



Characteristics of water resources in Changjiang River Basin and Three Gorges Project

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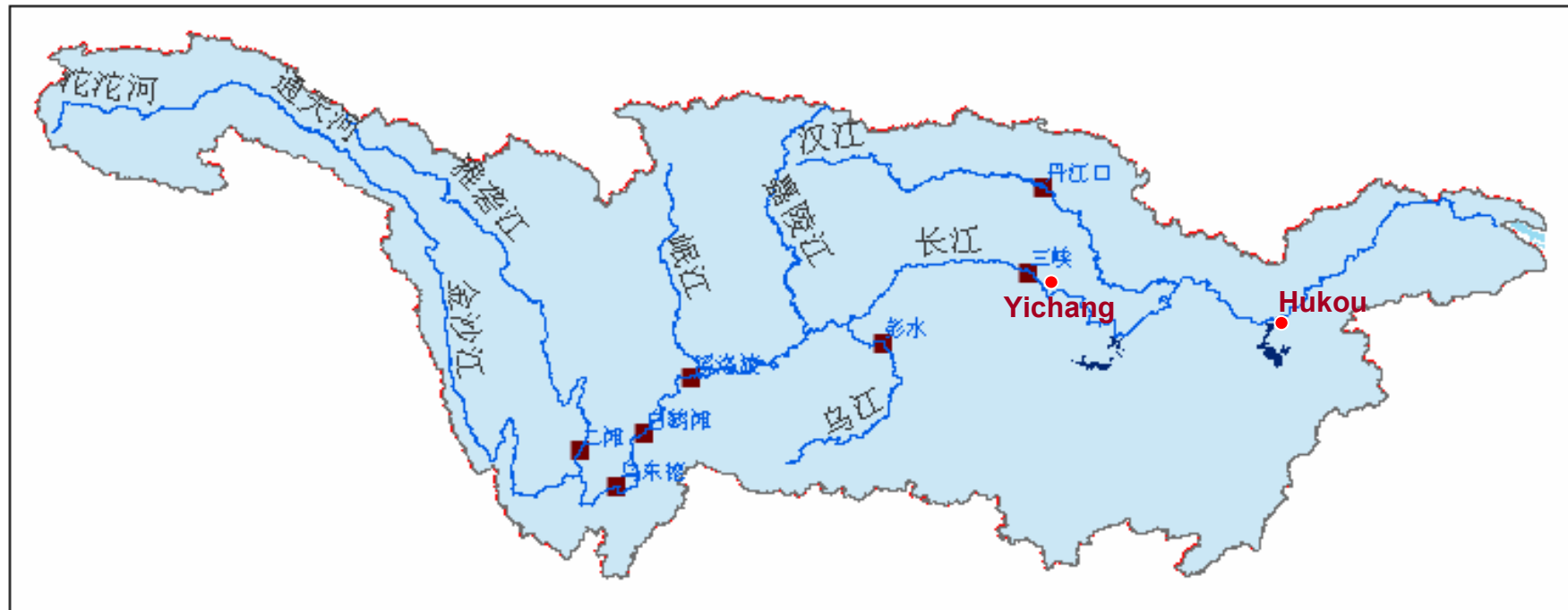
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1 Brief introduction

- Changjiang River is the longest river in China with a length of about 6300 km. The catchment area reaches 1.8 million square kilometers. The average water resources amount is 996 billion cubic meters, occupying 35% of that of the whole country.
- The hydropower on the main stem of Changjiang River and its tributaries is huge, with a potential of 268 million kW, the developable amount of 197 million kW and the annual power output is 1027 billion kW·h. The navigation conditions of the river are favorable with a navigable mileage of 70000 km.
- The economy in the basin occupies an important place in the country. The GDP in 2000 amounted to 33% of that of the whole country.

1 Brief introduction



Reach of headwaters to Yichang is upstream, reach of Yichang to hukou is middle reach, reach of hukou to river's mouth is lower reach.

