

CONSULTANCY SERVICES FOR RIVER BASIN MANAGEMENT

GHADIR RIVER BASIN POLICY TARGET AND PROGRAMME OF MEASURES

MAY 2023



5 Ghadir Policy Targets and Programme of Measures

5.1 Policy Targets

When designing a PoM, each measure comes with an associated investment cost. On top of the results of any assessment of measures, additional socio-economic factors come into interplay, such as the readiness of the technological solution, social acceptability, equitability, any constraints related to the implementation of the measures, etc. which can facilitate or impede the uptake and effectiveness of the measure.

It is thus of paramount importance to stimulate a discussion with various stakeholders who bring in their local knowledge and expertise, and can verify the applicability of the findings, or highlight relevant constraints.

In this context, the objectives of the participatory approach in the GRB were:

- Assess the level of awareness of stakeholders within the basin on the problem of unmet demand and water quality, its drivers and root causes, and future projections (Step 1).
- Discuss and define, together with relevant stakeholders, a bundle of measures which are deemed adequate to tackle the issues of water supply reliability and water pollution in the basin, in order to safeguard their relevance and acceptability (Step 2).
- Define relevant policy targets and an associated Programme of Measures (PoMs) in GRB based on a participatory process with stakeholders from all levels (central, regional, local), and draft an Action Plan with their relevant roles. (Step 3).
- Discuss additional and follow-up actions needed.

As a result of the participatory process, a set of five (5) policy targets have been defined for the GRB. These policy targets would be subsequently addressed through a comprehensive action plan with relevant Programme of Measures. The primary purposes would be mitigating the issues of unmet demand and prevailing water stress conditions in the basin, as well as improving the water quality and limiting water pollution which can affect socio-economic growth and welfare. These are presented in Table 1 below.

Table 1 Policy targets resulting from participatory approach

Target Name	Target Code	No. of measures
Increase water use Efficiency and water Supply Reliability	ERS	6
Promote water COnservation	PCO	1
Protection of the Water resources and the Environment	PWE	10
PARticipatory water management	PAR	4
Socio-economic DEVelopment	DEV	1

To achieve these targets, a bundle of measures has been defined for each target, spanning from technical (infrastructure) and regulatory measures, to financial, educational and socio-economic measures, and addressing multiple sectors (i.e. the urban, agricultural, industrial, touristic, environmental). A total of 22 measures have been elaborated as presented in Table 3 below.

5.2 Detailed measures description

5.2.1 Urban sector

Measure ID and Name	ERS_U1: Actions to modernize the operation of water supply networks and improve water efficiency
Description	<p>This measure focuses on modernizing the operation of water supply networks and improving water efficiency through the use of advanced technologies, upgraded infrastructure, and optimized operations. It aims to reduce water losses and enhance overall water management practices to achieve more sustainable water use. It includes:</p> <p>Leakage detection and control, rehabilitation of existing networks (incl. storage reservoirs), expansion of the BMLWE water supply network branches and connections. Improving network efficiency from 50% to 75%. The installation of solar panels in pumping stations is to be assessed.</p>
Target	Residents, Municipalities, BMLWE
Activity Breakdown	<p>In the Updated NWSS - 2020, there is a number of proposed rehabilitation/expansion projects for BMLWE (see section Error! Reference source not found.). It includes the implementation of new distribution networks, wells, storage reservoirs, pumping stations, treatment plant, etc. until 2035.</p> <p>In summary, the proposed projects in Baabda/Aley district include:</p> <ul style="list-style-type: none"> • 54 km of distribution network, • 106 km distribution network (priority 2), • 11 wells to be drilled and equipped, • 13 reservoirs to be constructed, • 1 WTP and 1 PS to rehabilitate • 2 springs to catch <p>The proposed projects in Chouf district include:</p> <ul style="list-style-type: none"> • 13 km of transmission lines, • 39 km distribution network (priority 2) <p>Moreover, the implementation of SCADA and DMA systems is suggested to connect all the components and facilitate the control and monitoring.</p>
Timespan/Timeline	<p>Medium - Long term, planned to be executed before 2035. Once the measure is implemented the expected results/impact will be immediate.</p>
Budget breakdown	<p>CAPEX Baabda Aley: 83,790,000 USD Chouf: 19,550,200 USD</p>
Constraints	Financial constraints, Stakeholder resistance

Measure ID and Name	ERS_U2: Greater Beirut Water Supply Augmentation Project (GBWSAP)										
Description	Construction of Bisri dam and completion of Bisri/Awali scheme Bisri Dam: Rockfill dam H = 73 m, L = 740 m; Lake: V=125 Mm ³ , A=450 Ha;										
Target	Residents, BMLWE, MEW, World Bank										
Activity Breakdown	Act.1: Preparation and Land Expropriation (Achieved) Act.2: Construction works Act.3: Operation and Monitoring										
Timespan/ Timeline	Medium to Long term Once the measure is implemented the expected results/impact will be immediate										
	Activity	Description	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9
	1	Expropriation and Land Preparation									
	2	Construction works									
	3	Operation and Monitoring									
Budget Breakdown	CAPEX: Bisri Dam: 364,000,000 USD Awali Project: 31,900,000 USD										
Constraints	Financial crisis, Stakeholder resistance,										

