

# Aquatic Ecological Protection and Restoration of Rivers and Lakes in China

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# 1

## Preface





# 1. Preface



中国水利普查  
CHINA CENSUS FOR WATER

流域面积 流域（区域）	50 平方公里 及以上 （条）	100 平方公里 及以上 （条）	1000 平方公里 及以上 （条）	10000 平方公里 及以上 （条）
合计	45203	22909	2221	228

湖泊面积 流域（区域）	1 平方公里 及以上 （个）	10 平方公里 及以上 （个）	100 平方公里 及以上 （个）	1000 平方公里 及以上 （个）
合计	2865	696	129	10

水库规模	合计	大型			中型	小型		
		小计	大(1)	大(2)		小计	小(1)	小(2)
数量（座）	98002	756	127	629	3938	93308	17949	75359
总库容 （亿立方米）	9323.12	7499.85	5665.07	1834.78	1119.76	703.51	496.38	207.13



# 1. Preface

Water conservancy construction gains great achievement, to support healthy development of the economic society.

Ecological problems of rivers and lakes: major restraining factors influencing national water security.

- The ability of regulation and control of river flow is continuously enhanced through major water engineering construction.
- Utilization of water resource consumption of which degree is increased continuously
- Water transfer among drainage basins of which distribution range is expanded continuously
- High discharging strength of water pollutants





# 1. Preface

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The nation pays high attention to ecological protection and restoration of water ecology

*Decision on accelerating water conservancy reform and development of the State Council (Z.F. No.[2011]1)*

- Water resources protection and health security system of rivers and lakes are basically set up by 2020.

*Opinions of the State Council on implementing the strictest water resources management system (G.F.No.[2012]3)*

- Promote protection and restoration of water ecosystem

*Opinions of Ministry of Water Resources on accelerating to promote ecological civilization construction of water (Water Resources No.[2013]1)*

- Implement 8 tasks.



# 1. Preface

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The nation pays high attention to ecological protection and repair of water ecology

*Plan of water pollution control (G.F. No.[2015]17)*

- Systematically promote water pollution control, water ecological protection and management of water resources

*Advices on formulating the 13<sup>th</sup> five-year plan of national economy and social development of the CPC Central Committee*

- Firm ecological security curtain

*Advices on enhancing management and control of ecological red line of resources and environment (F.G.H.Z.No.[2016]1162)*

- Set a red line for ecological protection.



# 1. Preface

## System of Protection and Restoration Measures of Aquatic Ecosystem

The **ecology of rivers and lakes** is for short of **aquatic ecosystem of rivers and lakes**, mainly including rivers, lakes, reservoirs, ground water system, riverside, lakeside, estuarine wetland, etc.





