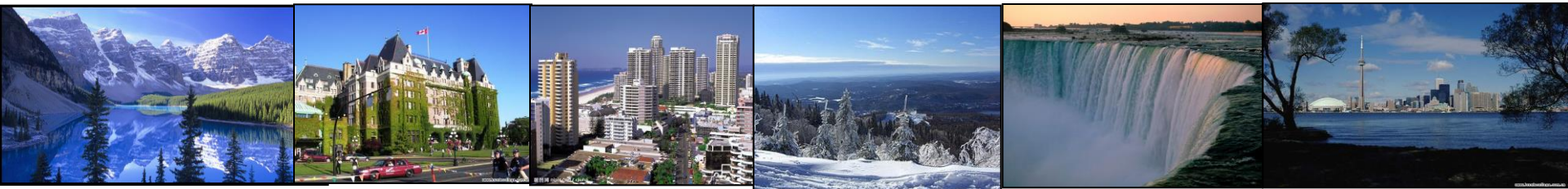




China Three Gorges Dam —— Development and Conflicts

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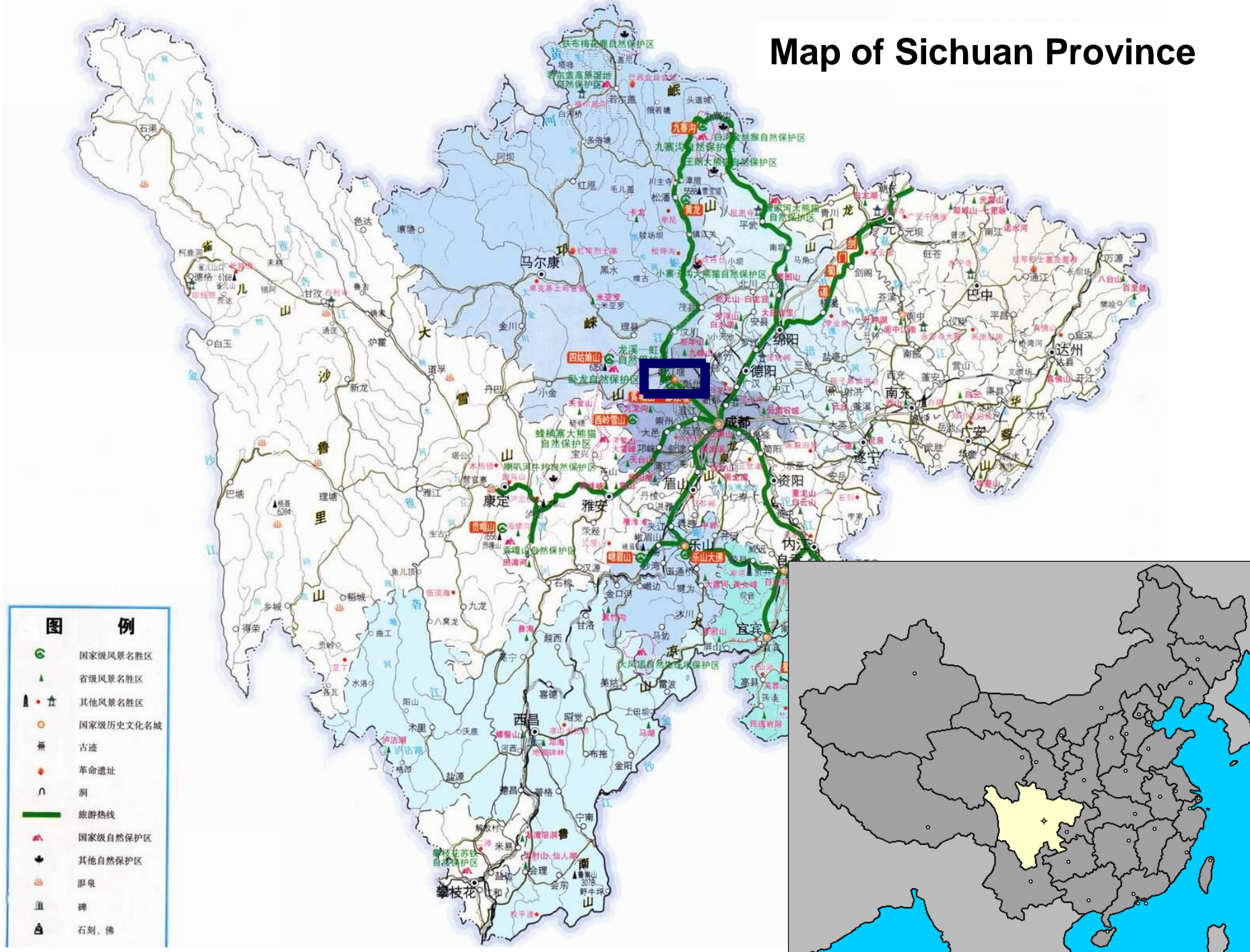
Along with China becoming an agricultural state, water irrigation has always been an issue of extreme importance. Construction of irrigation system is the key water policy in China.

History of Irrigation System

Dujiangyan is an irrigation infrastructure built in 256 BC during the Warring States Period of the Kingdom of Qin.

It is located in the Minjiang River in Sichuan province, 56 km northwest of the capital Chengdu. It is still in use today to irrigate over 5,300 square kilometers of land in the region.

