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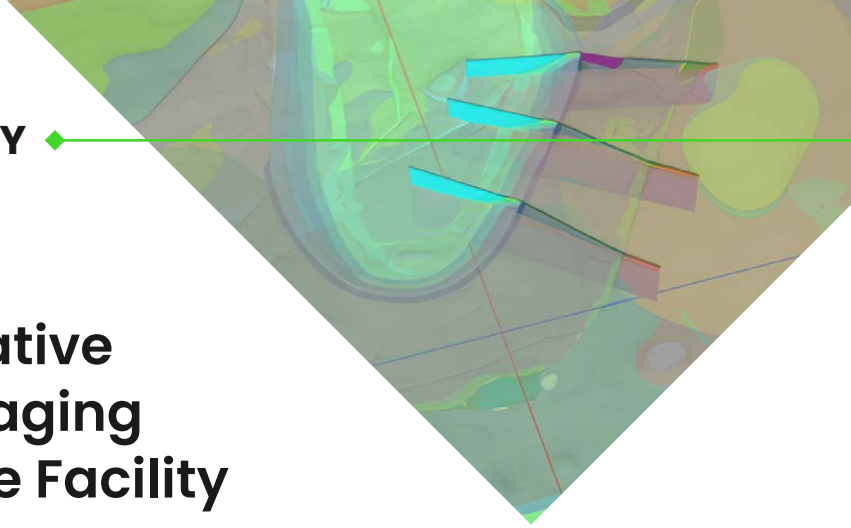
CASE STUDY



OceanaGold Pilots Innovative Digital Response for Managing the Waihi Tailings Storage Facility

Bentley and Seequent's Innovative Software Helped Create a Data-driven Digital Twin to Better Understand and Manage Safety

IMPROVING MINING STRATEGY AND MANAGEMENT

OceanaGold Corporation is an emerging multinational producer of gold, copper, and silver: minerals critical for renewable energy, transportation, life-saving medical equipment, and the technology that connects global communities. With over 24 years of sustainable operations in New Zealand, OceanaGold's Waihi operations received consent to develop the Martha Underground in early 2019, a project that extends the life of the mine and supports economic and social stability in the region.

Tailings storge facilities (TSFs) are typically designed, built, and operated using manual observational methods, data comparison, and reporting processes. However, OceanaGold wanted to find a way to better manage their Waihi Mine TSFs. Located on New Zealand's North Island, the town of about 5,800 people has a mining history that spans three centuries. OceanaGold's Waihi mine produces 50,000 to 60,000 ounces of gold per year, with an indicated resource of 2 million, and a life of mine of six to seven years, based on current resources.

Therefore, they initiated this crucial pilot project to validate the use of digital solutions. "Faced with vast amounts of siloed data, we sought to integrate data sets and develop a cloud-based digital twin to support collaborative, proactive monitoring of slope stability and to help ensure safety," said Andre Alipate, principal geotechnical engineer at OceanaGold.

Another challenge was the location. Set against the coastal, green foothills of the Hauraki District, Waihi's tailings impoundments are carefully engineered earthen structures, made up of several separate layers and designed to the same specifications as a water-retaining structure. "With dam safety at the heart of OceanaGold's project, having a fully integrated monitor, model, analysis workflow, with data versioning and auditing metadata, enables transparency at every stage of our project lifecycle," said Alipate.

EQUIPPING TSF MANAGEMENT TEAMS TO MAKE MORE INFORMED DECISIONS

Geoscience data underpins every major decision made within the mining lifecycle—from exploration and production to mining, processing and tailings storage, right through to the restoration of mining-related infrastructure at the end of its tenure. Therefore, to manage all this data, the team sought to create a digital twin of the site because they understood the value of supporting dynamic updates, which surpass static 3D models. A digital twin could enhance the way engineers visualize and interact with a TSF to better track changes, perform analyses, or inform decision-making.

"During the life of a mine, vast amounts of data are produced, which, if managed effectively, can enable new ways to solve increasingly complex problems. Having a digital workflow equips engineers and dam owners to easily condense, understand and analyze complex information, and uncover insights, in a very simple and accessible way," said Alipate. "As an example, after a significant rainfall event, we can closely monitor sensor readings from a section of our TSF to identify any changes, such as core pressure or groundwater levels in the structure, to manage risk or take action if needed."

Data-driven insights would also improve management and governance over the lifecycle of an asset to enable faster, more informed decision-making, while upholding safety and productivity. "Harnessing our existing technology to develop

PROJECT SUMMARY

ORGANIZATION
OceanaGold Corporation

SOLUTION
Subsurface Modeling and Analysis

LOCATION
Waihi, Waikato, New Zealand

PROJECT OBJECTIVES

- To create a digital twin of the Waihi Mine TSFs to better track changes, perform analyses, and inform decision-making.
- To improve management and governance over the lifecycle of an asset and uphold safety and productivity.