2 Characteristics of water resources in Changjiang River Basin

Water resources amount

- Precipitation

The Changjiang River basin is located in the subtropical monsoon region, with average annual precipitation of 1087mm and a total precipitation amount of 1937 billion cubic meters, taking up 31% of that of the whole country.

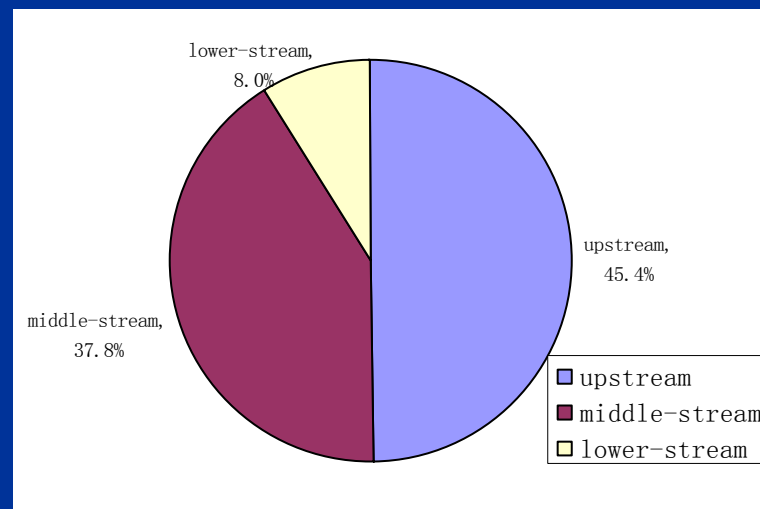


Figure 1 Precipitation in the Changjiang River basin

2 Characteristics of water resources in Changjiang River Basin

- Water resources total
The average annual water resources amount totals to 996.0 billion cubic meters, occupying 35% of that of the whole country.

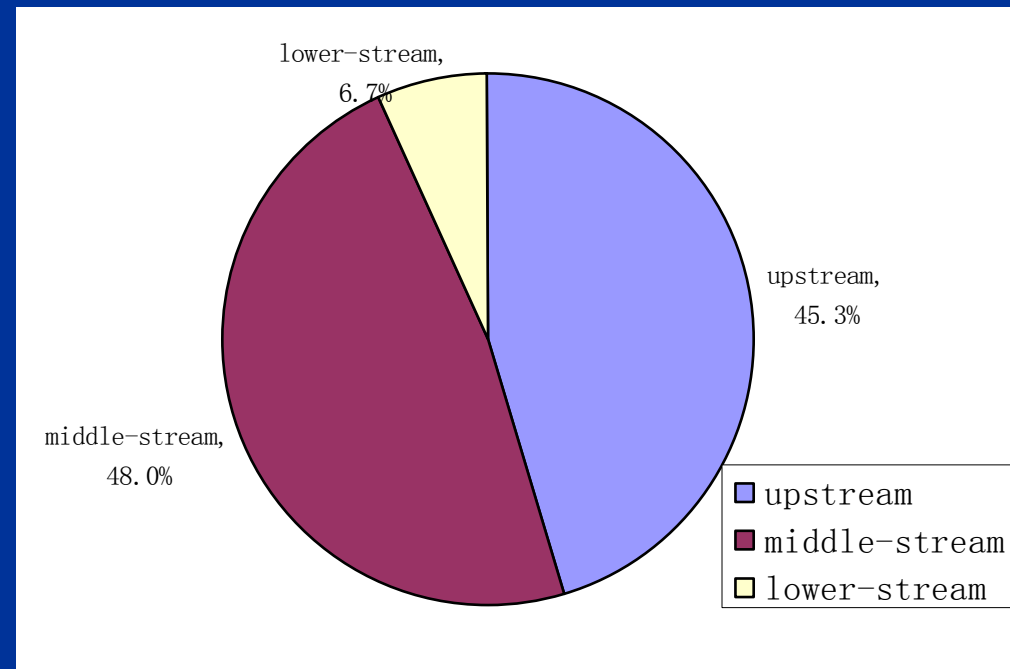


Figure 4 Water resources amount in the river basin

2 Characteristics of water resources in Changjiang River Basin

Characteristics of water resources

- The water resources and hydropower are rich in this river basin and the water resources amount takes up one third of that of the whole country and it is possible to divert to an extent water to the river basins lack of water in north China.
- The water resources are spatially unevenly distributed with a significant variation within one year. The amount in the flood season is huge, which exceeds the river channel capacities on the middle and lower reaches, causing severe flooding disasters.

