The Realistic Enlightenment of Sewer Facilities in 19th Century Britain on the Collaborative Management System of Cross Regional Water Pollution

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Abstract: With the development of China's economy and the convenience brought by the industrialization of urban chemicals, it has also brought pollution to water resources, especially the serious cross regional water pollution. Although various policies have been formulated by the central and local governments, the problem of water pollution remains prominent. This article, based on the treatment of sewage facilities in the UK, proposes to strictly control the discharge of industrial wastewater, flexibly control discharge standards, encourage the construction of large sewage treatment plants, improve sewage charging systems, etc., in order to improve the methods of cross regional water pollution collaborative governance in China and provide a practical basis for the collaborative governance system, to further promote environmental protection in China.
Keywords: Sewer Facilities, Cross Regional, Water Pollution, Collaborative Governance.

1. INTRODUCTION

In the process of urbanization in China's cities, due to blindly seeking economic development and neglecting the harmonious development between humans and nature, the natural ecological system of cities has been destroyed, the self regulating role of nature has been destroyed, leading to a large number of environmental pollution accidents. Causing a large amount of soil loss, causing a series of problems such as urban waterlogging and water pollution. The urban water area is a type of river, lake, and other water system distributed in the urban area, which plays a role in regulating the urban climate, beautifying the city's appearance, and providing citizens with a suitable living water environment. The urban water environment is closely related to the daily lives of the people, and its joint treatment is of great significance for the physical health and life safety of the people. However, the current water environment problem in China is becoming increasingly severe, and it is urgent for all departments to work together to solve this problem. Although the government has taken a series of measures to control water pollution, there are still significant problems. Therefore, this project takes "cooperative governance" as the starting

point, taking sewage treatment plants in the 19th century UK as an example, to explore their control mechanisms for environmental pollution, and analyze the current environmental pollution problems, in order to improve China's sewage treatment system and improve the multi-agent management system, and provide reference for relevant departments and agencies to formulate relevant laws and policies.

2. EXPLORATION OF RELATED CONCEPTS

2.1 Concept of Water Pollution

Water pollution refers to the incorporation of toxic chemicals or solid waste into the water body, which not only reduces the utilization value of the water body, but also completely disappears the utilization value of the water body, bringing huge harm to people's lives and property. Generally speaking, toxic chemicals in water bodies, such as acids and alkalis in wastewater, heavy metal pollutants such as mercury, arsenic, and copper, as well as organic toxicity such as benzene and chlorine. Toxic and harmful substances in the environment not only pose a threat to drinking water, but also pose serious harm to the surrounding environment (Chen, Chen, & Zhang, 2023). As shown in Figure 1.

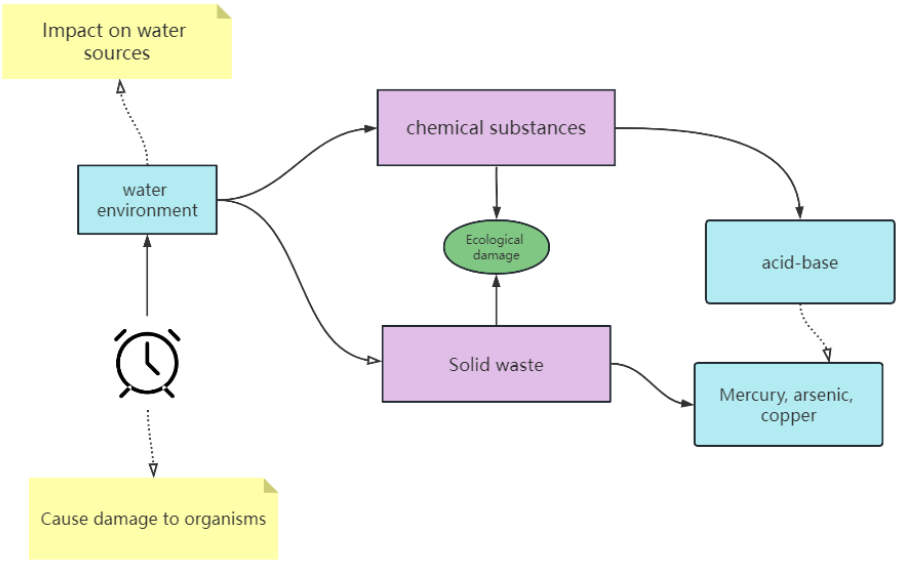

Figure 1: Concept of Water Pollution

2.2 Concepts Related to Collaborative Governance

The theory of cooperative governance is a new theory and concept gradually formed on the basis of integrating relevant concepts, and methods. From the perspective of cooperative governance, society is

viewed as an open system composed of government, enterprises, and the public, with everyone being a subsystem of the open system. The cooperative governance of public affairs can be divided into two levels: macro and micro. From a macro perspective, there should be cooperation between governments as well as with other social organizations; From a micro perspective, cooperative governance refers to the collaboration between various social organizations and government departments. Overall, collaborative governance refers to the co creation of public affairs by various organizations, including the government, enterprises, and the public, in the form of collaborative collaboration, in order to maximize the protection and promotion of public rights and interests (Belayutham, Gonzalez, & Yiu, 2016). As shown in Figure 2. Its meaning is:

