Part I

State of River Basin Management Institutions

Chapter 1

River Governance Structure in China: A Study of Water Quantity/Quality Management Regimes

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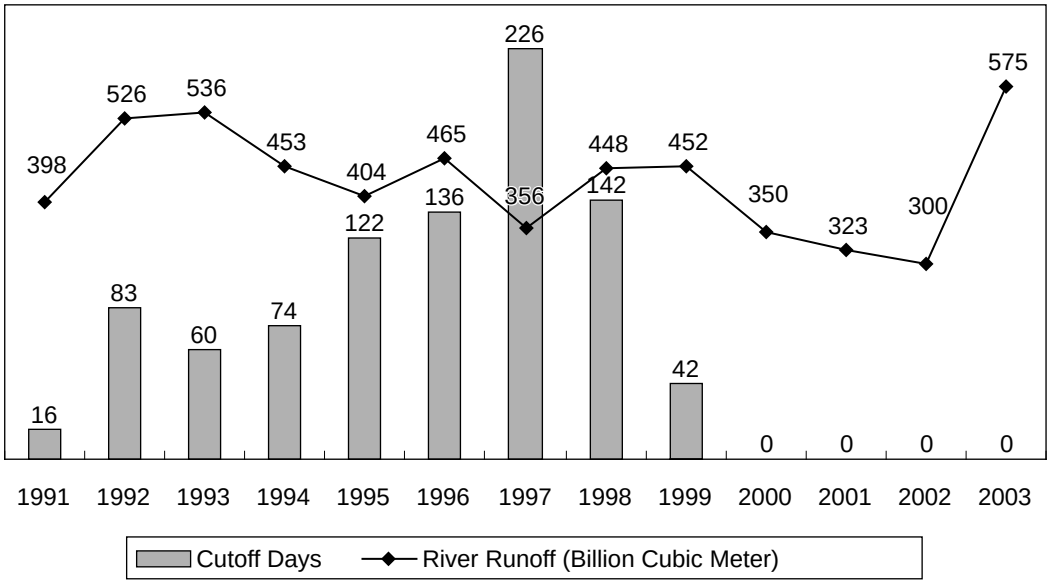
INTRODUCTION

In the past quarter century, China's economy has been expanding dramatically, which has been inflicting a high cost on the country's environment. A variety of water crises are among the most challenging environmental problems facing China—ranging from flood disasters caused by deforestation and rivers and lakes choked with toxins from unregulated dumping by industries and cities to crippling water shortages due to over pumping of ground and surface water. Ultimately, many of these water problems are linked to with ineffective and insufficiently coordinated water management. In order to mitigate the water shortages and pollution, which are becoming key threats to sustainable development in China, the Chinese government must address these shortcomings within the current management regime.

Water is one of the scarcest natural resources in China—the country must support 21 percent of the world's population with only 7 percent of the global freshwater resources. Moreover, the distribution of water in China is very uneven—the north is dry and suffering from frequent droughts while the south enjoys frequent rains, but must combat floods. The semi-arid north contains 42 percent of China's farmland but only 8 percent of the country's freshwater runoff (Wang Rusong, et.al. 2000, p.2). Nationwide almost 700 million people lack access to safe water and adequate sanitation. Among 668 cities in China, there are more than 400 facing some water shortage and 108 with serious water deficits. Throughout the country the deficiency of urban water supply reaches about 6.0 billion cubic meters annually, resulting in more than 200 billion Yuan in economic losses in industrial production each year (State Council 2002, p.13). Since the early 1970s the flow in China's

Fig. 1. Contrast between Runoff and Cut-off of Yellow River (1991-2003)



Source: Yellow River Conservancy Commission

Table 1. Water Quality Classification in China's Seven Major Rivers (1991-2003)