Measure ID and Name	ERS_U3: Water metering and subscription to BMLWE													
Description	<p>Water metering is essential to identify how much water is actually used/ consumed in households, commercial or public buildings, etc., and thus better plan water allocation. Subscribing to the BMLWE can support better water supply management, and increase of the economic resources for the rehabilitation or expansion of water supply networks. Includes: installation of water meters in households, public buildings (e.g. schools), camps, commercial buildings. This measure also includes the installation of district water meters to monitoring main transmission and distribution lines in order to better control the distribution and address leakage issues. Approximately 186,000 meters have been installed within BMLWE.</p>													
Target	Residents, BMLWE, MEW													
Activity Breakdown	<p>Act.1: Identify water users Act.2: Conduct site assessments Act.3: Design the metering system Act.4: Procure equipment Act.5: Install water meters and flow meters Act.6: Train water users Act.7: Integrate with billing system Act.8: Monitor and maintain</p>													
Timespan/ Timeline	<p>Medium term Once the measure is implemented the expected results/impact will be immediate. Yet, this requires that the meters' measurements are read at regular basis and the respective volumes recorded are properly organized into a central database. Automatic data acquisition systems can be installed to facilitate the activity.</p>													
	Activity	Description	Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Month 7	Month 8	Month 9	Month 10	Month 11	Month 12
	1	Identify water users	■											
	2	Conduct site assessments	■	■										
	3	Design the metering system		■	■	■								
	4	Procure equipment			■	■	■							
	5	Install water meters and flow meters					■	■	■	■	■	■	■	■
	6	Train water users					■	■	■	■	■	■	■	■
	7	Integrate with billing system									■	■	■	■
8	Monitor and maintain									■	■	■	■	
Budget breakdown	<p>In the NWSS the installation of 16,500 Service Connections + 50,000 Water Meters is foreseen. The associated CAPEX is 26,250,000\$ O&M is the responsibility of the BMLWE.</p>													
Constraints	Financial, infrastructure limitations, cost implications, lack of awareness, lack of political will													

Measure ID and Name	ERS_U4: Drafting / Updating of the BMLWE Water Supply Masterplan							
Description	Drafting/updating of the BMLWE Water Supply Masterplan to meet water supply needs in the medium and long term							
Target	Residents, Residential areas, households, BMLWE							
Activity Breakdown	<p>Both the MEW and BMLWE are responsible for establishing long term consolidated planning for water, irrigation and wastewater</p> <p>Act 1: Review existing policies and regulations Act 2: Conduct water demand assessment Act 3: Evaluate water supply Act 4: Develop wastewater management plan Act 5: Engage stakeholders Act 6: Develop implementation strategies</p>							
Timespan/ Timeline	Short term Once the measure is implemented the expected results/impact will be immediate							
	Activity	Description	Month 1	Month 2	Month 3	Month 4	Month 5	Month 6
	1	Review existing policies and regulations	■					
	2	Conduct water demand assessment		■	■			
	3	Evaluate water supply		■	■			
	4	Develop wastewater management plan			■	■	■	
	5	Engage stakeholders					■	■
	6	Develop implementation strategies						■
Budget breakdown	Cost of the Masterplan: internal work of the engineers of the BMLWE Subcontracting cost for specific expertise							
Constraints	Financial crisis, Stakeholder resistance, BMLWE shortage of staff							

