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7th International TOCPA Conference
23-24 May 2013, South Africa

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SOUTHERN AFRICA
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Getting the RSA Mining Industry Unstuck

Rudy Phillis



Name: Dr **Rudy Phillis** (Ph. D. Pr. Eng.)

Brief bio:

Rudy has 13 years TOC experience. His Jonah Programme resulted in a business plan which served him well for a decade as a TOC Entrepreneur, servicing the RSA Mining Industry. Services included; Mining Construction & Management Consulting within the Gold, Platinum & Coal sectors. Rudy built capacity of some 350 TOC staff at various levels of competency; facilitated through the adoption of TOC as its single, overall management philosophy.

Currently, Rudy works as a Mine Manager of a deep level (+2000m), underground gold mine, with a compliment of some 3000 employees.

Rudy has PhD based on TOC, Mining Engineering and Postmodernism. He is a TOC Implementation Expert and continues to working on his aspiration of making "TOC the Main [Mining] Way".



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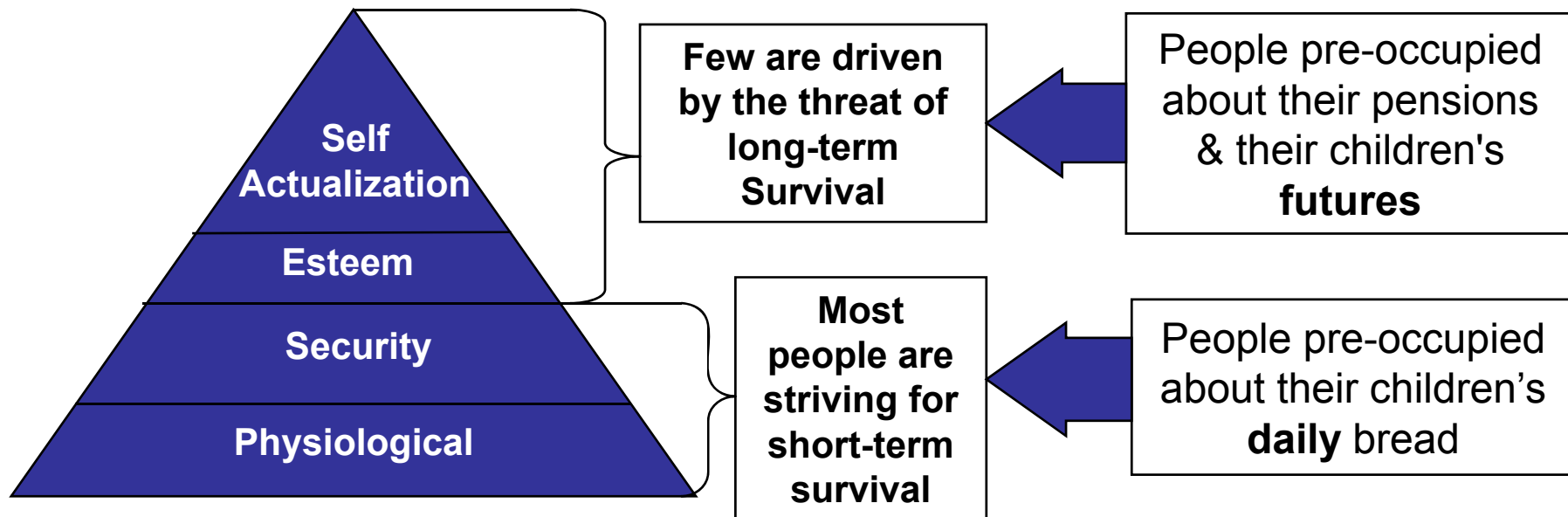
Postmodern RSA Mining Industry

- What to change:
 - Undervalued share price
 - Mining is a complex business
 - Miners understand it best, so Investors trust their promises
 - Miners underachieve their promise, more often than not.
 - Highly volatile
 - Net cash cost
 - Uncertain job security & satisfaction
 - Comfort Zones
 - Inertia
 - Technical complexity vs. Dynamic complexity



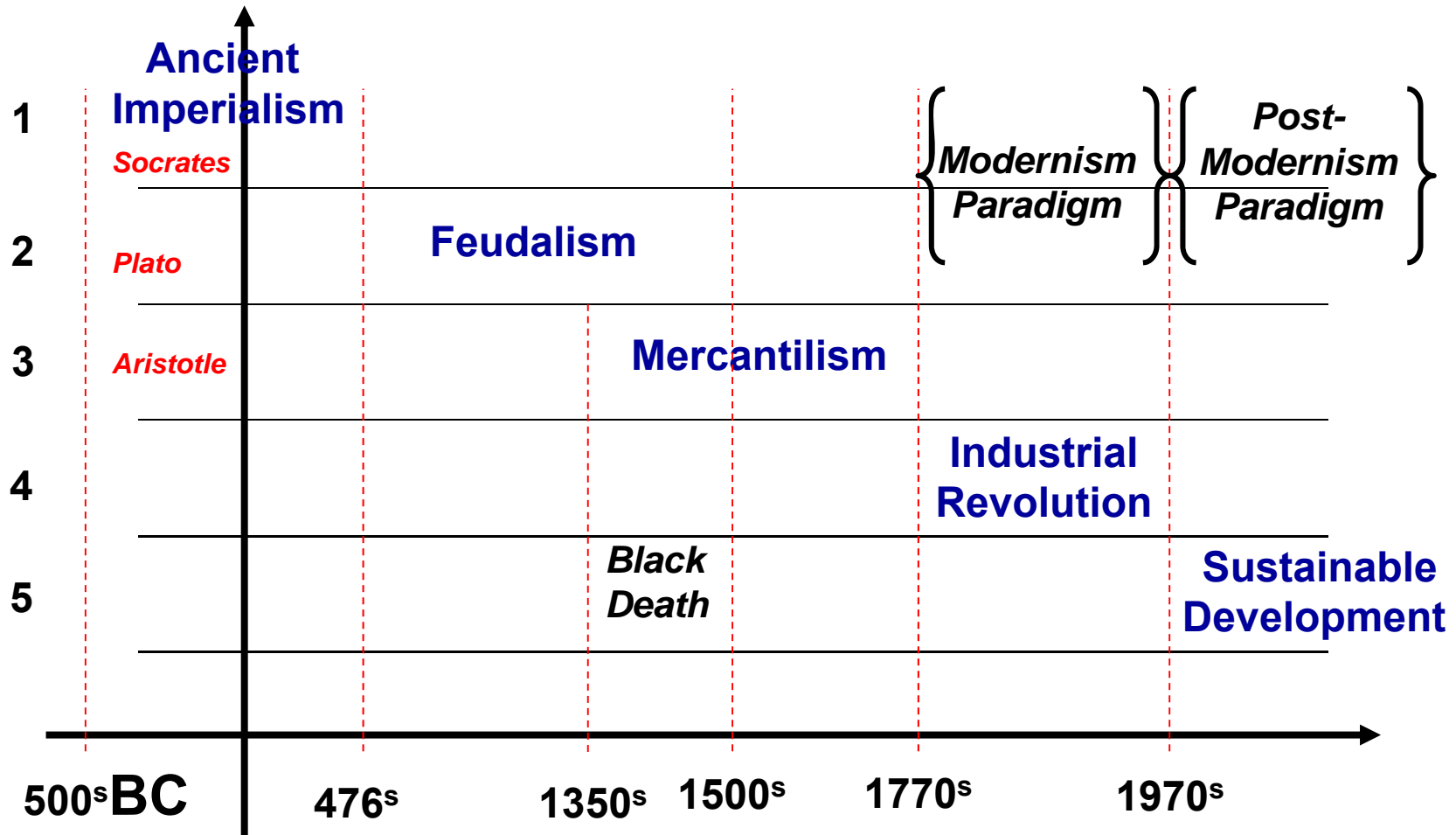
RSA – Developing / Emerging Economy

- A legacy – “two juxtaposed worlds poverty & affluence”





Postmodernism



Not to scale



Leadership - Paradigm Shift

Modernism

- Stable
- Closed
- Determined
- Predictable / measurable / controllable

Postmodernism

- Unstable / chaos
- Open (holistic)
Systems thinking
- Relative / randomness / indeterminacy
- Complex



Academics - Paradigm Shift

Quantitative

- **Positivistic** (quality or state characterized by certainty and dogmatic assertiveness; excluding metaphysical consideration)
- **Quantify** (Express as a number or measure or quantity)
 - Single reality
- **Remote, inferential, empirical**
 - Abstract, study indirectly
- **Scientific Law** (Theory, mathematically verified - Gravity)

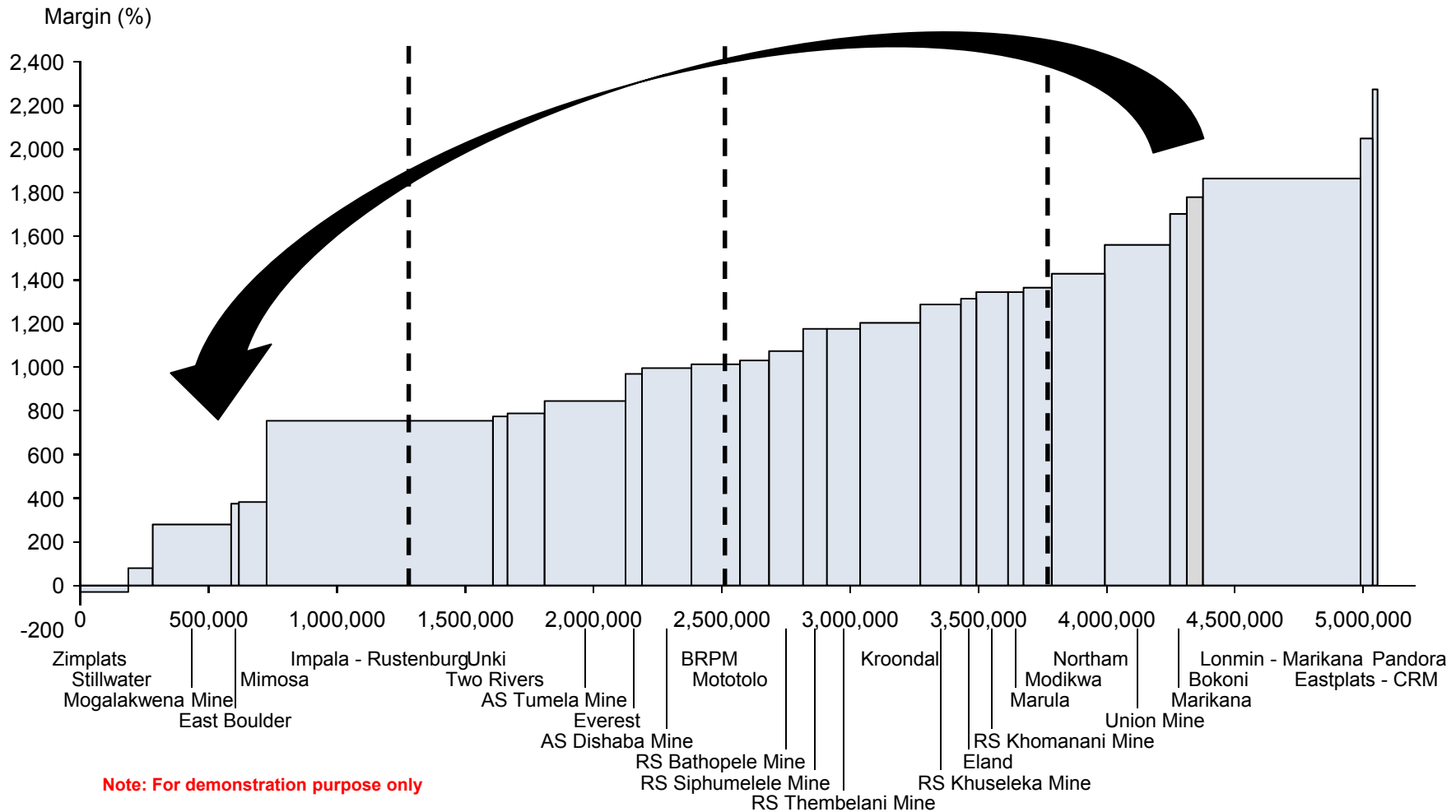
Qualitative

- **Phenomenological** (study of human experience; excluding considerations of objective reality)
- **Qualify** (Involving distinctions based on qualities)
 - Approximate reality
- **Subject's perspective / Context specific**
 - Deal with constraints of everyday life
- **Scientific Principles** (Archimedes principle)



What to change to: Net Cash Cost Curve

“Moving from the 4th Quartile to the 1st Quartile is the ultimate achievement”



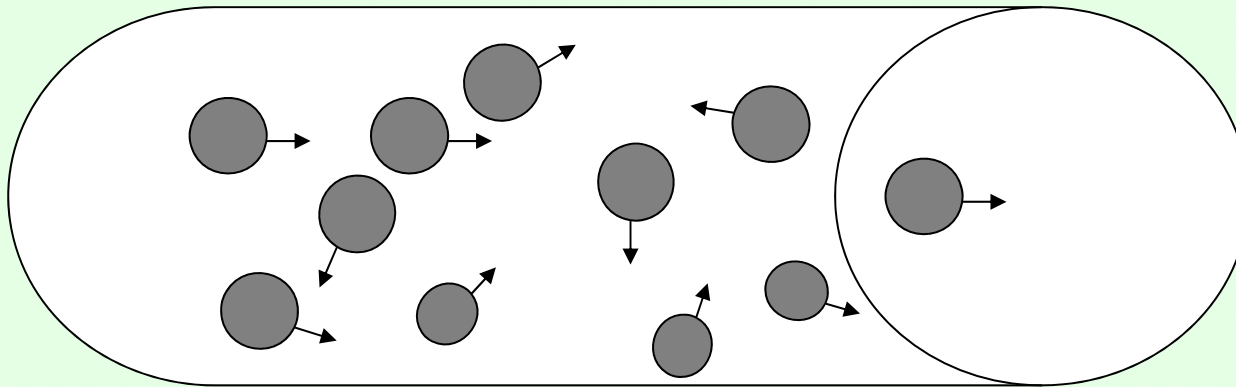


So what's the problem?

“Adam Smith (Philosopher: 1723-1790) -

"Father of Modern Economics":

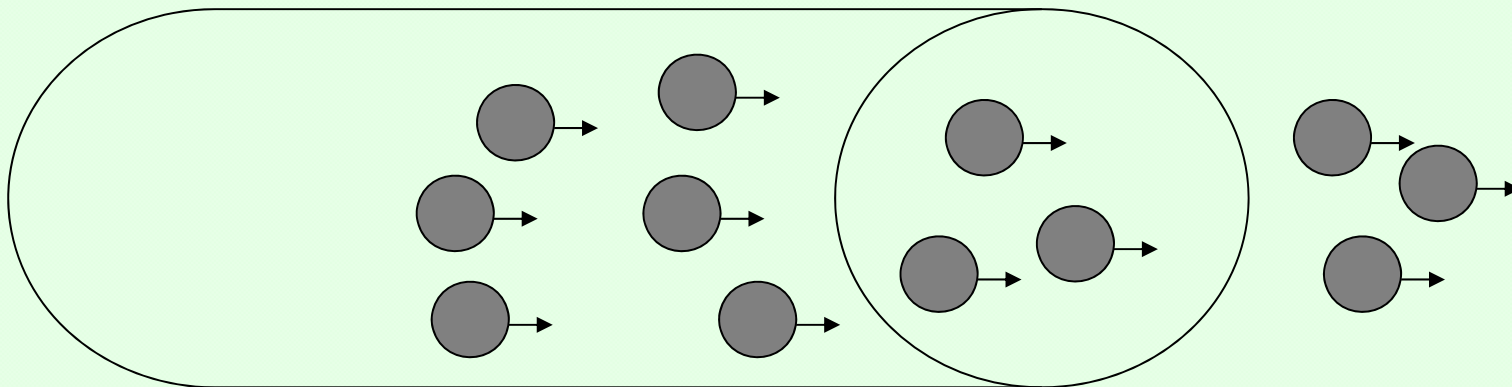
**"IN COMPETITION, INDIVIDUAL
AMBITION SERVES THE COMMON
GOAL - EVERY MAN FOR HIMSELF ... ”**





So what's the solution?

