoune Water Supply System	Baalbek-Hermel / Baalbek	Expansion and upgrade of Yamoune water supply system	25	0.5	Master plan level; subject to change during phase 1	1	Improve supply to meet demand growth	2	0.25	3	2
W24-1	Yahfoufa Water Supply System	Baalbek-Hermel-Bekaa / Baalbek and Zahle	Expansion and upgrade of Yahfoufa water supply networks	10	0.5	Master plan level; subject to change during phase 1	1	Improve supply to meet demand growth	2	0.1	3	2
W25-1	Qaa El Rim System	Bekaa / Zahle	Expansion and upgrade of Qaa el Rim water supply system	4	0.5	Master plan level; subject to change during phase 1	1	Improve supply to meet demand growth	2	minor	3	2
W26-1	Qab Elias, Jdita and Zebdol Water Supply systems	Bekaa / Zahle	Expansion and upgrade of Qab Elias, Jdita and Zebdol water supply networks	6	0.5	Master plan level; subject to change during phase 1	1	Improve supply to meet demand growth	2	minor	3	2
W27-1	Aanjar Water Supply System	Bekaa / Zahle	Expansion and upgrade of Aanjar water supply system	5	0.5	Master plan level; subject to change during phase 1	1	Improve supply to meet demand growth	2	minor	3	2
W28-1	Chamsine Water Supply System	Bekaa / Zahle and West Bekaa	Expansion and upgrade of Chamsine water supply networks	3	0.5	Master plan level; subject to change during phase 1	1	Improve supply to meet demand growth	2	minor	3	2

Ref	Project	Region	Description	Estimated Cost (MUSD)		Status		Impact		Generated Employment	Priority Score	Implementation Cycle
				Investment	Land Expropriation					Million Labour-Days		
W29-1	Ain El Zarqa Part1 Water Supply System	Bekaa / West Bekaa	Expansion and upgrade of Ain El Zarqa water supply system Part 1	7	0.5	Master plan level; subject to change during phase 1	1	Improve supply to meet demand growth	2	minor	3	2
W30-1	Ain El Zarqa Part2 Water Supply System	Bekaa / Rachaya	Expansion and upgrade of Ain El Zarqa water supply system Part 2	2	0	Master plan level; subject to change during phase 1	1	Improve supply to meet demand growth	2	minor	3	2
SOUTH WATER ESTABLISHMENT – Cycle 1												
W31	Saida Water Supply Systems	South / Saida	Expansion and upgrade of water supply networks in the Caza of Saida, including construction of 1 new well, 34 reservoirs, 5 pump stations, and 84 km of pipelines.	25	1	Detailed Design is required.	2	Reduce the shortage in water supply in the Region. Response to Syrian crisis through generated employment.	3	0.15	5	1
W32	Zahrani Water Supply System	South / Zahrani	Expansion and upgrade of water supply networks in the Caza of Zahrani, including construction of 1 water treatment plant, 21 reservoirs, 5 pump stations, and 70km of pipelines.	39	0.5	Detailed Design is required.	2	Reduce the shortage in water supply in the Region Response to Syrian crisis through generated employment.	3	0.2	5	1
W33	Jezzine Water Supply System	South / Jezzine	Expansion and upgrade of water supply networks in the Caza of Jezzine, including construction of 1 new well, 8 reservoirs, 6 pump stations, and 30km of pipelines.	6	0.5	Detailed Design is required.	2	Reduce the shortage in water supply in the Region. Response to Syrian crisis through generated employment.	3	minor	5	1
W34	Sour Water Supply System	South / Sour	Expansion and upgrade of water supply networks in the Caza of Sour, including construction of 2 water treatment plants, 30 reservoirs, 3 pump stations, and 147km of pipelines.	42	0.5	Detailed Design is required.	2	Reduce the shortage in water supply in the Region. Response to Syrian crisis through generated employment.	3	0.2	5	1
W35	Nabatiye Water Supply System	Nabatiye	Expansion and upgrade of water supply networks in the Caza of Nabatiye, including construction of 1 water treatment plant, 20 reservoirs, 3 pump stations, and 78km of pipelines.	26	0.5	Detailed Design is required.	2	Reduce the shortage in water supply in the Region. Response to Syrian crisis through generated employment.	3	0.15	5	1
W36	Bint-Jbeil Water Supply System	Nabatiye / Bint-Jbeil	Expansion and upgrade of water supply networks in the Caza of Bint-Jbeil, including construction of 3 water treatment plants, 26 reservoirs, 1 pump station, and 122km of pipelines.	63	0.5	Detailed Design is required.	2	Reduce the shortage in water supply in the Region. Response to Syrian crisis through generated employment.	3	0.3	5	1

Ref	Project	Region	Description	Estimated Cost (MUSD)		Status		Impact		Generated Employment	Priority Score	Implementation Cycle
				Investment	Land Expropriation					Million Labour-Days		
W37	Marjaayoun & Hasbaya Water Supply Systems	Nabatiye / Marjaayoun & Hasbaya	Expansion and upgrade of water supply networks in the Cazas of Marjaayoun and Hasbaya, including construction of 1 water treatment plant, 15 reservoirs, 4 pump stations, and 90km of pipelines.	24	0.5	Detailed Design is required.	2	Reduce the shortage in water supply in the Region. Response to Syrian crisis through generated employment.	3	0.15	5	1
SOUTH WATER ESTABLISHMENT – Cycle 2												
W31-1	Saida Water Supply Systems	South	Expansion and upgrade of water supply networks in the Caza of Saida, including construction of 1 water treatment plant (Besri Dam), 5 local reservoirs, pump stations, and 57km of pipelines.	8	1	Master plan level; subject to change during phase 1	2	Improve supply to meet demand growth	2	0.1	4	2
W32-1	Zahrani Water Supply System	South	Expansion and upgrade of water supply networks in the Caza of Zahrani, including construction of 3 local reservoirs, and 7.5km of distribution lines.	1	0.5	Master plan level; subject to change during phase 1	2	Improve supply to meet demand growth	2	minor	4	2
W33-1	Jezzine Water Supply System	South	Expansion and upgrade of water supply networks in the Caza of Jezzine, including construction of 1 water treatment plant (Besri Dam), 2 regional reservoirs, 4 pump stations, and 18km of pipelines.	5	1	Master plan level; subject to change during phase 1	2	Improve supply to meet demand growth	2	minor	4	2
W34-1	Sour Water Supply System	South	Expansion and upgrade of water supply networks in the Caza of Sour, including construction of 8 local reservoirs, 3 regional reservoirs, and 13.5km of distribution lines.	2	0	Master plan level; subject to change during phase 1	2	Improve supply to meet demand growth	2	minor	4	2
W35-1	Nabatiye Water Supply System	Nabatiye	Expansion and upgrade of water supply networks in the Caza of Nabatiye, including construction of 1 water treatment plant, 6 local reservoirs, 2 regional reservoirs, 2 pump stations, and 32km of transmission lines.	20	1	Master plan level; subject to change during phase 1	2	Improve supply to meet demand growth	2	0.2	4	2
W36-1	Bint-Jbeil Water Supply System	Nabatiye	Expansion and upgrade of water supply networks in the Caza of Bint-Jbeil, including construction 6 local reservoirs, 1 regional reservoir, and 1km of distribution lines.	1	0	Master plan level; subject to change during phase 1	2	Improve supply to meet demand growth	2	minor	4	2

Ref	Project	Region	Description	Estimated Cost (MUSD)		Status		Impact		Generated Employment	Priority Score	Implementation Cycle
				Investment	Land Expropriation					Million Labour-Days		
W37-1	Marjaayoun&Hasbaya Water Supply Systems	Nabatiye	Expansion and upgrade of water supply networks in the Cazas of Marjaayoun and Hasbaya, including construction, 1 local reservoir, and 16km of distribution lines.	1	0	Master plan level; subject to change during phase 1	2	Improve supply to meet demand growth	2	minor	4	2
B	**Development of Resources**											
W38	El Bared Dam	North / Akkar	Construction of Water Supply dam (37-90) MCM) and associated water treatment plant and transmission network, including expropriation and supervision works.	300	0	Tender Documents available; ready for construction. EIA requires update	2	Increase water supply, reduce deficit, and improve hygienic conditions and social wellbeing Conserve and recharge groundwater Response to Syrian crisis through generated employment	3	3	5	1
W38A	Additional funds for Mseilha Dam	North / Batroun	Additional funds to complete Mseilha Water Supply and Irrigation dam (6-12 MCM)	15	-							1
W38B	Additional funds for Balaa Dam	North / Batroun	Additional funds to complete Balaa Water Supply dam (1.2-2.2 MCM)	7	-							1
W38C	Repairing works for Brissa Dam	North / Denniyeh	Consultancy services for a solution and implementation of the required works to solve the problems of the constructed Brissa dam (Irrigation 0.8MCM)	15								1
W39	Ain Dara - Azounieh Dam	Mount Lebanon / Aley	Construction of Water Supply dam (4-5 MCM) and associated water treatment plant, transmission lines and reservoirs including expropriations and supervision costs.	110	5	Tender Documents available; ready for construction	3	Increase water supply, reduce deficit, improve hygienic conditions Conserve and recharge groundwater	2	1.1	5	1
W40	Maaser Chouf Dam	Mount Lebanon / Chouf	Construction of Water Supply hill lake (2.2 MCM) and associated water treatment plant, transmission lines and reservoirs including expropriations and supervision costs.	85	2	Tender Documents available; ready for construction. EIA requires update	3	Increase water supply, reduce deficit and improve hygienic conditions Conserve and recharge groundwater	2	0.85	5	1

Ref	Project	Region	Description	Estimated Cost (MUSD)		Status		Impact		Generated Employment	Priority Score	Implementation Cycle
				Investment	Land Expropriation					Million Labour-Days		
W41	Assi Phase I Dam	Bekaa / Hermel	Completion of execution works for Assi Phase 1 Water and Irrigation Dam (63 MCM), and supervision works.	65	-	Dam construction stopped since 2006. Design required for the plant and transmission pipe	2	Increase irrigation capabilities in the region (Hermel and El Qaa Valley), increase agriculture production, stabilise rural population, generate job opportunities, and improve social and economic wellbeing in the region. Conserve and recharge groundwater	3	0.65	5	1
W41A	Remaining Expropriations for Besri Dam	Beirut & Mount Lebanon	Additional funds of 15MUSD are required to complete the expropriations.	-	15							1
W41B	Remaining Expropriations for Chabrouh Dam	Beirut & Mount Lebanon	Expropriations of 4,000,000 m2 for Chabrouh Dam (remaining expropriations)	-	20		2					1
W42	Assi Phase 2 Dam	Bekaa / Hermel	Construction of Assi Phase 2 Water and Irrigation Dam (15 MCM).	300	40	Tender documents available. EIA requires update	2	Increase irrigation capabilities in the region (Hermel and El Qaa Valley), increase agriculture production, stabilise rural population, generate job opportunities, and improve social and economic wellbeing in the region. Conserve and recharge groundwater	2	3	4	2
W43	Barhashah Dam	Bekaa / Zahle	Construction of Water Supply Hill lake (0.55 MCM)	40	1	Tender Documents available; ready for construction. EIA requires update	2	Increase water sources for Zahle and surrounding localities, reduce deficit on national and local level, improve water quality and hygienic conditions, reduce health bill Conserve and recharge groundwater.	2	0.4	4	1

Ref	Project	Region	Description	Estimated Cost (MUSD)		Status		Impact		Generated Employment	Priority Score	Implementation Cycle
				Investment	Land Expropriation					Million Labour-Days		
W44	Ibl es Saqi Dam	South / Marjaayoun	Construction of Irrigation and Water supply dam (50 MCM) on the Hasbani river next to Ibl es Saqi; the main use will be for Irrigation with 30% for water supply.	200	100	Tender documents available. Technical validation is required. EIA requires update	2	Provides Irrigation water for the villages of caza of Hasbaya and Marjaaoun. This enhances agriculture and thus improves life conditions of the habitants Increases potable water supply and reduces deficit Provides employment for habitants and displaced Syrians	2	2	4	2
			Total Cycle 1	**2,151**	**106**							
			Total Cycle 2	**722**	**156**							
			Total Water Cycles 1 and 2	**3,135**								

Table 3-4: Water and Irrigation Future Capital Investment Projects – Cycle 3

Ref	Project	Region	Description	Estimated Cost (MUSD)		Status		Impact		Generated Employment	Priority Score	Implementation Cycle
				Investment	Land Expropriation					Million Labour-Days		
A	**Expansion and Improvement of Supply**											
PART 1: Projects associated with completed or ongoing Dams												
W6B	Water Supply system for Choumariye Dam	South	Downstream works for proposed Choumariye Dam	70								3
PART 2: Expansions, Upgrades and Rehabilitations of Existing Networks												
NORTH WATER ESTABLISHMENT – Cycle 3												
W9-2	Qobayat Water Supply Systems, Phase 3	Akkar	Expansion and upgrade of Qobayat water supply networks.	9		Detailed Design is required.	1	Improve supply to meet demand growth	1	0.1	2	3
W10-2	Halba Water Supply Systems, Phase 3	Akkar	Expansion and upgrade of Halba water supply networks.	13		Detailed Design is required.	1	Improve supply to meet demand growth	1	0.15	2	3
W11-2	Danniyeh Water Supply Systems, Phase 3	North / Meniyeh-Danniyeh	Expansion and upgrade of Danniyeh water supply networks.	3	0.5	Detailed Design is required.	1	Improve supply to meet demand growth	1	minor	2	3
W12-2	Minieh Water Supply Systems, Phase 3	North / Meniyeh-Danniyeh	Expansion and upgrade of Minieh water supply networks.	2	0.5	Detailed Design is required.	1	Improve supply to meet demand growth	1	minor	2	3
W13-2	Tripoli Water Supply Systems, Phase 3	North / Tripoli	Expansion and upgrade of Tripoli water supply networks.	12	0.5	Detailed Design is required.	1	Improve supply to meet demand growth	1	0.1	2	3
W14-2	Zgharta Water Supply Systems, Phase 3	North / Zgharta	Expansion and upgrade of Zgharta water supply networks.	7	1	Detailed Design is required.	1	Improve supply to meet demand growth	1	minor	2	3
W15-2	Bcharre Water Supply Systems, Phase 3	North / Bcharre	Expansion and upgrade of Bcharre water supply networks.	3	0	Detailed Design is required.	1	Improve supply to meet demand growth	1	minor	2	3
W16-2	Koura Water Supply Systems, Phase 3	North / Koura	Expansion and upgrade of Koura water supply networks.	12	0.5	Detailed Design is required.	1	Improve supply to meet demand growth	1	0.1	2	3
W17-2	Batroun Water Supply Systems, Phase 3	North / Batroun	Expansion and upgrade of Batroun water supply networks.	3	0.5	Detailed Design is required.	1	Improve supply to meet demand growth	1	minor	2	3

Ref	Project	Region	Description	Estimated Cost (MUSD)		Status		Impact		Generated Employment	Priority Score	Implementation Cycle
				Investment	Land Expropriation					Million Labour-Days		
BEKAA WATER ESTABLISHMENT – Cycle 3												
W18-2	Ain El Hawr - Ras El Meil Systems	Baalbek-Hermel / Hermel	Expansion and upgrade of Ain El Hawr (Merjhine), Ras El Meil water supply networks.	1.5	1	Detailed Design is required.	1	Improve supply to meet demand growth	1	minor	2	3
W19-2	Ein El Zarqa	Baalbek-Hermel / Hermel	Expansion and upgrade of Ein El Zarqa water supply networks.	0.5	1	Detailed Design is required.	1	Improve supply to meet demand growth	1	minor	2	3
W20-2	Laboue Water Supply System	Baalbek-Hermel / Baalbek	Expansion and upgrade of Laboue water supply system.	1	0.5	Detailed Design is required.	1	Improve supply to meet demand growth	1	minor	2	3
W21-2	Ouyoun Orghosh Water Supply System	Baalbek-Hermel / Baalbek	Expansion and upgrade of Ouyoun Orghosh water supply system.	3	0.5	Detailed Design is required.	1	Improve supply to meet demand growth	1	minor	2	3
W22-2	Younine, Maqne and Nahle water supply systems	Baalbek-Hermel / Baalbek	Expansion and upgrade of Younine, Maqne and Nahle water supply networks.	0.5	0.5	Detailed Design is required.	1	Improve supply to meet demand growth	1	minor	2	3
W23-2	Yamoune Water Supply System	Baalbek-Hermel / Baalbek	Expansion and upgrade of Yamoune water supply system.	7	0.5	Detailed Design is required.	1	Improve supply to meet demand growth	1	minor	2	3
W24-2	Yahfoufa Water Supply System	Baalbek-Hermel -Bekaa / Baalbek and Zahle	Expansion and upgrade of Yahfoufa water supply networks.	2	0.5	Detailed Design is required.	1	Improve supply to meet demand growth	1	minor	2	3
W25-2	Qaa El Rim System	Bekaa / Zahle	Expansion and upgrade of Qaa el Rim water supply system.	3.5	0	Detailed Design is required.	1	Improve supply to meet demand growth	1	minor	2	3
W26-2	Qab Elias, Jdita and Zebdol Water Supply -systems	Bekaa / Zahle	Expansion and upgrade of Qab Elias, Jdita and Zebdol water supply networks.	0.5	0	Detailed Design is required.	1	Improve supply to meet demand growth	1	minor	2	3
W27-2	Aanjar Water Supply System	Bekaa / Zahle	Expansion and upgrade of Aanjar water supply system.	2	0	Detailed Design is required.	1	Improve supply to meet demand growth	1	minor	2	3
W28-2	Chamsine Water Supply System	Bekaa / Zahle and West Bekaa	Expansion and upgrade of Chamsine water supply networks.	2	0	Detailed Design is required.	1	Improve supply to meet demand growth	1	minor	2	3
W29-2	Ain El Zarqa Part1 Water Supply System	Bekaa / West Bekaa	Expansion and upgrade of Ain El Zarqa water supply system.	1.5	0	Detailed Design is required.	1	Improve supply to meet demand growth	1	minor	2	3
W30-2	Ain El Zarqa Part2 Water Supply System	Bekaa / Rachaya	Expansion and upgrade of Ain El Zarqa water supply system.	2	0	Detailed Design is required.	1	Improve supply to meet demand growth	1	minor	2	3
SOUTH WATER ESTABLISHMENT – Cycle 3												
W31-2	Saida Water Supply Systems	South	Expansion and upgrade of water supply networks in the Caza of Saida.	8	1	Detailed Design is required.	1	Improve supply to meet demand growth	2	0.2	3	3
W32-2	Zahrani Water Supply System	South	Expansion and upgrade of water supply networks.	1	0.5	Detailed Design is required.	1	Improve supply to meet demand growth	2	0.2	3	3
W33-2	Jezzine Water Supply System	South	Expansion and upgrade of water supply networks.	4	0.5	Detailed Design is required.	1	Improve supply to meet demand growth	2	0.2	3	3

Ref	Project	Region	Description	Estimated Cost (MUSD)		Status		Impact		Generated Employment	Priority Score	Implementation Cycle
				Investment	Land Expropriation					Million Labour-Days		
W34-2	Sour Water Supply System	South	Expansion and upgrade of water supply networks.	2	0.5	Detailed Design is required.	1	Improve supply to meet demand growth	2	0.2	3	3
W35-2	Nabatiye Water Supply System	Nabatiye	Expansion and upgrade of water supply networks.	15	0.5	Detailed Design is required.	1	Improve supply to meet demand growth	2	0.2	3	3
W36-2	Bint-Jbeil Water Supply System	Nabatiye	Expansion and upgrade of water supply networks.	1	0.5	Detailed Design is required.	1	Improve supply to meet demand growth	2	0.2	3	3
W37-2	Marjaayoun&Hasbaya Water Supply Systems	Nabatiye	Expansion and upgrade of water supply networks.	1	0.5	Detailed Design is required.	1	Improve supply to meet demand growth	2	0.2	3	3
B	**Development of Resources**											
W45	Noura el Tahta Dam	North/Akkar	Construction of dam (35-50MCM) for Nour el Tahta and surrounding villages.	80	10	Design is required	1	Provides water for the neighbouring villages Helps recharge of groundwater Response to Syrian crisis through generated employment.	2	0.8	3	3
W46	Atolbe Dam	North/Akkar	Construction of Water Supply hill lake (0.70 MCM) to supply Qbayat	18	2	At preliminary design stage	1	Provides Irrigation water for the Qobayat village and neighbouring villages Response to Syrian crisis through generated employment.	1	0.18	2	3
W47	Dar Baachtar Dam	North/Koura	Construction of Water and Irrigation Dam (7 MCM) for Koura and Batroun	75	10	At preliminary design stage	1	Provides potable and irrigation water for the Caza of Koura and Batroun villages. Helps recharge of groundwater Response to Syrian crisis through generated employment	2	0.75	3	3
W48	IaaL Dam	North/Zgharta	Construction of Water and Irrigation Dam (12-18 MCM) for Caza of Zgharta villages	70	10	Under design	1	Provides potable and irrigation water for the Caza of Zgharta villages. Response to Syrian crisis through generated employment.	2	0.7	3	3

