

Report No. 63546-LB

The Inspection Panel 

Report

**Follow-up to Board Decision of
March 10, 2011**

**Lebanon: Greater Beirut Water
Supply Project
(IBRD Loan No. 7967-LB)**

July 29, 2011

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Introduction

1. On November 4, 2010 the Inspection Panel (the “Panel”) received a Request for Inspection relating to the Lebanon: Greater Beirut Water Supply Project (GBWSP) (the “Project”). The Request was submitted by Mr. Fathi Chatila (the Requesters’ Representative) on behalf of himself and 50 residents of the Greater Beirut area, who fear that they are likely to suffer harm as a result of failures and omissions of the Bank in the design and preparation of the Project.
2. The Panel registered the Request on November 10, 2010 and on December 13, 2010, Management submitted its Response to the Request.
3. On January 20, 2011, the Panel submitted its Report and Recommendation to the Board of Directors. The Panel determined that the Request and the Requesters met the criteria set forth in the Resolution for eligibility, and recommended that the Board authorize the Panel to carry out an investigation of some of the matters raised in the Request for Inspection. Specifically, the Panel recommended that its investigation would focus on issues of compliance and potential harm related to water quality, costs and water availability.
4. In early February, members of the Board requested a full Board discussion of the Panel’s recommendation. This Board meeting took place on March 8 and 10, 2011. In advance of this meeting, the Panel issued a written statement clarifying questions some Board members had raised with respect to the Panel’s determination of eligibility.
5. After the Panel had submitted its Report to the Board and a full Board discussion of the Panel’s recommendations had been requested, Management commissioned an Independent Technical Review of Source Water Quality by the Water Institute of the University of North Carolina. Prior to the Board meeting, it provided the Panel with an Interim Report containing preliminary findings of the Technical Review, indicating that the final report of the Review would be completed by May 2011. During the Board meeting on March 8, 2011, Management committed to expand the breadth of the study to cover water availability and costs issues.
6. At the conclusion of the Board meeting on March 10, 2011, the Board of Directors determined that “*acknowledging the legitimacy of the requesters' concerns, the Board invited the Inspection Panel to return by July after considering and taking into*

account the analysis of the study commissioned by Management on the water quality, availability, and cost, in order to inform the Board on whether or not subsequent investigation is warranted, and if so, on its precise focus.”

7. On June 9, 2011, Management provided the Panel with the final reports of the three studies it had commissioned: an Independent Technical Review of Source Water Quality¹; an Independent Technical Review of Source Water Quantity² and a Study of Project Cost Estimates, Financial and Economic Analyses³.

Scope and Methodology of this Report

8. This Panel Report (the “Report”) responds to the Board’s request to report back, after considering and taking into account the above-mentioned studies, in order to inform the Board whether subsequent investigation of the issues of water quality, availability and costs is warranted, and if so, on its precise focus.
9. This Report presents an assessment of the three Management studies to verify whether these studies adequately address the concerns expressed in the Request for Inspection that the Panel had found warranted an investigation. In particular, the Panel has focused on whether the studies a) address the risk that current project design may not provide adequate assurances that potable water of acceptable quality can be guaranteed, b) address the risk that future availability of water may be compromised by external factors not adequately addressed, and c) have adequately analyzed project costs with respect to the required water treatment and related costs and the adequacy of the financial analysis and assumptions.
10. The Panel retained three independent experts to assist in the assessment of Management’s studies and the preparation of this Report: Prof. Perry McCarty, who reviewed the study on water quality; Prof. Jose Rafael Cordova, who considered the study on water quantity, and Mr. Roberto Mosse, who analyzed the study on project cost estimates. Annex 1 to this report includes biographies of the experts. The Panel provided the experts with relevant information about the Project and the issues under review. Such information included documents provided by Management and Requesters in the course of the process, as well as material gathered by the Panel team during the field visit and/or researched by members of the Panel’s secretariat staff.

¹ UNC, The Water Institute, *Greater Beirut Water Supply Project, Independent Technical Review of Source Water Quality, Final Report*, Dr. Jamie Bartram, Director of the Water Institute at UNC, Joseph LoBuglio, P.E., May 31, 2011.

² UNC, The Water Institute, , *Independent Technical Review of Source Water Quantity, Final Report*, Dr. Jamie Bartram, Director of the Water Institute at UNC, Joseph LoBuglio, P.E., May 31, 2011

³ Travers, L. *Greater Beirut Water Supply Project (P103063), Study of Project Cost Estimates, Financial and Economic Analyses*.

The Project

11. The Project's objective is to *“increase the provision of potable water to the residents in the project area [Greater Beirut and Mount Lebanon region] including those in the low-income neighborhoods of Southern Beirut, and to strengthen the capacity of the Beirut Mount Lebanon Water Authority⁴ in utility operations.”* The Project aims to meet the demand for 250,000 cubic meters per day (m³/d) of potable water in the project area. The Project consists of three components: 1) Bulk Water Supply Infrastructure, 2) Supply Reservoir Distribution Network and Metering, and 3) Project Management, Utility Strengthening and National Studies.
12. Component 1 provides for the construction of water supply infrastructure including two water tunnel conveyors of 3 and 21km respectively, transmission pipelines, storage reservoirs and a water treatment plant. Component 2 provides for the construction of 16 supply reservoirs and pumping stations, the design and construction of a distribution network of 187 km of pipelines and installation of household meters (approx. 200,000) in selected areas and bulk water meters at reservoirs and distribution chambers. Component 3 is focused on strengthening the capacity of the water utility Establishment of the Water of Beirut Mount Lebanon–(EBML) and of the Ministry of Energy and Water (MoEW), which is responsible for implementation.
13. The Project, which is also known as the Awali Conveyor Project, will supply the Greater Beirut area with potable water by gravity. The raw water, to be transported by the use of tunnels to a water treatment plant at Ouardaniye, is from three sources flowing into the Joun Reservoir. The main source is the artificial Qaraoun (Karaoun in Management Response) Lake on the Litani River in the Bekaa valley. Water from this reservoir is currently transferred by tunnels to generate electricity at three hydropower plants before being released to the Awali River. The Awali Conveyor will connect to this system of tunnels below the second hydropower plant at Joun. The water from Qaraoun Lake is mixed with water from the Awali River (the second source of water) at the Joun Reservoir. Seepage of groundwater into the main tunnel from the Qaraoun Dam is the third source adding to the raw water supply for the Project. The Project will require land acquisition and involuntary resettlement for building surface structures and for establishing easement rights of way along the corridor of the water conveyor.
14. MoEW is the agency responsible for Project implementation through a Project Management Unit to be established within the EBML. MoEW will delegate the implementation of Component 1 of the Project to the Council for Development and Reconstruction (CDR) and will maintain responsibility through EBML for Components 2 and 3.