Map of Sichuan Province



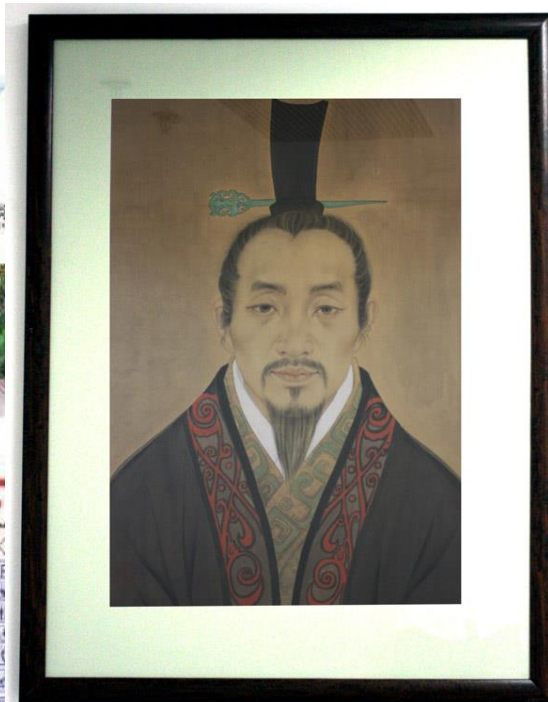
Tourist Map of Dujiangyan Scenic Area

国家级重点风景名胜区
State-level Main Scenic Spot

全国重点文物保护单位
National Protection Unit for Cultural Relics

国家AAAA级旅游区
National AAAA Tourist Destination

国家级文明风景区
State-level Civilized Scenic Spot



Grand Canal (China)

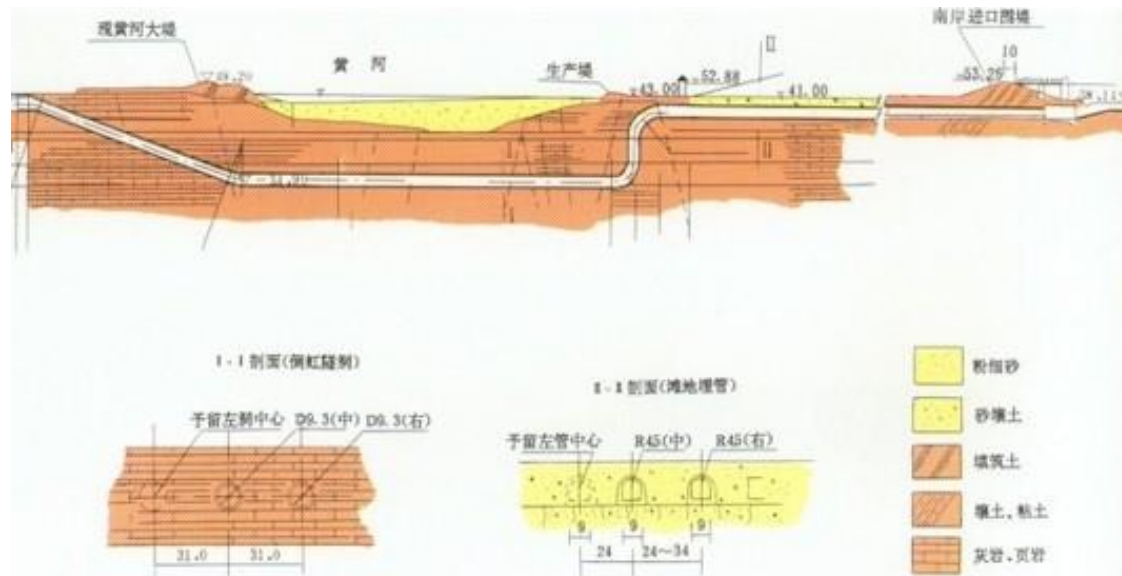
Between 604-609 AD, emperor of the Sui dynasty ordered a number of canals be dug from Hangzhou in the south to termini in Beijing. It links the river systems of the Qiantang River, the Yangtze River, the Huai River, the Yellow River, the Wei River and the Hai River.







South-to-North Water Diversion Project requires construction of three routes, stretching across the eastern, central and western parts of the country with 44.8 bn cubic metres of water diverted annually and expected cost \$62 bn.



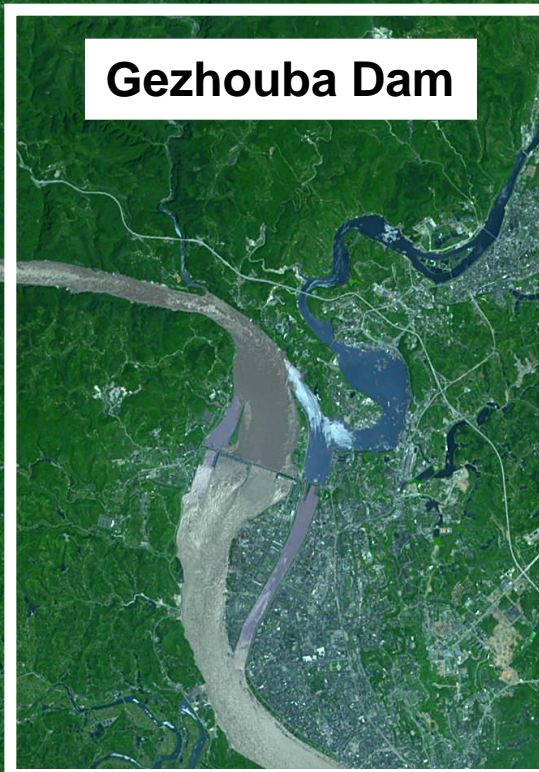
Geography of China, and the Location of the Three Gorges Dam



