

## **RIVER OF PIPES - GREAT MAN MADE RIVER (LIBYA)**

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**Извод:** Река од цеви је пројекат транспорта воде из јужних региона Либије, где се налазе велики подземни извори (Сахара), до северних области где је концентрисан највећи број становника, пољопривредне и индустријске делатности. Ово је највећи пројекат те врсте на свету. Циљ овог рада је да објасни основну идеју овог пројекта и да истражи перспективе развоја.

**Кључне речи:** Либија, пројекат реке, река од цеви, човек гради реку

**Abstract:** River of pipes, is a project to transfer water from the southern regions in Libya, where there are large quantities of groundwater (the Sahara) to the north where the concentration of population and agricultural and industrial. This project is the largest in the world. The aim of this research paper is to explain the idea of this project and to predict future perspectives.

**Key words:** Libya, river project, river of pipes, man made river

### **Introduction**

Since the emergence of Revolution in 1969, Libya is regarded as an outstanding example in all respects for its solid will and the serious efforts it has devoted for development and progress in a decisive challenge against various problems and obstacles, in particular the essential problem that is the scarcity of water resources facing the era. Since most of the Libya lands lies in arid regions and barely have any rainfall, which ultimately led to water shortage to farmlands, albeit the availability of agricultural potentials. Hence the active factor in the agriculture production is water with which everything lives and survives. Also due to the accelerated increase in population, the great industrial and agricultural progress and development at the northern parts of Jamahiriya which in turn led to consumption of water that caused serious shortage of local water resources and caused deterioration of water quality due to seawater intrusion into the coastal water bearing layers. This caused pollution and increased salinity of potable water beside its negative effect on the agriculture and land by salinity

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and deterioration of its quality and productivity. Realized by the historical decision, the Made River Project embodied the solid spirit that tackles challenges of the times “Water Disputes” and “Wars for food”. An effort ultimately regarded the last historical serious and real effort to save life on earth. Thanks to this great project, pure clean water shall flow from its natural resources beneath the desert at the southern parts of Libya, which have been accumulating for thousands of years during the rainy epoch and settled at the rocky layers. These waters shall, by the will be conveyed in a natural flow from South to North where the fertile agricultural lands. Great Man-Made River (GMMR) Project plays a special role in the series of gigantic achievements achieved by the Arab Libyan People, embodied in an advanced civilization achievement to benefit from the immense underground water reserves latent in aquifers in the heart of the desert. This is represented by the largest Water System of its kind to transfer huge amounts of water from the desert to the suitable soils in the coastal areas through huge buried pipelines, hence forming the largest man-made irrigation Conveyance System in the world known to human being so far. And the largest civil engineering project at present times.

### **Groundwater basins**

It is then esteemed a new discovery in itself of the desert ambiguities to use its huge contents of pure waters imprisoned over thousands of years during rainy epoch in the following underground basins (G. W. Murrat, 1952).

#### **1- Al Serir Basin**

This basin extends from Serir region to the Mediterranean coast. Its waters latent at a layer 600 meters deep, and contains 1000 km<sup>3</sup> of waters 84% of this water is of good quality ready for exploitation.

#### **2- Murzuq Basin**

The second main basin situated at Fezzan region south west of Libya covering an area of 450,000 and contains 4800 km<sup>3</sup> of waters latent in the rocky aquifer 800 meters thick. It is known for its good water quality, salinity not more than 300 (ppm). Studies also revealed that Al Kufra and Murzuq basins collectively contain a volume of water equivalent to 220 years with the Nile River flow. (Alhadi Abolgma, 1995).