⁴ The Beirut Mount Lebanon Water Authority is officially called the Establishment of the Water of Beirut Mount Lebanon Establishment (EBML).

15. The total project costs are US\$ 370 million, of which US\$ 200 million are funded by an IBRD Investment Loan to the Government of Lebanon. The EBML is to finance US\$140 million and the Government of Lebanon (GOL) will finance US\$30 million for land acquisition and the front-end fee. The World Bank Board of Executive Directors approved financing of the Project on December 16, 2010. The closing date of the loan is June 30, 2016.

The Request

16. The Requesters claim that the raw water to be used by the Project is not fit as a source for potable water. The Request states that independent analyses conducted on the water stored at the Qaraoun Dam confirmed that the water is heavily polluted with high levels of chemicals and bacteria. These analyses also indicate that the water carries carcinogens. The Requesters are concerned that standard water treatment techniques would not deliver potable water to Greater Beirut, as promised, if such contaminated water is the source.
17. The Request also argues that the Project, as designed, will not be able to meet the water quantity demands from competing uses of the Qaraoun dam waters and thus will deprive of water the south of Lebanon and/or the Upper Litani River Basin. This could harm the livelihood of agriculture-dependent communities living in these areas.
18. With respect to the economic analysis, the Requesters state that it is not clear whether the Project is the least costly option because, in their view, certain investment costs, including the cost of treating highly contaminated water, were not taken into consideration. As a result of this, the total cost of the Project will almost double in their estimation. This raised price tag, the Requesters believe, will force water tariffs to increase by 10 to 15 percent annually, making the service unaffordable for poorer people.

The Panel's Eligibility Report

19. The Panel carried out a careful assessment of the eligibility of the Request based on a review of the Request, the Management Response and relevant Project documents, as well as the field visit by the Panel team. Moreover, as part of its due diligence, the Panel took the additional step of seeking expert advice from a water resources specialist who reviewed studies of the water quality of the Litani River and the Qaraoun Lake, which as indicated earlier is the principal source of water for the Project. The results of this eligibility assessment were presented in the Inspection Panel's Report and Recommendation issued on January 20, 2011, and further elaborated in a written statement issued by the Panel to clarify the basis for eligibility in direct response to questions posed by Executive Directors during preparatory meetings for the Board meeting held on March 8-10, 2011.
20. The Panel determined that the Request met the eligibility criteria listed in the Resolution and subsequent Clarifications. The Panel considered that the Request

raised serious concerns about potential harm and non-compliance. It noted that there were certain specific issues in the technical and financial appraisal of the Project that gave “prima facie” credibility to the concerns expressed by the Requesters: the issues of water quality, water availability and project costs. For this reason, the Panel recommended that an investigation be carried out on these three issues of potential harm raised by the Request that relate to allegations of violations of Bank operational policies and procedures.

21. With respect to the quality of the water to be supplied to Greater Beirut, the Panel’s eligibility assessment identified numerous reports that suggest that the principal water source for the Project contains toxic pollutants that may be difficult to remove through standard treatments. These pollutants may require prevention and treatment options (e.g. at source) that appear not to be adequately contemplated in the current project design and cost estimates. In this context, the Panel determined that the Request makes a credible and serious claim that project studies have not met the requirements of Bank policy, including OP 4.01 on Environmental Assessment, to identify such potentially significant impacts, and feasible and available options that might be available to address them in a cost effective way.
22. The Panel also determined that there is a credible and serious claim that water availability to reach project objectives is in question and that policy-required studies may not have adequately considered potential significant impacts on other water users, as well as available options to address these concerns as required by OP/BP 4.01. In addition, the Panel was informed that rainfall patterns have been exhibiting a downward trend in recent years, both in total amounts and in the length of the rainy season, which would affect water availability. Significantly, Project-related correspondence seemed to indicate that there were diverging views on the issue of water supply availability.
23. Finally, the Requesters raised an issue related to the Project costs and its overall financing, including the need for eventual tariff increases that may place a disproportionate burden on the poor. In the case of this Project there were *prima facie* indications that some of the key standards to ensure reliability of the financial projections may not have been followed at appraisal, *inter alia*, with respect to the available financial information about the Project entity, project costs, financial projections, calculations and assumptions in Project documents. This raised concerns that the Project may result in additional costs, not properly estimated at appraisal, for which financing would not have been identified during project preparation.
24. As noted above, the Panel believed that it could only clarify these issues of alleged non-compliance and eventual harm through an investigation.
25. Following these clarifications and Board discussion, the Board invited the Inspection Panel to consider the expanded studies commissioned by Management on water quality, water quantity, and cost, and to inform the Board whether subsequent

investigation is warranted. The Panel’s independent assessment of these three reports (which are first briefly summarized) follows.