2 Characteristics of water resources in Changjiang River Basin

Characteristics of water resources

- The water quality in the river basin is fairly good as a whole. The river length with a quality better than Class 3 occupies 83% of the total river length. But water pollutions exist on local river sections and lakes.

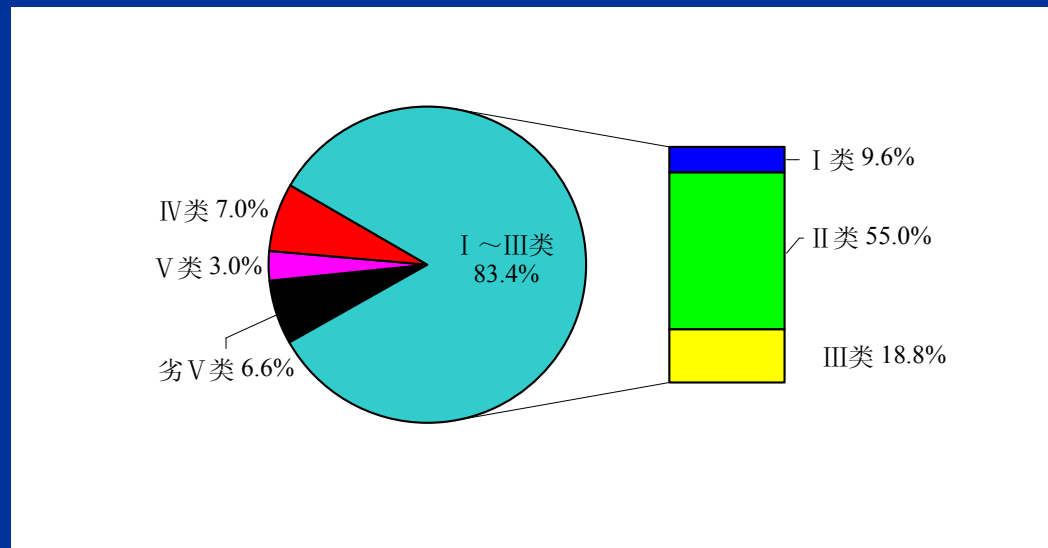


Figure 5 Water quality review in 2000

3 Three Gorges Project

Content:

- (1) Developed objective of Three Gorges Project(TGP)
- (2) Attention Issues
- (3) TGP construction scheme



Developed objective of TGP

- China changjiang TGP, as one of the biggest hydropower-complex project in the world, ranks as the key project for improvement and development of changjiang River, which cannot be replaced by any means.
- TGP control a drainage area of 1 million km² ;
- Average annual runoff of 451 billion m³ .
- TGP is a multi-objective development project with great benefits in flood control, power generation, and navigation .

Developed objective of TGP

- Organized by the scheme officially briefed as “developed in one scale, completed in one time, water-storage by stages, and continuous migration (一次开发，一次建成，分期蓄水，连续移民)”.
- Axial length is 2309.47m, the crest height is 185m, a normal storage level at 175m, the total capacity of the reservoir reaches 39.3 billion m^3 , flood control capacity reaches 22.15 billion m^3 .
- The total period of TGP construction is 17 years(1993-2009), which can be divided into three phases.

Developed objective of TGP

Developed objective of TGP is flood control, power generation and navigation.

- **Flood control**

The total capacity of TGP Reservoir is 39.3 billion m³, of which the effective flood control capacity reaches 22.15 billion m³.