Ref	Project	Region	Description	Estimated Cost (MUSD)		Status		Impact		Generated Employment	Priority Score	Implementation Cycle
				Investment	Land Expropriation					Million Labour-Days		
W49	Rahwe Dam	North / Batroun	20 m dam height, providing additional statice storage capacity of 2 MCM for the irrigation of 200 ha	25	10	Design completed. New EIA required	1	Provides Irrigation water for the villages of cazas of Batroun Helps recharge of groundwater	2	0.25	3	3
W50	Damour Dam	Mount Lebanon/Damour	Construction of Water and Irrigation DAM (42-106 MCM) for Beirut and Damour region.	150	30	Feasibility study done	1	Supply of Damour and surrounding coastal villages with domestic and irrigation water	2	1.5	3	3
W51	Khardali Dam	South/Nabatiye	Construction of Irrigation and Water supply dam (120 MCM) on Litani river (Khardali segment) including downstream works; the main use will be for Irrigation with 15-20% for water supply.	435	200		1	Provides Irrigation water for the villages of caza of Nabatiye, Marjaoun, and Jezzine. This enhances agriculture and thus improves life conditions of the habitants Increases potable water supply and reduces deficit Provides employment for habitants and displaced Syrians	2	2.8	3	3
W52	Kfarsir Dam	South/Nabatiye	Construction of Irrigation and Water supply dam (12 MCM) on the Litani river next to Kfar Sir village; the main use will be for Irrigation with 25% for water supply.	45	15	At preliminary design stage	1	Provides Irrigation water for the west villages of caza of Nabatiye. This enhances agriculture and thus improves life conditions of the habitants Increases potable water supply and reduces deficit	2	0.45	3	3
W53	Wadi Chich Dam	North/Bcharre	Construction of Water and Irrigation dam (200,000 CM) with treatment plant, storage tanks and distribution lines to the villages of Bcharre, Mar Iesha3, Hadshit, Bka3 Kafra, Bazaoun, and Hasroun.	20	-	Feasibility study	1	Provides domestic and irrigation water for the beneficiary villages	2	0.45	3	3
W53	Irrigation - Massa Dam	Bekaa / Zahle	Providing additional storage capacity of 8 MCM for the irrigation of 1600 ha	60	4		1	Provides Irrigation water for the villages of cazas of Zahle	2	0.6	3	3
W54	Irrigation - Younine Dam	Baalbek	Providing additional storage capacity of 5.8 MCM for the irrigation of 1200 ha	65	10		1	Provides Irrigation water for the villages of cazas of Zahle	2	0.7	3	3
W55	Qarqaf Dam	Akkar	Construction of Irrigation DAM (20-25 MCM) for Akkar coastal region.	81				Provides Irrigation water for the coastal villages of Akkar				3

Ref	Project	Region	Description	Estimated Cost (MUSD)		Status		Impact		Generated Employment	Priority Score	Implementation Cycle
				Investment	Land Expropriation					Million Labour-Days		
W56	Choumariye Dam	South	Construction of Water supply and Irrigation DAM on Litani River.	60	20							3
			Total Water Cycle 3	**1,377**	**333**							
				1,710								

Table 3-5: Proposed Water Capital Investment Programme by Cycle (MUSD)

Cycle	Project	Akkar	North	Baalbek / Hermel	Bekaa	South	Nabatiye	B & ML	Subtotal
1	Networks	144	214.5	111	104.5	114.5	114.5	474	1,277
	Dams	300	37	65	41	0	0	237	680
	Irrigation	0	0	0	0	100	200	0	300
	Total	**444**	**251.5**	**176**	**145.5**	**214.5**	**314.5**	**711**	**2,257**
2	Networks	33.5	43.5	79	40	18.5	23	0	237.5
	Dams	0	0	340	0	0	300	0	640
	Total	**33.5**	**43.5**	**419**	**40**	**18.5**	**323**	**0**	**878**
							Grand Total (MUSD)		**3,138**
Cycle 3 (Future)	Networks	22	45.5	17.5	14	17.5	88.5	0	205
	Dams	191	220	75	64	0	775	180	1,505
	Total (MUSD)	**213**	**265.5**	**92.5**	**78**	**17.5**	**863.5**	**180**	**1,710**

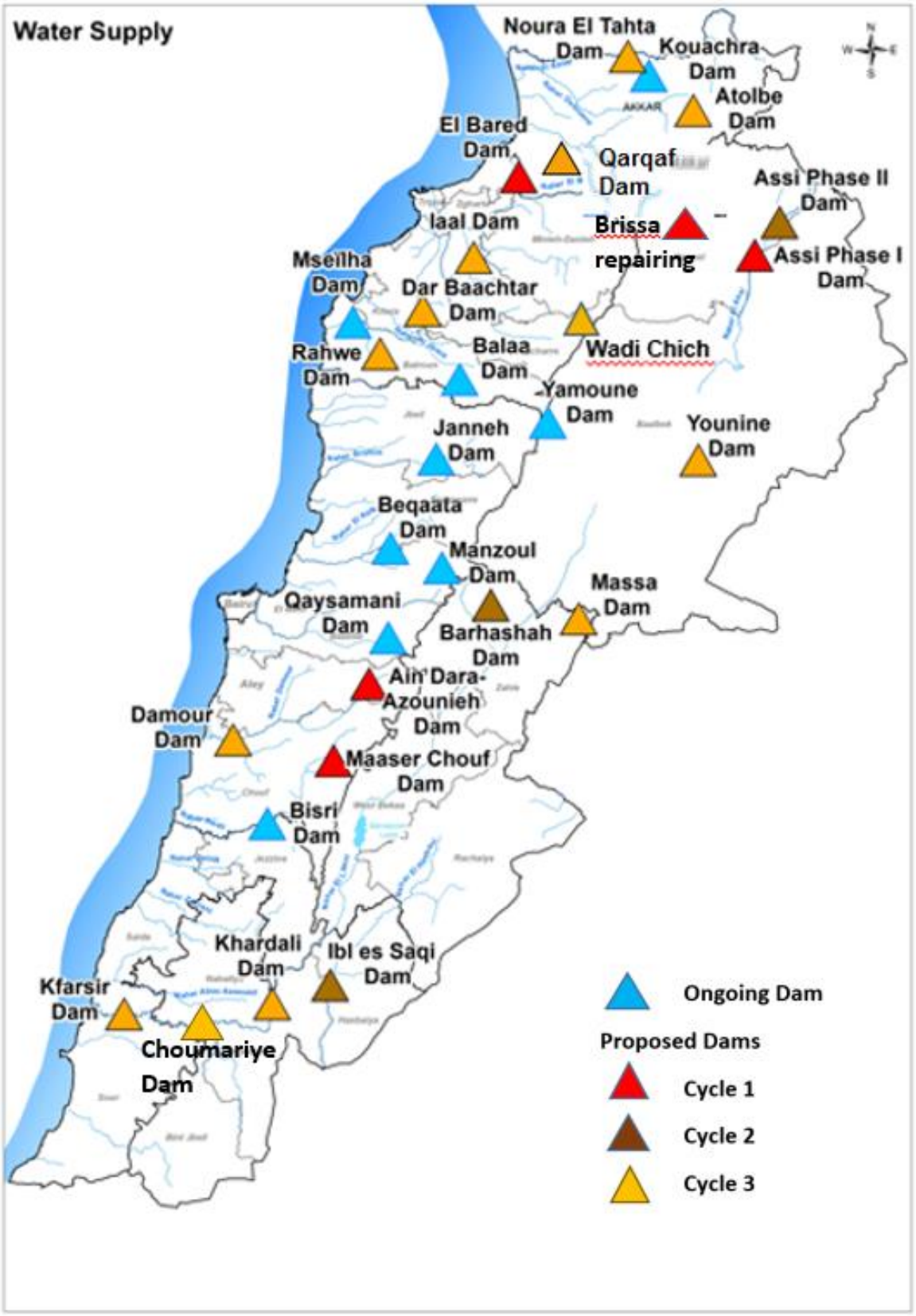

Figure 3-1: Surface Water Resources Priority Projects

3.8 Institutional Considerations

- **Capacity Building**

All master plans and previous studies of the sector discussed briefly the institutional capacities of the water establishment for handling the proposed development programmes. They all shared the opinion of capacity building without a proper definition of the requirements. A detailed study of the current conditions of the water establishments is necessary, including the human resources, the administrative structure, the O&M capacities for timely intervention, the relationship and satisfaction of the beneficiaries, the water quality monitoring, water billing, accounting, etc.

- **Dams Management**

With the various dam projects under construction or planned for construction, the MoEW would have to introduce in the national legislation the dam safety plan, as stated in the World Bank Operational Policy OP.4.37 Safety of Dams.

The dam-safety objectives are to protect the investment, and reduce the potential liability associated with a dam failure. The purpose of this Emergency Action Plan is to identify emergency situations that could threaten the dams, and to plan for an expedited, effective response to prevent their failure.

A Dam Safety Panel and an Environmental and Social Advisory Panel have to be established to advise on dam safety, safeguards and other technical studies during dam design, construction, impoundment, and dam monitoring. These panels are expected to meet twice a year during construction and once a year during operation, and their reports will be published.

- **Private Sector Participation**

The private sector is active in the water sector activities: starting from planning, design, construction, up to O&M.

The advantages of partnerships with the private sector would have to be assessed and explored depending on the establishment requirements, needs and constraints, and the general governmental policies.

4 WASTEWATER

4.1 Introduction

The Lebanese government launched a long-overdue development plan for the wastewater sector aiming at the protection of the water resources and the Mediterranean Sea, mitigating the health, environmental and economic costs from unsafe wastewater management, and improving social and economic wellbeing.

Traditionally, nearly 100% of the households had access to water resources, but wastewater collection was limited to large communities. Wastewater was commonly disposed of through percolation pits.

A study commissioned by the World Bank[2] in 2003 estimated the total cost of environmental degradation in Lebanon due to health impacts and degradation of quality of life to be about 2.1% of the Gross Domestic Product (GDP) of Lebanon.

More than a billion USD have been invested up to 2012 in the wastewater sector, yet only 8% of the generated wastewater could be treated. The Ministry of Energy and Water issued in 2012 the strategy of the wastewater sector within an integrated water resource management framework. However, due to regional instability and the Syrian crisis and in view of the unexpected upsurge of the demands as a result of the sudden increase in population by nearly 50%, the resources management plan had to switch to an emergency relief plan.

Successive response strategies were prepared since 2013 to prevent drastic potential consequences and outbreaks of waterborne diseases, through providing basic supplies to communities without water and wastewater access. The cost of the immediate response was estimated at 390 MUS$ in 2016, yet only 90 MUS$ were made available. The Lebanon Crisis Response Plan 2017-2020 (LCRP) prepared in 2016 estimated the fund requirements to be 280 MUS$ in 2017 and another 280 MUS$ in 2018.

The LCRP 2016 report estimated the people in urgent need for safe water access to be 2.6 Million Lebanese, 1 Million Syrian and 0.2 Million Palestinian as per the below table.

Table 4-1: Population in Need of Safe Services

Population Cohort	No. of People in Need
Lebanese	2,582,427
Displaced Syrian	960,000
Palestine Displaced Syrians from Syria	20,161
Palestine Displaced Syrians in Lebanon	177,910
Total	**3,740,498**

4.2 Background and Current Conditions

Background

The CDR and the Ministry of Energy and Water are the main implementing agencies of wastewater projects to the benefits of the regional Water Establishments (North Lebanon, Beirut and Mount Lebanon, South Lebanon and Bekaa) who have the responsibility of the wastewater sector operations and management since the promulgation of law 221/2000, which transferred the wastewater management from the Municipalities to the WEs whose experience in the sector is limited.

[2] METAP, the World Bank, *Cost of Environmental Degradation in Lebanon*, June 2003.

Current Conditions

The wastewater treatment rate and connection rate were estimated respectively to 8% and 60% in 2010 National Strategy for the Wastewater Sector (issued in 2012). Based on the below description of current conditions and wastewater projects status, the rate of connected population to operational treatment plants is estimated to 29%

The wastewater projects initiated or completed in Lebanon fall into three categories:

A- **Protection of the Lebanese Coast / Mediterranean Sea:** The Barcelona Convention of 1998 requires Lebanon to contribute towards the protection of the Mediterranean waters against pollution. The agreement stressed on the necessity of treating wastewater before it is discharged into the sea in cities and towns with populations exceeding 100,000 residents. In compliance with this requirement, 11 coastal wastewater treatment plants were designed, of which 8 were constructed and the remaining 4, namely, the treatment plants of El Aabde in Akkar, Maamltein and Jeita in Kesrouane and Daoura (formerly known as Burj Hammoud) serving parts of Beirut, Metn and Baabda districts are still under preparation. The constructed and planned plants are for secondary treatment except for Saida, Ghadir and Daoura that are for preliminary, respectively pre-treatment level and need to be extended to at least secondary treatment to comply with the Mediterranean Convention. The plan for Daoura is also to have preliminary treatment which also requires upgrade to comply with the Mediterranean Convention.
Main collectors and collection networks were initiated for the lower basins and need to be expanded to cover the upper basins currently discharging into water streams or ground water. Moreover, some of the constructed wastewater treatment plants require extension to meet the current and projected demand. While the main collectors of storm and waste water are now constructed in Beirut, the old collection networks of the city and its neighborhoods is not yet upgraded to separate rain water from sewage.

Below is a brief description of the coastal systems from North to South:

- **Akkar:** The tender documents for the coastal El Aabde wastewater treatment plant, its sea outfall and collection networks of the coast of Akkar (Phase 1) are under preparation. Phases 2 and 3 consist of expanding the capacity of the wastewater treatment plant and connecting other coastal and central villages of Akkar.
- **Tripoli** wastewater treatment plant and sea outfall were completed, servicing Tripoli coastal area, Al Qalamun, major parts of Koura and Zgharta districts, and the coastal areas of Baddaoui, Deir Aamar and Minnieh district. The approximate area covered by Tripoli plant is around 325 km^2, serving around 610,000 people expected to grow up to 950,000 in 2035. At present the networks cover less than 50% of the servicing area of Tripoli plant. The collection network in Tripoli city and the main collector towards the North are completed, and works on the South collector are still on-going but funds are lacking for Maarad – Bohsas link. The collection networks for the remaining parts of Tripoli district and other districts are still lacking and require funding. Zgharta coastal and central villages are planned to be connected to Tripoli plant but funds are not yet available. Danniye coastal and central villages are planned to be connected to Tripoli wastewater treatment plant through Zgharta but funds are not yet available.
- **Koura:** The implementation of Phase I collection networks including house connections in the coastal part of Koura is ongoing. Phase II project is planned to cover the missing secondary and tertiary lines for other villages.
- **Chekka and Batroun** wastewater treatment plants in North Lebanon were completed; however, they require expansion to meet the current demands. They serve the coastal part of Batroun and Koura that is already provided with collection networks.
- **Jbeil** wastewater treatment plant was completed, however the plant requires expansion to meet the current demand. Site works are progressing for the construction of part of the networks in the coastal part of Jbeil district. Additional networks are required for the remaining part of the Jbeil plant basin.

- **Kesrouane**: The plan for the coastal area of Kesrouane district is to have two treatment plants and their corresponding networks. The project is under preparation.
- **Beirut and parts of Mount Lebanon** districts are divided into two main drainage basins with two (2) treatment plants located at Daoura and Al Ghadir.
  - The construction and equipping of Al Ghadir wastewater pre-treatment plant as well as the sea outfall were completed and put in service in 1997. This plant designed to serve the Southern part of districts of Baabda and Aley, the west-southern part of Greater Beirut and the northern parts of the Chouf district, requires expansion works. One project is under preparation to upgrade the treatment plant to preliminary treatment. Additional funds are required to upgrade it to secondary treatment process. The main collector (Carlton – Al Ghadir) was constructed but the collection networks in Al Ghadir service area require upgrade and extension to cover the yet unserved areas, partial funds are available for the required works. The main wastewater lines and sewer networks in the villages of Aley and Baabda are under construction.
  - Daoura (formerly known as Burj Hammoud) preliminary treatment plant project is still under preparation while the main collector from Dbaye to Daoura was completed and the sea outfall north Beirut was constructed. The upgrade of the design to reach secondary treatment is required and additional funds are required to implement the upgrade. The plant will serve the coastal part and central villages of Metn district, part of Baabda district as well as the east-northern part of Greater Beirut. The collection networks in lower Metn are under progress.
  - The network in Beirut and suburbs requires upgrading to separate stormwater from wastewater, part of the works have already been initiated by the CDR and other by the Beirut Municipality, however funds are required to complete the rehabilitation of the infrastructure and in particular wastewater/stormwater networks.
- **Baabda – Aley:** Ghadir River is overflowing and causing damages to the population living along its bank as well as along major highways in Beirut towards Beirut Airport. A flood protection detailed design study was done and requires implementation once funds are made available.
- **Chouf**: Works are ongoing for the construction of the wastewater networks in the coastal villages and towns of the Chouf district, connected with the wastewater treatment plant located in Nabi Younes. The wastewater treatment plant requires expansion and additional networks are still required.
- **Saida**: The pretreatment plant in Saida and its sea outfall were completed and the first phase of the rehabilitation networks in Saida city and its suburbs were executed. Main collector lines were executed within the basin (exluding the city). Additional funds are required to upgrade the wastewater treatment plant to secondary treatment and completion of networks in the basin of the plant. Sarafand system is not yet executed but has secured funding.
- **Sour**: The secondary treatment plant in Sour was completed and its sea outfall is under construction. The first phase of the rehabilitation networks in Sour City and its suburbs were executed. The second phase is currently ongoing. The third phase that covers the remaining part of Sour system (upper basin) requires funding. The southern part of the Sour district, i.e. Naqoura system requires also funding.

B- **Protection of the Water Resources:** Based on the Wastewater Master Plan of 1982 (updated in 1994), basins and priority systems were identified to protect surface and ground water resources from pollution. Few inland treatments plants were constructed. All inland communities are either discharging into natural streams, hence polluting the surface water anticipated for development to meet the domestic and irrigation water requirements, or percolating into the groundwater currently used for domestic supply. Priorities for inland networks and treatment plants are given for the protection of the water resources, namely the mobilized surface waters, springs and groundwater resources. Tertiary treatment is preferable

to be able to re-use the treated effluent for irrigation. Most of the constructed plants provide tertiary treatment.

Small scale networks and a limited number of local treatment plants were constructed by Donors and International NGOs, yet not properly functioning due to the lack of expertise and technical and financial capabilities of the WEs and Municipalities.

The on-going construction of dams for the development of new water resources to meet the national increasing domestic supply shortages introduced new priorities for the water resources protection. In addition, the sector's objectives need to address the additional 1.5 million displaced Syrians (equivalent to 38% of Lebanese population) dispersed throughout the country either in hosting communities or camps.