Panel Consideration of Management-commissioned Studies: The “Independent Technical Review of Source Water Quality”

Brief Summary of Review

26. The Independent Technical Review of Source Water Quality (the “Review of Source Water Quality”) was prepared by the Water Institute at the University of North Carolina.⁵ According to the document, the review concerns the “*suitability of water in the Joun Reservoir as a source for a water treatment facility*”⁶ built under the Greater Beirut Water Supply Project. The Institute was also requested to provide comments on the “*relevancy of the data for helping solicit a design-build-operate (DBO) contract for the water treatment plant*”⁷ and to offer recommendations for the project as designed.
27. The Review of Source Water Quality concluded that the water from the Joun Reservoir is of “*sufficient quality*”, and that potable water that meets Lebanese and international standards and guidelines can be obtained with conventional water treatment technologies. The Review indicates that microbial contamination exists, but standard water treatment “*should be able to reduce contamination and result in product water meeting drinking water quality standards.*”⁸ It adds that the levels of pesticides and organic chemicals was found below guidelines or detection limits for all the existing data. With respect to heavy metals, which are a specific concern of the Requesters, the Review notes that samples taken in the Joun Reservoir between 1999 and 2011 show that heavy metals “*is not a high concern.*”⁹ As far as other parameters, such as nitrite levels, turbidity and color are concerned, the study indicated that although they will have to be addressed during treatment, they are “*well within the limits of treatability.*”¹⁰
28. It is important to note that the Review of Source Water Quality indicates that the above-mentioned conclusions are based on two “*key assumptions.*” The first assumption is that “*available water quality data are representative of long terms water quality.*”¹¹ The study notes that comprehensive sampling was available for only one year, and although the historic and recent data appeared consistent “*there is no assurance that the inter-year variability has been captured.*” The second assumption is that “*efforts to improve source water quality will be implemented.*”¹² Importantly,

⁵ Bartram, J. & J. LoBuglio. (2011). Greater Beirut Water Supply Project: Independent Technical Review of Source Water Quality. The Water Institute at UNC. 33 p.

⁶ Bartram & LoBuglio, Water Quality, p. 1.

⁷ Bartram & LoBuglio, Water Quality, p. 1.

⁸ Bartram & LoBuglio, Water Quality, p. 1.

⁹ Bartram & LoBuglio, Water Quality, p. 2.

¹⁰ Bartram & LoBuglio, Water Quality, p. 2.

¹¹ Bartram & LoBuglio, Water Quality, p. 2.

¹² Bartram & LoBuglio, Water Quality, p. 2.

the Review makes clear that implementation of measures to improve source water quality “*is needed to assure that the water quality does not degrade and to reduce the risk for water treatment upsets*” (emphasis added).

29. The Review of Source Water Quality further indicates that to preserve source water quality in the future it is important to understand the effect of catchment activities on source water and to develop a water quality protection plan for the management of watersheds, such as the Litani River and other rivers in Lebanon. The Review cites in this context a Ministry of Environment’s Business Plan for Combating Pollution of the Qaraoun Lake, which contains recommendations for protecting the upper Litani River.

Initial Panel Assessment

30. Based on his analysis to date, the Panel’s expert agrees with the key findings of the Review of Source Water Quality prepared by the Water Institute based on the assumptions that were made.¹³ In doing so, however, the expert has emphasized that these findings and conclusions are based on the key assumption of the review, noted above, i.e., that the proposals to improve source water quality are indeed implemented. Improving source water via these proposals will significantly reduce the risk of some unforeseen accident in water quality control.
31. Importantly, the Panel’s expert has also highlighted that the high concentrations of organic matter in Joun and Qaraoun reservoirs, as indicated by reported levels of Chemical Oxygen Demand (COD),¹⁴ Biochemical Oxygen Demand (BOD),¹⁵ and color concentrations, are cause for concern. While the Review suggests that these levels are caused by organic pollution from industry or municipalities or by normal runoff during the rainy season, the Panel’s expert notes that such high levels can also be caused by eutrophication.¹⁶ Efforts to reduce turbidity and color through source

¹³ McCarty, P. (2011). Summary Assessment of Water Institute Conclusions, Key Findings, and Assumptions.

¹⁴ COD can be indicative of algal as well as organic concentrations. The Qaraoun Lake recorded average/maximum COD levels in the summer of 10/65 mg/L as compared to the 6.2/15 mg/L in the eutrophic Canal 900 (McCarty). High COD concentrations were also noted in an earlier report of the Qaraoun Lake, with December/January levels in the 100 to 150 mg/L range which are “very high as compared to ‘natural’ state for lakes.” (Olofsson, J. & S. Mokdad. (2000a). Appendix D1, Environmental Master Plan for Litani River and Lake Qaraoun Catchment Area. Sweden: MVM konsult AB. 45 p.)

¹⁵ BOD measures total organic concentrations, and can be reflective of high COD levels (McCarty). BOD levels in the Awali River downstream of Joun Reservoir during the dry August and September months, when most of its water comes from Qaraoun Lake, was reported to be 33 and 27 mg/L respectively. (Hourii, A. & S.W. El Jeblawi. (2007). Water Quality Assessment of Lebanon Rivers During the Dry Season and Pollution Load into the Mediterranean Sea. Journal of Water and Health: 615-623)

¹⁶ Eutrophication of aquatic bodies is caused by the addition of artificial and natural nutrients, primarily nitrates and phosphates, from fertilizer and sewage runoff. These high nutrient concentrations promote the rapid growth of phytoplankton “blooms” that can overwhelm the oxygen supply available in the water body, leading to hypoxia (oxygen deficiency). Hypoxic conditions inhibit the ability of other organisms, such as plant and animal life, to survive in the water body. Eutrophication can thus create hostile conditions for natural aquatic ecosystems to sustain themselves.

protection may produce little improvement in water quality if the cause is nutrient loading to reservoirs. Furthermore, eutrophication and its related problems could be enhanced if treatment of wastewaters is effected without nutrient control.

