COMPANY
Water Supplies Department, the Government of the Hong Kong Special Administrative Region
Shenzhen Yuegang Technology Co., Limited
The University of Hong Kong, HKU Business School

PROJECT
Optimizing Water Supply Operation and Maintenance with BIM and AI Technologies

LOCATION
Dongjiang Raw Water Trunk Transfer System

TYPE
Waterworks

SCHEDULED TIME OF COMPLETION
2026

BIM and AI-Powered Digital Twins: Optimizing Hong Kong's Water Supply System

"The integration of BIM and AI in our STTSS and AMIS systems has revolutionized water supply operations, transforming static models into dynamic digital twins that predict and prevent issues in real time. Operators now access intuitive 3D integrated dashboards for seamless decision-making, slashing energy use and downtime. This innovation not only ensures resilient supply for millions but inspires endless possibilities in smart infrastructure."

–Ir CHAN Shu To, Antonio
Chief Engineer/ New Territories East, Water Supplies Department, the Government of the Hong Kong Special Administrative Region

–Ir LEUNG Chi Chung
Chief Electrical and Mechanical Engineer/ Maintenance, Water Supplies Department, the Government of the Hong Kong Special Administrative Region

–Ir WAN Wai Yin
Senior Engineer/ Building Information Modeling, Water Supplies Department, the Government of the Hong Kong Special Administrative Region

BIM PARTNER
Summit Technology (Hong Kong) Limited

AUTODESK PRODUCTS USED
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Infowater Pro

Overall View of Tai Po WTW OSCG BIM As-built Model
Image Courtesy of Water Supplies Department, the Government of the Hong Kong Special Administrative Region and Shenzhen Yuegang Technology Co., Limited and The University of Hong Kong, HKU Business School

Introduction and Project Overview

The Water Supplies Department (WSD) is leading a major digital transformation to modernize Hong Kong's water infrastructure. At the heart of this initiative is the Dongjiang Water Supply System, which has reliably provided 70–80% of the city's water since the 1960s. In response to growing climate challenges, the project aims to enhance operational resilience, sustainability, and service continuity for over 7 million residents.

By integrating Building Information Modeling (BIM), Artificial Intelligence (AI), Geographic Information Systems (GIS), Supervisory Control and Data Acquisition (SCADA), and the Internet of Things (IoT), WSD is developing a user-friendly Digital Twin platform. This platform transforms physical infrastructure into intelligent, connected systems optimizing asset management, improving energy efficiency, and enabling data-driven decision-making across treatment works and pumping stations.

Project Scale and BIM Application

This large-scale initiative spans both above ground and underground assets. Surface infrastructure includes reservoirs, treatment works, and pumping stations, while linear assets cover water mains and tunnels. The project integrates two core systems: the Asset Management Information System (AMIS) for surface assets and the Smart Trunk Transmission System (STTSS) for trunk networks. Together, they form a unified digital ecosystem for operations and maintenance.

BIM can be applied during the operations and maintenance (O&M) phase, converting static as-built models into dynamic digital

twins. These digital twins are enhanced by real-time IoT and SCADA data, enabling continuous monitoring and predictive analytics. In STTSS, BIM supports hydraulic modeling to anticipate pressure and flow anomalies; in AMIS, it tracks asset conditions and forecasts maintenance needs.

To streamline data sharing across the asset lifecycle, the project merges BIM and GIS into a single unified platform. Lightweight BIM engines ensure fast-loading 3D models, allowing operators to make timely, informed decisions in complex water distribution environments.

BIM Implementation and Value

BIM delivers wide-ranging operational, economical, and environmental benefits. It consolidates asset data, hydraulic models, and real-time sensor feeds into a single source of truth, enabling advanced analytics and digital twin capabilities. Within STTSS, BIM facilitates hydraulic simulations for pump and valve operations, helping reduce energy consumption and improve network performance.

The Integrated System Performance Dashboard provides a state-of-the-art environment for 2D and 3D visualizations. Operators can instantly monitor key metrics such as pressure transients and flow rates. Designed with end-users in mind, the dashboard enhances situational awareness, streamlines workflows, and improves access to spatial and asset data.

