E4576 v4

LEBANON

WATER SUPPLY AUGMENTATION PROJECT

ENVIRONMENT AND SOCIAL IMPACT ASSESSMENT

APPENDIX M

Assessment of Quarries and Associated Environmental Impact

Bisri Dam and Potential Use of Quarries

As per preliminary detailed design estimates, Bisri Dam will consume approximately 6 million tonnes of building materials, of which approximately 80% is expected to be from existing workings and borrow areas within the reservoir area.

The contractor will procure the remaining 20% of materials (mostly anticipated to be riprap materials) from existing commercial quarries. Lebanon has a large number of commercial quarries; all of which have been subject to a permit from the Ministry of Environment. Bisri is well located to take advantage of quarries in the foothills south of Damour and within the Nahr Awali Valley downstream of the dam site. Quarries in the vicinity of Bisri are shown in Figure 1.

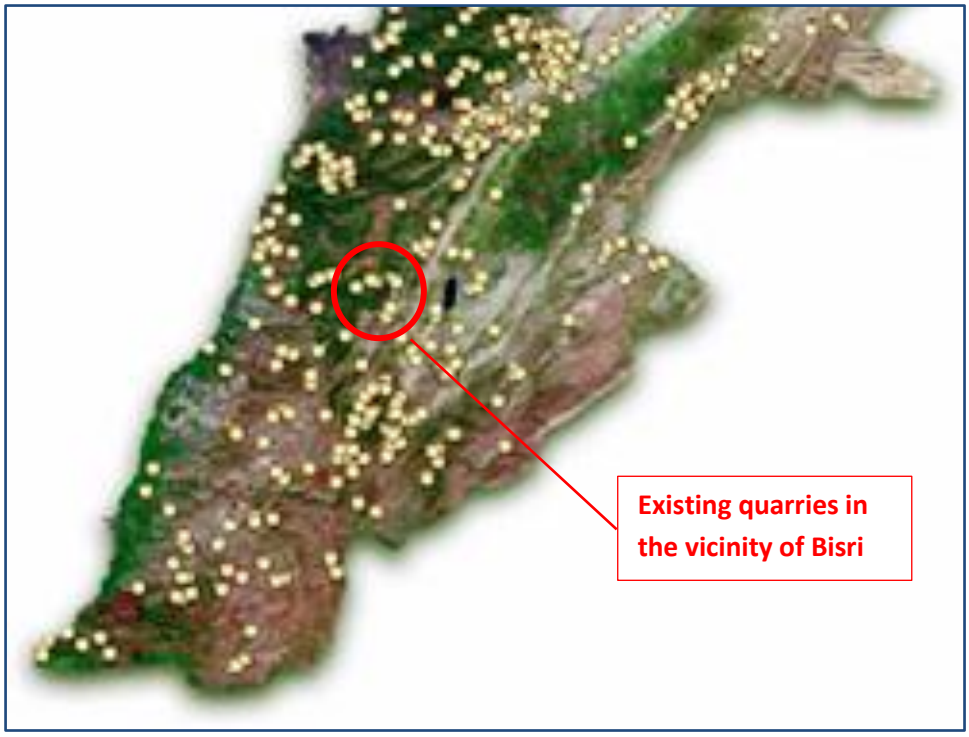

Figure 1: Location of Quarries in the Vicinity of Bisri

Quarry Permitting in Lebanon

Existing commercial quarries and/or re-opening new quarries are subject to strict environmental controls and permitting procedures through the Ministry of Environment (MoE). These include the following national applicable legislation:

- Law # 216 dated 2/4/1993 (Establishment of MoE) and its amendments (law # 667 dated 29/12/1997)
- Law # 64 dated 18/8/1988 (Conservation of the Environment Against Pollution from Harmful Wastes and Dangerous Substances)
- Order # 253/ LR dated 8/11/1935 (Organization of Existing and Future Quarries)
- Decree # 5591 dated 30/8/1994 (Organizational Structure of the Ministry of Environment and its Jurisdictions)
- Decree # 5616 dated 6/9/1994 (Organization of Quarries)
- Council of Ministers Decision # 15 dated 21/9/1994 (Halt All Work in Unlicensed Sand and Stone Quarries)