Three Gorges Dam



Gezhouba Dam



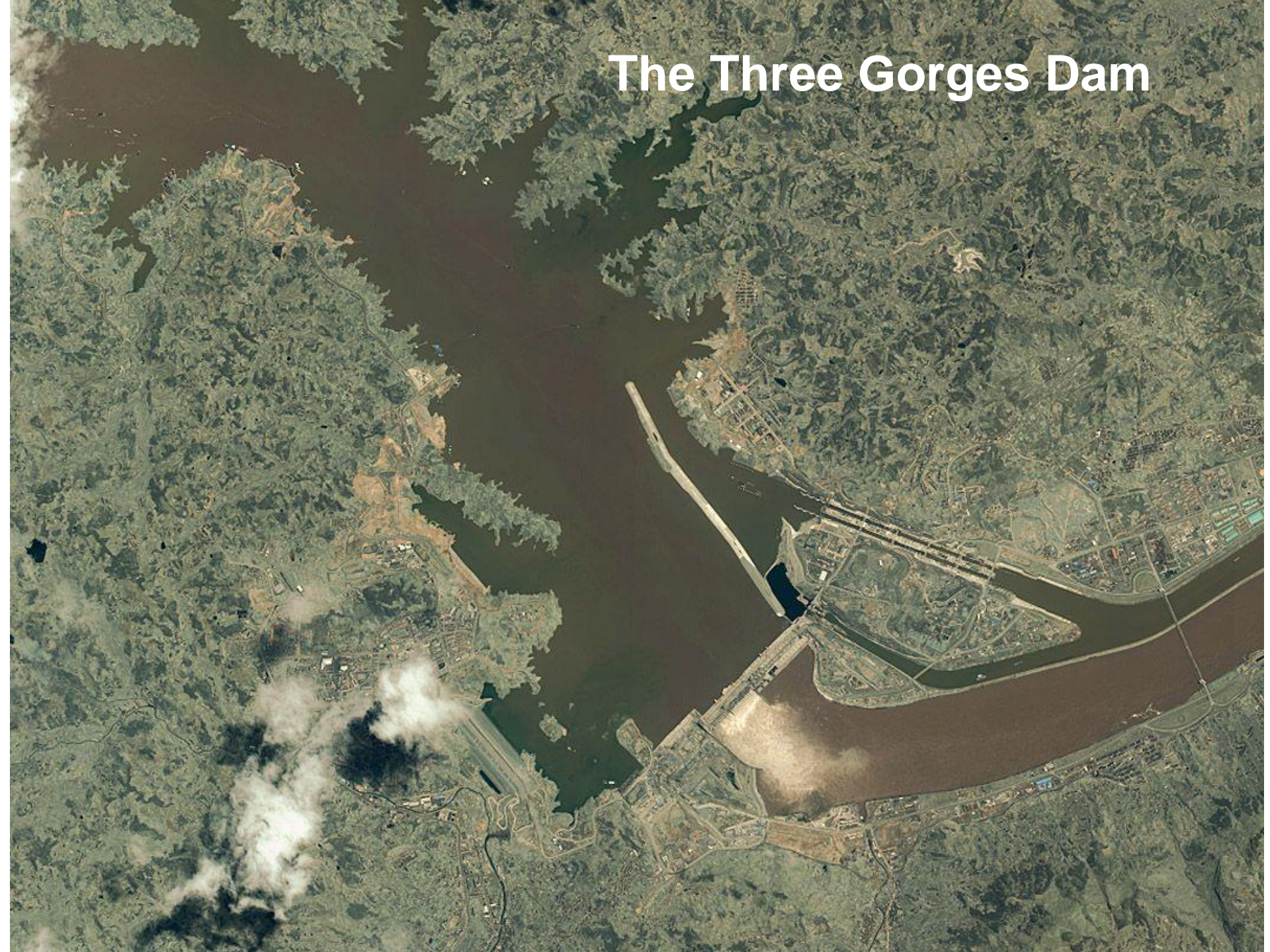
5 km



Gezhouba Dam, completed in 1988, is 38 km east of the Three Gorges. It has two power stations with capacity of 3.11 GW, three ship locks, and 27 gates of the spillway. The dam is 2,595 metres (8,514 ft) long with a maximum height of 47 metres (154 ft). The reservoir has a total volume of 1.58 cubic kilometres.



The Three Gorges Dam



The Three Gorges Dam





A large dam across the Yangtze River was originally envisioned by [Sun Yat-sen](#), the founder of the Republic of China, in his book “Plans of Nation Reconstruction” in 1919. He stated that a dam capable of generating 30 million horsepower (22 GW) was possible downstream of the [Three Gorges](#).



John Lucian Savage (December 25, 1879 – December 28, 1967) was an American [civil engineer](#). Among the 60 major dams he supervised the designs for the [Hoover Dam](#), [Shasta Dam](#), [Parker Dam](#) and [Grand Coulee Dam](#) in the United States along with surveying for the [Three Gorges Dam](#) in China.