AMIS supports maintenance strategy through Reliability-Centered Maintenance (RCM), combined with IoT for condition monitoring and predictive maintenance. This approach automates routine tasks and risk assessments, extends asset life, and helps prevent failures. Virtual visualizations assist with rapid emergency response, while embedded asset hierarchies ensure seamless data flow from design to decommissioning—minimizing information loss and enabling full lifecycle traceability.

By linking structured asset registers with BIM models, engineering drawings, and mobile inspection records, AMIS enables efficient condition tracking and proactive maintenance. AI-powered large language models (LLMs) further enhance BIM-AM by automating risk identification and enabling natural-language queries. This simplifies complex data interpretation and allows operators to flag potential issues such as equipment failures or inefficiencies before they escalate.

BIM also contributes to cost savings by reducing maintenance and energy expenditures. IoT-linked RCM strategies help minimize unplanned downtime, while STTSS optimizations aligned with ISO 50001 reduce operational costs. AI-enhanced lightweight engines accelerate model conversion and dashboard deployment. At Muk Wu Raw Water Pumping Station and Tai Po Water Treatment Works, BIM-AM streamlines asset registration, reduces rework, and supports real-time SCADA synchronization for proactive operations.

Innovations and Advanced Technologies

The project incorporates cutting-edge technologies to enhance functionality and user experience. Generative AI, including LLMs like DeepSeek, is embedded into STTSS to support intuitive queries—such as "Optimize pumps for peak demand" delivering real-time simulations and actionable insights. This operator-centric design democratizes complex analytics, allowing non-experts to interact with digital twins via natural language, accelerating decision-making and reducing training overhead.

Autodesk tools ensure interoperability across BIM–Asset Management workflows. Together, these technologies form a robust platform where digital twins not only replicate physical assets but also simulate "what-if" scenarios—such as climate-induced demand surges to support adaptive planning.

STTSS uses BIM as its foundation, enhanced by LLMs and genetic algorithms to optimize pump schedules and improve energy efficiency. Real-time data feeds into a 2D/3D integrated dashboard for performance monitoring and water delivery optimization. BIM and IoT also enable pipeline visualization and leak detection, reducing water loss and supporting sustainability goals.

BIM–GIS integration provides an AI-assisted workflow that links design with geospatial mapping, automates data flow, and eliminates rework. This unified view of surface and underground assets empowers WSD to monitor asset health, assess risks, and optimize operations. Realistic 3D models combine geospatial and asset data, offering a comprehensive understanding of system performance.

