

CHINA SHAANXI: INTRODUCTION TO THE WEIHE RIVER BASIN INTEGRATED MANAGEMENT PLANNING #311

The Weihe River Basin Integrated Management Plan (WRBIMP) aims to address the issues of water resources scarcity, sedimentation and water pollution in the Weihe River Basin, and to establish a sound foundation for the effective development and protection of water resources in the region.

Abstract

Description:

The Weihe River is the mother river of the far-flung Guanzhong region in Shaanxi Province, which covers an area of 135,000km². Since ancient times, the river has played a very important role in the development of Shaanxi. With the fast economic development in Weihe River Basin in recent years, many problems have arisen. These include increasing water resources scarcity, water pollution and regional ecological environment deterioration caused by sedimentation in the Sanmenxia reservoir region (which is located in the middle-stream and downstream of Weihe River). These problems have seriously constrained the socio-economic development of the region.

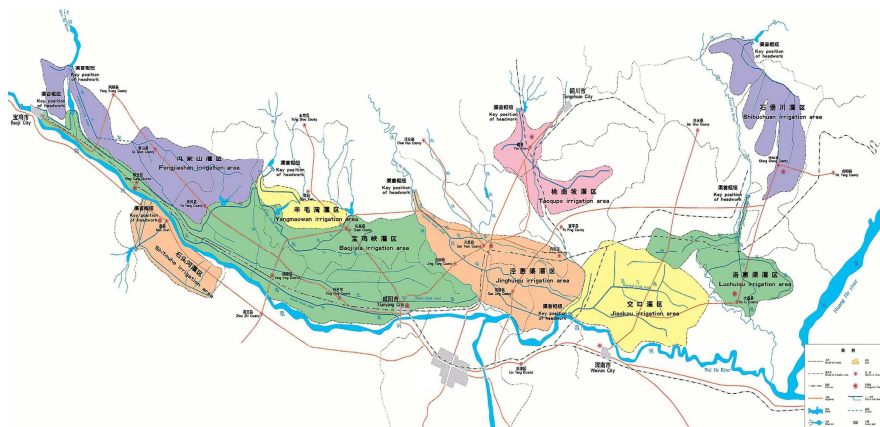


Figure 1. Plan of Weihe River Basin of Shaanxi Province

Lessons Learned

The Weihe River Basin Integrated Management Plan (WRBIMP) was developed based on the principles and approaches of IWRM, with the participation of many sectors and the application of management tools of water resources assessment, environment evaluation and formulation of IWRM models. The Plan is supported by society and raises broad awareness through public media. It is approved by the Chinese government and is supposed to be implement from the year 2006.

Importance of case for IWRM

The planners come from 19 organisations including the department of water resources, soil and water reservation, agriculture, meteorology and environment protection, and universities, research institutes and non-governmental organisations. Such participation ensures the cross-sectoral dialogue during the planning process and reflects the principles of IWRM.

The significance of this case is the promotion of public participation and gradual improvement of the market economy system that serve to facilitate institutional guarantees for the more integrated approaches towards IWRM.

Tools used

- A1.2 Policies with relation to water resources
- C1.2 Water resources assessment
- C1.3 Modelling in IWRM
- C1.5 Ecosystem assessment

Keywords

Weihe River Basin, China, Yellow River, Governance, Nature & Environment

MAIN TEXT

1. Problems

The Weihe River is the biggest tributary of the Yellow River. Originating from Niaoshu Mountain in Weiyuan County of Gansu Province, the river runs from west to east through Gansu, Ningxia and Shaanxi provinces, and joins the Yellow River at Tongguan County in Shaanxi Province. The Weihe River Basin covers an area of 135,000km², of which 67,100 km² are in Shaanxi Province (49.7% of the total). The main stream of the Weihe River is 818km long, of which 502km are in Shaanxi (61.4% of the total). The average annual volume of self-generated water resources reaches to 6.992 billion m³. The Weihe River Basin in this case refers to the part within Shaanxi.