River	Quality (%)	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Huaihe	I-II	0.0	0.0	0.0	0.0	0.0	0.0	11.1	22.2	10.1	9	7.8	5.4	7.0
	III-IV	87.5	100.0	88.9	80.0	44.4	33.3	66.6	66.6	25.8	45.7	32.5	34.4	41.9
	V-V*	12.5	0.0	11.1	20.0	55.5	66.6	22.2	11.1	64.1	45.2	59.7	60.2	51.1
Haihe	I-II	20.0	0.0	31.6	20.0	15.0	14.3	9.5	21.0	16.8	25	8.4	12.7	13.8
	III-IV	40.0	52.4	21.0	35.0	20.0	28.6	42.9	17.0	12.8	7.2	16.8	8.5	20.0
	V-V*	40.0	47.6	47.3	45.0	65.0	57.1	47.6	62.0	70.4	67.8	74.8	78.8	66.2
Liaohe	I-II	0.0	0.0	0.0	0.0	5.5	0.0	6.7	11.1	6.25	6.3	2.1	10.4	24.3
	III-IV	20.0	20.0	37.5	28.6	16.7	35.7	13.3	33.3	25	25	25.8	20.9	21.6
	V-V*	80.0	80.0	62.5	71.4	77.8	64.3	80.0	55.6	68.75	68.7	72.1	68.6	54.1
Yangtze	I-II	4.5	15.8	29.2	31.0	30.0	42.9	33.3	31.3	35.8	N/A	63.3	32.0	51.4
	III-IV	72.7	79.0	66.7	65.5	66.6	42.8	60.0	53.1	61.5	N/A	21.9	36.7	35.0
	V-V*	22.7	5.3	4.2	3.4	3.3	14.2	6.7	18.6	2.56	N/A	14.8	31.3	13.6
Huanghe	I-II	0.0	0.0	0.0	16.7	8.3	8.3	8.3	8.3	16.7	28.6	9.1	13.0	9.1
	III-IV	50.0	22.2	58.4	50.0	58.4	50.0	66.7	25.0	75	57.1	27.9	29.7	43.1
	V-V*	50.0	77.8	41.6	33.4	33.3	41.7	25.0	66.7	8.3	14.3	62.9	57.3	47.8
Zhujiang	I-II	0.0	18.2	4.5	8.3	12.0	43.4	45.8	31.0	64.4	85.7	60.7	51.1	60.6
	III-IV	91.3	72.6	77.3	83.3	84.0	43.4	45.9	54.7	17.8	14.3	32.2	34.6	33.3
	V-V*	8.7	9.1	18.2	8.3	4.0	13.0	8.4	14.8	17.8	0	7.1	14.3	6.1
Songhua--jiang	I-II	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.9	0	3.0	5.0	0
	III-IV	83.3	50.0	100.0	92.3	64.7	74.8	76.5	47.1	82.4	100	62.1	58.4	71.8
	V-V*	16.1	50.0	0.0	7.7	35.3	24.8	23.5	52.9	11.7	0	34.9	36.6	28.2

Notes: The data of the Yangtze, Huanghe, Songhuajiang and Liaohe reflect water quality of mainstreams V represents water quality worse than type V.*

Source: 1991-2000 data come from China Net of Environment Monitoring Center, SEPA, Wang Yuqing, Lu Xinyuan et. al (2001, p4). 2001, 2002 and 2003 data were drawn from China Environment Bulletin 2001, 2002, 2003, respectively.

second largest river, the Yellow River, has frequently stopped before reaching the ocean. The most serious flow cut-off occurred in 1997, when the cut-off days reached 226 days (see Figure 1).

China's water shortage is exacerbated by severe water pollution. China now holds the unenviable record of producing as much organic water pollution as the United States, Japan and India combined (Jasper 2003). According to *China Water Resource Bulletin* 2002, 63 billion tons of wastewater is discharged into China's waterways each year—mainly industrial wastewater and domestic sewage, 62 and 39 percent, respectively. The water quality monitoring of the 123,000 kilometers (km) of over 700 major rivers of the China reveal that 39 percent of the rivers are ranked the top water quality types I and II; 26 percent are type III, and 35 percent are categorized as the worst quality types IV and V. In northern China the water ecosystem of many rivers is very severely degraded—with approximately 90 percent of all urban waterways polluted in varying degrees. Table 1 displays the water quality changes of China's seven major rivers from 1991 to 2003. While the Zhu, Yangtze, and Liao rivers have increased the areas of type I and II water quality, most have experienced a downward trend in quality. Most notable is the Huai River where despite large-scale cleanup campaigns for ten years the quality of almost 60 percent of river mainstream cannot achieve the minimum national standard of water quality (type V). In her account of the political and managerial shortcomings in cleaning up the river, Economy (2004) accurately describes the Huai as a dead river that runs black.

There are many drivers—old and modern—that have caused China's water crisis, ranging from intensive exploitation of water resources in the ancient and more recent past (Shapiro 2001), inferior natural conditions, the rapidly industrializing economy and population pressures. Another central driver that many environmental and policy experts such as Qu Geping (2004, p.28) have identified is the failure of management. Rivers represent a central challenge to sustainable water manage since water flows ignore political boundaries. In order to address some of the obstacles to sustainable river governance, this article focuses on the weaknesses of water quantity and water quality management institutions in modern China. An analysis of the institutional faults of water quantity management will be followed by an overview of China's regime of water quality management. The last section discusses overall institutional arrangement deficiencies inherent in China's river governance system.

1. Analysis of Water Quantity Management Regime

After the founding of the People's Republic of China in 1949, not only were the economic and political systems changed to fit the communist leadership's socialist development goals, but ownership of water and land were also deemed the property of all citizens and the state. Under such a water rights regime water was exploited as an open-access resource—urbanites had their water heavily subsidized and peasants could use the water for free, in exchange for helping in the construction and maintenance of dams and dykes. This pattern of water allocation led to a rapid increase of water consumption and low efficiency of resource use throughout China.

After Deng Xiaoping sparked the economic transition through market reforms in 1978, the regime of water allocation also began to gradually change, for the leadership realized that sustainable water supplies would be crucial to fuel economic growth. In 1988, China enacted a national Water Law that introduced a series of important institutions to help clarify water use rights and improve water management, such as a water withdrawal permit system, water fee and water resource fees. In 2002, China amended the Water Law to promote a more integrated legal system of water management. This section highlights several key institutions that have emerged to strengthen water quantity allocation in China.