- ***“John Nash (1994 Noble Prize winner for economics)***
 - ***Nash Equilibrium: “A solution that maximises everyone’s benefit”.***





TOC – a Postmodern Mgt Philosophy

- Theory of empty words?
- Sasol Mining - **validation**
 - Coal Mining
 - Mechanized mining methods
 - Quick turnaround
- Impala Platinum - **validation**
 - Hard rock mining
 - Conventional mining methods
 - Moderate turnaround
- Harmony Gold – **discovery of new truths**
 - Current reality



RSA Mining: Holistic Approach

INTERNAL CONSTRAINTS

Production
Buffering
(*MINER*)

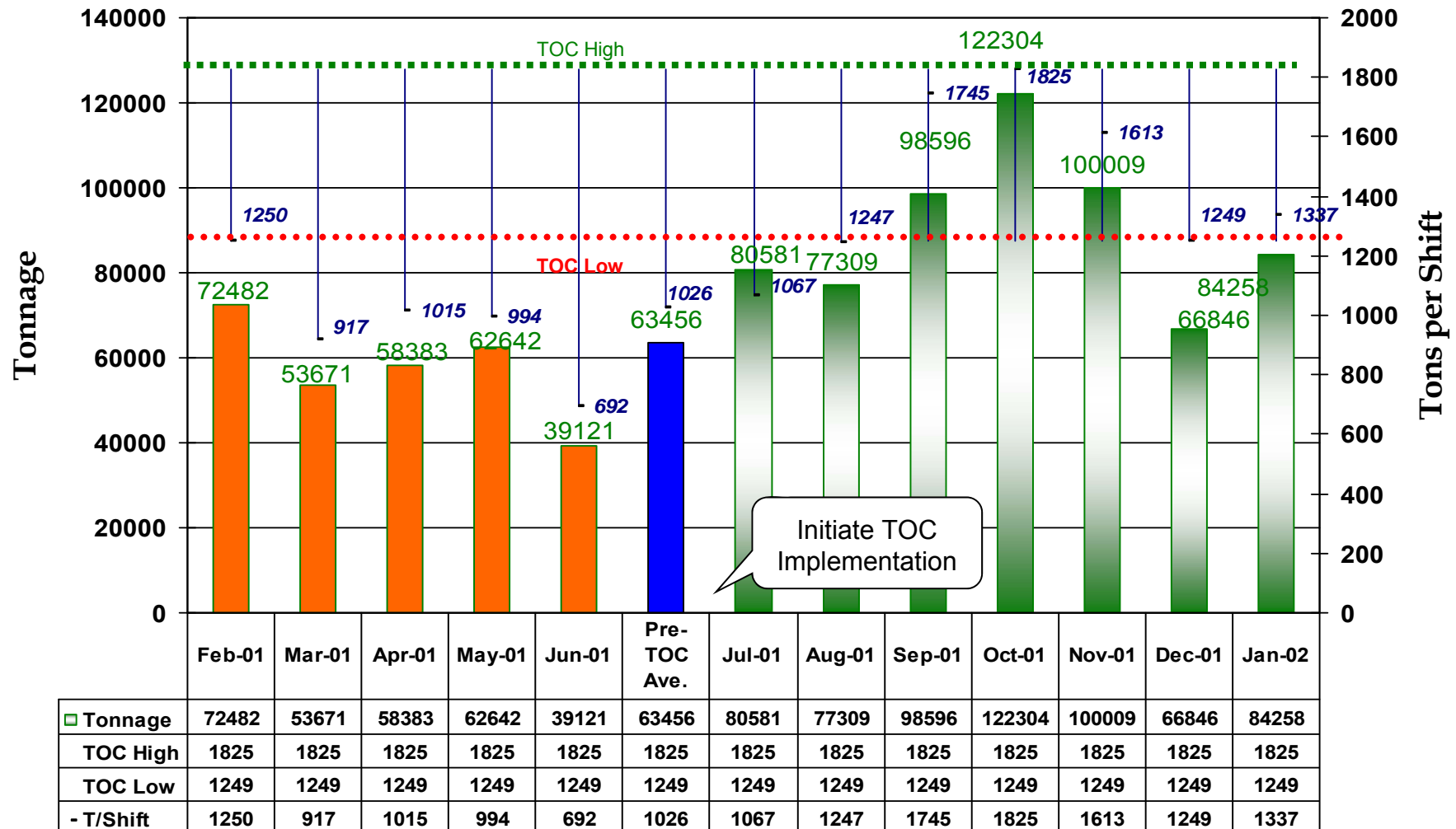
5FS: *Operator*

EXTERNAL CONSTRAINTS



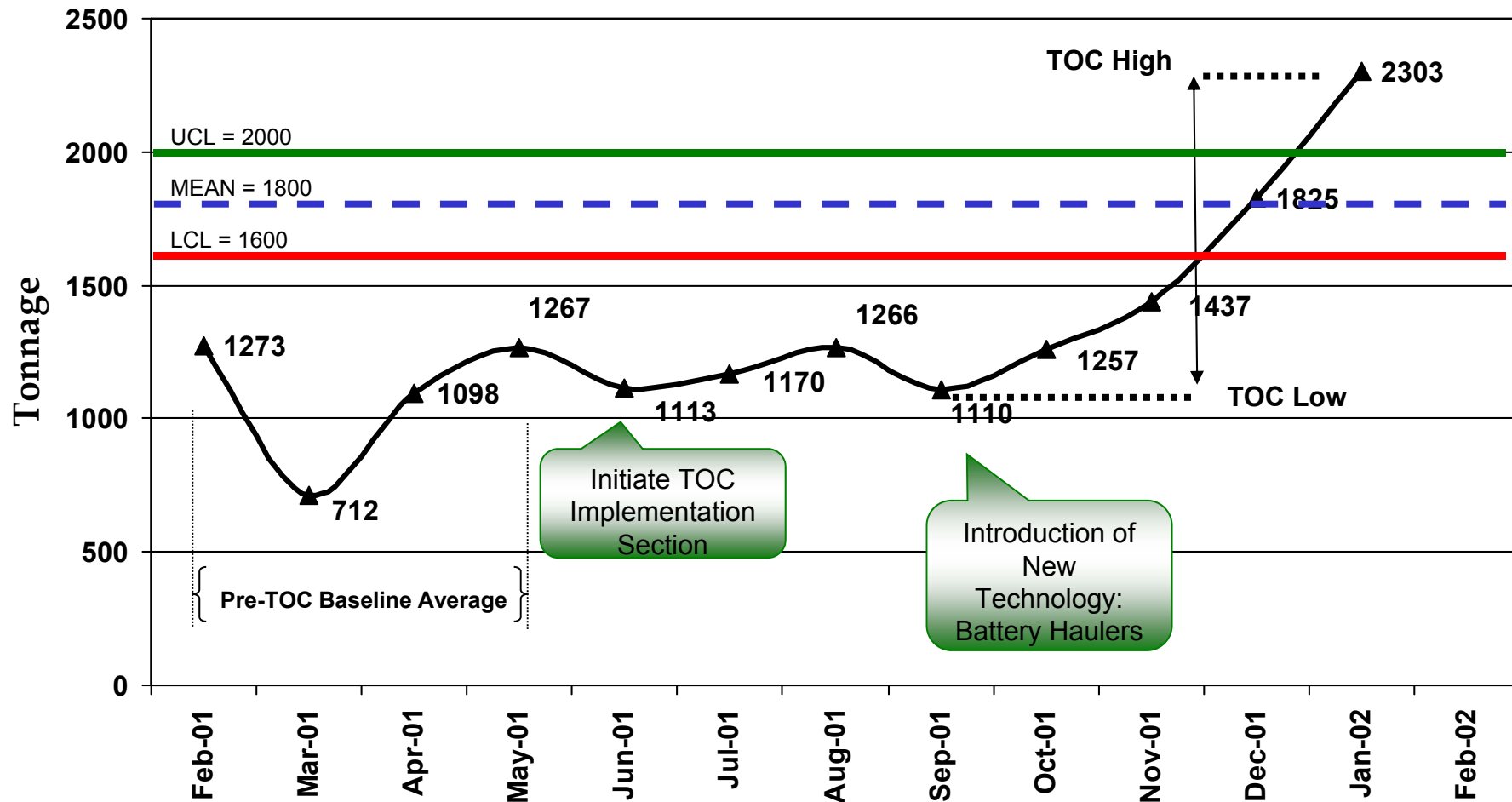
Sasol Mining: Middelbult West Shaft

Section 37



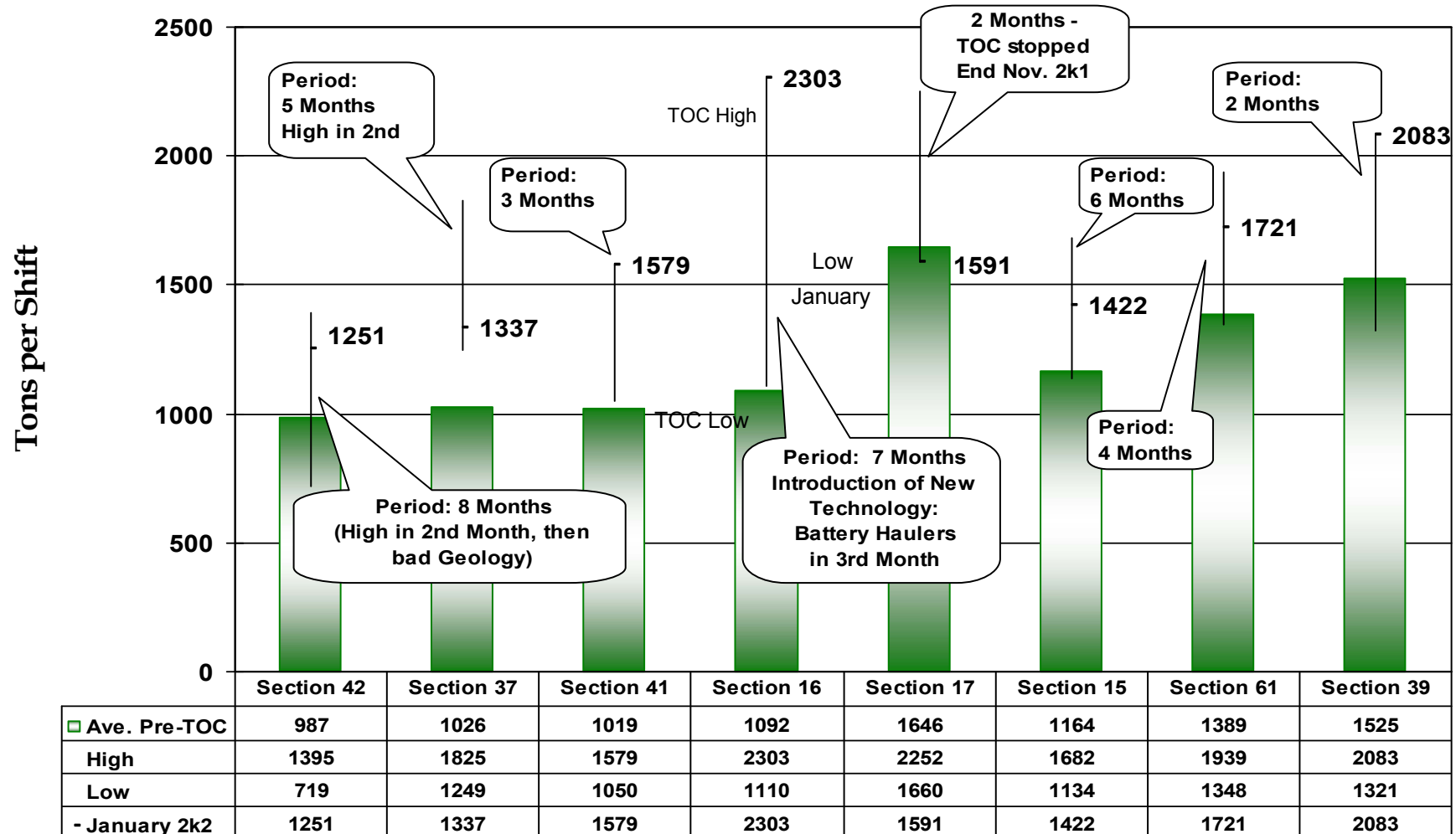


Sasol Mining: *Brandspruit Colliery* Section 16



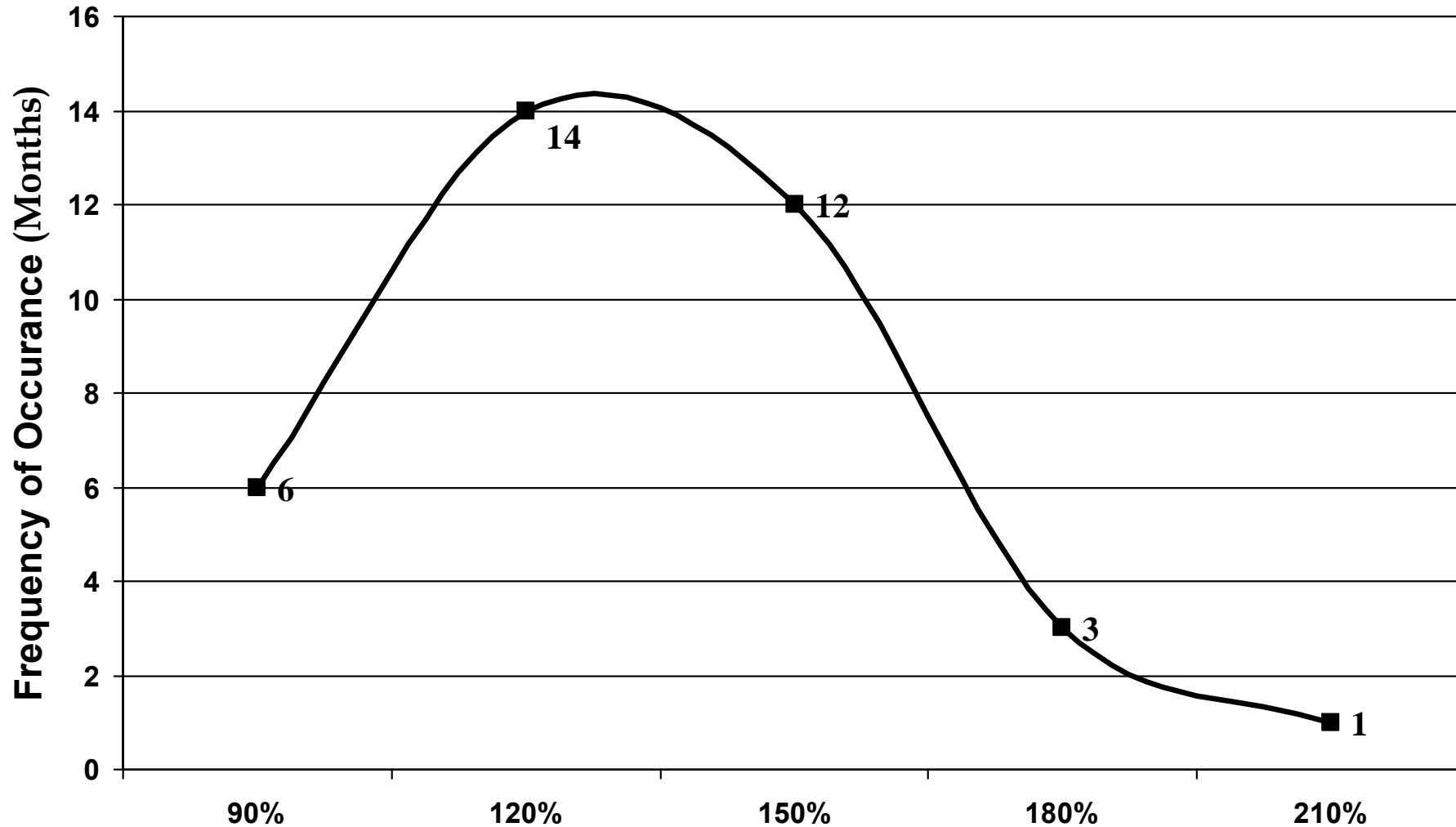


Sasol Mining: Various Sections





Sasol Mining: TOC Proven



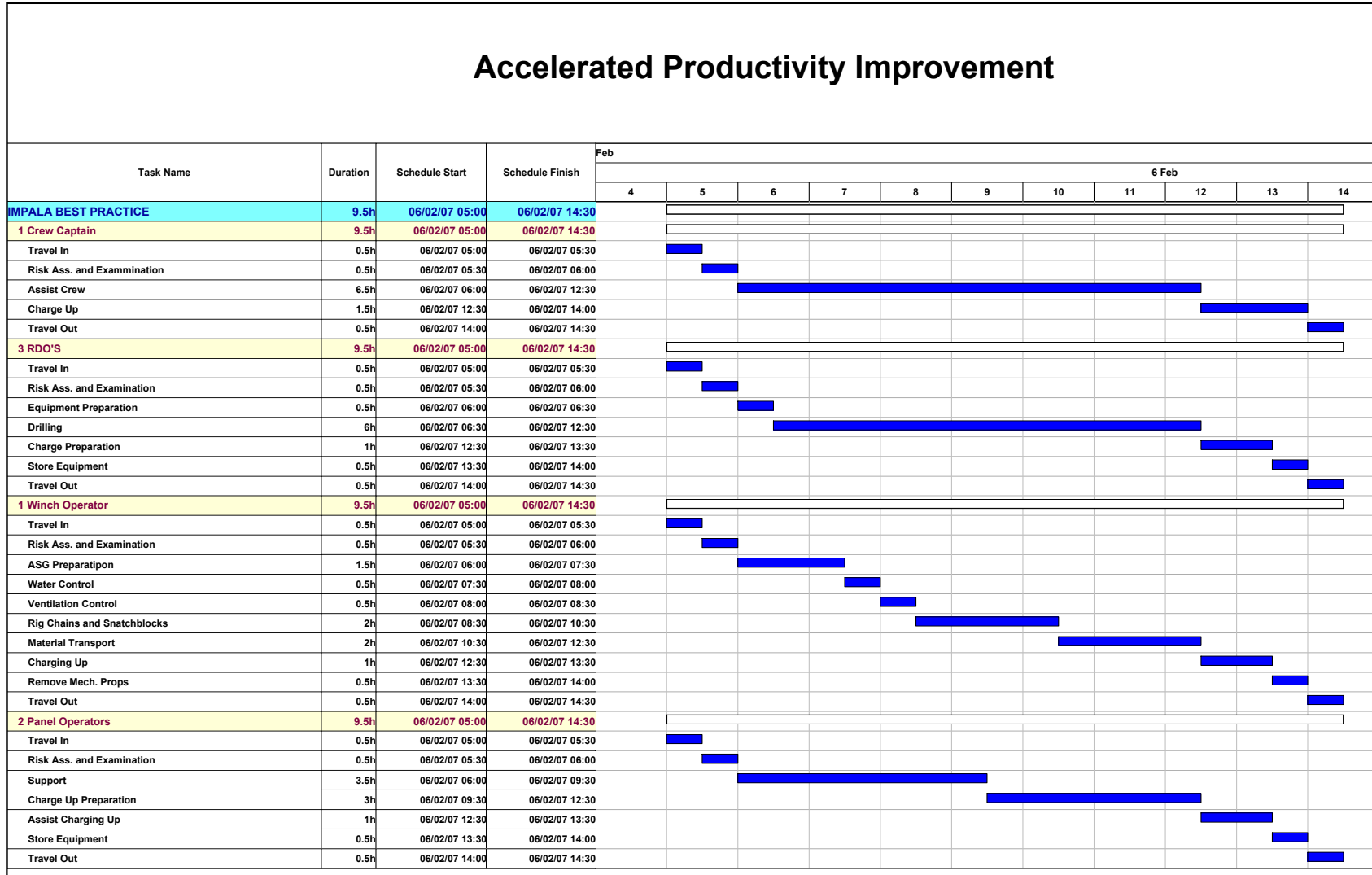


Impala Platinum: Case for change

- Impala average performance = 17m/month
 - *Platinum industry average = 12m/month*
 - *Impala management are very capable*
- Concern: Performance plateau / regression
- Goal: Increased overall annual production by at least 1m/month = +R 1 billion in Sales
 - *FY 2006 : Sales = R 17Bn : Face Advance = 17m*
- Focus: Improve performance at Face

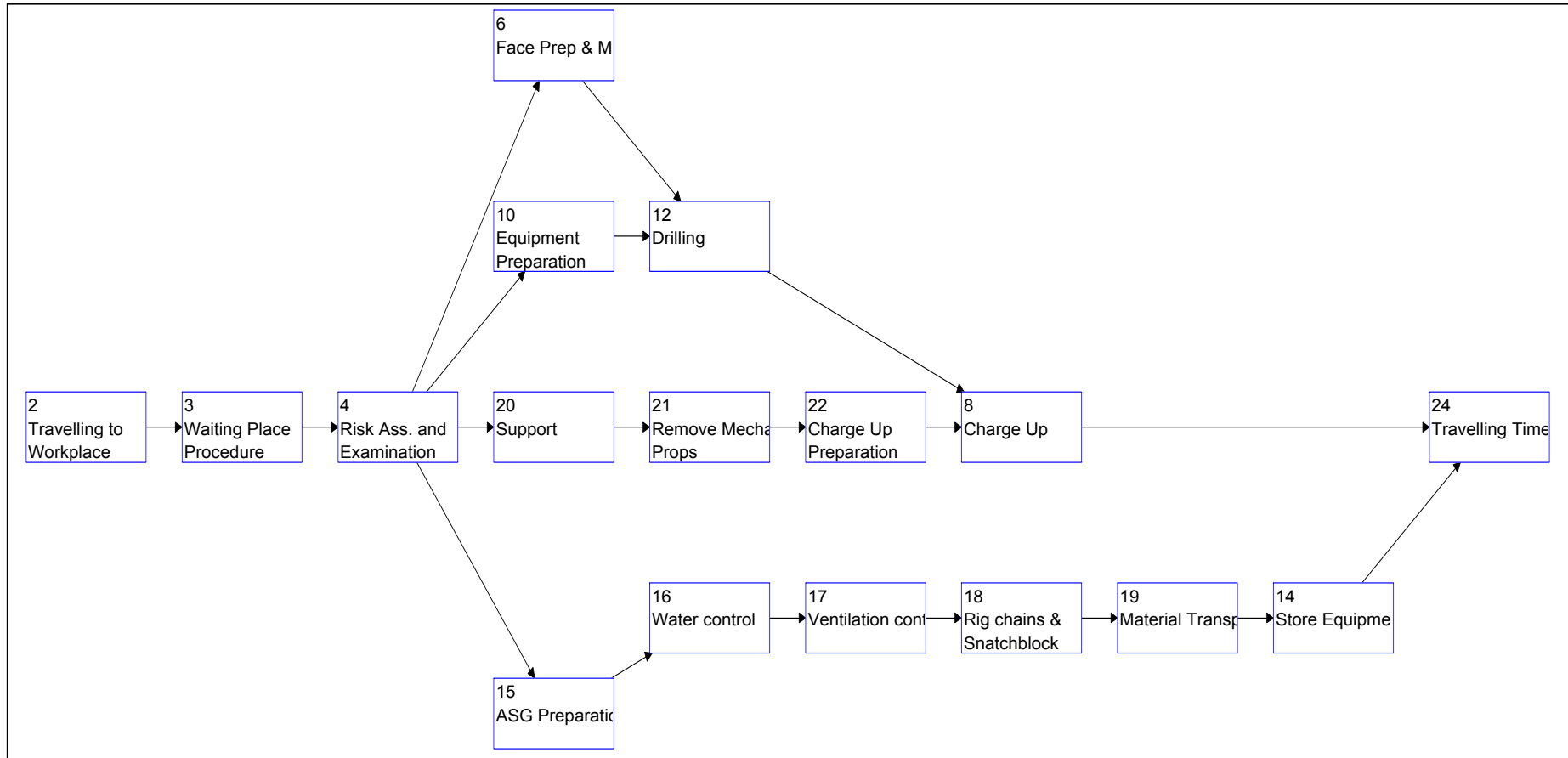


Impala Platinum: Resource Schedule



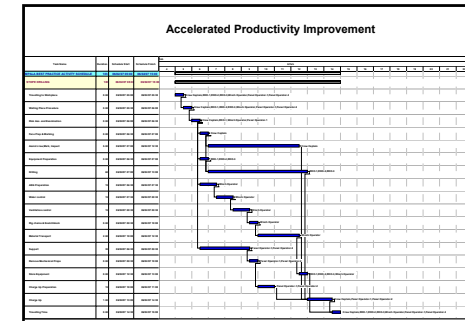


Impala Platinum: Crew teamwork - cooperation vs. competition





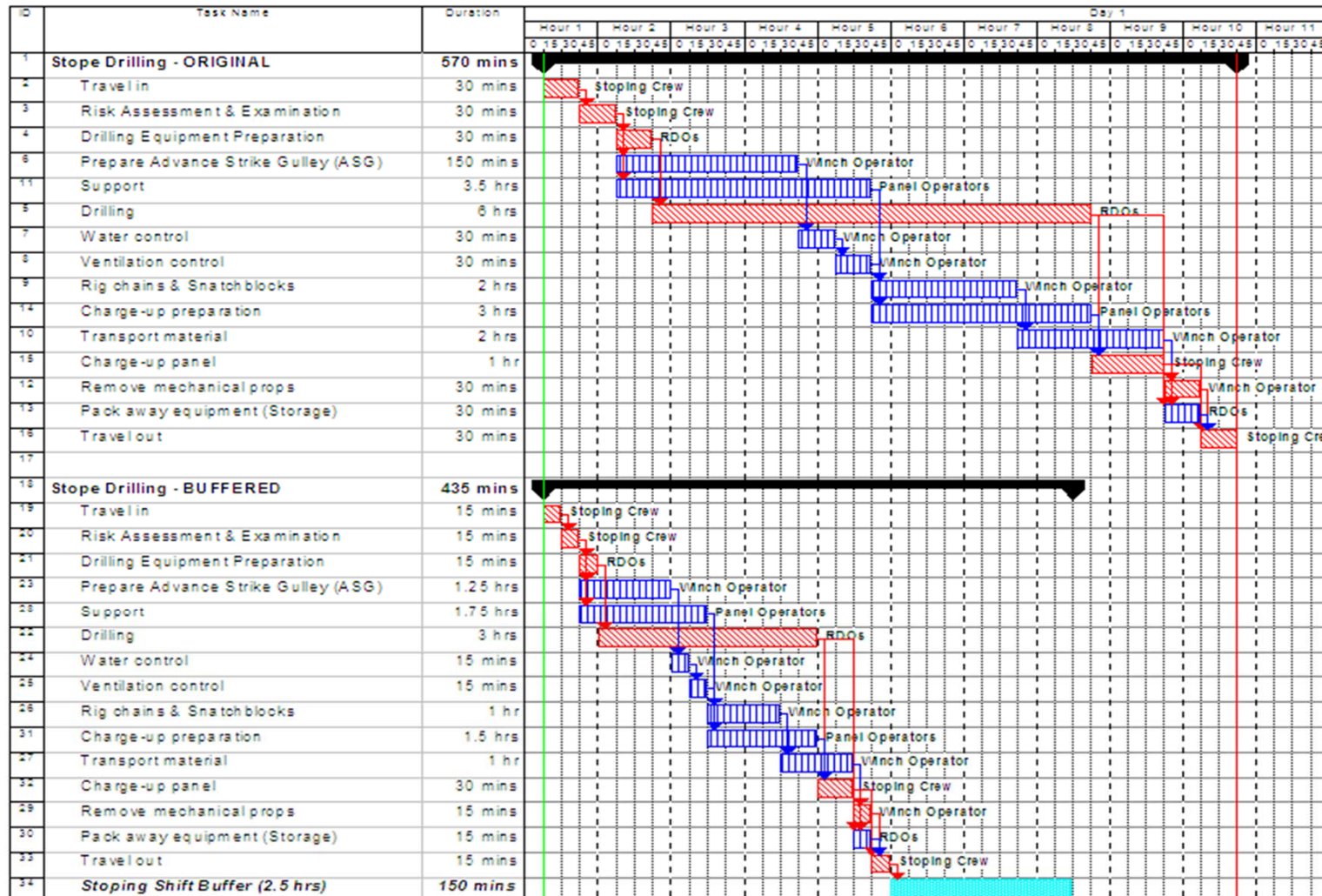