Weihe River is the mother river of Shaanxi Province. It runs from west to east through Baoji, Yangling, Xianyang, Xi'an and Weinan – 5 cities of Shaanxi, across the far-flung Guanzhong plain. In 2000, the population in the river basin reached 22,040,000 - 61% of the total population of Shaanxi; and incorporated a cultivated area of 1,665,000 hectares (56% of the whole), with irrigated areas covering 950,000 hectares (72% of total irrigated area). GDP amounts to 134.5billion RMB, due to the basin's importance for industry, national defence, and scientific research as well as an education base. Indeed, the area plays a crucial strategic role in the China Western Development Program.

Along with the socio-economic development in Weihe River Basin, the following problems have occurred:

- **Serious water resources scarcity (total quantity scarcity).** The Weihe River Basin is suffering from serious water shortage. The water available per capita per annum is just 317m³ - only 13% of the national level. The water resources volume of cultivated land per hectare is 4200m³ - only 17.7% of the national average. Due to the scarcity of water, the actual irrigation area is declining gradually, and the ground water overdraft is up to 0.46 billion m³. The scarcity of water has seriously constrained the socio-economical development in Guanzhong area and thus the whole province, and it has seriously affected the ecosystem as well.
- **Sedimentation in the downstream river course.** Due to the completion of the Sanmenxia reservoir and its inappropriate utilisation, soil erosion is getting more and more serious. From 1960 to 1998, sedimentation in the downstream of Weihe River had reached to 1.69 billion tons (1.35 billion m³). On the influx to Yellow River at Tongguan, the height of sedimentation reaches up to 5m. The flood discharge capacity of the main river course has reduced from 5000m³/s (1960) to 1700m³/s at present, and it continues to fall. The regional ecosystem is deteriorating seriously, with major challenges to flood control.
- **Serious Water Pollution.** A total of 78% of the water in the main stream of the Weihe River is classified as exceeding class V, which means that the water is

almost of no use and a serious challenge for waste and polluted water treatment.

2. Decisions and Actions Taken

In the year 2000, a proposal was put forward to include the Weihe River main stream integrated management project in the list of national key projects. It's proposed by some members of the National Committee of the Chinese People's Political Consultative Conference (CPPCC) headed by Mr. An Qiyuan, at the Ninth Meeting of CPPCC.

In October 2001, with the Leadership of Ms. Qian Zhengying, vice president of CPPCC, the Proposal Committee of CPPCC associated with Chinese Academy of Engineering carried out a site visit in Shaanxi. Ms. Qian called for "Saving the Weihe River; Protecting the ancient capital" after this visit, and she also submitted the Investigation Report on Weihe River Basin Integrated Management to the Chinese Central Government and the State Council. In response, Vice Premier Wen Jiabao gave important instructions: "This issue should be listed on the working schedule. The first step should be studying and planning". Later he gave the instruction again: "The environment protection and ecological issues should be taken into account in the integrated management of the Weihe River Basin".

In February 2002, to carry out the instruction, a leader group for WRBIMP was set up in Shaanxi, headed by vice governor Mr. Wang Shousen, organised by the Shaanxi Provincial Committee of Development and Reform, and including representatives from the department of water resources, soil and water reservation, agriculture, meteorology and environment protection, and universities and research institutes. In September 2002, the group submitted the first draft to the Ministry of Water Resources, and many experts were invited to work on consulting and discussions, coming from Chinese Academy of Science, Chinese Academy of Engineering, Ministry of Water Resources, State Environmental Protection Administration, Macro Economic Research Institute of the National Development and Reform Committee and some universities. The report was revised based on their comments and suggestions, and was submitted to the State Council.

During the development of the Plan, the media tracked and reported the planning process in time. People from all walks of life showed their concerns. They expressed their views and suggestions which effectively promoted and helped the planning process.

Following a review by a premier's working meeting of the State Council in July 2005, an approval was made by the State Council in December 2005.

There are many members of GWP China and GWP China Shaanxi involved in the planning process in different ways. Professor Qian Yi of GWP China TAC, Academician Prof. Wang Hao, Prof. Shi Jian from GWP China Shaanxi and Prof. Xing Dawei involved in the consulting and steering work. And some of them participated in the

practical compiling work (Prof. Kou Zongwu, Mr.Liu Anqiang (Senior engineer), Mr.Wang Jianjie (Senior engineer) and Mr. Huang Xingguo (Senior engineer)), also serving to incorporate the principles of IWRM throughout the whole planning process.