TGP Reservoir reserved flood control capacity can help cut flood peak by 27,000 ~ 33,000 m³/s.



Developed objective of TGP

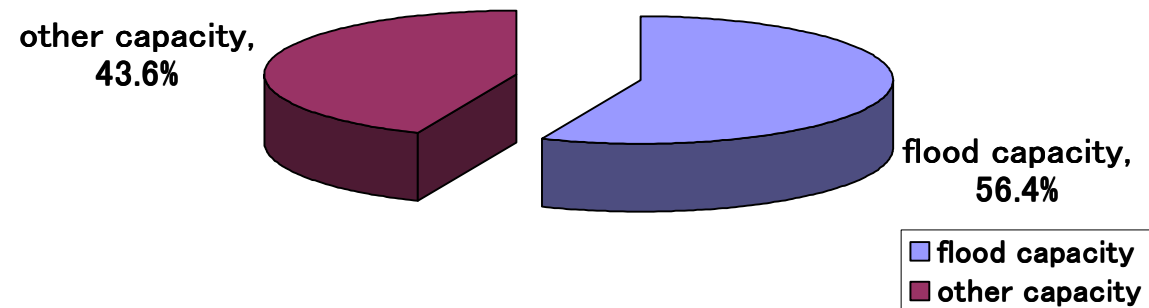


Figure 6 Storage capacity of TGP

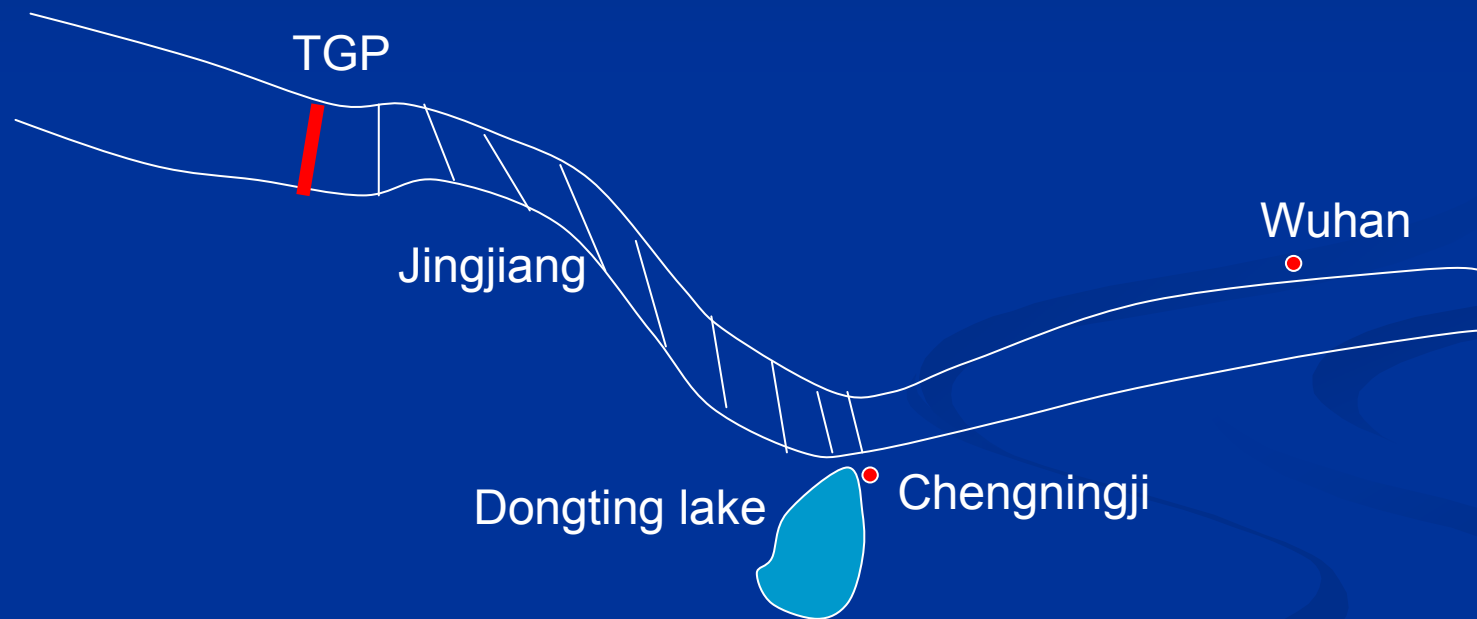
Developed objective of TGP

When the TGP is completed, the flood control standard of the middle and lower reaches of TGP, will be largely upgraded from the present level of preventing under-10-year floods to that of preventing 100-year floods.



Even in case of a rare occurrence of 1000-year flood, mass damages or injuries can still be prevented. So 15 million people and 1.5 million hectares of farmland in the Jiangnan Plain are relieved from flood threats.

Developed objective of TGP



The flood control standard of reach from TGP to chengningji, will be preventing 100-year floods.

Developed objective of TGP

- Power Generation

The Three Gorges Hydropower Plant (TDGP) contains twenty-six turbine-generator units, each with installed capacity of 700MW. It has the six more 700MW units in the Right Bank Underground Powerhouse under construction.

Its total installed capacity amounts to 18,200MW, and its expected annual average power generation accounts up to 84.7 TWH. At present, TGHP electricity is sent unceasingly to Central China, East China, Guangdong, and Chongqing.



