CASE STUDY:
SELECTING THE DMS TECHNOLOGY FOR A PILBARA MANGANESE EXPANSION

In 2023, Element 25 was preparing to expand its Butcherbird manganese operation in Western Australia's southern Pilbara. VBKOM was appointed to design the dense medium separation (DMS) plant at the back end of the expanded flowsheet. That started with the most consequential choice: which separator to build the plant around.

CLIENT
Element 25 Limited (ASX: E25)

PROJECT
Butcherbird Manganese, Stage 2 expansion

LOCATION
Southern Pilbara, Western Australia

COMMODITY
Manganese

SCOPE
DMS technology trade-off and plant design

DESIGN BASIS
830 ktpa nominal manganese product

YEAR
2023, three months

SOLUTION
Technical Consulting: Process and Recover Value

THE DECISION IN BRIEF

THE CHALLENGE

Choose a dense medium separator for a variable manganese feed at expansion scale, on an operation already producing.

THE THINKING

Three technologies compared on the client's mass flows and splits, ore and plant characteristics, DMS specifications and manganese properties, then on yield, efficiency, capital and risk.

THE OUTCOME

The LARCODEMS led on yield, efficiency and capital. Element 25 chose the Heavy Medium Drum to limit implementation risk, an informed trade-off carried into design.

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THE CHALLENGE

A producing mine with a bigger ambition

Butcherbird sits about 130 km south of Newman in Western Australia's southern Pilbara. Its manganese occurs in shallow, flat-lying sedimentary deposits. These are large, near-surface and cheap to mine, but low in grade, so the ore must be upgraded before it can be sold.

Element 25 brought Stage 1 into production in 2021, trucking concentrate to Utah Point at Port Hedland for export. By early 2023 the company was planning Stage 2, an expansion towards one million tonnes a year. The operation had shown that clay-rich feed could limit throughput through the front-end comminution circuit.

The expansion flowsheet called for a redesigned front end and a new dense medium separation (DMS) circuit at the back end. Element 25 had already confirmed DMS as the preferred technology through a bulk trial at an operating DMS plant. The next question was which DMS technology.

That choice would fix the plant layout, its capital and operating cost, and the yield the operation could achieve for the life of the mine.

BUTCHERBIRD IN 2023

Location
Southern Pilbara, WA

Ore
Shallow, low-grade sedimentary manganese

Stage 1
365 ktpa, producing since 2021

Stage 2
~1 Mtpa, engineering optimisation

Export
Utah Point, Port Hedland

Longer term
Feedstock for battery-grade manganese

THE QUESTION

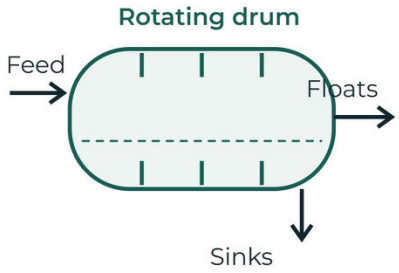
Which dense medium separator gives the best balance of **yield, efficiency, cost and risk** for this ore, at this scale, for this operating team?

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THE OPTIONS

Three proven ways to separate by density

Dense medium separation uses the density difference between manganese-bearing ore and lighter gangue. Feed is immersed in a fine ferrosilicon suspension set to a cut-point density. Lighter material floats and denser material sinks. The three separators apply that principle differently, and that changes what each one can do.

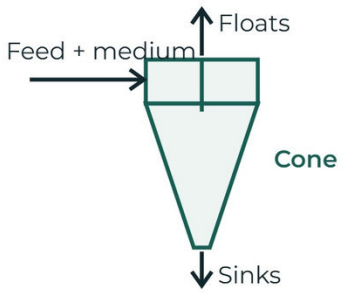


Heavy Medium Drum (HMD)

A slowly rotating drum holds a bath of medium. Floats overflow at the discharge end; internal lifters raise the sinks out onto a launder.

Strengths: treats a very wide, coarse size range (about 10 to 300 mm) in a single vessel. Tolerant of feed variation, high capacity, low maintenance.

Trade-off: separation relies on gravity alone, so it is generally less sharp than centrifugal units.

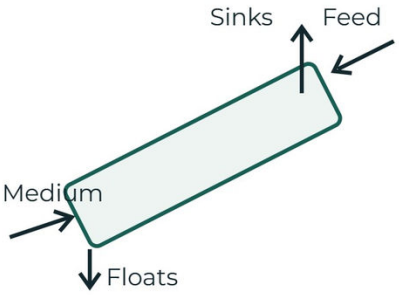


Dense Medium Cyclone (DMC)

Feed and medium enter tangentially under pressure. Centrifugal force drives the sinks to the wall and out of the spigot, while floats leave through the vortex finder.

Strengths: sharp separations, high throughput and a compact footprint for finer size fractions.

Trade-off: limited top size, so coarse feed needs a separate circuit. Higher medium pumping and wear.



Large Coal Dense Medium Separator (LARCODEMS)

A large-diameter cylindrical cyclone set at an incline. Feed enters by gravity at the upper end, and medium is pumped in tangentially near the lower end. Sinks leave at the top and floats at the bottom.

Strengths: treats a wide size range (up to about 100 mm) in one unit, with high separation efficiency and capacity.

Trade-off: developed for coal, so it has fewer reference installations in manganese.

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THE THINKING

Technical merit and operational reality, side by side

VBKOM ran a technology and plant-cost trade-off across all three separators. Equipment was sized from the client's mass flow rates and mass splits. It was then tested against the ore and plant characteristics, the DMS specification and the properties of the manganese. The dense medium cyclone was assessed, but the decision narrowed to two.