- MoE Minister Decision # 52/1 dated 29/7/1996 (Identification of Criteria for Limiting Air, Water and Soil Pollution)
- MoE Minister Decision # 182/1 dated 7/11/1997 (Documentation Requirements and Criteria for Stone Quarries)
- MoE Minister Decision # 183/1 dated 7/11/1997 (Documentation Requirements and Criteria for sand Quarries and Natural Pebbles)
- MoE Minister Decision # 184/1 dated 7/11/1997 (Documentation Requirements and Criteria of Stone Quarries for Mosaic Production)
- MoE Minister Decision # 185/1 dated 7/11/1997 (Documentation Requirements and Criteria of Quarries Producing Decorative Stones and Building Stones)
- MoE Minister Decision # 186/1 dated 7/11/1997 (Documentation Requirements and Criteria of Stone Quarries for Cement Production)
- Council of Ministers Decision # 31 dated 28/7/1999 (Quarry Permitting Requirements and Site Locations)
- MoE Minister Decision # 8/1 dated 30/1/2001 (National Standards for Environmental Quality)

MoE 2002 Decree no 8803 and its subsequent amendments governs the establishment of all new quarries. The Ministry of Environment procedure is well established and is illustrated in Figure 2.

As described in Figure 2, the licensing process commences with the owner applying to open a quarry through the Governor, who passes the request to the Ministry of Environment and its Higher Council for Quarries. Via the Ministry of Interior and Municipalities, the license application is passed to the local municipality or the "Kaim makam". The decision on the application then returns to the Governor (via the stakeholders described above) with final authority to the Governor to deny approval or issue the permit.

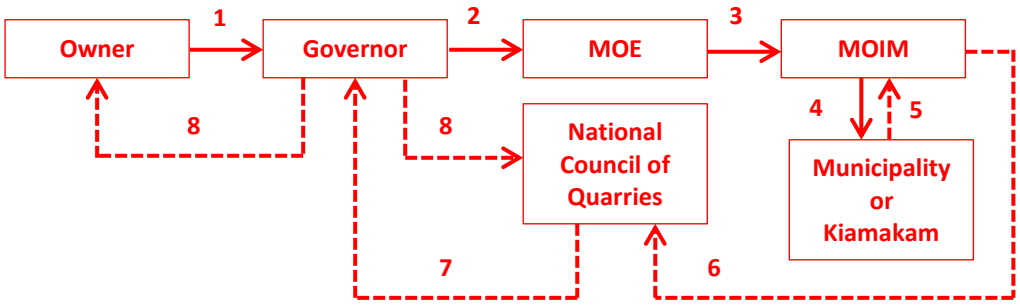

Figure 2: Permitting Procedure for Quarries in Lebanon

The Environmental and Social Impact of Quarries

In addition to the permitting requirements set by MoE, detailed environmental mitigation measures are also enforced by the Ministry on all quarries and this to mitigate positive and negative, short and long term, direct and indirect, reversible and irreversible impacts on the physical, biological and socio-economic environment.

In respect of the physical environment, the most significant impacts are likely to be the following:

- Degradation and/or pollution of water resources;
- Impairment of air quality and dust;
- Noise and vibration; and,

- Degradation of natural landscape and soils.
- Possibility of encountering archaeological materials

A list of potential impacts that commonly accrue form the development and operation of quarries are given below under Environmental Management Plan. To ensure these are addressed for any opening or re-opening of quarries for the construction of Bisri Dam, the contractor will take this framework document and produce an Environmental Impact Assessment (EIA) incorporating and Environmental Management Plan (EMP) tailored to his specific site, quarry plan, method of working, and after-use plan.

Considering Alternatives

The EIA for a new quarry will include an analysis of the consequences of adopting various alternatives including but perhaps not limited to:

- The quarry location, which depends on several factors such as distance to material destination, transportation access, adequate water supply and avoidance of areas with sensitive resources;
- The quarrying method which is determined for the most part by economics, depth, configuration, grade, characteristics of the body and the geology of the host rock;
- The site layout including the placement of the quarried material and the siting of structures/utilities in order to avoid resources conflict;
- The management or administrative practices including timing of operations and controlling rate of development in order to limit socio-economic impacts; and
- The mitigation and rehabilitation options.