1. 1 Trans-boundary Runoff Allocation

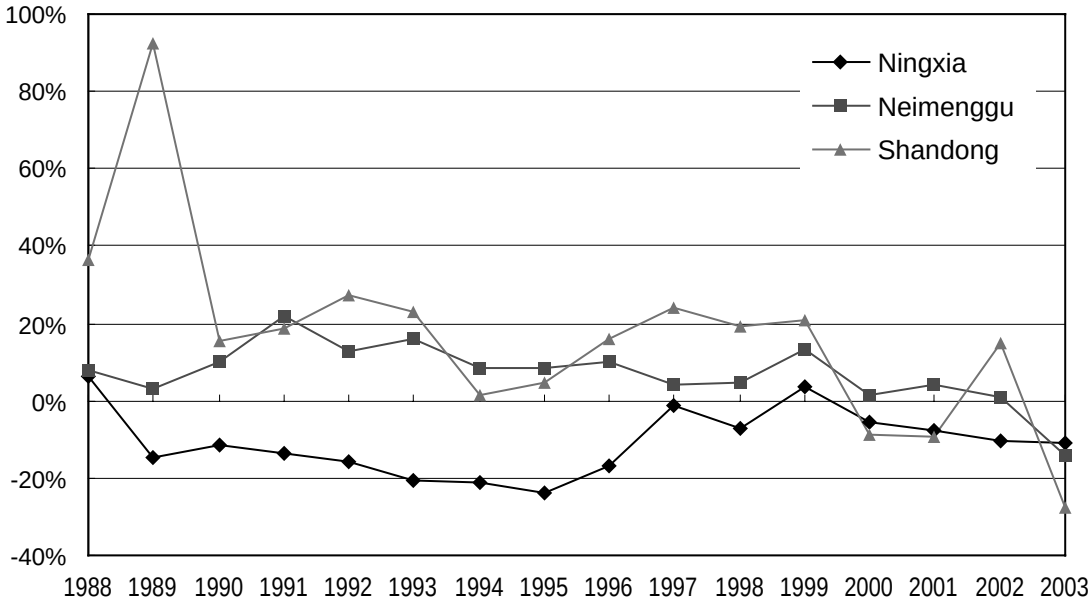
The 1988 Water Law prescribed that runoff allocation schemes for transboundary rivers should be introduced in watersheds under stress. The allocation scheme divides water rights among different riparian administrative districts (usually provinces), which are given upper limits on

drawing river runoff. Despite its potential to prevent conflicts and promote better ecological protection of rivers, this allocation scheme generally has not been implemented due to two key factors: (1) the Ministry of Water Resources (MWR) and provincial governments neglected to create enforcement institutions and (2) River basin organizations (RBOs) lacked sufficient clout and ability to coordinate provinces in practice. The new Water Law in 2002 improved these shortcomings by giving RBOs greater power to enforce a new institution of unified water diversion (*shuiliang tongyi diaodu*), in which river water is allocated by taking into account the needs of all water districts and in-stream ecological needs.

Currently, among the seven major river basins in Chinese territory, the runoff allocation scheme only has been formulated and implemented in the Yellow River Basin. Since most transboundary rivers besides the Yellow River haven not allocated runoff, it is difficult to implement another important new water management institution established in the 2002 Water Law—Total Amount Control (*zongliang kongzhi*), which puts restrictions on some district for the total water withdrawal.[1] The new Water Law encouraged the study and formulation of the more holistic runoff allocation scheme in more river basins. Currently the priority for instituting such allocation schemes has been given to rivers with transboundary conflicts in China's arid north—such as the Juma River in the Hai River Basin and the Daling River in Liaoning Province. Moreover, the allocation scheme is being considered for implementation during drought season in the lower basin of the Yangtze River. In these areas with long-term water conflicts, the formulation of a water allocation scheme is a time-consuming process, demanding drawn out negotiations and compromises among the riparian provinces.

Even if provinces and districts in a river basin come to agreement on the runoff allocation, there remain difficulties in guaranteeing its enforcement in practice. For example, riparian provinces did not comply with the allocation scheme of the Yellow River that the State Council approved in 1987. In the 1990s, almost every year actual withdrawals by Shandong

Fig. 2. Water Overdrafts of Water Allocation in the Yellow River Basin
(Percentage Versus Allocated Quota 1988–2003)



Source: Yellow River Conservancy Commission

1. The total amount control institution, created in the 2002 Water Law, draws lessons from the runoff allocation initiatives undertaken on the Yellow River in the 1990s. This total amount control institution encompasses activities at the macro, middle, and micro levels of the political hierarchy: the basin level implementation (with MWR oversight) of the runoff allocation scheme, the provincial-level oversight of water withdrawal permits, and local-level quota-based water management.