# 2

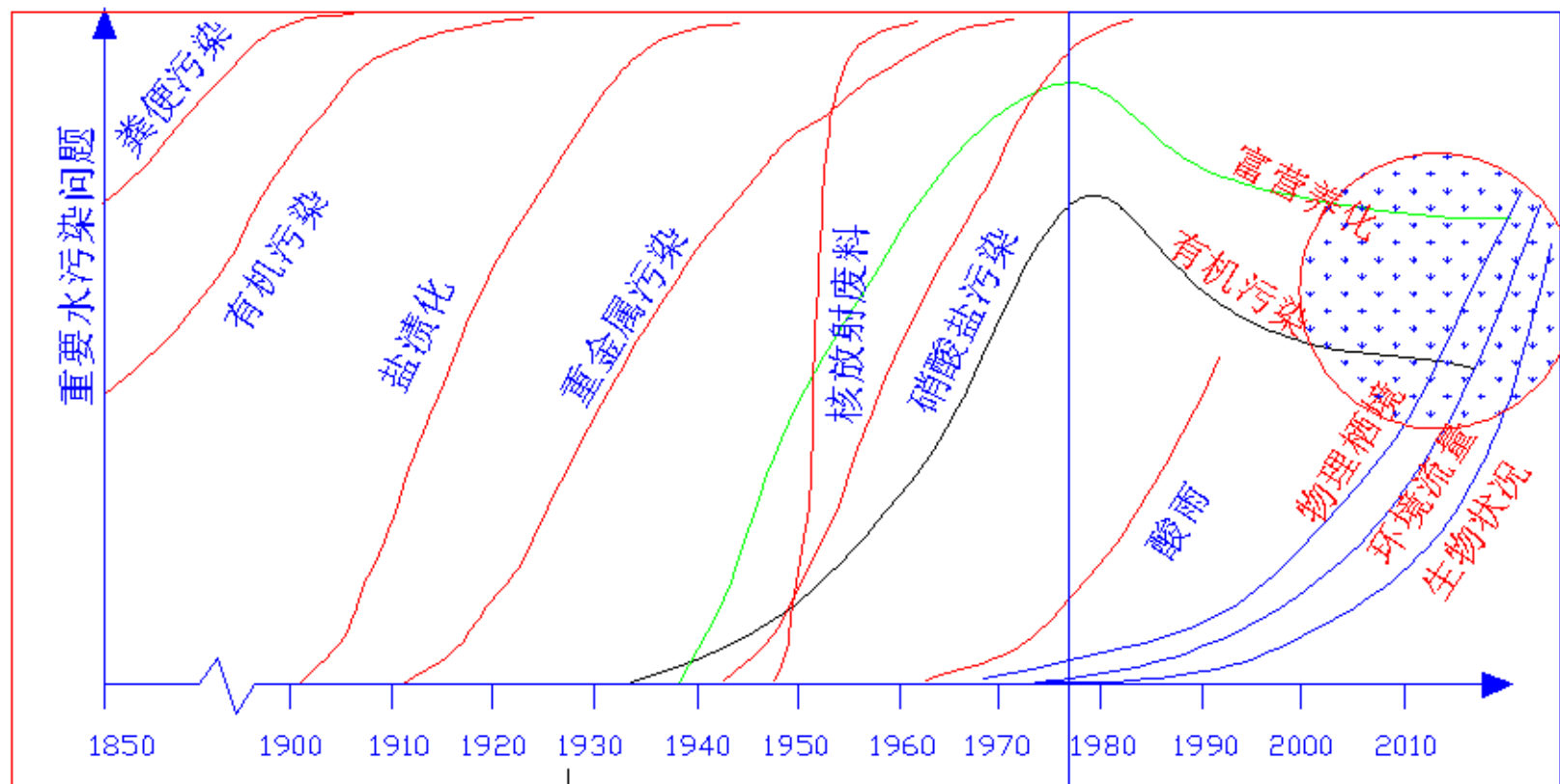
## Current Status and Problems





## 2. Current Status and Problems

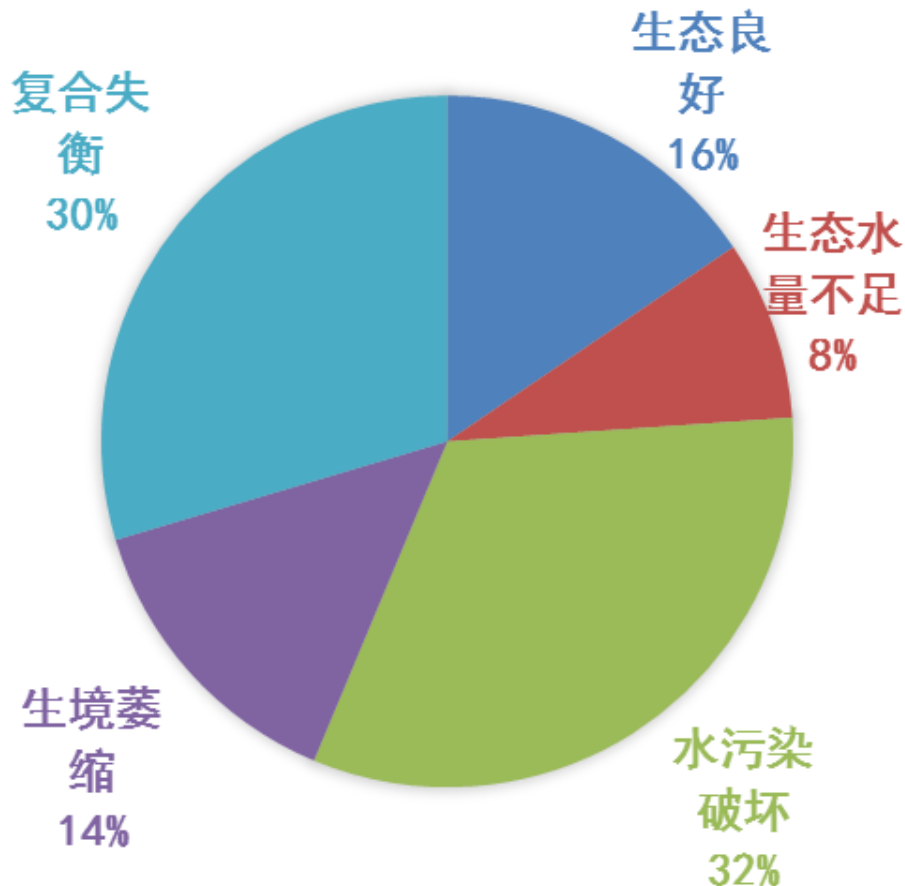
### Evolution Process of Ecological Environmental Problems of Rivers and Lakes





## 2. Current Status and Problems

### ■ Types of ecological problems of rivers and lakes



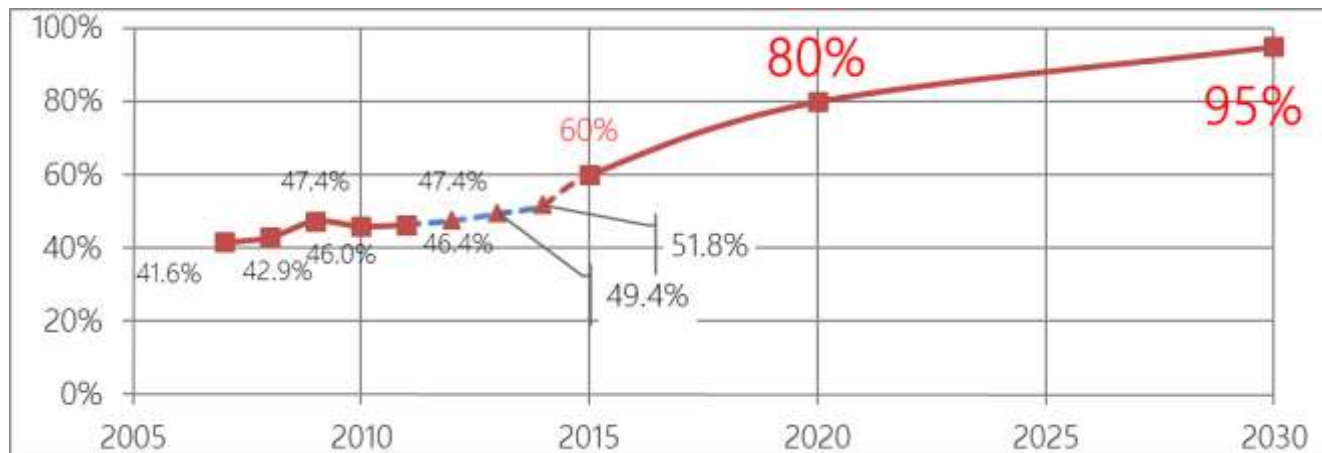
Rivers and lakes with good ecology: the Yangtze River, the Pearl River and River Source in the North

- Water shortage: the Haihe River, the Yellow River and rivers in northwest;
- Water polluted: the Haihe River and the Huaihe River
- Ecological atrophy: middle and downstream of water resources zones
- Composite unbalance: the Liaohe River, the Haihe River, the Yellow River, the Huaihe River 辽



## 2. Current Status and Problems

- Water pollution problems are still serious. The standard reaching rate water function zones is low.





## 2. Current Situation and Problems

- Ecological flow is occupied seriously and atrophy of rivers, lakes and wetland is serious.

### Ecological base flow control section

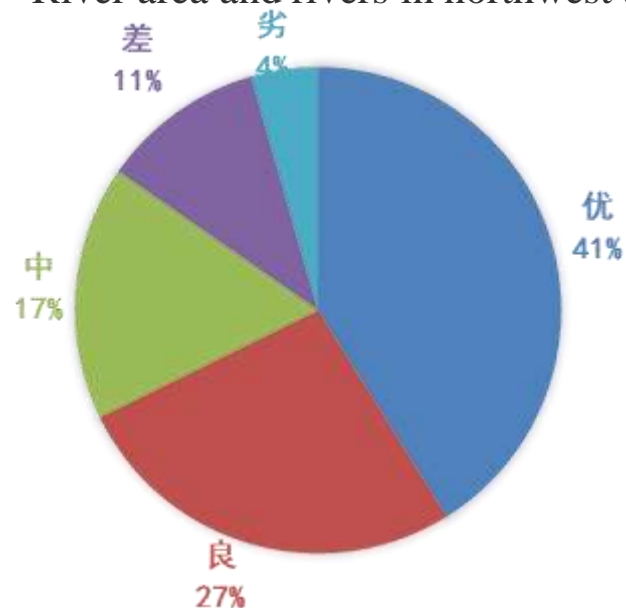
- Excellent and good ones account for 62.5%, which are mainly in the Yangtzer River area and the Pearl River area in the south as well as upper reaches of rivers in north. The poor ones account for 17.1%, which are mainly in the Liaohe River area, the Haihe River area, the Huaihe River area and the Yellow River area.

### Sensitive ecological water requirement section

- Excellent and good ones amount for 45.5%, which are mainly in the Yangtzer River area and the Pearl River area as well as upper reaches of the Yellow River. The poor ones account for 21.8%, which are mainly in the Haihe River area, the Songhua River area, the Liaohe River area and lower reaches of the Yellow River area.

