DAMS: THE GOOD, THE BAD AND THE DAMMED

by Garry Atterton

The Unacceptable Cost of Dams

WASHED AWAY

Turkish Dams Will Rob 70,000 of their Homes

THE FLOODGATES OPEN

India flooding hits 7 million

Figure 1: **Newspaper headlines about dams and flooding**

1 THE BACKGROUND

The headlines in Figure 1 were all in newspapers in recent years. Paul Brown, the Environment correspondent for *The Guardian* newspaper, wrote on 17 November 2000:

> 'Many of the 45,000 big dams built across the world cost too much, were late, damaged the poor and have failed to provide all the electricity and water for irrigation that the planners claimed they would, the World Commission on Dams reported yesterday.'

What are dams?

Dams are barriers constructed across a stream or river to hold water and raise its level. There are an estimated 800,000 small dams, 45,000 large dams and 300 major dams world-wide.

Large dams are higher than 15 metres – the size of a five-storey building. **Major or 'super' dams** are higher than 150 metres – at least the same height as the length of one and a half football pitches.

Country	Dam	Capacity (megawatts)
China	Three Gorges (being built)	18,200
Brazil/Paraguay	Itaipù	12,600
Venezuela	Guri	10,300
USA	Grand Coulee	6,809
Russia	Sayano-Shushensk	6,400

Figure 2: **Generating capacity of the world's largest dams**

Most of the newspaper headings and articles criticised dams. However, there is a good side ...

The good side of dams

- The Tarbela Dam on the Indus River in Pakistan created the largest irrigation scheme in the world. Millions of jobs were created for small farmers.
- The Tucurui Dam on the Toccartis River in Brazil creates 4,000 megawatts of power, half of which is used in the important aluminium industry.
- The Kariba Dam on the Zambesi River between Zambia and Zimbabwe is the largest artificial lake in the world. The dam produces huge amounts of electricity for the nearby copper mines and urban areas. Successful commercial fisheries have also been set up on the lake.

Dams provide massive social and economic benefits. Irrigation schemes help people to grow crops, and therefore feed people. Hydro-electric power from dams provides 20% of the world's electricity, which is used for industrial production and for heating and lighting villages, towns and cities (see Figure 2). Many millions of people are protected from the ravages of annual flooding because of dams.

Dams and flooding

There is another side to the Kariba Dam on the Zambesi River that is worth investigating. In February 2000, Mozambique – one of the poorest countries in the world – was devastated by floods, and the rains were blamed. But matters weren't helped by the operators of the dam upstream. Having kept the dam almost full of precious water at the start of the rainy season, they were forced to release massive amounts through the spill-gates, causing flooding of fields, schools and villages. This is not the only example of flooding caused by water being released too quickly from dams.

In 1975 the Banqia Dam on the Yangtze River in China released water too quickly and 85,000 people died in the flooding that followed. Some scientists say that if the latest project on the Yangtze, the Three Gorges Dam, went wrong it would result in the worst-ever man-made disaster.

Case Study

Aswan High Dam, Egypt

The Aswan High Dam on the Nile in Egypt was built with the aim of controlling regular floods, increasing irrigation and

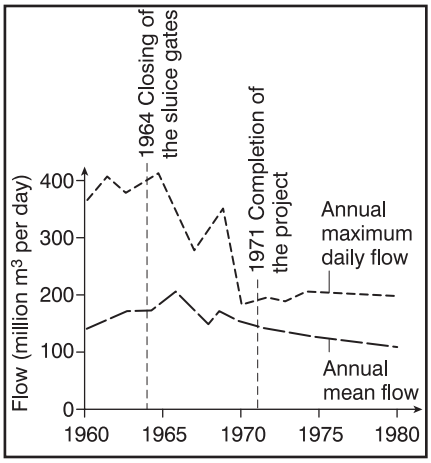

Figure 3: **Annual maximum daily flow and mean flow of the Nile, 1960–80**

producing electricity. Figure 3 shows the change in the annual maximum daily flow and annual mean flow before and after the construction of the dam.

Flood regimes recorded at the village of Musha next to the Nile show changes in river flow before and after construction of the Aswan High Dam (Figure 4).

As these graphs show very clearly, the primary aim of controlling flooding was achieved. However, there were a number of unexpected problems, too. The negative effects included:

- Water loss through seepage and evaporation affected the water supply needed for some of the planned developments.
- Fertile sediment that had previously been left on the land each year by the floods was not deposited but was trapped in Lake Nasser behind the dam. This meant that farmers on the Nile floodplain had to use expensive fertilisers on their crops.
- The great weight of the water on the dam is believed to increase the likelihood of seismic (earthquake) activity in the Aswan area.

Future trends

The present population of the world is 6 billion and within 50 years it could be 9 billion. Most of the population growth will be in less economically developed countries (LEDCs). Consequently the greatest demands for water and food will come from the poorer countries. So it is here that the greatest pressure will be to build more and more dams. People who question whether more dams should be built will have to face the argument from some of the poorer countries that dams are essential for the sustainable future of many millions of people.