PROJECT PLAYBOOK
GeoStudio®, iTwin® IoT, Leapfrog®

FAST FACTS

- OceanaGold wanted to find a way to better manage their Waihi Mine TSFs, where the mine produces 50,000 to 60,000 ounces of gold per year.
- The team selected Seequent® Central™, Leapfrog Geo, GeoStudio, and Bentley's iTwin IoT to develop 3D geological and geotechnical models, and a digital twin within a dynamic, cloud-based environment.
- Going digital has helped OceanaGold to minimize field time, simplify complexity, identify changes, manage risk, make decisions, collaborate with the EoR and other stakeholders, and improve day-to-day operations, workflows, and efficiencies.

> "A big win for us simply comes down to housekeeping. We collaborate more, we're more organized, and way more efficient. And most importantly it's ensuring that we meet standards and uphold our responsibilities and social license to operate in this unique and beautiful part of the world."
>
> *– Andre Alipate, Principal Geotechnical Engineer, OceanaGold Corporation*

a digital twin powered by real-time IoT, provided a new set of workflows for TSF governance, that align our Waihi operations with various domestic and international management standards," said Alipate.

ENHANCING RESILIENCE AND REDUCING RISK WITH DIGITAL TWIN TECHNOLOGY

The team selected Seequent Central, Leapfrog Geo, GeoStudio, and Bentley's iTwin IoT to develop 3D geological and geotechnical models, and a digital twin within a dynamic, cloud-based environment, enabling digital monitoring and automated, consistent reporting.

"A digital twin evolves and grows over the life of a mine and becomes key for general and best practice management of tailings dams. A better understanding of how your TSF is being built, along with its performance and safety profiles, brings a shift in mindset from a reactive to more proactive approach," said Alipate.

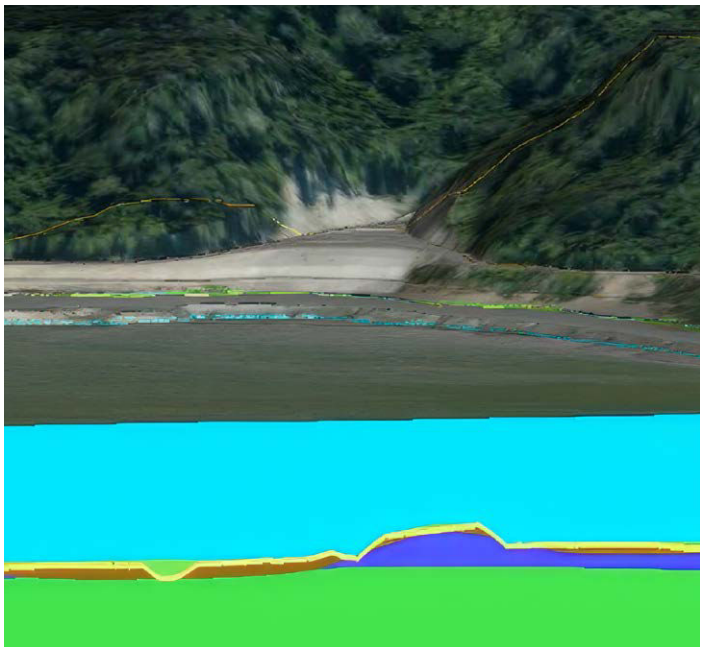
Seequent and Bentley's cloud-based, collaborative workflow integrates data with Leapfrog 3D modeling and GeoStudio analysis to provide real-time monitoring. "For our Waihi operation, this streamlined workflow is a technological leap bringing real-time connectivity of the structure and inner mechanics of our TSF, with the added ability to conduct workflows for improved safety," said Alipate.

Core to the digital solution for TSFs is Seequent Central, which serves as the knowledge base for the entire Waihi facility, housing all information succinctly, without duplication or multiple versions. "Historic and current models for the Engineer of Record (EoR) can be easily and quickly accessed to find key outcomes such as reporting and audits for slope stability, or to make comparisons following severe weather or seismic events," said Alipate. "If an auditor or regulator requires a certain document at a particular point in time, it can be accessed very quickly without having to chase our data or fish through files."

PROTECTING AN INDUSTRIOUS LOCAL COMMUNITY AND A UNIQUE ENVIRONMENT

Going digital has helped OceanaGold to minimize field time, simplify complexity, identify changes, manage risk, make decisions, collaborate with the EoR and other stakeholders, and improve day-to-day operations, workflows, and efficiencies. "A big win for us simply comes down to housekeeping. We collaborate more, we're more organized and way more efficient. And most importantly, it's ensuring that we meet standards and uphold our responsibilities and social license to operate in this unique and beautiful part of the world," said Alipate.

Renowned as a gold town, Waihi also hosts prosperous fruit and dairy industries in a landscape punctuated by pristine rivers, beautiful coastlines, and unique flora and fauna—all holding significant cultural relevance to local iwi [people]. This project was instrumental in preserving the beauty and way of life in the surrounding area. "Another positive impact of going digital is more responsive management and governance, enabling better resilience and ultimately minimizing environmental risks or impact to our local communities," said Alipate.



An integrated model with 2D cross sections spliced into the 3D model to show the Factor of Safety based on geotechnical analysis.