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LITANI RIVER BASIN MANAGEMENT SUPPORT PROGRAM

CONSTRUCTION OF MACHGHARA PLAIN IRRIGATION PIPE-DESIGN REPORT

April 2010
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LITANI RIVER BASIN MANAGEMENT SUPPORT PROGRAM

CONSTRUCTION OF MACHGHARA PLAIN IRRIGATION PIPE-DESIGN REPORT (APRIL 2010)

Contract No.: EPP-I-00-04-00024-00 order no 7.

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DISCLAIMER
The author's views expressed in this publication do not necessarily reflect the views of the United States Agency for International Development or the United States Government

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EXECUTIVE SUMMARY

The objective of the present report is to propose a structure to provide irrigation water to the upper Machghara plain during peak demand (summer) and to design the proposed structure. The construction of this structure aims to provide an alternative irrigation solution for the Machghara Plain farmers to replace the current unhealthy practice of using raw sewage.

A pipeline is proposed as conveying structure, to take water from the head of Canal 900 and bring it across the valley (at the foot of Qaraoun Dam) to Machghara. The proposed alignment was defined in collaboration with LRA and the Municipality of Machghara. Both approved the position of the pipeline. Several diameters and types of materials were considered to convey a minimal discharge of 10 l/s in a sustainable manner.

The proposed design was approved by both LRA and Municipality of Machghara:

- The pipe external diameter is OD180
- The pipe length is around 4 km.
- The pipe material is HDPE.
- The updated program of works for design, construction contract award and the construction of this pipeline is included in Appendix D.

The LRA also confirmed that the pipe alignment is within lands not requiring expropriations (Refer to Appendix C).

The project consultant will:

- Prepare the bidding documents and follow up the contract award.
- Supervise the Construction works and follow up the handing over of the pipeline to the LRA.

الملخص التنفيذي

الهد ف من هذا التقرير هو اقتراح مشروع تامين مياه الري للمنطقة العليا من سهل مشغرة في الذروة للطلب على المياه (الصيف) و تخطيط و درس المشروع المذ كور. و الغاية من اقامة المشروع هذا هو تامين حل بديل للري لمزارعي سهل مشغرة للأ ستغناء عن الممارسات الحالية غير الصحية التي تستعمل مياه الصرف الصحي غير المعالجة و قد جرى اقتراح خط من القساطل كوسيلة لجر المياه من راس القناة 900 ومدة عبر الوادي (اسفل سد القرعوي) الى مشغرة. كما تم اقتراح التخطيط لمسار الخط بالتعاون مع المصلحة الوطنية لنهر الليطاني و البلدية في مشغرة اللذين وافقا على المسار المذكور. وقد تم الأخذ بعين الأعتبار عدد من انواع القساطل و اقطا رها لجر تصريف ادنى قدره عشر ليترات بالثانية (10) بشكل مستدام.

و قد وافق على الدراسة النهائية كل من المصلحة الوطنية لنهر الليطاني و المجلس البلدي في مشغرة وفق ما يلي :

قطر القسطل الخارجي يساوي 180 كلم

يبلغ طول الخط 4 كلم تقريبا

اعتمدت في نوعية القساطل ما يلي: بولي اثيبلين ذي النقل النوعي العالي

وقد وضع وتم تحديث دراسة الأشغال و عقد التكريم ومد خط القساطل وفق الملحق (د) المرفق

كما اكدت المصلحة الوطنية لنهر الليطاني ان مسار خط القساطل يقع ضمن اراض لا تتطلب اي استملاك (يراجع الملحق س المرفق) و يقوم المكتب الأستشاري المكلف بالمشروع بما يلي:

تحضير دفتر الشروط و متابعة مراحل التلزيم حتى ارساء الألتزام

الأشراف على اعمال التنفيذ و متابعة الأشغال حتى تسليم خط القساطل نهائيا الى المصلحة الوطنية لنهر الليطاني.

1. INTRODUCTION

1.1. GENERAL DESCRIPTION OF THE PROJECT

The purpose of the LRBMS project is to set the ground for improved, more efficient and sustainable basin management at the Litani river basin through provision of technical support to the Litani River Authority and implementation of limited small scale infrastructure activities.