Below is a brief description of the inland systems:

- **Akkar** region has currently 14 small inland wastewater treatment plants of service areas ranging between 27 ha and 1200 ha, and a total equivalent to only around 1.5% of the region. Other local systems are planned for the remaining villages and towns in Akkar, in particularly for Jebrayel, Beit Mellat and surrounding villages, Qobayat, Wadi Khaled, Akkar el Atika, Bireh and Mounjiz, etc. Mechmech / Fnaydeq system (LCRP) project is under preparation and requires additional funds.
- **Danniye:** Bakhaoun (second town of the Danniye district) system is under preparation but requires additional funds. The remaining central villages and Terbol on the coast require local systems and wastewater treatment plants and some may be connected to El Aabde treatment plant planned in Akkar, in particular the villages discharging now in the Bared River upstream the planned Bared dam.
- **Zgharta**: The upper part of Zgharta district is mainly covered by Ehden wastewater treatment plant currently under construction and by Ijbaa and Aintourine treatment plants undergoing rehabilitation.
- **Batroun and Koura**: The upper part of Batroun district needs to be provided with collection networks to avoid wastewater discharge into the main watercourse of the planned Mseilha dam. The Ministry completed the networks of Kfar Helda system that cover some of the villages in Mseilha dam basin while the works in the wastewater treatment plant are still ongoing. Additional systems are required for Kfar Hai and Chebtine areas. The remaining parts of Batroun and Koura districts need to be covered by localized systems and wastewater treatment plants.
- **Bcharre:** Only Bcharre town is served by a collection network and a treatment plant (under construction). The remaining clusters and villages need to be served by localized systems and treatment plants. The most important ones are Hasroun and all villages discharging into Wadi Qadisha which has historical and environmental value.
- **Jbeil**: In upper Jbeil district, the Qartaba project was initiated. Additional funds are required for this project as well as for projects in Afqa, Aaqoura, Laqlouq and Janneh to collect and treat the wastewater currently discharged into the main watercourse of the under construction Janneh dam. Other complementary small scale systems are planned for the rest of the Jbeil district and require also funding.
- **Kesrouane**: The plan for upper Kesrouane district is to have one system for Jeita spring protection, several systems for the mountainous villages including Hrajel and Achkout. The projects are under preparation. Hrajel project (LCRP) requires additional funds while Achkout requires entire funding.
- **Beirut, Metn, Baabda and Aley**: A project is under preparation to cover villages of upper Metn, Baabda and Aley districts to protect the groundwater and the wells used for drinking water of Beirut; therefore funds are required for Sfaileh and Qortada systems. In upper Metn, Kfartai system discharging into the watercourse of the planned Boqaata dam is a priority for the protection of the dam and requires funding. In upper Baabda, wastewater collection systems and treatment plants are required for Bmaryam and Btibyat to protect local water wells. Other local small and large scale systems are required in upper Metn, Baabda and Aley districts and lack funding.

- **Chouf**: Two systems were completed in Chouf: Barouk and Nabaa Safa. Both systems will contribute in the improvement of the water quality of projected dams (Damour and Azzounie). Two other systems (Ouadi Es Sitt and Ouadi Ed Deir Benouati) are also required to protect the Damour dam from pollution. Other complementary small scale systems are planned for the rest of the Chouf district and require funding.
- **Hermel**: The main wastewater trunk lines are now constructed in Hermel. Works in collection networks, main collectors and wastewater treatment plant are under preparation. Additional funds are required for this project to make it operational.
- **Baalbek:** Baalbek/Iaat wastewater treatment plant was constructed but is working below its capacity. Additional funds are required for the networks of Baalbek City and surrounding villages and the upgrade of the wastewater treatment plant. Current projects under preparation in Baalbek district are the construction of new wastewater treatment plants and collection networks in Laboue area, Central and North Bekaa villages within Litani Basin (Timnine Part I). Timnine Part II will cover the remaining villages within Litani Basin but yet requires funds. Qaa and Jdaide remote areas are not covered by any system. They discharge into the Assi River upstream of the planned Assi dam. Aarsal located on the border of the country is also becoming an important agglomeration with more than 17,000 persons in addition to 40,000 displaced Syrians.
- **Zahle and the West Bekaa**: A special focus is directed towards Zahle and the West Bekaa area due to the extreme pollution of Qaraoun Lake and the Litani River requiring an urgent intervention, particularly for the projects under construction to mobilise the Litani water resources for domestic use. Villages boarding the lake have already wastewater systems and treatment plant (Machghara, Saghbine). Zahle wastewater treatment plant construction started in 2005 is completed. Site works are still underway to construct the associated collection networks. The expansion of the wastewater networks of Ablah and Furzol wastewater treatment plant is ongoing. The project of Anjar system covering Anjar and several towns and villages of West Bekaa and Zahle districts is under preparation. Another system covering North West Zahle is also under preparation. Funds are required for a system covering the Eastern part of Zahle, the expansion of networks between Saghbine and Joub Jannin and a system covering the remaining villages of West Bekaa located south Qaraoun Lake. Aitanit treatment plant is operational.
- **Rachaiya**: The system of Rachaiya City is under construction; however, the remaining villages of Rachaiya district need to be served as well to mitigate the pollution of the water resources.
- **Jezzine:** A project is planned for wastewater systems in Jezzine and surrounding villages for the protection of the planned Bisri dam. Additional funds are required to cover the remaining villages of Jezzine district.
- **Marjaayoun**: The project of Marjaayoun system including one wastewater treatment plant is under preparation. Two projects in Hasbaiya district are under preparation: the project of Arqub and the project of Hasbaiya system. The latter requires additional funding.
- **Nabatiye** district: site works of three treatment stations and associated networks in Yohmor, Kfar Sir and Zoutor discharging into Litani were recently completed. The treatment plant in Nabatiye town was completed as well as part of the collection networks of Part I (Western part of Nabatiye). Funds are required to complete the collection network of the Eastern part of the Nabatiye system and for the system of Jbaa and neighboring areas.
- **Bint Jbeil**: Tebnine system is almost completed in Bint Jbeil district. Funds are required for the remaining systems planned for the district: Bint Jbeil, Kafra and Chakra.

C- **Emergency Projects Related Directly to the Impacts of the Syrian Crisis (LCRP):** Those projects are mainly related to small scale interventions by Donors and NGO's in the Refugee Camps.

4.3 Impacts of the Syrian Crisis on the Wastewater Sector

The Syrians distribution in Lebanon towns and villages is not even, border areas in North and Bekaa as well as large cities are the mostly affected areas, thus the existing infrastructure of wastewater is completely overloaded and public is endangered as sewerage systems are still missing in most of the rural settlement areas.

In the cities, where the average connection rate to networks is estimated to 30%, the sudden increase in population contributes to an increased pressure on wastewater disposal, both on sewerage systems and wastewater treatment.

Given the lack of accurate data, it is difficult to determine the fate of the incremental wastewater generated by the displaced Syrians in the various Lebanese regions[3]. Since a limited percent of the wastewater generated at the national level is treated and the remaining is untreated and discharged into open lands or in watercourses, it is expected that similar trends would apply to the wastewater generated by the displaced Syrians. However, assuming an average water consumption 100l/c/d for the displaced, the expected corresponding wastewater generation is about 120,000 m^3/day.

Releases of wastewater in water bodies have several environmental, ecological and health impacts, as well as restrictions on drinking water consumption. Moreover important groundwater resources such in the North and Bekaa are endangered by pollution from the unregulated wastewater discharge in particular in camps and the increased extraction from water wells.

4.4 Existing Programme and Strategies

The Government of Lebanon embarked since 1992 on the following wastewater development strategies:

- Execution of urgent repairs and renovations of the existing wastewater networks and pumping stations, and tackling the new challenges faced.
- Continuing the completion of unfinished projects that were interrupted involuntarily, and expanding and rehabilitating networks according to needs.
- Launching two programs aimed at protecting the Lebanese coasts and water resources from pollution.

Moreover, the Ministry of Energy and Water issued in 2010 the National Water Sector Strategy, putting on track the surface water resources management plan, specifically the construction of the dams to meet water shortages and hence giving higher priorities for the protection of the additional water resources under development.

The objective of protecting the national water resources and the Mediterranean Sea requires strengthening the wastewater sector, including the provision of reliable wastewater collection systems, expanding the collection networks, upgrading existing wastewater treatment plans, construction of new plants, and upscaling the administrative, management and operation and maintenance structures.

The 2010 wastewater sector strategy issued by the Ministry of Energy and Water strategy in 2012 fixed the objective to treat all wastewater according to national standards, and where economic, to reuse treated wastewater. Cost recovery will be based on the “polluter pays” principle. The strategy provides five strategic initiatives:

1- An integrated and prioritized investment program, to rapidly increase wastewater collection, treatment and reuse rates.
2- Legal, regulatory and policy measures to set and regulate national standards for wastewater treatment and reuse.

[3] According to the study “Lebanon Environmental Assessment of the Syrian Conflict and Priority Interventions (MoE, EU and UNDP, 2014), wastewater generation have increased between 8 and 14 percent since 2011, challenging a system that only treats 8 percent of its sewage.

3- Institutional measures to define responsibilities and to create capacity for service delivery.
4- Financial measures for viability and affordable services.
5- Private sector participation in the wastewater sector.

The Lebanese Government approved one Programming Law (law 63 – 27/10/2016) to address water pollution in the Litani River Basin. The law approves financing specific projects in wastewater and solid waste sectors to be implemented in the coming 7 years. Total budget is 1100 billion Lebanese pounds. The projects are listed in Table 4-2.

Table 4-2: List of Projects included in the Programming Law 63 of 27/10/2016

Project Name	Budget (Billion LBP)	Budget (Million USD)
Expansion of Iaat Treatment Plant and related networks in Baalbek Caza	10	6.7
Wastewater collection networks and treatment plants in North Bekaa	98	65.3
Wastewater collection networks and treatment plant in the Eastern part of Zahle	52	34.7
Expansion of wastewater collection networks within Zahle city	17	11.3
Wastewater collection networks and treatment plants in the South of Central Bekaa	125	83.3
Expansion of the networks in the Qaraoun Lake region (West Bekaa)	6	4.0
Sour 2 (Remaining part of the coast of Sour city and internal and rural areas)	135	90.0
Halloussie (Halloussiye, Hmairi, Halloussiye el Fawqa)	11.25	7.5
Srifa (Srifa, Bafliyé, Kalaat Maroun, Neftakhiyé, Niha and Deir Kifa)	18	12.0
Ouadi Slouqi (Froun, El-Qoussair, Mazraat Azzi, Ghandouriyet, Qantara, Deir Siriane, Aadchit, Taybet, Aadayssé, Rabb Et-Tlatine, Ouadi Slouqi, Talloussa, Kabrikha, Bany haiyane, Borj qalaouiyé, Touline, Khirbet Selm, Jmaijmé, Majdel Selm, Markaba)	79.5	53.0
Deir Mimas (Deir Mimas, Houra and Kfar Kila)	12	8.0
Sarafund (Coastal part between Qasmiye river in the south and Zahrani river in the north, up to to Zrariye, Insar, En Nmaïrîyé and Deïr ez Zahrâni)	157.5	105.0
Braiqea (Braiqea, Qsaibet, Qaaqaaiyet Ej-Jisr, Jaouharie, Kfar Djal, Aadchit, Mayfadoun, Choukine, Jibchit, Harouf and Aabba	52.5	35.0
Nabatiye Part II (Kfar Jaouz, Zibdine, Kfar Roummane, El Midane, Nabatiye el Faouqa, Nabatiye el Tahta, El Bayad, Es Serail, El Aaqide, Kfar Tibnit, Aali et Taher and El Manzale)	72	48.0
Nabaa el Tasseh (Mazraat Biyad, Houmine el Faouqa, Jarjouaa, Aarab Salim, El Louaize, Mlikh, Aaramta and Kfar Houne)	42	28.0
El Aaichiyeh - Rayhan (Rayhan, Sejoud, Nabi Sejoud and El Aaichiyeh)	9	6.0
Zilaya (Zilaya, Qelaya, Aain Et-Tiné, Yohmor, Sohmor, Libbaya, Maydoun and Dellafi)	23.25	15.5
Other	180	120
Total	**1100**	**733.4**

Following is a brief listing of the on-going / recently completed projects. Table 4-3 presents the budget spent by the Ministry of Energy and Water on upgrading and expansion of wastewater networks during the last five years (2012-2016). It is around 42 million USD. The aggregate value of wastewater projects implemented between 1992 and 2015 by the Government is around 675 million USD excluding land acquisition (CDR, 2015 Progress Report).

Table 4-3: Ministry's Expenditure on Wastewater Networks (2012 – 2016)

Region	Total MUSD
North Lebanon	34
Mount Lebanon	2.2
South Lebanon	4.0
Bekaa	1.8
Total	**42**

Table 4-4 lists the major on-going and recently completed projects, and Table 4-5 presents a brief of the projects with secured funding.

Table 4-4: Listing of Major on-Going / Recently Completed Projects

Project	Budget MUSD
A - Protection of the Lebanese Coast / Mediterranean Sea	
Koura: Construction of wastewater collection network and house connections in coastal and middle areas (Phase 1)	18
Batroun: Construction of wastewater collection network	21.8
Batroun/Koura: Construction of wastewater collection network within Chekka treatment plant service area	19.1
Jbeil: Expansion of wastewater collection network of the coastal area	22.4
Kesrouane: Construction of 2 sewage treatment plants in Adma and Zouk and collection networks in coastal basin	190
Metn: Construction of wastewater collection network of coastal area	24
Beirut: Rehabilitation of Beirut infrastructure selected sections	40
Beirut: Construction of sea outfall at Beirut Fish Port	1.8
Baabda: Wastewater collection networks in coastal area (including Carlton – ElGhadir – Naame collector line; Damour – El Ghadir collector line)	23.5
Aley: Expansion of wastewater collection networks in Shahar area (middle Ghadir basin)	14.5
Aley and Baabda: Expansion of wastewater collection network within Ghadir basin.	16.3
Chouf: Completion of sewage treatment plant and collection networks of coastal areas and upper basin within Nabi Younes basin	18.6
Sour: Construction of sewage treatment plant, sea outfall and wastewater collection network of coastal areas of Sour (Phases 1 & 2)	112
B - Protection of Water Resources	
Bcharre: Construction of Bcharre treatment plant and upgrading wastewater networks	4.6 + 11.2 (part)
Zgharta: Construction of Ehden treatment plant and rehabilitation of Ijbaa and Aintourine treatment plants	16.5
Batroun: Construction of sewage treatment plant and collection network covering the villages within Kfar Helda system (MoEW)	26.7
Jbeil: Construction of sewage treatment plant and collection network in Qartaba	4
Kesrouane: Construction of Hrajel sewage treatment plant and collection networks for the protection of Jeita Spring (phases 1, 2 & 3)	19
Metn: Construction of sewage treatment plant of Khenchara	7.8
Chouf: Completion of sewage treatment plants and collection networks in Safa, Barouk, Kfar Qatra, Freidis, Ain Zhalta. Rehabilitation of treatment plants in Jdeidet El Chouf, Ainbal and Gharifeh	43.1
Hasbaiya: Construction of sewage treatment plants, and wastewater collection networks for Yohmor, Zawtar, Kfar Sir	15.4
Bint Jbeil: Tebnine wastewater collection networks and treatment plant.	2.86
Baalbek: Expansion of wastewater collection networks in several villages	9.3

Table 4-5: Listing of the Projects with Partially or Fully Secured Funding

Project	Budget MUSD
A - Protection of the Lebanese Coast / Mediterranean Sea	
Akkar: Completion of Aabde wastewater collection networks, sea outfall and treatment system (coastal basin Lot 1 & 2 and Phase1)	40
Tripoli: Completion of wastewater collection system in Tripoli-Mina	5
Koura: Construction of main collectors in Wadi Hab, Wadi Nakhle and Bohsas - Qalamoun	11
Baabda/Beirut: Expansion of Ghadir sewage treatment plant	84.6
Baabda/Beirut: Extension and upgrading of collection networks within Ghadir wastewater treatment plant drainage basin	86**
Metn/Beirut: Construction of sewage treatment plant (Daoura) in North Beirut and wastewater collection networks in coastal and middle basins up to elevation 800m in North Beirut basin	71
Saida: Completion of wastewater collection network in Dekerman area, coastal Zahrani area and sewage treatment plant, sea outfall and wastewater collection networks of Sarafand area	76.5
B - Protection of Water Resources	
Akkar: Completion of Meshmesh wastewater collection networks and treatment system	13**
Kesrouane: Construction of Hrajel System	18**
Kesrouane: Jeita Protection Plan	20**
Chouf: Sewage treatment plant and collection networks of Beiteddine – Deir Al Qamar	50
Jezzine / Chouf: Sewage treatment plant and collection networks of Jezzine area for the protection of Bisri Dam	25
Hasbaiya: Sewage treatment plant, and wastewater collection networks of Arkoub area and Hasbaiya and neighborhood	30**
Marjaayoun: Sewage treatment plants and collection networks for Marjaayoun and Khiam	47.6
Bint Jbeil: Sewage treatment plant of Bin Jbeil and expansion of wastewater collection networks of Bint Jbeil casa	19.3**
Hermel: Sewage treatment plant and wastewater collection networks of Hermel and neighborhood	21.9**
Baalbek: Sewage treatment plants and wastewater collection networks of Laboue, - Ras Al Ain & neighborhood and Central and northern Litani basin (Timnine I)	65
Zahle: Completion of Part I of wastewater networks and treatment plant in south Central Bekaa for Anjar – Majdal Anjar and neighbourhood	30.9
Zahle: Completion of wastewater collection networks of Zahle	26
Zahle: Construction of sewage treatment plant and part of the associated networks – Part II (West Zahle)	24
Zahle: Expansion and rehabilitation of collection networks in Ablah and El Forzol area	3.5
Rachaiya: Expansion of wastewater collection networks of Rachaiya	15**

(*) Partial funds are available.

(**) Additional funds are required

4.5 Development Vision

Introduction

The Water Sector Strategy adopted by the Ministry of Energy and Water in 2010 aims at providing access to adequate water resources to improve the social and economic wellbeing of the population. This requires focusing on the implementation of the wastewater development program, including adequate operation of the already constructed coastal and inland treatment plants, and providing adequate wastewater systems to all communities where raw wastewater is being discharged into water streams or ground water and primarily where the current disposal systems have a high risk of potential outbreaks of waterborne diseases.

The main investment projects needed in the wastewater sector can be grouped into six categories as below:

1. Completion of on-going wastewater projects;
2. Protection of planned dams;
3. Protection of major surface and groundwater resources;
4. Upgrade of the coastal treatment plants for secondary treatment and Expansion of existing wastewater treatment plants to meet future demand (2040);
5. Upgrade of the collection networks in Beirut and its neighbourhoods.
6. Completion of small scale works (municipal levels).

Development Criteria

The criteria adopted for the selection and prioritization of the wastewater sector projects are as follows:

- Recover the health, environmental, social and economic wellbeing.
- Enhance the benefit from the CAPEX already invested in the construction of the treatment plants and collection networks.
- Optimize the investment per capita and consider areas with high numbers of Syrian displaced.
- Mitigate and prevent pollution of surface water resources mobilized to meet water shortages. The Bisri-Beirut water conveyor system is based on mobilizing the Litani River / Qaraoun lake water resources to supply Greater Beirut and the dams currently under construction or scheduled for construction in the near future are Qaysamani, Janneh, Mseilha, Balaa, Boqaata, Bared, Kfar sir, Assi, Damour and Bisri dams / lakes.

4.6 Lebanon Crisis Response Plan

Funding required under the Lebanon Crisis Response Plan (LCRP) covers emergency wastewater management at the national scale including provision of septic or holding tanks, collection networks, desludging as well as small scale wastewater treatment plants. The budget for this plan is estimated at US$ 280 million per year over 2 years for the water and wastewater sector.

4.7 Capital Investment Programme

The proposed Development Programme includes the following projects grouped into six categories according to the sector development vision. The projects were evaluated according to the Development Criteria listed above and accordingly prioritized into three implementation cycles as per the below Table 4-6 and Table 4-7, and illustrated in the map shown on the below Figure 4-1 and Figure 4-2. Other projects are needed for Lebanon but they are considered for future implementation and therefore not presented here.

- **Completion of On-Going Wastewater Projects:**

It consists of completing networks to cover the service area of existing or under construction plants, including as priorities the following:

- Wastewater networks within the drainage area of El Aabde wastewater treatment plant within Akkar district in North Lebanon.
- Wastewater networks and main collectors within the drainage area of Tripoli wastewater treatment plant in Dannieh, Zgharta, Koura and Tripoli districts in North Lebanon.
- Wastewater network and main collector of Madfoun system within the drainage area of Batroun wastewater treatment plant in Batroun district in North Lebanon.
- Wastewater networks within the drainage area of Jbeil wastewater treatment plant within Jbeil district in Mount Lebanon.
- Halat and Nahr Ibrahim wastewater networks (Jbeil district) to be connected to either the existing wastewater treatment plant in Jbeil or the planned one in Adma (Kesrouane district) in Mount Lebanon.
- Additional funds for the already initiated wastewater systems of Mechmech (Akkar district – North Lebanon) and Hrajel (Kesrouane district – Mount Lebanon).
- Completion of the wastewater networks in coastal Chouf within the Nabi Younes wastewater treatment plant (Chouf district) in Mount Lebanon.
- Completion of Saida networks and Jbaa wastewater system within the drainage area of Saida wastewater treatment plant (Saida district) in South Lebanon.
- Completion of Sour networks system (Sour III) within the drainage area of Sour treatment plant and also considered part of the protection plan for Litani river against pollution (Programming Law 63 for Litani).
- Completion of Nabatiye wastewater networks (Nabatiye II or East Nabatiye project) within the drainage area of Nabatiye treatment plant and also considered part of the protection plan for Litani River against pollution (Programming Law 63 for Litani).
- Additional funds for Bint Jbeil wastewater system to complete the project.
- Additional funds for Hasbaiya wastewater system project aiming also at the protection of Hasbani River.
- Additional funds for Hermel system (Hermel district) in Baalbek – Hermel also located within the basin of the planned Assi dam.
- Completion of Baalbek networks within the drainage area of Iaat (Baalbek) wastewater treatment plant.

