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Integrated Feasibility Study: From Block Model to Investment Committee

How IMC Mining's integration program brought first-principles cost modelling, automated financial statements, and Bayesian risk analysis into a client-led feasibility study for a large-scale bulk commodity operation.

Many feasibility studies are assembled from disconnected workstreams. Geology delivers a block model. Mine planning produces a schedule. Cost engineers build spreadsheets. Finance builds a separate financial model. Each handoff introduces translation risk — assumptions get lost, version control breaks down, and the investment committee receives a document that nobody can fully reconcile.

On this project, the client managed the feasibility study and coordinated the various specialist inputs — geology, mine planning, process design, infrastructure, and tailings. IMC delivered the integration: connecting those workstreams into a single auditable pipeline through first-principles cost modelling, enterprise financial analysis, and Bayesian risk quantification. The goal was to ensure that every number in the financial model traces back to a physical source — a block in the geological model, a piece of equipment in the fleet, a rate in the cost tree — and that the investment committee receives a package where nothing is lost in translation.

The Integration Pipeline

The client's study team delivered the technical inputs across seven workstreams. IMC's integration program connected these layers into a single pipeline, ensuring every downstream calculation inherits directly from the layer above it — no spreadsheet handoffs, no version mismatches.

1	**Resource Estimation & Block Modelling** 3D geological block model built using geostatistical methods in unfolded stratigraphic space. JORC-compliant resource classification with full QA/QC traceability from drillhole to block grade.
2	**Mine Planning & Scheduling** Life-of-mine schedules with quarterly resolution, covering multiple pit areas over the full mine life. Progressive excavation sequencing with face positioning and equipment allocation tied directly to the block model.
3	**Beneficiation & Process Design** Pilot-plant validated process design with material characterisation from bulk sampling programs. Recovery models linked to ore quality attributes in the block model, not flat assumptions.
4	**Tailings & Fines Management** Innovative deposition strategies including in-pit storage from early in the mine life. 3D deposition modelling with full geotechnical characterisation — informing both design and cost.
5	**Infrastructure & Logistics** Haul road design, plant layout, and logistics networks. Product transport and related infrastructure sized to the production schedule, not a static throughput assumption.
6	**First-Principles Cost Modelling (MineCost)** IMC integration. WBS-driven cost tree covering mining, processing, tailings management, G&A, and capital. Every cost built from equipment fleets, activity rates, and consumption factors — not industry benchmarks. Linked directly to the mine schedule so costs vary with the plan, not in spite of it.
7	**Enterprise Financial Model (MiningIQ)** IMC integration. Full financial statements — income statement, balance sheet, cash flow — generated from the cost model outputs. Fiscal regime modelling (corporate tax, royalties), depreciation schedules, financing structures, and working capital. Automated Investment Committee reporting with Bayesian risk analysis.

Cost Modelling: Built from Equipment, Not Benchmarks

The cost model for this study has been built in MineCost — IMC's web-based cost engineering platform. It is not a spreadsheet with escalation rates applied to a single-year estimate. It is a structured, auditable model where every operating cost traces to a piece of equipment, a consumption rate, and an activity level derived from the mine schedule.

How It Works

WBS Cost Tree: The entire operation is structured as a Work Breakdown Structure hierarchy. Mining, processing, tailings management, camp and catering, site fuel, G&A — each is a branch of the tree with its own equipment fleets, labour rosters, and consumption inputs. This is not a flat list of line items; it is a structured cost architecture that mirrors how the operation actually runs.

Fleet and Activity Inputs: Each cost item is tied to physical inputs. Truck fleets have hourly operating costs, fuel consumption rates, and availability factors. Processing plant costs are driven by throughput rates and reagent consumption. Tailings management costs track deposition volumes from the schedule. Everything varies with the mine plan.

Revenue Inputs: Product pricing is handled through configurable price deck scenarios, not hardcoded assumptions. Exchange rates, commodity prices, and quality adjustments are maintained as structured inputs that flow through to the financial model.

Capital, Overheads and Administration: Capital expenditure is scheduled against project milestones, not lumped into a single pre-production figure. Sustaining capital, overheads, and administration costs are modelled separately with their own escalation profiles and timing.

What This Delivers

The output is not a single C1 cash cost. MineCost produces fully time-phased operating and capital cost profiles that feed directly into the financial model. When the mine plan changes — a pit sequence is reordered, a production rate is adjusted, an equipment fleet is resized — the cost model updates and the financial statements regenerate. There is no manual reconciliation step.

Corporate Alignment: From Cost Model to Board Paper

The step that most studies get wrong is the handoff from engineering to finance. The mine planner's schedule lives in one system. The cost model lives in a spreadsheet. The financial model is yet another spreadsheet, often maintained by a different team. By the time the investment committee sees the numbers, nobody can trace a line item back to its physical source.

This project eliminated that gap entirely. The enterprise financial model in MiningIQ receives its inputs directly from MineCost. There is no export-import cycle. There is no manual data entry. The financial statements are generated from the same data that produced the cost estimates, which were produced from the same schedule that was optimised against the block model.

