MANGLA DAM

KEY FACTS

Dam Type:	Earthfill
Height:	380 ft. (above riverbed)
Length:	10,300 feet
Lake Area:	97.7 sq. miles
Catchment Area:	12,870 Sq miles
Gross Storage Capacity:	5.88 MAF
Live Storage Capacity:	5.34 MAF
Main Spillway Capacity:	1.01 million cusecs
Year of Completion:	1967
Hydropower Generation:	1,000 MW from 10 units of 100 MW each
No. of people to be displaced by raising of dam:	40,000

Please Insert Sketch of in the file called "Location Map" sent separately in MS Word format. It is a scanned figure.

1.0 HISTORIC DEVELOPMENT

In April 1948, India diverted the flow of the Ravi, Sutlej and Beas rivers, an act, which threatened irrigated cultivation in Pakistan. That same year, in an effort to mitigate the consequences of possible interference by India with the supplies of the canals feeding from those rivers, Pakistan embarked on a program of link canal construction to enable the transfer of water between rivers.

Until 1967, the entire irrigation system of Pakistan was fully dependent on unregulated flows of the Indus and its major tributaries. The agricultural yield was very low for a number of reasons, the most important being a lack of water during critical growing periods. This problem stemmed from the seasonal variations in the river flow and the absence of storage reservoirs to conserve the vast amounts of surplus water during periods of high river discharge.

Mangla Dam was the first development project undertaken to reduce the shortcoming and strengthen the irrigation system.

2.0 THE MANGLA DAM PROJECT

Mangla Dam is the 12th largest dam in the world. It was constructed in 1967 across the River Jhelum, about 60 miles southeast of the federal capital, Islamabad. The main structures of the dam include 4 embankment dams, 2 spillways, 5 power-cum-irrigation tunnels and a power station.

The main dam is 10,300 feet long and 454 feet high (above core trench) with a reservoir of 97.7 square miles. Since its first impounding in 1967, sedimentation to the extent of 1.13 MAF has occurred, and the present gross storage capacity has reduced to 4.75 MAF from the actual design of 5.88 MAF. The live capacity has reduced to 4.58 MAF from 5.34 MAF. This implies a reduction of 19.22 % in the capacity of the dam.

The project was designed primarily to increase the amount of water that could be used for irrigation from the flow of the River Jhelum and its tributaries. Its secondary function was to generate electrical power from the irrigation releases at the artificial head of the reservoir. The project was not designed as a flood control structure, although some benefit in this respect also arises from its use for irrigation and water supply.

3.0 MAIN ELEMENTS OF MANGLA DAM

The Mangla Dam components include a reservoir, main embankment, intake embankment, main spillway, emergency spillway, intake structures, 5 tunnels and a power station. Besides the main dam, a dyke called Sukian – 17,000 feet in length and a small dam called Jari Dam to block the Jari Nala – about 11 miles beyond the new Mirpur town had to be constructed.

There was a total of 120 x 10^6 yds^3 of excavation for the reservoir whereas the total fill amounted to 142 x 10^6 yds^3 and concrete to 1.96 x 10^6 yds^3 respectively. The main embankment is earthfill with clay as the core material. Gravel and A-type sandstone are applied on the shoulders. The maximum height of embankment above the core trench is 454 feet and the length is 8,400 feet. The intake embankment is earthfill type with B-type sandstone as the core material. Gravel is applied on the shoulders. The maximum height of intake embankment above the core trench is 262 feet and the length is 1,900 feet.

Sukian Dam is earthfill with B-type sandstone as the core material. A-type sandstone is applied on the shoulders. The maximum height of the intake embankment above the core trench is 144 feet and the length is 16,900 feet. J

Jari Dam is also an earthfill type with silt as the core material. Gravel is applied on the shoulders of the dam. The maximum height of Jari dam above the core trench is 274 feet and the length is 6,800 feet. The main spillway is a submerged orifice type with 9 radial gates, 36 x 40 feet each; it has a maximum capacity of 1.1 million cusecs. The emergency spillway is weir type with an erodible bund and a maximum capacity of 0.23 million cusecs. The 5 tunnels are steel and concrete lined and 1,560 feet long in bedrock. The internal diameter ranges between 26-31 feet. The power station has 10 vertical francis type turbines, each generating 100 MW of power.

