PRESENTATION TO

"A Banker's Perspective on Feasibility": Focus on Production Ramp-up and Sustaining Capital

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Agenda

1. **Mining Project: Pre-Construction work to determine a project's feasibility**

2. **The financial impact of Mine and Plant Production Ramp-up**

3. **The financial impact of Sustaining Capital estimates**

Elements of a Viable Mining Project

Foundations:

- Orebody
- Mining Plan
- Ore Reserves
- Social License to Construct / Operate
- Environmental planning / impact mitigation
- Successful stakeholder engagement
- Successful studies → PEA → Pre-Feas → Feasibility

Leads to:

- Financing & Construction Decision by Mngt/Board/Investors

Financing and Investor Decisions often based on some key "high focus" items

- Total Metal ("How many ounces/lbs in the deposit")
- Construction Cost ("How much to develop")
- Production Rate ("How much per year")
- Economic Returns ("What IRR or NPV")
- Cash Cost ("What is competitive cost position")
- What are the risks ("Protests/Interruptions/Govts")

These are the key questions being asked, and Feasibility Studies spend much effort to answer them.

BUT, Are We Missing Anything Material?

How has project performance been recently?

- A lot of recent discussion on some areas of project performance– cost overruns, project construction delays, projects cancelled, etc.…

- Two other areas where mine projects have not performed well are:

1. Project Ramp-up: Mine and/or Processing Plant
2. Sustaining Capital Projections

- BUT are these problems MATERIAL? Does it Matter?

Ramp-up Period – the Basics:

Ramp-up occurs from the point the processing plant first takes feedstock until it is operating near steady-state with normal production crews.

Processing plants and mines are:

- Complex systems with many interdependencies
- Require a range of engineering fields to integrate (chemical, mechanical, electrical, mining, environmental, etc.)
- Impacted by decisions made in Feasibility studies (often based on limited information).
- Require considerable operator skill and sophistication.

Not like turning on a switch, or opening a highway…

→ Difficulty in predicting ramp-up period (and costs)

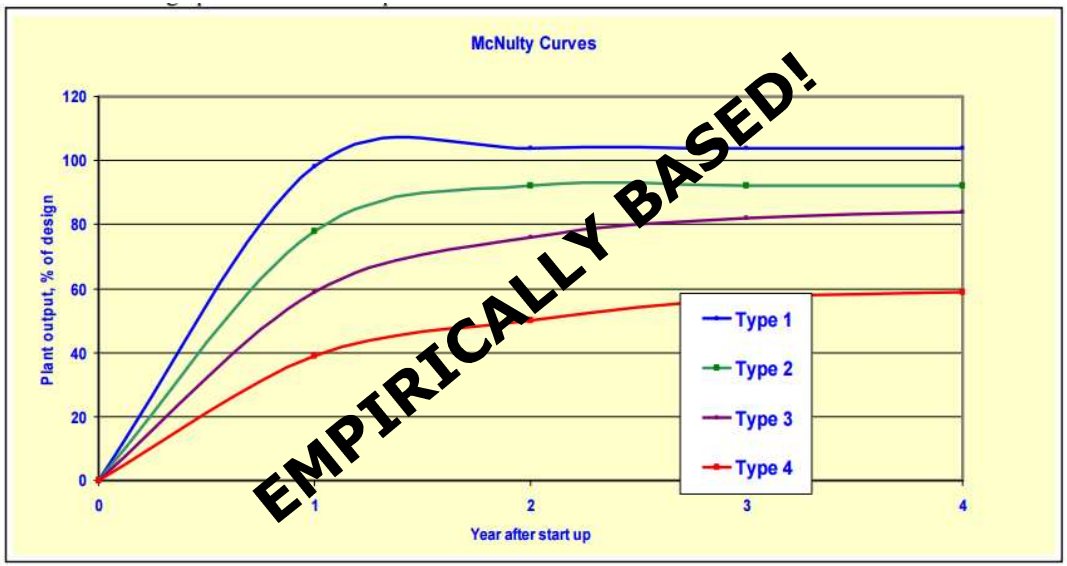
McNulty Curves: One method to address the difficulty of predicting ramp-up performance. Analysis of a series of actual plant ramp-up performance resulting in grouping into 4 categories:

Type 1 – Mature technology, standard equipment and/or thorough testing

Type 2 – Prototype, first licensee, first-of-a-kind, insufficient front-end-loading

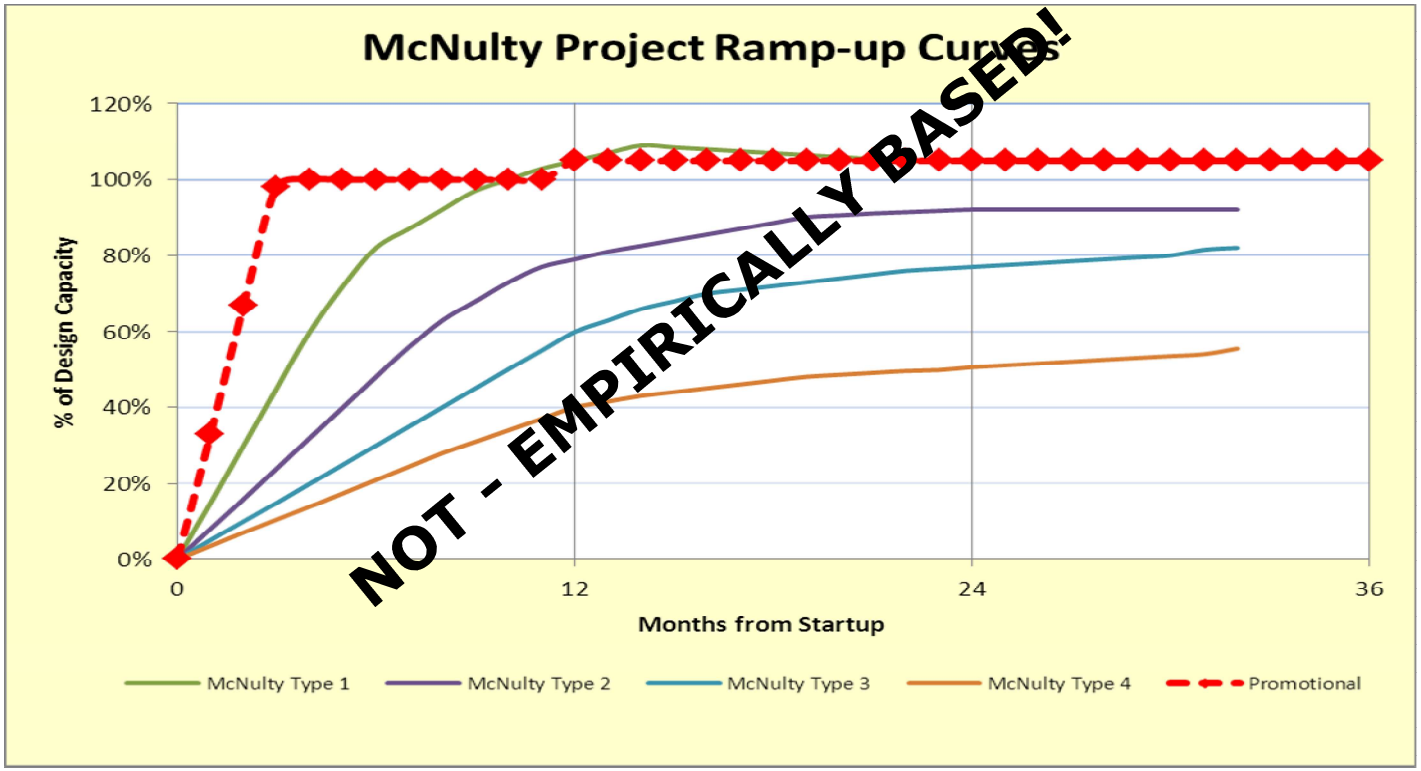
Type 3 – Limited testing, poor characterization of feed, 'fast track'

Type 4 – Little continuous testing, too much 'value engineering', very complex flowsheet, poor fundamental knowledge, poor direction from corporate management, etc.



There is also a fifth curve Type (growing in popularity) – seen a lot around Bay St.:

- **The PROMOTER's CURVE**



Impacts of an Extended Production Ramp-up:

- **Additional capex to fix the issues**
- **Unanticipated opex while fully staffing the operation**
- **Delayed Revenues**

Leads to:

- **Liquidity shortages**
- **Customer doubt**
- **Frustrated stakeholders and shareholders**

Key Question – Does Ramp-up Matter?