Canada Contribution to the Dam

- CIDA provided \$14.24 million dollars grant for feasibility study in 5 years from 1984 to 1988
- QuebecHydro, BCHydro, SNC Lavalin, ACREC involved with 500 experts taking part in the feasibility research
- The final document containing 11 volumes, 51 appendix, over 3 million English words
- In conclusion that suggests 185m dam height, 160m water elevation, 760 MW single turbine unit, total power capacity 16.7GW, total construction period 18 years

Approval of the Dam

- In April 1992, the Fifth Plenary Session of the Seventh National People's Congress (NPC) approved a resolution to construct the Three Gorges Dam, with 1,767 deputies voted in favour, 177 against and 664 abstained.
- The Three Gorges Project was adopted the way of river diversion by stages and three phases in construction. The total construction period is 17 years and complete in 2009.

Phase I (1994-1997)

Phase	Year	Construction stage	Water level* (m)
Preparatory Phase Phase I (1994-1997)	1993		66
	1994	Earthmoving starts; inauguration ceremony.	66
	1995	Concrete longitudinal cofferdam building starts; resettlement program is launched.	66
	1996	Xiling bridge, four-line highway from Yichang, and Yichang airport are into service; transverse cofferdams building starts.	66
	1997	Closure and diversion of the river; about 100,000 people have been resettled.	66

Inception of Construction



Infrastructure of an Artificial Island



东方IC

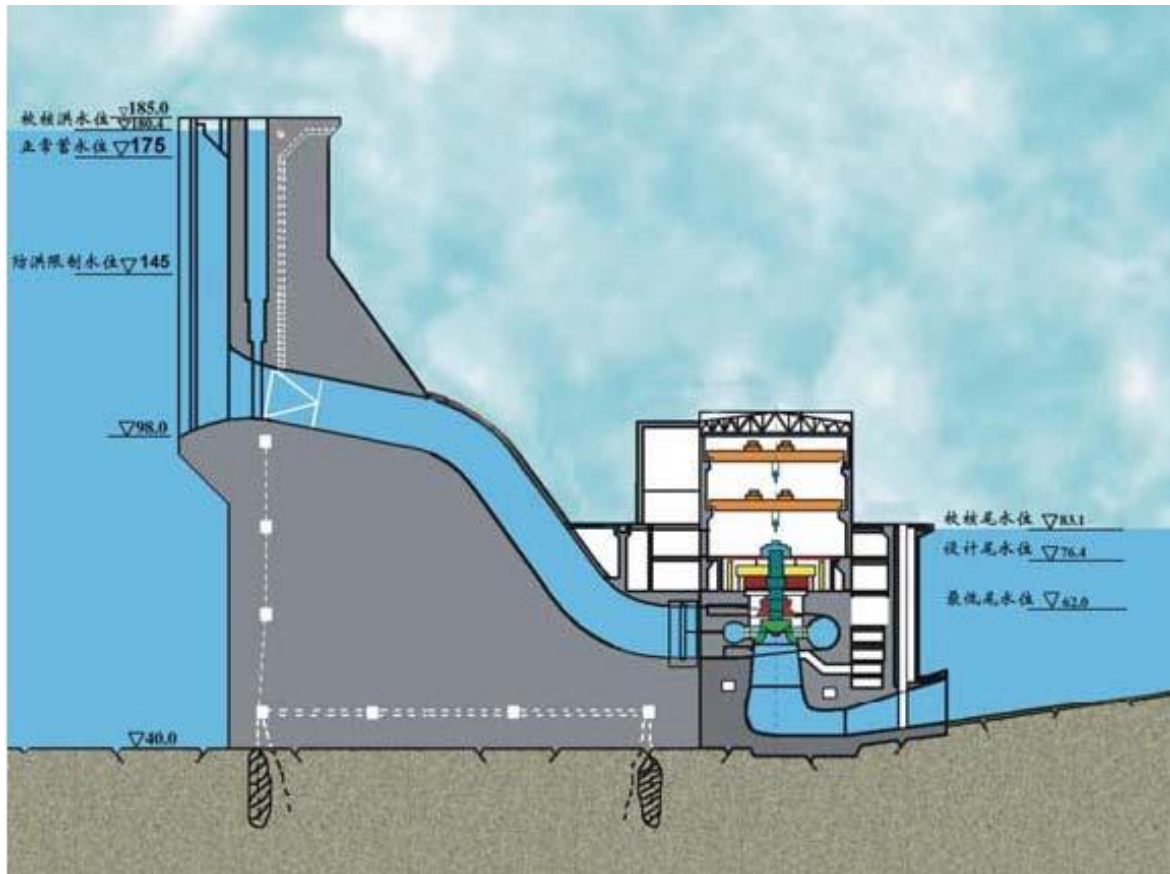
Phase II (1998-2003)

Phase II	Year	Construction stage	Water level* (m)
(1998-2003)	1998	Temporary ship-lock is put into operation	66
	1999	Excavation of the double-lane ship-lock is finished; about 230,000 people have been resettled.	66
	2000	About 295,000 people have been resettled.	66
	2001	About 325,000 people have been resettled.	66
	2002	The diversion channel is closed; left bank concrete pouring completed, about 640,000 people resettled.	66
	2003	The reservoir is filled up to 135 m pool level; first trials with the double-lane ship-lock; the four first generators are connected to the grid.	135 (139)