The project is composed of the following components:

- C.2.1: Building Capacity of the Litani River Authority (LRA) towards Integrated River Basin Management
- C.2.2: Long Term Water Quality Monitoring of the Upper Litani River
- C.2.3: Integrated Irrigation Management
    - C.2.3.a: Participatory Agriculture Extension Program (PAEP)
    - C.2.3.b: Machghara Plain Irrigation Plan
- C.2.4: Improving Litani River and Qaroun Dam Monitoring Systems:
    - C.2.4.a: Qaraoun Dam Monitoring System
    - C.2.4.b: Litani River Flood Management Model

1.2. PRESENT STUDY: MACHGHARA PLAIN IRRIGATION PLAN

Serving the overall objective of improved water quality and more efficient water distribution, the component C.2.3.b activity aims at providing an alternative proper irrigation solution for the Machghara Plain farmers to replace the environmentally unaccepted current practice of using raw sewage for irrigation.

The idea is to provide supplemental irrigation water during the summer peak demand (June-July-August), in replacement of the sewage water diverted by farmers. The solution consists of dragging water by gravity from the nearby Canal 900 supply pipe.

1.3. REPORT OBJECTIVES

The objective of the actual report is to perform an assessment of the Machghara plain water demand and to conduct the design of the proposed transmission line. The following points will be covered in this report:

- Determination of the required daily water requirement taking into account the financial limitations of the project.
- Design for the pipe construction and design criteria.

Tender documents and tender drawings are presented in separate documents.

1.4. PROJECT AREA

The area concerned by this study is the Machghara plain which is located 2 km away from the Qaraoun Lake towards the Litani river lower basin.

According to the Municipality of Machghara, the following information about the village and the plain were retrieved:

Total Population of Machghara:	25,000
Total permanent citizens:	7,500
Total area of Machghara plain:	651 ha
Permanent irrigated area:	320 ha
Seasonal irrigated area:	180 ha

1.5. RESULTS OF THE ASSESSEMENT AND DESIGN

1.5.1. ALIGNMENT

The proposed alignment of the pipe was defined by the LRA Engineer taking into consideration the following criteria:

1. The pipe should extend between the existing intake structure on the canal 900 consisting of an intake pipe and valve of 6" diameter (refer to Appendix B – Photo 1) and the beginning of the existing concrete canal of Machghara plain (refer to Appendix B – Photo 14).
2. The pipe alignment will be located within lands owned by public authorities: dam foot print, public roads, irrigation channels, unused tunnel,…
3. The pipe alignment will be located in order to minimize the execution works such as: demolition, excavation, retaining structures,…

Therefore a major part of the alignment was defined inside concrete channels and tunnel where the pipe will be installed without major earth works.

Therefore, the chosen alignment could he described briefly as follows (refer to figure 4.1 and figure 4.2):

- Reach 1: between intake structure and Litani River in earth roads or off-roads with high slopes.
- Reach 2: between litani River and the entry of the existing (110cm x 80cm) irrigation

channel in earth or paved roads with moderate slopes.

- Reach 3: Inside the existing (110cm x 80cm) irrigation channel.
- Reach 4: Inside the existing tunnel (150cm diameter).
- Reach 5: between the tunnel exit and the downstream discharge structure under an existing concrete channel (40cm x 40cm), in earth road and behind a bridge passing the Machghara spring water course.

1.5.2. PIPE FLOW

As defined by the project scope of works, the pipe will provide water that will replace the wastewater diverted by farmers for irrigation purposes. The following information was collected in order to estimate the required pipe flow:

- Machghara Municipality letter to LRA: where a flow of 10 l/s was required (refer to Appendix A).
- Capacity of Machghara WWTP which is around 1500m^3/d equivalent to an average flow of 17 l/sec taking into account that not the totality of sewer water is used for irrigation.
- The total capacity of the existing irrigation channel for Machghara plain which is around 250 l/sec and the water needs of the Machghara cultivated plain (320 ha) which could be even more. But, it should be taken into consideration that:
  - ★ Most of irrigation water needs are satisfied by diversion from the Nahr el Cheta stream and from local springs;
  - ★ Providing the entire Machghara plain with reliable irrigation water from the Qaraoun Dam is being studied separately by the Litani River Authority and could not be considered budget-wise by the LRBMS program;
  - ★ The scope of the LRBMS program very specifically focuses on simply replacing the sewage diversion by a better alternative.