Province and Inner Mongolia Autonomous Region exceeded their permitted quotas, driving the flow cut-off situation in the lower reaches to worsen. In 1998, the State Council revised the 1987 decree and authorized the Yellow River Conservancy Commission (YRCC) to unify the diversion (*tongyi diaodu*) of water to ensure the implementation of the decree. From then on, the allocation scheme has been implemented better (see Figure 2) and the situation of cut-offs has been alleviated (see Figure 1). The YRCC, which is the largest and strongest RBO in China, has struggled to successfully rationalize water allocation in the basin, which indicates that other rivers in China with weaker RBOs will also face difficulties in implementing a runoff allocation scheme.

1. 2 Water Withdrawal Permit

The water withdrawal permit system, introduced in 1988 Water Law empowers the State to issue permits for all water drawn directly from aquifers, rivers, or lakes. The 2002 Water Law reinforced this system, requiring water users to pay a water resource fee for acquiring water withdrawal permits, i.e., the entitlement of a "withdrawal right" (*Qushuiquan*). To date the water withdrawal permit system has been set up in most of China's watersheds, dividing water use rights among factories and individual users.

Despite its wide application, the water withdrawal permit system is also confronted with the issue of ineffective enforcement. The validity of this institution depends on universal water metering and penalties for excessive water consumption. In practice it is difficult for local water resource bureaus and RBOs to monitor all the users due to challenges of information asymmetry. Moreover, local governments do not always grant water agencies sufficient authority due to fears that water conservation is a burden hindering economic development. In addition, if the institution of total amount control of regional water is not enforced by the upper level water agencies, local water resource bureaus have little incentive to monitor water withdrawals of users. In some areas, water resource regulators even allow users to draw water in excess of their permit after collecting water resource fee from them—such overdrafts ostensibly steal water already allocated to other (usually downstream) users and are a major source of interregional water conflicts in China.

1. 3 Regulating End Users

In the mid-1980s, the MWR began stressing the use of water fees to promote conservation, but fee levels and collection rates have remained quite low. The new Water Law reemphasized that those who use the water supply system shall pay water charges based on actual consumption. The law also prescribes that each end user shall use water according to quotas and pay progressive water prices if these quotas are exceeded. Water fees, which combine market and administrative tools to limit water, have helped promote the concept of water as a commodity rather than a free good.

Despite improvements in implementing water fee systems, current water prices still are relatively low in China. For example, in most irrigated districts of north China, the water prices paid by farmers do not even cover the operational cost of the irrigation system. Though the news of water price hikes has been frequently reported in the Chinese news media in recent years, water charges from urban water supply do not raise enough money for water infrastructure construction. Sustainable use of water resources requires the price should cover all costs, including construction, maintenance, as well as environmental protection costs. Nevertheless, water pricing is a political economy problem in practice. Policymakers have to consider many factors besides water use efficiency, such as income level of citizens, costs to the poor and acceptance in culture. Thus we can expect pricing reform in China will still take considerable time to be more aggressively implemented.

While market tools have yet not worked very well to control water use in China, administrative instruments—such as allocating water quotas—are playing a limited role in improving demand side management. However, quota-based water management demands considerable capacity of administrative agencies, whose duties involve allocating quotas for all kinds of water uses, monitoring the enforcement, and amending the quotas over time in response to droughts. It is easier to implement quota-based management in large or medium-sized irrigated districts allocating water based on agricultural acreage but much more challenging in cities due to the heterogeneity of urban water uses and expensive start up costs for monitoring. For example, during Beijing's water pricing reform

in 2004, an approved plan of increasing block price structure for household water had to be postponed, because there are no monitoring instruments to support it.[2]

In sum, considering the continued state ownership of water and low-level of water fees, China has more advantages in building an administrative regulatory system to control water resource allocation than it has in using market tools. However, since administrative systems often carry high transaction costs and have not promoted sufficient water conservation, the Chinese government is attempting to employ market tools to improve water reallocation. For example, MWR is revising regulations to facilitate the trading of water withdrawal rights by approving experiments in the upper Yellow River.[3] In the past several years, some cases of water trading between cities or groups, while not officially legal, have indeed happened—such as the water right transfer between the counties of Dongyang and Yiwu in Zhejiang Province and water trading between power firms and irrigation districts in Inner Mongolia Autonomous Region—see Box 1 for examples of this and other water trades. These trades represent an emerging water right market aimed at addressing China's water shortage crisis, but also pose new challenges for China's existing water administrative management regime.

Box 1. Emerging Water Right Market in Contemporary China

Entering into the new century, water right trading begun to happen fragmentarily in China. Although the current state owned water right system prohibits water trading, large-scale water shortages have sparked some local governments to experiment with water transfers via the market. The first water trade case took place in central Zhejiang Province where in 2000 Yiwu County bought permanent use rights of 50 million m^3 reservoir water from the upriver neighboring county of Dongyang. While there were abundant water resources in Dongyang, the county leadership in Yiwu was concerned they lacked sufficient water supplies to support rapid economic growth. Yiwu County could save considerable money by buying water from outside than promoting development or conservation of water inside the county borders. This case has been regarded as the first trade of water rights in modern China. The trade not only sparked many debates within government and research spheres, but also inspired other cities in Zhejiang Province to undertake successful water trades.