32. The Panel's expert has noted that the Review of Source Water Quality does not address eutrophication directly, but it observed several indicators for eutrophic waters. For example, the Review noted large increases in color, turbidity, iron, and ammonia in Joun Reservoir water during December and January 2010-2011,¹⁷ quality changes associated with eutrophic waters. Given that the storage capacity of Joun Reservoir is relatively small in volume (0.18 Mm³), and water detention time at a typical average flow rate of 3 m³/s would be too short for eutrophication within the reservoir itself to be the cause, it is likely that the water quality changes are indicative of eutrophication in upstream sources.
33. The Panel's expert has further noted that fluctuations in color and ammonia in the Joun Reservoir, recorded during the drier summer months of 2010-2011,¹⁸ are indicative of bottom waters in eutrophic reservoirs. Since water in Joun Reservoir is largely coming from the Qaraoun Lake during summer months, these increased levels are likely to result from processes within the Qaraoun Lake itself, rather than from local runoff. Evidence of eutrophication can also be inferred from water samples from Qaraoun Lake in the summer of 2005.¹⁹ These samples display similar levels of nitrate and phosphate to what has been observed in Canal 900, where algal growth is significant enough to cause clogging problems in the piping systems used by farmers, leading authorities to apply copper sulfate to the Canal to curb further blooms from forming.²⁰ These similar high values are suggestive of plant growth in both of these bodies.
34. Overall, the Panel's expert has highlighted that a better understanding of the overall causes and locations of these observed changes is desirable as this may impact treatment design and operation, as well as reservoir operation and location of withdrawal ports for water to be treated.

Panel Consideration of Management-commissioned Studies: The "Independent Technical Review of Source Water Quantity"

Brief Summary of Review

35. The Independent Review of Source Water Quantity (the "Review of Source Water Quantity") was also prepared by the Water Institute at the University of North

¹⁷ Bartram & LoBuglio, Water Quality, p. 13.

¹⁸ Bartram & LoBuglio, Water Quality, p. 13-14.

¹⁹ Water samples taken from the Qaraoun Lake in June 2005 indicated average/maximum concentrates of nitrate and phosphate (P₂O₅), respectively, to be 21.7/31.2 mg/L and 0.13/0.35 mg/L in summer, compared with 27.9/34.1 mg/L and 0.22/0.22 mg/L in the winter.

²⁰ Blankinship, M., Chebaane, M., & M. Saadeh. (2005). Canal 900 Algae Control: Testing and Validation. Latain Basin Management Advisory Services, U.S. Agency for International Development. 44 p.

Carolina.²¹ The Review's stated objectives are to determine whether water is sufficiently available from the Litani and Awali rivers sources to meet the needs of the GBWSP, to assess the potential for water supply conflicts in case of competing uses, and to understand the impact of near term planned increases in water withdrawals.

36. The analysis concludes that based on a review of historic flow data “*there is adequate water available to meet the goals of the GBWSP*” and that “*there is ample water available*” for the Project, existing irrigation and other potable water projects.²² These conclusions, however, lay on a number of key assumptions,²³ including in particular that recent historic water availability data are representative of future patterns. The conclusions also are based on the Presidential Decree No. 14522 of May 16, 1970, which assigns 50 million cubic meters (MCM) of Litani river water and other sources to potable water and water for industrial purposes and asserts that the State is entitled to decrease the quantities allocated for irrigation by 25% if necessary and add this 25% to the 50 MCM for potable water. Other assumptions are that the GBWSP is designed to meet short term water needs of the Greater Beirut area until 2016 and that current demands for irrigation are at the highest observed, and that the Canal 800 irrigation project will begin to withdraw water only in 2021 and will reach maximum withdrawal value in 2031. Finally, the conclusions assume that the seasonal flows of the springs and the Awali River follow typical patterns and are proportional to water availability determined by the annual inflow in the Qaraoun Lake.

Initial Panel Assessment

37. Based on his analysis to date, the Panel's expert concludes that the water demands of GBWSP will be met if the estimates of water yield presented in the Review of Source Water Quantity – i.e., for the Litani River up to the Qaraoun Lake; and the Awali River, the Ain Zarqa spring and the Jezzine spring up to the diversion points – are reliable, and thus accurately depict future water availability.²⁴
38. The Panel's expert notes that the Review of Source Water Quantity makes two assumptions that make its analysis more conservative, including the use of the more recent period 1989-2008 to estimate flows in the Litani River rather than the full record from 1962 onwards. However, the Panel's expert notes that the data on storage in the Qaraoun Lake over the full period from 1962 to 2009 represents a statistically significant downward trend, which is likely to be a result of the increasing utilization of the Litani River over time. To determine future availability of water in the Litani River, it would be important to take into account any further utilization of the Litani River over time, as well as how this trend may be exacerbated by climate change.

²¹ Bartram, J. & J. LoBuglio. (2011). *Greater Beirut Water Supply Project: Independent Technical Review of Source of Water Quantity*. The Water Institute. University of North Carolina. USA.

²² Bartram & LoBuglio Water Quantity, p.1.

²³ Bartram & LoBuglio, Water Quantity, p. 3.

²⁴ Córdova, J. (2011). Review and assessment of the report ‘Independent Technical Review of Source of Water Quantity for Greater Beirut Water Supply Project.’

Overall, in order to manage the risk that there would not be sufficient water to meet the requirements of the project and other downstream demands, an analysis that takes into account changes in future patterns of water availability and water use in the Upper Litani River Basin is needed.

39. The Panel's expert has also raised important questions about the methodologies used to estimate streamflow and the reliability of the data for all water sources. For example, there are uncertainties arising from the methodology applied to extend the streamflow data from when it was collected in 2003-2005 and 2007-2009 over the entire 1989-2008 period. There is also reason to question the reliability of these streamflow data points. There are no flow gauging stations in the Awali River, the Ain Zarqa spring and Jezzine springs, and there is a higher potential for error in the water balance calculations used to estimate streamflow in their absence. There is further reason to doubt the streamflow estimates, given that they vary widely. Finally, it is important to note that the data provided by Litani Water Authority was presumed accurate and was not independently audited by the Water Institute at UNC.
40. Finally, the Panel's expert has noted that a project as important as GBSWP should have an updated hydrologic study of all water sources, covering inflows in the upper Litani watershed, the Qaraoun, Markabi, Anane and Joun reservoirs, and the contributing watersheds to the Awali River and the two major springs, as well as outflows to meet all demands for the use of water, including ecological demands.