CRITERION	HMD	LARCODEMS
Product yield	–	**Advantage**
Separation efficiency	–	**Advantage**
Capital cost	–	**Advantage**
Tolerance of feed variation	**Advantage**	–
Size range in a single vessel	**~10–300 mm**	up to ~100 mm
Maintenance cost	**Advantage**	–
Operating familiarity and implementation risk	**Advantage**	–

THE DECISION

On paper, the LARCODEMS was the stronger technology. It offered better yield, higher separation efficiency and lower capital cost.

Element 25 chose the Heavy Medium Drum. Its team knew the unit, and an expansion is not the place to absorb the risk of new technology on a producing operation. The drum's robustness, low maintenance and very wide size range made that a sound, defensible choice.

VBKOM's role was to make the trade-off clear, so the client could weigh performance against risk with full sight of both.

We don't make the decision for our clients. **We strengthen what informs it.**

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THE OUTCOME

From technology choice to plant layout

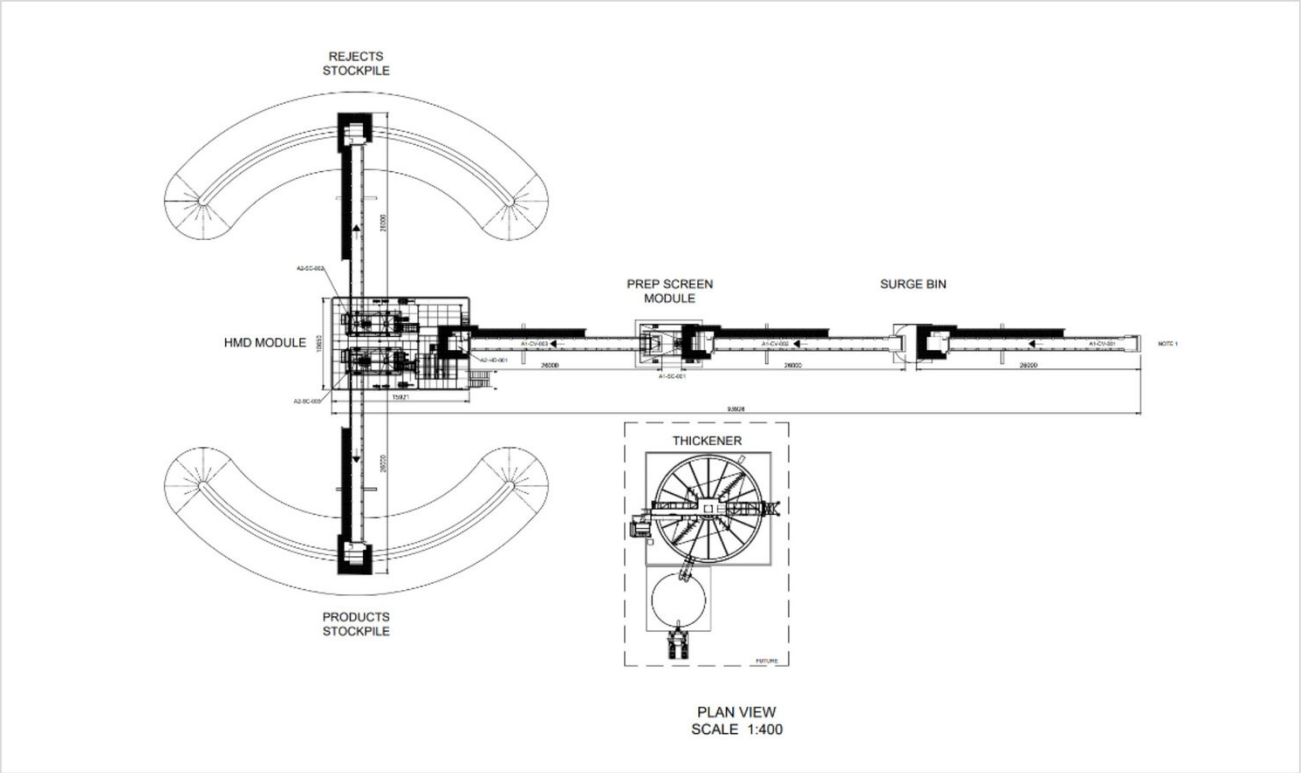


Fig 1. Block plan of the HMD-based DMS plant: surge bin, preparation screen module, HMD module, thickener, and product and reject stockpiles.

With the technology settled, VBKOM developed the layout of an HMD-based DMS plant around the client's design basis. Feed passes from a surge bin through a preparation screen module to the HMD module. Product and reject streams go to dedicated stockpiles, and a thickener recovers water for reuse.

The selection was carried into an updated design-throughput study and the detailed design phase. Element 25 went into it with a technology its team could run, and a clear view of what the alternative would have offered.

SINCE 2023: THE PROJECT ON THE PUBLIC RECORD

January 2024
Feasibility study for a 1.1 Mtpa expansion, with a DMS back end.

January 2025
Updated feasibility study released.

June 2025
A$50 million NAIF finance for the expansion.

Source: Element 25 public announcements.

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By unearthing opportunities, our solutions have the power to improve lives.

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RELATED CAPABILITY

Technical Consulting: Process and Recover Value

Beneficiation process design, debottlenecking studies, metallurgical plant audits, metal accounting, value-in-use and dynamic process simulation.

vbkom.com/solutions/process-and-recover-value

Let's talk about your next process decision.

ABOUT VBKOM

We bring together multidisciplinary engineering expertise, practical mining experience and commercial perspective to help our clients move from complexity to clarity.

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