Another well-publicized water trade case took place in 2000 in Inner Mongolia Autonomous Region in where a new coal power plant could not obtain sufficient cooling water because the province had used up its allocated quota of the Yellow River runoff. In order to resolve this issue, the plant invested 89.5 million RMB to develop water saving projects in nearby irrigation districts with the help of the province and local government. In return for its investment, the government granted the plant a withdrawal right of 50 million m^3 water per year from the Yellow River. The plant found the trade considerably cheaper than adopting another substitute of air-cooling technology. In order to satisfy more water demands from industry like the above case, in June 2003 the MWR released a document to approve experiments of water withdrawal rights trading in the upper Yellow River. So far five similar water transfer cases from agriculture to industry have happened in the two Autonomous Regions of Inner Mongolia and Ningxia.

Source: Wang Yahua (2004,pp.204-207.)

While many new institutions, policies, and pilot projects the Chinese government is pushing to create incentives for water use efficiency hold promise, many are encountering some problems

2. http://finance.qianlong.com/26/2004/07/07/180@2149708.htm
3. "YRCC Document: Implementing Rules for Water Rights Transfer in the Yellow River. *(Huanghe Shuiquan Zhuanhuan Guanli Shishi Banfa)*" June 29, 2004 in *China Water Resources* (*zhongguo shuili*) 2004 (15): pp38-40.

Table 2. International Comparison of Water Use Efficiency

Indicator	China Average	Developed Country
Water Use Percentage of Agriculture Sector (%)	69	9-64
Water Use Efficiency of Farm Irrigation (%)	45	70-80
Water Recycling Percentage of Industry Sector (%)	45	80
Water Use per Unit Steel Products (m^3/t)	23-56	6
Leakage Percentage of Urban Water Supply Network (%)	>20	12-25
Urban Wastewater Treatment Percentage (%)	30	80-90
US Dollar GDP Production per cubic meter (m^3) water		
Total Economy ($/$m^3$)	2	14-48
Agriculture Sector ($/$m^3$)	0.5	1.4-5.8
Industry Sector ($/$m^3$)	4.2	8-100
Service Sector ($/$m^3$)	12.6	27-175

Source: Wu Jisong (2002,p.238-240).

Box 2. China's Campaign to Build a More Water-saving Society[a]

In the early 1980s, the Chinese government started to develop water saving projects and programs at a national level. This campaign, which stems from the government's recognition of the worsening, has gradually improved the importance of water conservation over the past 20 years. In 2000, the concept of "building a water-saving society" first was placed on the agenda in the central government's tenth Five-Year Plan. Such water conservation programs and projects are mainly under the charge of the MWR. In 2002, the MWR arranged three pilot cities, Zhangye (Gansu Province), Mianyang (Sichuan Province), and Dalian (Liaoning Province), to develop a broad range of pilot programs to promote water saving activities.

The very successful pilot project in Zhangye, located in arid Northwest China, transferred water of the Hei River to an inland lake (dongju yanhai) that had been dry many years in the desert of Inner Mongolia. This well-publicized project was given high praises by the central government and inspired the MWR to accelerate the pace of promoting more similar cities to "build a water-saving society." By early 2004, such pilot projects have been developed to almost one hundred locations—in approximately three cities in every province.

The MWR's national plan for water-saving society building (2005-2020) is nearly finished. This draft plan has set ambitious goals—by the year 2010 the Chinese government aims to complete 10 national, 100 provincial, and 1000 district level pilot programs promoting water conservation. The growing acknowledgement and action by the government to water-saving programs and projects highlights a significantly stronger political will to deal with institutional weaknesses to resolve China's water shortage crisis and balance water demand and supply.

Source: Author.

a. More information please reference the special topic on internet: http://www.hwcc.com.cn/topic/topicold.asp?classid=1262

in implementation. Wang (2003b, p.16) summarizes the current water use situation in China as: (1) serious water shortages at the macro level due to very inefficient use at the micro level, and (2) continued unreasonable exploitation of water that is considerably damaging environmental and ecological health of watersheds. Table 2 provides a quantitative comparison of water efficiency between China and developed countries, which shows China's huge potential for water saving.

The central faults in China's current water quantity management regime revolve around issues of ineffective enforcement of legal institutions. While the 2002 Water Law introduced more holistic institutions and provisions for water management, it will take time to improve the enforcement of these new institutions. The great progress in water allocation along the Yellow River, which has mitigated flow cut offs since 1998 (see Figure 1.), as well as a recent campaign launched to build a more water-saving society (see Box 2.) demonstrate that China is moving in the right direction in improving water allocation and water conservation.