The guiding principle of the planning is to improve the ecosystems' functions and services as the foundation, and to focus on water saving, waste water treatment, water resources rational allocation and capacity improvement of flood control. The plan places emphasis on giving priority to urban water supply; stabilising agricultural water supply; allocating enough water for ecosystems; increasing incomes and decreasing expenditures; attaching same importance to development and protection; as well as on flood control and drought relief. It established an integrated management goal called "one society, four systems and coordinated development".

One society: A water saving society with high efficiency on water use. **Four systems:** An efficient water pollution prevention and treatment system; a rural and urban water supply system suitable to the socio-economic development; a scientific and well-prepared system to prevent drought and flood and protect ecological environment; as well as a river basin management system with sound legislation, regulations and rules. **Coordinated development:** Ultimately aims to achieve coordinated sustainable development regarding fundamental social, economic and environmental aspects.

During the planning, the participants (organisations and individuals) put forward many specific plans on behalf of their interest group based on their specialties. These included:

- *Water Resources Development Plan in Weihe River Basin;*
- *Agriculture Development Plan in Weihe River Basin;*
- *Irrigation Water Saving Plan in Weihe River Basin;*
- *Urban Water Supply and Water Saving Plan in Weihe River Basin;*
- *Water Pollution Prevention and Treatment Plan in Weihe River Basin;*
- *Ecological Environment Construction Plan in Weihe River Basin*
- *Flood Control Plan in Weihe River Basin.*

Based on these plans, all the parties concerned worked together, exchanging their ideas and taking numerous opinions and suggestions from the public. As a result, the WRBIMP came into being.

3. Outcomes

1) Water Saving:

- For agricultural water saving, the plan places emphasis on renovating and rebuilding the big and medium-sized irrigating district in Guanzhong area. Many measures are proposed to improve the overall water saving skill of agriculture. These measures include taking engineering measures, adjusting planting structures; reforming methods of cultivating, popularising water saving skills; and setting up an effective policy and pricing system. An area of 1.08 million hectares is planned as to be used as a water-saving irrigation area;

the utilisation rate for the irrigating water is to be improved to above 0.6, and the annual water-saving volume is to be 0.875 billion m³.

- For industrial water saving the plan suggests that measures should be taken by structure adjustment, policies making and quota control to improve industrial water use efficiency. Meanwhile, the plan also sets out the detail requirements for industrial water recycling ratios and water utilisation ratios for each 10,000 RMB production value for each city. This means that by 2010, water use should be reduced to 30 m³ for each RMB 10000 production value; and to 15 m³ by 2020.
- On the topic of urban water saving, the plan suggests
 - a) To reduce the water loss rate of the city pipeline network, and to improve the effective utilisation rate of water to and above 90~92% by 2020;
 - b) To popularise the domestic water saving utensils. By 2010, the reconstruction and renovation of those utensils which do not match the water-saving standard is to be completed;
 - c) To implement a system of individual water meters, and to abolish packaged water charging;
 - d) To gradually adopt a classified water-supply system. A reclaimed and recycling system must be adopted in hotels with a construction area above 20,000m², residential districts above 30,000m², as well as some governmental structures and enterprises with construction areas above 10,000m².

2) **Water pollution prevention:**

According to the division of 11 water environmental functional regions of the mainstream of the Weihe River, the plan has defined the environmental capacity index for the functional regions, that is, when the incoming water frequency is 50%, the COD environmental capacity is 89,000t; when 75%, 70,300t. With this standard, a total capacity control plan and some prevention and treatment measures for water pollution are proposed:

- a) To adjust industrial structure; to develop high-tech water-saving industries; to abolish the small-sized chemical pulp paper-plants; to widely adopt non-pollution producing skills.
- b) To construct waste and sewage treatment infrastructures. To perform treatment in both centralised and separated method. It is planned to set up 54 waste water treatment plants and 54 recycling plants. By 2010, the capacity of the urban sewage treatment is to reach to 2,000,000 m³ per day, with a wastewater treatment capacity of 60% and above. By 2020, the total treatment capacity will reach to 3,000,000 m³ per day, with a wastewater treatment rate capacity above 70%.
- c) To promote wastewater treatment to become an industry; to improve the charging policies; to bring the water treatment industries to market.
- d) To control the non-point source pollution; to reduce fertiliser consumption by the introduction of ecological agriculture; to popularise the use of pesticide-free methods.
- e) To increase the ecological capacity of river courses, and to maintain its basic

function of dilution and self-purifying. The flow volume at Linjiacun should be 10m³/s or above, 15 m³/s at Xianyang and 20 m³/s at Huaxian County.