Measure ID and Name	WCO_U1: Water saving in households and buildings (public, commercial)																																				
Description	A variety of available technologies designed to deliver domestic water saving targeting the urban water uses (e.g. low flow flush, taps and showerhead, aerators, etc.) can be installed in households, offices, schools, hospitals, public buildings, etc.																																				
Target	Residents, BMLWE																																				
Activity Breakdown	<p>The purchase and installation of the water saving fixtures in the households can be undertaken by the households, or the municipalities, or the BMLWE, or the MEW, or NGOs, depending on funding mechanisms (e.g. subsidies, reduction in water fees, donors' funds, etc.)</p> <p>The operation and good maintenance of the fixtures is the responsibility of the household or public building operators and end-users (in case of schools, etc.)</p>																																				
Timespan/Timeline	<p>Short-Medium term.</p> <p>Once the measure is implemented the expected results/impact will be immediate.</p>																																				
Budget breakdown	<p>CAPEX varies from 1.86 million USD to 15.47 million USD depending on the solution/ measures applied and target reduction in the unmet demand that is aimed to achieve.</p> <p>The CAPEX needs to be paid up-front, either by each household or through Programmes, incentives, subsidies, etc.</p> <p>Looking at the total investment needed for the basin (CAPEX in million USD), we can observe that with CAPEX < 2 million USD (more specifically with 1.86 million USD) 20.4% of the domestic water used (i.e. 2.88 Mm³) could be saved if efficient showerheads are installed in all the households.</p> <p>To achieve 30% savings (i.e. save ~4.3 Mm³ in the basin) the necessary CAPEX is about 12.4 million USD and requires the installation of efficient showerheads plus dual flush toilets, while for a 37% saving (i.e. save 5.2 Mm³ in the basin) the necessary CAPEX is 15.5 million USD (requires the installation of efficient showerheads, dual flush toilets and 2 low flow taps in each household).</p> <p>A 42.5% saving (i.e. save 6 Mm³ in the basin) can also be achieved but the CAPEX goes up to 52.6 million USD which is considered disproportionately high in terms of added value as compared to the previous solutions.</p> <p>Table 2 Annual Equivalent Cost (AEC) of the urban demand management measures based on a 7% discount rate</p> <table border="1" data-bbox="451 1388 1336 1682"> <thead> <tr> <th data-bbox="451 1388 781 1440">Water Saving Measure</th> <th data-bbox="781 1388 943 1440">Unit Cost \$</th> <th data-bbox="943 1388 1187 1440">N (Useful life in years)</th> <th data-bbox="1187 1388 1336 1440">AEC (\$)</th> </tr> </thead> <tbody> <tr> <td data-bbox="451 1440 781 1472">Dual Flush Toilet</td> <td data-bbox="781 1440 943 1472">\$ 170</td> <td data-bbox="943 1440 1187 1472">7</td> <td data-bbox="1187 1440 1336 1472">\$ 32</td> </tr> <tr> <td data-bbox="451 1472 781 1503">Showerheads (1 item)</td> <td data-bbox="781 1472 943 1503">\$ 30</td> <td data-bbox="943 1472 1187 1503">3</td> <td data-bbox="1187 1472 1336 1503">\$ 11</td> </tr> <tr> <td data-bbox="451 1503 781 1535">Low flow taps (2 items)</td> <td data-bbox="781 1503 943 1535">\$ 50</td> <td data-bbox="943 1503 1187 1535">3</td> <td data-bbox="1187 1503 1336 1535">\$ 19</td> </tr> <tr> <td data-bbox="451 1535 781 1566">Efficient washing machine</td> <td data-bbox="781 1535 943 1566">\$ 600</td> <td data-bbox="943 1535 1187 1566">7</td> <td data-bbox="1187 1535 1336 1566">\$ 111</td> </tr> <tr> <td data-bbox="451 1566 781 1598">Dishwasher</td> <td data-bbox="781 1566 943 1598">\$ 700</td> <td data-bbox="943 1566 1187 1598">7</td> <td data-bbox="1187 1566 1336 1598">\$ 130</td> </tr> <tr> <td data-bbox="451 1598 781 1629" style="text-align: center;">TOTAL</td> <td data-bbox="781 1598 943 1629"></td> <td data-bbox="943 1598 1187 1629"></td> <td data-bbox="1187 1598 1336 1629"></td> </tr> <tr> <td data-bbox="451 1629 781 1661">Per household (HH)</td> <td data-bbox="781 1629 943 1661">\$ 1,550</td> <td data-bbox="943 1629 1187 1661"></td> <td data-bbox="1187 1629 1336 1661">\$ 1,057</td> </tr> <tr> <td data-bbox="451 1661 781 1692">Per capita (cap)</td> <td data-bbox="781 1661 943 1692">\$ 310</td> <td data-bbox="943 1661 1187 1692"></td> <td data-bbox="1187 1661 1336 1692">\$ 264</td> </tr> </tbody> </table>	Water Saving Measure	Unit Cost \$	N (Useful life in years)	AEC (\$)	Dual Flush Toilet	\$ 170	7	\$ 32	Showerheads (1 item)	\$ 30	3	\$ 11	Low flow taps (2 items)	\$ 50	3	\$ 19	Efficient washing machine	\$ 600	7	\$ 111	Dishwasher	\$ 700	7	\$ 130	TOTAL				Per household (HH)	\$ 1,550		\$ 1,057	Per capita (cap)	\$ 310		\$ 264
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Constraints	Cost consideration, lack of awareness, resistance to change, lack of incentives																																				

Toilet flushes, usually accounting for one third of the domestic water use on average can deliver reductions up to 50% of the water used. Common options include the replacement of older style single-flush models (14 lt/flush) with low-flush gravity toilets (6 lt/flush), dual-flush valve operated toilets (4 lt/flush), air-assisted pressurized toilets (2 lt/flush). Evidence exists that flush volumes down to 4lt do not cause any problems in the drains and sewers in terms of the waste disposal.

Taps and Showerheads can be adjusted and render saving by installing water saving devices and inexpensive retrofits. Various options are available for retrofitting kitchen and bathroom taps, which are estimated to account for more than 15% of domestic indoor use, with respective savings of 20-30% and less than 2 years paybacks: fitting of new water efficient tap-ware (spray taps, push taps, etc.), low-flow aerators, durable tap washers, flow restrictors and regulators, automatic shutoff. Showerheads are usually gravity fed, electric or pumped (power showers). The average consumption of showers ranges across the households as it depends on many interrelated factors: frequency of use (from 0.75-2.5 showers/day) average shower time duration (2-5 minutes), type of shower, flow rate (6-16 lt/minute), etc. Yet, evidence exists that showers and baths account for 20-35% of the household water consumption and installing water saving devices (flow restricting devices, low-flow showerheads - aerating or laminar-flow, cut-off valves, etc.) can secure around 30-40% water savings. It worth mentioning that the expected savings from the installation of smart water saving devices in taps and showerheads is also highly influenced by the use patterns and habits of the users.