Therefore, the required flow to be transported by the new pipe is estimated between 10 and 20 l/sec.

1.5.3. PIPE MATERIAL

The proposed pipe will be pressurized and the possible materials for such kind of flows are GRP, Ductile Iron, Steel, and Polyethylene.

To select the most adequate material, the following criteria should be taken into consideration:

- The project SOW and the LRA demand to construct the pipe as soon as possible,
- The locally manufactured and approved pipes
- The pipe diameter (110mm to 225mm)
- The pipe cost limitation
- The hydraulic performance

In regard of the above the HDPE seems to be the most adequate for this pipe.

1.5.4. PIPE DIAMETER

Based on the required flow and the constraint of the allocated budget the pipe, the OD180 mm pipe seems to be the most adequate diameter for this project component.

1.5.5. NEXT STEPS

In light of this assessment and design, the following next steps are expected prior to the commencement of the execution works:

- The LRA is kindly required to:
    - Take all necessary administrative procedures allowing the construction works.
- The project consultant is required to:
    - Prepare the bidding documents.
    - Appoint a suitable contractor for this job.
    - Follow up the construction contract award.
    - Supervise the Construction works and follow up the handing over of the pipeline to the LRA.

The updated program of works for design, construction contract award and the construction of this pipeline is presented in the next page.

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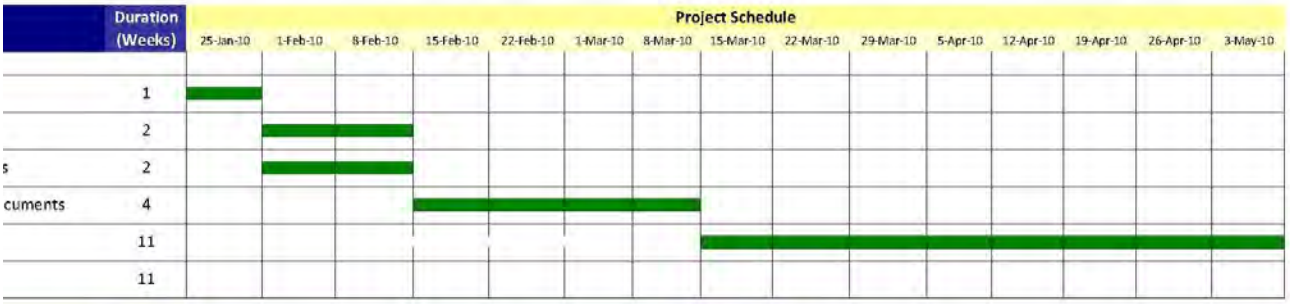

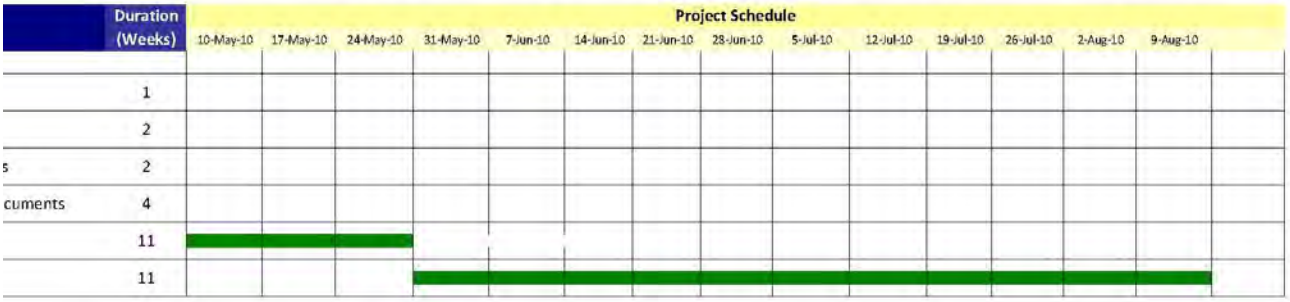

2. DESIGN DATA

2.1. ASSESSMENT

In order to determine the design flow and the pipe alignment, several meetings and site visits were undertaken by Dar Al Handasah Nazih Taleb Site Engineer Mr Rabih Darwich:

- Meeting with the General Director of Litani River Authority Mr Ali Abboud in the presence of Mr Eric Viala (IRG) in which he requested an additional function for the line i.e. the filling of the DN2000 existing pumping line at the beginning of each summer season. Mr Abboud also designated Engineer Mahmoud Ibrahim from the Bekaa office of the LRA as a reference for information concerning the design flow and the pipe alignment.
- Meeting with Municipality of Machghara Engineer Mr Abdallah Hadla in the presence of Mr Eric Viala (15/12/2009). In this meeting, additional information concerning the flow and alignment of the pipe were collected. Engineer Hadla showed the alignment and suggested a 6" diameter pipe. Concerning the flow, he pointed on the fact that the irrigation needs are high and should be calculated to fulfill the requirements of an area of approximately 300ha but the minimum requested flow should be equal to the quantity of waste water lost after the construction of Aitanit Waste Water Treatment.
- Site visit with Mr Mahmoud Ibrahim and DAHNT Topographer in which Mr Ibrahim designated the suggested alignment of the pipeline in order to run only though land owned by the LRA.
- Phone conversation with Mr Raed Ghantous representative of the Consultant CDM supervising the work on the WWTP. The representative indicated that the capacity of the treatment plant is 1500 m^3/d and that part of this quantity was derived from regions other than Machghara village.

2.2. ACTUAL SOURCES OF IRRIGATION WATER

Due to uncompleted Litani irrigation schemes, the Machghara Plain is not provided with water for irrigation from the Qaraoun Dam. According to the Machghara municipality, the primary water resources for irrigation are the local springs (Refer to appendix A).

The water quantities provided from these springs is not sufficient especially during the dry season and therefore farmers find themselves obliged to tap into a number of manholes on the sewer that collects

the domestic sewer of Machghara and discharge it into the Litani lower basin bed which is normally dry being on the lower dry end of the Qaraoun dam.

Under the Small Villages Wastewater Treatment Systems project (SVWTS), USAID has completed and commissioned the Aitanit Waste Water Treatment plant located between the Qaraoun dam and Machghara plain. This plant currently receives and treats the sewage collected from Machghara as described above and therefore the backup quantity of irrigation water is no longer provided.

2.3. DETRMINATION OF DESIGN FLOW

In order to determine the design flow of the transmission line, several points and restrictions were taken into consideration:

- The flow should at least compensate the deficit due to the non availability of waste water for irrigation.
- The flow should take into consideration the municipality and farmers' demands.
- The flow should not exceed the capacity of the receiving structures.

2.3.1. COMPENSATION OF WASTE WATER FLOWS

Taking into account the permanent number of citizens in Machghara of 7,500 and a waste water release estimate of 120 l/capita/d (from WWTP design study), the corresponding flow is around **10 l/s** (Refer to Appendix A).

Taking into account the capacity of the WWTP (1500 m3/d) and that a part of this flow is not derived from Machghara village, the corresponding flow is less than **17 l/s**.

2.3.2. FARMERS AND MUNICIPALITY DEMANDS

Several meetings were held in the presence of representatives of the farmers and the municipality. The conclusion of those meetings is that the limit of water demand for Machghara plain is the total demand for approximately 320 ha of agricultural lands. This flow cannot be insured by the structures to be installed in the scope of work of this project.

2.3.3. CAPACITY OF RECEIVING STRUCTURES

The transmission line that will be installed will connect the Canal 900 upstream structure to a 50 x 60 cm irrigation canal at the right bank of Litani river downstream Qaraoun Dam. For a slope of 0.5%, the capacity of such canal is around **250 l/s**.

2.3.4. ADOPTED FLOW

In reference to the above, and taking into consideration the Terms Of Reference of this project which addressed mainly to the replacement of the sewage flow by clean water for irrigation, the flow of **17 l/sec** will be adopted for the design of Machghara pipeline.