2. Analysis of Water Quality Management Regime

While the growing economy has placed growing demands on managing water quantity, water quality control presents an even more complex challenge in China. The Ministry of Water Resources (MWR) is the main organ of State Council to control water quantity management, while water quality is charged to two related organs of State Council—the State Environmental Protection Administration (SEPA) and MWR. In China's legal system, SEPA is empowered under the Environmental Protection Control Act (1979) and the Water Pollution Prevention and Control Law (WPPC, enacted in 1984 and revised in 1996) to regulate water pollution. The Water Law authorizes MWR to oversee "water resource management." Since the term "water resource" lacks of clear definition in the laws, MWR has been inclined to regard water quality protection also as one of its responsibilities, causing a contentious political struggle between SEPA and MWR. Some inconsistent stipulations in the WPPC law and Water Law have worsened inter-ministerial conflicts, which complicate the efficient implementation of water quality planning, protection and monitoring.

2. 1 Water Quality Planning

The WPPC law stipulates SEPA develops water quality planning according to national and basin-level targets. All operational responsibilities of pollution control plans are delegated downwards to Provincial Environmental Protection Bureaus (EPBs) which take direction from SEPA, but are mainly responsible to fulfilling demands by the provincial governments.[4] While these water quality plans, in theory, encompass requirements for protecting aquatic life and the capacity of waterways to absorb pollution these targets tend to be more bureaucratic than scientific. Thus water quality targets tend to be quite unrealistic in practice and have not, on the whole, been realized (Ongley and Wang 2004, p.7).

The 2002 Water Law authorizes MWR to develop water resources protection planning, aiming to establish water function zones, estimate pollution assimilation capacity of waterways, propose pollution loading targets. MWR is then supposed to pass these information onto SEPA. However, in practice, SEPA develops its own estimates of assimilation capacity and loading targets independently due in part to ambiguities between the WPPC and Water Law, which have created conflicting mandates for pollution control and water resources management (Ongley and Wang 2004, p.7). This lack of clarity in the legal framework has meant a lack of an integrated basin-level water resources and pollution control planning and management.

2. 2 Water Resource Protection Bureau

China's seven major river basins are managed by river basin organizations, which have broad responsibilities to manage water quantity issues (e.g., hydrologic planning, hydraulic works, flood warning and protection systems). Notably,

4. For a detailed introduction to China's environmental protection and water management regimes see reference UNDP(2002), Ongley and Wang (2004).

RBOs, which are subordinate organizations under MWR, have no formal responsibility to implement pollution plans issued by SEPA. To remedy this bureaucratic split and create stronger basin-wide water quality management of these major rivers, in 1980 the central government mandated the creation of Water Resource Protection Bureaus (WRPBs) within the RBOs. The WRPB is jointly run by both MWR and SEPA and is responsible for gathering water quality data and reporting to both ministries.

Under this double leadership regime, WRPB worked well until 1998 when the SEPA was elevated to a real ministry. SEPA leaders then announced they would withdraw their agency's involvement in WRPBs, apparently because they felt SEPA could not greatly influence the WRPBs operated under the authority of MWR. (Ongley and Wang 2004, p.7). In order to enhance capacity for effective water quality planning and management at the basin level, since 1998 SEPA has been attempting to set up its own monitoring network and has even proposed to set up its own river basin organizations—a request rejected by the State Council.[5]

2. 3 Water Quality Monitoring

The WPPC law provides that SEPA and its lower level environmental protection bureaus are delegated authority to protect river basin water resources by preventing and controlling water pollution and inspection and monitoring of the water quality at the provincial boundaries. As above mentioned, SEPA gradually withdrew from the Water Resource Protection Bureaus, which since 1998 have in fact fallen under complete control of MWR. SEPA therefore started to set up its own water quality monitoring sites, which means today there exist two monitoring networks in some of China's major rivers. Notably, MWR and SEPA do not share their network data with each other.[6]

While both SEPA and MWR follow the same state-prescribed analytical procedures and water quality standards in their water quality studies, the monitoring results in the same river often differ. An interesting example is the divergence on water quality data of Huai River. According to the monitoring data from the MWR's RBO, more than half of the river quality was worse than type V in 2003. In the same year, SEPA announced in its annual *China Environment Bulletin* that most of the stretches of the river was type IV. The data contradiction of the main pollutants diverged even more seriously with SEPA reporting the total amount of COD emissions in 2003 as approximately 700 thousand tons, implying water quality had almost been restored to the best level in the past ten years. Conversely, the MWR monitoring issued another figure of 1,230 thousand tons, almost approaching the maximal level in history (Li Shilin 2004).

The SEPA-MWR data duels underline the absence of inter-ministerial coordination, which ultimately fragments the management of water pollution control and water resource protection.[7] Competition for control of turf does little to inform policymakers on how best to address growing water pollution problems. As Ongley and Wang (2004, p.4) indicate, the continuing struggle between SEPA and MWR is counterproductive and results in poor water environment quality. In the future, China needs a permanent inter-ministerial coordination arrangement to deal with the institutional arrangements and operational practices between SEPA and MWR.

The issues of inter-ministerial friction have strong connections with the deficiencies in the legal framework for water quality and water quantity management. Therefore it is crucial that China create better legislation to amend the deficiencies in the pollution prevention and control laws of the WPPC law and its Implementing Rules. Equally important is the need to harmonize various laws, especially the relationship between the water pollution control and water quantity laws.