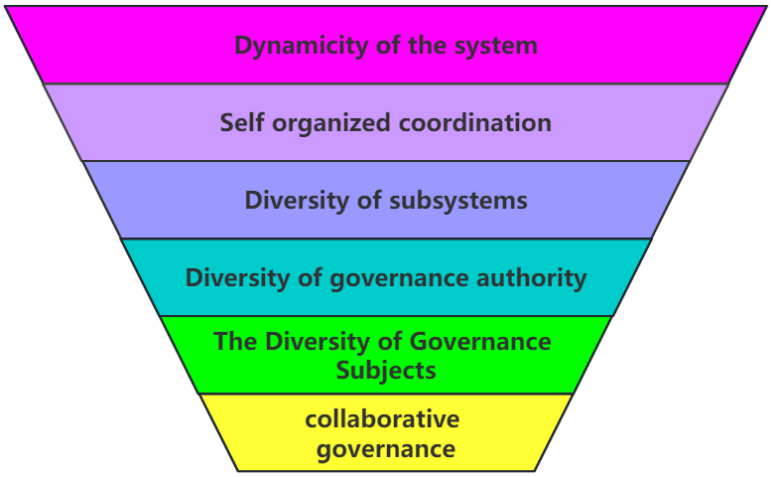

Figure 2: The Connotation of Collaborative Governance

(1) Diversification of management objects. To achieve joint management, it is necessary to have diverse management entities. From the perspective of collaborative governance, the government is no longer a single governance object, and in some cases, its leadership role will also change accordingly. The roles played by enterprises, non-governmental organizations, and the general public will become increasingly prominent (Nguyen et al., 2020). (2) Diversified government power structure. In cooperative management, there has not only been a diversification of management entities, but also a more diverse and diverse development trend. With the continuous improvement of national cultural level, many wise people have also actively participated in the coordinated management of environmental pollution (Wimordi, Yudianto, & Guan, 2021). (3) Collaboration between various subsystems. In collaborative governance, it is necessary for all parties to provide suggestions for environmental protection work with an equal and collaborative mindset. Each subsystem

coordinates and cooperates with each other, forming an organic whole. On this basis, fully utilizing the synergistic effects between various subsystems is of great significance for improving the scientific and effective nature of the Chinese government (Jayasuriya & Nadarajah, 2023). (4) Collaborative self-organization. As the various entities of collaborative governance, including government agencies, non-governmental organizations, enterprises, and individuals, they not only have a certain degree of interdependence, but also influence and interfere with each other. To achieve this goal, appropriate adjustments must be made in all aspects to fully leverage the importance of various stakeholders. In community autonomy, good cooperation will be beneficial for community members to reach consensus on public issues in the community Song (Mushi et al., 2021). (5) Power mechanism: The concept of cooperative governance advocates that because society is constantly changing, new requirements are put forward for the management of public affairs. He proposed higher standards. To effectively solve various problems in social life, it is necessary to enhance communication and cooperation, achieve multi-level interaction and cooperation (Dumnicka, Konopacka, & Żurek, 2018).

2.3 Basic Concepts of Cross Regional Collaborative Governance

Cross regional collaborative remediation of environmental pollution is an environmental pollution prevention and control action that involves cross department. Joint governance is the most important step in achieving the environmental protection interests of the majority of members in the same or similar geographical areas. In this process, many times it is led by government agencies, with non-governmental organizations, enterprises, and individuals participating, sharing responsibilities, and realizing resource information sharing on the basis of joint consultation, so that every member can benefit (Galal et al., 2021). The joint governance of cross regional water pollution has characteristics such as cross domain goals, diverse subjects, interactive processes, network governance structure, advanced planning and strategies. Cross regional pollution joint remediation mainly refers to water pollution and pollutant treatment, and the main body of its treatment is mostly led by relevant government departments, including all citizens including enterprises, non-governmental organizations, and individuals. It should be pointed out that in the process of collaborative management of environmental pollution within a watershed, different management agencies are equal and independent, only carried out to solve relevant problems. Governance mainly involves establishing and improving cross regional water pollution collaborative

governance mechanisms, formulating and improving laws and regulations related to environmental governance and protection, configuring and improving environmental protection infrastructure, popularizing environmental protection concepts, and cultivating a sense of environmental responsibility in the entire society (Zhilei et al., 2021). As shown in Figure 3.