### Wet land retention rate

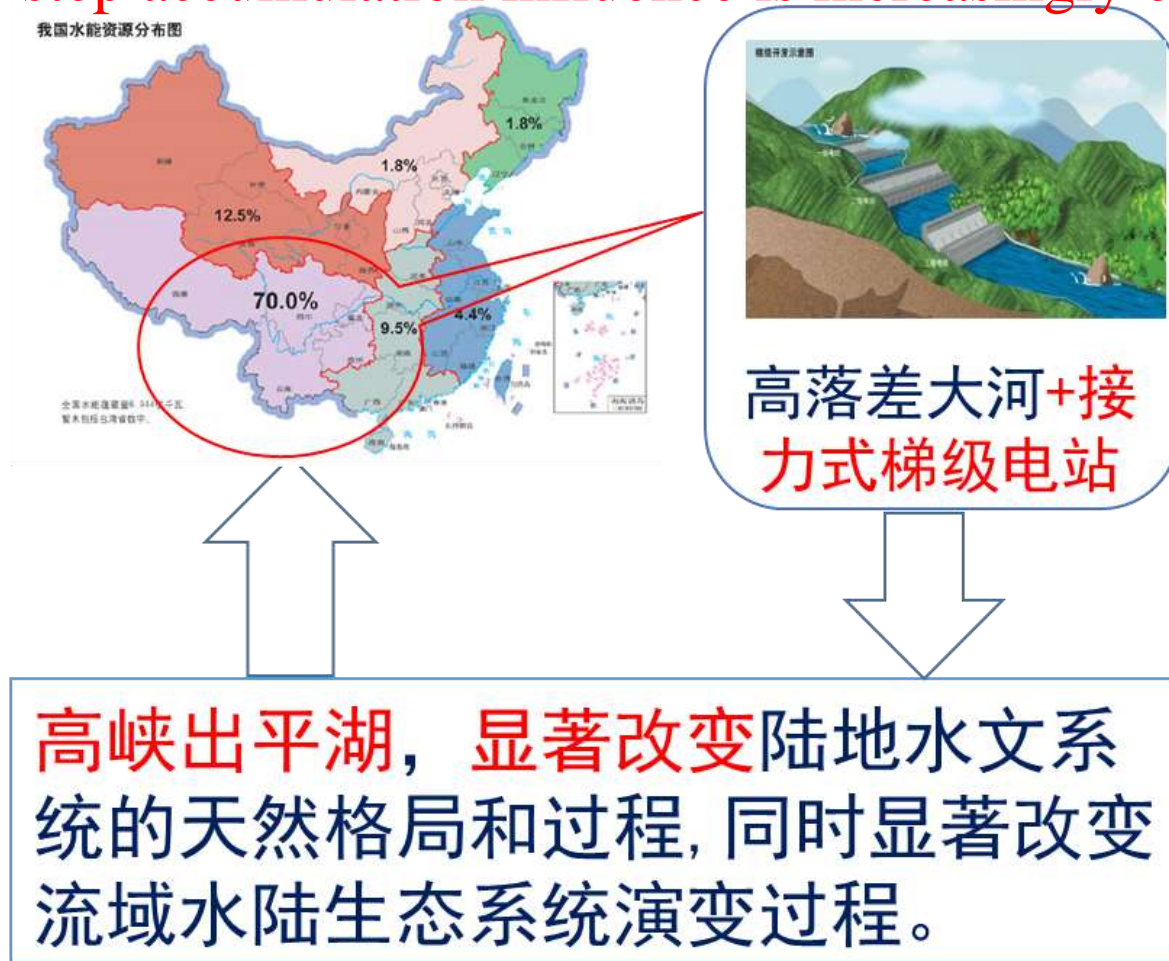
- The over-78% retention rate of wet land in the Songhua River area, the Yangtze River area and the Pearl River area is assessed to be excellent and good.
- More than 70% of wetland assessment results in the Yellow River area, the Haihe River area and rivers in northwest are poor.





## 2. Current Situation and Problems

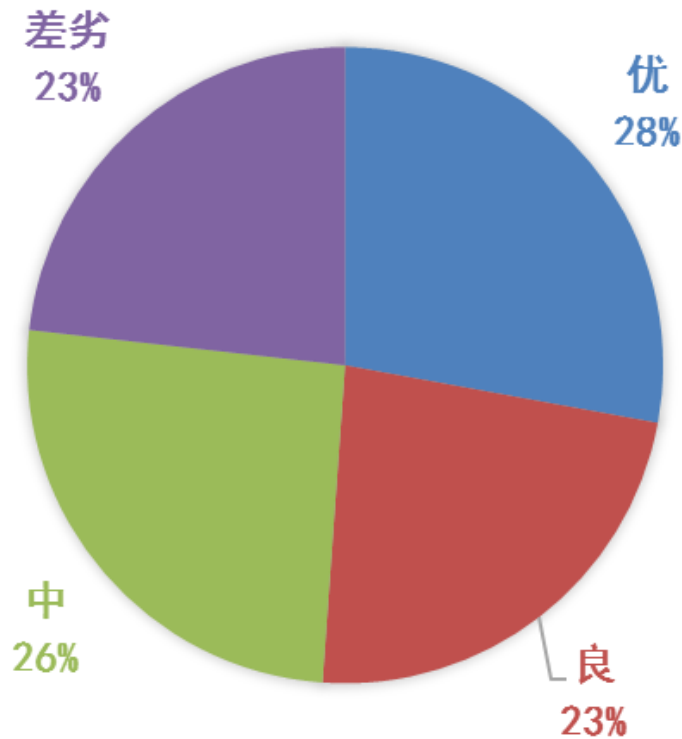
- Hydroelectric development intensity is increased continuously and the step accumulation influence is increasingly obvious.





## 2. Current Situation and Problems

- Important aquatic environment degrades, thus protection of biodiversity faces challenges.

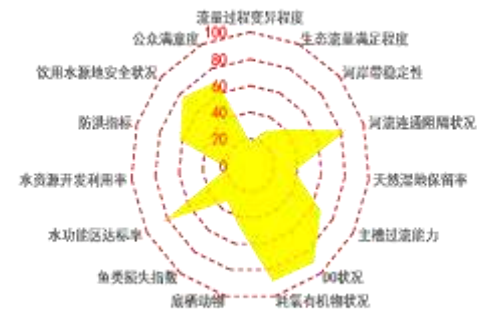
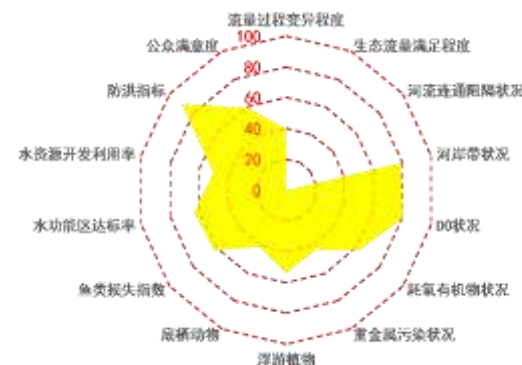
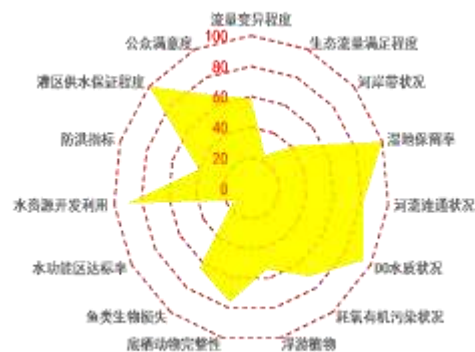
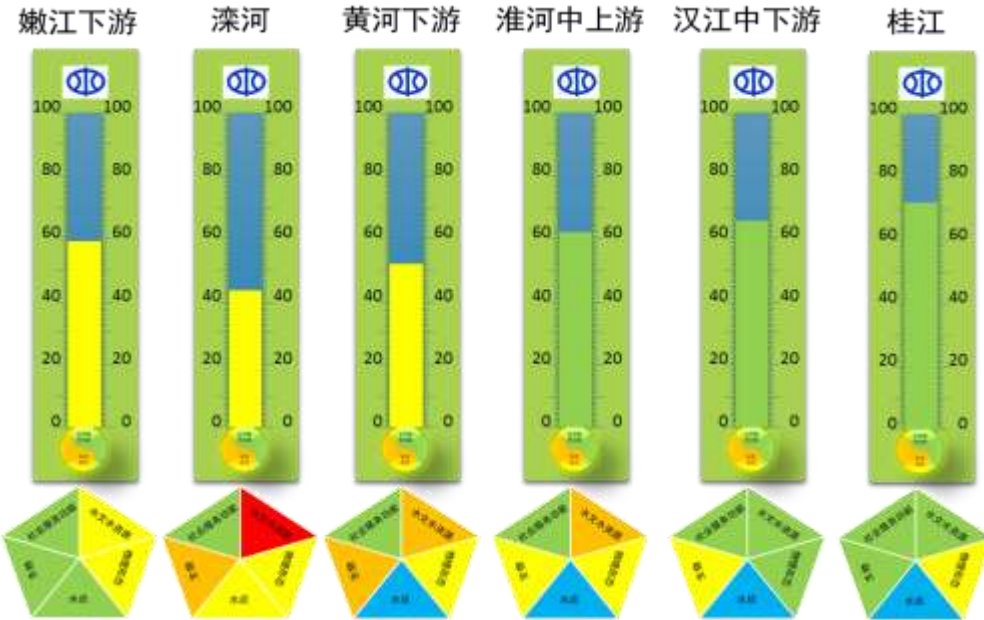