- **Protection of Dam Basins and Related Natural Watercourses:**

The following systems are proposed to avoid the discharge of wastewater effluents into the watercourses of selected dams:

- Ajed Ebrine (Koura district), Kfarhai and Chebtine systems (Batroun district) in North Lebanon within the basin of Mseilha dam.
- Qartaba, Aaqoura, Laqlouq and Afqa wastewater system in Mount Lebanon within the basin of Janneh dam (Jbeil district).
- Bakhoun and other small systems (Minieh and Dannieh district) and Qabaait (Akkar district) in North Lebanon within the basin of Bared dam.
- Kfartai system upstream of the Boqaata dam;
- Ouadi Slouqi and Deir Mimas wastewater systems (Marjaayoun district); Halloussieh and Srifa wastewater systems (Sour district) in Nabatiye – South Lebanon within the basin Kfar Sir dam, as well as for the protection of Qasmiye river (Litani basin) used for irrigation of coastal lands (Programming Law 63 for Litani).
- Bajjaje system, Qaa and Jdeide wastewater systems (Baalbek district) in Baalbek – Hermel within the basin of Assi dams.
- Aley Zone 7 (Gharb and Chahhar), Aley Zone 8 (Jurd Region) and Aley Zone 9 (Fouara / Wadi Es Sit) projects (Aley and Chouf districts) within the basin of Damour dam.

- **Protection of Major Surface and Groundwater Resources:**

For the purpose of protecting surface and groundwater resources from wastewater pollution, the following systems are proposed:

- 25 localized systems in Akkar rural areas to protect the groundwater ressources and El Qatlabe lake in Akkar.
- Qobaiyat and surrounding villages, and Akkar El Aatiqa wastewater systems (Akkar districit) in North Lebanon to protect the groundwater resources as well as the surface water used downstream for the irrigation of Akkar plain.
- Aachkout wastewater system and additional funds for Jeita system for the protection of Jeita groundwater ressources.
- Sfaileh and Qortada wastewater systems in Mount Lebanon (Metn district) to avoid the pollution of Ain el Delbe water sources of Beirut.
- Bmaryam and Btibyat systems in Mount Lebanon (Baabda district) for the protection of natural streams.
- Aley Zone 7 (Gharb and Chahhar), Aley Zone 8 (Jurd Region) and Aley Zone 9 (Fouara / Wadi Es Sit) projects (Aley and Chouf districts).
- Nabaa el Tasseh wastewater system (Nabatiye / Jezzine districts) for the protection of Nabaa el Tasseh which is a major water spring supplying water to Saida, also included in the protection plan for Litani river against pollution (Programming law 63 of Litani).
- Braiqea wastewater system in Nabatiye considered part of the protection plan for Litani river against pollution (Programming law 63 of Litani).
- Zilaya (also known as Sohmor and Yohmor and surrounding villages) wastewater systems, Timnine II wastewater system (Baalbek district) and Eastern Zahle wastewater system (Zahle district) in Bekaa plain. Those systems will protect the Litani and Qaraoun lake from pollution (Programming law 63 of Litani).
- Rachaiya wastewater system in Bekaa to avoid the pollution of water ressources and eventually the planned dams and lakes in the region.

- **Upgrade of Wastewater Treatment Plants:**
  - The Chekka, Batroun, Jbeil, Nabi Younes, Nabatiye and Iaat (Baalbek) treatment plants require studies and expansion to cover the current and projected population demands.
  - Upgrade of Daoura (Burj Hammoud), El Ghadir and Saida treatment plants from preliminary treatment to secondary treatment.

- **Upgrade of Beirut and Neighborhoods Collection Networks:**
  - The old collection networks of the Beirut city and its neighbourhoods need to be replaced and upgraded to separate rainwater from sewage.
  - Upgrading of wastewater networks within El Ghadir wastewater treatment plant service area and protection of communities on Ghadir banks from overflow of stormwater and wastewater (Baabda – Aley districts) in Mount Lebanon.
  - Flood protection system within El Ghadir basin.

- **Small localized projects to complete and rehabilitate existing systems:**
  - Budget will be allocated to Water Establishments for the implementation of wastewater projects including rehabilitation of existing systems, small connections, etc.

Table 4-6 and Table 4-7 list the proposed projects, their description, the estimated investment cost, their readiness for construction and their priorities.

4.8 Municipalities and Governorates Requirements

The consultation conducted by the Prime Minister Technical Committee with all Mohafazats between February and May 2017, development projects proposed by municipalities and villages were collected.

It is to be noted that:

- The requests were not homogeneous. Some districts (cazas) were very brief list a general statement of the requirement, while others were detailed.
- The number of requests per district is not representative of the extent of the requirement. In some cases, each village mentioned the requirement for a wastewater system, while in other cases the demands were submitted for a group of villages consisting a Union.
- The demands do not describe the geographic extent of the projects and only some requests included a cost estimate of the proposed projects.

The demands can be grouped into the following categories:

- Completion of wastewater systems, either by additional networks or a local wastewater treatment plant.
- New wastewater systems.
- Rehabilitation of existing systems (mainly in Beirut - Mount Lebanon).

Most of the demands of completion of systems and new wastewater systems are addressed by the CIP proposed projects. Other fall within ongoing or under preparation projects. Finally, the third category are related to local demands (e.g. extension of networks along short distances). The local demands as well as small scale rehabilitation projects are categorized as short to medium term projects. They could be tackled by the proposed CIP project WW78 (Localized projects to complete or rehabilitate existing systems).

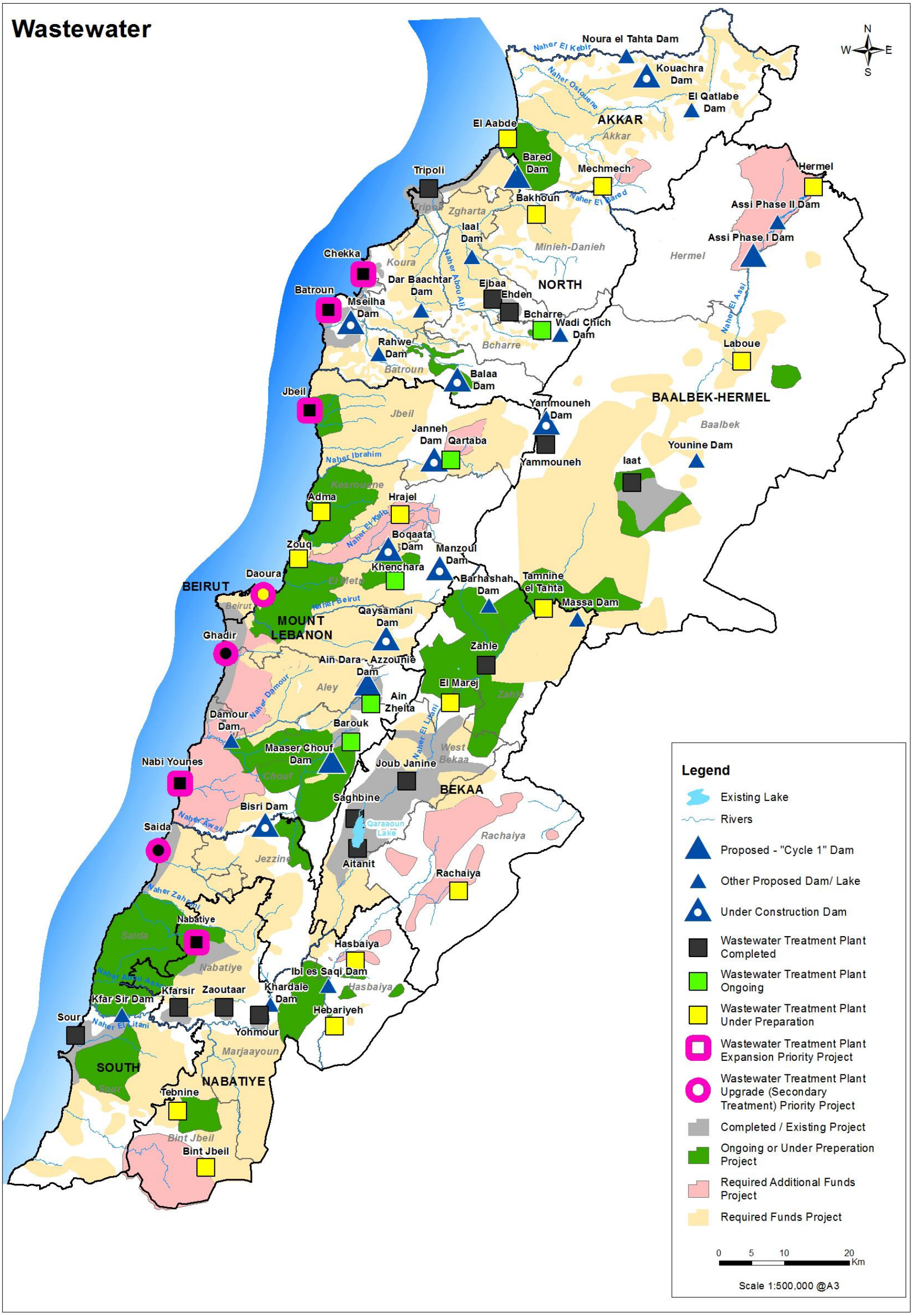

Figure 4-1: Wastewater Projects Status

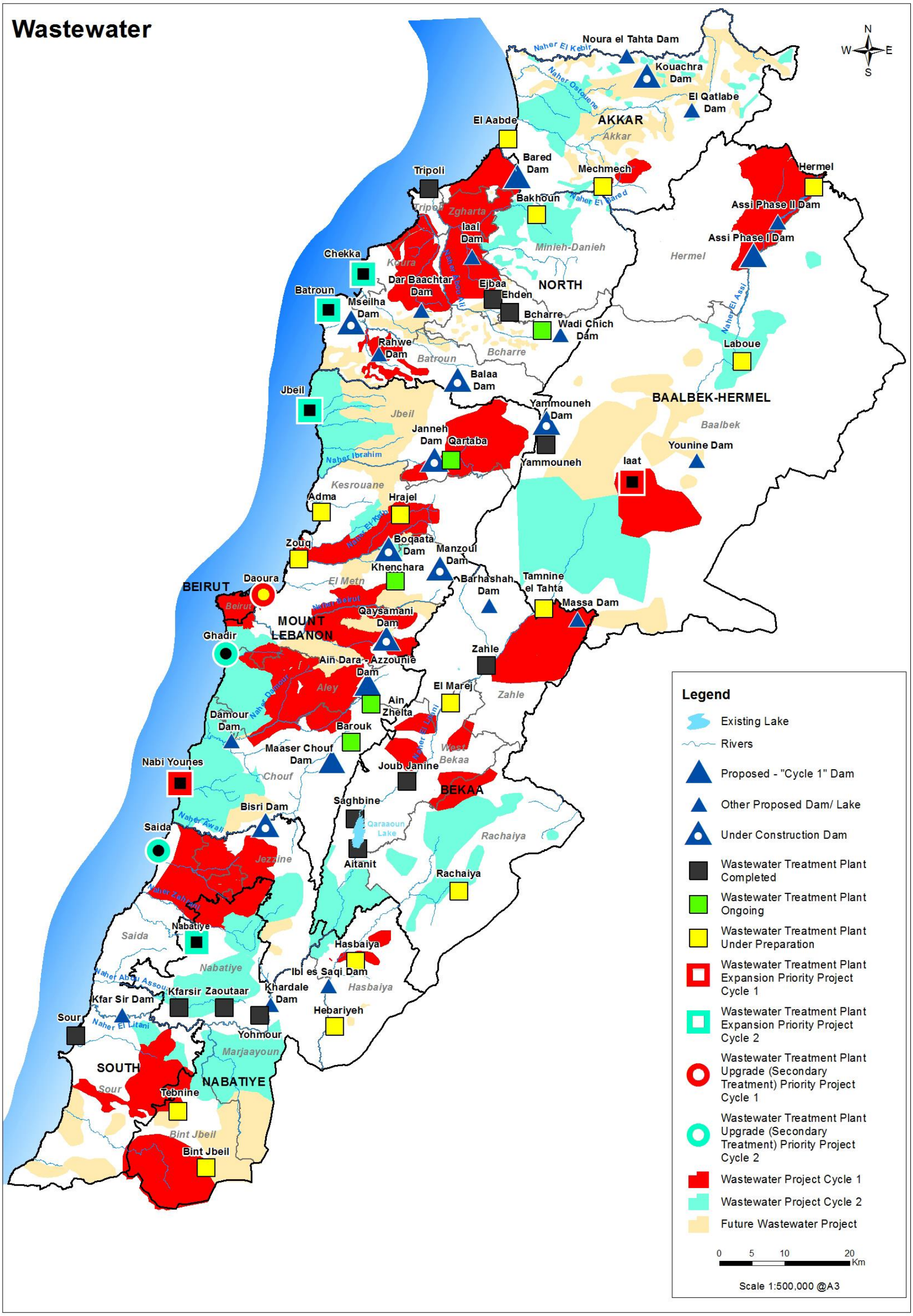

Figure 4-2: Wastewater Priority Projects

Table 4-6: Wastewater Capital Investment Projects - Cycles 1 and 2

Ref	Project	Region	Description	Estimated Cost (MUSD)		Status		Impact		Generated Employment	Priority Score	Implementation Cycle
				Investment	Land Expropriation					Million Labour-Days		
A	**Protection of Mediterranean Sea**											
WW01	**Completion of missing networks and collectors within Tripoli WWTP Service Area**	**North Lebanon**										
WW01a	1-km Link of the main collector Bohsas - Maarad	North Lebanon (Tripoli)	Wastewater networks	5		Detailed Design of the Tripoli networks completed and ready for tendering.	2	Capitalising on existing Tripoli WWTP.	3	0.1	5	1
WW01b	Qalamoun villages WW networks	North Lebanon (Tripoli)	Wastewater networks	5		Detailed Design of the Tripoli networks completed and ready for tendering.	2	Capitalising on existing Tripoli WWTP.	3	0.1	5	1
WW01c	Wastewater networks in the coastal and central villages and towns of Koura - Phase II	North Lebanon (Koura)	Wastewater networks	20	3	Master plan done. Main collector constructed. Detailed design is required.	2	Capitalising on existing Tripoli WWTP, protection of groundwater resources.	3	0.5	5	1
WW01d	Zgharta Wastewater networks	North Lebanon (Zgharta)	Wastewater networks	30		Master plan done. Detailed design is required.	1	Capitalising on existing Tripoli WWTP, protection of groundwater resources, protection of Iaal Dam.	3	1	4	1
WW01e	Wastewater networks for coastal part of Minie - Danniye District	North Lebanon (Minie -Danniye)	Wastewater networks	19		Master plan done. Detailed design is required.	1	Capitalising on existing Tripoli WWTP, protection of groundwater resources.	3	0.4	5	1
WW01f	Wastewater networks for villages in the center of Danniye	North Lebanon (Minie -Danniye)	Wastewater networks	20		Master plan done. Detailed design is required. Feasibility depends on the Zgharta system construction.	1	Capitalising on existing Tripoli WWTP, protection of groundwater resources.	3	0.4	4	2
WW02	Bakhoun WWTP and networks	North Lebanon (Minie - Danniye)	Wastewater treatment plant and networks	25		Master Plan.	1	Protection of Bared Dam water resources, protection of groundwater resources.	3	0.5	4	2
WW03	Qabaait system and Remaining small systems in Minie - Danniye	Akkar (Akkar) and North Lebanon (Minie - Danniye)	Wastewater treatment plants and networks	62		Master plan done. Detailed design is required.	1	Protection of Bared Dam water resources, protection of groundwater resources.	3	1.25	4	2

Ref	Project	Region	Description	Estimated Cost (MUSD)		Status		Impact		Generated Employment	Priority Score	Implementation Cycle
				Investment	Land Expropriation					Million Labour-Days		
WW04	Completion of wastewater networks within El Aabde WWTP Service Area	Akkar (Akkar)	Wastewater networks	60	1	Construction of the WWTP & Phase 1 networks will be launched soon. Detailed design and tender documents are required for phases 2 and 3.	1	Capitalising on under preparation El Abde WWTP in Akkar, protection of groundwater resources, and mitigation of seawater pollution.	3	1	4	2
WW06	Construction of small scale Wastewater Systems in Akkar	Akkar (Akkar)	25 Wastewater treatment plants and networks	25	5	Feasibility completed. Detailed design and tender documents are required.	1	Protection of groundwater resources.	3	0.5	4	2
WW07	Completion of wastewater networks within Jbeil WWTP Service Area	Mount Lebanon (Jbeil)	Wastewater networks	40		Feasibility completed. Detailed design and tender documents are required.	1	Capitalising on existing WWTP in Jbeil and tourist coastal development and protection of archeological and historic sites.	3	0.8	4	2
WW08	Networks for Halat and Nahr Ibrahim	Mount Lebanon (Jbeil)	Wastewater networks	9.1		Feasibility is completed. Detailed design is required.	2	Capitalising on Jbeil or Kesrouane WWTPs.	2	0.2	4	2
WW09	Upgrade of Daoura wastewater treatment plant	Mount Lebanon (Metn)	Upgrade of the treatment plant	300		Study required to update the current design from preliminary to secondary as per Barcelona convention.	1	Capitalising on the project under preparation for Daoura WWTP	3	7	4	1
WW10	Beirut wastewater systems	Beirut	Collection networks	50		Feasibility is completed. Survey and detailed design is required.	2	Improve hygienic conditions and operating efficiency of wastewater treatment plants.	3	1	5	1
WW11	Ghadir Flood Protection	Mount Lebanon (Baabda Aley)	Small dams and river banks protection.	30		Ready for tendering.	3	Protection against the flood of major highways, protection of population	3	0.6	6	1
WW12	Upgrade of Ghadir wastewater treatment plant	Mount Lebanon (Aley)	Upgrade of the treatment plant	200		Treatment plant upgrade to preliminary ongoing. Study required to update the current design from preliminary to secondary as per Barcelona convention.	0	Capitalising on the ongoing project for Ghadir WWTP	3	5	3	2
WW13	Extension and upgrading of collection networks within Ghadir wastewater treatment plant drainage basin (Partial funds)	Mount Lebanon (Beirut, Aley, Baabda & Chouf)	Collection networks	25		Feasibility is available. Detailed Design and Tender Documents are required.	1	Capitalising on existing Ghadir WWTP, protection of groundwater resources	3	0.5	4	2
WW14	Expansion of sewer networks for coastal Chouf	Mount Lebanon (Chouf)	Collection networks	40		Master plan done. Partial studies.	1	Capitalising on existing Nabi Younes WWTP.	3	0.8	4	2