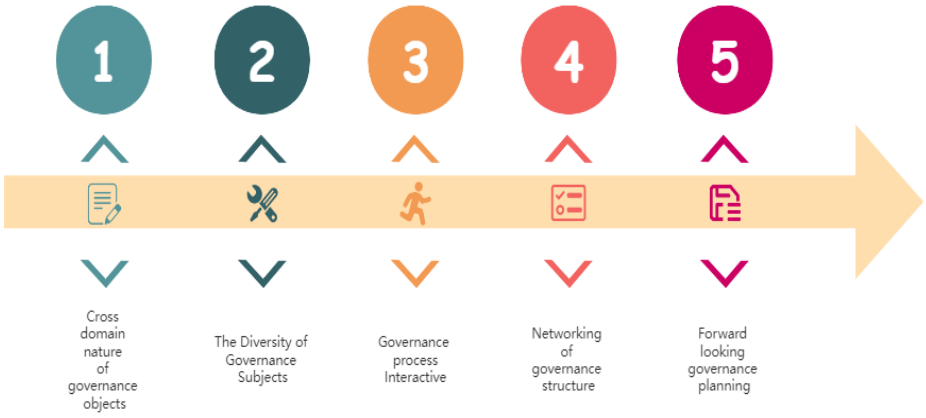

Figure 3: Exploration of Sewer Facilities in 19th Century Britain

3. ANALYSIS OF THE CURRENT SITUATION OF URBAN WATER POLLUTION IN CHINA: TAKING NN CITY AS AN EXAMPLE

3.1 Distribution of Water Pollution in NN City

In 2015, the Guangxi Zhuang Autonomous Region launched a "black and odorous" rectification action and hired surveys of various river channels and municipal pipelines in Nanning City. It was found that Nanning City has a significant problem of "black and odorous", and there is also a significant problem of "black and odorous". Through research, 38 river sections (including Chaoyang River, Ximing River, Shuitang River, Xinwei River, Liangqing River, Shibu River, Erkeng River, Erkeng River, Zhupai River, Naping River, Fenghuang River, Tingzichong, a tributary of Keli River, and Lengtangchong) were obtained in the built-up area of NN urban area. A total of 38 river sections (99.4 km) were found, and the total length of the polluted river was (99.4 km), with a severely polluted section (30.8 km) of 30.8 km. Among them, there are 9 rivers, including Machao River, Sitang River, and Shiling River, with a total length of 18.8 kilometers. At present, the proportion of V, V, and V level water bodies in 18 rivers in the urban area of Nantong is as high as 84%. As shown in Figure 4 and table 1.

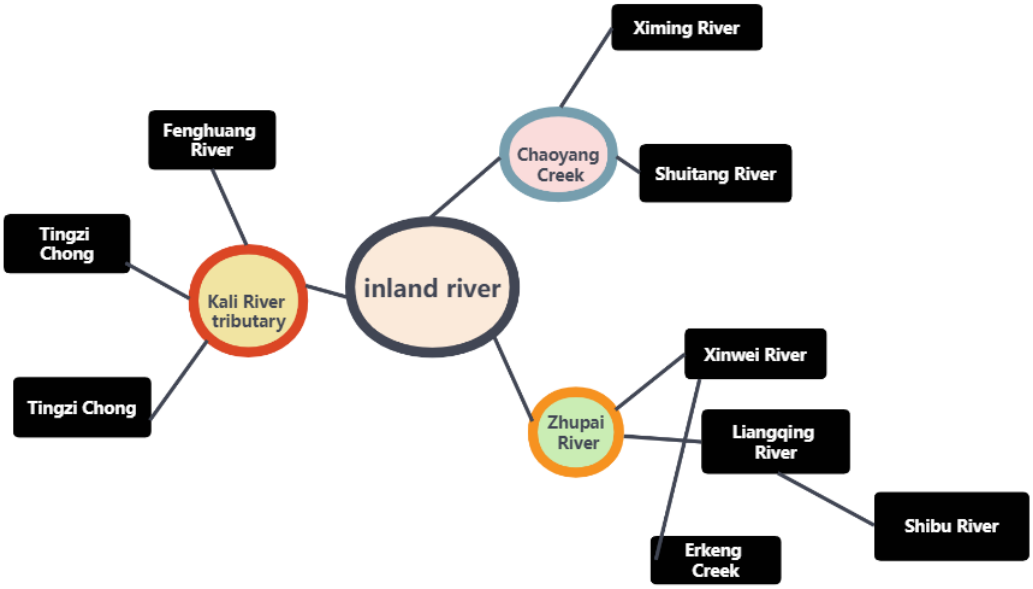

Figure 4: Urban Rivers in NN City

Table 1: Area of Water Polluted River Sections

Length of Polluted River Channel	**99.4 Kilometer**
Severely Polluted River Sections	30.8 Kilometer
Total Length of Water Polluted Outside the Built-Up Area	18.8 Kilometer