Let's consider a simple mining project as follows:

- *Commodity* *Gold Mine*
- *Type* *Greenfield Open Pit*
- *Processing Method* *Heap Leach*
- *Mine Life* *10 Years*
- *Payable Gold* *1.08 million ounces*
- *Production* *110 koz per year**
- *Cash Cost* *$598/oz**
- *Planned Construction Cost (US$mm)* *$200*
- *Planned Period to First Production (months)* *24*

- *First 5 years

Mining Project as per Feasibility Study

Ramp-up

Generic Heap Leach Gold Mine				2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Price		Gold	$/oz	1150	1150	1150	1150	1150	1150	1150	1150	1150	1150	1150	1150	1150
Production																
Rate (tpd)	50,000	Open Pit Ore Mined	(000's tpd)			13,505	19,102	19,163	19,163	19,163	19,163	19,163	19,163	19,163	19,163	-
		Waste Mined	(000's tpd)		18,250	36,500	38,203	38,325	38,325	38,325	38,325	38,325	38,325	38,325	38,325	-
		Strip Ratio		--	--	2.70x	2.00x	2.00x	2.00x	2.00x	2.00x	2.00x	2.00x	2.00x	2.00x	--
		Ore Placed on Heap Leach	(000's tpd)	--	--	13,505	19,102	19,163	19,163	19,163	19,163	19,163	19,163	19,163	19,163	-
		Head Grade Au	(g/t)	--	--	0.75	0.74	0.73	0.72	0.71	0.70	0.69	0.68	0.67	0.66	0.00
		Au Recovery				70%	70%	70%	70%	70%	70%	70%	70%	70%	70%	30%
		Total Payable Gold	(000's oz)			83	116	115	113	112	110	109	107.0	105.5	103.9	0.0
Revenue (US$ millions)																
		Metal Sales	(US$ mm)	0	0	72	134	132	130	129	127	125	123	121	119	24
Operation Costs (US$ millions)																
$/t	1.75	Mining Cost	(US$ mm)	0	12	32	37	37	37	37	37	37	37	37	37	0
$/t	2.25	Processing Cost	(US$ mm)	0	4	15	15	15	15	15	15	15	15	15	15	7
		Site G&A	(US$ mm)	0	5	5	5	5	5	5	5	5	5	5	5	5
		Cash Taxes	(US$ mm)	0	0	0	5	12	13	13	13	13	13	13	12	1
		Total Operating Cash Costs	(US$ mm)	0	20	52	61	69	69	69	69	69	69	69	69	13
Capital Costs (US$ millions)																
		Construction Capex	(US$ mm)	50	125	25	-	-	-	-	-	-	-	-	-	-
		Sustaining Capex	(US$ mm)	-	-	5	5	2	2	2	2	2	2	2	2	-
		Reclamation and Closure	(US$ mm)	-	-	-	-	-	-	-	-	-	-	-	-	15
		Total Capital Expenditures	(US$ mm)	50	125	30	5	2	2	2	2	2	2	2	2	15
After-Tax Unlevered Cashflow																
		Cashflow	(US$ mm)	-50	-145	-10	67	61	59	57	55	53	52	50	48	-4

Mining Project with Capex Overrun
Conduct Sensitivity on Project Capex → +25% , +$50mm