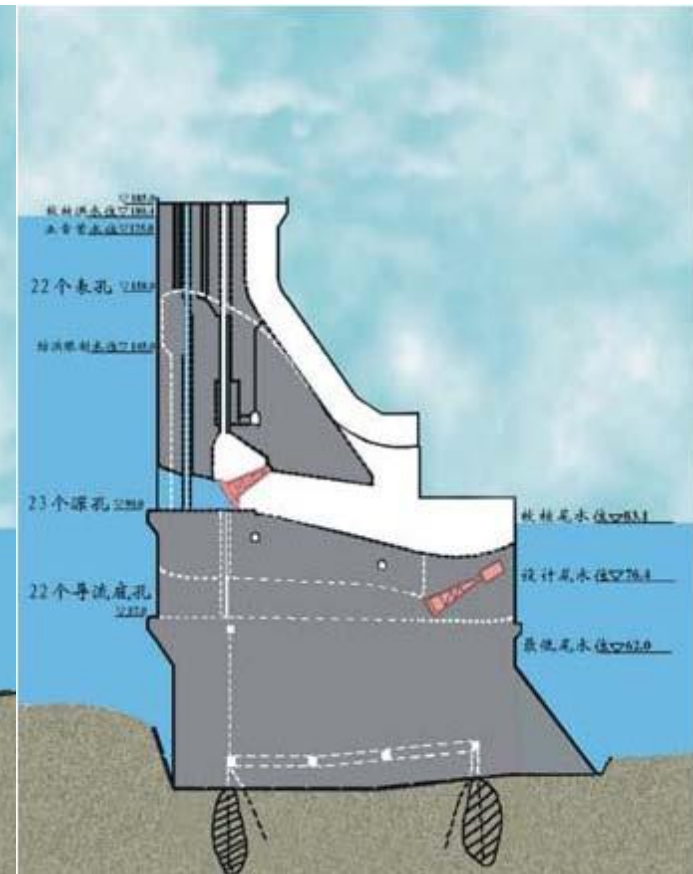
Construction in 2006



Cross-Section of the Dam



Cross section of power plant



Cross section of overflow dam

Phase III (2004-2009)

Phase III	Year	Construction stage	Water level* (m)
(2004-2009)	2004	The double-lane ship-lock is put into operation, ten turbines are already connected to the grid.	139
	2005	Left bank powerhouse completed (14 turbines in operation); about 1,000,000 people have been resettled.	139
	2006	Concrete pouring on the right bank is finished; the reservoir is filled up to 156 m; about 1,200,000 people relocated.	156
	2007	The ship-lift building starts (expected); original plan to fill the reservoir up to 156 m.	156
	2008	The reservoir will be filled up to 175 m pool level (expected); 26 turbines fully operational (expected)	175
	2009	1997 target for completion of the whole project; ship-lift will put into operation (expected).	175
	2011	The underground power plant will be connected to the grid (expected).	175
	2013	Water level should be risen to 175 m according to the original plans.	175



Information of the Dam

Official name: China Three Gorges Corporation

Location: Sandouping,
Hubei province

Status: Operational

Construction: Began
December 14, 1994

Opening date: 2008

Construction cost: ¥180
billion (US\$26 billion)

Dam and spillways

Type of dam: Gravity dam

Height: 180 m (592 ft)

Length: 2,335 m (7,661 ft)

Crest width: 40 m (131 ft)

Base width: 115 m (377 ft)

Impounds: Yangtze River

Spillway capacity: 116,000
m³/s (4,100,000 cu ft/s)

Information of the Dam

Reservoir: Three Gorges Reservoir

Capacity: 39.3 km³

Catchment area: 1,000,000 km²
(390,000 sq mi)

Surface area: 1,045 km²
(403 sq mi)

Normal elevation: 175 m (574 ft)

Reservoir length: 600 km
(370 mi)

Max. reservoir width: 1.1 km
(0.68 mi) avg.

Power Station

Commission Date: 2008–11

Type: Conventional

Hydraulic head: Rated: 80.6 m
(264 ft); Maximum: 113 m (371 ft)

Turbines: 32 × 700 MW
2 × 50 MW

Installed capacity: 20.3 GW

Maximum capacity: 22.4 GW

Annual generation: 80 TWh
(290 PJ)

Net generation: 368 TWh
(1,320 PJ) (2009)