Ref	Project	Region	Description	Estimated Cost (MUSD)		Status		Impact		Generated Employment	Priority Score	Implementation Cycle
				Investment	Land Expropriation					Million Labour-Days		
WW15	Upgrade of Saida wastewater treatment plant	South Lebanon (Saida)	Upgrade of the treatment plant	55		Master Plan done.	1	Upgrade of Saida WWTP from preliminary to secondary as per Barcelona convention.	3	1	4	2
WW16	Completion of wastewater networks in Saida	South Lebanon (Saida)	Collection networks	25		Ready for tendering.	2	Protection of groundwater resources, springs, surface water used for irrigation.	3	0.5	5	1
WW17	Sour Phase III	South Lebanon (Sour)	Collection networks	50		Master Plan done. Studies under preparation.	2	Capitalising on existing Sour WWTP, protection of groundwater resources, springs, surface water used for irrigation.	3	1	5	1
WW18	**Expansion of existing WWTP**	**Lebanon**										
WW18a	Chekka WWTP Expansion	North Lebanon (Batroun)	Expansion of existing wastewater treatment	20		Studies are required.	0	Capitalising on existing WWTP Chekka and tourist coastal developments.	3	0.4	3	2
WW18b	Batroun WWTP Expansion	North Lebanon (Batroun)	Expansion of existing wastewater treatment	20		Studies are required.	0	Capitalising on existing WWTP Batroun and tourist coastal developments.	3	0.4	3	2
WW18c	Jbeil WWTP Extension	Mount Lebanon (Jbeil)	Expansion of existing wastewater treatment	20		Studies are required.	0	Capitalising on existing Jbeil WWTP and tourist coastal developments.	3	0.4	3	2
WW18d	Nabi Younes - WWTP Expansion	Mount Lebanon (Chouf)	Expansion of existing wastewater treatment	20		Studies are required.	0	Capitalising on Nabi Younes existing WWTP and tourist coastal developments.	3	0.4	3	1
B	**Protection of Water Resources**											
WW19	Additional Funds for Meshmesh (Fnaydeq) Wastewater System	Akkar (Akkar)	Wastewater treatment plant and networks	8	1	Tender documents available. Contract agreement is pending additional funds required.	3	Protection of groundwater sources and protection of Bared dam.	3	0.25	6	1
WW20	**Wastewater systems upstream of the underconstruction Mseilha dam basin**	**North Lebanon**										
WW20b	Kfar Hay system	North Lebanon (Batroun)	Wastewater treatment plant and networks	25	In progress	Tender documents ready for tender	3	Protection of Mseilha Dam water resources.	2	0.5	5	1

Ref	Project	Region	Description	Estimated Cost (MUSD)		Status		Impact		Generated Employment	Priority Score	Implementation Cycle
				Investment	Land Expropriation					Million Labour-Days		
WW20c	Chebtine system	North Lebanon (Batroun)	Wastewater treatment plant and networks	15	In progress	Tender documents ready for tender	3	Protection of Mseilha Dam water resources.	2	0.3	5	1
WW22	Qartaba, Aqoura and Afqa wastewater systems	Mount Lebanon (Jbeil)	Wastewater treatment plants and networks	20	5	Qartaba network phase 1 under construction. Additional funds required for part 2. Design of Aqoura and Afqa systems will be completed in the coming months.	1	Protection of Janneh Dam water resources.	3	0.4	4	1
WW31	Additional Funds for Hrajel Wastewater System	Mount Lebanon (Kesrouane)	Wastewater treatment plant and networks	20	2	Tender documents available. Contract agreement is pending additional funds required.	3	Protection of surface groundwater sources to (Jeita), capaitalising on a major tourist area and winter sports.	2	0.4	5	1
WW32	Aachqout system	Mount Lebanon (Kesrouane)	Wastewater treatment plant and networks	20.5		Master plan done.	1	Protection of surface groundwater sources from pollution (Jeita) and capaitalising on a major tourist area and winter sports.	3	0.4	4	2
WW34	Additional funds for Jeita system	Mount Lebanon (Kesrouane)	Wastewater treatment plant and networks	15		Additional funds are required. Design under preparation	2	Providing dirinking water to Beirut. Protection of groundwater sources and capaitalising on a major tourist area and winter sports.	3	0.3	5	1
WW35	Kfartai Wastewater System	Mount Lebanon (Metn / Kesrouane)	Wastewater treatment plant and networks	6.5		Master Plan.	1	Protection of Boqaata dam.	2	0.15	3	2
WW40	Sfaieh and Qortada (Zandouqa) Wastewater Systems	Mount Lebanon (Metn & Baabda)	2 Wastewater treatment plants and networks	67.63	6.6	Ready for tendering.	2	Protection of surface and groundwater sources from pollution.	2	1.5	4	1
WW41	Bmaryam - Btibyat and Hammana Wastewater Systems	Mount Lebanon (Baabda)	Wastewater treatment plants and networks	28.11	4.85	Design done.	2	Protection of local wells.	3	0.7	5	1
WW47	Aley Zone 7 (Gharb and Chahhar)	Mount Lebanon (Aley - Chouf)	Treatment plants and collection networks	66	3.2	ESIA	1	Protection of water ressources	3	1.5	4	1
WW48	Aley Zone 8 (Jurd Region) and Zone 9 (Fouara /Ouadi Es Sitt) Systems	Mount Lebanon (Aley - Chouf)	Treatment plants and collection networks	83	3.5	Feasibility Study	1	Protection of water ressources	2	1.5	3	1

Ref	Project	Region	Description	Estimated Cost (MUSD)		Status		Impact		Generated Employment	Priority Score	Implementation Cycle
				Investment	Land Expropriation					Million Labour-Days		
WW58	Halloussieh Wastewater System	South Lebanon (Sour)	Networks	6	1.5	Master plan. Studies are required.	1	Capitalising on planned Sarafand WWTP, protection of Kfar Sir dam and Qasmiye river used for irrigation of coastal lands.	3	0.1	4	2
WW59	Srifa Wastewater System	South Lebanon (Sour)	Networks	8		Master plan. Studies are required.	1	Capitalising on existing Sour WWTP, protection of Kfar Sir dam and Qasmiye river used for irrigation of coastal lands.	3	0.15	4	2
WW60	Nabaa el Tasseh Wastewater System	Nabatiye - South Lebanon (Jezzine) and Nabatiye)	Treatment plant and networks	18		Preliminary studies.	1	Portection of Jarjou Lake and a major water spring (Nabaa Et Tasse) supplying water for Saida and Nabatiye.	3	0.35	4	2
WW61	Jbaa Wastewater System	Nabatiye (Nabatiye)	Collection networks	7.5		Ready for tendering.	2	Capitalising on existing Saida WWTP, protection of groundwater resources, springs, surface water used for irrigation.	2	0.15	4	1
WW62	Braiqaa Wastewater System	Nabatiye (Nabatiye)	Treatment plant and networks	26		Master plan.	1	Protection of groundwater resources, surface water.	3	0.6	4	2
WW63	Nabatiye Part II (East Nabatiye) Wastewater System	Nabatiye (Nabatiye)	Networks	50		Master plan. Design under preparation.	2	Capitalising on Nabatiye WWTP and protection of groundwater and surface water.	3	1	5	2
WW64	Expansion of Nabatiye Wastewater Treatment Plant	Nabatiye (Nabatiye)	Expansion of treatment plant	20		No studies	0	Capitalising on existing Nabatiye WWTP.	3	0.4	3	2
WW65	Additional funds for Hasbaiya System	Nabatiye (Hasbaiya)	Treatment plant and networks	27.67	0.48	Project under preparation requiring additional funds.	3	Protection of Hasbani River	2	0.4	5	1
WW66	Ouadi Slouqi Wastewater System	Nabatiye (Marjaayoun)	Treatment plant and networks	33		Detailed design partially done.	2	Protection of Litani, Kfar Sir dam and Qasmiye river used for irrigation of coastal lands	1	0.7	3	2

Ref	Project	Region	Description	Estimated Cost (MUSD)		Status		Impact		Generated Employment	Priority Score	Implementation Cycle
				Investment	Land Expropriation					Million Labour-Days		
WW67	Deir Mimas Wastewater System	Nabatiye (Marjaayoun)	Treatment plant and networks	5.5		Detailed design partially done.	2	Protection of Kfar Sir dam and Qasmiye river used for irrigation of coastal lands	1	0.1	3	2
WW68	Bint Jbeil Wastewater System	Nabatiye (Bint Jbeil)	Treatment plant and networks	32		Studies done. Partial funding is required to complete the project	3	Protection of groundwater. Financial gaps.	1	0.6	4	1
WW69	Additional funds for Hermel WWTP and Networks	Baalbek-Hermel (Hermel)	Treatment plant and networks	27		Studies done. Partial funding is required to complete the project	3	Capitalising on Hermel WWTP and protection of Assi Dam.	3	0.6	6	1
WW70	Bajjaje Wastewater System	Baalbek-Hermel (Baalbek)	Treatment plant and networks	39.5		Master plan.	1	Protection of Assi Dam.	2	0.8	3	2
WW71	Qaa and Jdaide Wastewater System	Baalbek-Hermel (Baalbek)	Treatment plants and networks	25.7		Master plan.	1	Protection of Assi Dam.	2	0.5	3	2
WW72	Upgrade of Iaat (Baalbek) WWTP and additional networks for Baalbek city and surrounding villages	Baalbek-Hermel (Baalbek)	Upgrade of a treatment plant and networks	11		Studies required.	0	Capitalising on existing Baalbek WWTP and protection of groundwater resources.	3	0.2	3	1
WW73	Timnine Part II Wastewater System	Baalbek & Hermel (Baalbek)	Networks	66	5	Phase 1 (including WWTP) under tender stage.	1	Capitalising on Timnine WWTP and protection of surface water resources (Litani).	3	1.2	4	2
WW74	Eastern Zahle Wastewater System	Bekaa (Zahle)	Wastewater treatment plant and networks	45	5	Feasibility completed.	1	Protection of water sources (Litani) from pollution, protection of groundwater ressources.	3	0.9	4	1
WW75	Wastewater Systems for Sohmor, Yohmor, Zilaya, Es Srayri and surrounding villages	Bekaa (West Bekaa) / Nabatiye (Hasbaiya) / South (Jezzine)	3 Wastewater treatment plants and networks	17.61	0.13	Master Plan. Feasibility.	1	Protection of Litani river and Bisri and Khardale dams.	2	0.35	3	2
WW76	Expansion of wastewater collection networks of West Bekaa (Phase 2)	Bekaa (West Bekaa)	Networks	27		Master Plan. Studies are done.	2	Protection of Litani river.	2	0.6	4	1

Ref	Project	Region	Description	Estimated Cost (MUSD)		Status		Impact		Generated Employment	Priority Score	Implementation Cycle
				Investment	Land Expropriation					Million Labour-Days		
WW77	Wastewater System for Rachaiya villages	Bekaa (Rachaiya)	Wastewater treatment plant and networks	64	0.63	Master Plan. Additional funds are required.	2	Protection of Ibl Es Saqi Dam and Salaa Lake, presence of displaced.	2	1.5	4	2
C	**Small Scale Muncipal Projects to Be Handled by Water Establishments**											
WW78	Small Scale Muncipal Projects	Lebanon	All	250		Mechanism of studies, documents and implementation to be defined	All					1
			Total Cycle 1	**1,329**	**35**							
			Total Cycle 2	**1,027**	**13**							
			Total Wastewater Cysles 1 and 2	**2,404**								

(*) Impacts include improving hygienic conditions and social wellbeing for all projects, not repeated below.

Table 4-7: Wastewater Future Capital Investment Projects - Cycle 3

Ref	Project	Region	Description	Estimated Cost (MUSD)		Status		Impact*		Generated Employment	Priority Score	Implementation Cycle
				Investment	Land Expropriation					Million Labour-Days		
A	**Protection of Mediterranean Sea**											
WW79	Madfoun System	North Lebanon (Batroun)	Main collector and networks	20		Master Plan.	1	Capitalize on Batroun WWTP once extended. Protection of sea and groundwater resources	2	0.5	3	3
WW05	Construction of wastewater systems for Akkar El Atika, Qobaiyat and surrounding villages	Akkar (Akkar)	Wastewater treatment plants and networks	25		Master plan done. Detailed design is required.	1	Protection of surface water used for irrigation in Akkar plain and protection of groundwater resources	2	0.5	3	3
B	**Protection of Water Resources**											
WW20	**Wastewater systems upstream of the underconstruction Mseilha dam basin**	**North Lebanon**										
WW20a	Ajed Ebrine system	North Lebanon (Koura)	Wastewater treatment plants and networks	4.5		Master plan done. Detailed design is required.	1	Protection of groundwater resources, protection of Mseilha Dam.	2	0.1	3	3
WW21	Small systems to protect Qadisha Valley	North Lebanon (Bcharre)	Treatment plants and networks.	50.25		Master plan. Feasibility still not ready.	1	Protection of Qadisha valley and groundwater resources.	2	1	3	3
WW23	Bchille system	Mount Lebanon (Jbeil)	Wastewater treatment plant and networks	5		Master Plan.	1	Protection of groundwater resources	1	0.1	2	3
WW24	Aabaydat system	Mount Lebanon (Jbeil)	Wastewater treatment plant and networks	11		Master Plan.	1	Protection of groundwater resources	1	0.2	2	3
WW25	Tartij Small Local Station	Mount Lebanon (Jbeil)	Wastewater treatment plant and networks	1.5		Master Plan.	1	Protection of groundwater resources	1	0.03	2	3
WW26	Aalmat system	Mount Lebanon (Jbeil)	Wastewater treatment plant and networks	12		Master Plan.	1	Protection of groundwater resources	1	0.25	2	3

Ref	Project	Region	Description	Estimated Cost (MUSD)		Status		Impact*		Generated Employment	Priority Score	Implementation Cycle
				Investment	Land Expropriation					Million Labour-Days		
WW27	Jaj WWTP	Mount Lebanon (Jbeil)	Wastewater treatment plant and networks	6.6		Master Plan.	1	Protection of groundwater resources	1	0.15	2	3
WW28	Lehfed Haqel Small Stations	Mount Lebanon (Jbeil)	Wastewater treatment plant and networks	2.2		Master Plan.	1	Protection of groundwater resources	1	0.05	2	3
WW29	Behdaydat WWTP	Mount Lebanon (Jbeil)	Wastewater treatment plant and networks	3.5		Master Plan.	1	Protection of groundwater resources	1	0.07	2	3
WW30	Yahchouch WWTP	Mount Lebanon (Kesserouan/ Jbeil)	Wastewater treatment plant and networks	8.3		Master Plan.	1	Protection of groundwater resources	1	0.15	2	3
WW33	Bqaatouta WWTP	Mount Lebanon (Kesserouan)	Wastewater treatment plant and networks	0.8		Master plan.	1	Protection of groundwater resources	1	0.02	2	3
WW36	Abou Mizane WWTP	Mount Lebanon (Metn)	Wastewater treatment plant and networks	3.25		Master Plan.	1	Protection of groundwater resources.	1	0.06	2	3
WW37	Zabbougha WWTP	Mount Lebanon (Metn)	Wastewater treatment plant and networks	0.8		Master Plan.	1	Protection of groundwater resources	1	0.02	2	3
WW38	Es Souane WWTP	Mount Lebanon (Metn)	Wastewater treatment plant and networks	20.7		Master Plan.	1	Protection of groundwater resources	1	0.4	2	3
WW39	Mtein WWTP	Mount Lebanon (Metn)	Wastewater treatment plant and networks	6.3		Master Plan.	1	Protection of groundwater resources	1	0.15	2	3
WW42	Hlaliye and Shwite Wastewater System	Mount Lebanon (Baabda Aley)	Wastewater treatment plant and networks	44.9	3.15	Feasibility Study.	1	Protection of groundwater resources	1	0.9	2	3
WW43	Mchikha Wastewater System	Mount Lebanon (Baabda Aley)	Wastewater treatment plant and networks	12.75	1.95	Feasibility Study.	1	Protection of groundwater resources	1	0.2	2	3

Ref	Project	Region	Description	Estimated Cost (MUSD)		Status		Impact*		Generated Employment	Priority Score	Implementation Cycle
				Investment	Land Expropriation					Million Labour-Days		
WW44	Deir Khouna (Qtale) Wastewater System	Mount Lebanon (Baabda Aley)	Wastewater treatment plant and networks	12.59	2.5	Feasibility Study.	1	Protection of groundwater resources	1	0.2	2	3
WW45	Arsoun Wastewater System	Mount Lebanon (Baabda Aley)	Wastewater treatment plant and networks	8.56	1.3	Feasibility Study.	1	Protection of groundwater resources.	1	0.1	2	3
WW53	WWTP1 Wastewater System	Mount Lebanon (Chouf)	Wastewater treatment plant and networks	0.2		Master Plan.	1	Protection of groundwater resources	1	0.01	2	3
WW54	WWTP2 Wastewater System	Mount Lebanon (Chouf)	Wastewater treatment plant and networks	8		Master Plan.	1	Protection of groundwater resources	1	0.15	2	3
WW57	Kfar Matta Small Local Station Wastewater System	Mount Lebanon (Chouf)	Wastewater treatment plant and networks	0.5		Master Plan.	1	Protection of groundwater resources	1	0.01	2	3
			Total Wastewater Cycle 3	**269.2**	**8.9**							
				278.1								

(*) Impacts include improving hygienic conditions and social wellbeing for all projects.

4.9 Institutional Considerations

The wastewater services are so far inadequate in Lebanon because of the insufficient public expenditure and several institutional limitations at the level of sector management and the cost recovery detailed below.

- **Sector Management**

The 1982 Wastewater Master Plan (updated later in 1994) defined centralized treatment plants serving relatively large drainage basins. The Government has been involved in the construction of the plants, the main collectors and secondary lines, lift stations, expropriation, etc. The tertiary networks and house connections construction responsibility was left to Municipalities and Water Establishments, which had neither the experience nor the funds for the required local wastewater systems. The cooperation institutional mechanism that defines the contribution of all stakeholders was and is still missing.

Until 2000 there were 21 water authorities in Lebanon who were financially and technically weak. The limited sewer networks were managed by the respective municipalities, which had often even less technical and financial capacity than the water authorities. In the absence of a sanitation tariff, municipalities lacked the financial resources to operate and maintain sanitation infrastructure. The Water Law 221/2000 reorganized the water sector into four Regional Water Establishments. The law was amended after it was passed and Law 337/2001 included wastewater treatment in the responsibilities of the Regional Water Establishments and of the Ministry of Energy and Water.

The Regional Water Establishments are charged with the operation and maintenance of main sewer collectors/trunks, and wastewater treatment plants. The Municipalities, being the owners of the collection networks, are charged with operation and maintenance of the house connections and collection networks. The interface among the two administrations is not clearly defined and the mechanism of cooperation among all stakeholders is lacking.

Within the Lebanese government, the Ministry of Energy and Water is in charge of developing and implementing policies related to water supply and sanitation. As of 2010, there was no specific policy or strategy document outlining the government's policy in the sector. The 2010 National Strategy for the Wastewater Sector final document issued in 2012 presented the broad lines of strategic initiatives to improve the wastewater sector including institutional measures to define responsibilities and to create capacity for service delivery. The target was that Water Establishment would progressively take over responsibility for service delivery. WE capacity would be developed and the private sector would be used where appropriate. On a case by case basis, WEs may agree with municipalities that the municipalities operate facilities by delegation. The MoEW would build its capacity for sector oversight and support. The plan set for 2011-2015 to reach the target of the institutional strategic initiative could not be implemented. It is also noticed that the plan did not target the municipality capacity building since municipalities report to the Ministry of Interior.

- **Investment and Cost Recovery**

Investment for the construction of new sewerage systems (networks and/or sewage treatment plants) is mainly secured by the Government either from the Country's annual budget, or from external funds. Some projects are developed by donors and NGOs acting locally.

Investment costs are not recovered. Cost is not recovered for the operation and maintenance (O&M) of the sewerage system. The municipalities collect an indicative tax for wastewater and sidewalk, which is a percentage of the rent value of the house/apartment/commercial building. No other tax is collected for wastewater investment or operation and maintenance.

One of the 2010 National Strategy for the Wastewater Sector plan targeted financial measures for viability and affordable services. Full recovery of O&M costs will be introduced progressively to generate revenues and the conditions of financial viability: measures will be introduced progressively to recover from users the full costs of O&M of wastewater services. As volumetric billing for water supply is introduced, wastewater charges would be billed on a volumetric basis together with water charges. Municipalities will continue to handle operation until assets and O&M responsibilities are handed over,

after which WEs will collect the fees through water bills. Fees will be increased progressively to reach 100% cost recovery by 2020. During the transition period and until adequate levels of cost recovery can be achieved, it is proposed that the WEs and government agree on principles of subsidy to cover the WEs deficits on O&M of wastewater services.

The introduction of water meters is implemented in limited number of regions of Lebanon and the volumetric billing principle is still under testing. Wastewater charges is not collected. The Government is still subsiding the O&M charges.

Connection to the electricity network delayed in some cases the operation of new treatment plants (Chekka, Batroun, Zahle), where the National or the Local Company of Electricity refused to supply electricity to those plants for free since the WEs are not paying the electricity bill for the plants that they are not even managing. Such problems reflect the difficulties faced by the sector due to lack of institutional framework and proper cost recovery system.

- **Private Sector Participation**

The private sector is active in the wastewater sector activities: starting from planning, design, construction up to the O&M, whether the management of the wastewater sector is carried out by the municipalities, water establishments, or both.