Generic Heap Leach Gold Mine				2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Price		Gold	$/oz	1150	1150	1150	1150	1150	1150	1150	1150	1150	1150	1150	1150	1150
Production																
Rate (tpd)	50,000	Open Pit Ore Mined	(000's tpd)			13,505	19,102	19,163	19,163	19,163	19,163	19,163	19,163	19,163	19,163	-
		Waste Mined	(000's tpd)		18,250	36,500	38,203	38,325	38,325	38,325	38,325	38,325	38,325	38,325	38,325	-
		Strip Ratio		--	--	2.70x	2.00x	2.00x	2.00x	2.00x	2.00x	2.00x	2.00x	2.00x	2.00x	--
		Ore Placed on Heap Leach	(000's tpd)	--	--	13,505	19,102	19,163	19,163	19,163	19,163	19,163	19,163	19,163	19,163	-
		Head Grade Au	(g/t)	--	--	0.75	0.74	0.73	0.72	0.71	0.70	0.69	0.68	0.67	0.66	0.00
		Au Recovery				70%	70%	70%	70%	70%	70%	70%	70%	70%	70%	30%
		Total Payable Gold	(000's oz)			83	116	115	113	112	110	109	107.0	105.5	103.9	0.0
Revenue (US$ millions)																
		Metal Sales	(US$ mm)	0	0	72	134	132	130	129	127	125	123	121	119	24
Operation Costs (US$ millions)																
$/t	1.75	Mining Cost	(US$ mm)	0	12	32	37	37	37	37	37	37	37	37	37	0
$/t	2.25	Processing Cost	(US$ mm)	0	4	15	15	15	15	15	15	15	15	15	15	7
		Site G&A	(US$ mm)	0	5	5	5	5	5	5	5	5	5	5	5	5
		Cash Taxes	(US$ mm)	0	0	0	2	11	12	12	12	12	12	12	12	0
		Total Operating Cash Costs	(US$ mm)	0	20	52	58	68	68	69	69	69	69	69	69	13
Capital Costs (US$ millions)																
		Construction Capex	(US$ mm)	63	156	31	-	-	-	-	-	-	-	-	-	-
		Sustaining Capex	(US$ mm)	-	-	5	5	2	2	2	2	2	2	2	2	-
		Reclamation and Closure	(US$ mm)	-	-	-	-	-	-	-	-	-	-	-	-	15
		Total Capital Expenditures	(US$ mm)	63	156	36	5	2	2	2	2	2	2	2	2	15
After-Tax Unlevered Cashflow																
		Cashflow	(US$ mm)	-63	-177	-16	70	62	60	58	56	54	52	50	49	-4

Compare Results:

	Base	High Capex	Var
Construction Cost	200	250	50
Construction Period to First Production	24	24	0
NPV	$ 104	$ 68	$ (36)
IRR	18%	14%	-5%
Total Cash Required to Positive Cashflows	$ 223	$ 269	$ 46

- **These results may spur some risk mitigation measures**
- **Sensitivities also typically produced for price, opex, fx, etc.**
- **How often for Ramp-up?**

Mining Project with Slower Ramp-up Sensitivity

- **Change Ramp-up profile from McNulty Type 1 to McNulty Type 2**
- **Add $10mm (5%) in capex to address problems in the ramp-up**

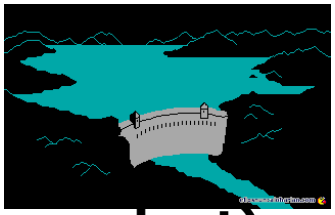
Generic Heap Leach Gold Mine				2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Price		Gold	$/oz	1150	1150	1150	1150	1150	1150	1150	1150	1150	1150	1150	1150
Production															
Rate (tpd)	50,000	Open Pit Ore Mined	(000's tpd)			8,882	16,045	16,790	16,790	16,790	16,790	16,790	16,790	16,790	16,790
		Waste Mined	(000's tpd)		18,250	36,500	32,090	33,580	33,580	33,580	33,580	33,580	33,580	33,580	33,580
		Strip Ratio		--	--	4.11x	2.00x	2.00x	2.00x	2.00x	2.00x	2.00x	2.00x	2.00x	2.00x
		Ore Placed on Heap Leach	(000's tpd)	--	--	8,882	16,045	16,790	16,790	16,790	16,790	16,790	16,790	16,790	16,790
		Head Grade Au	(g/t)	--	--	0.75	0.74	0.73	0.72	0.71	0.70	0.69	0.68	0.67	0.66
		Au Recovery				70%	70%	70%	70%	70%	70%	70%	70%	70%	70%
		Total Payable Gold	(000's oz)			55	98	101	99	98	97	95	93.8	92.4	91.0
Revenue (US$ millions)															
		Metal Sales	(US$ mm)	0	0	47	112	116	114	113	111	109	108	106	105
Operation Costs (US$ millions)															
$/t	1.75	Mining Cost	(US$ mm)	0	12	29	31	32	32	32	32	32	32	32	32
$/t	2.25	Processing Cost	(US$ mm)	0	4	15	15	15	15	15	15	15	15	15	15
		Site G&A	(US$ mm)	0	5	5	5	5	5	5	5	5	5	5	5
		Cash Taxes	(US$ mm)	0	0	0	0	5	10	10	10	10	10	10	10
		Total Operating Cash Costs	(US$ mm)	0	20	49	51	57	62	62	62	62	62	62	62
Capital Costs (US$ millions)															
		Construction Capex	(US$ mm)	53	131	26	-	-	-	-	-	-	-	-	-
		Sustaining Capex	(US$ mm)	-	-	5	5	2	2	2	2	2	2	2	2
		Reclamation and Closure	(US$ mm)	-	-	-	-	-	-	-	-	-	-	-	-
		Total Capital Expenditures	(US$ mm)	53	131	31	5	2	2	2	2	2	2	2	2
After-Tax Unlevered Cashflow															
		Cashflow	(US$ mm)	-53	-152	-33	56	57	50	49	47	45	44	42	41