3. DESIGN CRITERIA

3.1. HYDRAULIC ANALYSIS OF TRANSMISSION LINE

Computer simulation of the hydraulics of the transmission line will be conducted using EPANet in addition to internally developed software.

The following basic information was established in order to undertake the hydraulic model:

- Water supply source (Canal 900)
- Water demands calculation along the transmission line
- Proposed ground level for all nodes of the transmission line
- Pipes characteristics (diameter, length, roughness coefficient)
- All ancillaries in the network

Typical results of the computer model include anticipated flow quantities and direction, flow velocity in each pipe, the head losses due to friction and the calculated residual pressure at all nodes of the system. Pipe sizing procedures rely mainly on typical or limiting water velocities or allowable pressure drop. Linear headloss in pipelines is generally calculated using one of the three major formulas, Hazen – Williams Equation, Darcy – Weisbach Equation or Manning Equation. Hazen – Williams Equation is the most commonly used due to its simplicity and efficiency, therefore it will be considered for the current project

$$Hf = 10.68 (Q/C) 1.85 \times L \times l/D 4.87$$

Where:

Hf = Friction head loss	m
Q = Discharge	m3 /sec
C = Roughness coefficient.	
L = Pipe length	m
D = Pipe diameter	m

Roughness coefficient "C" in Hazen – Williams Equation for polyethylene pipes is considered equal to 150.

Linear head loss calculation for all pipelines will be done automatically using EPANet software.

The pressure loss in fittings and accessories is estimated between 10% and 15% of the linear head loss calculated using Hazen – Williams Equation. As a result, the total head loss in the system will be the sum of the linear head loss and the pressure loss in fittings and accessories.

3.2. MINIMUM AND MAXIMUM VELOCITY ON PIPE

For best exploited pipeline system water velocities in pipes should not be too low nor too high but limited between the values shown below for distribution lines:

- 0.3 m/s and 1.2 m/s for diameters ≤ 6 inches
- 0.4 m/s and 1.5 m/s for diameters ranging from 8 inches to 10 inches

Low velocities facilitate the accumulation of fine particles in the pipelines, thus delaying the purge out process, also low velocities lead to an over-sized and not cost-effective pipes system.

On the other hand, high velocities speed up the erosion of the interior pipe lining, generate noise, cause high head loss and most important amplify the magnitude of the water hammer.

3.3. MINIMUM PRESSURE

A minimum residual pressure of 0.5 bars shall be maintained at any point in the irrigation transmission line.
The pipe design pressures versus the pressure head used for the distribution lines are summarized in the following table:

Pressure (Bars)	Factor of Safety	Head (m)	Test Pressure (Bars)
PN10	1.5	< 65	12.5
PN16	1.4	65 – 115	20

3.4. PROFILES

Pipelines profiles should be as straight as possible avoiding all localized high and low points. Horizontal profiles are not accepted, the minimum slope should be 0.3% to allow for air to be purged out and for fine particles to be flushed out.
Washout valves are installed at low points and air-release valves are installed at high points and also at the highest point of each steep slope.

3.5. PIPE COVER

Pipe cover depending on the pipe diameter is as follows:

- DN80 mm ≤ D < DN200mm : Minimum Pipe cover 800 mm
- DN200 mm ≤ D < DN250mm : Minimum Pipe cover 1000 mm

In places where this cover cannot he insured, concrete encasement is to be provided.

3.6. PIPE MATERIAL

Recommended pipe material used on this project will be HDPE. The table below shows the values used for inside diameter in the calculation.

Nominal Outside Diameter OD in mm	Nominal Inside Diameter ID in mm
180	145.4

3.7. VALVES

Isolation valves

two valves will be installed within a valve chamber. The two valves will be of the flanged type complete with dismantling couplings. They will be installed at the lowest point of the transmission line in order to isolate the part situated at the left bank and to use it for the filling of the 2000 mm pumping line at the beginning of the summer season.

Regulating Valve and Discharge Structure

One valve will be installed within a valve chamber. The valve is of the flanged type complete with dismantling couplings. It will be installed at the end of the line at the entry of the downstream intake structure. Downstream this valve a dissipation structure will be provided allowing the pressurized flow passage to surface flow.