Impala Platinum: Stopping Activity Schedule



ID	Task Name	Duration	Day 1														
			Hour 1	Hour 2	Hour 3	Hour 4	Hour 5	Hour 6	Hour 7	Hour 8	Hour 9	Hour 10	Hour 11				
1	Stope Drilling - ORIGINAL	570 mins	[Solid black bar from Hour 1 to Hour 11]														
2	Travel in	30 mins	[Red hatched]	[Red hatched]													
3	Risk Assessment & Examination	30 mins		[Red hatched]	[Red hatched]												
4	Drilling Equipment Preparation	30 mins			[Red hatched]	[Red hatched]											
6	Prepare Advance Strike Gulley (ASG)	150 mins			[Blue hatched]	[Blue hatched]	[Blue hatched]	[Blue hatched]									
11	Support	3.5 hrs			[Blue hatched]	[Blue hatched]	[Blue hatched]	[Blue hatched]	[Blue hatched]								
5	Drilling	6 hrs			[Red hatched]	[Red hatched]	[Red hatched]	[Red hatched]	[Red hatched]	[Red hatched]	[Red hatched]	[Red hatched]	[Red hatched]				
7	Water control	30 mins				[Blue hatched]	[Blue hatched]										
8	Ventilation control	30 mins				[Blue hatched]	[Blue hatched]										
9	Rig chains & Snatchblocks	2 hrs					[Blue hatched]	[Blue hatched]									
14	Charge-up preparation	3 hrs					[Blue hatched]	[Blue hatched]	[Blue hatched]								
10	Transport material	2 hrs						[Blue hatched]	[Blue hatched]								
15	Charge-up panel	1 hr							[Red hatched]	[Red hatched]							
12	Remove mechanical props	30 mins								[Blue hatched]	[Blue hatched]						
13	Pack away equipment (Storage)	30 mins									[Red hatched]	[Red hatched]					
16	Travel out	30 mins										[Red hatched]	[Red hatched]				
17																	