The 2010 National Strategy for the Wastewater Sector plan targeted measures to optimize the private sector participation in the wastewater sector. The advantages of partnerships with the private sector would be explored and private enterprises would be increasingly involved through partnership approaches, including the financing and implementation of investments, and the conclusion of management contracts and possible BoT arrangements.

A study is required to analyze options of private sector participation, test models for private sector participation and strengthening WE capacity to prepare and oversee contracts.

5 ELECTRICITY

5.1 Introduction

The aim of this report is to shed the light on the current situation of the energy sector in Lebanon, its deficiencies and shortages and to highlight the vision of the Ministry of Energy and Water (MEW) in response to the economic and social needs and aspirations of Lebanon.

This chapter presents a summary of the objectives set for the power sector until the year 2030 based on the plans and the future forecasts as prepared by the MEW.

5.2 Background and Current Conditions

Lebanon has been suffering from shortage of power supply for the past 30 years. This deficiency is materialising into frequent short and long-term power interruptions in major cities and prolonged black outs in other areas. The shortage in power supply has worsened within the last five years due to the large influx of displaced Syrians. The increase in power consumption inflicted additional burdens on the electrical grid, which was already suffering from overloads. The Lebanese people are hence suffering from the expensive cost of electricity incurred by the uncontrolled private generators bills.

This persistent weakness in the quality of electricity supply has constrained the business and investment environment, as well as the performance of other infrastructure networks, such as the operation of water and wastewater treatment plants, water and wastewater pump stations, food storage and consequently hygienic conditions, industrial and economic performance, and social wellbeing and stability.

Generation

Insufficient generation caused the sector to enter a critical phase in terms of the production capacity, thus forcing a reconsideration of the priorities to prevent further deterioration in the first phase, bridging the deficit in the second, and anchoring the required stability at the end. The electrical energy produced and purchased in year 2016 as well as the demands can be summarized as follows in Table 5-1 below, as per the MEW.

Table 5-1: Power Made Available in 2016 and Projected for 2018

Year	Average Power Supplied - MW	Peak Power Demand - MW	Average Power Demand - MW
Year 2016	1,928	3,300	2,670
Year 2017	2,066	3,400	2,900
Anticipated Year 2018*	2,066	3,465	2,945

* It is assumed that 2018 will be similar to 2017.

According to the MEW, the peak power demand in 2016 was around 3,300 MW with an average demand of 2,670 MW. The average capacity and imports available in 2016 was 1,928 MW, resulting in a deficit in energy of 7,127 GWh, which is around 35.7 % of the energy demand. In 2017 the peak demand surpassed 3,400 MW, and the average demand has been 2,900 MW (with a 70% load factor which will result in the continuation of power rationing). The above factor can be related partially to the

increase in population and to the power demand increase due to the displaced Syrians presence in Lebanon.

Electricity in Lebanon is generated primarily from thermal power. The installed capacity of thermal power plants is 2082 MW but the actual capacity is at an average of 1,823 MW excluding the barges. The thermal capacity is divided into:

- Heavy fuel oil (HFO)-fired steam-turbines at Zouk[1], Jieh[1] and Hraycheh,
- Diesel-fired Combined Cycle Gas Turbine (CCGT) at Beddawi[2] and Zahrani[2],
- Diesel-fired Open Cycle Gas Turbine (OCGT) at Sour** and Baalbek**.

[1]: New extension in Zouk and Jiyeh with capacity 194MW, 78MW respectively which consist of reciprocating engines with steam turbines, that currently work on HFO but can switch to Gas when available in the future.

[2]: Beddawi, Zahrani,Sour, and Baalbek can function on NG when available in the future.

The power produced from the Litani, Nahr Ibrahim, and Bared hydro power plants constitutes 3% of the total energy production in the country. The installed capacity of the hydro power plant is 273 MW but the actual generation capacity is 119 MW. This however is seasonal and relies on water resources availability. The drought period Lebanon is passing through and the climate change may have a major impact on the hydropower generation capacity.

Additional Electric power from external sources is being supplied to the country through two links, one in Deir Nbouh in the north, the other in Anjar through an overhead line at 66kV. However, since the start of the war in Syria in 2011, the power drawn from Syria has dropped considerably to around 15% of what it used to be in 2011.

Furthermore, the average cost of production, transmission and distribution of electricity is higher than the average selling price per kilowatt-hour. Consequently, all financial losses attributed to the electricity of Lebanon are actually government support to the citizens. This results in an average loss paid by the Government of 1B$ to 1.5B$ on a yearly basis depending on oil prices.

Transmission

The current transmission system employs 66, 150, 220 and 400 kV (only Ksara S/S) voltage lines, 1.92 km of which is still missing in the Mansourieh area for the 220kV network. This missing link has been halted for the past years, and has stalled the completion of the 220 kV loop which, if completed would increase stability, and the transmission capability of the system. It is to be noted that the National Control and Dispatch Center for monitoring and controls of the major substations has not been finalized yet, awaiting some grid connection problems to be resolved in order to reach its full capacity. In addition, the Ministry of Energy and Water is planning to upgrade all substations to 220kV for main cities and load centers and 66 kV for regional areas.

Distribution

The network is further weakened and abused by illegal connections, which results in a further increase of losses. As the bills collected for power consumed do not cover for all the power delivered to the different consumers, illegal connections to the Grid result in unbilled wasted energy.

5.3 Impact of Syrian Crisis on the Power Sector

Since the onset of the Syrian crisis in 2011, Lebanon has been hosting displaced Syrian nationals of more than 1.5 million, which increased power shortages and rationing hours. The total power consumption by the displaced Syrians according to the MEW based on a report prepared by the UNDP in 2017 is around 447 MW. This resulted in a negative financial impact of around 313M$ on the Country.

The Lebanon Crisis Response Plan in 2016 by the MEW/UNDP shows that the yearly consumption of Syrian households amounts to 2,013 GWh/year. Knowing that the average production cost is currently 13.5 USc/kWh, and that fees are collected at a subsidized rate of 8.97 USc/kWh (equally to Lebanese and others). The cost of the additional 447 MW is estimated at $333 million in 2016, or around $1.33 billion until 2020. In addition, the study shows that at least 45 percent of the electrical connections of

Syrian households to the grid are illegal, which not only implies lost sales to the already exhausted Government and EDL, but also incurs technical losses on the grid and deprivation of other legally connected customers. These losses are borne by the Government who is already lacking means to cover its subsidies to the sector, and is therefore not in a position to afford additional expenses. This extra demand caused an additional reduction in power distribution by an average of approximately 5 hours of daily rationing.

The implications of the displaced Syrians on the Electricity sector as stated by UNDP report can be summarized as follows:

- Additional burden on the already deteriorated electricity network as a result of the Increased demand.
- Impact on quality of the supplied power due to the increased load in some areas where people are suffering from voltage drop and are forced to use their diesel generators even during supply hours.
- Indirect impact of the additional power consumption of the schools hosting displaced Syrian students caused by the additional four-hour shift the schools need to work.
- Additional power consumption of some municipalities/water establishments that are operating their water pumps for longer hours to cover the additional water demand as a result of the displaced Syrians.
- Damage of the distribution transformers and/or MV and LV cables due to overload.
- Increase of the non-technical losses and damage to the distribution network caused by the Non-Metered connections of a large portion of the Syrian shelters.
- The 486 MW caused by the direct and indirect additional power consumption has a major implication on EDL's grid that is already suffering from a shortage in generation capacities.

5.4 Existing Programs and Strategies

To set in motion an efficient and sustainable sector, the government took the initiative to restructure the sector by implementing reform programs that would work on the short/rescue, mid and long terms in parallel. In June 2010, the Lebanese Government ratified the Policy Paper for the power sector that gears at securing the financial balance and the sector stability therefrom.

There are several aspects that need institutional reform, which can be summarized by the corporatization of the sector. The ratified policy paper by the government to improve the power sector also addressed securing the financial balance of the sector. The multitude of the projects being planned for in the policy paper will require a proper legal framework for a transitional phase until a permanent and stable situation of the sector is established. Electricité Du Liban (EDL) is regarded by the policy paper to be the core entity of the sector. Its "revitalization" entails providing the financial, administrative and human resource flexibility needed to cope with the rapid and vital changes. Corporatization is viewed to be the ideal solution for reforming the sector.

The policy targets a gradual implementation of the initiatives in the short and medium terms. The increase in the generation capacity requires investments where the international donor community can contribute on the medium and long term. The short term projects are assumed financed by the Government.

Several projects have been completed by the MEW to compensate and upgrade the existing electrical network. A summary of the completed and ongoing projects up to year 2016 are listed below.

- Rehabilitation of Zouk power plant. The project is in bidding process, awaiting the Council of Ministers approval.
- Additional power from the rented power generation vessels that ensures around 370 MW of generated power in Zouk and Jieh.
- Bidding Contract of a combined cycle power plant in Deir Ammar designed for a triple fuel firing system considering heavy fuel oil (HFO) and Natural Gas (NG) as a primary fuel, and light fuel oil (LFO) as backup (capacity 538-569 MW). The contract was awarded but construction has not stated yet awaiting resolution of conflicts with the contractor.

- Completion of 260 MW reciprocating engines power plants in Zouk and Jieh. Zouk=194 MW, Jiye=78 MW. These have been completed and connected to the grid since March 2017.
- Rehabilitation and expansion of the 66 kV transmission in regional areas and the 15/20 kV distribution networks. The project is still pending awaiting funding.
- The rehabilitation and expansion project of Al-Ayoun and Fneidek transmission and distribution network in Akkar.
- Rehabilitation of Markaba Hydro plant Units 1 and 2, and purchasing of two step-up transformers.
- Completion of the 220 kV transmission lines, which will minimize the technical losses, and completion of the 220 kV loop at Mansourieh.
- Completion of the national control center, which allows full control of the grid after it has reached its full capacity.
- A feasibility study was completed for upgrading the Tyre and Baalback power plants by 35 MW additional capacity each. This project is currently on hold.

Other planned projects by the MEW are described hereafter in details at different level starting from generation up to distribution.

Generation

Major cities and other areas suffering from curtailments and power rationing rely heavily on private-high-speed diesel generation subscription to meet their demand for power. The private small size generators, ranging from 50 kVA to 250 kVA, are widely spread throughout the country and have been the cause of the high increase in pollution levels. This resort to private generation imposes financial burdens and deteriorates the population's health and quality of life.

In 2017, the Council of Ministers approved a Rescue Plan for the Electricity Sector that included renting two additional vessels to deliver around 825 MW as additional power to the grid and the usage of mobile substations for the evacuation of the additional power. A mid term plan recommends the construction of two power plants by private investors (IPP) in Salaata I and Zahrani 2 with a total power of 1000 MW in addition to the construction of new Jiyeh, Zouk[1] and Salaata II[14] power plants. A long term plan recommends the construction of additional two power plants with a total capacity of 1000MW. Furthermore, the plan includes the construction ofconstructing stations for the natural liquid gas in Deir Ammar, Zahrani and Salaata and constructing the coastal gas pipe line. The strategy also tackles renewable energy by the construction of 450 MW of solar photovoltaic farms and 100 MW of concentrated solar power throughout the country, 450MW from Wind, and 473 MW form Hydro power and 15MW from Geo-thermal source. This is in addition the plan calls for adjustment to the tariffs to reduce governmental subsidies on Electricity.

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[4] The Concil of Ministers (CoM) is yet decided on whether to implement a new Zouk PP or to rehabilitate the existing one. Salaata II project is also awaiting CoM's approval.

Table 5-2: Generation Planned Projects by the MEW

Plan	Project	Power (GW)
Rescue Plan	Two Vessels[1]	0.825
Policy Paper 2010	Build new CCGT in Deir Ammar 2[2]	0.569
	Renewable Energy[3]	0.831
Total Rescue Plan & Policy Paper 2010		*2.225*
Mid Term Plan	Salaata I(IPP)	0.5
	Zahrani 2(IPP)	0.5
	New Jiye	0.5
	New Zouk[4]	0.5
	Salaata II[5]	0.5
Total Mid Term Plan		*2.500*
Long Term Plan	Two new Power plants[6]	1
	Renewable energy[7]	0.655
Total Long Term Plan		*1.655*
Grand Total		**6.38**

1: The two vessels are in the bidding process;
2: Project is on hold;
3: Subject to LCEC approval;
4: On going , Funded by KFAED and AFESD;
5: To be approved by CoM;
6: Locations not defined yet;
7: to be defined for future plan.

Generation Demand Analysis

The Ministry of Energy and Water electricity plan till 2030 shows the following:

- The power demand growth rate is assumed to be around 5% annually from year 2018 to 2021
- The power demand growth rate is assumed to be around 3% beyond year 2021 for the next coming nine years; i.e; till end of 2030.
- Currently the demand load of the country is around 3.4GW.

In addition, it is assumed that:

- Jiyeh power plant will be out of service, and the 0.825MW vessels will be connected to grid in year 2018
- The generated power of new thermal power plants is estimated to be around 95% of the installed capacity.
- A production factor of 40% is considered for the hydro power plants.

The Ministry of Energy and Water electricity plan is to develop the power generation sector to cope with the forecasted load up to 2030. This plan is summarized below.

Both the generation and demand loads are graphically presented showing the shortage or excess power resulting from both forecasted loads and generated power.

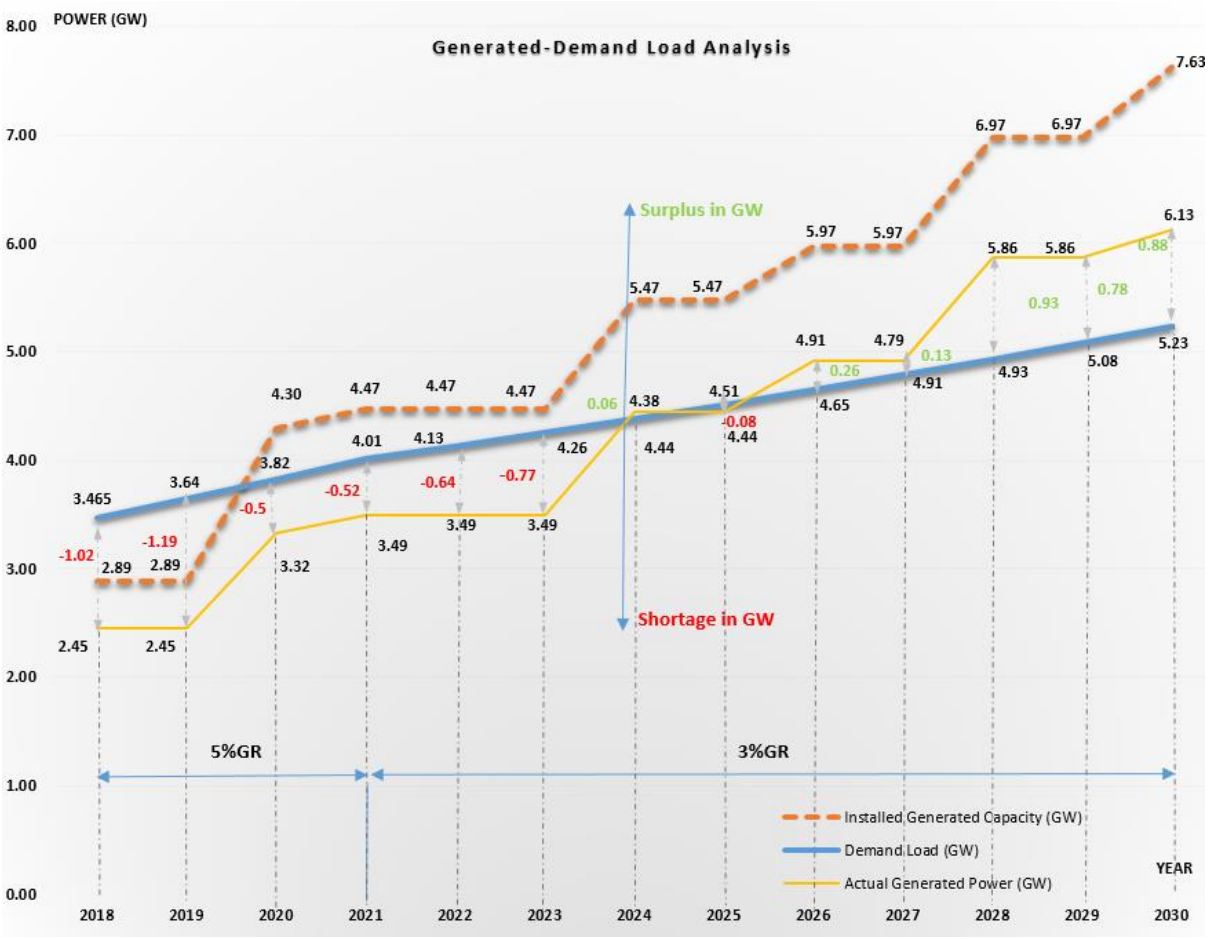


Figure 5-1: Generated Demand Load Analysis

Table 5-3: Growth /Generated Power and Shortage Analysis

years	Demand Load GW	Installed Generated Capacity GW	Actual Generated Power GW	Shortage(-) Excess(+) GW	Notes
2018[1]	3.465	2.89	2.45	-1.07	The current total generated power of the country is around 2.89 GW versus a total anticipated demand load of 3.465GW. As per MEW plans, Jiyeh power plant will be out of service. An emergency plan comprised of renting two vessels to boost the shortage by a total capacity of 0.825GW is anticipated by 2018. The current contract of the 374MW rented vessels will end by September 2018. As a result, the country will have a shortage in electricity around 1.07GW.
2019	3.64	2.89	2.45	-1.19	Power generation similar to 2018. Shortage in electricity will increase due to the 5% annual increase of the demand load (3.64GW) to reach 1.19GW
2020	3.82	4.30	3.32	-0.50	Deir Ammar 2 with an expected installed capacity of 0.569GW and Renewable resources such as Wind, Solar, and Hydro, with a total expected capacity not less than 0.844GW will be connected to the grid. The total power generated will become around 3.32GW. The estimated demand load growth is 3.82GW. Shortage will be around 0.5GW.
2021	4.01	4.47	3.49	-0.52	The contract of the 825MW rented vessels will end during this year. The construction of new power plants Salaata I and Zahrani II would be completed and connected to the grid by end of 2021. The additional capacity will be around 1GW. The shortage will be almost 0.52 GW.
2022	4.13	4.47	3.49	-0.64	The growth rate as of 2022 is considered 3%.The total demand load will keep increasing to reach 4.13GW, as a result the shortage will reach 0.64GW.
2023	4.26	4.47	3.49	-0.77	The shortage will become 0.77GW as a result of the growth rate of power demand load in the absence of any generated power source.
2024	4.38	5.47	4.44	0.06	The construction of Jiye and Salaata 2 new power plants will be completed. This will result in adding 1GW generated capacity to the grid. The total generated power will reach 4.44GW. The total demand load will keep increasing to reach 4.38GW (3% annual increase). No shortage is expected this year.
2025	4.51	5.47	4.44	-0.08	Power generated similar to year 2024. Shortage is almost nil.
2026	4.65	5.97	4.91	0.26	A new 0.5GW power plant will be completed.The location of the plant is still not defined. The total generated power will reach 4.91GW. The total demand load will keep increasing to reach 4.65GW (3% annual increase). This will lead to increase the surplus of power by 0.26GW.
2027	4.79	5.97	4.91	0.13	Power generated simialr to year 2026. At this year there will be no shortage in electricity
2028	4.93	6.97	5.86	0.93	Addional 1GW will be connected to the grid due to the construction of a new power plant, and new Zouk power plant[2].This will lead to a surplus of energy around 0.93GW.
2029	5.08	6.97	5.86	0.78	Power generated similar to year 2028. Surplus of power will slightly decrease due to the 3% annual increase of the demand load (5.08GW) to reach 0.78GW
2030	5.23	7.63	6.13	0.89	The completion of phase 2 of the renewable energy will result in addition of 0.65GW to the generated power. The generated power will reach 6.13 with a surplus of 0.89GW

Transmission

Transmission forms one of the major parts in MEW 2030 plans. According to the MEW criteria for the power demand growth rate, the load should be transferred to the customer by interconnecting the main generating power plants and substations at 220 kV. This will effectively decrease the losses on the grid and unify the voltage network on the grid.

Most of the projects detailed in the below table are comprised of upgrading the interconnection to 220 kV.