- Dams obstruct migration pathway
- Habitat breaking
- Reservoir submergence
- Disordered sand excavation in river channels
- Ecological water shortage and hydrological imbalance
- Water pollution



# 2. Current Situation and Problems

Health problems of important rivers and lakes are serious.



Lower reaches of Nenjiang River

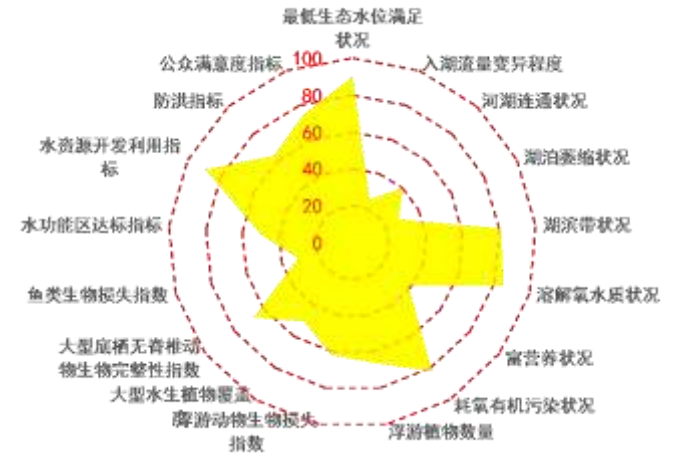
Luanhe River

Lower reaches of main stem of Yellow River

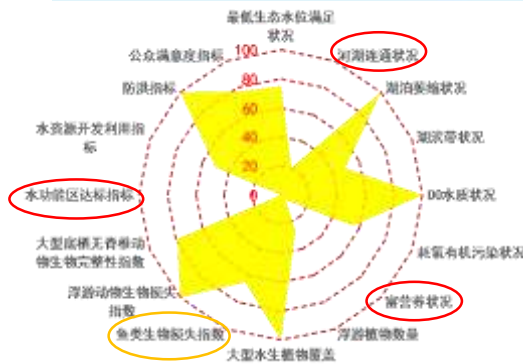


# 2. Current Situation and Problems

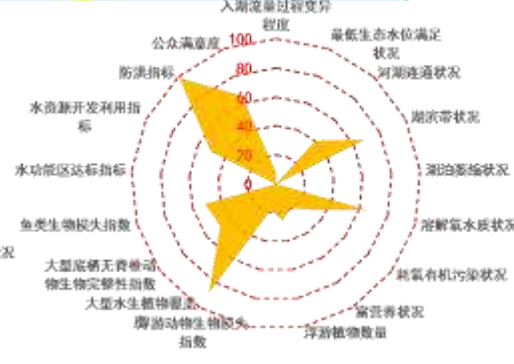
■ Health problems of important rivers and lakes are serious .



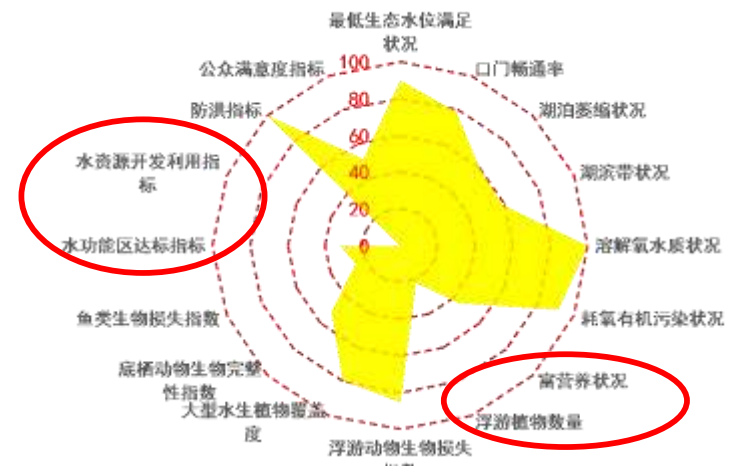
Hongze Lake



Chagan Lake



Baiyangdian Lake



Taihu Lake



## 2. Current Situation and Problems

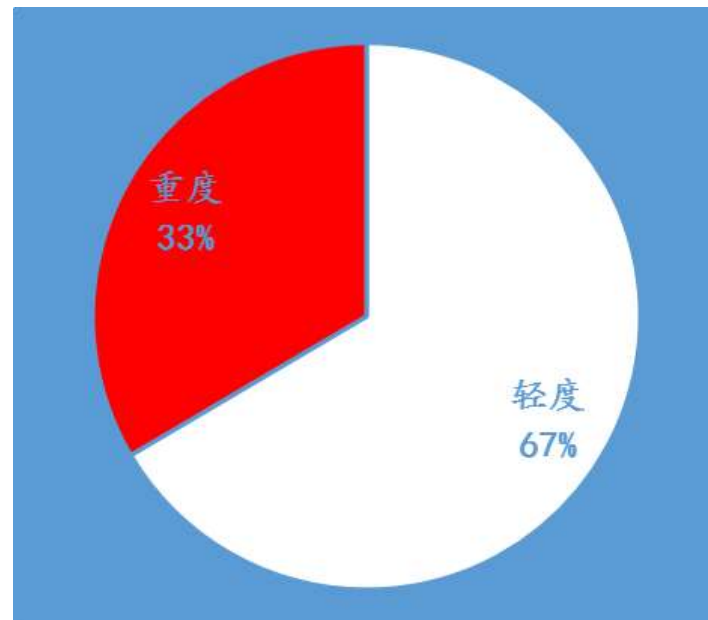
- The problems of black and odorous rivers in cities are serious and ecological function is damaged severely.



表2 城市黑臭水体污染程度分级标准

特征指标 (单位)	轻度黑臭	重度黑臭
透明度 (cm)	25~10*	<10*
溶解氧 (mg/L)	0.2~2.0	<0.2
氧化还原电位 (mV)	-200~50	< -200
氨氮 (mg/L)	8.0~15	>15

注: \* 水深不足 25 cm 时, 该指标按水深的 40%取值



1861 black and odorous rivers are declared, with a total length of 47371 km. The number of severely polluted rivers accounts for 1/3.