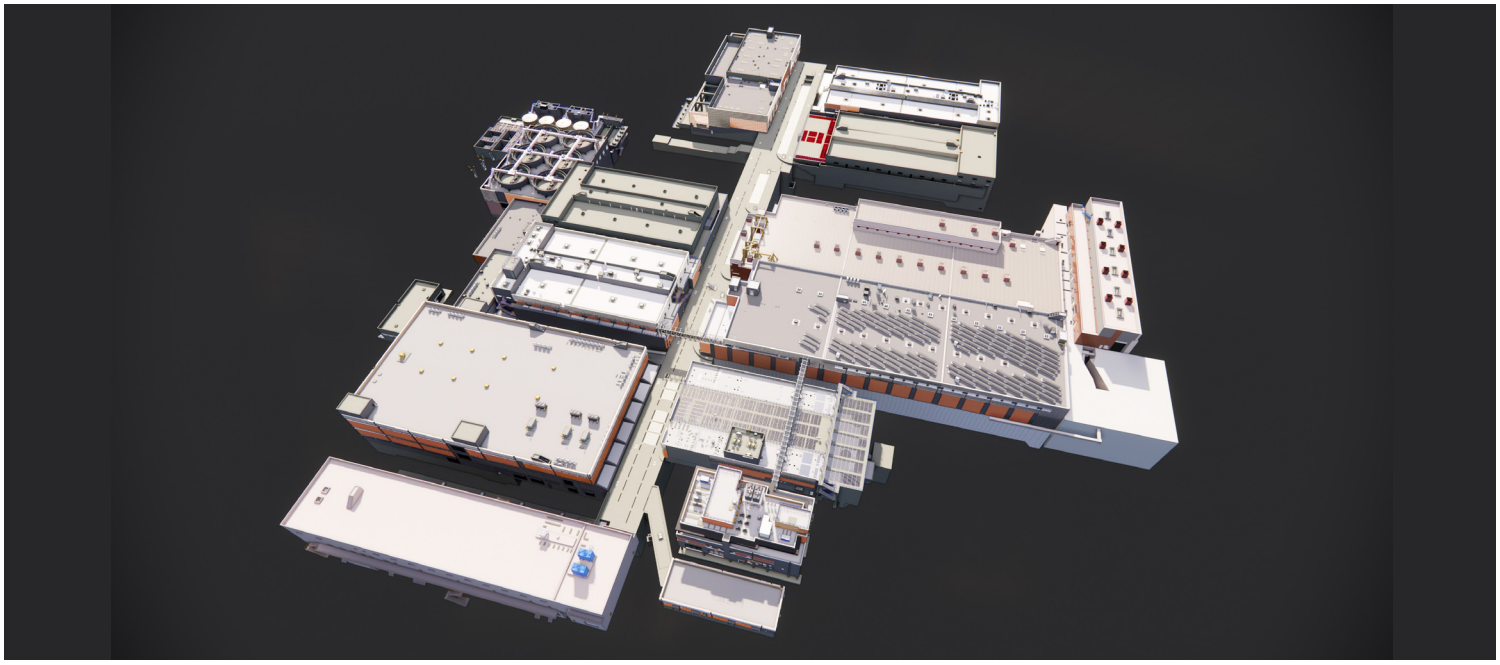
Interoperability with GIS and AI further enhances efficiency through SCADA-driven pump control and predictive maintenance analytics. The result is a reliable AI dashboard platform aligned with ISO 50001 standards, helping reduce energy use and operational costs. With BIM, WSD gains a "one-picture overview" of the entire raw water network—combining hydraulic models, dynamic 3D GIS visualization, and operational insights. Advanced features such as automated anomaly detection use LLMs to cross-reference IoT data with historical BIM records, ensuring uninterrupted service in critical infrastructure.

Recognition and Future Directions

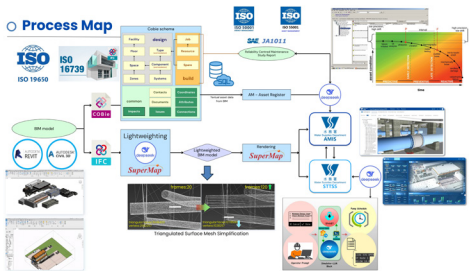
The STTSS project has received great encouragement from Minister Mr. Li Guoying during his 2025 visit. WSD has been privileged to share its BIM/GIS solutions with global experts, government leaders, and students, while using STEAM outreach to inspire future engineers and promote broader BIM adoption.

With the support of universities, consultants, and water specialists, the project has achieved remarkable outcomes: substantial energy savings valued at HK$30 million annually, a reduction of 18,000 tonnes of CO_2, and progress toward fully autonomous digital twins.

Looking ahead, WSD remains committed to innovation. Future LLM prototypes will support smarter, autonomous decision-making, including applications in reclaimed water systems. The department continues to share its learnings, such as STTSS's AI-powered semantic query pipeline tested at Muk Wu Pumping Station. This initiative marks a meaningful step toward strengthening Hong Kong's water resilience and contributing to global digital transformation.