Impala Platinum: Inducing Buffer Mgt



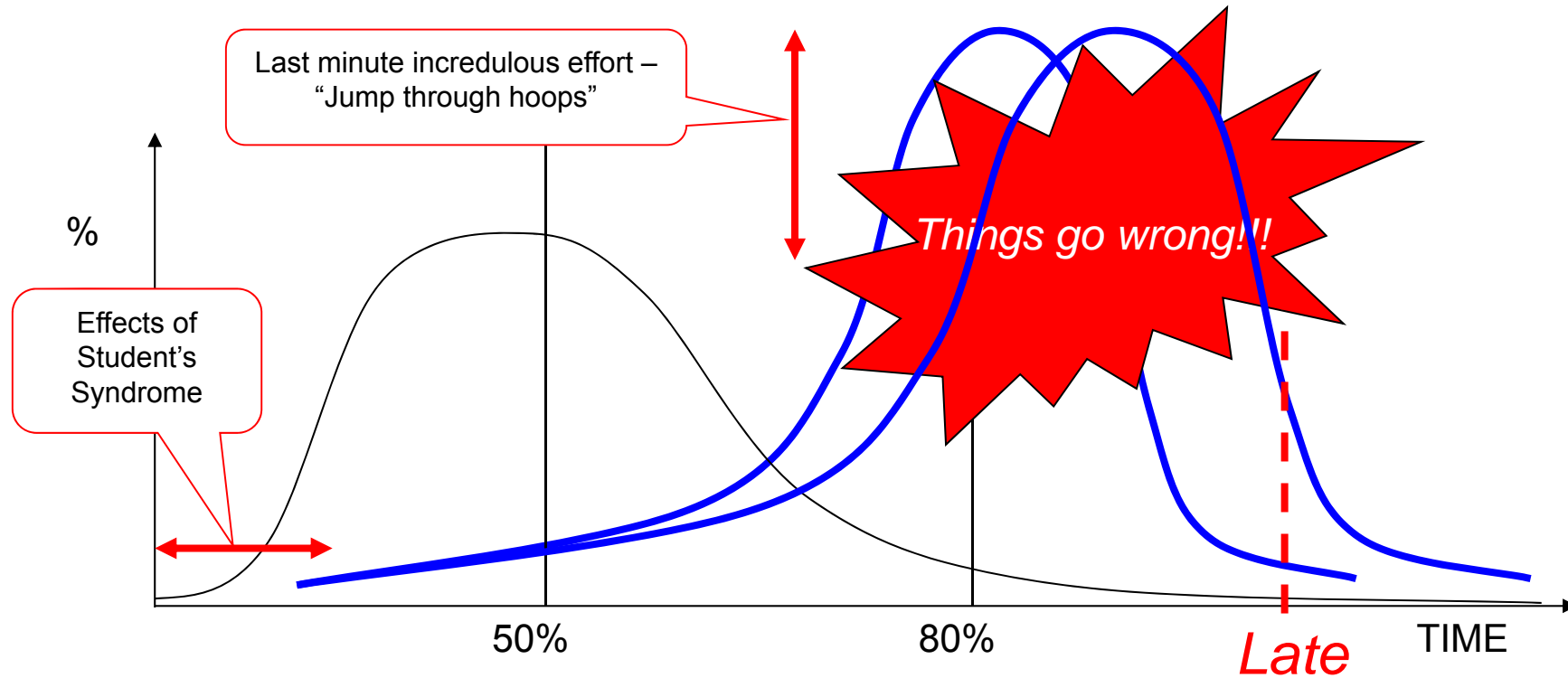


Impala Platinum: Crew control charts

CREW PERFORMANCE CHART																		
SECTION :				PANEL :				CREW NO :										
MINER (Day):				MINER (Night):				UPM INTERGRATOR (Day):										
No.	Task Name	Responsibility	Dur. (Min)	From	RED	YELLOW	GREEN	Shift 1	Shift 2	Shift 3	Shift 4	Shift 5	Shift 6	6th Shift Recon.			Shift 7	
COMMENTS/REMARKS														Actual	Budget	Variance		
					NO	Partial	YES											
BLAST					NO	Partial	YES											
STOPE DRILLING					330	660	230											
1	Travelling to Workplace	Crew	15	1hr	45	30	15	●	●	●	●	●	●	●	●	●	●	●
2	Waiting Place Procedure	Crew	15		45	30	15	●	●	●	●	●	●	●	●	●	●	●
3	Risk Ass. and Examination	Crew	15		45	30	15	●	●	●	●	●	●	●	●	●	●	●
4	Face Prep & Marking	Crew	15		45	30	15	●	●	●	●	●	●	●	●	●	●	●
5	ASG Preparation	Crew	30		60	45	30	●	●	●	●	●	●	●	●	●	●	●
6	Equipment Preparation	RDOs	15		45	30	15	●	●	●	●	●	●	●	●	●	●	●
<i>Equipment Prep. Feeder Buffer</i>				15	15	10	5	●	●	●	●	●	●	●	●	●	●	
7	DRILLING	RDOs	180	3hrs	540	360	180	●	●	●	●	●	●	●	●	●	●	
8	ASG	RDOs			NO	●	●	●	●	●	●	●	●	●	●	●	●	●
9	Face	RDOs			NO	●	●	●	●	●	●	●	●	●	●	●	●	●
10	Sidewall	RDOs			NO	●	●	●	●	●	●	●	●	●	●	●	●	●
11	Drilled rig holes (Cleaning setup)	RDOs			NO	●	●	●	●	●	●	●	●	●	●	●	●	●
12	Pump Water (Control)	Winch Operator			30	120	60	30	●	●	●	●	●	●	●	●	●	●
13	Ventilation control	Winch Operator	30	120	60	30	●	●	●	●	●	●	●	●	●	●		
14	Rig chains & Snatchblock	Winch Operator	15	45	30	15	●	●	●	●	●	●	●	●	●	●		
15	Material Transport	Winch Operator	75	225	150	75	●	●	●	●	●	●	●	●	●	●		
<i>Services Feeder Buffer</i>				75	75	50	25	●	●	●	●	●	●	●	●	●	●	
16	Set-up Support	Panel Operator	15	45	30	15	●	●	●	●	●	●	●	●	●	●		
17	SUPPORT	Panel Operator	120	360	240	120	●	●	●	●	●	●	●	●	●	●		
19	Decommission Support	Panel Operator	15	45	30	15	●	●	●	●	●	●	●	●	●	●		
<i>Support Feeder Buffer</i>				75	75	50	25	●	●	●	●	●	●	●	●	●	●	
20	Charge Up Preparation (Setup)	Panel Operator	30	0.5 hrs	60	45	30	●	●	●	●	●	●	●	●	●		
21	ASG	Panel Operator			NO	●	●	●	●	●	●	●	●	●	●	●	●	
22	Face	Panel Operator			NO	●	●	●	●	●	●	●	●	●	●	●	●	
23	Sidewall	Panel Operator			NO	●	●	●	●	●	●	●	●	●	●	●	●	
<i>Feeder Buffer</i>				15	15	10	5	●	●	●	●	●	●	●	●	●	●	
24	CHARGING	Miner	45	1hr	135	90	45	●	●	●	●	●	●	●	●	●		
25	ASG	Miner			NO	●	●	●	●	●	●	●	●	●	●	●	●	
26	Face	Miner			NO	●	●	●	●	●	●	●	●	●	●	●	●	
27	Sidewall	Miner			NO	●	●	●	●	●	●	●	●	●	●	●	●	
18	Remove Temporary Support	Panel Operator			15	45	30	15	●	●	●	●	●	●	●	●	●	
28	Decommission Panel	Crew	15	45	30	15	●	●	●	●	●	●	●	●	●			
<i>Day Shift Buffer</i>				165	165	109	54	●	●	●	●	●	●	●	●	●	●	