3.2 Main Causes of Water Pollution in NN City

Water pollution control is a complex system engineering that involves illegal discharge by enterprises, non-point source pollution caused by agricultural pesticides and pesticide residues, direct discharge of domestic sewage, pollution caused by livestock breeding on both sides of rivers, mixed connection and leakage of urban rainwater and urban pipeline networks, shortage of river water resources, and poor water flow dynamics. Simply put, that's it. Firstly, substandard sewage such as domestic sewage and industrial wastewater will be discharged into surrounding rivers and lakes. The organic matter in domestic sewage will consume a large amount of dissolved oxygen, leading to the blackening and odor of the water body (de Guzman et al., 2022). Secondly, non point source pollution from livestock and farmland on both sides of the river, discharge and stacking of household waste (such as household waste and construction waste), and organic pollutants caused by early rain will disrupt the self purification capacity of the river to varying degrees, and affect the growth of vegetation, leading to ecological imbalance (Baran, Nalbantcilar, & Koktan, 2023). Thirdly, with the increase of bed load in the riverbed, there is a shortage of river resources and a decrease in the carrying capacity of the water environment, which in turn leads to the circulation and exchange of substances in the river, leading to the pollution of organic matter in the

river and the resuspension of riverbed sediment. Heavy metals and hydrothermal factors in water bodies are both major factors leading to black and foul odors (Wang, 2007). The fourth is the misconnection, mixed connection, and disorderly connection in the construction of urban sewage pipe networks, which leads to frequent occurrences of rain, pollution, and other phenomena, and some roads and residential areas have a black odor (Rajesh, Jiji, & Raj, 2020). As shown in Figure 5.

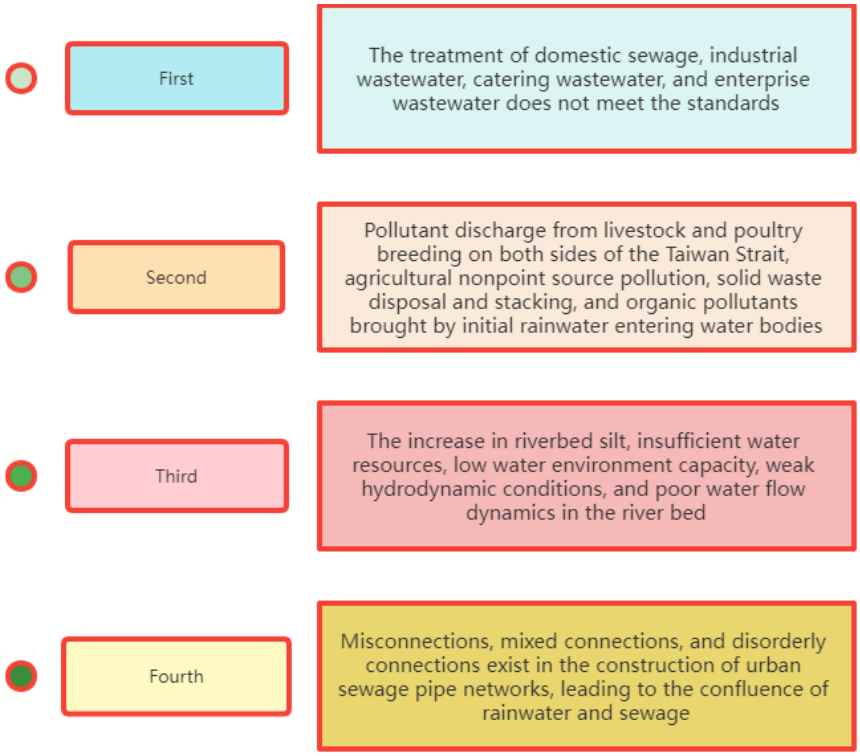

Figure 5: Reasons for Water Pollution in NN City

4. DIFFICULTIES IN CROSS REGIONAL WATER POLLUTION CONTROL IN CHINESE CITIES

Water resources are of great significance to human life and development. This issue is not only related to the safety of drinking water and food for the people, but also to the overall ecology and security of the country. With the deterioration of the water environment, the country has introduced a large number of relevant laws and regulations, elevating water safety to a high level, making significant strategic arrangements for promoting water environment governance, and achieving significant results. However, we also need to be aware that the current situation of water environment quality is still very serious, and the governance and improvement of the water environment still requires a long period of time (Waldichuk, 1956). As shown in table 2.