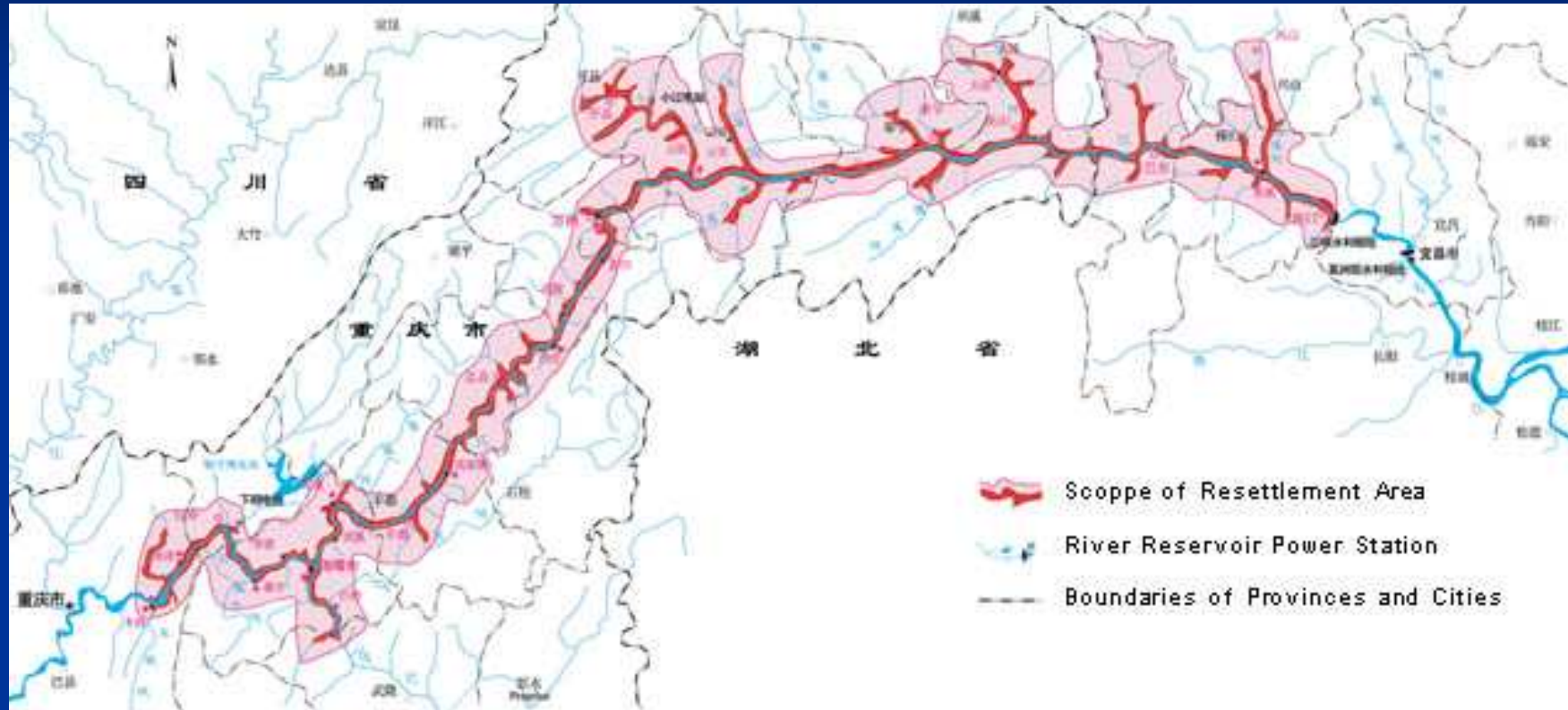
Developed objective of TGP

- Navigation

Backwater of the TGP reservoir goes as far as to the southwest metropolis Chongqing, therefore it improves 660 km waterway, and largely enables 10000-tonnage fleets to navigate between Shanghai and Chongqing. The annual one-way navigation capacity of the changjiang at the dam will be upgraded from ten million tons to fifty million tons.



Developed objective of TGP



TGP improves 660 km waterway, between yichang and Chongqing.

Developed objective of TGP

The navigation facility includes the double-lane five-step shiplock and the shiplift laid in the mountains at the left side of the dam. The effective size of each shiplock chamber is 280 length \times 34 wide \times 5 high m. the annual one-way navigation capacity is 50 million tons, an 10,000 tonnage fleet of ship can sail through.



Attention Issues

•Environmental Benefit

First Target of TGP is Flood Control. TGP will assure a flood control standard of the Jingjiang section.

At the same time, social problems such as environmental deterioration and epidemics related to the flood or flood diversion can also be avoided. Thus the project will protect 1.5 million hectare of farmland and towns, and 15 million of people from flood damage at Jiangnan Plain and Dongting Lake area.



Attention Issues

And also the project will raise the reliability of flood control in the middle reach of Changjiang River, relieve the sand silt of Dongting Lake and create favorable conditions for dredge of the lake, and prevention and cure of the schistosomiasis epidemics in the lake area .



Attention Issues