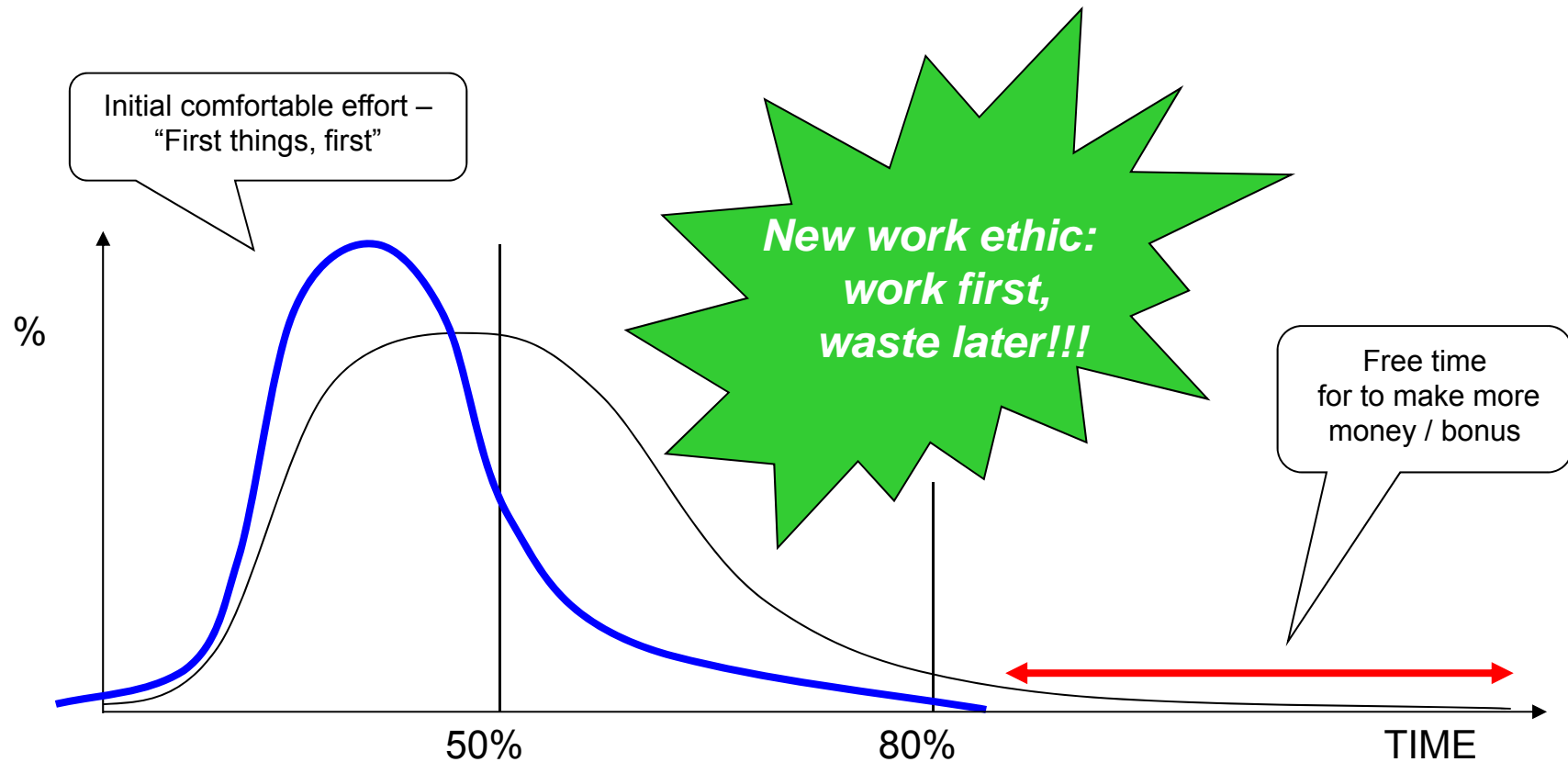


Murphy thrives on chaos





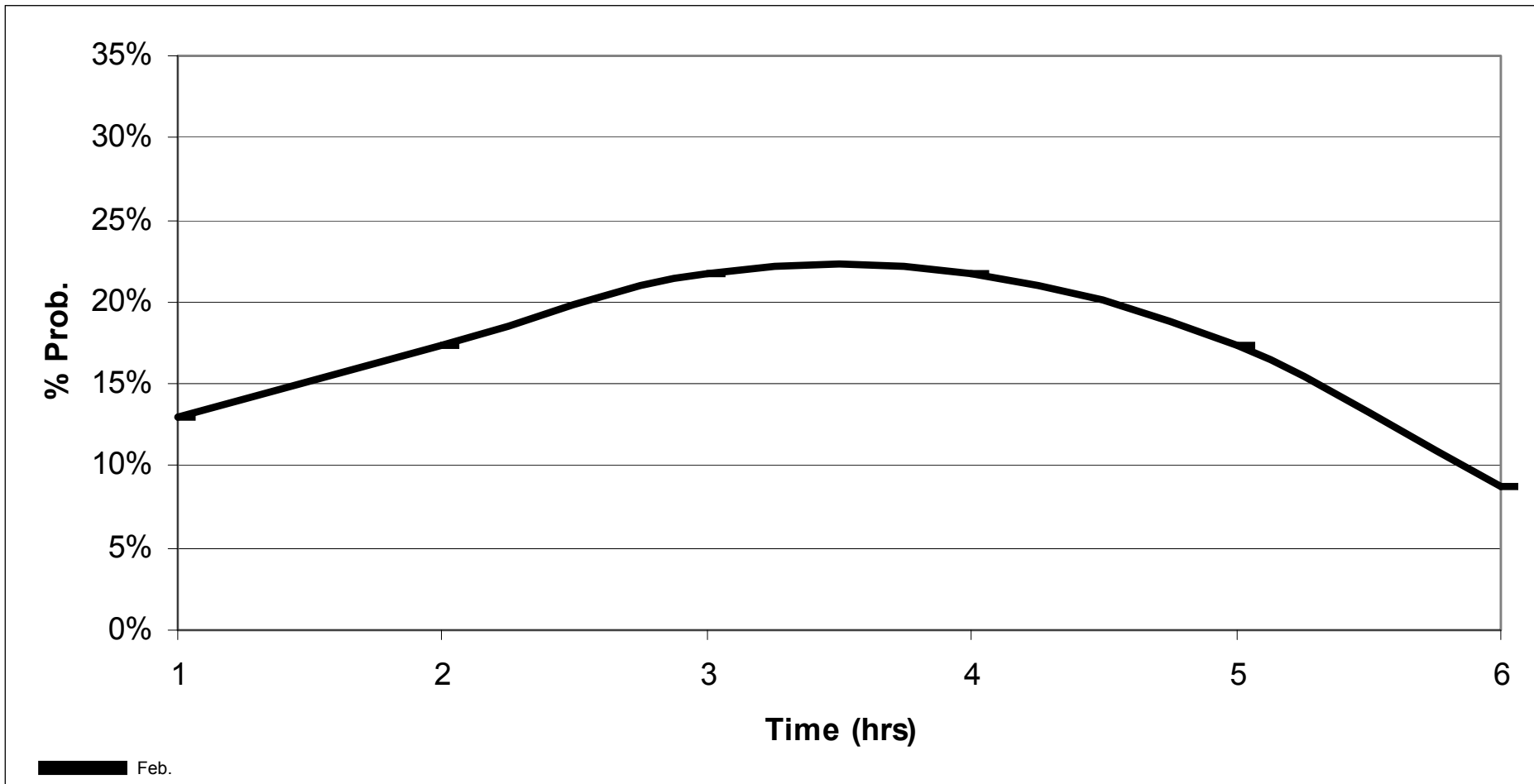
Paradigm Shift – work ethic





Impala Platinum: 11 Shaft - Section 114

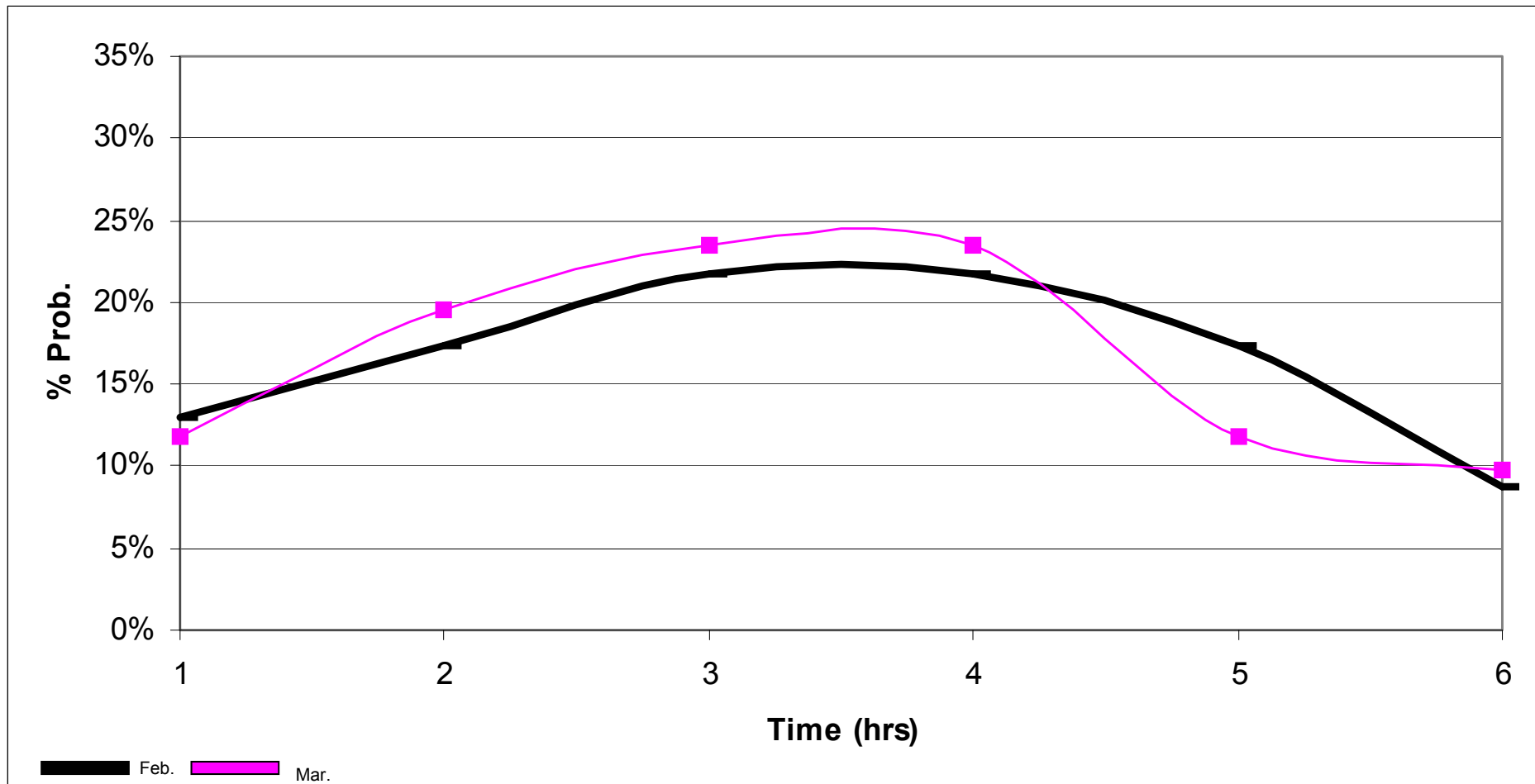
Crew BA44D





Impala Platinum: 11 Shaft - Section 114

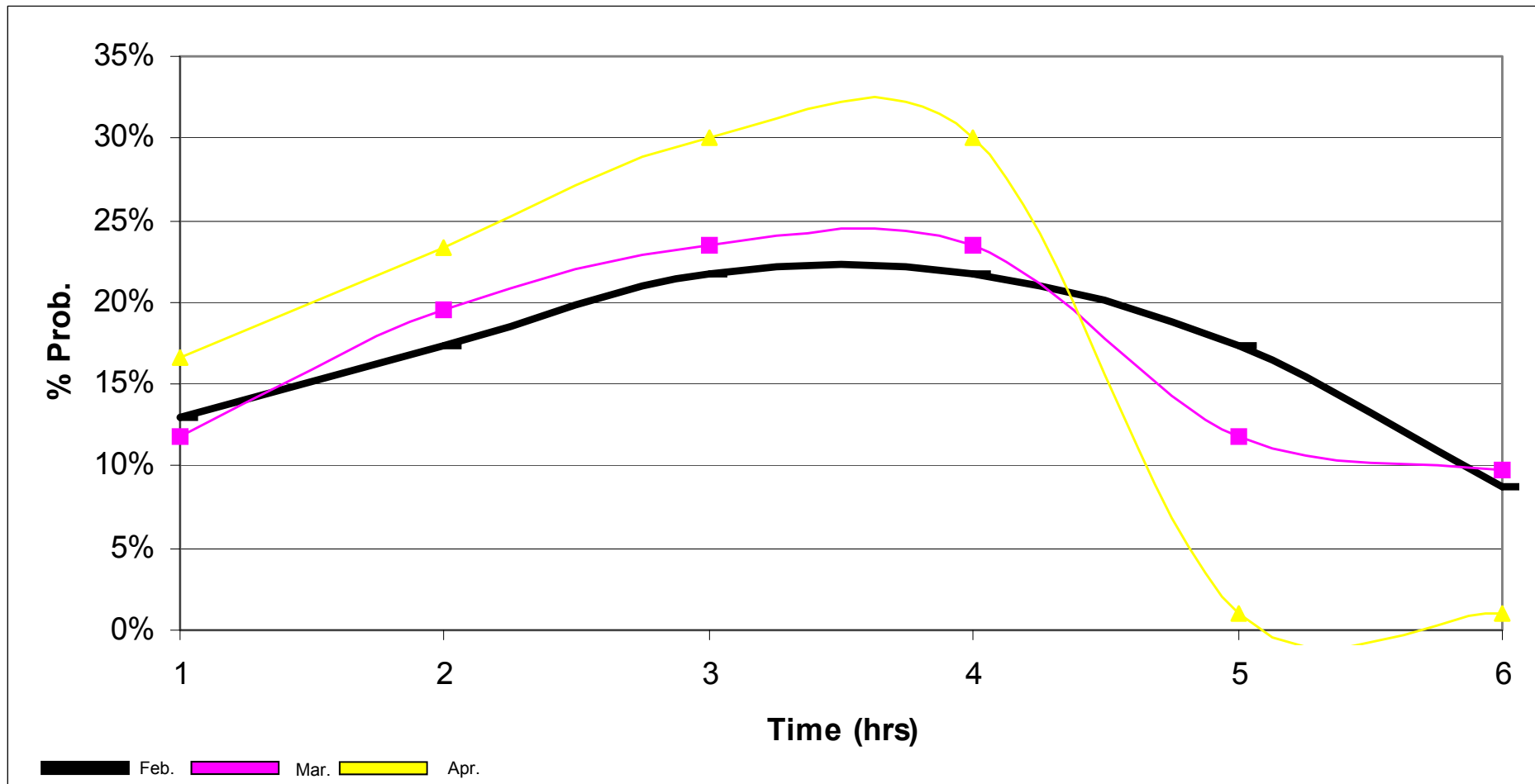
Crew BA44D





Impala Platinum: 11 Shaft - Section 114

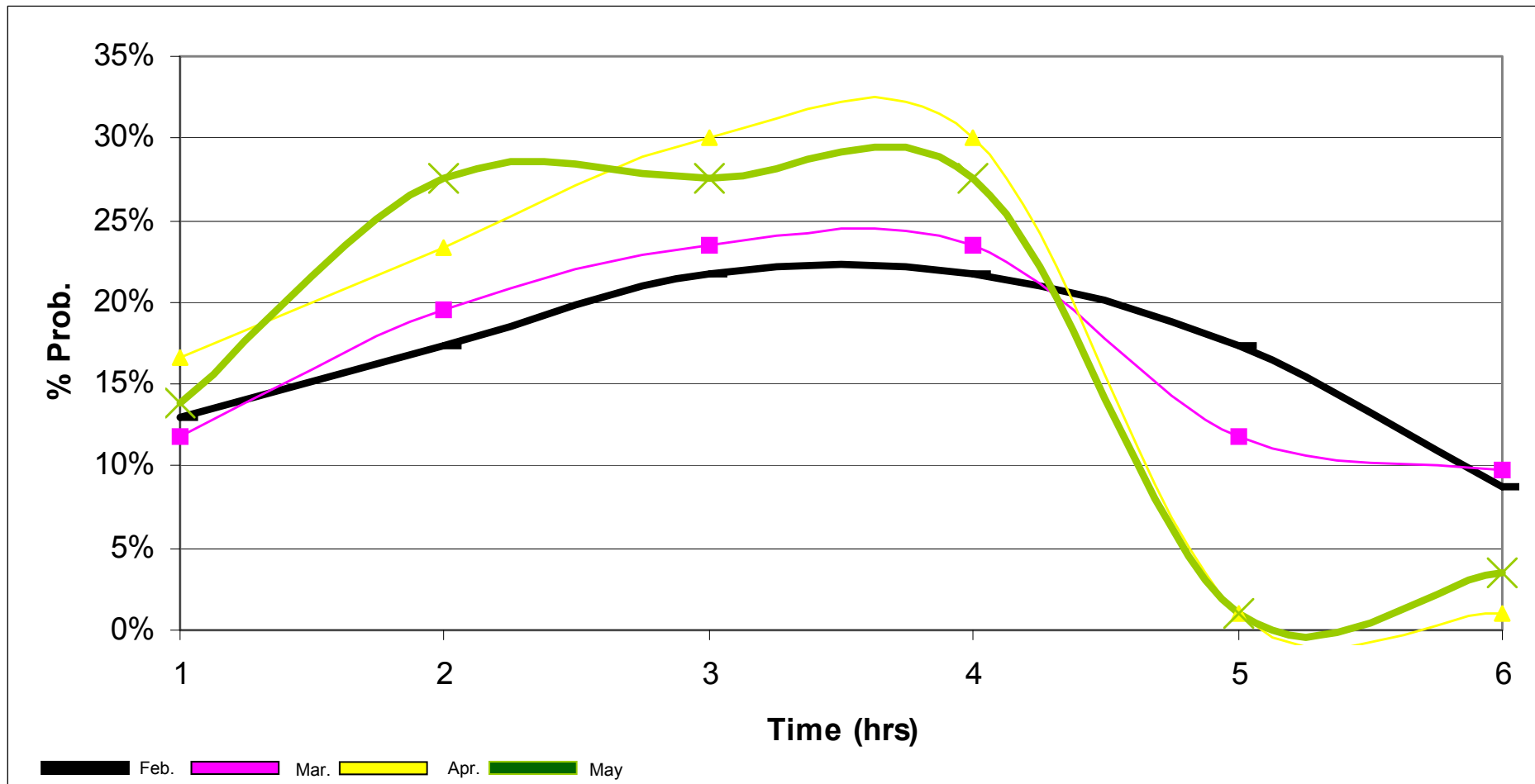
Crew BA44D





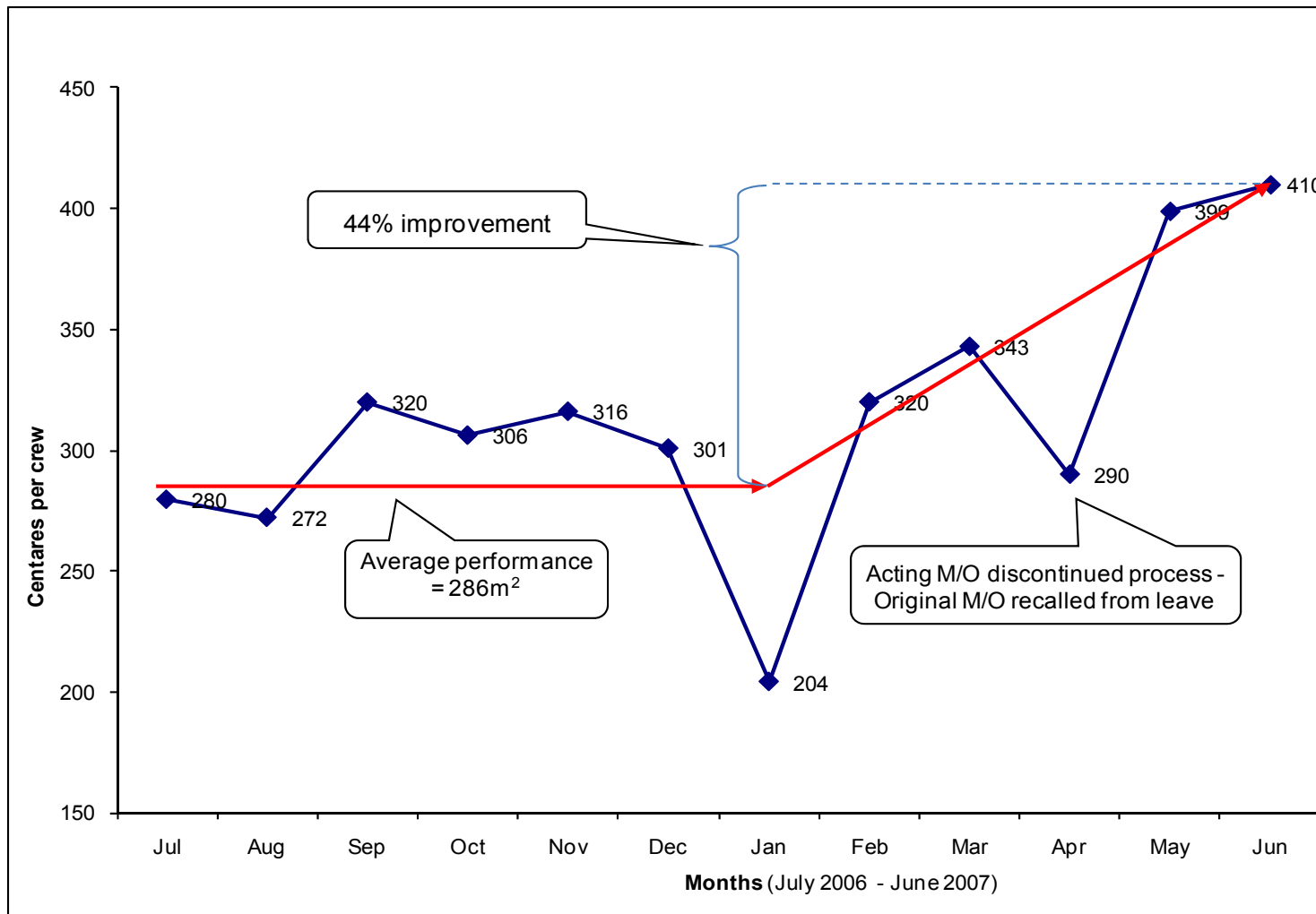
Impala Platinum: 11 Shaft - Section 114

Crew BA44D



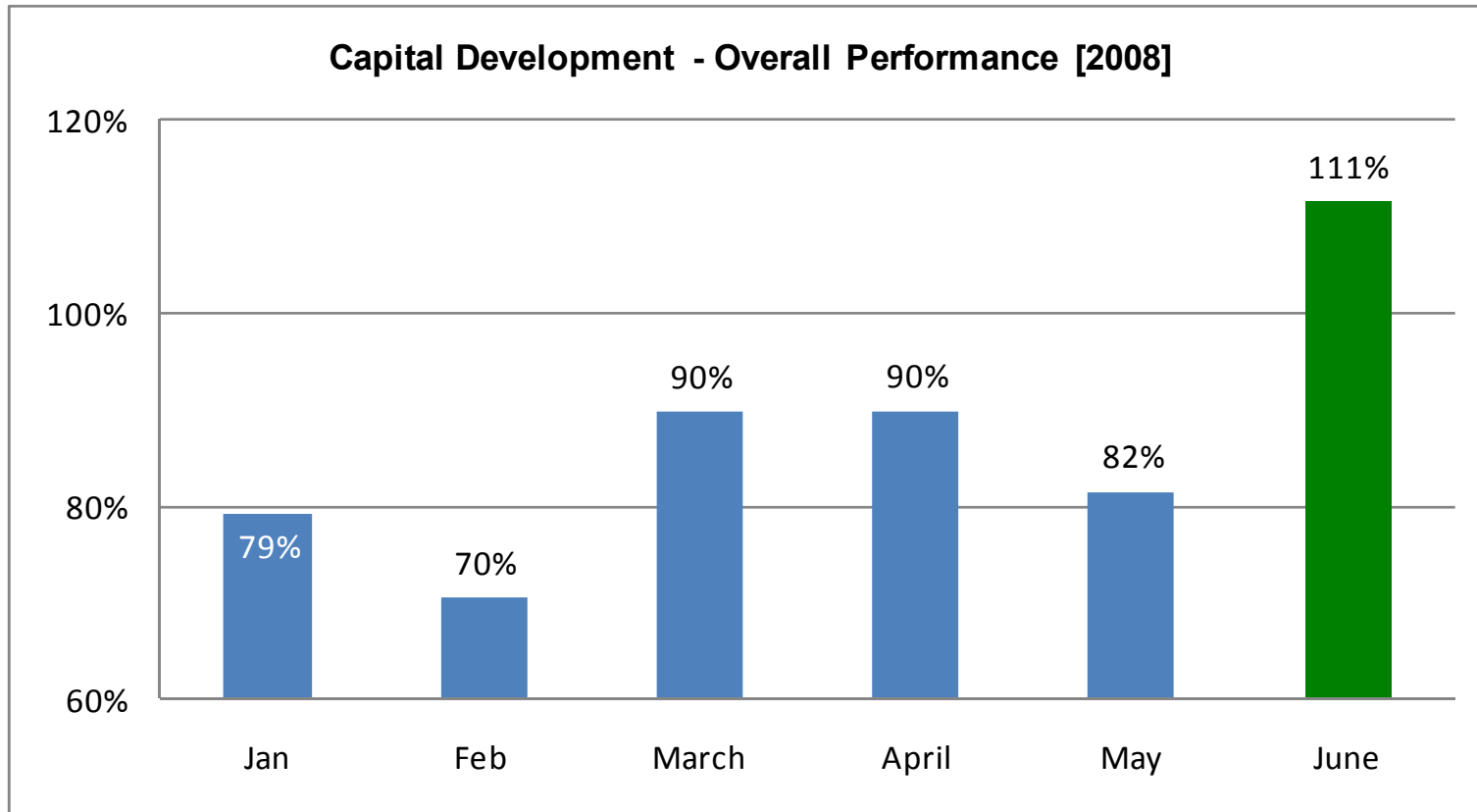


Impala Platinum: 11 Shaft - Section 114



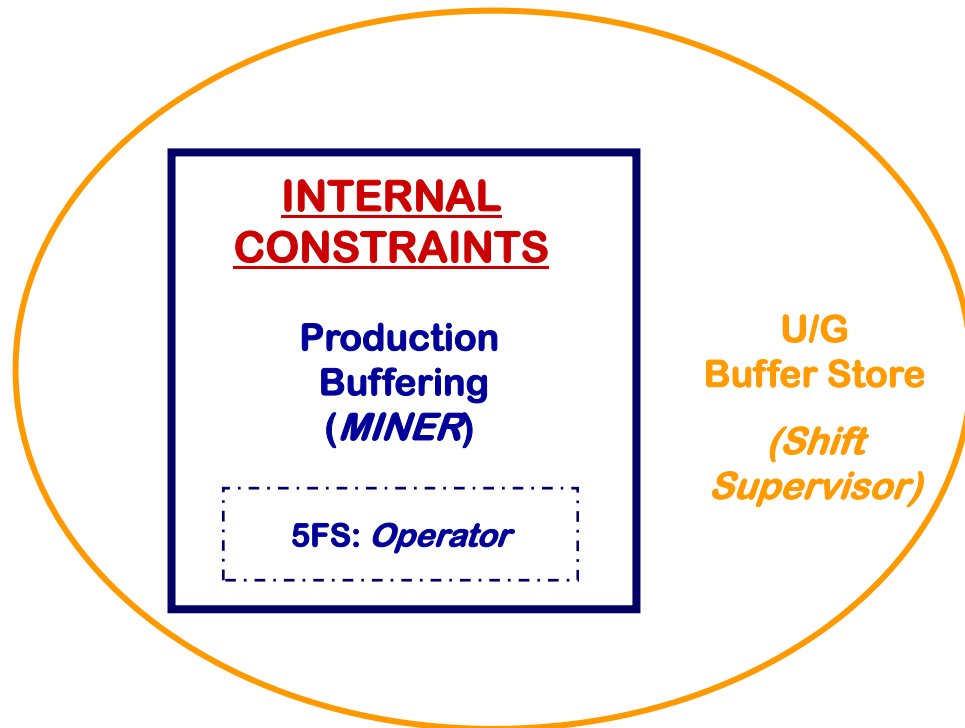


Impala Platinum: E&F Shaft





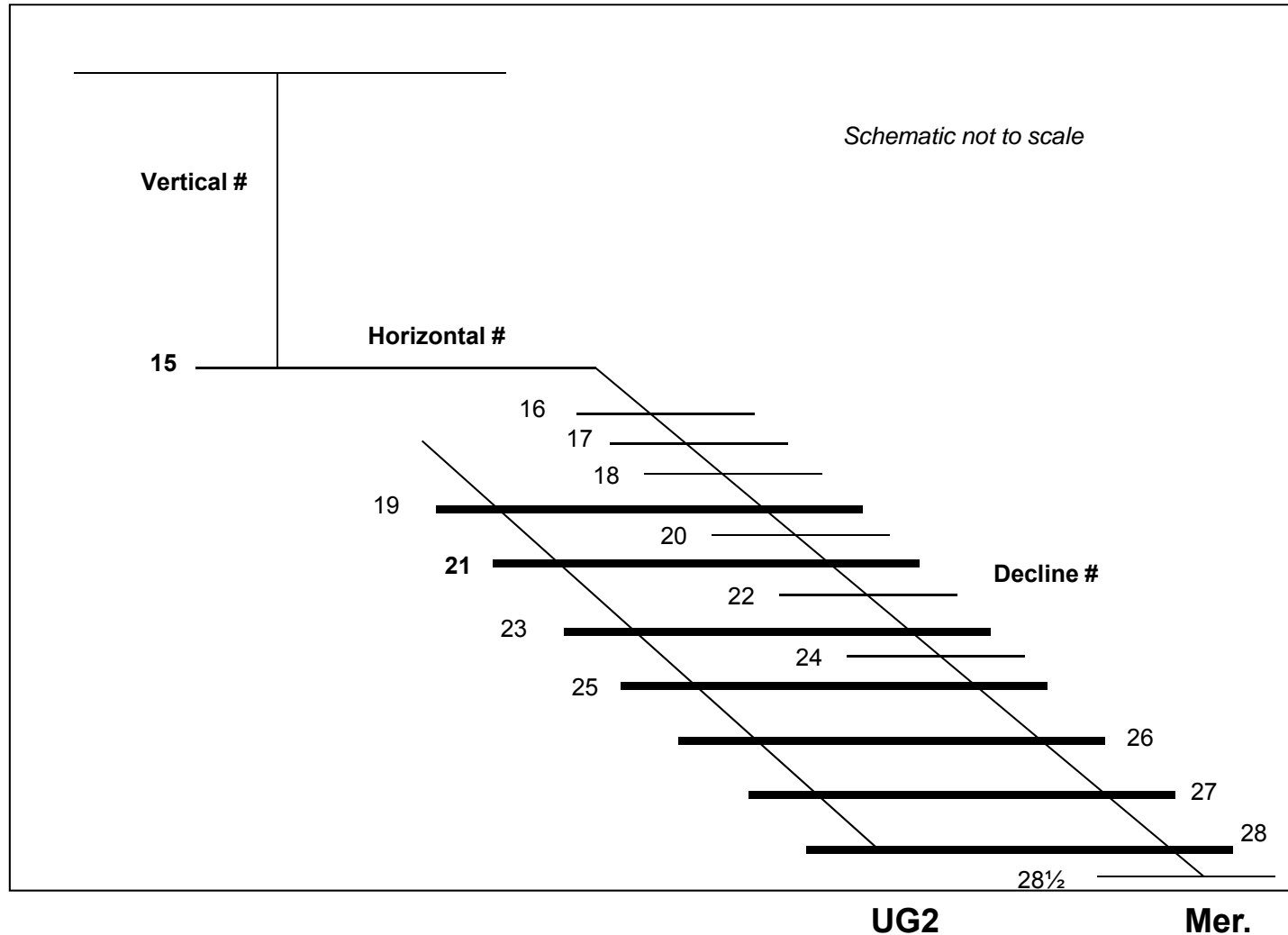
RSA Mining: Holistic Approach



EXTERNAL CONSTRAINTS



Schematic of a Platinum Mine





On-mine material supply chain

