



# Yuba Water Agency Automates Monitoring of California's Second Tallest Dam to Ensure Public Safety

Using Bentley's iTwin<sup>®</sup> Applications for Situational Intelligence Significantly Improves Risk Assessment

## MODERNIZING A LEGACY DAM MONITORING SYSTEM

Situated in the Yuba County foothills along the edge of Tahoe National Forest on the North Yuba River, New Bullards Bar Dam is a 645-foot-tall concrete arch dam. It is the second tallest dam in California, and the fifth tallest in the United States. The dam has a capacity to hold 1.19 cubic kilometers of water, which forms the New Bullards Bar Reservoir that provides flood control and serves as a popular recreation area. The reservoir also ensures colder downstream river temperatures for fishery enhancement. Owned and operated by Yuba Water Agency, the dam was constructed in 1970 as part of the Yuba River Development project, which was aimed at reducing flood risk, generating clean hydropower, and ensuring a reliable water supply for county residents and the environment.

Committed to dam safety and efficient, reliable infrastructure operations, Yuba Water sought to modernize the dam monitoring system by collecting continuous, real-time operational data. "The project was implemented so Yuba Water can better understand the entire performance of New Bullards Bar Dam, especially when dealing with inclement weather and seismic events," said Tim Truong, chief dam safety engineer at Yuba Water. With multiple monitoring prisms and pylons, the new automated system provides real-time monitoring of the movement of the dam structure as time passes and it is exposed to different natural elements. The project has improved dam safety by allowing for quicker detection of abnormal deformation of the dam, which could result in more timely investigations and possible risk reduction measures.

## ADDRESSING SITE, SURVEY, SECURITY, AND SAFETY RISKS

Implementing the new monitoring system involved performing drone surveys and installing automated survey equipment for detecting 3D deflection, as well as monitoring any propagation or deformation of the dam structure. The project required establishing local survey benchmarks, installing reflective survey targets across the dam face, and building a secure enclosure house to protect the automated motorized station. Challenges faced by the project team included securing permitting and approvals for drilling and installing devices directly to the dam, as well as the engineering and construction activities necessary to build a dedicated enclosure for survey equipment at a location with visibility of the entire downstream dam face. Compounding these issues was the steep terrain around the dam, accessible only via a narrow, restricted road.

The dam's previous monitoring system posed safety hazards, requiring time-consuming, costly, and hazardous manual data collection that spanned only a portion of the dam. To reduce personnel safety risks, Yuba Water wanted to implement a more cost-efficient, safe, and comprehensive automated monitoring system, eliminating manual surveys. They sought to implement an integrated reality modeling and digital twin solution to remotely collect and visualize real-time data and automate alerts and reports of potential issues, while securing the on-site station equipment necessary to perform the digital monitoring.

## LEVERAGING ITWIN CAPTURE AND ITWIN IOT TO AUTOMATE DAM MONITORING

Yuba Water used iTwin Capture to process an existing 3D reality mesh of the entire dam

## PROJECT SUMMARY ORGANIZATION

Yuba Water Agency

## SOLUTION

Survey and Monitoring

## LOCATION

Camptonville, California, United States

## PROJECT OBJECTIVES

- ◆ To increase operational efficiency and reliability of New Bullards Bar Dam.
- ◆ To implement a digital automated dam survey and monitoring system.

## PROJECT PLAYBOOK

iTwin Capture, iTwin IoT

## FAST FACTS

- ◆ Yuba Water implemented a digital automated survey and monitoring system to better understand the performance of New Bullards Bar Dam, ensuring safe, reliable operations.
- ◆ Leveraging iTwin Capture and iTwin IoT, they generated a reality mesh and digital twin to collect, monitor and visualize the dam data and its components.
- ◆ The project provides a cloud-based platform to visually track stability of the structure and effectively communicate with the team to address any potential damages.

## ROI

- ◆ The automated total station provides 1,000 times more data monitoring points per week and has enhanced data accuracy.

“Going digital has allowed us to communicate the needs of the project effectively with the members of our team and visualize the data in real time.”

– Tim Truong, Chief Dam Safety Engineer, Yuba Water

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from thousands of drone-captured images and uploaded it to Bentley's cloud-based iTwin Platform, where the model was associated with the monitoring devices. The team was able to generate a digital twin that can visualize the sensor data in real time. “Bentley software was chosen because of its ability to collect monitoring data remotely and automate analysis and alerts based on predetermined thresholds,” said Truong. “The location of the dam is quite remote, so the ability to track the stability of the structure remotely is very valuable.”

The digital twin visualizes, analyzes, and provides automated decision support and thorough dashboards and reporting on structural integrity and reliability of the dam. Using Bentley's iTwin IoT to incorporate sensor data within the model, Yuba Water can view the sensor locations within the geospatial context of the dam, determine if they have reached any alert thresholds, and monitor deformation and propagation of the dam structure. In addition, the team can now track direction of deformation using slope stability and graph sensor data directly on the digital twin without having to utilize multiple software platforms. The software allows Yuba Water Agency to track events, provide timely alerts, and report to stakeholders, all in one platform. It also provides peace of mind within a secure system, locking access to the total station for the majority of the time that live monitoring is not occurring.

### **DIGITAL TWIN OPTIMIZES DAM OPERATIONS AND ENSURES PUBLIC SAFETY**

“[The] Bentley solution has reduced the cost and time associated with getting data from the monitoring system,” said Truong. The original legacy system took approximately one week to get a data point from a target and cost USD 5,000 for each manually collected data event. The new cloud-based system can collect a data point from over 80 prisms twice a day, and make it immediately accessible to the authorized users at no extra cost other than the purchase of the iTwin software. It has saved hours every week and improved workflows and productivity, all while eliminating risky on-site visits.

Compared to a conventional monitoring system, the digital twin automated total station provides 1,000 times more data monitoring points per week and has significantly improved data accuracy and risk assessment.

Moreover, the digital twin allows the team to closely monitor the structure, working toward the agency's ultimate goal of ensuring public safety and protecting the surrounding environment. Using iTwin IoT, the dam can be monitored more closely and quickly during heavy rainfall and seismic events. “For Yuba Water Agency, there is nothing more important than public safety. Investing in a real-time, automated total monitoring station at New Bullards Bar Dam significantly improves our monitoring capabilities and is testament to our continued commitment to public safety and infrastructure resilience,” said Truong.



*Yuba Water implemented a digital automated survey and monitoring system to better understand the entire performance of New Bullards Bar Dam, ensuring safe, reliable operations.*