Three Gorges Power Plant will Provide Clean Energy. Compared to the coal-fired power stations with equivalent electricity generation, Three Gorges Power Plant will decrease emission of 100 million tons of CO₂, 2 million tons of SO₂, 0.37 million tons of nitrogen oxide and a lot of waste water and solid waste. It will bring a great benign influence in improvement of environment, especially preventing acid rain and greenhouse effect in East and Central China.

Attention Issues

•Protection of Water Quality

The reservoir has a mixed influence on the water quality of Changjiang River. Due to its adjustment, the flow in drought period will increase, which will improve the water quality and relieve the invasion of saline tide in the river's mouth to East China Sea. On the other side, the sewage discharged into the River is more than 1.35 billion tons per year nowadays, which forms a heavy pollution of the water. With the rise of water level, the flow will slow down, which is unfavorable to the quality. Therefore, the state has increased investment to control the pollution in this area.

Attention Issues

According to the *Gazette of Ecological and Environmental Monitoring* published by the State Environmental Protection Administration of China in 2002, the water quality of the changjiang in TGP area still kept not bad in 2002, most better than or at class III, though industrial wastes directly emitted to the river increased by 23.8% than in 2001, the environmental quality of the project areas kept good.

Environmental monitoring in 2003 indicates that overall management of water quality in TGP area has obtained initial achievement, with a decrease ratio at class IV and increase at class II and III compared to the period before impoundment.