Table 2: Difficulties in Cross Regional Water Pollution Control

First	**Difficulty in Coordination among Governments within the Region**
Second	Difficulty in Maintaining Long-Term Governance Benefits
Third	Unbalanced Environmental Infrastructure among Local Governments
Fourth	Insufficient Supply of Cross Regional Water Pollution Control Systems and Mechanisms
Fifth	Lack of Collaborative Governance Platform

4.1 Difficulty in Coordination Among Governments within the Region

The current environmental protection work in China is characterized by a "block based approach, a combination of blocks", "vertical classification, and horizontal dispersion". In this system, government departments at all levels share common responsibilities with their functional departments and lower level governments, which is a relationship between leadership and being led. From the current management system, it can be seen that there are significant multi-level leadership in water pollution control work. The biggest drawback of such multi-level leadership is the overlap of rights. When the values of the two are inconsistent, there will inevitably be a lack of supervision (Zhao et al., 2023). As shown in Figure 6.

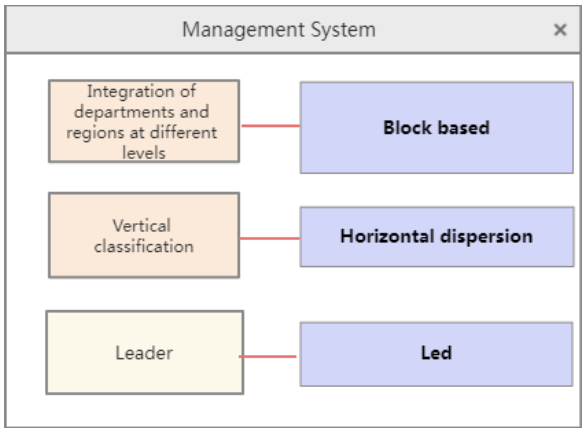

Figure 6: Division of Management System

4.2 Difficulty in Maintaining Long-Term Governance Benefits

Currently, the water environment problems in China are mainly solved by the state and relevant departments. Although adopting the "unitary governance" model of "unitary governance" can achieve a high degree of integration of resources, material resources, and financial resources in a relatively short period of time, it also brings the following problems: firstly, it is difficult for a single administrative agency to effectively control the pollution behavior of enterprises. At present, the methods of pollution discharge management in Chinese enterprises mostly adopt a combination

of surprise inspections, law enforcement inspections and supervision, administrative coercion, and administrative fines. Although they have a certain short-term governance effect, their external constraints are weak. Enterprises, with the goal of maximizing profits, will continue to discharge pollutants in the absence of government regulation and driven by economic profits, resulting in the failure of water pollution control. Secondly, it is difficult for a single administrative system to ensure its long-term and effective governance. However, currently, the only legal responsibility subject in China - water environment governance - is being questioned for its legitimacy due to the lack of external forces and supervision by public opinion. In addition, controlling environmental pollution is a long-term systematic project that requires huge funds to support, and the governance of environmental issues is closely related to the efficiency of environmental governance. At present, in terms of pollution control, it still mainly relies on financial support from governments at all levels, while private funds are relatively small. Although the central and local governments have already arranged some special funds, there is still a significant gap compared to other regions (Toyama et al., 2020). As shown in Figure 7.

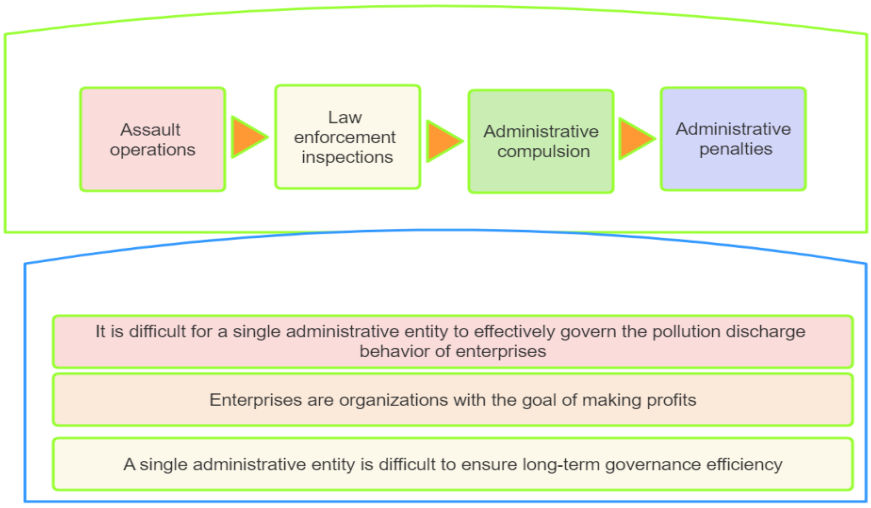

Figure 7: Problems in Pollution Control by Government Organizations

4.3 Unbalanced Environmental Infrastructure Among Local Governments

At present, the urban sewage treatment rate in China has exceeded 90%, but rural areas are still at a relatively low level. Rural areas, which account for 41.48% of the total population, have caused great harm to the ecological environment of the region and become a bottleneck in water pollution control. In addition, considering the economic structure of our country, most of the middle and lower reaches of the Yangtze River belong