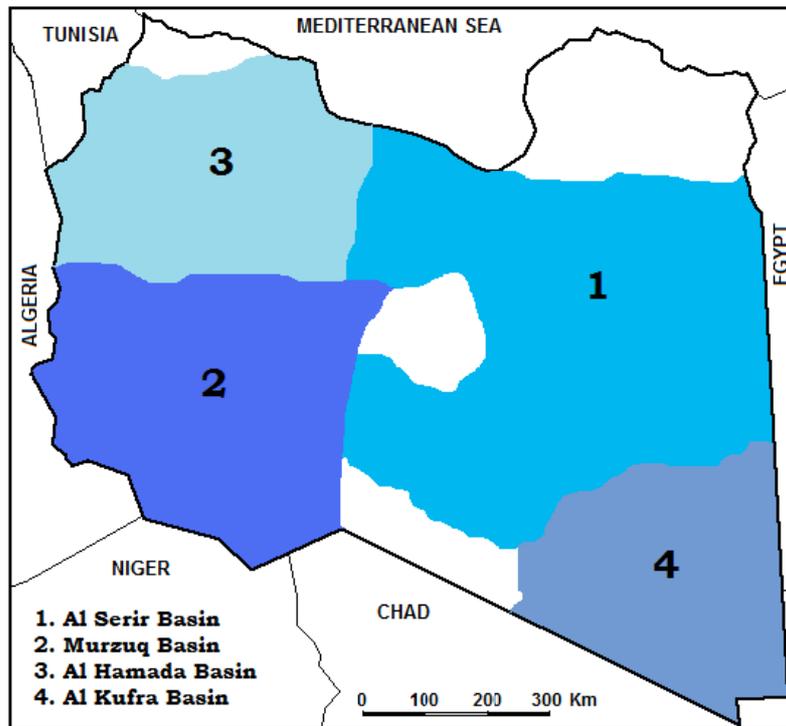
#### **3- Al Hamada Basin**

This basin is located at the northern Fezzan region and extends along Jabel Al-Sawda up to Mediterranean Sea. Studies confirmed that waters of Serir and Hamada basins are of lower quality. Studies prove that the water quality of these 2 basins, Serir and Hamada decrease as they get closer to the coast of the Mediterranean Sea.

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**4- Al Kufra Basin**

This basin is located east south of Jamahiriya. It is the largest of the main underground basins, covering an area of 350,000 km<sup>2</sup> and contains 3,400 km<sup>3</sup> of waters latent in the water bearing layers at a depth of 2000 meters. 90% of this underground reserve capacity is still awaiting exploitation. Al Kufra basin is singled out for its excellent water quality with its total salinity not exceeding 250 part per million (ppm) (Public Authority for Agricultural Production 1989).



*Figure 1 Groundwater distribution in Libya*  
Source: Mohamed Ali Fadel, (1995).

**Manufacture of pipes and digging trenches**

Moving these huge amounts of water latent at Al Kufra, Serir, Tazerbu and Fezzan basins from south to northern coast requires a giant Conveyance System of large scale pipelines. For this purpose two of the most modern and largest factories in the world were established to produce pipes. One of which located at Brega and the other in Serir, with total production capacity of 220

pipe a day. This ranked Jamahiriya today at the top of the list of Pre Stressed Concrete Pipe Manufacturers in the world.

Factors taken into consideration on producing these pipes; nature of the region, type of earth which will accommodate pipelines, hence using material and substances that resist corrosion and erosion and can withstand high pressure fluctuation. Pre-fatigued concrete pipes are manufactured of iron, steel, cement, sand, gravel, grout, carbon and other reinforcing elements. Each pipe segment is 7.5 meters long, 4 meter diameters and weighs between 73 and 80 tons, buried in 7 meters wide, 7 meter deep land trench. Tons of the soil produced in trench works are immediately transferred to pipe factories to be recycled in forming the pre fatigued concrete paste for pipe fitting ([www.maktoobblog.com](http://www.maktoobblog.com)).



*Figure 2 connecting pipe segments.* Source: ([www.majed.in/archives/36](http://www.majed.in/archives/36))

Connecting pipe segments into one pipeline involves accurate engineering processes so that segments gradually overlap by means of rubber-bands in accordance to accurate specifications. These laid pipes are extend from sources of water in the south to north of the Libya for more than 4000 km. So the Great River of Pipes is ready and equipped to accommodate and transfer immense amounts of fresh water to cover all coastal areas in Libya, in particular to lands suitable for agriculture.

### **Water transportation systems**

This great achievement is executed through a number of huge Conveyance Systems to transfer water cross the great desert from south to north, to provide large amounts of fresh water for drinking and agriculture, at an estimated rate of 6.5 million cubic meters daily. Through the following Water Systems:

#### **1. "Tazerbu Benghazi – Serir Sirte" Water System:**

This Water System carries 2 million m<sup>3</sup> of fresh water per day through two main lines, first of which carries water from Tazerbu water fields and the other from Al Serir water fields east-south of Libya. The two main lines are directed northward to the collecting and balance reservoir in Ajdabia, capacity of which is 4 million m<sup>3</sup> of water and where from Conveyance System is bypassed in two

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branches, one of which goes east to carry 1.18 million m<sup>3</sup> of water to Omar Mukhtar Reservoir with capacity of 4.7 million m<sup>3</sup>, the other branch heads westward carrying 820,000 m<sup>3</sup> of water to settle in Ghurdabia Reservoir at Sirte capacity of which 6.8 million m<sup>3</sup> of water. 234 producing wells feed this conveyance system 126 of which at Serir region, and 108 wells at Tazerbu region. Well depth varies in both fields from 450 to 650 meters. This water trip from the well fields to the coast takes about 9 days at a speed of 0.95 m/sec.