Attention Issues

•Sediment

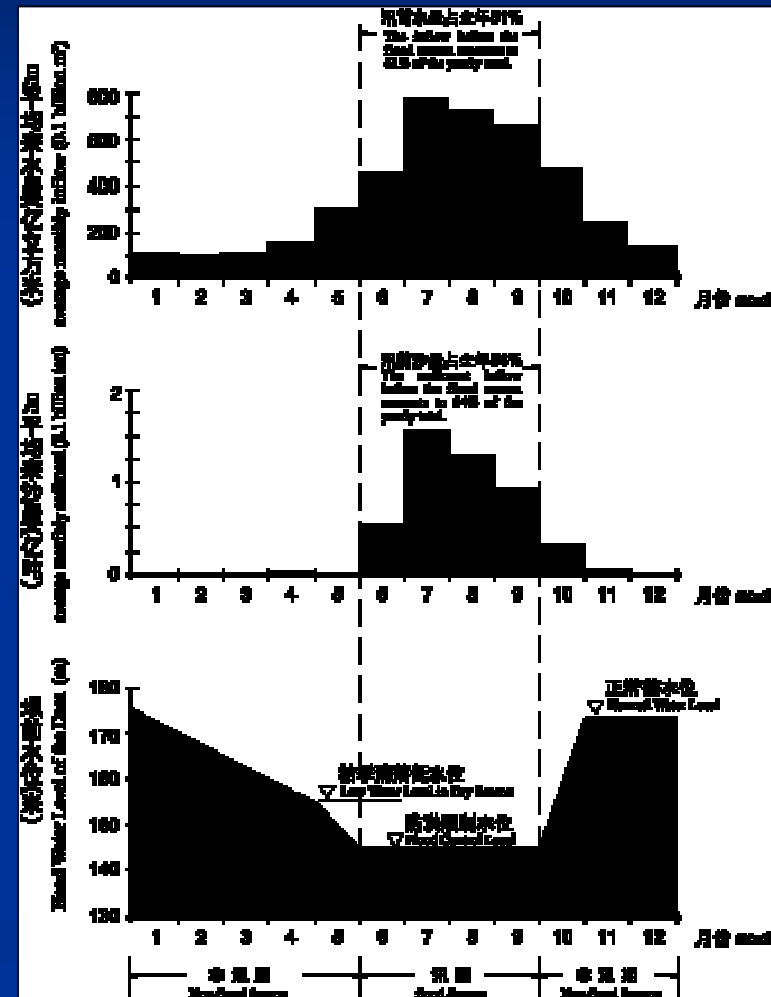
The sediment ranks as a crucial difficult issue for reservoir construction worldwide. There will be 530 million tons of sediment coming into the reservoir per year, which may, if not properly dealt with, influence the function and decrease the life of the reservoir, also impact unfavorably on the navigation of changjiang river.

Attention Issues

The research is done based on prototype observation, mathematic modeling, physical modeling test, and also with reference to the construction of the as-built projects. Adoption of reservoir dispatching method of “storing clean water and emitting more-sediment water” can protect reservoir for long period operation, according to topographic and landform features of TGP reservoir.

Attention Issues

It is estimated that the reservoir, after one hundred years, may reach the inflow and outflow balance of sediment, and the capacity of reservoir for flood control will still be kept at about 86%, and that for adjustment will be kept at 92%. A strain of methods adopted in the project will assure smooth function of the navigation and power plant .



