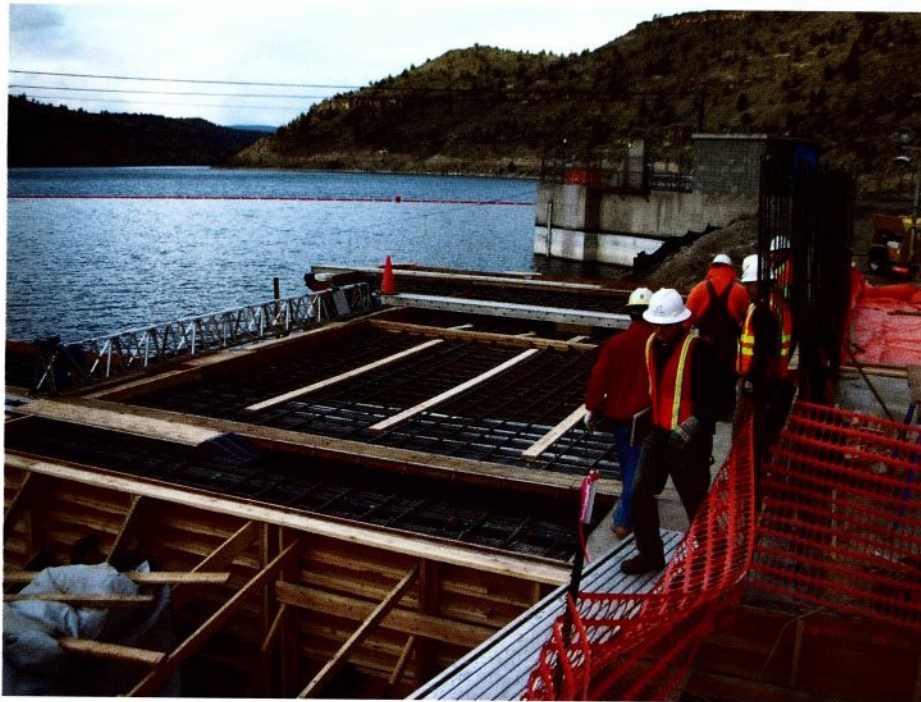


Innovative Water Withdrawal System

By Bentley Systems



that modifies the direction of the surface current. The system better guides the migrating fish into a fish-handling area, provides a fish-collection system, and ensures that the water released complies with state and tribal water-quality standards.

The system consists of a selective water withdrawal top structure and a selective water withdrawal bottom connected by a 40ft-diameter vertical flow conduit. The intakes dewater through two conventional V-screens supported by an elaborate steel framing with a unique geometry used to support the screens and fish facility. The selective water withdrawal bottom is anchored to the bedrock and placed in front of the existing intake structure, which contains bottom exclusion plates that prevent fish from entering the powerhouse flow. The goal is to have the system operating by the 2009 migrating season.

Because Chinook salmon, steelhead trout, redbreast trout, and bull trout are among the fish species the Federal Wild and Scenic Rivers Act protects, keeping them out of water intakes at major hydroelectric dams is critical. Simple modifications, such as installing baffles and gates, are sometimes all that is needed to keep fish from the intakes. But there are also strict water-quality regulations established by the Federal Energy Regulatory Commission (FERC) and the Clean Water Act (CWA). To comply with FERC and CWA requirements, selective water withdrawal at Round Butte Dam in Oregon required a far more complicated and innovative design.

When Portland General Electric Company (PGE) constructed Round Butte Dam in the 1960s, one of three dams that comprise the Pelton Round

Butte hydroelectric project, it also constructed an upstream and downstream migration system to maintain anadromous fish runs. However, the downstream system was deemed ineffective due to migration problems in Lake Billy Chinook, the reservoir behind the dam, negatively impacting the fish population. PGE abandoned the system in favor of a steelhead trout and Chinook salmon hatchery program. www.bentley.com

Now, as part of a 50yr FERC license period, PGE and the Confederated Tribes of the Warm Springs Reservation, which co-owns the dam, have committed to re-establishing the fish runs while meeting CWA water requirements. To accomplish the objective, CH2M HILL designed a one-of-a-kind selective water withdrawal system



Re-engineered water intakes at Round Butte Dam protect native fish.



Other challenges included designing and constructing a steel-and-concrete platform in the middle of the lake that would selectively divert water from specific lake depths as well as divert migrating fish from the turbine intake. Using traditional 2D CAD file methods would have been complex and time consuming, and developing the engineering data and material quantities would have taken more effort. www.ch2m.com

To maintain the tight schedule, the contractor and steel fabricator came onboard at the start of the final design, which would not have been possible without using the 3D models and data generated for material lists. The decision to develop 3D models of the structure in place of 2D CAD files was made early in order to visualise the project and share it with the design team and fabricators. The project team used TriForma to track materials and quantities, and fabricators used the program to collect data and materials to construct specific components.

The software also helped track the weight of the project to maintain a design based on weight and determine the center of gravity for each structural component, important when designing floating structures. Because TriForma automatically generated the data in the database, extensive engineering calculations were eliminated. The 3D model became the sole source of design information that tied all of the aspects of the project together, from seeing the design take shape and driving the engineering data to maintaining the design and unifying the project team. Whenever a component change was required, the model was revised and the data extracted for quantities and materials. The components developed and extracted from the 3D model files drove the design cycle all the way to the construction process.

"The first thing CH2M HILL did on this project was help the client understand and communicate the various options being considered through 3D renderings via MicroStation models," said Wally Bennett, CH2M HILL project manager for the Round Butte Selective Water Withdrawal project. "We took advantage of 3D tools because of the very complex geometry and the need to visualise these structures. We would not have been able to implement such a geometrically complex solution without state-of-the-art 3D tools."

These tools helped the designers and consultants understand the issues, resolve conflicts, and design solutions while saving thousands of man-hours in the process. The software helped design, fabricate, and construct a structure that encourages fish populations to thrive, guaranteeing that fish

species will flourish for generations to come - resulting in a truly sustainable environment.

About the Contributor

With over 2,800 employees in over 50 offices worldwide and annual revenues surpassing \$450mn, Bentley Systems has invested over \$1bn in research, development and acquisitions since 1993. Nearly 90% of the Engineering News-Record Top 500 Design firms are Bentley subscribers and Daratech has ranked Bentley as the world's No 2 provider of software solutions to the architecture, engineering, construction and owner-operator market as well as No 2 in the GIS/geospatial market.

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