Panel Consideration of Management-commissioned Studies: The “Study of Project Cost Estimates, Financial and Economic Analyses”

Brief Summary of Study

41. The Study of Project Cost Estimates, Financial and Economic Analyses (hereafter the “Study”) was prepared by a World Bank consultant.²⁵ The stated objective of the Study is to assess whether the Project's cost estimates, financial and economic analyses comply with the Bank policies on Project Appraisals (OMS 2.20) and Economic Evaluation of Investment Operations (OP/BP 10.04).
42. The overall conclusion of the Study is that “*the Bank team responded appropriately to the requirements*”²⁶ of the policies and although “*gaps*”²⁷ existed they did not affect the conclusions of the PAD and the Project does represent the least cost solution to achieve the project objectives of providing potable water to the residents of the Greater Beirut Area. Thus, while pointing out that decisions made throughout Project design could have been more systematically documented, the Study “*confirms the team's decision to support the Awali option.*”²⁸

²⁵ Lee Travers, PhD. At retirement Manager, Bank/IFC Subnational Finance Group; from 1998 to 2001 Lead Water and Sanitation Economist in the Bank's central water group.

²⁶ Travers p. 1.

²⁷ Travers p. 1.

²⁸ Travers p. 1.

43. In terms of costs, according to the Study, the financial analysis overstated the incremental energy costs so utility net revenues are likely to be stronger than estimated. On the other hand, the Study found that the economic analysis significantly overestimated the Project expected net present value. As a result, the Project has less room for cost overruns or benefit delays than originally envisioned.

Initial Panel Assessment

44. Based on his analysis to date, the Panel's expert concludes that the Bank's Study was generally satisfactory.²⁹ However, he raises several major questions about the assumptions and calculations made in the Study and Project documents that, if inadequately addressed, could put the financial viability of the Project at risk.

45. Overall, the Panel's expert is concerned that the revenue forecast, particularly as it regards revenue up to 2016, is overestimated. This concern is based upon several analytical gaps in the Study and Project documents. First, EBML's financial statements reference "other revenues" that represent 21% of total monies collected on any given year from water users. However, the PAD does not explain where these revenues will come from. Moreover, the PAD assumes that revenues will increase 2% per year until 2016 due to annual increases in water connections, but this assumption seems optimistic considering it depends on an increase in water supply and a simultaneous decrease in both water losses and illegal connections. In practice, significant reductions in water losses and illegal connections will only materialize after water meters are installed, additional qualified staff is hired, and the technical assistance project components have been implemented and have begun to show results. Taking these points together with the Study's critiques – namely that there is a need for an additional US\$ 41 million investment in distribution and reservoirs – the Panel's expert is concerned that, although EBML is and will remain financially viable, the cash generation surpluses forecasted in the PAD (estimated at 20%) will not allow it to make any meaningful contribution to cover debt service requirements. In the event of this shortfall, the Government would have to cover debt service requirements via capital injections and possibly also by tariff increases. These tariff increases may be necessary in the short-term especially if the proposed contributions from the Central Bank of Lebanon of US\$ 170 million are not readily available (see below).

46. Furthermore, the Panel's expert also noted in his report to the Panel that it is uncertain that the Central Bank of Lebanon has the US\$ 170 million, on which the Bank appraisal team based its financial analysis of the proposed project investments, readily available to EBML without any further clearance or approval from the Government of Lebanon. Apparently, there was no audited financial statement that attested to this fact at the time of the Panel expert's review. The Panel now

²⁹ Mosse, R. (July 2011). Desk Review of Study of Project Cost Estimates, Financial and Economic Analyses by Dr. Lee Travers.

understands that such a letter has been received confirming that this money is indeed available.

47. Finally, the Panel's expert has noted that Project documents show a key contradiction regarding tariff increases. On the one hand, the PAD assumes that (a) average tariffs will increase by 1.5% between 2010 and 2015 and by 5% starting in 2017, approximating the rate of inflation; (b) other revenues will follow inflation; and (c) expenses will increase by 5% more than inflation between 2010 and 2015 and will remain equal to inflation thereafter. These inflation adjustments are in line with the projections provided by the Bank's country economic team. On the other hand, according to information provided to the Inspection Panel mission to Lebanon in January 2011, Government officials indicated that *"there are no plans to increase water tariffs and...it will not be politically feasible to increase tariffs until 24/7 supply throughout the year is guaranteed."* Moreover, the loan documents do not show that the Bank and the Borrower have agreed to maintain water tariffs at the same level in real terms. The Panel's expert notes the need to clarify this contradiction, which may entail reassessing EBML's operational revenue and expense and cash generation forecasts.

Observations

48. The Panel notes that the three studies/reviews commissioned by Management, according to the assessment of the Panel's experts, provide valuable additional analysis of the issues identified in the Panel's eligibility report as warranting further investigation, namely water quality and safe drinking water, water tariffs, and water availability and the reliability of water supply. The three studies, taken together, conclude that the Project, as designed and described in the PAD, does not entail unacceptable risks with respect to future guarantees of water quality, availability of water, and financing.
49. The Panel wishes to acknowledge the thoroughness of the three studies, as confirmed by the technical assessment of the Panel's experts. This notwithstanding, the Panel has identified important issues that warrant further consideration, including consultation with Project-affected people, in order to ensure the robust determination of risks associated with the Project, and the development of corresponding steps to avoid and mitigate such risks. These are all issues of direct relevance to the allegations of potential harm raised in the Request, and include:
- The nature and extent of future measures to improve source water quality in the upper Litani River Basin and, in this respect, the need for nutrient control and the containing of risks for the Project associated with eutrophication in the Qaraoun Lake and upstream.
 - The need for better analysis and forecasting of future water inflow and water use in the upper Litani River Basin to have a reliable basis for managing competing demands on the water resources of the river basin.