Washing Machines and Dishwashers can be replaced with more efficient ones delivering water and energy savings. Washing of clothes is probably the third largest consumer of domestic water, around 20%. Installing high-efficient washing machines can save up to 40% of the volume need per cycle. Modern washing machines use about 50 lt/cycle or 35 l/cycle for the most efficient ones, as opposed to 150 lt/cycle in the 1990's, due to technological advances (i.e. intelligent sensor systems, advanced and customized washing programmes, improved time functions, etc.). Dishwashers manufactured prior to the year 2000 typically consume 15-50 lt/load, while modern dishwashers consume 7-19 lt/load under normal setting and as low as 8-12 lt/load under the eco-setting, which means average water savings at the range of 40-60%. The share of water use consumed by dishwashers varies from 6-14% as it depends on the cycle time, the frequency of use and their degree of penetration in the households, the latter being influenced by e.g. lack of space, conception that this investment is not necessary due to small load of dishes feasible to be hand-washed, etc.

Water pricing reform usually involves a modification in the rate structure and/or the water tariffs in order to influence the consumers' water use. It often includes the shifting from decreasing block rates to uniform block rates, the shifting from uniform rates to increasing block rates, the increasing of rates during summer months, or the imposing excess-use charges during times of water shortage. This economic instrument needs a very careful design as it can easily raise conflicts among users and trigger many disputes.

Measure ID and Name	PWE_U1: Adjust existing or implement separate stormwater and wastewater drainage systems										
Description	Adjust existing or construct new separate networks for collection of municipal wastewaters (blackwater from toilets, greywater and industrial wastewater) and urban runoff (stormwater) in newly developed residential, commercial and industrial areas.										
Target	BMLWE, MEW, Municipalities										
Activity Breakdown	Act.1: Assessment of existing collection and drainage network Act.2: Stakeholder engagement Act.3: Design of the separate networks Act.4: Construction of separate networks and separation of existing systems Act.5: Operation and maintenance										
Timespan/Timeline	Medium term Once the measure is implemented the expected results/impact will be immediate										
	Activity	Description	Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Year 1	Year 2	Year 3
	1	Assessment of existing collection and drainage network	■	■	■						
	2	Stakeholder engagement			■	■	■	■			
	3	Design of the separate networks				■	■	■			
	4	Construction of separate networks and separation of existing systems							■	■	
	5	Operation and maintenance							■	■	■
Budget breakdown	NA										
Constraints	Financial, existing networks, Stakeholder coordination, lack of awareness, regulatory framework										

Measure ID and Name	PWE_U2: Assessment of potential Artificial Aquifer Recharge for the prevention of seawater intrusion										
Description	There are significant unexploited runoffs during the rainy season. Injecting part of it in the aquifers would have a positive impact on the potential groundwater availability and would reduce seawater intrusion in GRB. AAR has a great potential to increase the renewable resources and ease the water stress in Lebanon.										
Target	BMLWE, MEW, Municipalities										
Activity Breakdown	Act.1: Review and update of feasibility studies Act.2: Data collection and Analysis Act.3: Development of 3D Variable-Density Flow and Solute Transport model Act.4: Expansion of study area Act.5: Data collection and monitoring Act.6: Policy and management recommendation Act.7: Stakeholder collaboration and coordination										
Timespan/Timeline	Medium to Long term Once the measure is implemented the expected results/impact will be immediate										
	Activity	Description	Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Year 1	Year 2	Year 3
	1	Review and update of feasibility studies	■	■							
	2	Data collection and Analysis	■	■	■	■	■	■			
	3	Development of 3D Variable-Density Flow and Solute Transport model				■	■	■	■		
	4	Expansion of study area							■		
	5	Data collection and monitoring				■	■	■	■	■	
	6	Policy and management recommendation							■		
7	Stakeholder collaboration and coordination							■	■	■	
Budget breakdown	CAPEX: 500,000 USD										
Constraints	Water availability, water quality, hydrogeological conditions, regulatory framework, financial, stakeholder engagement, climate change and uncertainty										

Measure ID and Name	PWE_U3: Drinking water protection perimeters							
Description	Detailed demarcation of protection zones around groundwater abstraction points (springs, wells) for water abstraction > 1,000,000m ³ per year							
Target	MEW, BMLWE, Municipalities							
Activity Breakdown	Act.1: Vulnerability and risk assessment Act.2: Demarcation of protection zones Act.3: Development of protection plans Act.4: Enforcement and control Act.5: Awareness-raising							
Timespan/Timeline	Medium term Once the measure is implemented the expected results/impact will be immediate							
	Activity	Description	Month 1	Month 2	Month 3	Month 4	Month 5	Month 6
	1	Vulnerability and risk assessment	■	■	■			
	2	Demarcation of protection zones	■	■				
	3	Development of protection plans		■	■	■		
	4	Enforcement and control			■	■	■	■
	5	Awareness-raising					■	■
Budget breakdown	Internal staff work of MEW Study costs if a relevant study is sub-contracted							
Constraints	Legal and regulatory framework, lack of awareness							