The 'Do Nothing' or 'Without project' alternative will always be considered.

The selection of the preferred option will be justified in terms of:

- Meeting the project objectives (material quantity and quality);
- Considering environmental factors including biophysical and socio-economic factors;
- Complying with the national standards for environmental quality;
- Reducing the costs, including the environmental costs;
- Preserving natural and cultural heritage;
- Safeguarding public health and social issues; and
- Reducing public controversy.

Environmental Management Plan

An Environmental Management Plan (EMP), an integral element of any EIA, sets out the measures to be taken to avoid, mitigate potential environmental and social impacts, and to manage any residual impact. The EMP comprises three sections; Mitigation Plan to resolve the impacts, Monitoring Plan to show how the mitigation measures are succeeding, and Institutional Strengthening/Capacity Building Plan to provide the expertise necessary for project and EMP implementation throughout design, construction and operation.

Mitigation: Common impacts accruing from the development and operation of quarries, and their prime means of mitigation, are listed in Table 1.

Table 1: Potential Environmental Impacts of Quarries and Selected Mitigation Measures

Environmental Concern	Potential Impacts	Selected Mitigation Measures
Water resources and water quality	• Decrease in aquifer recharge and increase in surface runoff; • Disturbance to land drainage, overload and erosion of watercourses; • Changes to the surface over which water flows; • Changes to surface and groundwater resources quantity and quality due to stream blockage and contamination by particulate matter or waste; • Contamination of aquifers due to removal of the natural filter medium. • Groundwater contamination by quarry wastes.	• Utilise retention ponds to equalise storm discharge to watercourses and reduce sediment load; • No quarry-related activities to be located with the watercourse corridor; • Divert drainage from upper catchments around project area; • Implement affective waste management.
Air quality and dust	• Reduction in visibility due to dust plumes. • Coating of surfaces leading to annoyance and loss of amenity. • Physical and/or chemical contamination and corrosion. • Increase in the concentration of suspended particles in runoff water. • Coating of vegetation leading to reduced photosynthesis, • Inhibited growth, destroying of foliage, degradation of crops; • Increase in health hazards due to inhalation of dust.	• Plant wind breaks; • Cover crushers, screens and heaps of stared material; • Mist access roads and other place where dust may accumulate; • Cover trucks; • Fit dust suppression systems.
Noise and vibration	• Annoyance and deterioration of the quality of life; • Disturbance to animals and birds, reduced reproduction; • Shaking due to blasting of buildings and people; • Propelling of rocks fragments by blasting; • Disturbance to subsurface geology and ground water flow paths.	• Provide noise control measures; • Limit hours of operation; • Adopt suitable blasting techniques for each site; • Measure vibration and air overpressure as a function of distance, charge and delay; • Adopt adequate blasting design protocols; • Use more frequent blasting and reduce the surface area; • Use delayed detonation for better fragmentation and less vibration; • Avoid gas venting by filling shot holes; • Blast a heave depth not more than 6 m and adopt terracing to reduce rock flight, vibration, overpressure and instability; • Avoid blasting in adverse weather conditions.
Landscape and soils	• Destruction of natural landscapes; • Visual impairment; • Changes in soil characteristics; • Soil erosion and slope instability.	• Avoid unnecessary tree felling; • Create landscaped amenity bunds to improve distant vistas
Visual intrusion	• Excavated scars on open hillside visible from long distances; • Crushing, grading and coating plants visible from road; • Reject material and redundant plant dumped along roadside;	• Plant trees to provide local treatment and windbreaks; • Place crusher and other plant within quarry, not on the road; • Avoid a straight uninterrupted vision of the working site;