- The need for better analysis of revenue forecasts for EBML and its likely capacity to contribute towards debt servicing.

50. The Panel has informed Management of these issues that warrant further consideration, and Management has issued a Note that includes a summary of the identified risks and risk management measures and a proposed action plan to address these risks, which structures its response to these issues (the “Management Note”).
51. The Management Note is attached as Annex 2 to this Report. The Note states that, while the three independent studies have reconfirmed the Project’s design details and implementation arrangements, some potential implementation risks were identified. The Note indicates that Management has reviewed these risks, takes them very seriously, and is fully committed to addressing them satisfactorily. It also indicates that Management will report to the Board within 18 months (i.e., by end January 2013) on progress in project implementation and in the implementation of the risk mitigation and management measures.

Conclusion

52. In view of the above, the Panel will await further developments in light of actions by Management, as they are outlined in the Management Note, to address key issues and risks. In discharge of its responsibilities, the Panel will report to the Board by early 2013 on whether subsequent investigation is warranted.
53. The Panel notes that, as enshrined in the Resolution and the 1999 Clarifications, the Panel cannot provide its independent assessment of issues of compliance and related harm unless through a formal investigation. The Panel is mindful that the level of technical assessment, undertaken as a basis for this Report in reporting back to the Board, is greater in depth than is normal outside a formal investigation. This was necessitated by the Board’s request to revert “*after considering and taking into account the analysis of the study commissioned by Management on the water quality, availability, and cost.*” However, this report has carefully avoided any pre-judgment of policy compliance and simply addresses the question of whether there are outstanding issues of risk raised in the Request for Inspection that remain to be addressed.

Annex 1: Expert Biographies

Perry McCarty, the recipient of the prestigious Stockholm Water Prize in 2007, is the Silas H. Palmer Professor Emeritus of Environmental Engineering and Science at Stanford University. A member of the Stanford faculty since 1962, Prof. McCarty is widely recognized for pioneering relatively economical wastewater treatment processes, in particular anaerobic (oxygen-less) treatment systems that rely on complex chemical reactions carried out by naturally occurring, beneficial microbes. In addition to serving on the Stanford Faculty, Prof. McCarty directed the Environmental Protection Agency-sponsored Western Regional Hazardous Substances Research Center from 1989 to 2003. Prof. McCarty has over 300 publications, with over 50 papers in the last 10 years, and is coauthor of the textbooks, *Chemistry for Environmental Engineering and Science* and *Environmental Biotechnology - Principles and Applications*. He has been active with several professional groups, especially the National Academies with memberships since 1971 on three Councils, two Boards, and 19 Committees. Among his numerous awards are an honorary Doctorate from the Colorado School of Mines, Honorary membership in the American Water Works Association and the Water Environment Federation, and Fellow with the American Association for the Advancement of Science and the American Academy of Microbiology. He was selected by the National Academies to be the 2001 Abel Wolman Distinguished Lecturer. Among other awards are the Harrison P. Eddy Award for Noteworthy Research (1964 and 1977) and the Thomas Camp Award for Unique Application of Engineering Research (1975) of the Water Environment Federation; the A. P. Black Research Award of the American Water Works Association (1989); and the Walter L. Huber Research Prize (1964), the Simon W. Freese Environmental Engineering Lecture Award (1979), and J. James R. Croes Medal (1995) of the American Society of Civil Engineers.

José Rafael Córdova received his PhD, in Water Resources and Hydrology, from Massachusetts Institute of Technology (M.I.T) in 1979; a Masters degree in Civil Engineering from Massachusetts Institute of Technology (M.I.T) in 1977; and a first degree from Universidad Central de Venezuela. He is a former professor of Simón Bolívar University in Venezuela, and currently is a professor of graduate studies in Hydraulic Engineering at Universidad Central de Venezuela. He is also the Director of CGR Engineering consulting firm in Venezuela. He has published more than 40 papers in Journals, Book Chapters and Conferences Proceedings; more than 230 technical reports related to hydrological and hydraulics studies; and has presented more than 50 papers in national (Venezuela) and international Congress, Conferences and Seminars. Dr. Córdova has participated in more than 250 engineering projects and consulting activities in Venezuela, Bolivia, Costa Rica, Dominican Republic, Ecuador, Egypt, El Salvador, Greece, Guatemala, Honduras, Paraguay, Peru, Nicaragua and Yugoslavia.

Roberto Mosse has been employed by the World Bank in various capacities since 1972. He received his MBA with emphasis in Finance, Accounting and Auditing from Universidad de Chile and his CPA from the Institute of Public Accountants in Chile. He also has a Bachelor of Commerce from Melbourne University in Australia. He began his career in the private sector where he worked as a financial officer and auditor, and

subsequently joined the World Bank as an internal auditor in 1972. During his tenure at the Bank, Mr. Mosse was a Senior Financial Analyst, Senior Operations Officer, Principal Financial Officer, and later, Operations Adviser to the Managing Directors, overseeing projects relating to industry and energy, microenterprise, and transportation, as well as providing training and advice on financial and operational matters to managers and staff, among other responsibilities. Beginning in 1999, he has conducted financial consultancies for World Bank projects in over a dozen countries spanning Africa, East Asia, and Central and South America. He has authored and co-authored several World Bank publications, including: the Performance Monitoring Indicators Handbook; a study on Core Services Delivery in the Bank; Brazil – Financial Sector Reform; Brazil – Selected Issues of the Financial Sector; and Brazil – Review of State Banks.

