



Project Summary

Organization:
CH2M

Location:
Singapore

Project Objective:

- Expand Changi WRP water treatment facilities within a limited footprint to meet future demand for NEWater and handle peak flow management without compromising feed quality.
- Provide multi-discipline engineering services from detailed facility design through construction supervision and commissioning.
- Minimize hazards and risks for safe, reliable plant operations.

Products used:

AECOSim Building Designer, ConstructSim, MicroStation®, Bentley Navigator, OpenPlant, ProjectWise®, and STAAD.Pro®

Fast Facts

- Using ProjectWise as the common interface and AECOSim Building Designer as the multi-platform design application to deliver information-rich deliverables enhanced information mobility, improving project performance, minimizing risk, and avoiding delays.
- The automated publishing of i-models using Navigator accelerated accurate interdisciplinary design reviews for more coordinated modeling.

ROI

- Leveraging Bentley's BIM technology, CH2M optimized design efficiencies and streamlined workflows among a multi-discipline project team. This eliminated errors, saved time, and reduced project costs while delivering the SGD 400 million Changi WRP expansion.
- CH2M produced high quality models and visualizations that facilitated client engagement and allowed involvement of the end users early in the design process.

BIM Strategy Increases Treatment Capacity at One of the World's Most Advanced Water Reclamation Plants

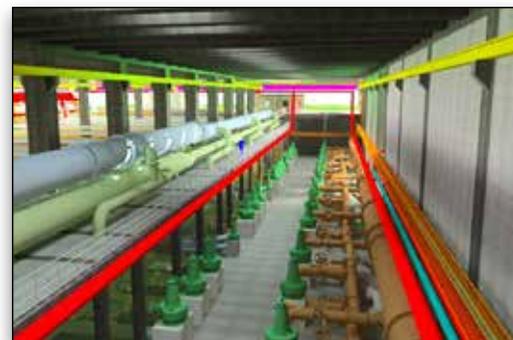
CH2M Selects Bentley's BIM Advancements to Improve Efficiencies and Optimize Water Sustainability on SGD 400 Million Singapore Expansion Project

A Pillar for Water Sustainability

Located at the eastern end of Singapore, Changi Water Reclamation Plant (WRP) is one of the world's largest and most advanced reclamation facilities capable of treating 920 million liters per day (MLD) of used water. The treated used water from Changi WRP is further purified to produce high-grade reclaimed NEWater, supplementing Singapore's indirect potable and industrial water demands, which currently supplies 30 percent of the country's demand. A pillar of Singapore's water sustainability strategy, NEWater is expected to meet up to 60 percent of the country's water demand.

To accommodate future demand for used water treatment and produce a NEWater feed that meets water quality standards for biodegradable materials, suspended matter, and pathogens, which subsequently allows used water to be beneficially reused within the community to improve water sustainability and security, Public Utilities Board Singapore (PUB) initiated a SGD 400 million expansion of the Changi WRP. The expansion will increase the plant's capacity by 200 MLD with a new liquid treatment facility and membrane bioreactor that produces a high quality filtrate to be used as the feed to a NEWater facility, as well as a new wet weather facility to handle peak flow. "With this expansion, Changi WRP will be one of the world's largest membrane bioreactor facilities. More importantly, it will produce more treated used water effluent for NEWater production and increase our water recycling rate, which will allow us to ensure a robust and sustainable supply of water for Singapore's future," said Yahya Abdul Ghani, PUB's director of water reclamation (plants).

PUB retained CH2M to provide multi-discipline engineering services for the Changi WRP expansion, ranging from detailed process and facility design through construction supervision and commissioning. CH2M faced a limited footprint for expansion, which necessitated a compact design to optimize land use and fully integrate the new treatment facilities with existing structures. Given the space limitations and the multi-discipline project team dispersed among three countries, CH2M needed to implement a collaborative BIM strategy to deliver the expansion plan on time and within budget.



The automated publishing of i-models using Navigator provided the multi-discipline team real-time access to view the design at key stages in the project.