Attention Issues

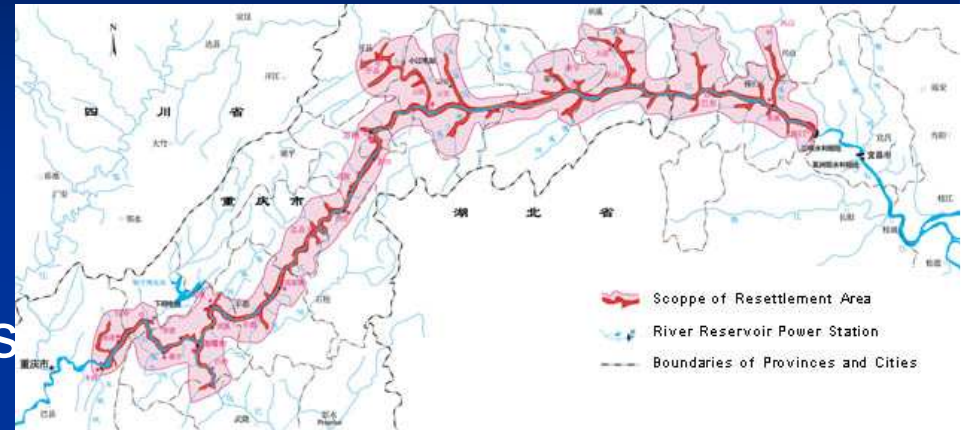
Latest result of monitoring indicates that the content of sediment in the water has a trend of decreasing, and soil and water losses in Three Gorges area goes down at about 1% per year.

Attention Issues

•Migrants

The migrants relocation of Three Gorges reservoir involves 19 counties and cities of Hubei and Chongqing.

The physical submerge based on a survey in 1991-1992 mainly includes affected population of 844 thousand, affected farm land and citrus land of 245 thousand hectares. Considering the growth of population in the construction period, the total population to be relocated reaches 1.13 million.



Attention Issues

The relocation is arranged under development principles to the nearby areas, and also some to other provinces. By the end of August 2004, the accumulative total relocated population is more than 900 thousand, including 166 thousand to other eleven provinces, such as Shanghai, Jiangsu, Zhejiang, Anhui, Fujian, Jiangxi, Shandong, Hubei, Hunan, Guangdong, Sichuan.

TGP construction scheme

- On 3rd April 1992, The *Resolution to Construction of Three Gorges Project* was adopted at the 5th meeting of the Seventh People's Congress, which indicates that the project entered into the executive process from legislative process On 2 April 1993.



TGP construction scheme

- On 27 Sept 1993, China Changjiang Three Gorges Development Corporation (CTGPC) was, under the authorization of the State Council, founded in Yichang, Hubei province.

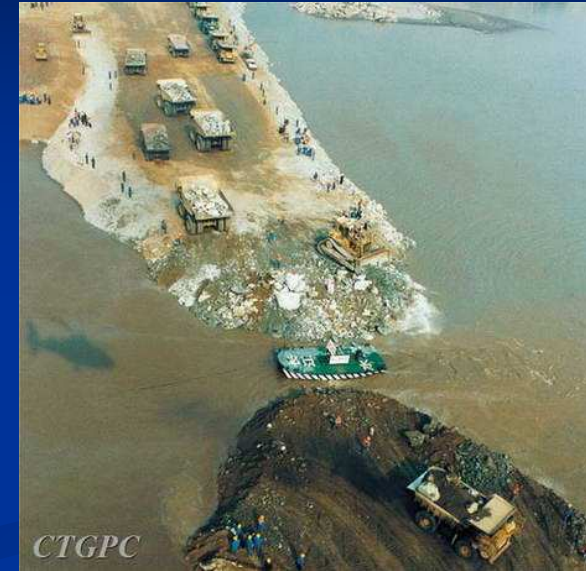
TGP construction scheme

- On 14 Dec 1994, the Three Gorges project was officially started.



TGP construction scheme

- On 8 Nov 1997, the river close-off succeeded, which indicates the construction target of phase I was completed.
- On 6 Nov 2002, the close-off of diversion channel succeeded.



TGP construction scheme

- On 1 st June 2003, the reservoir began its storage, the water reached at 135m on 10 June and at 139m on 5 November.

TGP construction scheme

- On 10 July 2003, the first generator unit began generating and connected to power grid.



TGP construction scheme

- On 8 July 2004, the double-way and five-step shiplock passed acceptance (water level between 135-139m).





Thank you !