



# Libyan National Plan to resolve water shortage problem Part Ia: Great Man-Made River (GMMR) project — capital costs as sunk value

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## Abstract

Libyan National Plan (LNP) to resolve the water shortage problem will be illustrated through a quartet of a series of papers. The first series of papers (I) will deal with GMMR supplied from rich groundwater reservoirs located in the southern desert regions, and will be composed of two papers. This paper (Ia) will conduct the cost analysis study by treating capital costs as sunk value, without interest rates. The second paper (Ib) will consider interest rates on capital costs and evaluate their influence on the cost analysis study. The second series of papers (II) will be dealing with desalination projects in the country. It represents a desalination river supplied by desalination plants located in the northern coastal regions, which is the longest in the Mediterranean. The third series of papers (III) will evaluate miscellaneous means of supplying water from outer regions such as utilization of rainfall waters by modern means; exporting water from rich EuroMed regions, north of Libya and rich African regions, south of Libya. Then, the following papers will concentrate on building the strategic plan to resolve the water shortage problem conducting comparative comprehensive feasibility studies on the different means.

*Keywords:* LNP; Water shortage problem; GMMR; Sunk value; Groundwater; Modelling

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## 1. Introduction

Groundwater, which constitutes about 0.6% of the world water reserve, is defined as water

concealed in underground reservoirs originated mostly from rain as a renewable source. If man in one day with his modern technology could benefit from falling rain waters on earth, which is potable

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and suitable for all uses with minimum treatment, the world water shortage problem could be resolved radically. “We send fertility winds to make water falls from the sky for you to drink and can not store.” [1].

Although water sciences, in general, and hydrology, in particular, are so developed, groundwater resources are still considered as an unseen resource as compared to surface water resources, especially in two ways:

- Quality: the change that could occur in quality is normally expected and hardly predicted.
- Quantity: due to the complication of the nature and engineering of underground reservoirs, the scientific estimation of these waters does not accurately assure its disappearance and deepening. “We sent down water from the skies in due measure, and lodged into earth, and we are capable of taking it away.” [2]. “Say: think: if your water has become deepened, who would give you flowing water.” [3].

The phenomenon of seawater intrusion is a manifestation of the deterioration of water quality of many groundwaters and a proof of the continuance contact of ground reservoirs underneath.

The management of different water resources and treatment of water for specific usage would mean the proper evaluation and utilization of these resources taking into account the following:

- 1) Resource expected life: what is its life span, how could it be managed properly, and its basic participation in resolving the water shortage problem.
- 2) Resource suitability: for the different uses and the required treatment for certain use in case its quality is degraded.
- 3) Resource cost analysis: in order to be utilized fully in comparison with others.

Hence, groundwater is a natural un-renewable resource, like other water resources, it should be utilized and managed wisely, its consumption rationalized, and it should be preserved and con-

served by sound scientific means. In this regard, Libya is endowed with two great water resources:

- a) Groundwater resource located in underground reservoirs under the desert in the southern regions,
- b) Seawater resource located in the coast, which is considered to be the longest (~1900 km) on the Mediterranean, in the northern regions.

In order for these two resources to be utilized fully in an integrated manner that takes into account the previous considerations, in addition to:

- 4) Water local exploitation: which advocates the utilization of water resources locally in a manner that provides the development of the local surrounding and considers the costs of transport and distribution of these water as follows:
  - Development of coastal regions domestically, agriculturally, and industrially (desalination is worthier).
  - Development of desert regions in a similar manner (GMMR is worthier).

In the framework of conserving these two resources, a comprehensive national plan should be implemented. Here is a citation of some of the features:

- Environmental dimension: It means that the proper cautious utilization of any resource should not neglect environmental issues, such as:
  - For desalination: Air and water pollution and conservation of marine life should be considered.
  - For GMMR: Avoid severe depletion of groundwaters which might cause the cracking and sliding of earth surfaces. It is worth mentioning that the consumption of groundwaters should not exceed the safe yield parameter which is defined by Kongling and Bank [4,5] as the yearly water consumption rate that takes into account the following:

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