Another major problem in improving the water quality of river basins is the challenge of coordinating trans-boundary relationships. In China,

5. The State Council refused SEPA's request to setup its own RBOs in 2002, after which time SEPA has attempted to setup monitoring districts along the lines of those created by the U.S. Environmental Protection Agency. To date SEPA has setup two pilot monitoring districts in southern China, not by the boundary of river basin but along a watershed straddling several provinces.
6. SEPA issues an annual report *China Environment Bulletin*, while MWR issues an annual report *China Water Resources Bulletin*—each using their agency's own monitoring system and data.
7. For more detailed discussions of such inter-ministerial conflicts please reference Ongley and Wang (2004).

as in most countries, upstream and downstream differ in their power to control the water, with upper regions possessing dominant power to draw more water and produce pollution that possibly harms lower regions. In China the lower regions possess more economic and political power than the upper regions, which opens up a potential to develop cooperation by self-governance in a river basin, solving trans-boundary affairs and conflicts like water allocation, water pollution control. But in China's top-down political structure, most trans-boundary affairs depend on the intervention and coordination of the central government. Therefore it is very difficult for the riparian provinces to solve problems by equal negotiation among themselves. In other words, the riparian provinces usually compete with each other to seek resolutions from the central government rather than dialogue and cooperation with other provinces, resulting in more trans-boundary conflicts. As Wang (2003a) indicates through an investigation of water disputes during the Yellow River Basin 2002 drought, economic growth in China has created innumerable demands on water and it is impossible to mediate conflicts among so many stakeholders solely by administrative orders.[8]

In examining various water conflicts in China it would appear that under a top-down system it is more difficult to resolve trans-boundary water quality conflicts than water quantity conflicts. For example, although conflicts around water allocation still occur in the Yellow River Basin, the flow cut-off situation has become less frequent through the government centralization of water allocation.[9] By contrast, the pollution situation of Huaihe worsened despite ten years of large-scale cleanup campaigns that the central government began initiating to create an effective pollution control regime in this river. One major cause of the pollution clean up failures is that the inter-ministerial conflicts between SEPA and MWR to improve water quality have counteracted the centralizing attempts from the central government in the campaigns. If the central government cannot create incentives and empower the riparian provinces to create solutions among themselves, there is almost no hope to resolve the serious issue of river pollution under the regime of countless inter-ministerial conflicts.

Following in the tradition of ancient river management institutions, today's top-down system of river governance was designed to control fierce floods, which it has done quite effectively. However, this top-down system is not adequate in resolving water shortage conflicts and water pollution problems in the decentralized political system of modern China.[10] Moreover, the top-down system is one of the most important factors hindering the introduction and development of a water rights market, which demands considerable negotiation among equal decision entities.[11] In the current centralized structure of river governance, it is difficult for the riparian provinces not only to negotiate water trades, but also to develop relationships of equal and essential cooperation. Overly centralizing water management also means a lack of multi-stakeholder and public participation in water protection and management issues.

Another central problem meriting discussion in the water quality area is the ineffective enforcement of legal institutions, which mirrors challenges faced by the water quantity management regime analyzed in Section I. Two examples of ineffective enforcement are given below. The first is a typical failure of water quality control caused by the absence of enough technology supports, and the second is mainly caused by the complex and conflicting political institutions.

2. 4 Total Load Control

The WPCC law specifies the institution of total load control in important river basins. In theory, provincial governments are required to draw up regional plans for pollution control according to the national water quality targets for the basin. The quotas of emissions are then distributed

8. In fact, the failure of administrative measures in balancing water needs in the Yellow River Basin is an important reason why local governments began, albeit somewhat illegal, initiatives to create water rights market happened in the upper regions of the basin.
9. The central government empowered the Yellow River Conservancy Commission to undertake unified water diversion since 1999, which is a major example of this growing trend to centralize water management. RBOs that oversee the seven major rivers in China are organizations under the MWR and can be regarded as subagents of the State Council.
10. The authors of the UNDP's China Human Development Report (2002, p.73.) believe that China's traditional top-down political structure cannot resolve new environmental issues and inter-sectoral cooperation in sustainable development field.
11. Wang Yahua (2003) gave a case study on water allocation of the Yellow River to support this judgment.

downward to local governments, municipalities, and firms. During the process of enforcement, this total load control policy has encountered a series of problems, which are highlighted below:

(1) In the beginning, the control index was determined more subjectively and not based on scientific calculations related to local environmental quality and bearing capacity. Currently, total load control is being evaluated considering assimilation capacity, against the scientific tool of "water environment function zone."

(2) Since the system of "water environment function zone" developed by SEPA has not been completed for the basin as a whole, the link between pollution control planning and assimilation capacity is cut, thus further bringing about the separation between total load management and pollution planning. Also SEPA is in the dilemma of whether to improve its "water environment function zone" or accept another competitive system of "water function zone" developed by MWR—yet another example of inter-ministerial turf battles over water.