Full Financial Statements

MiningIQ generates complete, period-by-period financial statements across the life of mine:

- Income Statement — revenue, cost of sales (mining, processing, tailings, G&A, fuel, camp), gross profit, operating expenses, depreciation, and amortisation
- Balance Sheet — fixed assets, depreciation schedules, working capital, debt, and equity
- Cash Flow Statement — unlevered free cash flow, cumulative cash position, and funding requirements
- Schedule Data — direct linkage to the mine schedule for production, grade, and material movement by period

Fiscal Regime & Government Take

The model is configured for the applicable jurisdiction with corporate income tax, state royalties, and the relevant royalty regime. The effective government take is calculated across the life of mine, giving the investment committee visibility into the true post-tax economics — not just pre-tax NPV.

Financing & Debt Service

Peak funding requirements, debt service coverage ratios, interest costs, and dividend capacity are all modelled within the platform. The model identifies when debt is fully repaid, what the minimum DSCR is, and when the first dividend can be distributed. This is not a bolt-on analysis — it is integral to the financial model and updates whenever the underlying cost model changes.

Scenario Comparison

Multiple scenarios (base case, downside, upside) can be run and compared side by side. Each scenario inherits the full cost model and schedule — the only differences are the assumptions being tested (commodity price, exchange rate, capital cost, operating cost). This allows the investment committee to see the range of outcomes from a single, consistent model rather than from competing spreadsheets.

Bayesian Risk Analysis: Not Monte Carlo

Traditional feasibility studies present a single-point NPV and perhaps a basic sensitivity table. More sophisticated studies run Monte Carlo simulation, which treats every input as an independent random variable and produces a probability distribution that often overstates uncertainty because it ignores the correlations that mining engineers know exist.

This study uses Bayesian risk analysis. The distinction matters.

How the Bayesian Approach Differs

Prior knowledge is incorporated: The Bayesian framework combines prior knowledge from geology, metallurgy, operating history, and expert judgement with the available evidence to produce a distribution of outcomes. It does not treat every variable as equally uncertain.

Correlations are modelled naturally: In mining, grade and recovery are correlated. Price and exchange rate move together. Cost and production volume are linked. The Bayesian approach represents these correlations explicitly rather than assuming independence, which means the tails of the distribution reflect realistic worst-case and best-case scenarios rather than physically impossible combinations.

Probabilities are refined, not restarted: As new data arrives — additional drilling, updated pricing, revised cost estimates — the Bayesian model updates its probabilities rather than being rebuilt from scratch. This makes it a living risk model, not a one-time analysis.

What the Investment Committee Sees

The automated IC report generated by MiningIQ presents the risk analysis alongside the deterministic results:

- Decision Summary — NPV, IRR, peak funding, payback, C1 cash cost, AISC, AIC, and margin at a glance
- Tornado Chart — which key drivers (commodity price, exchange rate, capital cost, operating cost) have the largest impact on NPV
- NPV Exceedance Curve — probability that the project exceeds a given NPV value, with the base case highlighted
- Price vs Opex Heatmap — NPV under combinations of price and operating cost flexes, showing the project's resilience to simultaneous adverse movements
- Risk Summary — P10, P50, P70, and P90 NPV values with probability of negative NPV
- Cash Flow Profile & Funding Chart — period-by-period free cash flow with cumulative position, plus net debt trajectory over the mine life

The narrative section of the IC report is generated automatically from the model outputs — key points, value drivers, funding requirements, and risk highlights are composed from the calculated results, not written by hand. The report can be exported as a PDF or reviewed in-browser for immediate distribution.

Key Technical Highlights

Geostatistical Modelling	Ordinary kriging in unfolded stratigraphic space with JORC-compliant resource classification and peer-reviewed density estimation methodology.
Mine Scheduling	Quarterly-resolution life-of-mine schedules across multiple pit areas, with face positioning and progressive excavation sequencing tied to equipment allocation.
Pilot Plant Validation	Process design validated through independent pilot plant testing, confirming beneficiation recoveries and product quality specifications.
3D Tailings Modelling	Advanced deposition modelling for innovative in-pit and broad-area storage strategies, with full geotechnical characterisation.
WBS Cost Architecture	22-category work breakdown structure with equipment-level cost build-up, roster-based labour, and schedule-driven activity rates.
Automated Financial Statements	Full income statement, balance sheet, and cash flow generated directly from cost model outputs with no manual intervention.
Bayesian Risk Engine	2,000-sample Bayesian analysis incorporating correlations between key drivers, producing calibrated P10–P90 NPV distributions.
Automated IC Report	Board-ready investment committee report generated from model outputs with narrative, charts, sensitivities, and risk analysis.

The Difference: One Model, One Truth

The value of IMC's integration program is not in replacing any single workstream. The client's team delivered the geology, mine planning, process design, and infrastructure. What IMC brought was the connective tissue — a single, auditable pipeline where changing one assumption propagates through every downstream calculation automatically, from cost model to financial statements to investment committee report.

When the investment committee asks what happens if the commodity price drops 10%, the answer is not a back-of-envelope calculation. It is a fully recalculated financial model with updated income statements, cash flows, debt coverage ratios, and risk distributions — available in minutes, not weeks.

This is what IMC Mining's integration program delivers: the audit trail and analytical rigour that turns a collection of study inputs into a decision-ready package.