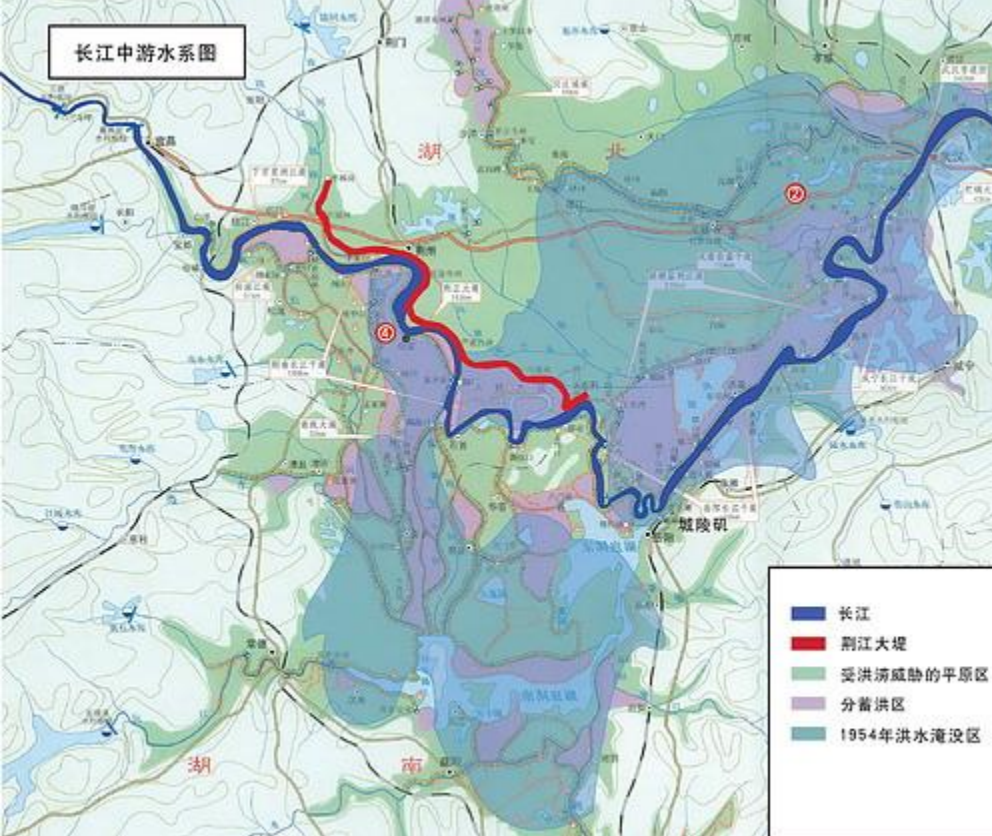
Benefits of the Dam

The primary goal of the Three Gorges Dam construction is flood control. Along with completion of the project, it is able to impound flood from upper Yangtze River, which makes flood control standard of Jingjiang River downstream enhance from 10-year to 100-year period.

Jingjiang Dyke, over 180 km long between the cities of Jingzhou and Wuhan, is the most vulnerable part of the Yangtze River. In the history record, from 1560 to 1949, dyke burst over 36 times causing millions of people died. In 1998, dyke break threat causing 500 K people evacuation.



长江中游水系图



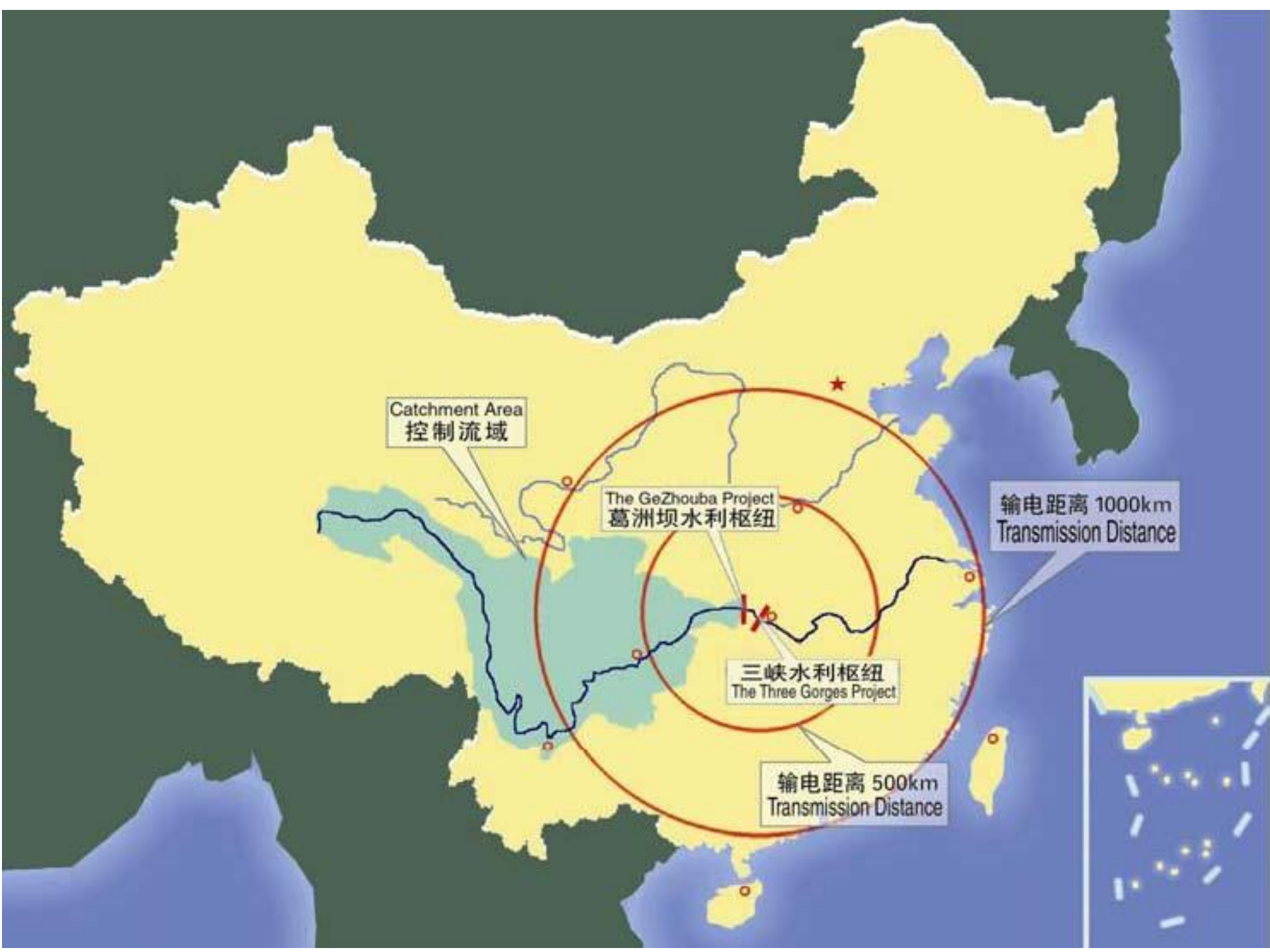
Benefits of the Dam

The Three Gorges Project has power generation of 32 hydro-units with a single unit capacity of 700 MW. The total installed capacity of 22,400 MW, and annual power production of 84.68 TWh. Its renewable power takes 5% total country's power (including Gezhouba), saving 60 million tons of raw coal thermal plants each year.



