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## Big Data Platform of Provincial Key Basin's Ecological Environment Information

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# Big Data Platform of Provincial Key Basin's Ecological Environment Information

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**Abstract.** The big data platform of basin ecological environment information is an important technical support for environmental protection management and emergency response to sudden environmental pollution incidents. Constructing a provincial platform for overall design idea, technical framework and route, the basin big data source library is formed through integrating the relevant basin water environment data based on WASP water contamination diffusion model. For a better understanding of the basin ecological environment information of the whole province, the platform strengthens the energy of monitoring, and establishes the foundation for analysis and early warning of the ecological environment.

## 1.Introduction

With the rapid development of economy, environmental protection and pollution control in rivers, lakes and sea basins are facing increasing pressures <sup>[1]</sup>. At present, China has implemented scientific management of rivers, lakes and seas from districts, sub-regions and stages, and systematically promoted the water pollution prevention and control, water ecological protection and water resources management under the overall requirements, earnestly increased the efforts of water pollution prevention and control to ensure national water security <sup>[2]</sup>.

Currently, the basin ecological environment information system presents deficiencies in some aspects, like low level of automated monitoring and insufficient monitoring density; leak of integration and sharing caused by scattered data of basin environment monitoring information; low comprehensive utilization level of data and inadequate depth analysis ability, etc. <sup>[3-5]</sup>. Therefore, it is necessary to establish a corresponding information system for a comprehensive process and analyse to all kinds of data, in order to provide data and technical support for environmental management and emergency response to sudden environmental pollution incidents.

## 2.Overall design

Provincial Basin Ecological Environment Big Data Platform Project takes standard norm system, security system, operation and maintenance system as the building standards, relying on existing information facilities to realize the information management of provincial basin. The overall structure of the platform is shown in Figure 1&2.



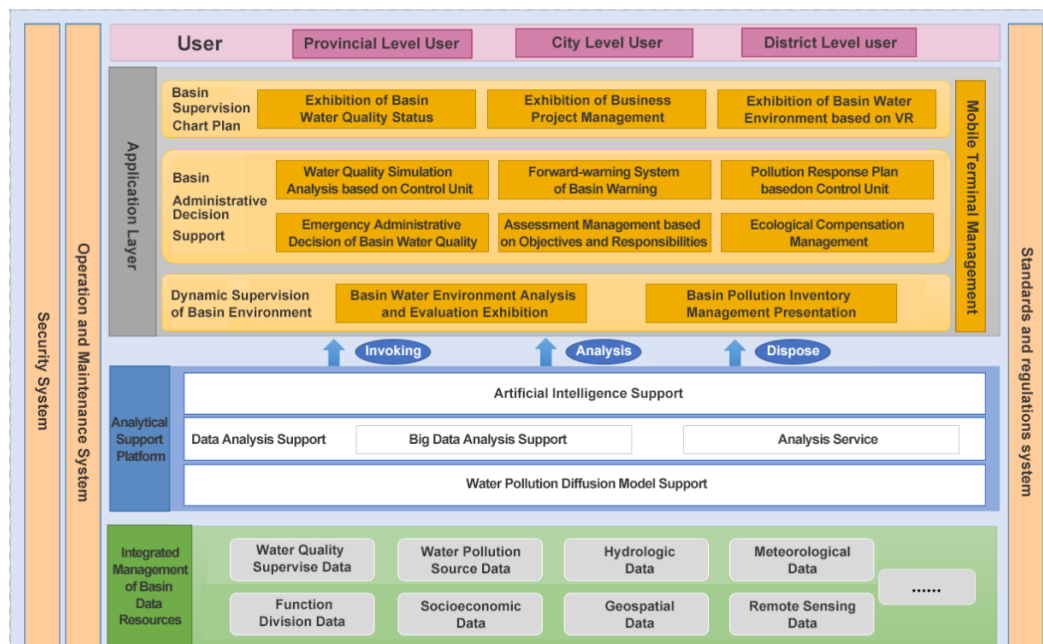


Figure 1 Overall Framework of Provincial Basin Environmental Big Data Platform

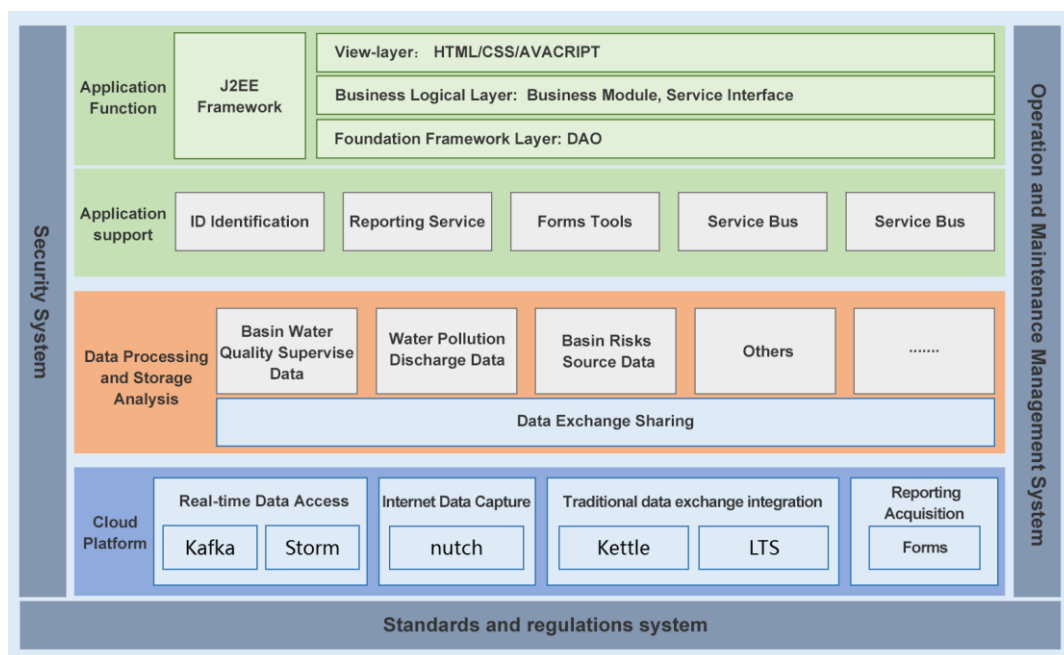


Figure 2 Overall Technical Framework Design

Contents:

### 1. Integration of Basin Data Resource

Effectively integrating the water quality monitoring data, water pollutant discharge data, basin source data, hydro-meteorological data and basic geographic data by formulating a unified data acquisition system and standard norms, the platform improve its acquisition ability and integration degree of data resources to provide basic data resources supporting services for a deeper application of basin environmental big data.

### 2. Environment Building for Basin Big Data

Big data supporting environment is the foundation of the project of basin environment big data platform. The big data supporting environment can be divided into infrastructure support and analysis support.

Infrastructure support will be realized on the software and hardware environment of the cloud platform; the analysis support platform includes water pollution diffusion model support, data analysis tools and artificial intelligence support.

### 3. Application Building of Big Data Business

The application is the direct reflection of big data business in basin environmental management business which can be realized through water environment analysis and evaluation, revealing pollution source list management, water quality simulation analysis, basin supervision wall map operation, etc. in order to meet the application needs of basin environmental management business.

### 3. Technical Framework and Route Design

The platform realized the data exchange, integration, cleaning and transform by relational database, data integration ETL technology. By using strong relational database to realize the storage and manage of systematic data for all kinds of business, and realize the application supporting integration by software like reporting tools and GIS platform, etc.

For application, the platform develops its function through J2EE three-ply BS framework by matured developed platform, and integrates the interface, application and function through portal finally. Figure 2 shows the technical framework of the big data management platform of key basin ecological environment.

### 4. Water Contamination Diffusion Model

Based on the basin big data management platform, a model base of water contamination diffusion mechanism is established, which can simulate and predict the impact of water pollutant discharge on the basin water quality. In the process of building water contamination diffusion model, on the basis of collecting and analysing the hydrology, meteorology and water quality from site, calibrating the calculating parameter of mathematic model after visual analysing by simultaneous equation solutions from specific boundary condition and original data. Secondly, the results of the mathematical model are validated by the measured water quality data. The validated model can simulate the changes of dissolved oxygen, COD, ammonia nitrogen, total nitrogen and phosphorus nutrients under different pollutant discharge conditions and hydrometeorological conditions.

The selection of numerical model tools of water contamination diffusion in model base needs to be mature, stable, universal and adaptable to multiple scenarios. After decades of development, the WASP model has formed a stable version during usage and has many application cases in China. The model is applicable to simulate the surface water of lakes, reservoirs, bays, wetlands and estuaries in one, two and three-dimensional numerical simulation.

From the structure of water quality model, the water quality mathematical model can be divided into two categories: white box and black box. White-box model belongs to mechanism model, which is based on the movement rule of model variables and their theoretical reasoning. White-box model is usually established by logical deduction. Theoretically, white-box model is universally applicable model. Black-box one belongs to empirical model, and it reflects objective changes of things, through statistics according to the law of data reflecting the relationship between data by some expressions.

WASP model ((The Water Quality Analysis Simulation Program) is a surface water quality model system developed by the Environmental Research Laboratory of the United States Environmental Protection Agency (EPA) <sup>[6]</sup>. It can be used to simulate hydrodynamics, one-dimensional unstable flow of rivers, three-dimensional unstable flow of lakes and estuaries, transport and transformation of conventional pollutants (including DO, BOD and nutrients) and toxic pollutants (including organic chemicals, metals and sediments) in water.

### 5. Basin Data Source Database

Through the comprehensive integration of the relevant data of water environment in the basin, all kinds of scattered environmental data are unified, which improves the standardization level and availability of the data and forms the basic management ability of the basin data, including water quality monitoring, water pollutant discharge, risk source, hydrometeorological and hydraulic engineering, spatial function zoning and basic geographic, remote sensing, social and economic data. On the basis of data integration, it provides data audit, flexible query and comprehensive display functions, and finally builds a data supporting system covered the whole basin management business of the province, which provides strong support for the application and development of basin big data, as well as reliable, timely and comprehensive environmental information.

The basic data of basin integration can be divided into two parts, internal and external environmental protect departments, as shown in Table 1.

Table 1 Basic data resources of basin

Data Content	Data source	Approach	Frequency	Database type of business system
<b>Data from environmental department</b>				
Automatic monitoring data of environmental quality	Business system integration (monitoring center)	Data integration	Once/4 hours	SQL SERVER
Manual monitoring data of environmental quality	Manual monitoring data (monitoring center)	Lead-in from template	Once/day	SQL SERVER
<b>Data from non-environmental department</b>				
Hydrologic data	Achieved from big data management platform	Input/Lead-in	Real time	SQL SERVER
Meteorological data	Achieved from big data management platform	Input/Lead-in	Real time	SQL SERVER
Agricultural data	Achieved from big data management platform	Input/Lead-in	Once/year	SQL SERVER

### 6. Conclusion

Through the integration of river basin data resources, the big data supporting environment and business application of the river basin will be built, and finally the provincial river basin environment big data platform be formed. The basin big data source database will be formed based on WASP water pollution diffusion model by integrating relevant basin water environmental data. It could strengthen the energy of monitoring, analysis and early warning of the ecological environment of the river basin in the whole province.

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