Vertical

Inventories flow
Surface to U/G –
Station @ level 15

Horizontal

Inventories flow
Station along
level

Upper Decline

Inventories flow level
15 to all levels up to
level 21

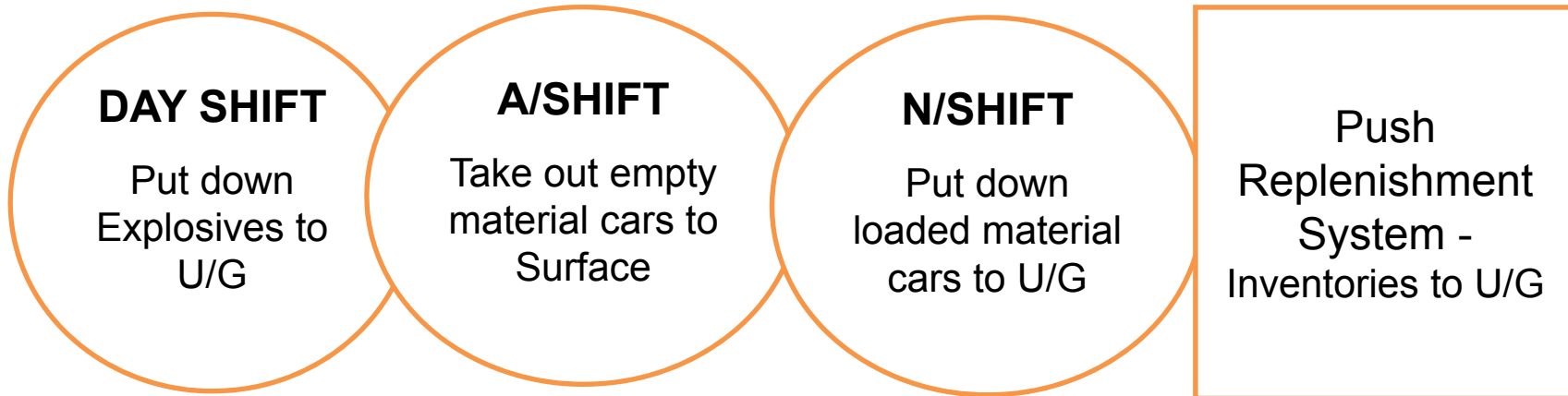
Lower Decline

Inventories flow level
21 to all levels up to
level 28½

$$80\% \times 80\% \times 80\% \times 80\% = 41\%$$

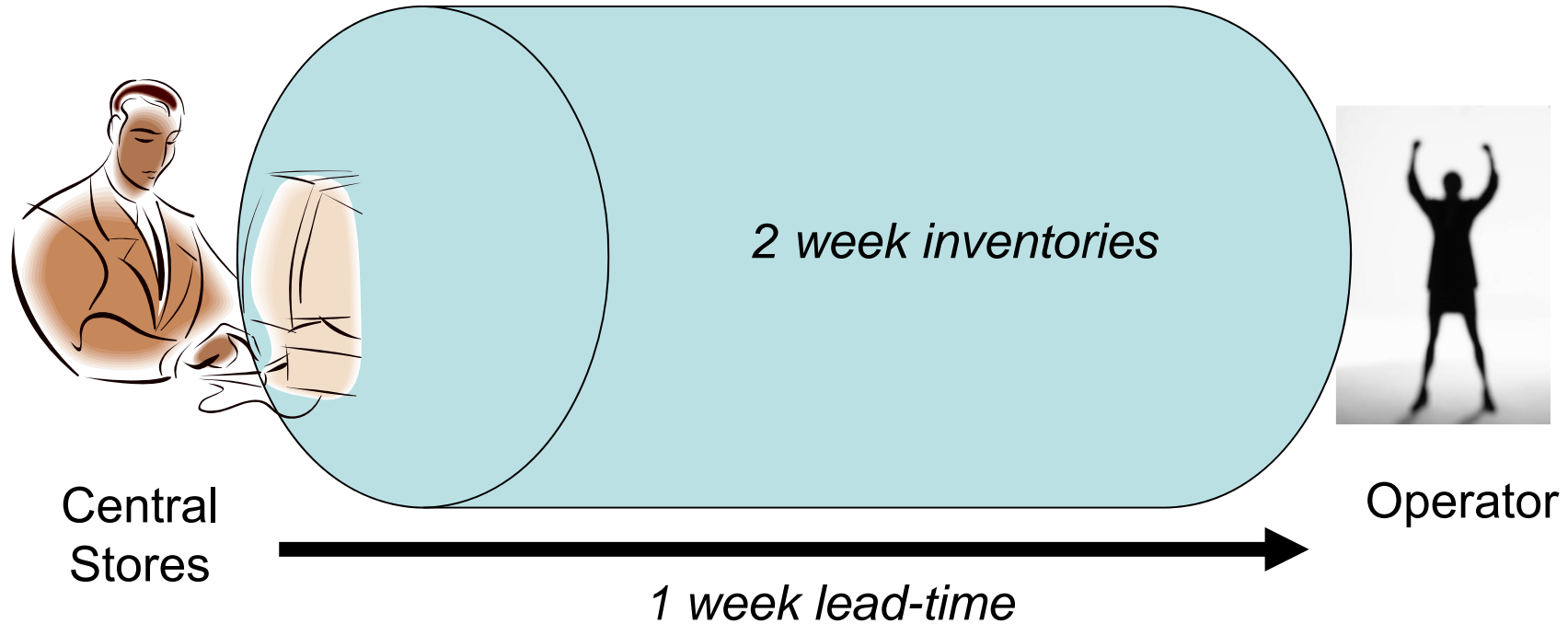


Inventories Daily Cycle





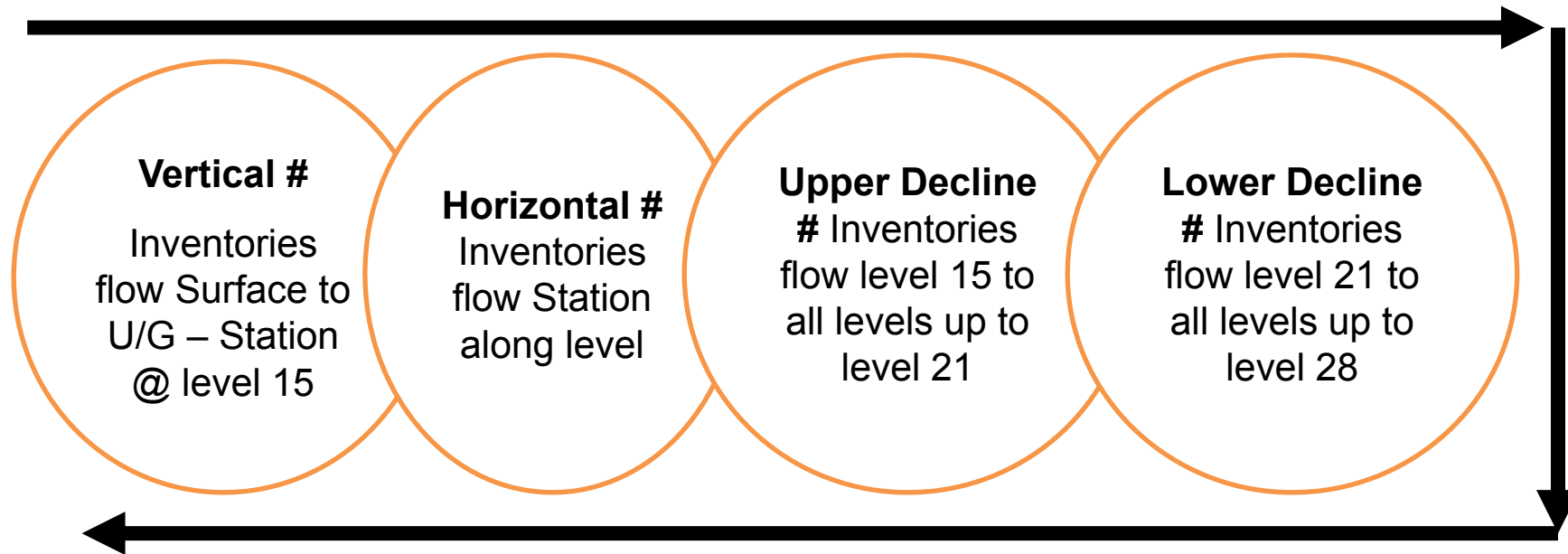
Mining material logistics - Pipeline





Material Cycle Times – too long

Bank



Bank



Absence of 1/2 Level Stores dramatically increased inventories

LOCAL OPITIMA RULE:

Probability of reliable services reduces exponentially
(i.e.: multiply probability per line
e.g.: 4 lines @ 90% = 65.61%)

LOCAL OPITIMA RULE:

If each operator protects hes own flow line, how many lines must be managed?