Air valves

Air valves will be installed at high points along the transmission line, to provide the following:

- Ventilation during filling and draining of the pipeline
- Release of accumulated small quantities of air at high points of pipeline.
- Protection to the pipeline from vacuum pressures caused by surge conditions or a pipe breakage.

Washout Valves

Washout valves will be located at low points of transmission line to cater for cleaning, flushing, etc, prior to commissioning and for periodic flushing of accumulated sediments.

4. DESIGN RESULTS

4.1. ALIGNMENT

The alignment of the transmission line was discussed and decided in collaboration and under the instructions of the Litani River Authority and local authorities.

The transmission line will originate from an existing 6" Valve located at the upstream structure of the Canal 900. This valve, in addition to a water meter and an air valve will be installed inside an Intake structure.

The pipe will then run along the DN 2000 pumping line arriving to the Canal 900 and after that along an earth road until reaching the Litani water course level downstream the Qaraoun Lake.

At the lowest level near the Litani water course, a valve chamber will be installed in order to connect the pipe to a mobile pump allowing the filling of the DN 2000 pumping line at the beginning of the summer season.

At the right bank of Litani River, the transmission line will run along and near the access roads to the dam before entering an existing and non functional 110cm x 80cm channel and then inside an existing and non functional 150cm diameter tunnel before passing under another 40cm x 40cm existing channel and then along a winter water course before entering the receiving channel in the mean of the outlet structure.

The pipe alignment is shown in drawings:

- LO924\AL-100: ALIGNMENT GENERAL PLAN VIEW
- LO924\AL-101: ALIGNMENT PLAN VIEW (1/2)
- LO924\AL-101: ALIGNMENT PLAN VIEW (2/2)

The details of the intake structure are shown in the drawing:

- LO924\In-401: INTAKE STRUCTURE PLAN VIEW AND SECTIONS

The details of the outlet structure are shown in the drawing:

- LO924\Ou-401: INTAKE STRUCTURE PLAN VIEW AND SECTIONS

The details of the valve chamber in addition to air valves and washouts valves chambers are shown in the drawing:

- LO924\Ch-401: CHAMBERS WASHOUT VALVES, AIR-RELEASE VALVES & VALVE CHAMBER

4.2. PROTECTION OF THE PIPE AND FITTINGS

The types of protection works for the pipes are illustrated in the profiles drawings and typical drawings:

- LO924\AL-201: ALIGNMENT PROFILE (1/3)
- LO924\AL-201: ALIGNMENT PROFILE (2/3)
- LO924\AL-201: ALIGNMENT PROFILE (3/3)
- LO924\SDTD-Tr401: TRENCHES TYPICAL SECTIONS

Typical details of manholes, retaining walls and thrust blocks are shown in the following drawings:

- LO924\MH-401: MANHOLES (1/2) PLAN VIEWS & TYPICAL SECTIONS
- LO924\MH-401: MANHOLES (2/2) PLAN VIEWS & TYPICAL SECTIONS
- LO924\SDTD-RW401: TYPICAL RETAINING WALLS STRUCTURAL PLAN TYPICAL SECTION DETAILS (1/2)
- LO924\SDTD-RW401: TYPICAL RETAINING WALLS STRUCTURAL PLAN TYPICAL SECTION DETAILS (2/2)
- LO924\SDTD-TB401: THRUST BLOCKS AND ANCHORS (1/5) PLAN VIEWS & TYPICAL SECTIONS
- LO924\SDTD-TB401: THRUST BLOCKS AND ANCHORS (2/5) PLAN VIEWS & TYPICAL SECTIONS
- LO924\SDTD-TB401: THRUST BLOCKS AND ANCHORS (3/5) PLAN VIEWS & TYPICAL SECTIONS
- LO924\SDTD-TB401: THRUST BLOCKS AND ANCHORS (4/5) PLAN VIEWS & TYPICAL SECTIONS
- LO924\SDTD-TB401: THRUST BLOCKS AND ANCHORS (5/5) PLAN VIEWS & TYPICAL SECTIONS

4.3. HYDRAULIC DESIGN

The hydraulic design results are illustrated in the plan views and profiles of the tender drawings.