	• Surrounding areas coated in dust.	• Construct amenity embankments to obscure view, define rights of way of rivers, and prevent erosion; • Fill depressions with soil to promote vegetative growth; • Promoting vegetation on quarry faces.
Biological impacts	• Direct impacts include land clearance and excavation causing destruction of flora and fauna and loss of habitats; • Indirect impacts include habitat degradation due to noise, dust, and human activity.	• Early in project development, undertake an ecological survey; • Utilize mitigation measures as for the physical issues for the biological environment.
Socio-economic impacts	• Resettlement and loss of livelihood; • Health and safety of workers and the general public; • Reduction in property values; • Loss of agriculture; • Increase in traffic volumes and sizes of road vehicles; • Economic issues, including the increase in employment opportunities; • General deterioration of the quality of life. • Possibility of encountering archaeological materials.	• Avoid the need for resettlement; where inevitable, relocation will be fully compensated; • Train all staff in effective management and H&S; • Minimise transport-related impacts by effective fleet management including adherence to load capacities; vehicle maintenance; adequate space for site ingress and egress; clear signage, wheel washes at site exits, and driver instruction • Develop an After-Use Plan for the site. If no immediate use is expected, document proposals to maintain slope stability and Public Health and Safety. • Chance finds of archaeological materials can be mitigated by contacting the Directorate General of Antiquities (DGA) at the Ministry of Culture, and following the guidelines as provided in the relevant ESIA appendix.

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Monitoring*:* Appropriate environmental quality monitoring will be carefully designed and related to the predictions made in the EIA and the key environmental indicators that will demonstrate the sustainability of the project. The EIA will outline the need for and use of any monitoring, monitoring intervals and reporting procedures. Responsibility for monitoring primarily rests with the contractor, but check measurements will also be undertaken by the supervision consultant. The Ministry of Environment may also wish to undertake selected verification monitoring independently of other parties. Parameters that are commonly measured throughout quarry development and operation include:

- Air quality (particulate and equipment emissions);
- Groundwater (drawdown);
- Seismic (blast) vibrations;
- Noise level;
- Pit wall slope and stability;
- Surface water flow and quality (especially sediment);
- Amount and timing of stream diversion;
- Quarry drainage; and,
- Sanitary wastes.

The Monitoring Plan will separately identify and disposal of non-economic quarried material and that of other wastes, including any hazardous waste.
At crushing operations, the following parameters will be monitored:

- Air quality at stacks, on-site and facility boundaries;
- Quantity and quality of water discharge;
- Identification and proper handling of hazardous wastes; and,
- Noise levels both on-site and facility boundaries.

At rehabilitation operations, the following parameters will be monitored:

- Restoration of land surface (drainage, slope, and stability);
- Re-vegetation (cover, type, vigor);
- surface water quality; and,
- Other parameters depending on the future use of the quarry.

The Monitoring Plan must provide the following details:

- Key parameters that will be monitored, and for each, the monitoring locations, intervals and duration as well as the party responsible; and.
- Procedures to be undertaken if monitoring indicates non-compliance or abnormality, the internal reporting procedures and links to management practices and action plans, and reporting to relevant authorities.

Institutional Strengthening Plan: The institutional strengthening plan will demonstrate that sound environmental practice will be followed during the operation and rehabilitation of the quarry through:

- Training programs for the staff and labour such as equipment operation, materials disposal, occupational health and safety, and emergency response to accidents and incidents;
- Training programs for government officials charged with supervision of an environmental management and monitoring plans;
- Strategies to feed information from the monitoring plan back into the management practices and action plans to improve the environmental performance and sustainability of all components of the scheme;
- Organizational charts to show the division of responsibilities for environmental management and the reporting mechanism during quarry operation and rehabilitation;

Project Implementation Arrangements in case of quarry requirements

As described above, the exact volume of construction materials remains an estimate, as per standard dam design and construction practices. As agreed with CDR and described during public consultations, the project implementation agency, prior to, and during construction of Bisri dam as relevant, an EMP for required quarries that includes detailed mitigation measures, monitoring plan, roles responsibility and cost will be submitted to the World Bank for review and no objection. The EMP will include the estimated costs for applying the respective mitigation, monitoring and institutional strengthening measures during quarry operation and rehabilitation. The cost of EMP implementation will rest with the quarry developer and/or operator. Monitoring and supervision will be undertaken by the design consultant, as detailed in the terms of reference for the design engineer, also subject to Bank review.