BIM Strategy Accelerates Optioneering

With numerous disciplines required to satisfy all technical, operational, and maintainable aspects of the plant expansion within a limited space, CH2M relied on Bentley's BIM advancements, using AECOSim Building Designer as the multi-platform design application for analysis to provide rich information deliverables. Bentley technology fostered an efficient interdisciplinary approach, streamlining workflows and accelerating decision making. Working in a collaborative BIM environment using ProjectWise as the shared interface facilitated seamless integration of project data and models, which allowed early involvement of the entire team and the end users in developing the design. CH2M used the models during hazard and operability studies, and in access, lifting, and maintenance workshops to analyze the proposed design and discuss options relating to operations and maintenance of the expansion facilities with the existing plant.

Bentley's collaborative modeling and analysis software provided a vendor-neutral, adaptive facility design incorporating all possible equipment options, enabling effective optioneering and decision making to meet the various original equipment manufacturer (OEM) requirements. Furthermore, the ability to work within an evolving, federated design in real time enabled the multi-discipline teams to make decisions quickly and collaboratively within the specified time frames.

"The portfolio of Bentley's design applications has been an essential basis for us to deliver a first-class design and give the ultimate users of the facility a key role in the design process."

— Colin Newbery,
Design Manager and
Principal Engineer,
CH2M

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Unified Design Environment

With an engineering team located in Singapore, Delhi, and Sydney, it was critical that data and information was shared efficiently and effectively throughout all project stages to avoid delays. Using ProjectWise provided instant, controlled access to design files and engineering content, enhancing collaboration and facilitating a seamless communication flow among the team. Coordinating the project through ProjectWise accelerated design sharing and increased accountability. This process optimized information mobility and empowered an integrated team approach, which shortened approval cycles and resolved issues quickly to reduce overall risk.

The automated publishing of i-models and concurrent use of Bentley Navigator provided the various engineering disciplines real-time access to review the most current plant design from ProjectWise. This allowed for effective planning and design coordination, enabling interdisciplinary reviews to be completed earlier in the design cycle. Using Navigator Mobile the client, PUB, could access the i-model and view the design at key stages in the project and provide input.

Lastly, CH2M used ConstructSim to merge the BIM model with the project schedule. This allowed engineers and project schedulers to better understand the complexities of constructing the plant facilities in a restricted space, providing a clear visualization of the sequencing to minimize rework and help meet construction milestones. Using Bentley mobile applications provided construction supervisors on-site access to the design and visualization reports to check construction works with the design and accurately monitor and report on progress to help keep the project on schedule. Bentley software helped CH2M optimize information mobility among the multiple disciplines and geographically dispersed project team, as well as with the client, from design through construction, resulting in a more coordinated approach and comprehensive outcome.

Integrated Technology Delivers Savings

Bentley technology provided the flexibility and interoperability necessary to seamlessly incorporate project information in multiple file formats, which optimized collaboration among

the team as well as with the client. For example, the ability to provide the client with 3D PDF rapid prototypes to review in their own offices after meeting enabled PUB to gain further insight into and understanding of the design to contribute valuable suggestions.

Using AECOsim Building Designer as an integrated platform for architects and electrical, mechanical, and structural engineers enabled the team to effectively communicate design intent, increasing productivity by bridging barriers among the different disciplines and facilitating accurate material takeoffs to estimate construction costs. When integrated with STAAD.Pro, the solution shortened time spent on structural analysis, increased the team's efficiency, and eliminated design errors.

Bentley's interoperable, collaborative software provided CH2M a connected data environment for comprehensive project delivery that reduced time, saved costs, and enhanced safety by facilitating optimal solutions for risk management and regulatory compliance issues. The integrated applications prevented information silos, ensured data integrity, and allowed coordinated design reviews and clash detection analysis for improved project performance, enabling CH2M to deliver on time and within budget.

Secure and Sustainable Water Management

The amount of useable water in Singapore is limited and therefore has become a strategic resource for the country. With the main goal of this WRP expansion to increase the reclamation and reuse of water, the country intends to reduce the stress on the minimal sources of useable water in the region.

Bentley provided CH2M the collaborative design, analytical, and construction modeling solutions necessary to deliver this innovative water treatment facility that represents a step forward in the design of compact advanced facilities in terms of energy use, reliability, and operability. The completed expansion will increase the capacity of Singapore's largest WRP. Using cutting-edge technology to treat used water from the eastern half of the island will enable greater production of NEWater, diversifying Singapore's water sources to improve water security and sustainability in Singapore.