5. ENVIRONMENTAL SCOPING AND IMPACT ASSESSMENT

The construction of a 4 km 6-inch pipeline is considered under the USAID-funded LRBMS program. The objective is to providing an alternative for the Mashghara Plain farmers to replace the current practice of using raw sewage as supplemental irrigation water during the summer peak demand (June-July-August). The pipeline would instead supply fresh water from Canal 900 by gravity.
The environmental impacts of this construction activity must be assessed and if found significant prevented or mitigated or compensated for. This is required to comply with Lebanese environmental laws as well as with USAID regulations.

5.1. USAID ENVIRONEMNTAL REGULATION 22 CFR 216

All activities under LRBMS have already been cleared as per 22CFR 216 through an Initial Environmental Examination approved by USAID. The pipeline activity is covered by a Negative Determination with Conditions which requests that the construction complies with the following requirements:

- Approval and support of the relevant municipalities and applicable governmental entities: both LRA and the Mashghara Municipality have approved in writing the concept, design and layout of the pipeline; no further approval is necessary;
- Site selection and design based on consultation with relevant stakeholders: project was requested by Mashghara Municipality; it was reviewed and approved by both LRA and Municipality (Refer to Appendices A & C); a public meeting held April 21 in Mashghara cleared questions from beneficiaries and confirmed their full support (Refer to Appendix E).
- Best environmental practices for construction, excavation, dust and noise control: contractor will be required to take reasonable measures to mitigate negative impacts:
    - Construction and excavation: contractor will be requested to follow standard signalization measures (posting of signs, taping, installation of barriers) to warn and prevent access to work areas;
    - Dust and noise control: limited nuisances since no residential areas are located within 500 m of the pipeline course;
    - Crossing of roads: 2 public roads will be crossed by the pipeline through trenches; work will be done with minimal disruption of traffic (trench excavation will be done

by halves), proper signalization (roadwork signs and stationed workers waving flag 100 m before work area on both sides of the road) and trenches will be resurfaced afterwards.

- Proper collection and disposal of solid waste generated during construction activities: all solid waste generated will be disposed off in an appropriate site as indicated by the Municipality.

Finally all work activities will be supervised directly by an engineer from the LRBMS team. This engineer will ensure that the proper safety measures and environmental mitigation activities are carried out by the Contractor at all times.

5.2. ENVIRONMENTAL IMPACT REVIEW

A scoping review based on the final design of the pipeline confirms that the activity is small-scale and is not expected to generate any significant negative impact (on the contrary the operation of the pipeline will replace use of sewage water and thus provide positive health and environmental benefits). No specific environmental assessment is formally required by Lebanese regulations.
The potential environmental impacts include:

Type of impact	During construction	After construction
Impact on public health and safety	Standard safety regulations (signs, barriers, etc.) will be used to prevent access of public to worksite. Dust and noise pollutions will also be limited. Pipeline layout is entirely on lands owned by LRA and generally fenced to prevent public access. No residential area is located within 500 m of pipeline.	Pipeline does not present a hazard as it is clearly visible and on land with restricted access. Positive impact: pipeline will replace wastewater with fresh water for supplemental irrigation. This will protect the health of farmers and residents.
Social or economic impacts on human activities	Project is carried out upon request from Municipality who has endorsed design and layout. No adverse impacts are foreseen.	Positive impact: the better quality of irrigation water will improve yield and quality of crops.
Impact on historic or cultural resources, park lands, prime farmlands, wetlands, or ecologically critical areas	None of these unique characteristics are present in the project area. Qaraoun reservoir is considered to become a protected area.	Pipeline would not produce any pollution even through leakage as conveyed water comes from the reservoir.
Individually insignificant but cumulatively significant impacts.	Not applicable. This project is unique.	

Impact on endangered or threatened species or its habitat.	No known threatened or endangered species or their habitats are affected by the pipeline.	

This scoping review also complies with Lebanese environmental laws and confirms that an environmental impact assessment is not necessary and will not be prepared.

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