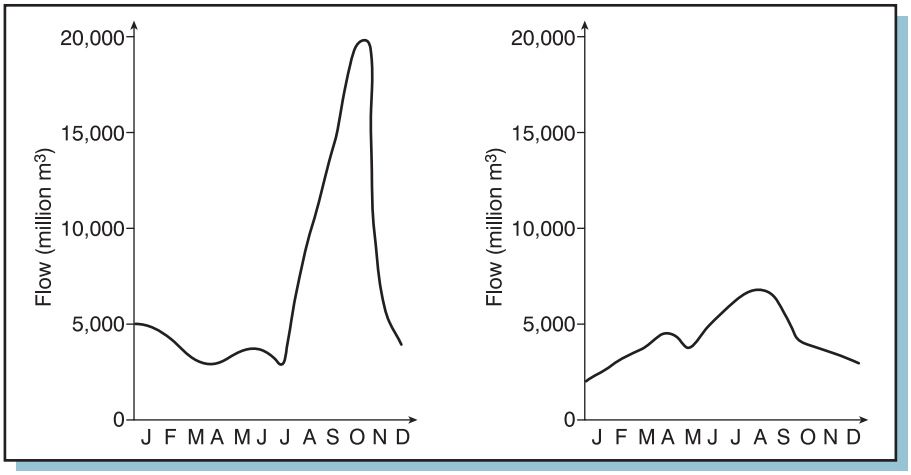

Figure 4: **Regimes of the Nile at Musha before and after the construction of the Aswan Dam**

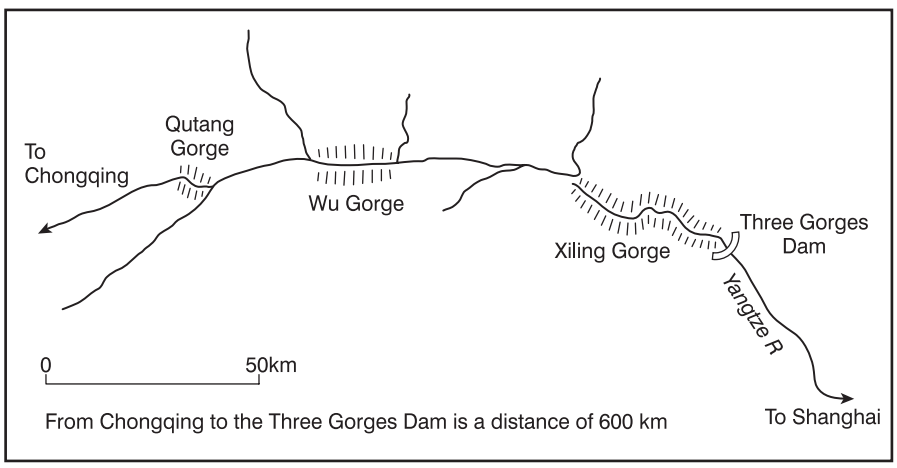

Figure 7: **The Three Gorges Dam and the Yangtze River**

2 THE OPTIONS

The Three Gorges Dam Project

Flooding is nothing new to the Chinese. The mighty Yangtze River floods annually. However, the floods do seem to be getting worse. The solution has been to build the world's largest dam (Figures 5 and 6, and see figure 9 on page 4). The first stage of flooding is due to start in 2003 when the water level will be raised to 135 metres. This will turn part of the river into a reservoir 632km long. The second stage, on completion in 2009, will raise the water level to 175 metres. The finished dam will be the largest in the world, with a 185 metre wall stretching 24km and holding back 70 billion cubic metres of water. Only time will tell if the 'wildest and wickedest' river in the world is tamed, and whether any unforeseen circumstances such as those that affected Egypt after the Nile was controlled, have any impact on the people and environments of the Yangtze River.

3 THE DECISION

Alternatives to the major dams

For many millions of people throughout the world, access to clean drinking water is just a dream. In Kaguro, a remote village in western Sudan, it rains only during a period of about three months a year, from July to September. When it does rain it pours down, flooding the dry riverbeds and moving quickly out

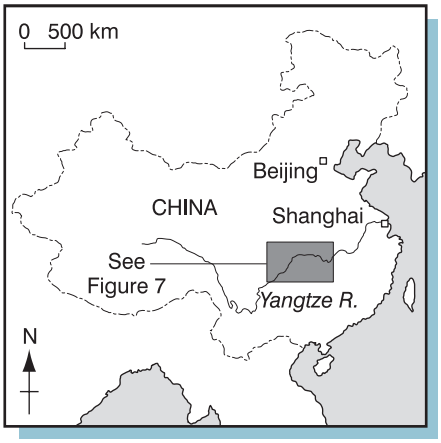

Figure 6: **China, and the location of the Three Gorges Dam**

of the area. Until recently, at around 12 midnight the village women and some children would start walking 8 km to the nearest waterhole. This was the only way they could provide water to keep their animals alive and provide water for their families. They would often have to wait for many hours in a queue before returning to the village with heavy cans of water on their heads, some weighing as much as 20 kilograms.

