

COMPANY

Water Supplies Department, HKSAR Government
Ming Hing – Ming Hing Civil – Vasteam Joint Venture
Summit Technology (Hong Kong) Limited

PROJECT

In-situ Reprovisioning of Sha Tin Water Treatment Works (South Works) – Advance Works

LOCATION

Sha Tin, New Territories

TYPE

Water Treatment Works

SCHEDULED TIME OF COMPLETION

2019

“BIM has always been part of WSD’s ongoing development agenda and exploration of new BIM applications in projects has always been encouraged. Sha Tin Water Treatment Works (South Works) - Advance Works is a proven example with great success in this area.”

—Heinz Wong Hin-chi

Engineer/ Project Management,
Water Supplies Department,
HKSAR Government

BIM PARTNERS

AECOM Asia Company Limited
A.LEAD architects Limited
ATAL Engineering Limited
Aurecon
Black & Veatch Hong Kong Limited
Vigor Engineering Limited

AUTODESK PRODUCTS USED

3ds Max
Advance Steel
AutoCAD
AutoCAD Civil 3D
Autodesk Rendering
Dynamo
InfraWorks 360
Navisworks
Recap Pro
Revit
Autodesk CFD

Diverse BIM Applications Help Expand Major Waterworks



General View of the Sha Tin Water Treatment Works after Project Completion
Image courtesy of Water Supplies Department, HKSAR Government and Ming Hing – Ming Hing Civil – Vasteam Joint Venture and Summit Technology (Hong Kong) Limited

Sha Tin Water Treatment Works (WTW), which is the largest water treatment works in Hong Kong, is providing water supply to various areas in Sha Tin, Kowloon, and Central and Western districts of Hong Kong Island. Sha Tin WTW consists of two portions, namely the South Works and North Works. The South Works of Sha Tin WTW was commissioned in 1964 with a treatment capacity of 364,000 m³ per day while the North Works was commissioned in stages since 1973. After more than 50 years of service, the reliable output of the South Works has reduced to 220,000 m³ per day, and it has become uneconomical to maintain its operation, thus requiring in-situ reprovisioning of the South Works. Apart from replacing the aged treatment facilities, the treatment capacity of the

South Works will also be increased to 550,000 m³ per day upon completion of the reprovisioning project to meet the increase in water demand arising from the new housing developments in the supply zone.

The Sha Tin WTW (South Works) reprovisioning project is being implemented in two phases, i.e. the current Advance Works and the future Main Works. The Advance Works is to pave the way for implementation of the Main Works. The scope of the Advance Works includes site formation for a new administrating building and construction for a logistics centre, alum tanks, a hydropower plant, a temporary washwater recovery tank, a power house and access roads. The



Visualization of Logistics Centre, Alum Saturation Tanks and Hydro Turbine House
Image courtesy of Water Supplies Department, HKSAR Government and Ming Hing – Ming Hing Civil – Vasteam Joint Venture and Summit Technology (Hong Kong) Limited



UAV Survey Record Rendered as Point Cloud with Autodesk Recap Pro
Image courtesy of Water Supplies Department, HKSAR Government and Ming Hing – Ming Hing Civil – Vasteam Joint Venture and Summit Technology (Hong Kong) Limited

Advance Works commenced in October 2015 for completion in 2019. As a major challenge of implementing the project, the normal operation of the North Works is to be maintained during the reprovisioning for the South Works.

Water Supplies Department (WSD) has continued to promote BIM applications and the associated R&D since its first successful completion of the BIM-Asset Management pilot study on Telegraph Bay Salt Water Pumping Station and Tai Po Salt Water Pumping Station in 2015. Shortly after the pilot study, BIM requirement was incorporated in the tender documents for the Advance Works of the Sha Tin WTW (South Works) in-situ reprovisioning project. In October 2015, the Advance Works contract was awarded to Ming Hing – Ming Hing Civil – Vasteam Joint Venture (MMVJV). Then Summit Technology (Hong Kong) Limited was engaged by MMVJV as the BIM sub-contractor. AECOM Asia Company Limited (AECOM) acted as the Engineer of the project.