Power Transmission

- 6814 km long power transmission with 500kV capacity has been completed (6519 km by A.C. line and 295 km by D.C. line).
- The total capacity of A.C. line 22.75×10^6 kVA, and the capacity of D.C. transmission station 18×10^6 kW.
- Power from Three Gorges Dam sending out by 15 loops and 500 kV transmission line radiating to ten provinces.



Benefits of the Dam

Navigation construction composes double-line five-steps ship lock and a vertical ship lift. Annual one-way transportation capacity is of 500 million tons. The completed project improves 660 km long navigation passing from Yichang city to Chongqing city, the ten-thousand-ton-rank fleet can directly arrive at Chongqing.



双线五级船闸、升船机和西陵长江大桥

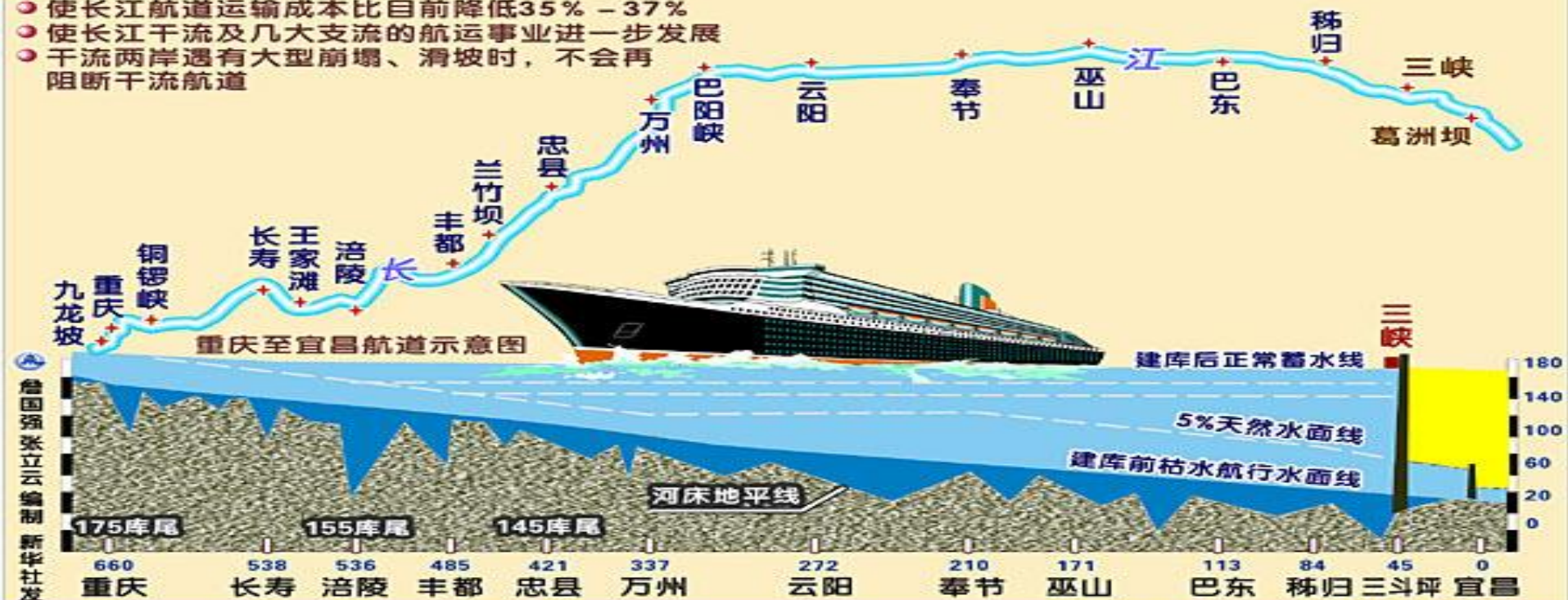
5 ship locks allowing
3000 tons passengers
and cargo ships