Compare Results for Slow Ramp Up Sensitivity:

	Base	High Capex	Slow Ramp-up	Var
Construction Cost	200	250	210	10
Construction Period to First Production	24	24	24	0
Ramp Up Curve	McNulty Type 1	McNulty Type 1	McNulty Type 2	
NPV	$ 104	$ 68	$ 48	$ (56)
IRR	18%	14%	12%	-6%
Total Cash Required to Positive Cashflows	$ 223	$ 269	$ 258	$ 35

- **Lower NPV and IRR than High Capex Case**
- **Almost as much expenditure until breakeven**
- **Is a slow ramp-up Material?**

Turn our attention to another of the "Forgotten Components" in Feasibility Studies – Sustaining Capital



What is in Sustaining Capital?

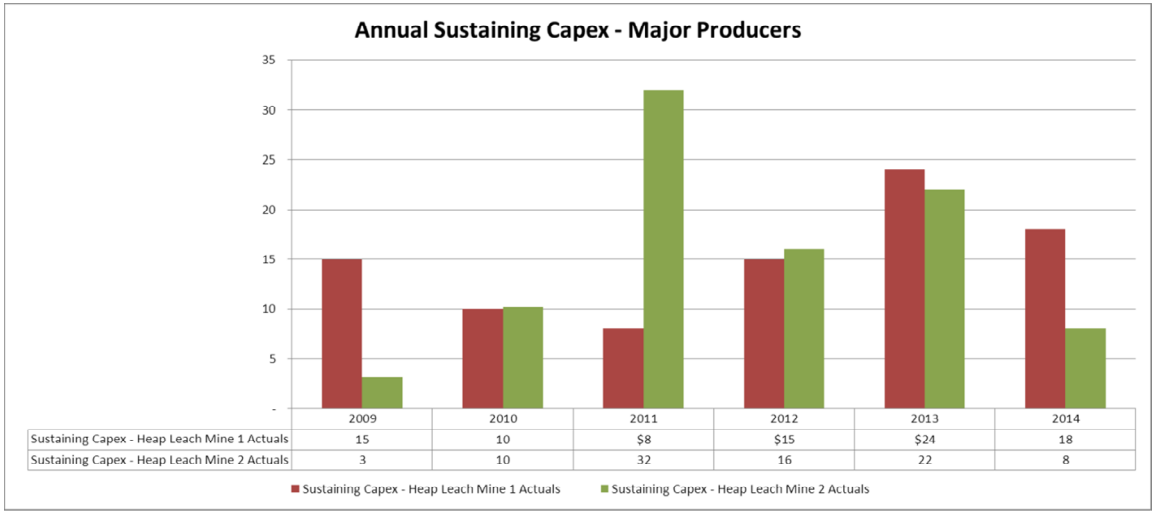
- **Equipment Replacement**
- **Some Open Pit Stripping (accounting dependent)**
- **Underground Mine Access Drifts and Infrastructure**
- **Enhancement Projects**
- **Tailings expansion**
- **Site exploration drilling**

How many of the above items are detailed in the Feasibility Study?