# 3

## Development and Trend





## 2. Development and Trend

-2004

Technical  
preparation

- *Comprehensive planning of water resources* (detailed rules of investigation and evaluation technologies of ecological problems related to water)
- *Opinions on protection and restoration of water ecosystem* (Shui-Zi-Yuan No.[2004]316)

2004-2015

Pilot exploration

- *Opinions on protection and restoration of water ecosystem* (Shui-Zi-Yuan No.[2004]316); 14 pilots of protection and restoration of water ecosystem
- The pilot of national lake health assessment releases health assessment report of 6 rivers, 4 lakes and 3 reservoirs.
- ◆ *Opinions on accelerating to promote water ecological civilization construction* printed and issued by the Ministry of Water Resources (Shui-Zi-Yuan No.[2013]1)
- ◆ In October, 2013, the Ministry of Water Resources printed and issued *Guidance opinions of Ministry of Water Resources on promoting connection of water systems of rivers, lakes and reservoirs*
- ◆ Formulation of *Protection planning of water resources*
- ◆ 2 batches of cities of water ecological civilization construction

2016-

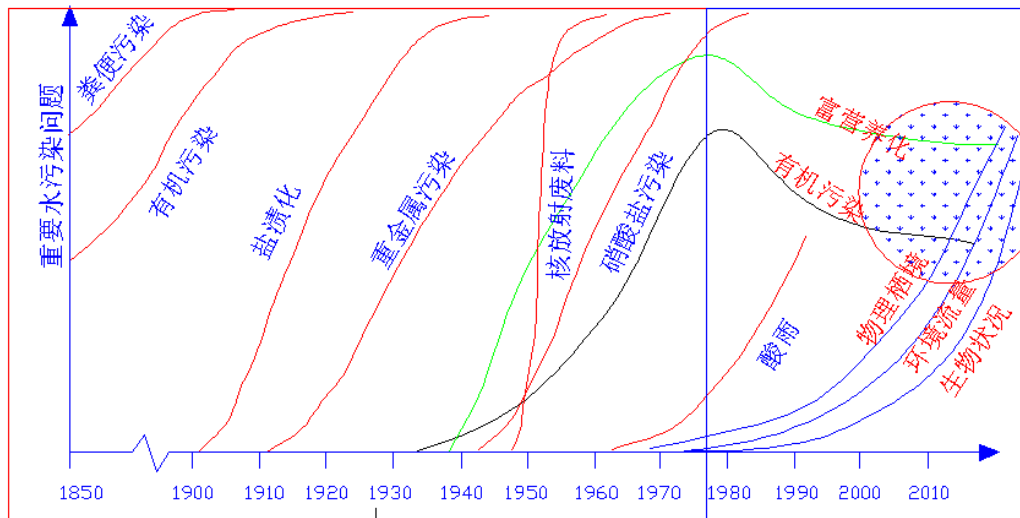
Full promotion

- *Opinions on accelerating to promote ecological civilization construction* printed and issued by the State Council in April, 2015
- *Prevention plan of water pollution* released in April, 2015



## 2. Development Process

- Ecological monitoring and health assessment of rivers and lakes



Water  
chemical  
assessment

1950s-  
1980s

Water  
pollution  
assessment

1980s-

Assessment  
on standard  
reaching in  
water  
functional  
zones

2000s-

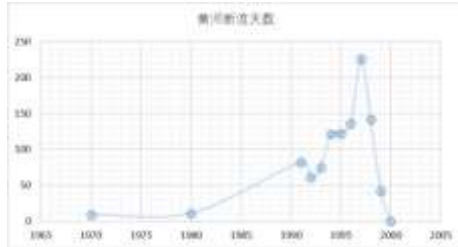
Water  
ecological  
health  
assessment

2010s-



# 2. Development Process

## ● Guarantee of emergency water compensation and ecological flow



In December, 1998, the State Council approved, issued and implemented *Annual distribution of the Yellow River's available water supply and regulation scheme of water volume in main stream and Dispatching management method of water volume of the Yellow River*

2001-, Zhalong wetland  
2002, emergency water diversion of Nansi Lake  
2005-, water diversion from the Yangzte River to Taihu Lake



*Comprehensive planning of drainage basin and Planning of water resources protection:*

officially state the ecological water requirement target of 183 rives, 265 control sections and 44 lake wetlands.

*Prevention of water pollution (Guo-Fa No.[2015]17)*

- Enhance water dispatching management of rivers, lakes and reservoirs. Maintain basic ecological water demands of rivers and lakes, and focus on guaranteeing ecological base flow in dry season.
- Determine ecological flow scientifically. **Conduct pilot program in drainage basins of the Yellow River and the Huaihe River**, to determine ecological flow (water level), as important reference for water dispatching of drainage basin.

Water dispatching and emergency water diversion

1998-

Planning of ecological water requirement

2000s-

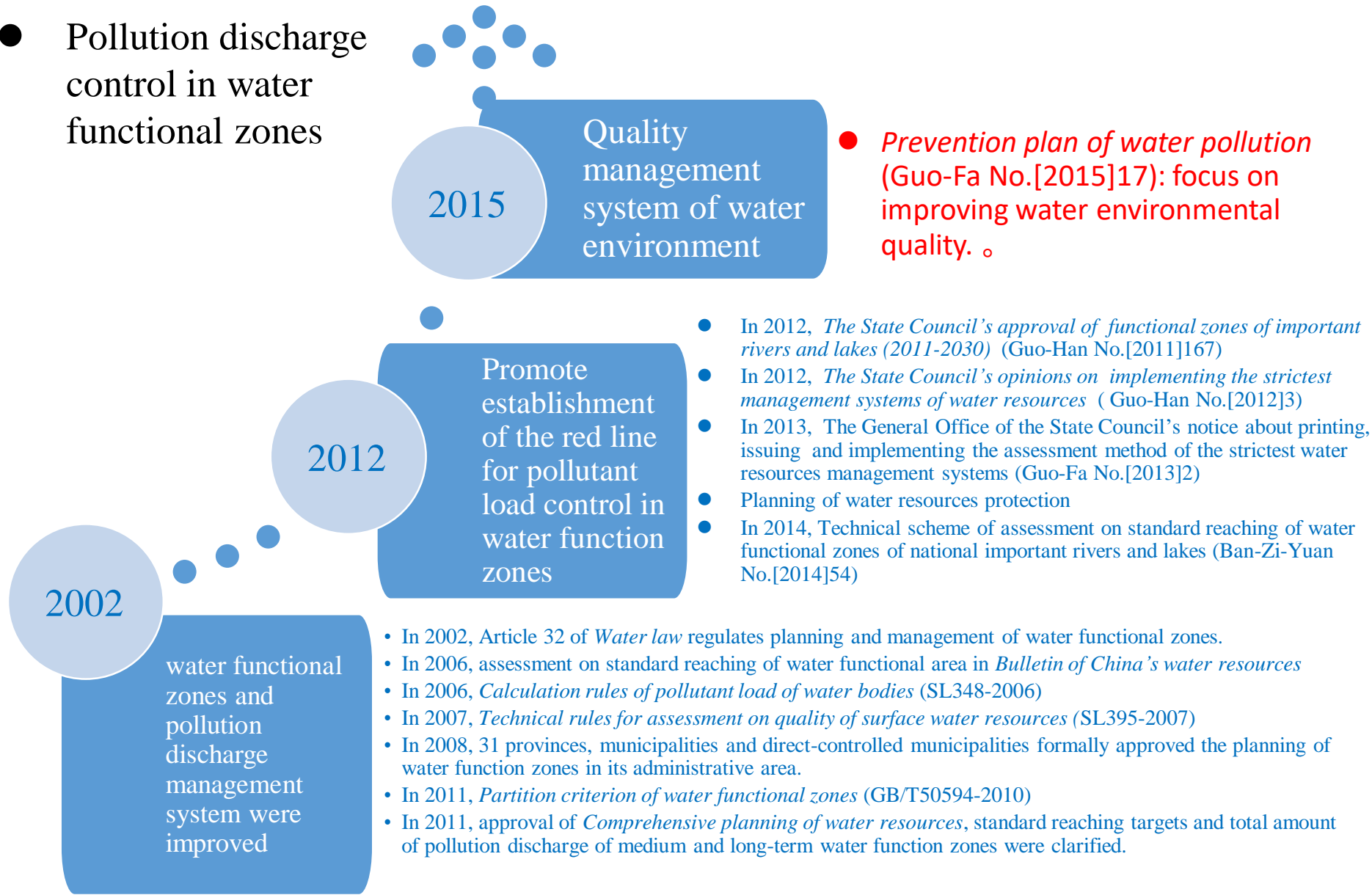
Supervision and guarantee of ecological flow