(3) Current total load management is focusing on the control of point source pollution and is not applied to stemming non-point source pollution. Since non-point pollution in China has become one major source of water pollution, it should be put into the system of total load management (Zhang Wei et al. 2001, p.748).

2. 5 Payment for Discharge

The institution of pollution charges began in 1982 and due to continual improvements these charges have become the main economic instrument for pollution abatement in China. Despite the growing role of charges in water quality management, their enforcement is in practice still unsatisfactory. In many regions in China, pollution charges are important funds used to support local EPBs. Thus, pollution regulators have incentives to charge more rather than try to abate pollution, which weakens the function of EPBs as regulators. Some local EPBs even help polluters evade inspection from upper EPB regulators. Though the central government has realized this shortcoming in pollution abatement fees and is taking steps to reform the system, this problem will continue especially in poorer regions of China, where local governments view pollution control measures as hindering economic development. Moreover, the low rate of pollution charges does not create enough incentives for enterprises to halt polluting practices.[12]

China has made profound achievements in water quality management through large-scale institution building over the past 20 years. However, though legal institutions of water quality management were introduced earlier than water quantity management, the former is facing more challenges ahead due not only to problems of ineffective enforcement, but also serious legislative faults, inter-ministerial conflicts and trans-boundary conflicts. Serious water quality deterioration represents a major challenge for the current river governance system of China to resolve.

3. Deficiencies in the Current River Governance System

The essence of river basin management is a process of coordinating not only the development of different regions within a river basin, but also coordinating the management of different natural elements, water, land, biological and related natural resources within a river basin (CCICED Task Force, 2004). Such coordination demands effective water quantity and quality management, both of which are weak in China because the current legislative system and institutional arrangements cannot resolve efficiently the management problem of inter-sector and trans-boundary coordination. Although the Chinese government has made considerable progress in water management over the past 20 years, some core challenges, summarized below, remain:

(1) Legislative conflicts within the current legal framework present major impediments to the creation of a unified legal framework and coordinated institutions necessary to promote strong river basin governance. For

[12] For a systemic presentation of research in this field please reference Yang and Wang (1998).

example, the regulatory regimes stipulated by the WPPC Law and Water Law are inconsistent. China's laws regulating water are notably missing important ingredients for river basin governance, such as public participation provisions, requirements for information sharing among government agencies, and measures to enforce non-point pollution management.

(2) Laws regulating water are usually drafted by the ministries that are later given power to enforce them. For example, the WPPC law and the Water Law give power to SEPA and MWR, respectively. Much of the problem that faces these two ministries arises from the concept that "power" is vested in the ministry by virtue of "their" law, rather than in the western context where power is vested in the law which may be exercised by specific ministries acting in concert with other laws and other ministries (Ongley and Wang 2004, p.4). In other words, in China where water legislation is created as "sector-based laws" (*bumen lifa*) instead of "universal laws," a unified framework of river governance is difficult to create.

(3) Many water and environmental laws have been passed in China, but it is still a universal phenomenon that these laws cannot be implemented in practice (*youfa buyi, zhifa buyan weifa bujiu*) (Qu Geping 2004, p.412). Failures in enforcing stem from many causes—China's huge population, scarce environmental resources, fragile ecological carrying capacity, economic developing pressures, and most importantly the overly top-down political power structure that lacks an ability to leverage this power over local governments. These challenges underline how China faces a long road in protecting the environment through a new governance pattern of "rule of law" (*yifa zhiguo*) (Qu Geping 2004, preface pages).

(4) Current RBOs are not real spokesmen for river basins. As an extension of the Ministry of Water Resources, RBOs have little administrative power and are not mandated to manage river basins in a holistic context. In short, an integrated regime of river basin management has not yet been established in China.

(5) Although Water Resource Protection Bureaus have been set up for China's seven major rivers, quantity and quality of water are still managed in a fragmented manner due to continued inter-ministerial struggles between SEPA and MWR. The lack of coordination between the WPPC law and the Water Law has led to many conflicts between water resources and water pollution management.

(6) Current river basin commissions of China's seven major rivers are nominal committees without members. And these RBOs coordinate trans-boundary benefits as an agency of central government. In this top-down river governance structure, trans-boundary conflicts are difficult to be coordinated in the current decentralized economic system and stakeholder involvement and public participation in water management decision-making is very limited. World Bank (2001, p137) has indicated China made no significant progress toward achieving integrated river basin management, and the major barriers are essentially administrative and political.

A better river governance structure in China would require the coordination of inter-ministerial and trans-boundary relationships. In order to achieve such coordination, there are a number of crucial legislative and institutional improvements that should be made. Furthermore, as the suggestion from the World Bank (2001,p137), Chinese government should create new and separate river basin management institutions whose governance structure makes adequate provision for effective participation of key stakeholders—principally provincial governments—in their decisionmaking processes. In other words, China's river governance should not continue down an over-centralizing path, instead water management authority should flow downward to encourage self-governance of local government, stakeholder involvement and public participation. Such decentralization of water authority would demand more macro-level changes of the country's political structure. The process realizing better river governance also depends on the state transition from "rule by law" to "rule of law."

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