Progressive and Diverse BIM Applications

Under the supervision of AECOM, MMVJV and Summit faithfully executed the BIM requirement under the Contract, including design coordination, 4D construction sequencing, construction method statement simulation and preparation of as-built records for future handover. However, typical BIM applications were insufficient to meet many different needs of implementing such a large scale, complex and multi-disciplinary infrastructure project. As such, the Contractor and BIM team had to apply BIM to the project implementation in a progressive and diverse manner.

Resolving Concerns over Design-Construction

For the logistics centre and alum tanks, the largest structures in the project, the Contractor and BIM team established different BIM applications over the design-construction cycle. During design, the team took initiative in utilizing the BIM models for quantity surveying by adopting Autodesk AutoCAD Civil 3D and Autodesk Revit to estimate the excavation volume for the site formation works and concrete volume for the building structural works. This came in handy when the team tried to estimate the excavated soil and rock volume at various basement levels.

During carrying out excavation, how to implement the suppression measure to minimize the impact of airborne dust generated from the excavation area on the operation of the nearby water treatment facilities was one of the major concerns of the operation and maintenance team of the treatment works. To evaluate the effectiveness of the proposed dust screens, the team modelled the layout of the works site and simulated the dispersion of airborne dust generated

from the excavation area, such that the height, orientation and layout of dust screens could be arranged in a most effective way to minimize the impact of airborne dust.

During construction, the team organized weekly unmanned aerial survey (UAV) to record the site works progress. Data from our UAV survey were then processed by Autodesk Recap Pro to form point clouds of the constructed works. The point clouds were then overlaid with the BIM models to check for any discrepancy when compared with the original design. In case any discrepancy was identified, the discrepancy would be reflected in the BIM models, and our designers would evaluate the impact and develop mitigation or rectification measures accordingly.

Environmental-Friendly Measures

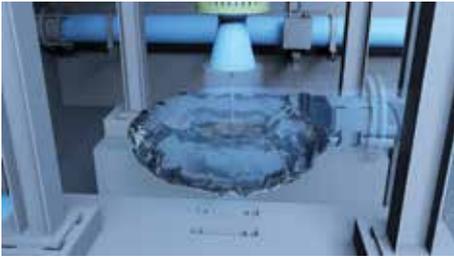
As part of WSD's ongoing effort to be sustainable, the Advance Works



BIM-Oriented Coordination Meeting
Image courtesy of Water Supplies Department, HKSAR Government and Ming Hing – Ming Hing Civil – Vasteam Joint Venture and Summit Technology (Hong Kong) Limited



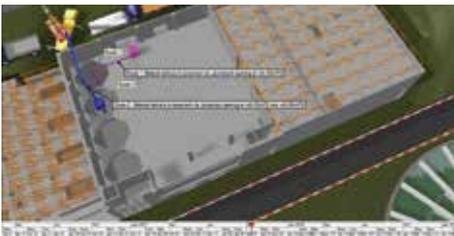
Visualization of Future Control Training Workshop in the Logistics Centre
Image courtesy of Water Supplies Department, HKSAR Government and Ming Hing – Ming Hing Civil – Vasteam Joint Venture and Summit Technology (Hong Kong) Limited



Generation of Hydro Power by Gravity-Fed Raw Water
Image courtesy of Water Supplies Department, HKSAR Government and Ming Hing – Ming Hing Civil – Vasteam Joint Venture and Summit Technology (Hong Kong) Limited



Visualization of Proposed Woodland Compensation along New Road and Pile Wall
Image courtesy of Water Supplies Department, HKSAR Government and Ming Hing – Ming Hing Civil – Vasteam Joint Venture and Summit Technology (Hong Kong) Limited



4D Simulation of the Logistics Centre's Excavation, Construction and Installation
Image courtesy of Water Supplies Department, HKSAR Government and Ming Hing – Ming Hing Civil – Vasteam Joint Venture and Summit Technology (Hong Kong) Limited



Periodic Removal of Sludge Accumulated in the Temporary Washwater Recovery Tank
Image courtesy of Water Supplies Department, HKSAR Government and Ming Hing – Ming Hing Civil – Vasteam Joint Venture and Summit Technology (Hong Kong) Limited

involved the construction of a new hydropower plant and a temporary washwater recovery tank, which will reduce the ecological footprint of the treatment works. In addition, the use of renewable energy was relatively new to the operation and maintenance team of the treatment works. Considering that any setback in the progress of the Advance Works would impede that of the upcoming Main Works, it was crucial that the current operation and maintenance team fully comprehends the new facilities as soon as possible. To achieve this target, the BIM team and the designers were tasked to simulate the future operation and maintenance procedures through the BIM models.