Annex 2: Management Note

- (i) Cover memorandum from Managing Director
- (ii) Cover memorandum from Regional Vice President
- (iii) Note and action plan matrix regarding the Request for Inspection of the GBWSP

OFFICE MEMORANDUM

DATE: July 29, 2011

TO: Roberto Lenton, Chairperson, IBRD/IDA Inspection Panel

FROM: Sri Mulyani Indrawati, Managing Director, MDI



EXTENSION: 88109

SUBJECT: **Request for Inspection of the Lebanon Greater Beirut Water Supply Project (P103063)– Note/Action Plan addressing identified risks following submission of three studies commissioned by Management**

Following my memo to you dated June 9, 2011 which enclosed the three studies commissioned by Management, please find attached for your reference (i) a note addressing the identified project risks along with an action plan to mitigate the risks, and (ii) a cover memo from Ms. Shamshad Akhtar, Regional Vice President MNA.

Attachment

OFFICE MEMORANDUM

DATE: July 28, 2011

TO: Roberto Lenton, Chairperson, IBRD/IDA Inspection Panel

FROM: Shamshad Akhtar, Regional Vice President, MNAVVP 

EXTENSION: 84477

SUBJECT: **Request for Inspection of the Lebanon: Greater Beirut Water Supply Project – Note addressing issues following submission of studies commissioned by Management**

1. Following the Board meeting of March 8, 2011 on the Inspection Panel Report regarding the Greater Beirut Water Supply Project, MNA Management commissioned three independent reviews of: (i) Project Water Quality; (ii) Project Water Availability; and (iii) Project Cost, financial analysis and economic analysis.
2. While the three independent studies reconfirmed the project's design details and implementation arrangements, some potential implementation risks were identified and are described in the attached note.
3. MNA Management has reviewed these risks and is confident that they can be managed within the confines of an enhanced supervision regime for the project. I would also like to reiterate that we take the potential risks very seriously and are fully committed to satisfactorily addressing them. Instructions will be issued to my senior management team, both in Washington and in Beirut, to closely monitor the implementation of the risk mitigation and management measures outlined in the attached note. I also commit to personally reviewing the progress.
4. In addition, MNA Management will report to the Board within 18 months (i.e., by end January 2013) on: (i) progress in project implementation; and (ii) progress in the implementation of the attached risk mitigation and management measures.

Attachment

Greater Beirut Water Supply Project
Summary of Risks, Management Measures and
Proposed Action Plan with respect to Inspection Panel Request

On November 10, 2011, the Inspection Panel registered a Request concerning the Greater Beirut Water Supply Project (GBWSP). Following the Management Response dated December 13, 2011 and the Inspection Panel's report dated January 21, 2011, a Board discussion was held on March 8, 2011, after which MNA Management commissioned three independent studies: (i) a Water Quality Study by The Water Institute at the University of North Carolina, (ii) a Water Availability Study also by The Water Institute at the University of North Carolina, and (iii) a Project Cost, Financial Analysis and Economic Analysis Study undertaken by Mr. Lee Travers, former Lead Water Economist at the World Bank. The three studies were submitted to the Inspection Panel on June 9, 2011, publicly disclosed and have been translated into Arabic.

While the three independent studies reconfirmed the project's design details and implementation arrangements, some potential risks were also identified and are described below. MNA Management accordingly commits to revising plans for supervision of project implementation to include the risk management measures described below and summarized in Table 1.

Water Quality

Identified Risks:

- The provision of water quality that meets all applicable health and aesthetic-based standards and guidelines is contingent on the implementation of upstream catchment protection measures in addition to the water treatment infrastructure planned under the GBWSP.
- An increased input of nitrogen and phosphorous could lead to eutrophication of Qaraoun Lake. This could pose a risk to the quality of project source water.

Risk Management Measures:

- In its Ministerial Declaration dated June 13, 2011, GoL committed to: (i) "the implementation of strategies and action plans for river basin management and solid waste management" and (ii) "the involvement of non-governmental organizations in the implementation of such plans" among other high-priority actions.

The Ministry of Environment's (MoE) "Draft Business Plan for Combating Pollution of Qaraoun Lake" is an action plan commissioned based on the recommendation of an Inter-Ministerial Committee. The Inter-Ministerial Committee included the MoE, Ministry of Energy and Water, Ministry of Agriculture and Ministry of Industry, among others. The Committee was tasked with diagnosing the state of the Litani River basin, and the Plan is to be finalized in September 2011. The Plan will subsequently be presented to the Environmental Parliamentary Commission and to the Council of Ministers for final approval, provisionally by December 2011. A donor meeting to identify potential sources of Plan financing will also be held this Fall. The MoE has confirmed that the World Bank will be invited to participate in this meeting.

The World Bank will continue to work closely with GoL in managing the preparation of upstream catchment protection activities. The World Bank will also ensure that the findings of continuous downstream water quality monitoring are reported in a dedicated annex to supervision aide-memoires. A water quality expert will join the supervision team to review the consistency of the technical design of the water treatment plant with the observed water quality.

- The risk of eutrophication will be managed by upstream catchment protection measures (as included in the Business Plan for Combating Pollution of Qaraoun Lake) as well as effective downstream water treatment, mitigating the risk to water quality.

The World Bank will work with MoE and the Ministry of Energy and Water to analyze and better understand the potential causes of eutrophication of Qaraoun Lake and proposed management and mitigation measures to prevent and/or limit its impacts.

The World Bank will also assist MoE with preparation and implementation of upstream pollution abatement programs specific to the agricultural sectors and will ensure that monitoring data on nitrogen, phosphorous and dissolved oxygen is included in the tender for the Design/Build/Operate contract for the water treatment plant.

Water Availability

Identified Risks:

- Increased water demand in the upstream portion of the Litani River basin could impact the availability of water for the GBWSP.
- Beyond the water demand from the present GBWSP, additional demand from future downstream water users could exceed the supply from the Litani/Awali Rivers.

