Northgate Minerals Corporation is a leading gold and copper producer with mining operations, development projects, and exploration properties in Canada and Australia. Northgate prides itself on its strong operating abilities and has gained a reputation as one of the finest operators in the business.

Northgate’s Stawell Gold mine is located alongside the town of Stawell, northwest of Ballarat in central Victoria, Australia. Stawell has a history of gold mining dating back to the mid-19th century Victorian gold rushes. It is an underground gold mine, with a long 26-year history, having produced its two millionth ounce in March 2010.

At Stawell, one of its main aims is to achieve operational excellence. A change in production profile requiring the processing of lower grade ore at higher throughput rates solicited the need for increased recovery condition in the milling environment.

**STAWELL GOLD IMPROVES RECOVERIES FOLLOWING FLOTATION CIRCUIT UPGRADE FROM OUTOTEC SERVICES**

**CHALLENGE**
- Turnkey installation of 2 x Outotec TankCell® 20s within highly challenging footprint

**SOLUTION**
- Outotec Services full turnkey installation
- 2 x TankCell 20s technology
- Strong partnership approach between Stawell Gold and Outotec Services teams

**BENEFITS**
- Project on time and on budget
- Increased recoveries – target 3.5%, actual 4.5%
- Payback in less than four months
- Easier operation
- Reduced maintenance costs
Flotation circuit
The original flotation circuit at Stawell consisted of a bank of eight mechanical trough cells in the rougher circuit, followed by two banks of two OK3 Outotec cells as cleaners. The feed rate to the cells was between 90–105 tph, at 50–55% solids. The overall flotation circuit was not performing at optimal rate due to entrainment problems in the rougher cells when feed density increased from 45% to 55% solids, typically at 105 tph. In anticipation of future production levels and as part of Stawell’s focus on operational excellence, it was decided to upgrade the flotation circuit at Stawell. Since site’s test work had shown that a 12.5 m³ conditioning tank was no longer required and could be removed, the new rougher cells were to be installed in that location.

Rougher circuit optimization
Following a site audit from Outotec Services, a 2 x TankCell 20 configuration was proposed to help optimize flotation operation. The old rougher circuit had all cells on the same level and was prone to back mixing, short circuiting, and flotation inefficiency. Additionally, the old circuit had to operate with a very shallow froth depth in order to get the froth concentrate to the collection launders.

Outotec Services proposed the existing rougher circuit of eight cells be replaced with two TankCell 20 cells. These cells were to be equipped with larger TankCell 30 mechanisms, which would allow operation at very high percent solids (50% and over). The TankCell design also allows a much deeper froth depth and better concentrate grade through optimized launder lip length and surface area. Outotec TankCells are renowned in the industry for their superior performance, ease of operation, and reduced power and air consumption.

Turnkey installation
Outotec Services were commissioned to handle the complete turnkey solution of the new rougher circuit, including design, supply, installation, and commissioning. This comprised all civil works, electrical, instrumentation, mechanical, ancillary equipment, piping, and structural steel work. Plant cut-in services were also included in the project scope, along with the supply of two blowers, which were to provide for the complete flotation circuit at Stawell. The schedule was demanding but achievable, with work to commence in February 2010 and complete in September 2010, just 30 weeks later.

Partnership approach
It was decided to adopt a partnering approach between Stawell and Outotec Services, as this collaborative method ensured open communication, with all parties having greater ownership of the project and its aims. The close teamwork between Stawell and Outotec Services ensured meticulous planning and enabled the site to be fully operational at all times. Pipework and electrical easement ducts, for example, were rerouted early in the project and helped ensure continuous site operation. Issues such as tie-in points for new cells and rerouting of pipework were also planned upfront and all disruptive work was completed during shutdowns, ensuring no interruption to production. The connections to the new TankCells were conducted during one of Stawell’s scheduled shutdowns.

Challenging footprint
The planned site for the new rougher circuit was challenging and on an extremely limited footprint. The site was adjacent to a gabion wall, close to the run-of-mine pad and also a reagents shed, which could not be moved. Additionally, existing process requirements at
Stawell required specific elevations for the new TankCells. Structural stability was the main issue when designing the tank support structure due to the height of the tanks and the limited footprint. Sufficient stiffness was required such that the operating frequencies of the TankCells would not interfere with the natural frequency of the tank support structure. Through FE modeling of the structure, section sizes and bracing orientations were optimized to produce the required stiffness.

Civil works
The civil work was also highly challenging. An underground slab was discovered during the excavation work of the site. In order to ascertain how to best proceed, core samples from various layers and testing were arranged by Outotec. Fortunately, it emerged that only part of slab needed to be removed for the TankCells’ support civils. Although this caused a delay to site work, all parties worked hard to quickly resolve the issue and stay within the project timelines.

On-time commissioning
The weather proved to be an additional hurdle as the site experienced the wettest seasonal weather in recorded history during the project. Simple tasks such as curing of the paintwork, which normally takes 24 hours, took days instead. Despite these challenges, the turnkey installation of the new rougher circuit, along with blowers for the complete flotation circuit, happened within deadlines. As all tie-in points had already been carefully planned upfront, commissioning was a seamless exercise.

On 13 September 2010, just 30 weeks from commencement, the new circuit, complete with TankCell technology, was commissioned and brought on line – on time and within budget.

State-of-the-art flotation technology
Designed to cope with projected increases in production and considerably more operator friendly than its predecessor, the new TankCell 20 cells have quickly proved their worth at site. The air demand for the old rougher cells, for example, was estimated at over 3,000 Am³/hr, whereas the estimated air demand on the TankCells is a maximum of 992 Am³/hr.

The Outotec FloatForce® rotor-stator mechanism, with its unique design, delivers enhanced flotation cell hydrodynamics and improved wear life and maintenance.

Results from site
Following the flotation upgrade at Stawell, the targeted recovery rate improvement was projected at 3.5%. The actual recovery rate, however, improved instantly by 4.5%. Payback was also impressive, occurring in less than four months.

“The projected payback was five and a half months, so it was a pleasant surprise when it happened so soon,” explains Jodie Hendy, senior metallurgist at Stawell. “Maintenance on the TankCells has also been minimal since the upgrade. Basically we check the cells during shutdowns but there has been no maintenance required in the nine months since commissioning. The TankCells have really delivered on their reputation. Basically they do exactly what they are supposed to do.”