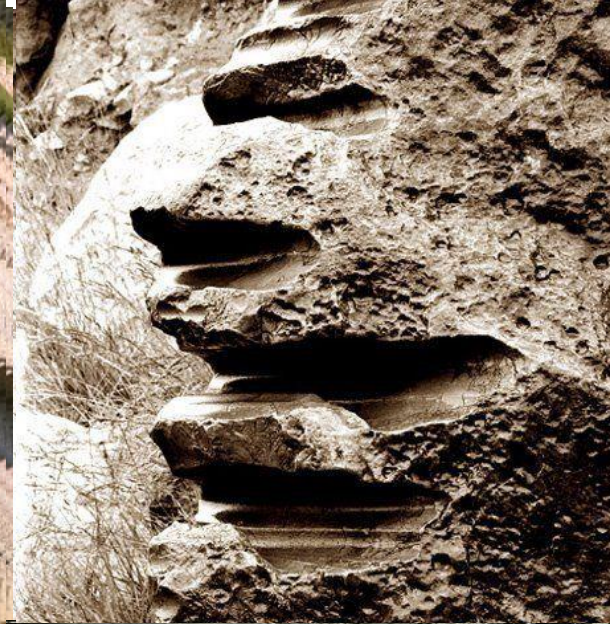
三峡工程带来的五大航运效益

三峡工程带来的五大航运效益--

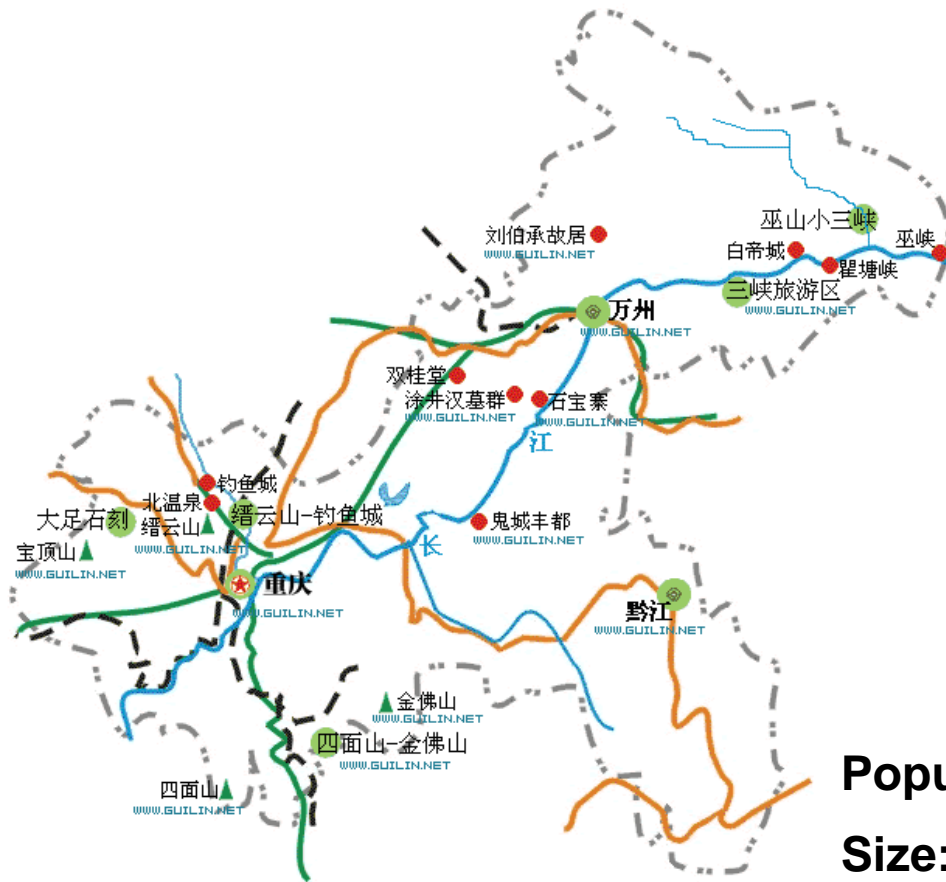
- 万吨级船队可从重庆直达汉口和上海
- 使重庆至汉口的年单向下水通过能力达1亿吨，过坝下水货运量达5000万吨
- 使长江航道运输成本比目前降低35% - 37%
- 使长江干流及几大支流的航运事业进一步发展
- 干流两岸遇有大型崩塌、滑坡时，不会再阻断干流航道



Boat trackers along Yangtze River



Chongqing, a province equivalent city created



Population: 31 million

Size: 82.4 K km²

Negative effects of the Three Gorges Dam construction

Resettlement

One of the most visible effects of the Three Gorges Dam building consists in a large-scale of human habitat loss due to inundation of more than 600 km² of land.



After the Three Gorges Dam reservoir filling in 2009, 12 major cities including 2 prefectures, 10 counties, 140 towns, 326 townships, and more than 1,500 villages are partially or completely flooded.

The total figure of population living in the area to be inundated was estimated of 846,200, which, considering the natural population growth, could reach nearly 1.2 million in 2009.

- The heaviest resettlement load corresponds to Chongqing Municipality, with more than 85% of the relocatees.
- The main policy is to resettle the farmers as much people as possible in the vicinity of their former homes, mainly to the upper hills.
- Relocation of 125,000 peasants outside the reservoir region, downstream the Yangtze River and on coastal areas.
- In addition, about 40% of the rural migrants are transferred from agriculture sector to secondary and tertiary industries.

Negative effects of the Dam

Blocking a river would involve a series of physical and geological consequences that will affect to air, soil, and water.

The Three Gorges Dam has caused a decline in the populations of three endemic ancient fish species, Chinese sturgeon, Yangtze sturgeon and Chinese paddlefish.



Negative effects of the Dam

The Three Gorges Dam building will not only affect terrestrial and aquatic biodiversity and ecosystems in the reservoir area but also those located downstream.

- the decrease and loss of floodplains and riparian wetlands
- the regression of river deltas and ocean estuaries
- the elimination of beaches and backwaters
- and it would also accelerate the intrusion of salt water into the estuary region