Table 5-4: Substations and Distribution 220kV Cables - Cycle 1

Item	Year
Substation	
Upgrade 220kV Halba SS to receive wind power	2019
Baouchrieh	2020
Chebbak	2020
Upgrade of Jamhour SS from 150 kV to 220 kV	2020
Airport	2020
Hazmieh	2020
Choueifat	2020
Extension of Zahrani SS 220 kV	2020
Nabatieh	2020
Transmission	
Connection 220 kV OHTL to Halba SS	2019
New OHTL Head Transmission Line Selaata- Bsalim/Bahsas	2019
Marina to Baouchrieh	2020
Chebbak to Baouchrieh	2020
Chebbak to Bsalim	2020
Airport to Hazmieh	2020
Jamhour to Hazmieh	2020
Jamhour to Choueifat	2020
Airport to Choueifat	2020
Zahrani-Nabatieh	2020
Total MUSD	**223.63**

Table-5-5: Substations and Distribution 220kV Cables - Cycle 2

Item	Year
Substation	
Upgrade of Zouk SS to 220 kV	2022
Batroun (66kV)	2022
Amchit	2022
Extension of Halate SS	2022
Basta	2022
Unesco	2022
AinMreisseh	2022
Upgrading of Jieh SS	2023
IklimKharroub	2023
Damour	2023
Extension of Aramoun SS	2023
Extension of Sour SS	2022
Adma SS	2024
Extension of Selaata SS	2023
New Connection SS on the line routing	2023
Extension of Jamhour SS	2023
Upgrade of Kobayat SS to 220 kV	2024
Extension of Halba SS	2024
Transmission	
Connection 220 kV OHTL to Kobayat SS	2024
OHTL for the new SS-Jamhour	2023
Adma -Zouk	2024
Jieh- Aramoun	2023
Basta to Jamhour	2022
Basta to Unesco	2022
Basta to AInMreisseh	2022
Basta to Hazmieh	2022
AinMreisseh to Unesco	2022
Total MUSD	**253.963**

Table 5-6: Substations and Distribution 220kV Cables - Cycle 3

Item	Year
Substation	
Extension Basta 220 kV	2026
Extension Unesco 220 kV	2026
Extension Airport 220 kV	2026
Extension Choueifat 220 kV	2026
Extension Jamhour 220 kV	2026
Extension Zouk 220 kV	2027
Jounieh	2027
Bickfaya	2028
Marjeyoun	2030
Extension of Marjeyoun SS	2030
Extension of Aramoun SS	2029
Extension of Zahrani SS	2029
Extension of Deir Ammar SS	2026
Extension of Sour SS	2030
Extension of Bahsas SS	2030
Transmission	
Adma- Jounieh	2027
Jounieh-Zouk	2027
OHTL Bickfaya to Bsalim/Bahsas	2027
OHTL Marjeyoun- Nabatieh	2030
OHTL Marjeyoun- Ksara	2030
OHTL Zahrani- Aramoun	2029
Total MUSD	**134.585**

Distribution

The distribution network is being upgraded by the ministry through Distribution Service Providers, in full cooperation with municipalities on both short and mid term periods. There are several projects proposed by the municipalities, which are being studied by the MEW at the distribution level.

Development Vision

The government has taken several initiatives for the development of the Energy Sector, including rehabilitation of Power Plants, addition of new generation units, and arranging for the private sector to take a share in the power generation in the form of IPP projects. On the supply side, capacity additions are planned to include economical conventional energy sources like natural gas, and renewable energy sources like wind, solar, and waste to energy that are known to impact the environment the least.

The MEW policy statement is being implemented although several aspects are under reconsideration noting that several projects have been executed while others are awaiting either award or completion of feasibility studies. The procedures for the corporatization are expected to be prepared in a gradual and smooth manner and executed simultaneously upon completion to avoid unwanted and additional burden on EDL.

The infrastructure requirements for the natural gas (LNG terminal, pipeline along the coast, etc.) are also taken into consideration. All this will be done in collaboration and partnership with the private sector and the donor community to benefit from their vast experiences and resources.

Priority Municipalities Projects provided by MEW

In addition to the Transmission projects, the MEW has included in the CIP a list of priority projects for the municipalites. The projects are classified into two main categories:

- Lighting projects, which consist of installing street lighting network including Solar, and conventional street lighting luminaires, Poles, and upgrade of existing lighting network.
- Power distribution networks which consist of installing or upgradeupgrading existing transformers, Medium Voltage, and Low voltage networknetworks.

The table below summarizes the projects which will need to be funded.

Table 5-7: Municipal Projects included in CIP projects by MEW

Nip Reference Id	Governorate	Cost (Mus$)	Cycle	Installation Period (Years)
	Mount of Lebanon			
EM-01	Normal Lighting & PV supplied	10	1	2
EM-02	Network & Substations	10	1	2
	North			
EM-03	Normal Lighting & PV supplied	3	1	1
EM-04	Network & Substations	3	1	1
	Akkar			
EM-05	Normal Lighting & PV supplied	3	1	1
EM-06	Network & Substations	3	1	1
	Bekaa			
EM-07	Normal Lighting & PV supplied	3	1	1
EM-08	Network & Substations	3	1	1
	Baalbek-Hermel			
EM-09	Normal Lighting & PV supplied	3	1	1
EM-10	Network & Substations	3	1	1

Nip Reference Id	Governorate	Cost (Mus$)	Cycle	Installation Period (Years)
	South			
EM-11	Normal Lighting & PV supplied	3	1	1
EM-12	Network & Substations	3	1	1
	Nabatiye			
EM-13	Normal Lighting & PV supplied	3	1	1
EM-14	Network & Substations	3	1	1
	Total Cost	**56**		

Some municipalities have requested secondary electrical items that are not covered by the capital Investment Plan. These could be categorized as self-funded projects such as:

- Generators
- Electrical devices or accessories for electrical rooms

Table 5-8: Proposed Projects by the Municipalities Versus Mew Projects

Governorate	CIP	Non-CIP	Total Number of Projects
Beirut[1]	4	7	11
Mount of Lebanon	156	28	184
North	7	1	8
Akkar	4	--	4
Bekaa	11	2	13
Baalbek-Hermel[2]	--	--	0
South	3	1	4
Nabatiye	18	--	18

1: There are 4 potential projects that could be included in the CIP, for which the MEW did not allocate additional funds.
2: No demands were received from the Municipalities of Baalbek and Hermel. However the MEW has dedicated around 6M$ for high priority projects of the governorate.

5.5 Capital Investment Program

Shortage in power generation requires immediate action to increase the generation capacity, including:

- Construction of new generation plants based on the master plan conducted by Electricité De France (EDF), which confirmed the need for additional power plants in Deir Ammar and new generation units in Zouk and Jieh power plants.
- Expansion of the Zahrani Power plant by constructing a cycle power plant designed for a triple fuel firing system, considering heavy oil and natural gas with a power of 450-550 MW.
- Construction of Salaata Power plant that consists of a cycle power plant deigned for a triple fuel firing system, considering heavy oil and natural gas with a power of 450-550 MW.
- Expansion of the main substations of Deir Nbouh and Deir Ammar to accommodate the new plant in Deir Ammar.
- Decommissioning of the Jieh Power plant, and Erection of the new Jieh Power plant.

Other proposed sources for power generation include different renewable energy technologies that can be implemented in Lebanon. By 2030 the plan is to have a 20% of the total power generated from renewable resources. The table below represents the anticipated power that could be generated from renewable resources as well as thermal and hydro power plants.

Table 5-9: Planned Non-Conventional Generation Sources

Year	2020				2030			
	MW	**Gwh**	**Ktoe**	**MUSD**	**MW**	**Gwh**	**Ktoe**	**MUSD**
Wind	200	595.7	128.7	340-490	450	1,422.6	307.3	425-612.5
PV. Concentrated PV (solar farms)	150.0	240.0	51.8	225	300.0	480.0	103.7	450
Distributed PV (email scale, rooftops)	100.0	160.0	34.6	321	150.0	240.0	51.8	481.5
CSP (concentrated solar power)	50.0	170.6	36.8	300	100.0	341.2	73.7	600
SWH (solar water heater)	1,053,988 m2	685.5	148.1	192	1,716,835 m2	1,116.6	241.2	312
Total Hydro	331.5	961.9	207.8	264.1	473.0	1,677.3	362.3	
Geothermal	1.3	6.0	1.3	5	15	69.2	15	57.7
Bioenergy		771.5	166.6			1,177.0	254.2	

CSP: Concentrated Solar Power,
SWH: Solar Water Heater,
PV: Photovoltaic,
GWH: Gega Watt Hour,
Ktoe: Kilo tons of Oil Equivalent.

Besides the above, the investment programme has to tackle other projects which will improve the Sector on the technical and financial level. This includes but is not limited to:

- The coastal Gas pipeline project by the Private Sector.
- Floating Storage and Regasification Unit (FSRU) Project + Liquefied Natural Gas LNG Marine Terminal in Deir Ammar, Zahrani, and Salaata.
- Photo voltaic (PV) Renewable Energy Project.
- Wind Power, and Waste to Energy by the private Sector.
- The immediate substitution of diesel oil by Natural Gas for operating Deir-Ammar and Zahrani thermal power plants.
- Completion of the second loop of the 400 KV transmission lines to establish regional electricity interconnections with the neighboring countries (Syria, Jordan, Egypt, Turkey).

The Government of Lebanon plans to purchase LNG to reduce the high cost of Gasoil. The country has a critical need for LNG import as it revamps and expands its power generation capacity. The MEW is planning to start the construction of a natural gas coastal pipeline from Beddawi to Tyre.

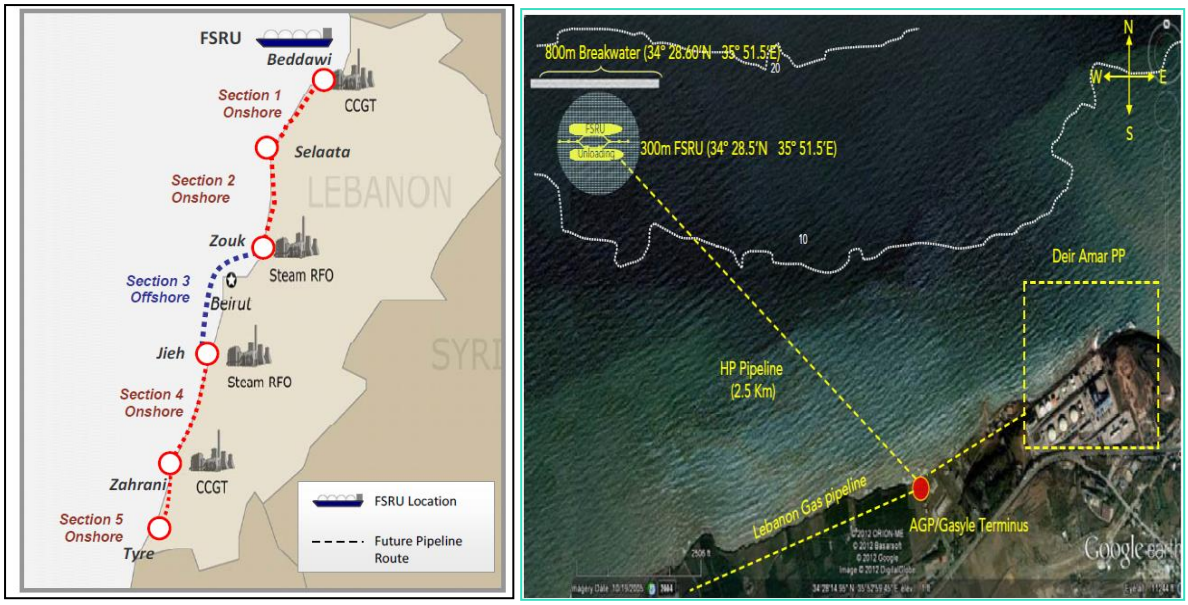


Figure 5-2: FSRU Location

The key to import natural gas is by constructing a Floating Storage and Regasification Unit (FSRU). The FSRU will be located in Tripoli as indicated on the above figure.

Table 5-10: Short Term Electrical Projects

Generation Project	Budget MUS$
Vessels renting	4,250[1]
New power plant on short term – 550 MW – Deir Ammar 2 financed by the Lebanese government; contract signed.	435[2]
Rehabitation of Zouk Power Plant	220

1: Classified as operation expenditure
2: Pending agreement with Contractors

Table 5-11: Electrical Capital Investment Projects – Cycles 1 and 2

Ref.	Project	Region	Description	Estimated Cost (MUSD)		Status		Impact		Generated Employment	Priority	Implementation Cycle
				Investment	Land Expropriation					Million Labour-Days	Score	
	GENERATION											
E1	New Power Plants on Medium Term - IPP-1000MW	Zahrani Salaata	Capacity of 1000 MW financed by the Private Sector	1,200	Existing Land Dedicated for the power plantor to be Purchased	Feasibility study done. First two locations are Zahrani & Salaata. Launch the project.	2	Meet shortages, improve social wellbeing, encourage stability	3	10	4	1
E2	Jiye Power plant-500MW	Jieh	New Power Plant in Jieh	500	Existing Land Dedicated for the power plant	Feasibility study is being prepared. Launch the project.	1		3	5	4	2
E3	Salaata 2 Plant on Longer Term - 500MW	Salaata	Capacity of 500 MW	600	Existing Land Dedicated for the power plant							2
E4	Hydro power plants (331.5 MW)	National	Rehabilitation & Upgrade of Existing Hydro Plants-92MW		Existing Land Dedicated for the power plant	Feasibility Study Done	1		2	6.6	3	
			Installation of new Hydro Plants - 25 sites-(233MW-315MW)	264.1 for year 2020	New Location							1
			Micro-Hydro on non-river streams - 13 Pilot sites identified -5MW		New Location							
E5	Geothermal Plant of 1.3MW	National		5								1
	TRANSMISSION											
E6	Transmission Master Plan Project (High Importance)	National	Upgrade/Installation of 220KV Substations, and Installation of underground Cables	223.63								1
E7	Transmission Master Plan Project including Infrastructure at KSARA Substation (Mid Importance)	National	Upgrade/Installation of 220KV Substations, and Installation of underground Cables	253.693								2
	DISTRIBUTION											
E8	LV Network Upgrade	Governorate	Installation of Lighting luminaires, tansformers, and Low Voltage transmission lines – Akkar	6								1
			North	6								
			Mt Lebanon	20								
			Baalbek & Hermel	6								

Ref.	Project	Region	Description		Estimated Cost (MUSD)		Status		Impact		Generated Employment	Priority	Implementation Cycle
					Investment	Land Expropriation					Million Labour-Days	Score	
				Bekaa	6								
				Nabatiyeh	6								
				South	6								
				Total	**56**								
E9	DSP	National	Finish the Smart Grid		262.5		Implement the Smart Meters.	1		3		4	1
					87.5								2
	FUEL SOURCING												
E10	Gas Pipeline	North/ south	Build a gas pipeline along the coast to feed all power plants		140		Pre-feasibility study done. Budget law in discussion at the parliament.	3		1	0.1	6	1
			Total Cycle 1		**2,151**								
			Total Cycle 2		**1,441**								
			Total Electricity Cycles 1 and 2		**3,592**								

1: Need decision form the Council of Ministers

Table 5-12: Electricity Future Capital Investment Projects – Cycle 3

Ref.	Project	Region	Description	Estimated Cost (Musd)		Status		Impact		Generated Employment	Priority Score	Implementation Cycle
				Investment	Land Expropriation					Million Labour-Days		
	GENERATION											
FE1	Zouk Power plant-500MW	Zouk	New Power Plant in Zouk[2]	500	Existing Land Dedicated for the power plant	Technical report will soon be sent to the CoM. Launch the project.	1		3	5	4	3
FE2	New Power Plants on Longer Term -1000MW	National	Capacity of 1000 MW	1,200	New Location							3
FE3	*Hydro power plants (141.5 MW)*	National	Rehabilitation & Upgrade of Existing Hydro Plants-92MW	112.73	Existing Land Dedicated for the power plant	Feasibility Study Done for the new Hydro Plants	1		2	6.6	3	
			Installation of new Hydro Plants - 25 sites-(233MW-315MW)		New Location							3
FE5	Geothermal Plant of 15MW	National		52.7								3
	TRANSMISSION											
FE6	Transmission Master Plan Project (Low Importance)	National	Upgrade/Installation of 220KV Substations, and Installation of underground Cables	134.585								3
			Total Electricity Cycle 3	**2,000**								

2: New or rehabilitation of Zouk power plant to be decided by CoM

6 TELECOM

6.1 Background and Current Conditions

During 1995-1997 the rehabilitation of all the telephone exchanges buildings was accomplished and new ones were built in the needy areas , where new equipment were installed in these centers with performing all the necessary connections between these centers and with the customers. The current network can handle 1.8 million customers with the average of one line for each 3 individuals.

At the same time, studies started for reorganizing the ministry for the sake of separation of the operation and maintenance activities from organizing and monitoring. In this regards, the ministry assigned to OGERO the duties of connecting lines to the customers, applying maintenance and issuing bills.

Starting 1993, contracts were signed between MoT and each of Alcatel, Ericsson, and Siemens, to supply and install switch where 300 new digital switches and 3 international exchanges have been supplied and installed by these three vendors. The network's transmission system uses a fiber optic backbone SDH (Synchronous Digital Hierarchy) and supports various protocols, with the speed of STM-1 (155 mbps) and STM-4 (622 mbps) transmission backbone. International traffic is carried by satellite, terrestrial microwave, and submarine cable links.

6.1.1 *Narrow band services*

In parallel with the above network nodes (switching and transmission) implementation, the PSTN and OSP projects concluded and executed between 1995 and 2005, offered a wide network of copper local loop infrastructure for 1,700,000 access points to end-users and subscribers. As for rural areas, a new technology (considered advanced at the time of implementation by year 2000) with quick deployment was introduced and implemented providing fixed / wireless voice services for around 100,000 subscribers mainly in Bekaa areas.

6.1.2 *Broad Band services for Business / Commercial users*

Regarding the high bit rate network offered to the customers, MoT introduced by 1996 the leased line services, (ISDN) Basic Rate and ISDN Primary rate access that offered a maximum bandwidth of 2Mbits/s over the copper Out Side Plant Network

With the low demand, declining market and high cost technology for ISDN technology, Leased Line services have become a Must to be offered for business communications and was subject to expansion by end of 2002.

It is to mention that, with rapid growth and high demand for high speed connection, the WLL technology network with its limited connection speed was unable to follow high speed and bandwidth demand and was never developed to meet the market demand.

6.1.3 *DSL network and services*

With the TDM switches, ISDN and Leased line edging their limited capacity and evolution to the IP world, MoT reacted to the market demand and offered DSL services to the major cities and commercially potential zones starting from 2004. This interim solution will always find its limit given that these services are delivered and transported over the existing copper network.

6.2 Impact of the Syrian Crisis

Syrian crisis, if resulting from the massive presence of refugees or Syrian civilians on the Lebanese territory, cannot be in theory but positive: the more connected users or more usage of the prepaid or post services are additional income and revenue to MoT.

However, and as Syrian presence is massively located near Syrian borders, Syriatel SIM cards are connected to Syriatel network which constitute an additional loss of revenue to MoT.

6.3 Existing Programme and Strategy

The necessary technological and environmental underpinnings exist today for next-generation service providers to begin the process of transforming their infrastructures to enable the provision of a variety of new services and with value added services to the fixed network. This will open a path for introducing a state-of-the-art network based on a network convergence within what is called the “next-generation networks NGN).”

6.4 Development Vision

The actual vision of telecommunication begun with a full scale program from the Ministry of Telecommunication to reforming their network and service infrastructures. Prerequisite for realization of such a vision is the convergence of the current multiple networks into a unified, multi-service, data-centric network offering services for different demands and at a reduced costs on open service platforms.

The development of such a network, will enable MoT to respond to the market needs with higher quality of services built over Fiber Optic future proof and evolving infrastructure and technology with maximizing the use of the existing copper network.

With such network deployment, MoT will pave the way to moving and transforming Lebanon into one of regional leading digital economy: when we refer to “digital”, we are defining it from an application perspective. Digital includes the foundations and underlying technologies and capabilities such as network and connectivity, Cloud Computing, Central Monitoring & Control, Cyber Security / Information Security and whole sale storage & hosting , all of which enable the digitization of back-end processes as well as B2B (Business–to-Business) and B2C (Business-to-Consumer) interactions

The following list of projects, considered with high priority to MoT, are already part of the subject national wide scale Capital Investment programme.