Risk Management Measures:

- As part of the World Bank's ongoing technical assistance to GoL for the development of the National Water Sector Strategy, a plan will be developed to monitor and manage consumption trends, identify and exploit opportunities for irrigation efficiency improvements, and develop climate change mitigation and adaptation measures, among others. This process would include specific recommendations for management of the Litani/Awali Rivers and their basins.
- The GBWSP has been designed to meet the short-term water demand needs of the project area. GoL has confirmed that no other projects utilizing the Litani/Awali Rivers will be implemented before 2021. Beyond 2021, any additional demand from future water users will be met by various supply augmentation projects, already under consideration by GoL.

The World Bank will support GoL in examining future supply augmentation projects as requested.

Project Cost, Financial Analysis and Economic Analysis

Identified Risks:

- The project has less room for cost overruns than originally envisioned. Cost overruns could pose a risk to the positive net present value of the project as well as to the viability of the financing plan.
- The BMLWE may not have the cash reserves of USD 170 million, stated to exist at the time of project appraisal.

Risk Management Measures:

- The GBWSP is a technically complex project which comprises extensive tunneling, water treatment and distribution infrastructure. As such, the project has been designed to incorporate USD 20 million in contingencies. The project will also finance independent construction supervision contracts for various works package as well as a dedicated procurement specialist position within the Project Management Unit.

In addition, the World Bank will recruit a technical expert with demonstrated experience in tunneling infrastructure (the highest-cost project component) to join select supervision missions and review the

tenders for tunneling works. Furthermore, if cost overruns above the existing project contingency do occur, the World Bank will work with GoL to mobilize additional financing resources.

- The BMLWE has submitted documentation to the World Bank confirming that the available balance held in its dedicated account at the Central Bank exceeds USD 170 million.
- The total project cost is USD 370 million. The BMLWE will finance USD 140 million of these costs from its cash reserves as described above. The remaining USD 30 million will be financed by GoL which has also assumed responsibility for debt servicing of the World Bank loan of USD 200 million.

	Description of Risk	Risk Management Measures	World Bank Action Plan
	<p>GoL not committed to implementing upstream catchment protection measures</p>	<p>GoL has reconfirmed its commitment to implementation of Ministry of Environment (MoE) Business Plan for Combating Pollution of Qaraoun Lake (reference Ministerial Declaration dated June 13, 2011) and has mobilized stakeholder and donor meetings to mobilize support and financing</p>	<p>The World Bank will maintain the ongoing dialogue with the MoE on upstream catchment protection and will participate in the Fall 2011 donor meeting to finalize the Business Plan for Combating Pollution in Lake Qaraoun.</p> <p>The World Bank will ensure that the findings of continuous downstream water quality monitoring are reported in a dedicated annex to supervision aide-memoires.</p>
<p>Water Quality</p>	<p>Increased input of nitrogen and phosphorous could lead to unquantified eutrophication of Lake Qaraoun and impact project water quality</p>	<p>An analysis of the causes and impacts of eutrophication in Lake Qaraoun will be commissioned. Implementation of the MoE Business Plan for Combating Pollution of Qaraoun Lake will control discharge of nitrogen and phosphorous to Lake Qaraoun. Downstream, the Water Treatment Plant at Ourdaniyeh, included in Component 2 of the GBWSP, will treat nitrogen and phosphorous (among other parameters) to Lebanese and international health and aesthetic based standards</p>	<p>The World Bank will ensure that the findings of continuous downstream water quality monitoring are reported in a dedicated annex to supervision aide-memoires. A water quality expert will join the supervision team to review the consistency of the technical design of the water treatment plant with the observed water quality</p> <p>A water quality expert will join the supervision team to review the consistency of the technical design of the water treatment plant with the observed water quality</p> <p>The World Bank will work with MoE and the Ministry of Energy and Water (MOEW) to conduct an analysis on the causes, impacts and mitigation options for possible eutrophication in Lake Qaraoun.</p>
<p>Water Availability</p>	<p>Increased water demand in the upstream Litani River basin could impact the availability of water for the GBWSP. Also additional water demand from future water users could exceed the supply from the Litani/Awali rivers</p>	<p>The GBWSP will be implemented by 2016. GoL is currently in various stages of preparation for future medium and long-term water projects that utilize Litani and Awali rivers. GoL has confirmed that these projects will not be fully implemented until 2021 and beyond. GoL has also begun the preparation of various supply augmentation projects that will supplement Litani and Awali river waters in the future.</p>	<p>The World Bank will work closely with GoL, and through project supervision activities, to ensure that the GBWSP is implemented on schedule by 2016. The World Bank will also support the GoL in examining future supply augmentation projects.</p> <p>As part of the World Bank's ongoing technical assistance to GoL for the development of the National Water Sector Strategy, a plan will be developed to monitor and manage consumption trends, opportunities for irrigation efficiency improvements and climate change mitigation and adaptation measures among others. This process would include specific recommendations for management of the Litani/Awali rivers and their basins.</p>
<p>Project Cost, Financial Analysis and Economic Analysis</p>	<p>Potential cost over-runs could negatively impact project implementation.</p> <p>Funds may not be available to service the project debt. BMLWE has not confirmed availability of cash reserves for project financing and could thus negatively impact project implementation</p>	<p>20 million USD of contingency budget has been incorporated into project costs. The Project Management Unit will also be staffed by experienced professionals that will assist the BMLWE in project implementation and supervision.</p> <p>The GoL has committed to servicing the World Bank loan of USD 200 million. The Beirut Mount Lebanon Water Establishment has confirmed availability of cash reserves to finance USD 140 million of project costs. The remaining USD 30 million will be financed by the GoL.</p>	<p>An experienced technical specialist (with demonstrated experience in tunneling infrastructure) will join the World Bank supervision team, review the tenders for the tunneling bids and will join select Bank supervision missions.</p> <p>The World Bank will assist GoL in mobilizing additional financing for the project if practical and timely.</p> <p>Letter from Beirut Mount Lebanon Water Establishment is available upon request.</p>