

The Bayu Zhishui application system: an integrated smart sensing network for sustainable water management

Region	Asia and the Pacific
Award Scheme	Shanghai Manual
Themes	Data-Driven Process and Management Environmental Resilience Local Govts & decentralization Urban Governance and Legal Frameworks
Sustainable Development Goals	Goal 11 - Make cities and human settlements inclusive, safe, resilient and sustainable Goal 13 - Take urgent action to combat climate change and its impacts Goal 15 - Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss

Summary

The Bayu Zhishui application system in Chongqing, China, represents a pioneering model of digitalized water governance that integrates intelligent sensing, early warning and citizen participation. Developed under the city’s Nine-Treatment Campaign, the platform unifies data from 22 departments, consolidating over 150 million records into a single cross-departmental network. By linking satellites, drones, ground sensors and underwater monitors, it enables real-time water quality assessment and rapid response to pollution incidents. Detection times for water contamination have fallen from more than seven days to less than 24 hours. The system supports coordinated, closed-loop governance among municipal, district and township levels while facilitating cross-regional cooperation with Sichuan Province for shared river management. It also empowers citizens through digital and offline reporting tools, rewarding verified submissions to promote environmental stewardship. The platform’s success has led to tangible improvements; the Yangtze River’s Chongqing section now maintains Grade II water quality, with 74 state-controlled sections achieving a 100 per cent good-quality rate. By merging advanced sensing technologies, AI analytics and public participation, Chongqing has created a replicable framework for intelligent water management. The Bayu Zhishui model demonstrates how smart environmental governance can strengthen resilience, enhance transparency and accelerate progress toward sustainable and inclusive urban ecosystems.

Background and Objective

Chongqing, located in the upper reaches of the Yangtze River, faces acute challenges in managing its vast network of over 5,300 rivers. Rapid urbanization, industrial expansion and agricultural runoff have intensified water pollution, leading to degraded ecosystems and health risks for residents. Traditional water management systems, reliant on manual inspections and isolated data sources, struggled with slow response times and weak coordination among agencies. In response, the Chongqing Municipal

Government launched a comprehensive strategy for digital ecological governance under its Nine-Treatment Campaign, addressing interconnected issues such as water, air, soil and waste pollution. Within this framework, the Bayu Zhishui application system was introduced as a cornerstone of smart water management. Its objective is to integrate digital technologies such as AI, remote sensing, IoT and big data to enable real-time monitoring, early warning and coordinated action across departments and regions. The initiative aims to build a transparent, efficient and participatory system that accelerates pollution control, safeguards water ecosystems and enhances public trust in environmental governance.

Actions and Implementation

Launched in 2023 by the Chongqing Municipal Bureau of Ecology and Environment, the Bayu Zhishui system builds upon existing smart city infrastructure and integrates over 900 data sources from 22 government departments. It creates a unified, multi-level digital monitoring network combining satellite imagery, drones, ground sensors and underwater probes. The system analyses indicators such as ammonia nitrogen and total phosphorus in real time, issuing immediate alerts and task lists when anomalies occur. AI algorithms prioritize issues, reducing detection times from more than seven days to under 24 hours. The platform covers over 16,000 sensing points and delivers multi-channel alerts through mobile apps and SMS notifications, ensuring coordinated responses among city, district and township authorities. It also promotes interprovincial collaboration, as demonstrated by the joint Chongqing–Sichuan management of the Tongbo River, where cross-regional pollution sources were traced and resolved within 48 hours. By linking data, enforcement and public participation, the system has established a closed-loop model of discovery, response and accountability for comprehensive water governance.

Outcomes and Impacts

The Bayu Zhishui system has delivered measurable environmental and governance outcomes. Detection and response times for water pollution events have improved dramatically, reducing risk and minimizing ecological damage. The Yangtze River's Chongqing section now maintains Grade II water quality, while all 74 state-controlled monitoring points achieved a 100 per cent good-quality rating in the past two years. The integration of AI-driven monitoring and predictive analytics has improved interdepartmental efficiency and resource allocation. Cross-regional collaboration mechanisms have strengthened institutional coordination and transparency, turning formerly isolated governance units into a shared data ecosystem. Meanwhile, community engagement has expanded through digital reporting tools and incentive mechanisms, with verified citizen reports feeding directly into environmental enforcement workflows. Collectively, these measures have enhanced public accountability, trust and the city's overall resilience to environmental challenges.

Sustainability and Scalability

The Bayu Zhishui system's design emphasizes institutionalized collaboration and modular scalability. Its "sky-space-ground" sensing network offers flexible entry points—allowing smaller cities to replicate core components such as citizen reporting apps or basic sensor installations before scaling up to advanced AI and drone monitoring. Chongqing's interdepartmental coordination mechanisms and standardized data protocols ensure long-term system maintenance and transparency. The project aligns with China's national digital governance and ecological protection strategies, providing a sustainable model that integrates technological innovation with institutional reform.

Gender and Social Inclusivity

The system embeds inclusivity through participatory governance mechanisms that bridge digital and socioeconomic divides. Residents can report pollution via WeChat, hotlines or local service centres, enabling both digital and non-digital participation. Reward mechanisms encourage public involvement, while transparency features allow citizens to track responses to their submissions. By valuing community knowledge and integrating local insights into system design, Bayu Zhishui enhances both inclusivity and the social legitimacy of environmental governance.

Innovative Initiative

The Bayu Zhishui system exemplifies innovation through its comprehensive integration of multisource data and intelligent analytics within a real-time governance framework. Its use of a "sky-space-ground" network combines satellite and drone monitoring with ground sensors and AI-based predictive tools, enabling adaptive management of water ecosystems. The platform's closed-loop coordination—linking detection, response and verification—represents a breakthrough in multi-level, cross-regional environmental governance. Equally innovative is its hybrid model of digital technology and civic participation, transforming residents from passive recipients of services into active contributors to ecological stewardship.

Resources devoted to delivery

The initiative is financed by municipal and provincial funds, supplemented by investments from the Ministry of Ecology and Environment and partnerships with local technology firms. Human resources include interdisciplinary teams from environmental science, data engineering and AI analytics. The Bureau of Ecology and Environment manages platform oversight, while district-level agencies conduct on-site interventions. Strategic collaboration with universities and private enterprises ensures continuous system optimization and training for public officials.

Conclusion

Chongqing's Bayu Zhishui application system marks a significant step toward data-driven, collaborative and citizen-centred environmental governance. By unifying information flows, enabling early warnings and fostering interprovincial cooperation, it transforms traditional water management into an intelligent, transparent and participatory model. The initiative not only enhances local environmental resilience but also offers a scalable framework for other cities seeking to harness digital innovation for sustainable resource management and inclusive urban development.