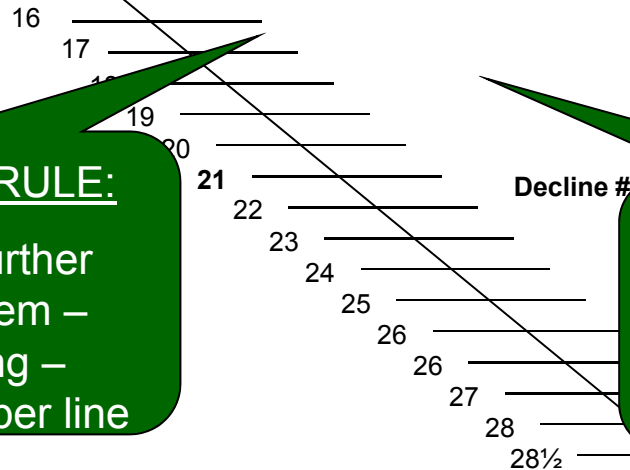
Schematic not to scale

LOCAL OPITIMA RULE:

Additional cars further congest the system – increase queuing – reduce probability per line

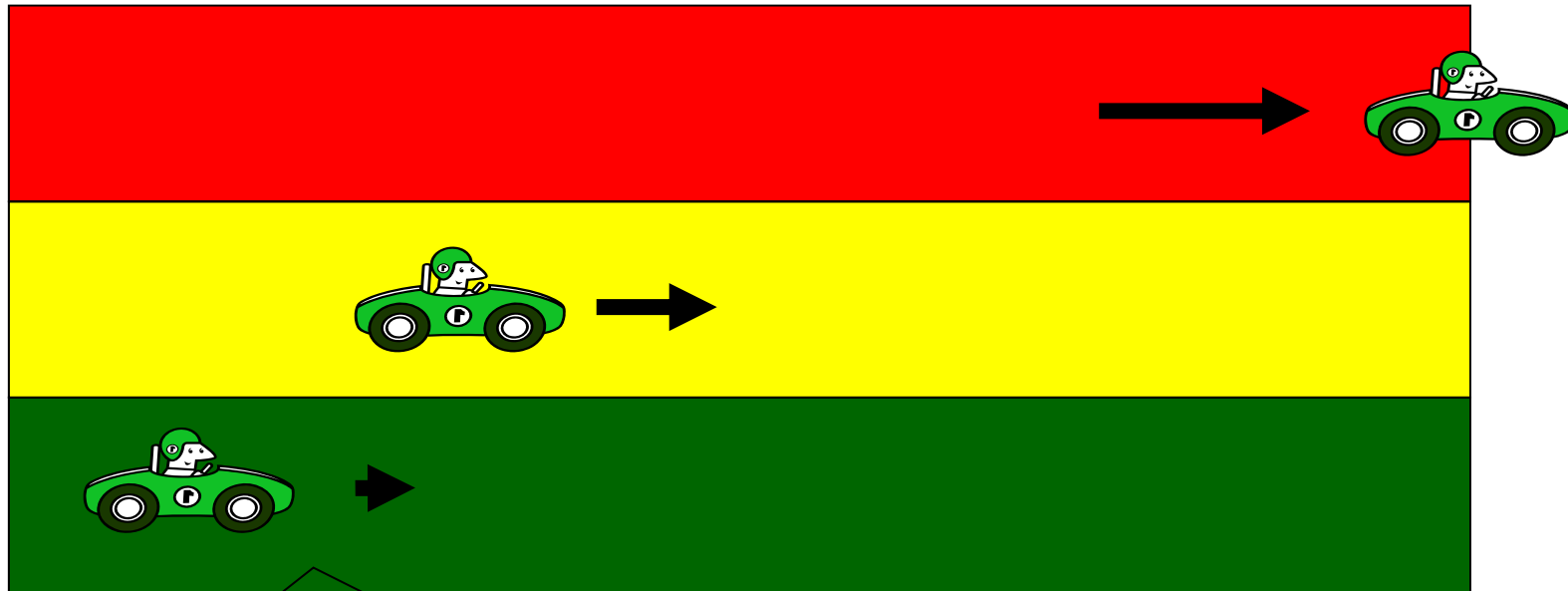
LOCAL OPITIMA RULE:

What about duplication?





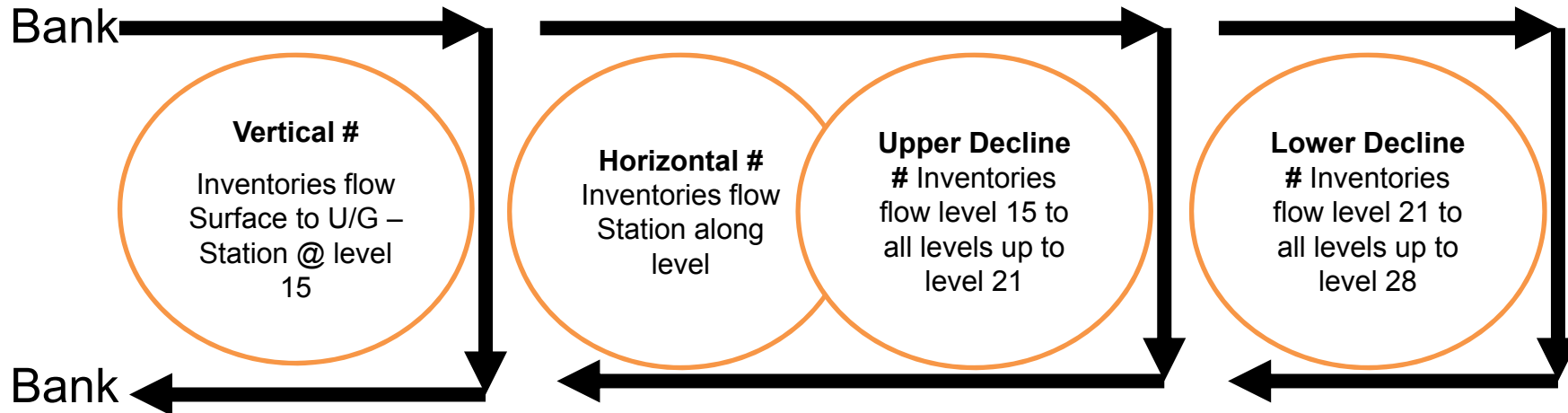
Average ordering vs. Usage



What about Batching?
Batching works with Monthly Groceries, not Daily Blasts



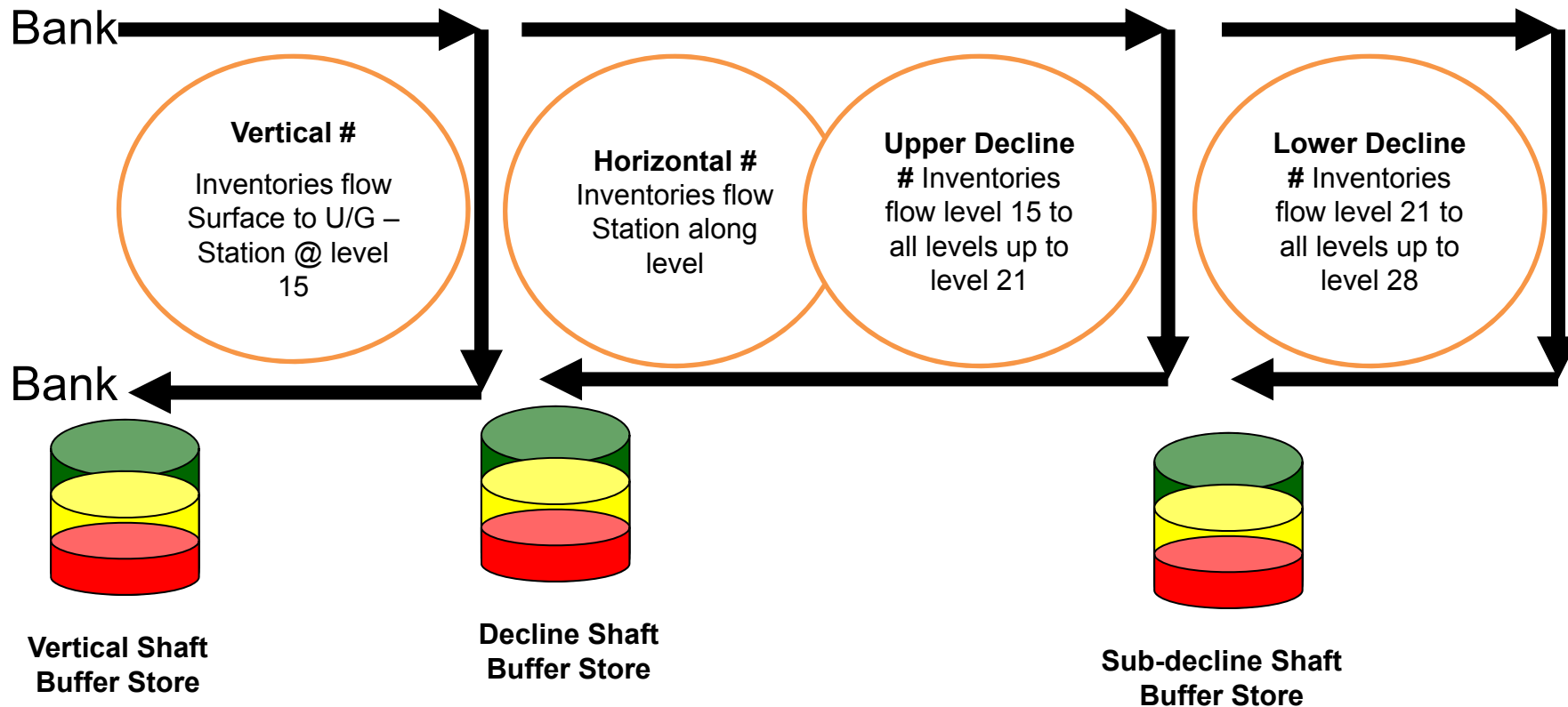
Reduced Replenishment Times





Increase Stores Reliability

(excluding 1/2 Levels)