Measure ID and Name	PWE_U4: Municipal Solid Waste Management (SWM)										
Description	In addition to Costa Brava dumpsite, solid waste management in GRB is managed by municipalities and usually in 4 exposed dumpsites located in communal land (e.g., Mashaa land belonging to the monasteries). Some dumpsites accept only municipal solid waste and other accept both MSW and construction and demolition waste.										
Target	Municipalities, BMLWE, MEW, MoE, MoPH, NGOs/CSOs.										
Activity Breakdown	Act.1: Assessment of existing solid waste management practices and infrastructure Act.2: Identification of suitable sites Act.3: Development of solid waste management plan, development of action plans, Act.4: Establishment of collection systems Act.5: Implementation of waste segregation and awareness campaigns Act.6: Procurement and installation of equipment and facilities Act.7: Monitoring and enforcement of waste management regulations Act.8: Closure and rehabilitation of existing dumpsites Act.9: Monitoring and maintenance of new waste management facilities										
Timespan/Timeline	Medium term Once the measure is implemented the expected results/impact will be immediate										
	Activity	Description	Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Sem. 2	Sem. 3	Sem. 4
	1	Assessment of existing SWM practices and infrastructure	■	■	■						
	2	Identification of suitable sites		■	■						
	3	Development of SWM plan		■	■	■	■				
	4	Establishment of collection systems			■	■	■	■			
	5	Implementation of waste segregation and awareness campaigns					■	■			
	6	Procurement and installation of equipment and facilities							■	■	■
	7	Monitoring and enforcement of waste management regulations							■	■	■
	8	Closure and rehabilitation of existing dumpsites							■	■	■
	9	Monitoring and maintenance of new SWM facilities							■	■	■
Budget breakdown	The budget for municipal solid waste management can vary widely depending on the specific needs and circumstances of the municipality, and the range of the budget breakdown provided earlier reflects this variability. The total budget for municipal solid waste management can range from 650,000 USD to 3,000,000 USD excluding the dumpsite construction.										
Constraints	Limited facilities, lack of awareness, institutional and governance challenges, financial.										

Measure ID and Name	PWE_UI1: Wastewater collection and treatment, maintenance of existing WWTP							
Description	Expansion of the BMLWE wastewater collection network. Assessment of the current operational status and capacities of existing Ghadir WWTP and identification of necessary actions for their proper operation.							
Target	Residents, Residential areas, BMLWE							
Activity Breakdown	Act 1: Assessment of the current wastewater infrastructure, networks and WWTP and their operational status. Act 2: Identification and prioritization of necessary actions Act 3: Design of new collection networks and WWTP Act 4: Rehabilitation and expansion of existing collection networks and construction of WWTP as cited in Error! Reference source not found..							
Timespan/Timeline	Medium term. Once the measure is implemented the expected results/impact will be immediate.							
	Activity	Description	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
	1	Assessment of the current wastewater infrastructure, networks and Ghadir WWTP and their operational status.						
	2	Identification and prioritization of necessary actions						
	3	Design of necessary collection networks						
	4	Rehabilitation and expansion of existing collection networks and WWTPs						
Budget breakdown	According to the Updated NWSS 2020, the CAPEX of the wastewater projects in the BMLWE District of Baabda Aley within GRB amount to 47 million USD. The OPEX of Ghadir WWTP is estimated to 385,000 USD.							
Constraints	Financial, political resistance, operation and maintenance, lack of awareness							

Measure ID and Name	PWE_UI2: Drafting/Updating of BMLWE Wastewater Masterplan																																																																																																			
Description	Drafting/updating of the BMLWE Wastewater Collection and Treatment Masterplan to meet future needs in the medium and long term																																																																																																			
Target	BMLWEs, MEW, municipalities, and private operators																																																																																																			
Activity Breakdown	<p>The activity breakdown for drafting/updating the BMLWE Wastewater Collection and Treatment Masterplan:</p> <p>Act. 1: Data collection and analysis Act. 2: Technical and financial feasibility studies Act. 3: Stakeholder consultations Act. 4: Development of wastewater treatment options Act. 5: Development of wastewater collection options Act. 6: Cost-benefit analysis Act. 7: Drafting of the wastewater masterplan Act. 8: Review and approval process</p>																																																																																																			
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Budget breakdown	<p>Internal staff resources of BMLWE Subcontracting costs if the study needs to be supported by external consultants. In the NWSS, the adoption of a shared wastewater management framework is planned with goals to address the issue of the organization responsible for managing the WW network and treatment plants (WEs, municipalities, private operators) and determine the financing method (estimated cost 250,000\$ for all Lebanese territory)</p>																																																																																																			
Constraints	Financial, stakeholder engagement, regulatory framework, lack of will,																																																																																																			