4.0 FINANCIAL BENEFITS

The Indus River System Authority (IRSA) indented 4.21 MAF of water releases for irrigation purpose during 1999-2000, against 5.1 MAF during the previous year, worth Rs 3,789 million at a rate of Rs. 900 per acre-feet. In addition, the Mangla Power Station generated 3,184.77 million kilowatt hours (MKWH) of electricity, worth Rs. 955.43 million at a rate of Rs. 0.30 per kwh unit. The financial benefits for the years 1996 and onwards are given below:

Year	Water		Power		Total Benefits
	Storage Releas	Rs. 900 per Ac-Ft	Generation	Rs. 0.3 per Ac-Ft	
July to June	MAF	Benefit, Rs. Millio	MKWH	Benefit, Rs. Millio	Rs. Million
1996-97	4.98	4,482	5,665.63	1,699.69	6,181.69
1997-98	4.36	3,924	6,103.72	1,831.11	5,755.11
1998-99	5.10	4,590	4,778.53	1,433.56	6,023.56
1999-00	4.21	3,789	3,184.77	955.43	4,744.43

5.0 THE MANGLA WATERSHED MANAGEMENT PROJECT

The primary objective of this project is to prolong the life of the Mangla reservoir through improved methods of land-use and implementation of watershed management practices in the catchment area above Mangla dam. The project, besides reducing silt entry into Mangla reservoir, has also improved the following:

- socio-economic conditions of the people living in the area by improvement of land with consequent increase in agriculture,
- forest and range-land produces,
- increase in sub-soil water resources and perennial stream flows,
- minimizing runoff with consequent reduction in flood hazards and
- environmental protection of the area

The total catchment area of the River Jhelum above Mangla is 12,870 square miles. 56% of this lies in the Indian-held Kashmir territories and the remaining 44% in Pakistan and Azad Jammu and Kashmir. Of the total area in Pakistan, only 3,433 square miles is covered by this project, which includes the critical sediment source areas.

The watershed management practices include reforestation of bare and denuded lands, development of range-lands, improvement of cultivated fields by land leveling/ improvement of terraces and structural works such as silt trap storages, spillways, check dams, retaining diversion walls and gully control structures.

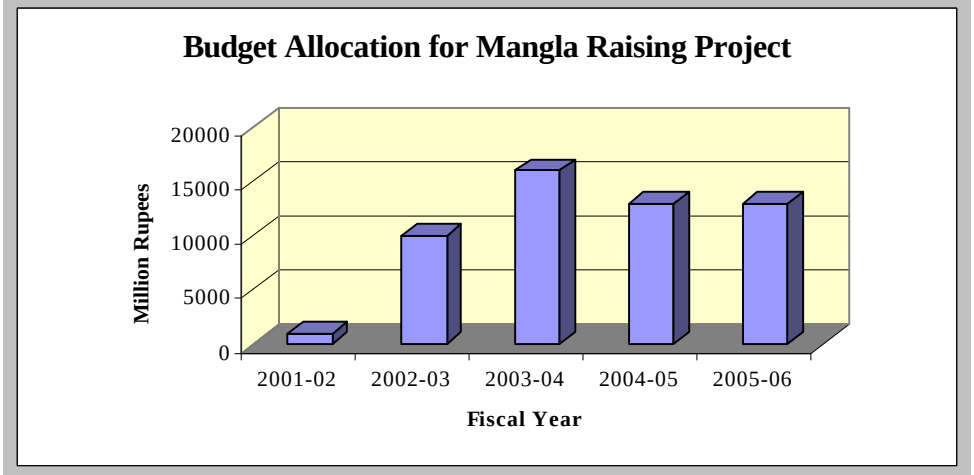
6.0 THE RAISING OF MANGLA DAM

A joint venture of consultants comprising NESPAK, Barqaab, Binnie and Partners and Harza has been awarded the contract to undertake the feasibility for raising Mangla Dam by 40 feet. The proposal for raising of Mangla Dam was part of the Final Completion Report submitted by Binnie and Partners in 1971. This will raise the elevation of the dam from 1,234 feet to 1,274 feet and subsequently increase the conservation level from 1,202 feet to 1,252 feet and the minimum operating level from 5.88 MAF to 9.6 MAF.

According to recent investigations (1999), the capacity of Mangla has reduced by 19.22% due to silting i.e from 5.88 MAF to 4.75 MAF. Concerned by this, the government initiated the raising of Mangla Dam as a fast-track project on August 14, 2000.

The raising of Mangla dam will make the main dam 494 feet high, providing an additional 1,000 GWh or an 18% enhancement and 3.1 MAF of additional storage under normal conditions.

The Government of Pakistan has allocated 53 billion rupees for this project between 2001-06.



7.0 THE RESSETLEMENT ISSUE

During the construction of the Mangla dam, 65,100 acres of land was submerged. This led to the resettlement of the residents of old Mirpur town and the affected people were provided accommodation in the newly designed and developed town of Mirpur. Most of the people were accommodated however, some grudges remained after resettlement.

An important concern on the raising of Mangla dam is the resettlement of an estimated 40,000 people living in 7,000 houses. Some of these may be the same people or their descendants who would forced to leave their hometown for the second time. Rs. 20 billion have been allocated for population resettlement in the Rs 53 billion project. WAPDA is developing a policy and compensation package for resettlement of the affectees.

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