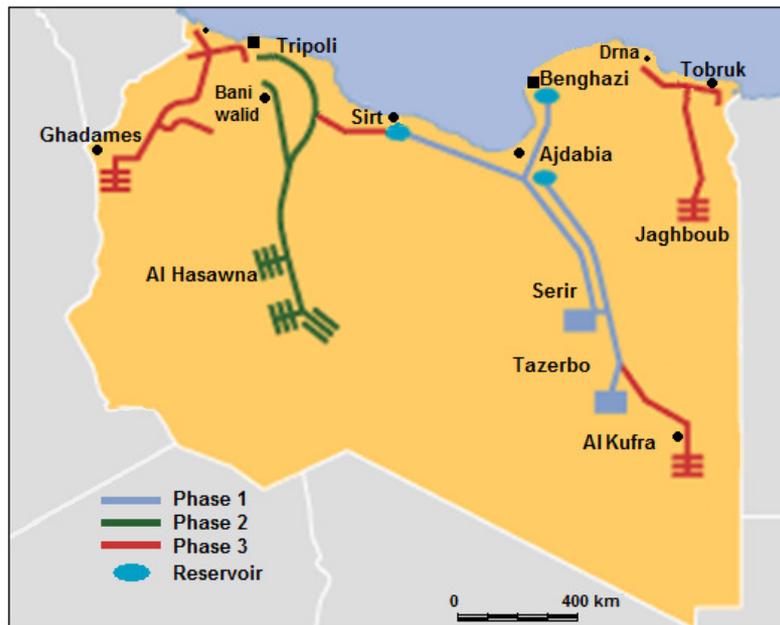


Figure 3 Water transportation systems

Source: [www.libyanpeoplesbureau.com/manmaderiver.html](http://www.libyanpeoplesbureau.com/manmaderiver.html).

## 2. “Al-Hasawna Al-Jefara” Water System

This Water System aims to transfer 2.5 million m<sup>3</sup> of fresh water every day from west-south of Jamahiriya, precisely from Jabel Hasawna region situated above Murzuq natural basin to the western coast and the fertile lands in Jefara Plain. This water system extends to 1.676 km length fed by 484 producing wells, 168 of which situated at North East Jabel Hasawna field and 316 wells at East of Jabel Hasawna. Well depth in both fields varies from 400 to 600 meters, 50 km to the North, Conveyance System line splits into the following two branches:

### A. Central Branch:

This line heads northward across Wadi Zamzam region and Sof El-Jean Bene Walid to the regulating reservoir in Tarhouna Region. This routing then is di-

rected towards Jabel Nafusa through a tunnel of 288 meters long to Jefara Plain. From there, to Abu Zayan Reservoir feed Jabel Gharbi region with water. This line carries 0.834 million m<sup>3</sup> of water, per day.

**B. Eastern Branch:**

This branch heads eastern northward from a point lies between Wadi Girza and Wadi Rashada at Esdada. This branch will be directed to the west along the coastal highway, passing close to Misurata, Zlieten, Al Khums until it reaches ultimate destination at Gharabulli, where the balance reservoir is erected at 160 meters above sea water level. From this reservoir water is carried over to Tripoli and surrounding regions, and also to supply irrigation water to agriculture projects at Jefara Plain This bypass carries 1.7 million m<sup>3</sup> of water daily. (GMMR, Tripoli office, 1994). It is worthwhile to note here that this Conveyance System is more difficult to execute for its extensions pass through rough lands with many hills and canyons and rocky surface

**3. “Jaghub- Tobruk” Water System**

This Conveyance System aims to carry 120,000 m<sup>3</sup> of fresh water per day from Jaghub fields that contain 20 producing wells to Tubruk and local areas.

**4. “Ghadames – Zuara - Zawia” Water System**

This Conveyance System should carry quarter of a million m<sup>3</sup> of fresh water per day from Ghadames basin comprising 143 producing wells to Zuara, Zawia and close by cities.