2015-



# 2. Development Process

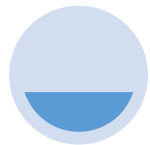
## ● Pollution discharge control in water functional zones





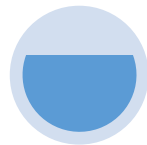
## 2. Development Process

- Water ecological protection and restoration
  - Water conservation and cleaning of drainage basin
  - Connection between rivers and lakes as well as ecological water network
  - Protection and restoration of important ecology
  - Comprehensive governance of ecosystem



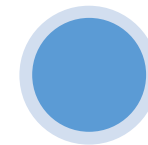
2000-

14 pilot program of protection and restoration of water ecosystems



2013-

Pilot cities of water ecological civilization



2016-

Great protection

- ◆ *Opinions on accelerating to promote water ecological civilization construction* printed and issued by the Ministry of Water Resources (Shui-Zi-Yuan No.[2013]1)
- ◆ In October, 2013, the Ministry of Water Resources printed and issued *The Ministry of Water Resources' guidance opinions on connection of water systems of rivers, lakes and reservoirs*
- ◆ Formulation of *Planning of water resources protection*
- ◆ Construction of 2 batches of 104 pilot cities for water ecological civilization



# 4

## Measures





# 4. Measures

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## Strategic scheme of enhancing protection and restoration of ecology of rivers and lakes

1 Perfect the legal system of water ecological civilization and accelerate to implement management of red line of water ecology

2 Enhance planning and coordination management of drainage basin and implement comprehensive governance of mountains, water, forest, farmlands and lakes

3 Construct an ecological friendly water engineering system and give play to the function of protection and restoration of water engineering

4 Construct ecological water network system and implement connection of rivers and lakes

5 Conduct water ecological restoration of key areas

6 Guided by water ecological civilization city construction, construct water ecological protection pattern of harmony between human and water

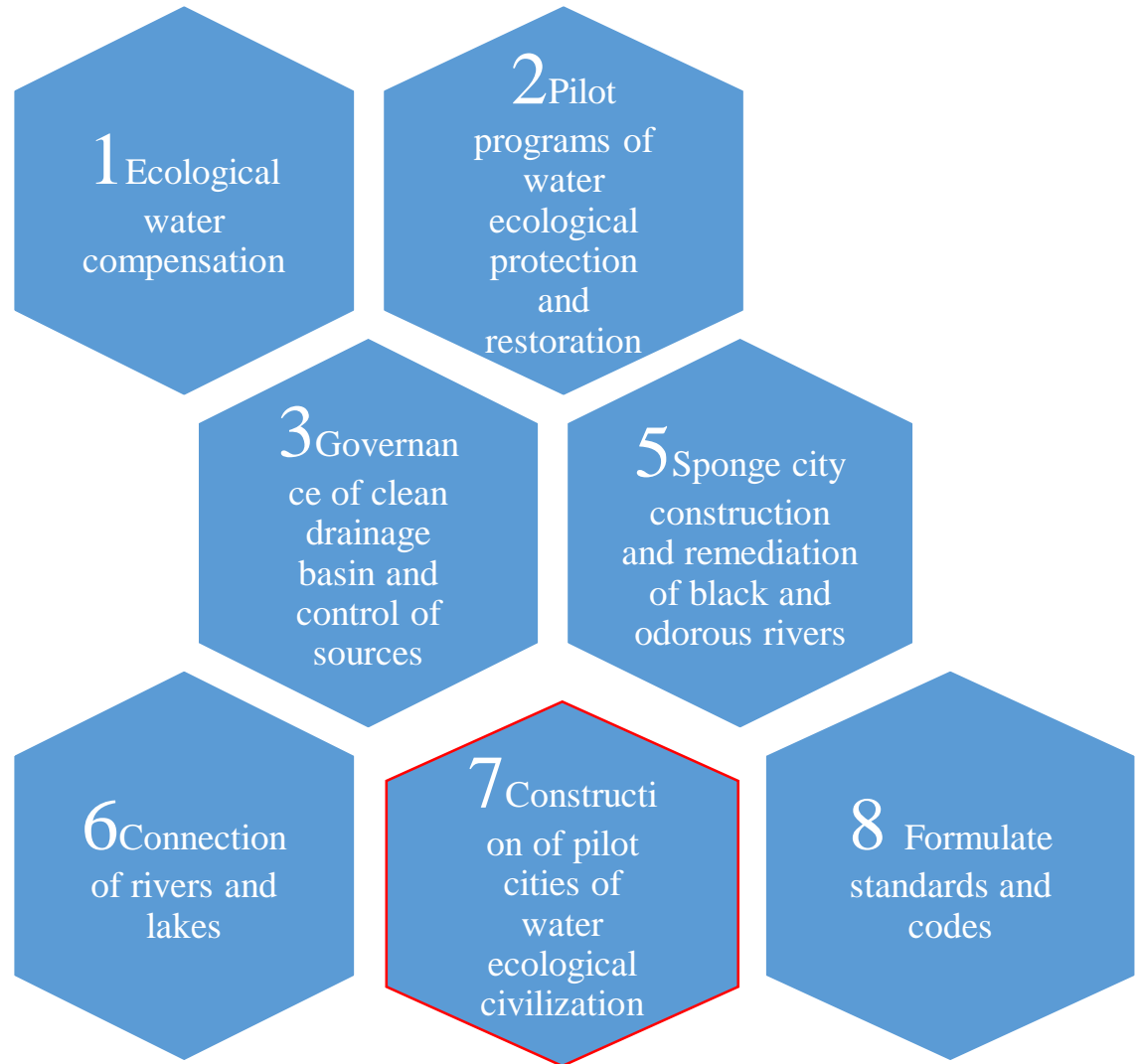
7 Promote technical innovation and enhance supervision capacity



# 4. Measures

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Measures and actions for ecological protection and restoration of lakes and rivers





# 4. Measures

## 1. Ecological water compensation—ecological restoration of rivers

Conduct comprehensive governance and scientific investigation of water resources of the Yellow River, the Tarim River and the Heihe River, and have got significant results.



Vitality of East Juyanhai Lake reappears.