Solutions to water storage and collection in Kaguro in Sudan

The following are the three options available for the village of Kaguro:

Option 1: Pipe the water the 8 km from the waterhole to the village. This would immediately solve the problems of travelling to collect water and it would literally bring water on tap! Although not technically difficult to do, this remote village would have problems bringing in 8 km of piping.

Option 2: Build a reservoir and dam just outside the village to store water all year around. A reservoir would also solve the problems of travelling the long distance to collect water. Technical support and advice would be needed from engineers, but the villagers could build the dam themselves.

Option 3: Use stronger, more durable and lighter-weight water containers that have been designed by villagers, but made and offered

Figure 7: **Opinions of the people of Kaguro**

free by aid agencies, such as Oxfam. The problem of travelling the long distances for water would not be solved – and the women would still have to carry the weight of water. The scheme would cost the villagers nothing.

All three options have advantages and disadvantages. However, the solution that the whole village decided to go for was to build a dam just outside the village. With practical help and technical advice from the British aid agency Oxfam, the project began in November 1999 (see Figure 7 for the villagers' reactions).

Criteria for successful dams

At the beginning of this unit we saw that many dams were severely criticised by the World Commission on Dams. The report actually stated the dams *could* be successful if the criteria outline in Figure 8 were followed.

Conclusion

In summary, this unit has shown that there is a good side to dams. They store water, they allow irrigation schemes to be developed, produce electricity, provide jobs and protect people from flooding. However, there is also a 'dammed' side... Many of the large and major dams were too costly and often are no help to the poorest people. Dams can be successful if they are well planned and involve local people in the decision-making process, to follow the principles of economic, environmental and social sustainable development.

Figure 8: **Criteria for successful dams**

Activities

1 Study the newspaper headlines in Figure 1 and the quote by Paul Brown on page 1, then write down four reasons why dams can be described as **bad**.

2 Write down a definition of a dam.

3 What are the differences in number and size of structure of **small, large** and **major dams** throughout the world?

4 Study 'The good side of dams'. Write down four reasons why dams can be described as **good**.

5 Draw a bar graph to display the figures given in Figure 2.

6 (a) What will happen to the world's population in the next 50 years?
(b) Where in the world will most of the population growth occur?
(c) What link is there between the growth of population in LEDCs and the needs of these people, and the possible construction of more large and major dams?

7 Study the section on 'Dams and flooding'. Use examples to explain how dams can make flooding worse downstream.

8 Study Figures 3 and 4. What evidence is there that the closing of the Nile at the Aswan High Dam in 1964, and the completion of the project in 1971, resulted in a control of flooding of the Nile?

9 Study Figure 9.
(a) Copy and complete Figure 10.
(b) In pairs, discuss the benefits and problems of the Three Gorges Dam project. Then answer this question:

Do you think the benefits are greater than the problems? or do you think the problems are greater than the benefits?

Explain your answer.

10 Study the section 'Alternatives to the major dams'. What are the problems that the villagers of Kaguro in Sudan face in terms of storage of water during the storms and collection of water throughout the year?

11 In groups, study 'The solutions to water storage and collection in Kaguro'. Each group should choose **one** of the three options, research it, then explain its advantages and disadvantages to the class.

Decision-making exercise

12 (a) Which of the three options do *you* think would be best for the villagers of Kaguro?
(b) How well does your decision compare with the villagers' final decision?
(c) Explain in writing why you think the option chosen was likely to be successful.

13 Study Figure 9. Explain how well the Kaguro dam project fits with the criteria.

14 Using all the information in this unit, explain in not more than 100 words why you think the author of this unit chose the title 'The Good, the Bad and the Dammed'.

Arguments for the scheme

1 It will protect 50 million people, and millions of hectares of farmland, from flooding.
2 It will generate 10–15% of the country's electricity, replacing polluting fossil-fuel power stations.
3 It will store vast amounts of water for irrigation.
4 It will improve navigation.
5 It will create thousands of jobs and boost local and regional economies.

Arguments against the scheme

1 It will flood vast areas of land, submerging 13 cities, 140 towns and 4,500 villages. Many industries and factories will be lost.
2 1.2 million people will have to be relocated.
3 The landscape will be changed for ever, drowning the world-famous Three Gorges scenery.
4 Vast areas of forests and productive farmland will be lost.
5 The estimated cost is an enormous £15 billion.

Figure 9: **Arguments for and against the Three Gorges Dam Project**

	Benefits of the Three Gorges Dam project	**Problems of the Three Gorges Dam project**
Economic (financial cost)		
Social (people cost)		
Cultural (historical and environmental cost)		

Figure 10: **Benefits and problems of the Three Gorges Dam project**

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