- f) To enhance the protection of the waterhead areas. For the specified waterhead areas of urban water supply, labelling and marking work should be carried out. It is suggested to set up a practical protection plan.

3) **Water resources allocation**

- a) It is estimated that the annual water demand in the Weihe River Basin will be 7.84 billion m³ in 2010 and 8.08 billion m³ in 2020. With the current water supply facilities, the water supply capacity is only 5.3 billion m³, which means the shortage of 2.6 billion m³ and 2.8 billion m³ respectively. After the increase of dam height and establishment of sluices of some projects (such as Jinpen reservoir project in Heihe River, Donglei Project, Xijiao reservoir in Sanyuan and Baojixia Project, and new construction of Nangoumen reservoir in Luohe River, and water transfer projects such as Hong-Shi project, Qian-Shi project, Han-Wei project (stage 1)), it is still in shortage of 1.33 billion m³ water by 2010 and 1.27 billion m³ by 2020. This is even after the construction of several middle and small sized waterhead projects in Tingkou, Nianli and Dayu. The total water transfer volume will reach to 1.7 billion m³ after the completion of Hanwei Project (II Stage), and only at that point the water supply and demand conflict can be resolved.
- b) As for the ecological water demand of Weihe River, besides maintaining by remaining water from the completed projects, recycling water and water-saving water, the water transfer project from Yaohe river to Weihe river in Gansu province can add 0.37 billion m³ to the total capacity. And the water transfer projects of Hong-Shi and Han-Wei project, together with the Dongzhuang reservoir project, can also help to improve the downstream watercourse ecological flow.
- c) As to domestic and industrial water use in cities, by 2010, to the south of Weihe River from Xi'an to Weinan will mainly use the surface water from tributaries of southern Qinling Mountains, such as Shitouhe River, Heihe River, Youhe River and Jianyu river. The insufficient portion will be made up by the Qian-Shi and Han-Wei water transfer projects (stage I).
- d) As to cities and towns to the north of Weihe River, such as Baoji, Xianyang, Xingping and Tongchuan, the demanded water is still supplied by Fengjiashan reservoir, Taoqupo reservoir and other surface waters; meanwhile, the Hong-Shi water transfer project can supply water to Xianyang and Yangling districts. After 2010, the domestic and industrial water use alongside the Weihe River will be supplied by the Han-Wei water transfer project.
- e) As to the agricultural water use, it will be addressed mainly by upgrading the present hydro engineering projects, water-saving reconstruction, sewage recycling and enhancing management.

4) **Flood control and disaster relief**

It is planned to construct flood control projects in the middle and downstream of the Weihe River. This includes flood control and security project for the reservoir regions,

and the city flood prevention project of Xian'an city. It is also planned to establish a non-engineering flood prevention system, of which the kernel consists of a modern flood control commanding system and flood forecasting information system. The Jinghedongzhuang reservoir is to be constructed, which has the function of water and sand diversion. Meanwhile, it is proposed to coordinate with concerned governmental divisions to change the performance pattern of the Sanmenxia reservoir to relieve the sedimentation problem at Tongguan - the influx to the Yellow River downstream of the Weihe River.

5) Soil erosion treatment.

The treatment principles are to consider the river basin as a unit, to combine engineering measures with biological measures, and to put the same importance on both trenches and slopes. Focused on treatment of the region of rich sand and grand sand, there are 759 key dams, 2414 middle and small-sized soil-retaining dams will be constructed. The total treatment area planned reaches 31,790km². It is estimated that 51 million tones of silt (coming into the Yellow River) will be reduced. Meanwhile, the plan also emphasises basic farmland construction, such as turning the hillside into terraces for farming, planting soil and water conservation forest and grass, and ecological reconstruction.