Populus euphratica forest of the Tarim River



Estuarine wetland of the Yellow River

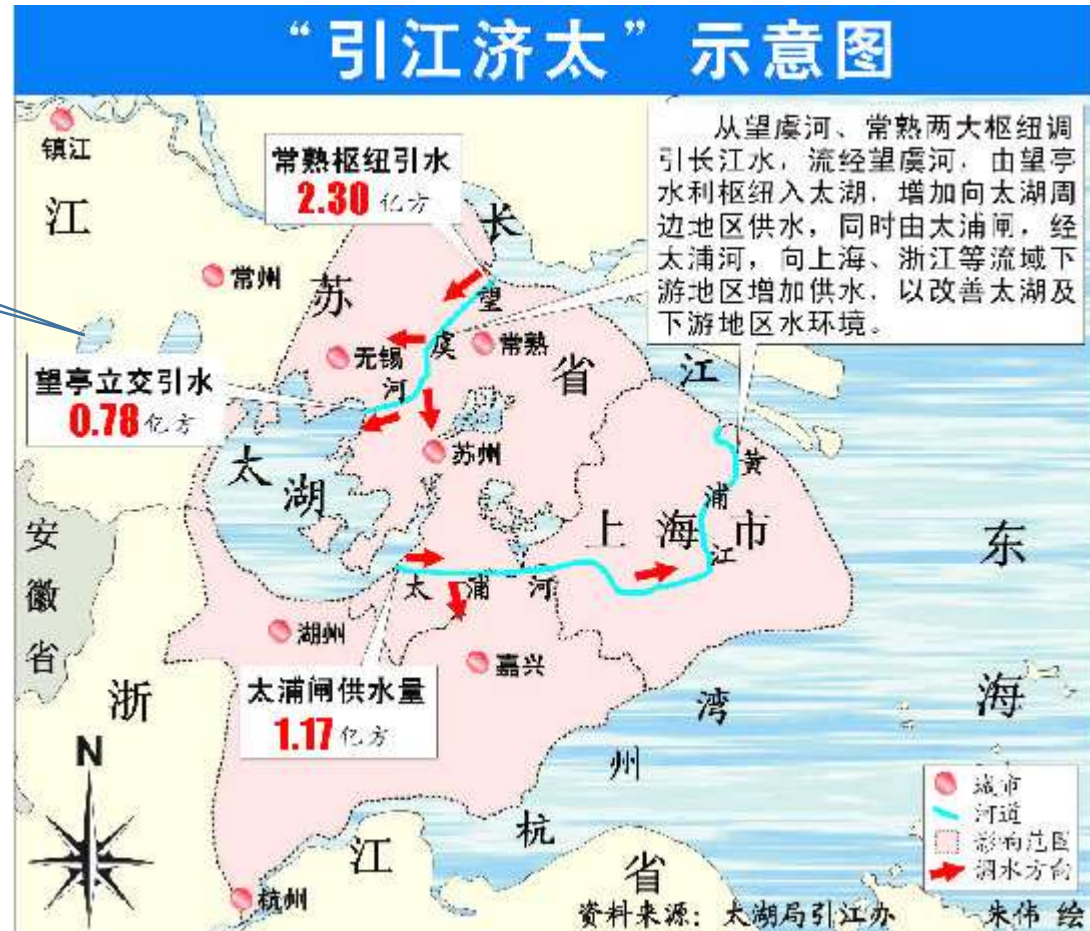


# 4. Measures

## 1. Ecological water compensation—water quality improvement of lakes



Govern statistic state  
with dynamic state,  
reduce pollution with  
cleanness, compensate  
shortage with richness,  
to improve water  
quality





## 4. Measures

## 1. Ecological water compensation—restoration of ecological wetland



## Zhalong Wetland



## Baiyangdian Lake



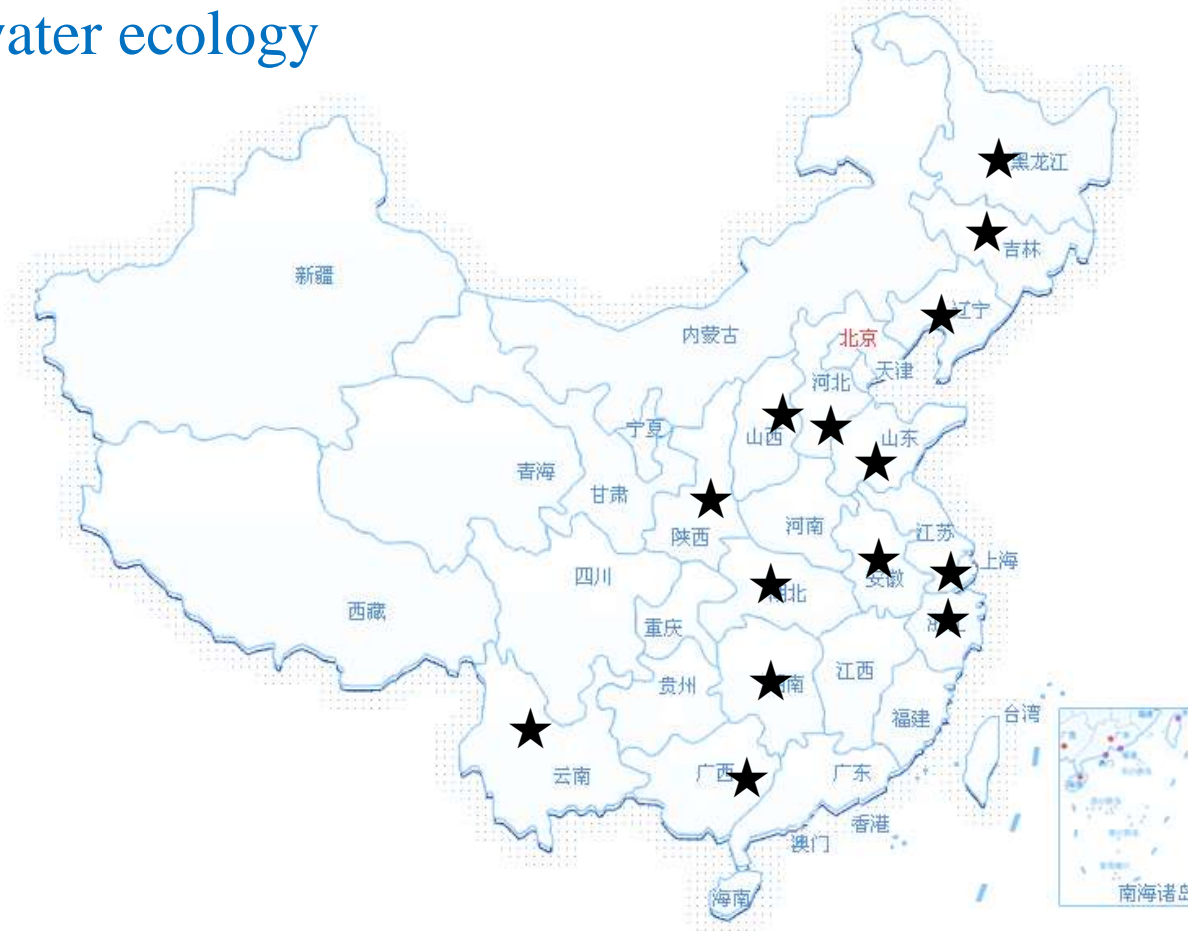
## Nansi Lake





# 4. Measures

## 2. Pilot programs for protection and restoration of water ecology



Wuhan



Guilin



Laizhou



Wuxi



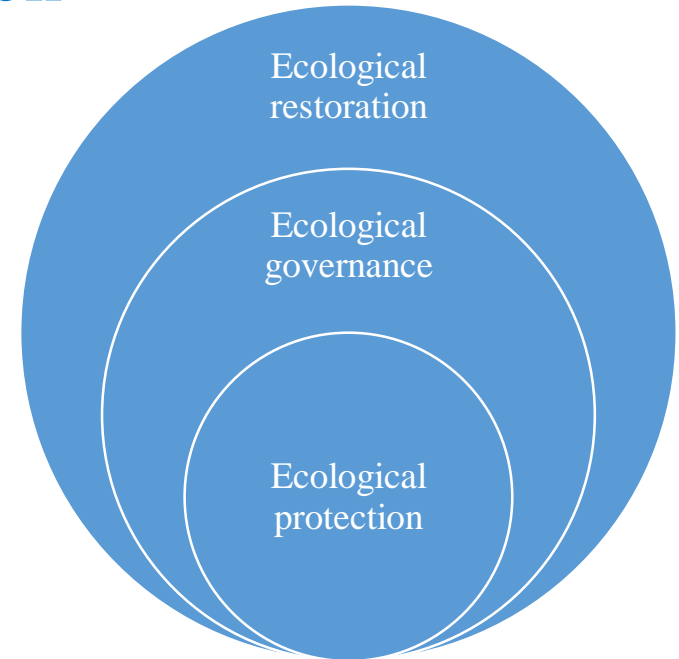
Lishui

Acceptance of 14 pilot programs for protection and restoration of water ecosystems is completed.