5.2.2 Other Environmental and Regulatory and mixed measures

Measure ID and Name	ERS_M1: Regulating water tariffs, achieving cost recovery										
Description	Water pricing reform usually involves a modification in the rate structure and/or the water tariffs in order to influence the consumers' water use. This economic instrument needs a very careful design as it can easily raise conflicts among users and trigger many disputes. It also must be noted that there is always a price elasticity that needs to be considered, and that beyond a certain threshold any further increase in water price might not bring any further decrease in the water consumption.										
Target	BMLWE, MEW, NGOs, CSOs/ Municipalities										
Activity Breakdown	Act.1: Tariff analysis Act.2: Cost assessment Act.3: Stakeholder consultation Act.4: Regulatory framework Act.5: Tariff setting and tariff approval process Act.6: Public awareness and communication										
Timespan/Timeline	Medium term. Once the measure is implemented the expected results/impact will be immediate										
	Activity	Description	Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Month 7	Month 8	Month 9
	1	Tariff analysis	■	■	■						
	2	Cost assessment		■	■						
	3	Stakeholder consultation			■	■					
	4	Regulatory framework					■				
	5	Tariff setting and tariff approval process						■	■	■	■
	6	Public awareness and communication							■	■	■
Budget breakdown	Also, a water pricing elasticity study to establish fair and equitable water tariffs, which also achieved costs recovery, is necessary, which has some associated cost if additional experts, outside the BMLWE staff, are used										
Constraints	Political resistance, Socio-economic, Lack of awareness, administrative and institutional capacity, technical and financial, Legal and regulatory framework										

Measure ID and Name	ERS_M2: Monitoring and control of illegal abstractions and private wells, and definition of safe yield per groundwater body										
Description	Illegal abstractions from groundwater cause drawdown of the aquifer and sea intrusion, while jeopardize the safe yield. The measure includes: field surveys to register all illegal abstractions, measures to control these abstractions, as well as the installation of water meters in private wells for subsequent monitoring of the abstracted volumes. Creation and operation of a single registry of licensed water wells from the water permitting process, shared among the relevant authority. Definition/ update of groundwater safe yield for each groundwater body. Additionally, the requirements (regulatory framework) for granting permits for new wells need to be revised in view of the groundwater sustainability.										
Target	Municipalities, BMLWE, MEW, CSO, NGOs										
Activity Breakdown	Act.1: Review and update existing legislation and regulations Act.2: Capacity Building and Training Act.3: Illegal Abstraction Identification and Mapping Act.4: Awareness and outreach Act.5: Stakeholder Engagement and Collaboration Act.6: Enforcement and compliance Act.7: Regular monitoring and reporting										
Timespan/Timeline	Medium term. Once the measure is implemented the expected results/impact will be immediate										
	Activity	Description	Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Month 7	Month 8	Month 9
	1	Review and update existing legislation and regulations	■	■							
	2	Capacity Building and Training		■	■						
	3	Illegal Abstraction Identification and Mapping			■	■					
	4	Awareness and outreach			■	■	■				
	5	Stakeholder Engagement and Collaboration			■	■	■	■	■	■	■
	6	Enforcement and compliance							■	■	■
	7	Regular monitoring and reporting							■	■	■
Budget breakdown	Internal costs of the BMLWE. Additional staff (inspectors) is required										
Constraints	Lack of legal framework, lack of coordination between stakeholders, Political and administrative challenges, Informal practices and resistance, Lack of awareness,										

Measure ID and Name	PWE_E1: Flood protection and mitigation (Ghadir flood control, CDR 2014)							
Description	This measure aims to minimize the impacts of flooding on communities and ecosystems through a combination of proactive planning, infrastructure development, community engagement, and sustainable practices. Implementation of the CDR study including check dams, river bed protection and channelling, etc. Also, the implementation of Early Warning Systems (EWS)							
Target	Municipalities, BMLWE, MEW, CSOs, NGOs							
Activity Breakdown	Act.1: Flood risk assessment Act.2: Infrastructure design (check dams, etc.) Act.3: Riverbed adjustment and expropriations Act.4: Infrastructure construction Act.5: Establish Monitoring and Early Warning Systems Act.6: Awareness campaigns Act.7: Stakeholder engagement							
Timespan/Timeline	Medium term. Once the measure is implemented the expected results/impact will be immediate							
			Sem. 1	Sem. 2	Sem. 3	Sem. 4	Sem. 5	Sem. 6
	1	Flood risk assessment	█	█				
	2	Infrastructure design		█	█			
	3	Riverbed adjustment and expropriations			█	█		
	4	Infrastructure construction			█	█	█	█
	5	Establish Monitoring and Early Warning Systems			█	█	█	
	6	Awareness campaigns			█	█		
	7	Stakeholder engagement			█	█	█	█
Budget breakdown	CAPEX: Ghadir river flood control study (CDR) Option 1: 61.1 Million USD Option 2: 20.4 Million USD							
Constraints	Urbanization and illegal construction, Financial, poor stormwater management, , Poor solid waste management, climate change, lack of awareness;							