6.5 Capital Investment Programme

6.5.1 *Migration from TDM – PSTN to Converged Network - IMS / LTEA*

The Ministry of Telecommunication is driven by competition, technological advances and evolving market demand by implementing and upgrading the existing telecommunication transport layer for voice and data. Next Generation Network (NGN) project, namely IMS / LTEA, holds the promise of offering data and multimedia services, giving access to new revenues, noting that the actual traditional switching systems will coexist alongside new technology elements some years from now and will be phased out under a new upgrading and migration plan.

The actual switches are highly reliable within PSTN infrastructure but never optimized for data or multimedia. Consequently, as more and more data traffic flows onto the public network via Internet, it has become apparent that a new and more data centric approach will be needed for the common transport of voice and data.

With the completion of IMS / LTEA project and implementation of the softswitches, the following steps and benefits will follow:

- Provision of an evolving and a multi-service national platforms,
- Extensive and extended deployment of xDSL services through a the converged network with the adequate and progressive performance for the full satisfaction of the Operator the end-user:
    1. reduction in Opex and Capex

2. Delivery of incremental services to users with a reach, cost and capability set superior to those of any competitor
3. A telecommunication platform that provides rapid and cost-effective innovation
4. Rapid integration of new services
5. Economies of scale from the deployed broadband infrastructure

6.5.2 *Phase 2 Security Systems*

With the deploying of the Open System of IP Based national wide network, end-user protection and network mitigation against Cyber Attacks become a must and obligation to avoid network vulnerability of the network at all levels: MoT will implement, in compliance with international standards, cyber security platforms (DDoS - Distributed Denial of Service, DPI – Deep Packet Inspection) systems at various government institutions, Cloud platforms and data center.

6.5.3 *National Cloud Platform*

MoT will offer, mainly for governmental, corporate, business and heavy users a national cloud based data center to be used as primary as well as disaster recovery site as needed by Government and non-governmental institutions. This platform will create local and regional platforms to overcome business dependence on imported digital services. Joint ventures with international players can be also considered such as Amazon, Google, Twitter... (Similar case: Chinese e-commerce giant Alibaba has extended its cloud offerings to the Middle East. Alibaba partnered with Dubai-based Meraas Holding to provide cloud-based systems integration services to enterprises and government bodies in Middle East and North Africa).

6.5.4 *Phase 2 – New BSS (Business Support Subsystems)*

With a Business Converged Billing, Charging, CRM (Customer Relationship Management) and OSS (Operational Support Systems), the BSS platform will offer a complete service management and customer relationship management for the fixed network, analysis of customer interactions, analysis, improvement of Service Providers business relationships, assisting in customers market and sales growth…

6.5.5 *Out Side Plant Fiber Optic Deployment –*

With the migration to IMS / LTEA network topology and technology for broadband network, access to end users shall be carried over high speed infrastructure:

- Fiber Optic or
- Segmented Fiber Optic / Copper networks.

Wireline broadband subscribers are commonly served using one of the following topologies:

I. Active outside plant, in which active electronics are placed in outside plant to derive facilities gains through multiplexing and statistical gains
II. Passive outside plant, in which active electronics that require power have been completely eliminated from the outside plant, thus serving the subscribers directly from the central office (CO) / Switch Exchange.

Power blackouts are still a major concern in Lebanon today, for this reason, passive outside plant topologies are favored at this stage and shall be deployed as much as possible and where applicable. PON would be the main technology to be applied in this case.

6.6 Passive Optical Networks

Gigabit passive optical networking (GPON) and Ethernet passive optical networking (EPON) are both PON-based technologies. The PON optical line terminal (OLT) in the CO-Switch Exchange is connected via optical splitters to multiple fibers that fan out to reach optical network terminals (ONTs) at the subscriber's home. A basic PON is illustrated in the figure below.

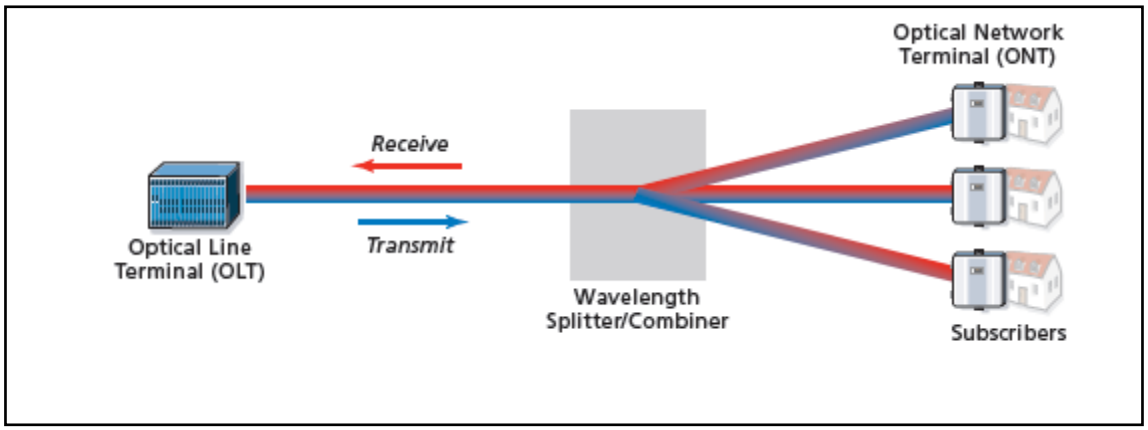
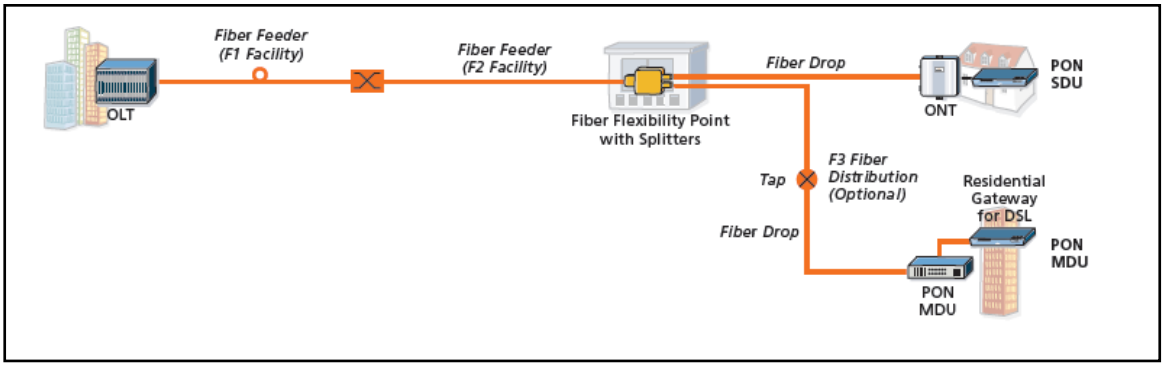


Figure 6-1: PON: Basic Model

We assume that most of existing civil works infrastructure has the required spare ducts to pull a considerable number of new fiber cables either in the primary network or in the secondary networks. Consequently, PON technology is considered for quick deployment of FTTX within the existing telecom ducts infrastructure. PON technology also offers the following advantages:

I. Capital savings are primarily achieved through the optimization and grouping of the feeders at the Central Office and through sharing of the PON (optical Line Terminal) OLT ports.
II. Locating the PON OLT in outside plant and thus extending the PON's reach while optimizing the amount of fiber between it and its serving CO-Switch Exchange.

The below figure show a typical PON deployment for Single- Dwelling Unit (SDU) and Multi-Dwelling Unit (MDU) Applications



6.7 External Network and End user Sides

Below are typical Fiber Optic network examples for different land use occupation namely the FTTC/B/H/O (Fiber to The Curb/Building/Home/Office). The common thing for all the below applications is that the entire network from the OLT and up to the townhouse / dwelling / apartment is fully passive, thus responding to the blackout issue that the country still faces.

OSP Fiber Optic deployment and implementation that MOT are willing to deliver are driven by the following class of users for which different services will be offered:

a- Project “Phase 7 – FTTO” for Heavy Users

Heavy users are identified as, but not limited to:

- Universities
- Hospitals
- Security authorities
- Banks
- Big industries

For the subject class of users, end-users buildings are connected directly over OSP Fiber Optic cables for very high speed Internet and additional services

b- Project “Phase 7 – FTTC” for common or normal Users

Normal users are identified as tenants of new residential, retail and commercial buildings other than Heavy Users.

For the subject class of users, end user will benefit from the deployment of OSP Fiber Optic Network and terminated inside street cabinet: distance between cabinet and subscribers / buildings not to exceed 1000 meters. Network cabling between the street cabinet and the subscriber will kept over the existing copper cables.

c- Project “Phase 8 Infrastructure” – for Bekaa and Kesrouan

Under the subject project, all households and subscribers of some areas of Bekaa and Kesrouan that are connected over the very obsolete and WLL (Wireless Local Loops) will be provided with Fiber Connection. As these zones and areas have no infrastructure connectivity, all required underground civil (excavation / refilling, ducting, cables chambers…) are carried out and constructed under the subject project.

Sample of OSP deployment is illustrated in the below table

Table 6-1: Telecommunication Capital Investment Projects – Cycle 1

Ref	Project	Region	Description	Estimated Cost (MUSD)		Status	Impact	Generated Employment	Priority Score	Implementation Cycle
				Investment	Land Expropriation			Million Labour-Days		
TL1	Phase 2 FTT(X) - FTTO: Fiber -To-The-Office - FTTH: Fiber-To-The-Home Phase 7 FTT (X) infrastructure	National Bekaa / Keserouan	Fiber deployment and connection to the most economical Points / Users	100	None	Design Completed		500 man months, with majorities of road works labors	High	1
TL2	Phase 2 - Core Network and IMS (IP Multimedia Subsystem)	National	Upgrade and expansion of the network backbone (international gateway, core and edge). Upgrade and expansion DWDM, IP/MPLS, and Access with centralized NOC (network operation center) and Converged Billing, Charging, CRM, etc.) and OSS (Operational Support Systems: service management and activation, etc.) for the fixed network	90	None	Design Completed		200 man months, with majorities of road works labors	High	1
TL3	Expansion of international connectivity	National	Deployment of 2 new submarine cables connecting Lebanon to Europe directly an via Cyprus	50	None	Design Completed		Minor	High	1
TL4	Phase 2 Security System	National	Deploying cyber security, DDoS, and DPI systems at various government institutions and data center	60	None	Design in progress		Minor	High	1
TL5	Phase 2 Spectrum Monitoring	National	Upgrade and expansion of Nation Wide Spectrum Monitoring and Management, Locate and Intercept of Illegal use of Spectrum	20	None	Design in progress		Minor	High	1
TL6	National Cloud Platform	National	Build a national cloud based data center to be used as primary as well as disaster re recovery site as needed by Government and non-gov institutions	200	None	Design in progress		Minor	High	1
TL7	Phase 2 IOT, Lora and WiFi Network	National	Deployment of nationwide IOT (Internet of things) and public WiFi networks	30	None	Design not started yet		Minor	High	1
TL8	GSM network	National	Upgrade of GSM network to 5G	150	None	Design completed		Minor	High	1
			Total Telecom Cycle 1	**700**						

7 SOLID WASTE

Lebanon currently generates around 2.4 million tons / year of Municipal Solid Waste (MSW). The MSW composition comprises: organic waste (52.5%), dry recyclables (i.e. paper/cardboard, plastic, metals and glass) (36.5%), and residual general waste (11%). The generated MSW quantities are currently managed as follows:

- Around 50% are disposed of at about 940 illegal open dumpsites
- Around 35% are disposed of at sanitary landfill sites
- Around 15 % are either recycled or composted

In addition, Lebanon generates around 50,000 tons / year of potential Hazardous Waste (HW). Part of this waste is safely disposed of, while the remaining quantities are disposed of in a haphazard manner.

The Solid Waste Management (SWM) sector in Lebanon suffers several problems on the institutional, technical, economic, and financial levels. This was clearly visible during the 2015 Waste Crisis.

At the beginning of 2018, the Lebanese Government approved the “Integrated Solid Waste Management (ISWM)” Policy, which mainly included the below.

Abiding by the principles set out in the Environmental Protection Act, recovering the maximum amount of waste possible, adopting a decentralization waste management strategy, ensuring Government role in the proper distribution of resources, and achieving a balanced development of the sector.

On the operational level, Municipalities and Unions of Municipalities are responsible for waste management under the supervision of the Ministry of Environment. Municipalities that are unable to conduct the various stages of the ISWM strategy, on their own, could request their involvement in projects implemented by the Central Authority.

The ISWM Policy establish the formation of a committee which involves all concerned parties to overlook the proper implementation of the strategy until the issuing of specific law for ISWM; although a draft of this law is currently being discussed by relevant committees at the Parliament in order to present it to the General Council.

In parallel with issuing the ISWM Policy, the Lebanese Government approved the tender documents to tender for Waste to Energy (WtE) plants. It is expected that the bidding process will start after selecting the most suitable location for these WtE plants, in a way that does not contradict with the ISWM Policy.

The capital investment in these WtE plants is excepted to be covered by the private sector, with the return on investment achieved through fees, imposed on the waste treatment processes.

It is also expected that the WtE technology will be applicable on large developments and communities. However, rural areas will adopt other solid waste treatment techniques that are more appropriate at their economical / financial and technological level.

A budget of 1,400 million Us dollar is allocated for this sector to be spent during cylcle one at the national scale as indicated in the below table.

Table 7-1: Capital Investment Plan for Solid Waste Managements – Cycle 1

Ref	Project	Region	Estimated Cost (MUSD)		Implementation Cycle
			Investment	Land Expropriation	
SW1	Solid Waste Management to cover all Lebanon including collection, sorting, treatment and landfill sites.	National	1,400	n.a.	1
		Total	**1,400**		

8 INFRASTRUCTURE FOR TOURISM AND INDUSTRY

Infrastructure is required to revitalise the tourist sector and support industrial activities.

8.1 Tourism

Lebanon has a diverse and very rich urban and archaeological heritage, which if rehabilitated, constitutes an authentic nucleus for the local development of cities and surrounding towns.

Interventions in a number of locations in previous projects have helped to attract economic activities and increased the attraction of local and foreign cultural tourism of these cities.

The aim of the programme of the Ministry of Culture is to benefit from the rehabilitation of the heritage referred to as an essential source of assistance for sustainable local environmental development and to promote awareness among the population to preserve cultural heritage values.

On the other hand, improving and developing the management of cultural and artistic activities helps to sustain the investments that will be made and will help encourage private sector support to invest in artistic and cultural activities.

The objectives of the Ministry of Culture in the short and medium term are summed up around the three main headings.

1. To complete the rehabilitation of the heritage and historical cities of Lebanon in order to improve the conditions and conditions of local development associated with the cultural tourism of these cities;
2. Development of the protection and management systems of archaeological sites and access routes to increase the ability of attracting larger number of visitors.
3. To increase the efficiency of the Ministry of Culture in spreading cultural awareness and promoting the arts in all regions through the establishment and development of national libraries, museums, theatre, cinema, music and all the arts.

Based on these development goals and to be able to achieve them, the Ministry has established the following programme for the first and second phases. The proposed interventions include two parts:

1. In the dissemination of cultural activities and the development of the arts of theatre, cinema, music and arts of all kinds:
- Development of national libraries.
- Establishment of cinema tech to promote film and documentary films.
- Establishment of additional branches of the “Conservatoire”.
- Museums for plastic art and sculpture.
- Scientific and cultural conferences.
- Improve the management of these activities.
2. In developing the preservation and protection of the historical and archaeological sites
- Protection of historical and heritage buildings and cities.
- Rehabilitation of archaeological sites and their surroundings.
- Establishment and rehabilitation of museums;
- Improving the management of historical and archaeological sites, including warehouses;

Table 8-1 below summarizes the ministry of Culture plan to restore archaeological sites, enhance the museums and support all cultural activities for Cycles 1 and 2.

Table 8-1:Capital Investment Plan for Cultural / Tourism Projects – Cycles 1 and 2

Ref	Project	Region	Estimated Cost (MUSD)		Implementation Cycle
			Investment	Land Expropriation	
CH1	National and Public Libraries	National	15	n.a.	1 & 2
CH2	Movies (Cinematic and documentaries)	National	7	n.a.	1 & 2
CH3	Theater	National	7	n.a.	1 & 2
CH4	Music (new branches for the Conservatoire)	National	15	n.a.	1 & 2
CH5	Scientific and Educational Centers	National	17.5	n.a.	1 & 2
CH6	Arts Museum	National	7	n.a.	1 & 2
CH7	Arts General	National	9.5	n.a.	1 & 2
CH8	Warehouse	National	36	n.a.	1 & 2
CH9	Historical cities and buildings	National	50	n.a.	1 & 2
CH10	Archeological sites and surroundings	National	70	n.a.	1 & 2
CH11	Museums	National	30	n.a.	1 & 2
		Total	**264**		

8.2 Industry

The project is part of a new national plan for industrial development in Lebanon (as laid out in a number of official documents, such as the Integrated Vision For The Lebanese Industrial Sector 2025, Strategic Plan 2016-2020, Operational Plan 2016-2017, draft Strategy for the Development of Industrial Zones in Lebanon) and is seen as a pilot for a series of potential industrial zones projects throughout the country. It will remedy to the current situation of inadequate informal private industrial areas.

It aims to support enterprise development through giving them good conditions for operation (accessibility, power, wastewater management, etc). As the project involves in particular SME's, it has high potential for job creation, including for youth and women.

The project involves the construction of three new industrial zones, which will host both new industries as well as companies re-locating, mainly local SME's (agri-food, car repair and services, construction, creative industries, potential incubators, etc).

Phase 1 of the infrastructure for 3 industrial areas is funded by the EIB and Italian for a value of 70 MUS$.

Table 8-2: Infrastructure for Industrial Zones – Cycle 2

Ref	Project	Cost MUS$	Implementation Cycle
IN1	Infrastructure for 3 industrial cities, Alkaa, Baalbek, and Terbol – Phase 2	50	2
IN2	Infrastructure for the Tripoli Special Economic Zone	25	2
	Total	**75**	

9 SUMMARY

The total investment cost for Cycles 1 and 2; is estimated at 17.25 billion US$, as indicated in Table 9-1.

The cycles are of a period of 4 years each. They are assumed to start with securing the required funds. The actual implementation of a particular project may span beyond its corresponding period, depending on its size, construction constraints, and handing over to the concerned authority.

Cycle 1 investment is 10.8 billion US $ of which 693 million are for expropriation. Cycle 2 investment is 6.45 billion US$, of which 1 billion is for expropriation.

The transport sector has the highest share of 32.94% of Cycles 1 and 2, versus 20.82% for electricity, 18.17% for water and 13.93% for wastewater. Solid waste management and telecommunication have a share of 8.1% and 4.06%, respectively to be spent all in cycle 1, and 1.96% are for the infrastructure of the cultural / tourism and industrial sectors.

Table 9-1: Total Investment Cost for Cycles 1 and 2

Capital Investment Summary of Cycles 1 and 2, in MUS$						
Sector	**Cycle 1**			**Cycle 2**		
	Investment	**Land Expropriation**	**Total Cycle 1**	**Investment**	**Land Expropriation**	**Total Cycle 2**
Transport	2,311	552	**2,863**	1,964	856	**2,820**
Water & irrigation	2,151	106	**2,257**	**722**	156	**878**
Wastewater	1,329	35	**1,364**	1,027	13	**1,040**
Electricity	2,151		**2,151**	1,441		**1,441**
Telecom	700		**700**			**0**
Solid Waste	1,400		**1,400**			**0**
Cultural Heritage	84		**84**	180		**180**
Support to Industry	0		**0**	75		**75**
Total	**10,126**	**693**	**10,819**	**5,409**	**1,025**	**6,434**
Grand Total	**17,253**					

Cycle 3 is programmed for another 4 years period. Its total investment cost is estimated at 5.7 billion of which 871 million are for expropriation, as indicated in Table 9-2.

Electricity has the highest share of cycle 3 with 35% versus 30% for each of the transport and water sectors and 5% for wastewater.

Table 9-2: Total Investment Cost for Cycle 3

Capital Investment Summary of Cycle 3, in MUS$			
Sector	**Cycle 3**		
	Investment	**Land Expropriation**	**Total Cycle 3**
Transport	1,169	529	**1,698**
Water & irrigation	1,377	333	**1,710**
Wastewater	269	9	**278**
Electricity	2,000		**2,000**
Telecom	0		**0**
Solid Waste	0		**0**
Cultural Heritage	0		**0**
Support to Industry	0		**0**
Total	**4,815**	**871**	**5,686**