**5. “Al-Kufra – Tazerbu” Connection**

This connection aims to increase the flow of water into Tazerbu – Benghazi – Serir – Sirte Water System with a rate of 1.68 million m<sup>3</sup> of water per day from Al-Kufra well fields that contain 260 producing wells, so that total Conveyance System capacity becomes 3.68 million m<sup>3</sup> of fresh water daily, length of this line is 377 km.

**6. “Al-Gardabia – Al-Sdada” Connection**

This line connects the Tazerbu – Benghazi – Serir – Sirte Water System and Jabel Hasawna – Jefara Water System aiming to carry 980,000 m<sup>3</sup> of water daily to Jabel Hasawna – Jefara Water System after increase of flow rate due to connection to Al-Kufra Tazerbu. Upon completion of these Conveyance Systems GMMR Project should be completed and total volume of conveyed water is about 2,400 millions m<sup>3</sup> a year, hence forming the largest civil engineering project known to humanity in this epoch (Karima Slama,1996).

**Investment management of water project**

By virtue of the General People’s Committee’s Decree 230 of the year 1989 the “Authority for the Investment of Jabel Hasawna – Jefara Water System of the Great Man-Made River” was established, with the task and the responsi-

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bilities for organization and investment of the Conveyance System Jabel Hasawna Jefara. Through policies, plans, programs which it sets up aiming to reach maximum levels of agricultural and animal production with the best possible economic returns.

**Objectives**

Investment plan aims to achieve in its wide strides to optimize utilization that takes in consideration the economic side in order to guarantee the best possible returns not ignoring of course the social side which dictates development of as much as possible of producing agricultural commodities, and other ambitious targets which include:

- 1- Participation in the creation of water equilibrium at the western parts of Libya, especially at Jefara Plain and regions which according to available information and studies, are subject to shortage of water resources and seawater intrusion, which jeopardize the region with effects of salinity and desertification.
- 2- Creation of agricultural development in some of the absentee regions through investment of waters supplied by Jabel Hasawna – Jefara Water System of GMMR, which are yet incomplete, also to support the already existing agricultural projects in order to keep up substantial investment in such projects and to rehabilitate and farm large areas of land creating food producing farms in order to increase agricultural production and to raise self sufficiency of essential commodities In addition to ecological impact by the creation of new circumstances such as irrigated farming and forests and pastures also planting wind brakes and erection of dams to preserve soil and develop agricultural resources.
- 3- To increase the share of the agricultural sector in the Gross Domestic Production and to widen base of production and provide alternative sources of revenue instead of oil providing variation in National Income sources and also providing jobs for numerous individuals of Libyans. And other ambitious targets aiming at creation of extensive comprehensive ecological, social and economical benefits and bounty to all masses of the Arab Libyan People.

In the course of investment in Jabel Hasawna Jefara System, it is planned to use 64.28% of GMMR conveyed water for Agricultural Investment Plan has been accomplished in Jabel Hasawna Jefara System. This is quite keen to participate to maximize production of essential agri-commodities according to approaches and needs of Society, and to increase self-sufficiency and fulfill

food security in its comprehensive concept. This is based on studies prepared by the staff of the Authority and studies of the Master Plan. The original crop pattern of project was approved as per studies conducted to establish these projects. This is in order to keep and maintain the infra structure therein. With the possibility to use it to cut costs such as main and secondary irrigation water systems and farm, storage tanks etc. Libya shall be able to fulfill self-sufficiency in a large number of strategic and essential agro-commodities, 50% of which being imported at the time being and to export surplus of other crop production.

### Conclusion

The Great Man-Made River Project is bringing water to the people and providing water for municipal, industrial and agricultural use. The strategy of the responsible Libyan authority is aimed at increasing both crop and livestock production to a level that achieves the highest possible rate of self-sufficiency and reduces dependence on imports from foreign markets to the lowest possible level. It also aims at increasing the productive capabilities of the labor force and of the capital investments in the sector, and at producing raw materials for food processing industries. The river is a new lesson and an example in the struggle to achieve self-sufficiency, food security and true independence. No nation that depends on a foreign country to feed its people can be free. The Great River is a triumph against thirst and hunger. It is a defeat against ignorance and backwardness. It reflects the determination of Libyans to resist colonial pressure, to acquire technology, to develop, to improve their lives, and to control their own destiny in accordance with their own free will.

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