Measure ID and Name	PWE_E2: Quantitative and qualitative water resources monitoring programme, Meteorological and Hydrometric network expansion and improvement							
Description	Procurement, purchase and installation of a monitoring network to monitor the quantitative status of surface and groundwater bodies, as well as their water quality. Operation and maintenance of the network, and entry of all collected data into a water database to be shared among the relevant stakeholders. Implementation of the IHIS proposed in the Updated NWSS 2020							
Target	MEW, BMLWE, LRA, LARI, Municipalities, NGOs/CSOs, Universities							
Activity Breakdown	Act.1: Assessment study of the current situation of the hydrometric, climatic and water quality monitoring and stations Act.2: Planning and design for the expansion and improvement of the monitoring networks Act.3: Procurement Act.4: Installation of the monitoring equipment and software Act.5: Training of the staff for the monitoring and operation of the network Act.6: Data Collection Act.7: Analysis and Reporting Act.8: Operation and Maintenance							
Timespan/Timeline	Medium term. Once the measure is implemented the expected results/impact will be immediate							
			Sem. 1	Sem. 2	Sem. 3	Sem. 4	Sem. 5	Sem. 6
	Activity	Description						
	1	Assessment study	■	■				
	2	Planning and design		■	■			
	3	Procurement			■			
	4	Installation of the monitoring equipment and software				■	■	■
	5	Training of the staff			■	■		
	6	Data Collection			■	■	■	■
	7	Analysis and Reporting			■	■	■	■
8	Operation and Maintenance			■	■	■	■	
Budget breakdown	CAPEX MH A. Meteorological and Hydrometric network expansions and improvements: 6,066,400 \$ MH-B. Integrated Hydrological Information System 9,548,400 \$							
Constraints	Financial crisis, lack of awareness, priority,							

Measure ID and Name	PWE_E3: Increase the frequency and effectiveness of river bed cleaning activities										
Description	Increasing the frequency and effectiveness of river bed cleaning activities involves regular and systematic cleaning of the river bed to remove accumulated sediment, debris, and pollutants. It aims to maintain and restore the natural flow capacity of the river, improve water quality, and reduce the risk of flooding.										
Target	MoE, MEW, Municipalities, CSO, NGOs.										
Activity Breakdown	Act.1: Assessment and planning Act.2: Contracting cleaning activities Act.3: Setting the cleaning operation schedule Act.4: Cleaning activities and operation Act.5: Monitoring and evaluation Act.6: Stakeholder engagement										
Timespan/Timeline	Short term. Once the measure is implemented the expected results/impact will be immediate										
			Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Month 7	Month 8	Month 9
	1	Assessment and planning									
	2	Contracting cleaning activities									
	3	Setting the cleaning operation schedule									
	4	Cleaning activities and operation									
	5	Monitoring and evaluation									
	6	Stakeholder engagement									
Budget breakdown	-										
Constraints	Financial, Regular and legal framework, Accessibility and logistics, Lack of awareness;										

Measure ID and Name	PWE_E4: Register of all pollution sources, estimation of pollution loads, assessment of significant pressures, and control of illegal dumping activities							
Description	Many illegal wastewater outfalls exist within ARB. (i.e. direct disposal of untreated domestic sewage into the river). A first step is to identify and map all these outlets, and then to ban and control illegal wastewater discharges. Similarly, uncontrolled waste dumping occurs in ARB. It is thus also relevant to identify and map all these uncontrolled sites, and then to ban and control illegal waste dumping.							
Target	MoE, MEW, Municipalities, CSO, NGOs.							
Activity Breakdown	Act.1: Mapping and recording of all wastewater outfalls (Licensed and illegal) and waste dumping sites (legal and uncontrolled) Act.2: Estimation of all pollution loads, from point sources and agricultural Act.3: Analysis of the discharged wastewater characteristics, including chemical and biological analysis Act. 4: Monitoring and control of wastewater discharge into the river/ fields Act. 5: Updating and reviewing of the relevant permits for waste disposal Act. 6: Monitoring and control of waste dumping into the river/ landscape.							
Timespan/Timeline	Medium term. Once the measure is implemented the expected results/impact will be immediate							
	Activity	Description	Month 1	Month 2	Month 3	Month 4	Month 5	Month 6
	1	Mapping and recording						
	2	Estimation of all pollution loads						
	3	Analysis of the discharged wastewater						
	4	Monitoring and control of wastewater discharge						
	5	Updating and reviewing of the relevant permits						
	6	Monitoring and control of waste dumping						
Budget breakdown	NA							
Constraints	Lack of awareness;							

Measure ID and Name	PAR_M1: Development of Ghadir River Basin Coordination Committee							
Description	Define the modalities, roles and operational framework for the formation of a ARB committee, charged with safeguarding the water resources and the environment							
Target	Municipalities, BMLWE, MEW, MoE, MoA, MoPH, NGOs/CSOs:							
Activity Breakdown	-							
Timespan/Timeline	Short - Medium term. Once the measure is implemented the expected results/impact will be immediate							
Budget breakdown	NA							
Constraints	Legislation and regulatory framework, lack of engagement, lack of awareness,							