to backward areas, with relatively backward environmental protection infrastructure. Local governments invest less funds, which leads to difficulties in their governance. In its downstream areas, which are generally relatively developed, local environmental protection projects also receive funding and funding from local governments. Therefore, from the perspective of infrastructure construction, the ecological environment in the downstream areas is superior to that in the upstream. However, if the upstream water is polluted, it will be affected, which makes it unable to effectively manage downstream. At present, the imbalance of ecological and environmental protection facilities in China has seriously affected the overall benefits of the entire ecosystem (Kong et al., 2023). As shown in Figure 8.

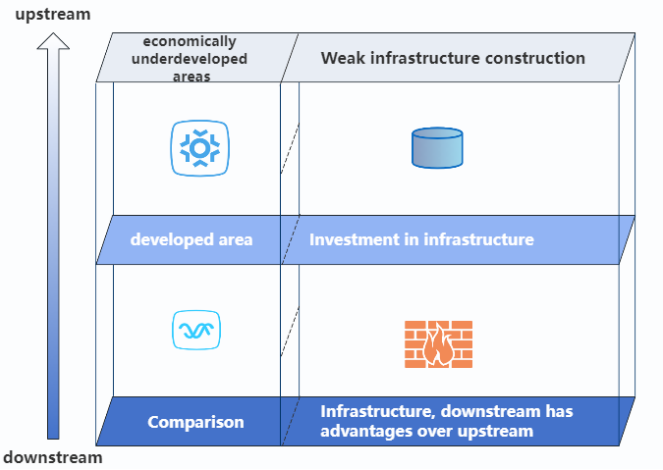

Figure 8: Aspects of Environmental Protection Facilities

4.4 Insufficient Supply of Cross Regional Water Pollution Control Systems and Mechanisms

Firstly, there are no corresponding laws and regulations in terms of environmental protection. At present, China's existing laws and regulations have systematically managed the watershed ecosystem in accordance with the provisions of the Water Law of the People's Republic of China on water resources. However, existing laws lack systematic research on regional pollution control, inter regional cooperation, rights and obligations, responsibility allocation, and supervision and management, leading to issues such as lack of initiative, difficulty in collaboration, and poor governance effectiveness in implementing regional pollution control by local governments. Secondly, the government lacks a system of public participation. In the management of water environment in river basins, society can play functions such as information, supervision, and funding. However, looking at the various existing laws and regulations in China, they

are only some relatively vague legal provisions, and there are no clear provisions on the legal status, procedures, conditions, and legality of public participation. Thirdly, the current mechanism for allocating water resource benefits is not yet perfect. Water is a type of public good that has the nature of a public good and is not exclusive or competitive. Non exclusivity means that everyone can receive free water without paying any fees; The meaning of "competition" is that after "people" own "water", "water" becomes "private property". In this situation, a rational person who, for their own benefit, accepts the public welfare products provided by others and provides free services for themselves has formed a "prisoner's dilemma" game: everyone is making choices for their own benefit, which leads to environmental pollution between regions and damage to the interests of the general public (Qu & Fan, 2010). As shown in Figure 9.