These simulations were proven to be more pragmatic than a study of stacks of operation manuals.

Besides the new facilities, WSD was also responsible for compensating trees that were displaced under the Advance Works, in order to mitigate the environmental impact arisen during the course of works. The locations of new trees were pre-determined, but the distribution of trees in these locations had not been precisely defined at the outset of the project. As an experimental approach, the Contractor attempted to stimulate the tree distribution through a combination of Autodesk 3ds Max, Autodesk AutoCAD Civil 3D, Autodesk Infraworks and Autodesk Dynamo. Site information from Civil 3D was put into Dynamo, which applied the prerequisite to automatic distribution of trees in selected locations. The end results were combined from 3ds Max and Revit for demonstration in Infraworks.

Works to be Done

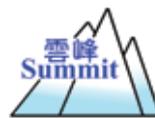
Going forward, BIM will remain a crucial part in WSD's development of asset management strategy. As one of WSD's pilot projects to incorporate BIM for

design and construction, it is intended to handover the project data through BIM. To achieve this, the Contractor and the BIM team will develop Autodesk Revit-based application programming interfaces that allow data export to the Integrated Materials and Job Records Management System and Construction-Operations Building Information Exchange, which are respectively the existing and future WSD's asset management information system.

Although the Advance Works is coming to completion, our initiatives in diversifying BIM applications in the project will further fuel WSD's continuous resolution to expand BIM implementation within the department. The research and applications in this project will be documented as references for review and integration into future WSD's works whenever applicable. Following the successful completion of the pilot study on BIM for asset management in 2015, WSD has continued to adopt BIM applications in the Advance Works of the Sha Tin WTW (South Works) reprovisioning project and will remain steadfast in advocating BIM culture and BIM diversity in waterworks.



Visualization of the Hydro Turbine House's Plant Room
Image courtesy of Water Supplies Department, HKSAR Government and Ming Hing – Ming Hing Civil – Vasteam Joint Venture and Summit Technology (Hong Kong) Limited



Location of the Sha Tin Water Treatment Works
Image courtesy of Water Supplies Department, HKSAR Government and Ming Hing – Ming Hing Civil – Vasteam Joint Venture and Summit Technology (Hong Kong) Limited

About Water Supplies Department, HKSAR Government

Water Supplies Department (WSD) is responsible for supplying fresh water and seawater (for flushing) for consumption by Hong Kong's population of 7.3 million for domestic and non-domestic use. In 2015/16, the WSD supplied 982 million cubic metres (Mm³) of fresh water. In the same year, WSD supplied 268 Mm³ of seawater for flushing. As of 1 April 2016, WSD administered 2.91 million water accounts.

About Ming Hing – Ming Hing Civil – Vasteam Joint Venture

Ming Hing – Ming Hing Civil – Vasteam Joint Venture (MMVJV) is formed by Ming Hing Waterworks Engineering Co., Ltd., Ming Hing Civil Contractors Ltd., and Vasteam Construction Limited (which is a subsidiary of Chun Wo Development Holdings Limited). MMVJV aims to provide its clients with the best quality of work by utilizing the BIM technology and leveraging the expertise and strengths of waterworks and constructions.

About Summit Technology (Hong Kong) Limited

Summit Technology (Hong Kong) Limited is a Hong Kong-based private limited company dedicated to actively working with the local AEC industry in providing BIM product, project solution, R&D, training and coaching. Summit advocates for a shift to the traditional working culture and embraces BIM culture, which requires changes to the stakeholders, the technology and work process.