Measure ID and Name	PAR_M2: Strengthen the capacity and financial resources of local municipalities to effectively manage and address environmental issues in the basin.
Description	Promote water conservation, educate people on water use efficiency, raise awareness on the impacts of illegal abstraction and over-abstraction, raise awareness on the impact of illegal wastewater discharge and waste dumping, sensitize people to act in favor of the river, build sense responsibility and ownership. Includes: awareness campaigns, outreach activities to the community
Target	BMLWE, Municipalities, NGOs/CSOs
Activity Breakdown	-
Timespan/Timeline	Medium term. Once the measure is implemented the expected results/impact will be immediate
Budget breakdown	Human resources and staff of the involved parties
Constraints	Limited data, lack of awareness, limited engagement, lack of coordination, socio economic conditions, resistance to change,

Measure ID and Name	PAR_M3: Raising awareness and sensitizing the community on the water resources and environmental related issues in Al Assi
Description	Promote water conservation, educate people on water use efficiency, raise awareness on the impacts of illegal abstraction and over-abstraction, raise awareness on the impact of illegal wastewater discharge and waste dumping, sensitize people to act in favor of the river, build sense responsibility and ownership. Includes: awareness campaigns, outreach activities to the community
Target	BMLWE, Municipalities, NGOs/CSOs
Activity Breakdown	NA
Timespan/Timeline	Medium term. Once the measure is implemented the expected results/impact will be immediate
Budget breakdown	Human resources and staff of the involved parties
Constraints	Limited data, lack of awareness, limited engagement, lack of coordination, socio economic conditions, resistance to change,

Measure ID and Name	PAR_M4: Strengthen environmental program actions in primary education
Description	Educate the youth on water conservation, the impacts of illegal abstraction and over-abstraction, the impacts of illegal wastewater discharge and waste dumping, Includes: education programmes in schools, students as "gradients" of GRB future
Target	NGOs/CSOs, Local Universities, Municipalities,
Activity Breakdown	-
Timespan/Timeline	Medium term. Once the measure is implemented the expected results/impact will be immediate
Budget breakdown	NA
Constraints	Limited curriculum integration, teaching material, institutional support, funding, social and cultural factors,

Measure ID and Name	DEV_M1: Capacity building activities
Description	Capacity building mainly for the staff on the BMLWE and the technical staff of the municipalities
Target	BMLWE, MEW, NGOs/CSOs,
Activity Breakdown	-
Timespan/Timeline	Medium term. Once the measure is implemented the expected results/impact will be immediate
Budget breakdown	NA
Constraints	Funding, community engagement, lack of awareness;

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5.3 Programme of Measures

Table 3 Programme of Measures for GRB

Measure ID	Name of the Measure	Category	Sector
Measures linked to the target “Increase water use efficiency and water supply reliability” (ERS)”			
ERS_U1	Actions to modernize the operation of water supply networks and improve water efficiency	Infrastructure	Urban
ERS_U2	Greater Beirut Water Supply Augmentation Project (GBWSAP)	Infrastructure	Urban
ERS_U3	Water metering and subscription to BMLWE,	Infrastructure	Urban
ERS_U4	Drafting / Updating of the BMLWE Water Supply Masterplan	Regulatory	Urban
ERS_M1	Regulating water tariffs, achieving cost recovery	Regulatory	Mix
ERS_M2	Monitoring and control of illegal abstractions and private wells, and definition of safe yield per groundwater body	Regulatory	Mix
Measures linked to the target “Promote Water Conservation (PCO)”			
WCO_U1	Water saving in households and buildings (public, commercial)	Infrastructure	Urban
Measures linked to the target “Protection of the Water resources and the Environment (PWE)”			
PWE_U1	Adjust existing / Implement separate stormwater and wastewater drainage systems to prevent intermixing.	Infrastructure	Urban
PWE_U2	Assessment of potential Artificial Aquifer Recharge for the prevention of seawater intrusion	Infrastructure	Urban
PWE_U3	Drinking water protection perimeters	Regulatory	Urban
PWE_U4	Municipal solid waste management	Regulatory	Urban
PWE_E1	Flood protection and mitigation (Ghadir flood control, CDR 2014)	Infrastructure	Environment
PWE_E2	Quantitative and qualitative water resources monitoring programme, Meteorological and Hydrometric network expansions and improvement	Infrastructure	Environment
PWE_E3	Increase the frequency and effectiveness of riverbed cleaning activities	Infrastructure	Environment
PWE_E4	Register of all pollution sources, estimation of pollution loads, assessment of significant pressures, and control of illegal dumping activities	Regulatory	Environment
PWE_UI1	Wastewater collection and treatment, maintenance of existing WWTP	Infrastructure	Urban, Industry
PWE_UI2	Drafting/Updating of BMLWE Wastewater Masterplan	Regulatory	Urban, Industry
Measures linked to the target “Participatory Water Management (PAR)”			
PAR_M1	Development of Ghadir River Basin Coordination Committee	Regulatory	Mix
PAR_M2	Strengthen the capacity and financial resources of local municipalities to effectively manage and address environmental issues in the basin.	Regulatory	Mix
PAR_M3	Raising awareness and sensitizing the community on the water resources and environmental related issues in Ghadir	Education	Mix
PAR_M4	Strengthen environmental program actions in primary education	Education	Mix
Measures linked to the target “Socio-Economic Development (DEV)”			
DEV_M1	Capacity building activities	Education	Mix