Sustaining Capex for our Generic Gold Heap Leach Mine (as per FS Model):

Generic Heap Leach Gold Mine				2016	2017	2018	2019	2020	2021	2022	2023
Capital Costs (US$ millions)											
		Construction Capex	(US$ mm)	50	125	25	-	-	-	-	-
		Sustaining Capex	(US$ mm)	-	-	5	5	2	2	2	2
		Reclamation and Closure	(US$ mm)	-	-	-	-	-	-	-	-
		Total Capital Expenditures	(US$ mm)	50	125	30	5	2	2	2	2

Actual Sustaining Capex at two operating Gold Heap Leach Mines



Averages:

Feas. Study: $2.5mm

Mine #1: $17mm

Mine #2: 15mm

Return to Test Cases considered above and sensitive Sustaining Capex – Add $11 million per annum

Generic Heap Leach Gold Mine				2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Price		Gold	$/oz	1150	1150	1150	1150	1150	1150	1150	1150	1150	1150	1150	1150	1150
		Days		365	365	365	365	365	365	365	365	365	365	365	365	365
Production																
Rate (tpd)	50,000	Open Pit Ore Mined	(000's tpd)			13,505	19,102	19,163	19,163	19,163	19,163	19,163	19,163	19,163	19,163	-
		Waste Mined	(000's tpd)		18,250	36,500	38,203	38,325	38,325	38,325	38,325	38,325	38,325	38,325	38,325	-
		Strip Ratio		--	--	2.70x	2.00x	2.00x	2.00x	2.00x	2.00x	2.00x	2.00x	2.00x	2.00x	--
		Ore Placed on Heap Leach	(000's tpd)	--	--	13,505	19,102	19,163	19,163	19,163	19,163	19,163	19,163	19,163	19,163	-
		Head Grade Au	(g/t)	--	--	0.75	0.74	0.73	0.72	0.71	0.70	0.69	0.68	0.67	0.66	0.00
		Au Recovery				70%	70%	70%	70%	70%	70%	70%	70%	70%	70%	30%
		Total Payable Gold	(000's oz)			83	116	115	113	112	110	109	107.0	105.5	103.9	0.0
Revenue (US$ millions)																
		Metal Sales	(US$ mm)	0	0	72	134	132	130	129	127	125	123	121	119	24
Operation Costs (US$ millions)																
$/t	1.75	Mining Cost	(US$ mm)	0	12	32	37	37	37	37	37	37	37	37	37	0
$/t	2.25	Processing Cost	(US$ mm)	0	4	15	15	15	15	15	15	15	15	15	15	7
		Site G&A	(US$ mm)	0	5	5	5	5	5	5	5	5	5	5	5	5
		Cash Taxes	(US$ mm)	0	0	0	4	12	12	12	11	11	11	11	11	0
		Change in Working Capital	(US$ mm)									-	-	-	-	-
		Total Operating Cash Costs	(US$ mm)	0	20	52	61	68	68	68	68	68	68	68	67	12
Capital Costs (US$ millions)																
		Construction Capex	(US$ mm)	50	125	25	-	-	-	-	-	-	-	-	-	-
		Sustaining Capex	(US$ mm)	-	-	16	16	13	13	13	13	13	13	13	13	-
		Reclamation and Closure	(US$ mm)	-	-	-	-	-	-	-	-	-	-	-	-	15
		Total Capital Expenditures	(US$ mm)	50	125	41	16	13	13	13	13	13	13	13	13	15
After-Tax Unlevered Cashflow																
		Cashflow	(US$ mm)	-50	-145	-21	57	51	49	47	46	44	42	41	39	-4

Compare Results for Higher Sustaining Capex:

	Base	High Capex	Slow Ramp-up	High Sustaining
Construction Cost	200	250	210	200
Construction Period to First Production	24	24	24	24
Ramp Up Curve	McNulty Type 1	McNulty Type 1	McNulty Type 2	McNulty Type 1
NPV	$ 104	$ 68	$ 48	$ 45
IRR	18%	14%	12%	13%
Total Cash Required to Positive Cashflows	$ 223	$ 269	$ 258	$ 226
Average AISC	798			890
Minimum AISC	721			813
Maximum AISC	835			966

- **NPV is lower than the High Capex Case and similar to Slow Ramp-up Case!**
- **AISC rises substantially**
- **Is accurate Sustaining Capex material?**

- **A mining project's Ramp-up performance and Sustaining Capital cost can be as important to Investor value and financial returns as the initial construction Capital cost estimate.**

- **These areas have traditionally received less focus in Feasibility Studies and are less commonly sensitized for impact to the project.**

- **CHALLENGE: Try these sensitivities on your next Feasibility Study (if you haven't already)**