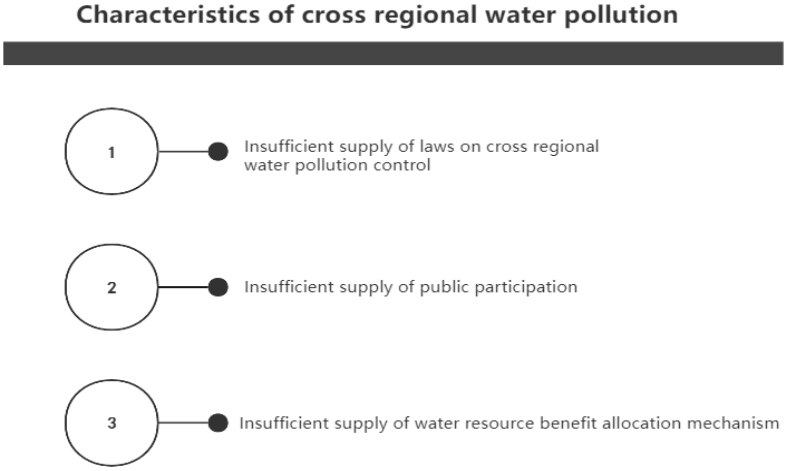

Figure 9: Characteristics of cross regional water pollution

4.5 Lack of Collaborative Governance Platform

Currently, the country is facing regional water environment issues. In order to solve the coordination problem between regions, governments often reach consensus and collaboration through joint meetings and other means, which is of great significance for promoting regional water environment governance. In addition, with the promotion of the "river chief system" in various parts of China, some regions have also established a large pattern of "diversified co governance" and absorbed some social groups to participate in it. For example, in the process of implementing the "river manager system" in Beijing, it is also recommended to "take river managers as the main body, mobilize the masses to participate in reservoir water storage and moisture preservation, form a river protection team mainly composed of river managers, and promote ecological restoration in the Liangma River Basin." This is a beneficial attempt for the government

and social organizations to jointly participate in environmental protection work. However, there are currently problems in China such as "government offside, public lack, and collaborative failure". If an operational platform for collaboration and competition can be established, then civil society organizations, enterprises, and citizens other than the government can participate in this work. As shown in table 3.

Table 3: Promoting the Development of Civil Organizations through the River Chief System

	River Chief System
First	Volunteer River Patrol Team of "On Duty River Captain"
Second	Xicheng Dama Water Protection Team

5. EXPLORATION OF SEWER FACILITIES IN 19TH CENTURY BRITAIN

The underground drainage engineering in London began in 1372-1307 AD, during the reign of Edward I at the end of the 13th century. The British built a reservoir in Tiburn and used pipes to deliver water to London. In order to deal with the sewage problem in London, in 1532, Congress approved the establishment of eight sewage treatment institutions in London to deal with the sewage problem. Eight sewage treatment institutions focus on treating surface water bodies in urban areas, while neglecting the treatment of groundwater and lacking unified planning, resulting in unsatisfactory treatment effects for surface water bodies. After the fire in 1666, London built an underground sewage pipeline here. As of 1751, the 49 kilometer London drainage system was still unable to meet people's needs. In the early 19th century, the waste generated by London residents every day was dumped into septic tanks or personal drainage pipes next to their homes, while rainwater and public wastewater were discharged into the Li River and the Thames River through public sewage pipes. To avoid blockage of public sewage pipelines, the authorities prohibit both from sharing, otherwise fines will be imposed. In London, due to the continuous expansion of the city's scale, people's daily wastewater is increasing, leading to a large amount of wastewater flowing into the streets. In 1815, eight sewage management agencies in London agreed to connect sewage collection tanks and personal sewage pipelines with public sewage pipelines, with a fee standard of personal responsibility. This measure requires a higher cost (17 pounds and 6 pence), which exceeds the financial resources of ordinary households and has not been widely implemented, but it has accelerated the process of the sewage

system discharging into the river (Wen et al., 2011). According to data, as of 1828, there were 139 to 145 rivers on the River Thames. As shown in table 4.

Table 4: Initial Construction of London Sewers

Drainage Responsible	Drainage Responsible	Sewer Usage Fees	The Sewer of the Thames River
Sewer Commissions	Sewer Commissions	£ 17 6p	139-145 Articles

Lambeth grew up in the suburbs and became the main industrial base in England, located in the south of the Thames. It is a micro city in London. This area is full of feces, without toilets or sewage treatment plants. The same situation occurred in some low-lying areas in eastern London, where "the drained waterways and channels still maintain their natural form, covered in dirty substances." Due to increasingly severe environmental pollution, the British government gradually took measures to control water bodies. In 1859, the Metropolitan Urban Development Agency of England divided the main sewage pipelines into three northern and two southern rivers using the Thames River. Starting from Bram, the underground drainage system in the south is connected to Putney at Deptford. Because there was a falling point, the water pump was raised 18 feet to equalize the height above and below, and then the water was directed into the discharge pipe. The pipeline has a total length of 8 kilometers and extends all the way to the Kronis North outlet below 1.5 kilometers. From Hampstead to the north of the Thames in Kessel Green, they met at Old Ford before passing through the Li and Ba Jin rivers and entering the Thames. In 1868, sewage treatment facilities were completed in the southern region, including 450 miles of main roads connected to 13000 miles of branch lines, costing 4.6 million euros. After the completion of the project, the sewage discharge problem in the southern region of the Thames was effectively alleviated, while also avoiding the outbreak of cholera in the coastal areas of Henan in 1866. In the late 19th century, Britain began to attach importance to ecological treatment of sewage treatment, and the British government set up a group of laboratory technicians as sewage pipelines in London (Conservancy, 2023). As shown in table 5.