# 4. Measures

## 3. Governance of ecological clean drainage basin and control of non-point source pollution



Construction system of three defense lines

- The first line: “ecological restoration”
- The second line: “ecological governance”
- The third line: “ecological protection”



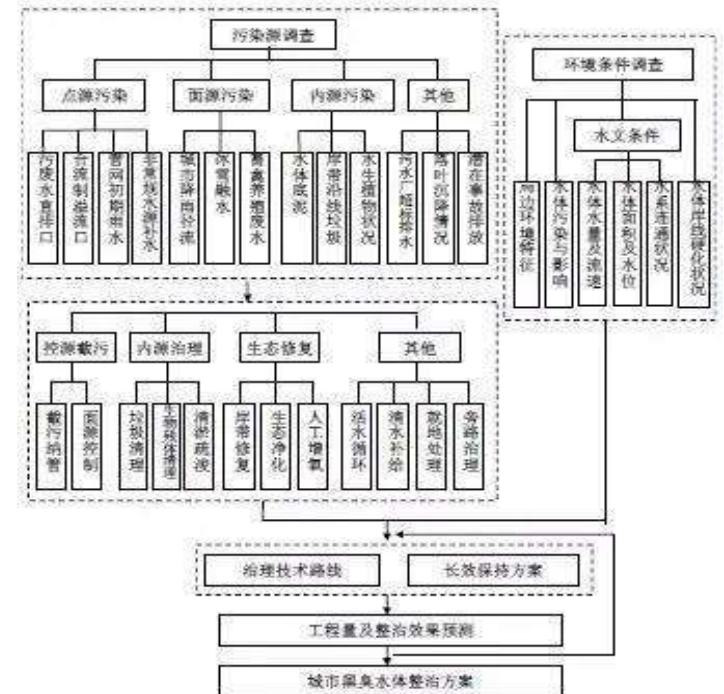
# 4. Measures

## 4. Sponge city construction and remediation of black and odorous rivers

### Remediation of black and odorous rivers

#### 海绵城市 Sponge City

海绵城市是指城市能够像海绵一样，在适应环境变化和应对自然灾害等方面具有良好的“弹性”，下雨时吸水、蓄水、渗水、净水，需要时将蓄存的水“释放”或加以利用。





# 4. Measures

## 5. Connection of rivers and lakes

**Connection of rivers and lakes:** based on rivers, lakes and reservoirs, through measures such as dredge, linkage, introduction, drainage and dispatching, the hydraulic connection between rivers, lakes and reservoirs is established or improved.

***Guidance opinions on accelerating to promote connection of systems of rivers, lakes and reservoirs.***

Build a “reasonable pattern, complete function, both storage and discharge, proper introduction and drainage, multiple sources for compensation, rich and dry dispatching, smoothness and beautiful environment” connection system of rivers, lakes and reservoirs.

Emphasis in work:

- Pay attention to functional requirements for connecting different types of rivers and lakes, allocation of water resources, to conduct flood control and disaster reduction, protection and restoration of water ecological environment
- Precisely grasp regional features of connection of rivers and lakes in east, middle, west and northeast
- Pay attention to connection features at national, regional, urban and rural levels.

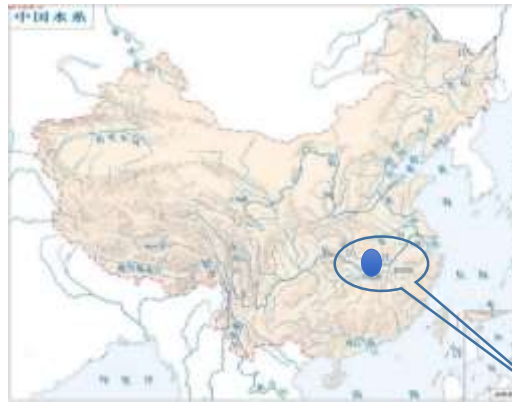




# 4. Measures

## 5. Connection of rivers and lakes

- Connection of rivers and lakes is an important measure that could help the construction of pilot cities combined with the urban overall planning and main functional area.
- In 61 pilot cities which have been approved for the implementation scheme, more than 200 water systems connecting rivers and lakes are planned, referring to investment of more than 80 billion Yuan, wherein some have commenced.
- The projects aiming at construction of river network, facilitating water circulation flow and ecological water compensation accounts for 40%; the projects aiming to improve water supply capacity and optimize allocation of water resources accounts for 7%; the projects aiming at comprehensive governance of water system and solving problems of water environment accounts for 53%.



The connection of rivers and lakes in Wuhan  
The largest domestic urban wetland was built up: healthy water network pattern integrated with rivers and lakes





# 4. Measures

## 6. Pilot cities of ecological civilization

- Construction goal: pilot cities take water system as vein, and set foot in systematical governance of mountains, water, forest, farmlands and lakes, to construct modern urban ecological pattern with complete system and balanced space according to the target requirements for realizing “circulation of rivers and lakes, integrity of water system, high water quality, diversity of ecology and inheritance of culture”.

### Main content of ecological civilization construction

- (1) Implement the strictest management system of water resources
- (2) Optimize allocation of water resources
- (3) Enhance the management of water saving
- (4) Protect water resources strictly
- (5) Promote protection and restoration of water ecological system
- (6) Enhance ecological protection in water conservancy construction
- (7) Improve guarantee and supporting capacity
- (8) Develop wide propaganda and education

General requirements: construct a batch of pilot cities of water ecological civilization with “5 available”:

- Implement the most strict management systems of water resources
- The pattern of optimized allocation of water resources is available
- The system of flood prevention and drainage is available
- Environmental protection measures of water ecology are available
- Ideas of water ecological ecology are available

- 105 cities (in 2 batches) have been included as pilot cities in the list of ecological civilization construction of Ministry of Water Resources.



# 4. Measures

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## 7. Standard and Criterion

- Assessment: *Assessment index, standards and method for river health (pilot)* (Ban-Zi-Yuan No.[2010]484) is issued, and corresponding standards are under formulation; *Guidance rules of ecological water requirements for rivers and lakes* (SL/Z479) and *Guidance rules of assessment on ecological risks SL/Z467* are issued;
- Planning: *Guidance rules of protection and restoration of rivers and lakes* (SL709) and *Formulation rules of plan of water resources protection* (SL613) are issued;
- Engineering technology: *Fishway design rules of water resources and hydropower engineering* (SL609) is issued; Technical guidance rules of ecological protection and restoration of rivers and lakes are under formulation; *Planning of embankment project design*(GB50286), *Channel improvement and design specifications* (GB50707), *Technical specifications of anti-penetration engineering of channels SL18-91* is issued, but ecological restoration engineering of rivers and lakes is not clearly regulated.



# Thank You!