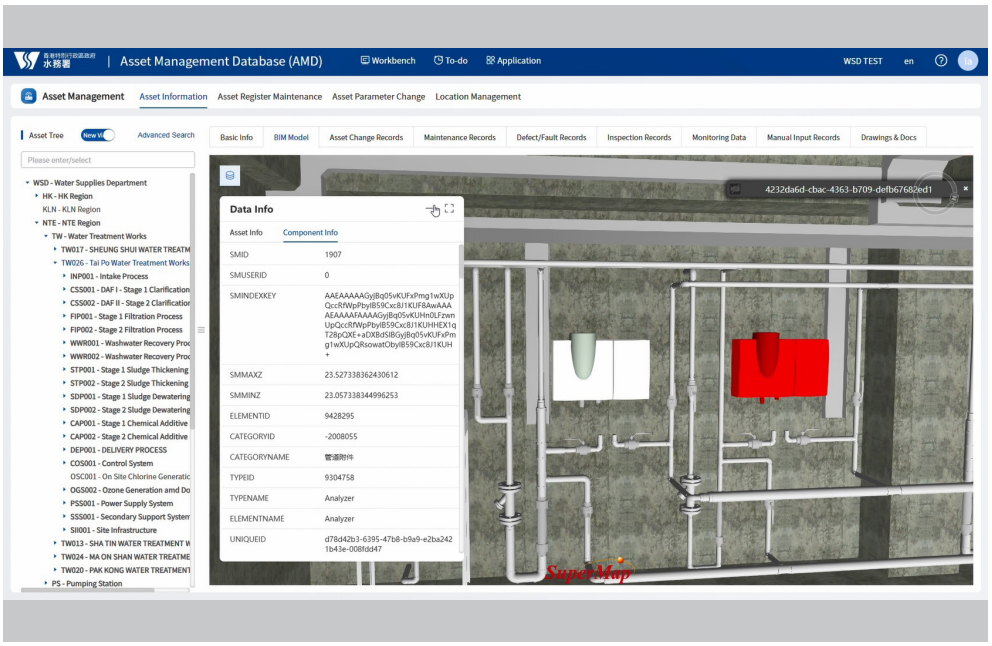


Overall View of Tai Po WTW BIM As-built Model
Image Courtesy of Water Supplies Department, the Government of the Hong Kong Special Administrative Region and Shenzhen Yuegang Technology Co., Limited and The University of Hong Kong, HKU Business School

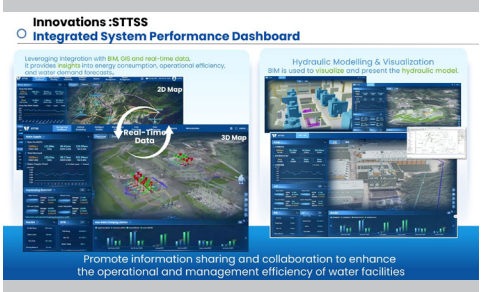


Process map for BIM integration in AMIS and STTSS
Image Courtesy of Water Supplies Department, the Government of the Hong Kong Special Administrative Region and Shenzhen Yuegang Technology Co., Limited and The University of Hong Kong, HKU Business School

Visualization of Tai Po WTW in AMIS
Image Courtesy of Water Supplies Department, the Government of the Hong Kong Special Administrative Region and Shenzhen Yuegang Technology Co., Limited and The University of Hong Kong, HKU Business School



Utilizing BIM in AMIS for Asset Management
Image Courtesy of Water Supplies Department, the Government of the Hong Kong Special Administrative Region and Shenzhen Yuegang Technology Co., Limited and The University of Hong Kong, HKU Business School



Integrated System Performance Dashboard in STTSS
Image Courtesy of Water Supplies Department, the Government of the Hong Kong Special Administrative Region and Shenzhen Yuegang Technology Co., Limited and The University of Hong Kong, HKU Business School

Visualization pump scheduling in STTSS
Image Courtesy of Water Supplies Department, the Government of the Hong Kong Special Administrative Region and Shenzhen Yuegang Technology Co., Limited and The University of Hong Kong, HKU Business School

Muk Wu RWPS lightweighted BIM model at STTSS
Image Courtesy of Water Supplies Department, the Government of the Hong Kong Special Administrative Region and Shenzhen Yuegang Technology Co., Limited and The University of Hong Kong, HKU Business School

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