Table 5: Distribution of Sewers in the Main Urban Area

To the North	3 Articles
To the South	2 Pieces
Pipeline Length	8 Miles

The laboratory technician needs to test the flushing force in the sewage

pipe to determine whether soda can prevent corruption. In order to accurately grasp the oxygen content in wastewater, British scientists conduct weekly fish testing by desalinating the sludge in various areas of the river mouth and beaches. In a three-year study, British scientists collected 6400 samples that recorded the ratio of oxygen to organic matter on the Thames River, the first data to study oxygen balance in important aquatic ecosystems (Qiang & Tangchun, 2023).

6. ENLIGHTENMENT OF UK SEWER FACILITIES ON REGIONAL COLLABORATIVE MANAGEMENT OF WATER POLLUTION IN CHINA

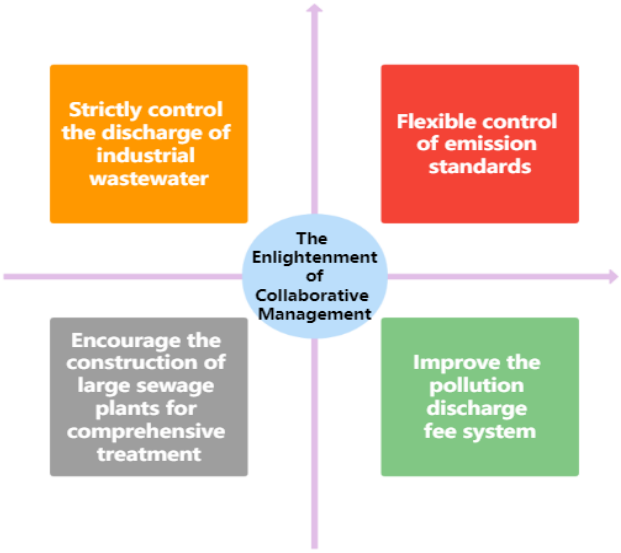

Figure 10: Inspiration from Collaborative Management

6.1 Strictly Control the Discharge of Industrial Wastewater

As shown in Figure 10.Usually, industrial wastewater is discharged into the municipal drainage system, mixed with domestic sewage, and then subjected to secondary or advanced treatment. The discharge of municipal sewage should meet the following requirements: non flammable, non corrosive, non clogging, non biological treatment of wastewater treatment plants, treatment of sludge, and normal use of receiving water bodies. Therefore, before purifying urban sewage, the content of harmful components in the sewage should be minimized.

6.2 Flexible Control of Emission Standards

Currently, most countries adopt national standard emission standards. Whether it is the environmental management of new projects or the

treatment of old pollution, it is often based on location, not capacity, or technical and economic standards. This inevitably leads to a large amount of waste in environmental protection. In the UK, the pollution discharge standards of various enterprises are based on: ① the nature, quantity, and location of the sewage; ② Self purification and environmental carrying capacity of sewage discharge channels; ③ Technical and economic conditions of pollutant discharge units. The specific capacity of a power plant can also change with changes in the power plant itself and water bodies.

6.3 Encourage the Construction of Large Sewage Plants for Comprehensive Treatment

Encourage enterprises to discharge domestic wastewater into large drainage systems and conduct joint treatment of wastewater and domestic wastewater in a comprehensive wastewater treatment plant. It can improve the quality of water, reduce the cost of wastewater treatment, and enable enterprises to better invest in production and life (Lin & Zhang, 2023).

6.4 Improving the Pollution Charge System

In the new environment, there is a lack of scientific evaluation criteria for water environment protection in China. The pollution charging system, especially in terms of the standards and scale of pollution discharge, still needs improvement. Firstly, the level of pollution charges should be raised. In addition, compared to the investment in environmental governance, there are significant differences in charging standards, making it difficult to achieve the goal of effective governance. Secondly, the main body and scope of pollution charges are narrow. In the past few years, most of the pollution charges have been directed towards industry and commerce. There is a significant gap in pollution charges in the tertiary industry, small businesses, livestock and poultry farming, and other fields. Fourthly, strengthen the connection between China's current pollution discharge fee system and other environmental protection policy measures. From the perspective of pollutant emissions, we should adhere to the principle of "total amount control" and implement "emission permits". We need to effectively handle the relationship between the emission permit trading system, the total amount control system, and the emission fee system.

7. CONCLUSION

Cross regional water pollution control is based on better improving and

solving cross regional water pollution problems, and provides a new direction for cross regional water pollution control reform: from the source, such as strict control of industrial wastewater discharge, flexible control of discharge standards, encouragement of the construction of large-scale sewage treatment plants, and improvement of sewage charging systems. We should recognize that effective control of cross regional water pollution must go through a long-term and repeated process, which cannot be achieved overnight. At the same time, we should firmly believe that with the innovation of social governance systems, cross regional water pollution control will be successful.

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