Furthermore, based on the actual situation of Weihe River Basin, the plan indicates that for the highland to the north of the Weihe River the focus is to use natural rainfall, constructing 400,000 water cellars (to keep rainfall) to solve the drinking water problem for 400,000 people. To add to this water-saving skills and planting techniques in dry land will be promoted. In Guanzhong plain, it is suggested that the focus be on improving water use efficiency, adjusting the structure of industry, developing infrastructural agriculture and building a high-tech agricultural pilot project.

This plan exhibits the following features:

- a) Giving priority to water saving and insisting on sewage processing, to take both as prime treatment measures.
- b) Carrying out rational allocation of water resources to achieve sustainable use of the limited water resources of the Weihe River Basin, and support the sustainable socio-economic development in the area.
- c) Emphasising ecosystem restoration by water pollution prevention, afforestation, and establishment of soil and water conservation projects to reduce the incoming silt flowing into the Weihe River and the Yellow River.
- d) Based on the water resources assessment and water demand estimation, as well as further efforts on water saving, it is advised to exploit the local water resources properly, to study the implementation of water transfer measures from outside to increase the effective water supply.
- e) As for the issue of Sanmenxia reservoir, which is bearing the heavy burden of flood control in the reservoirs region due to the increasing level of water bed by silt, it is suggested to change the performance pattern of the reservoir, and to construct the Dongzhuang reservoir to reduce the river bed elevation at Tongguan in order to thoroughly solve the problems of flood control and water

environment deterioration at the middle and downstream of the Weihe River.

In order to ensure the effective implementation of the planning outcomes, the following measures are proposed in the plan:

- (1) To strengthen the leadership, by building up a sound river basin management system with authority, high efficiency and coordination. The planning involves water resources development, utilisation, protection, water saving, as well as ecological environment treatment, and the stakeholders are from different sectors and regions representing different interests. Therefore, it is essential to keep multi-stakeholders dialogues and coordination ongoing.
- (2) To broaden financing channels and set up an investment reward-security system. In addition to the 11 billion RMB investment from central government budget and 4.5 billion RMB from provincial government budget, the role of market mechanisms should be utilised efficiently, including the utilisation of domestic and foreign investment. The intention is to encourage economic entities of different ownerships to become involve in the treatment projects. And it is suggested to promote the implementation of BOT (Build-Operate-Transfer) and TOT (Transfer-Operate-Transfer) measures in the Weihe River Basin Integrated Management Planning. Thus, establish an enabling environment for investment which can attract all kinds of social resources.
- (3) To make use of the market adjusting role in water use. To use water effectively and efficiently by water price adjustments, water pricing reform, a reasonable ratio between tap water and recycled water and including sewage treatment cost into water pricing must be established.
- (4) To deepen the institutional reform and unify the allocation of water resources of the Weihe River Basin. To carry out the rural and urban integrated water resources management and the integrated planning and management, the aim is to achieve a balance of quality and quantity. This will be achieved by introducing a water extraction permit system and discharge permit system to foster and promote the establishment of a water market.
- (5) To enhance legislation to ensure the implementation of the WRBIMP according to law. To make great efforts to disseminate and implement the China Water Law, China Flood Control Law, China Soil and Water Conservation Law, China Water Pollution Prevention and Treatment Law, China Environment Protection and China Forest Laws. Meanwhile, it is urged to formulate Shaanxi Weihe River Basin Management Rules and other local legislations based on the local situation of Shaanxi.
- (6) To strengthen the implementation of science and technology in the integrated management in Weihe River Basin. To organise and manage the plan with scientific methods, to cooperate with both domestic and international professionals to set up an expert assessment and consulting mechanism.

4. Lessons learned and replicability

There are about 20 departments participating in the planning process, and the related information was reported by the media. It guarantees the stakeholders' rights to know, to comment, and to participate, and achieved positive social effects. The limitation of the previous "water issues discussed only by water sector" was changed, and many elements were integrated for consideration.

However, attention still has to be paid to:

- IWRM approaches require the integrated coordination and management of all environment elements including water itself, and it should not be constrained by separation of sectors. During social transformation period, the interest separation of sectors is the systematic obstacle for the promotion of IWRM.
- It is necessary to establish dialogue platform and mechanism to enable more stakeholders to participate in dialogues and express their wills. The cross-sectoral participation was practiced in the planning, but its scale and scope needs go further e.g. to better address the MDG targets and in particular poverty reduction aspects of IWRM efforts.

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