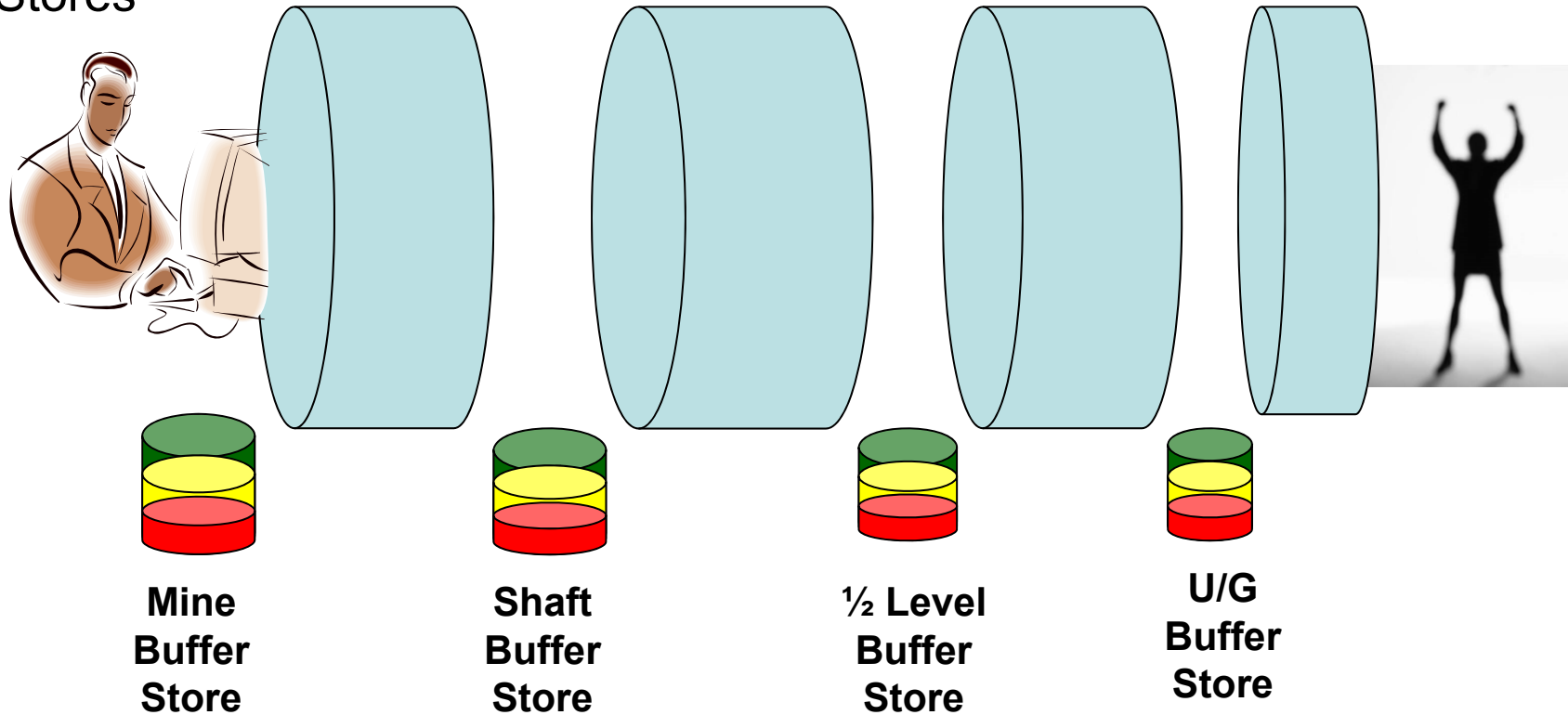




Operator satisfaction & trust

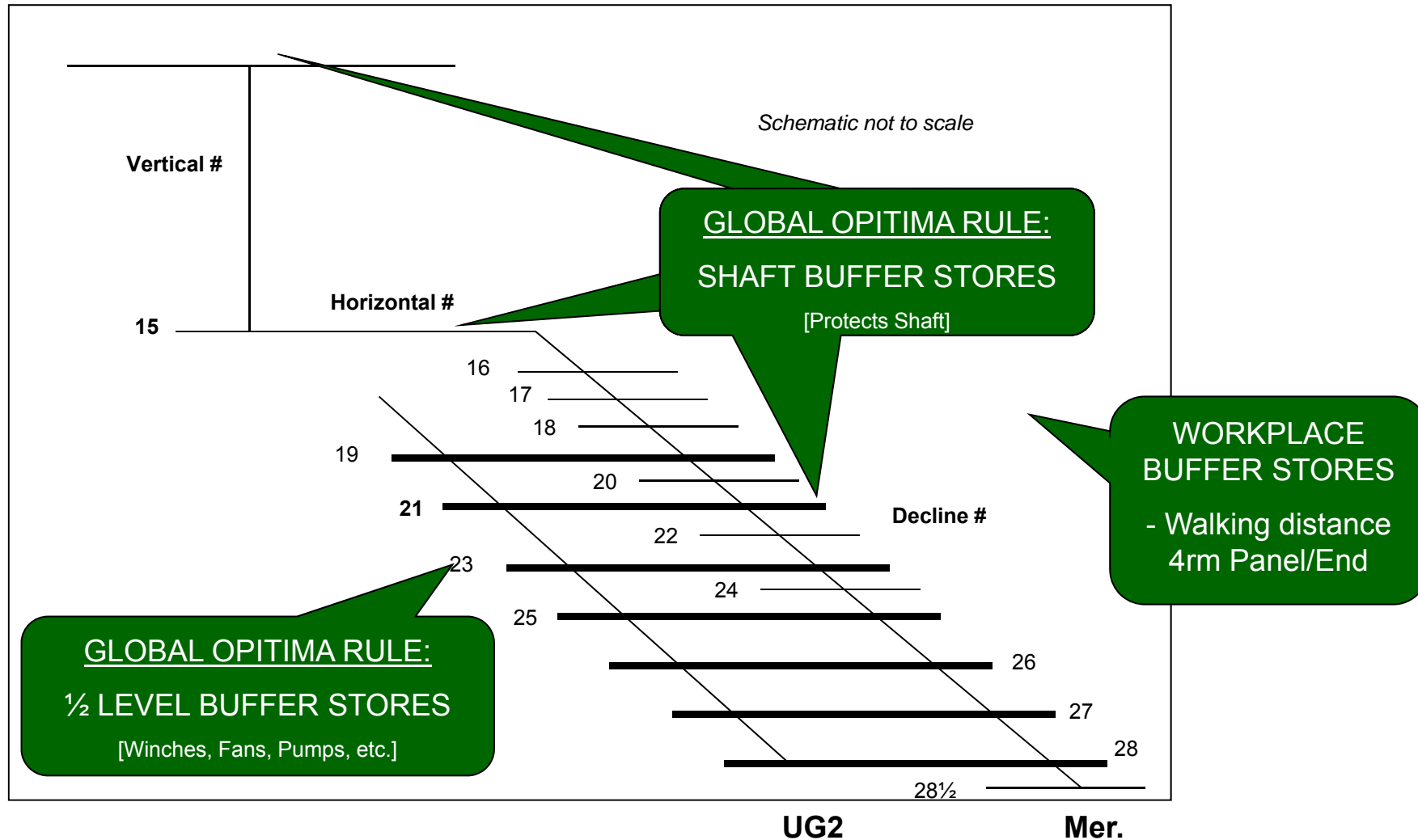
Central
Stores

Operator



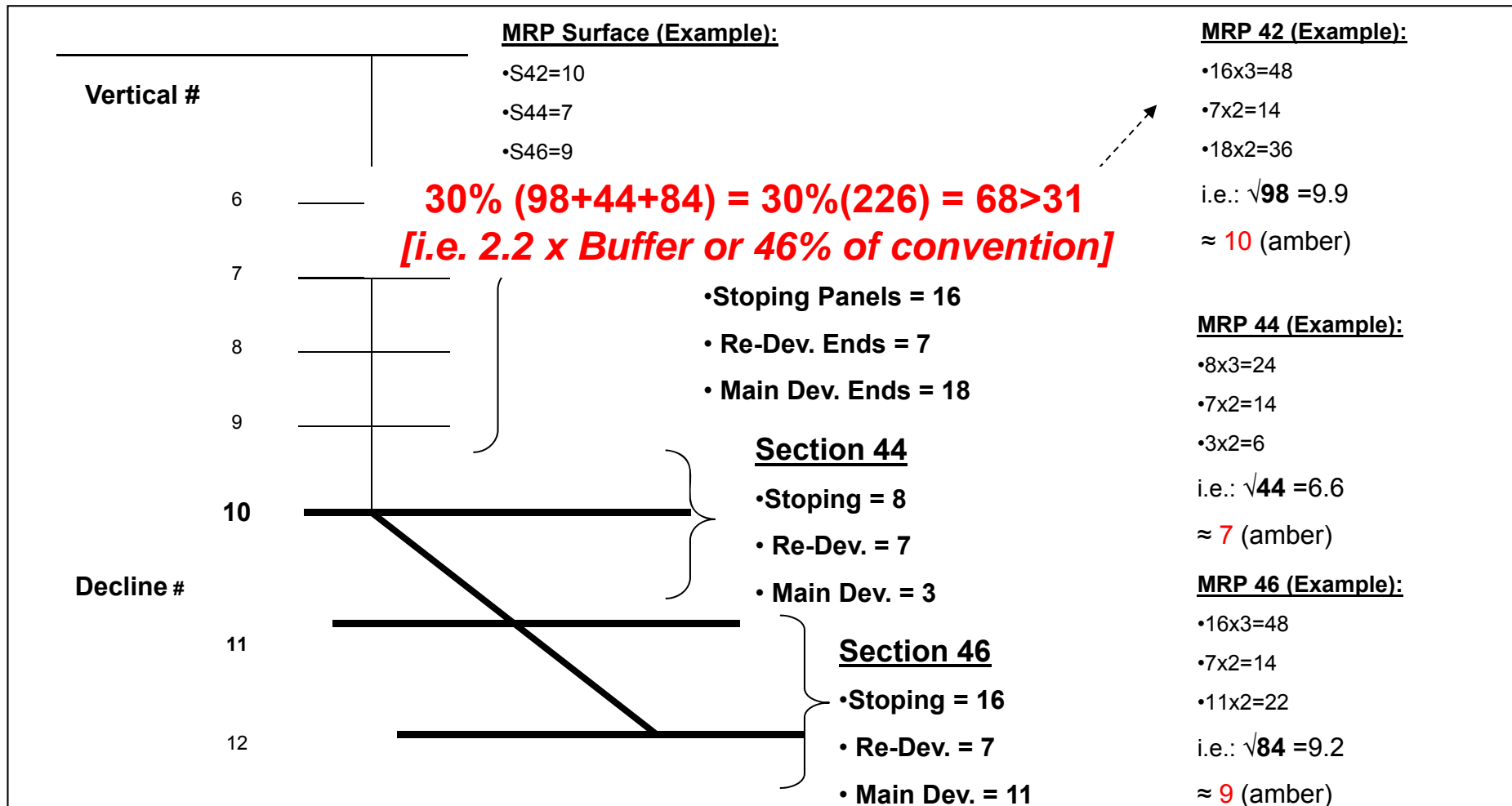


Institution of Buffer Stores



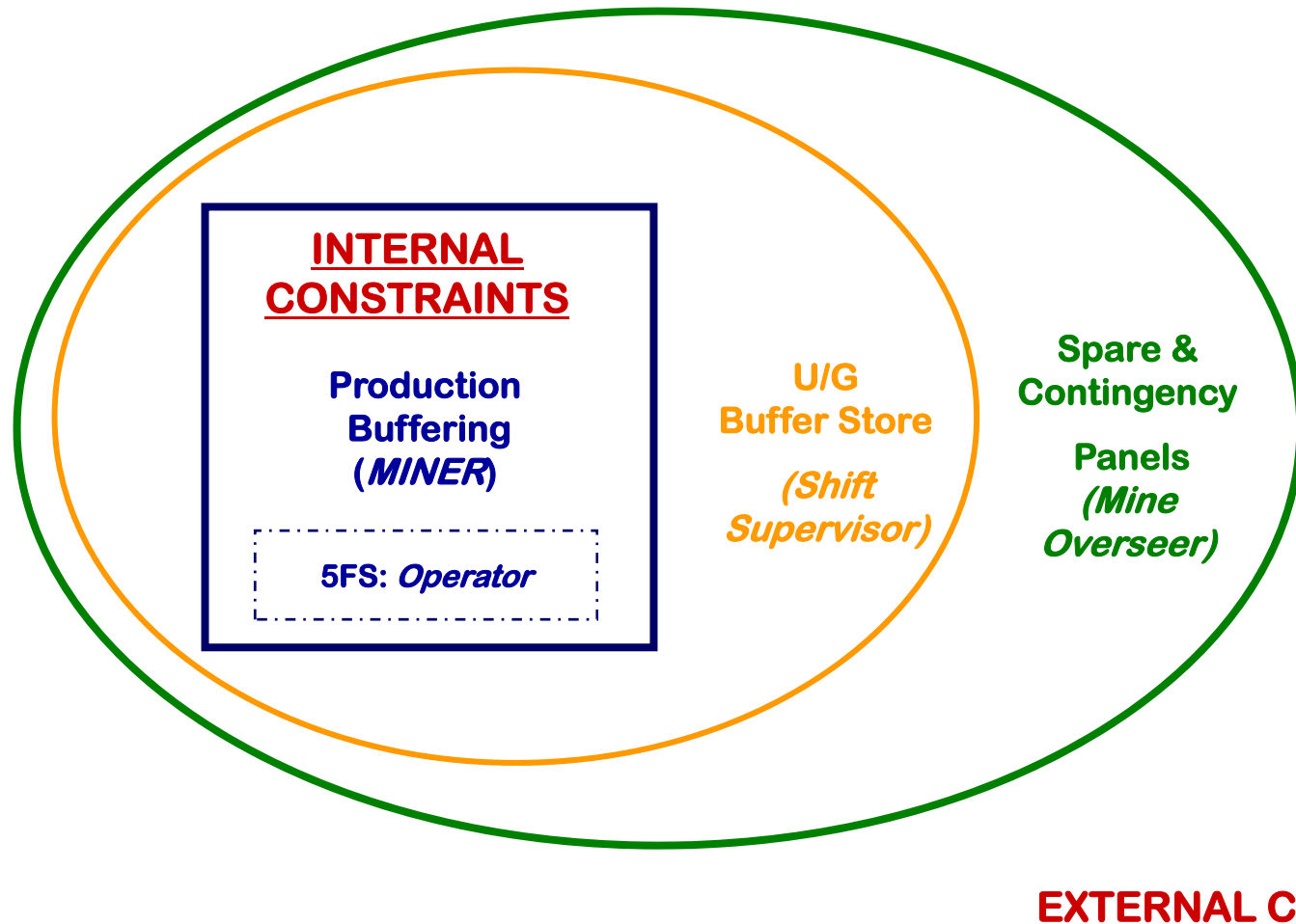


Buffer stores viability – Rock Drills



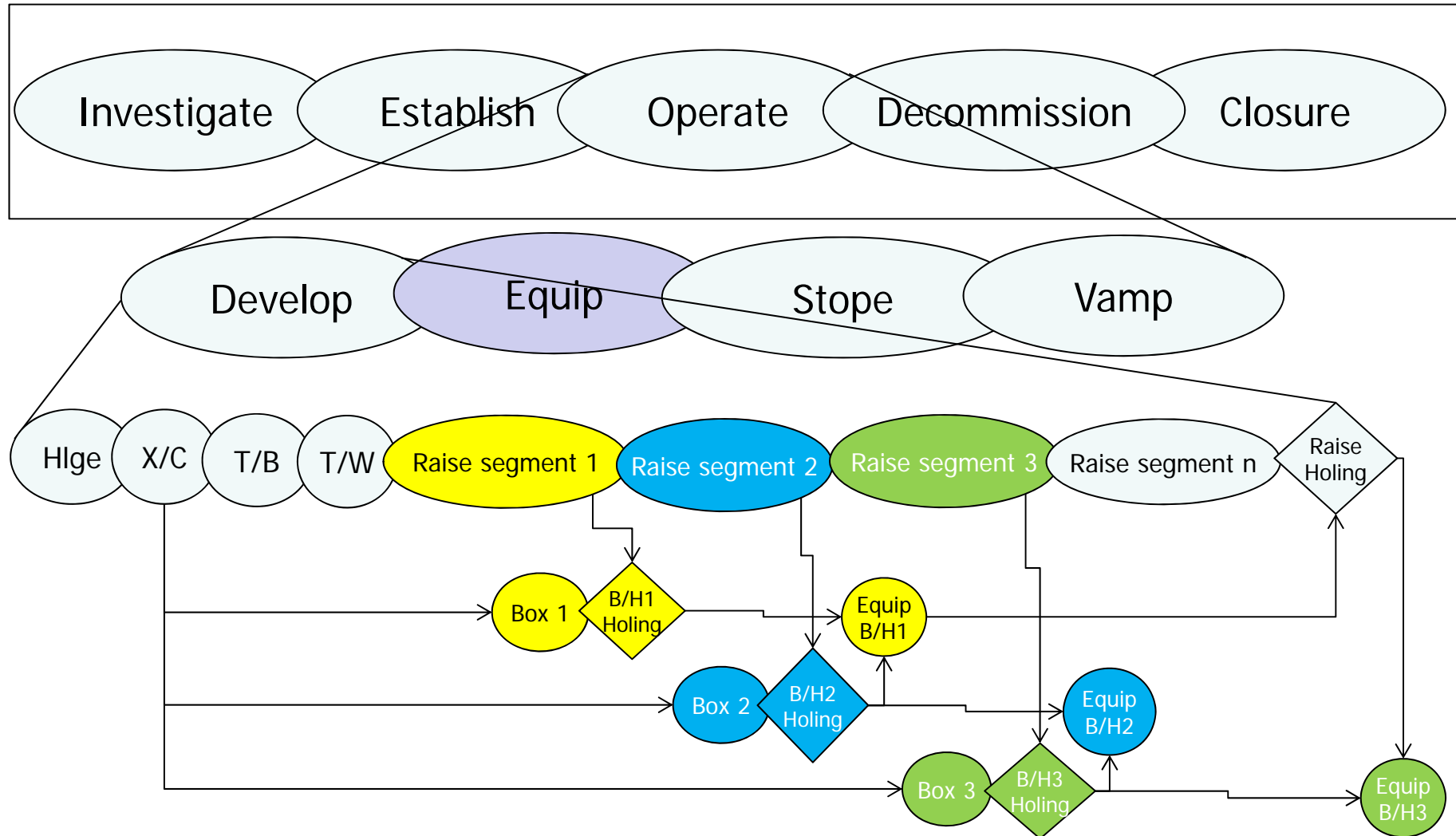


RSA Mining: Holistic Approach





Mining Model - Development

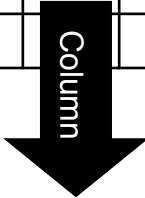
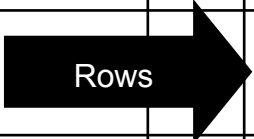




Planning conventional accounting

- Process in rows vs. Account in columns

	Footwall Haulage	Lay-Bye	Boxhole Cubby	Crosscut	Timber Bay	Travel Way	Step Over	Winze / Raise	Boxhole Drop-Raise	Ventilation Holing	Ledging	Equipping	Stoping	Vamping / Sweeping
Levels														
½ Levels														
Blocks (Months)	8.0	2.0	0.3	2.0	0.7	2.0	0.5	9.0	2.0	◇	9.0	2.0	75	2.0
Aggregate	Σ	Σ	Σ	Σ	Σ	Σ	Σ	Σ	Σ	Σ	Σ	Σ	Σ	Σ
Resources														
Accounting														



Lead time = 9.5 years; 51 Crews @ 3 Crews/block = 17 Blocks



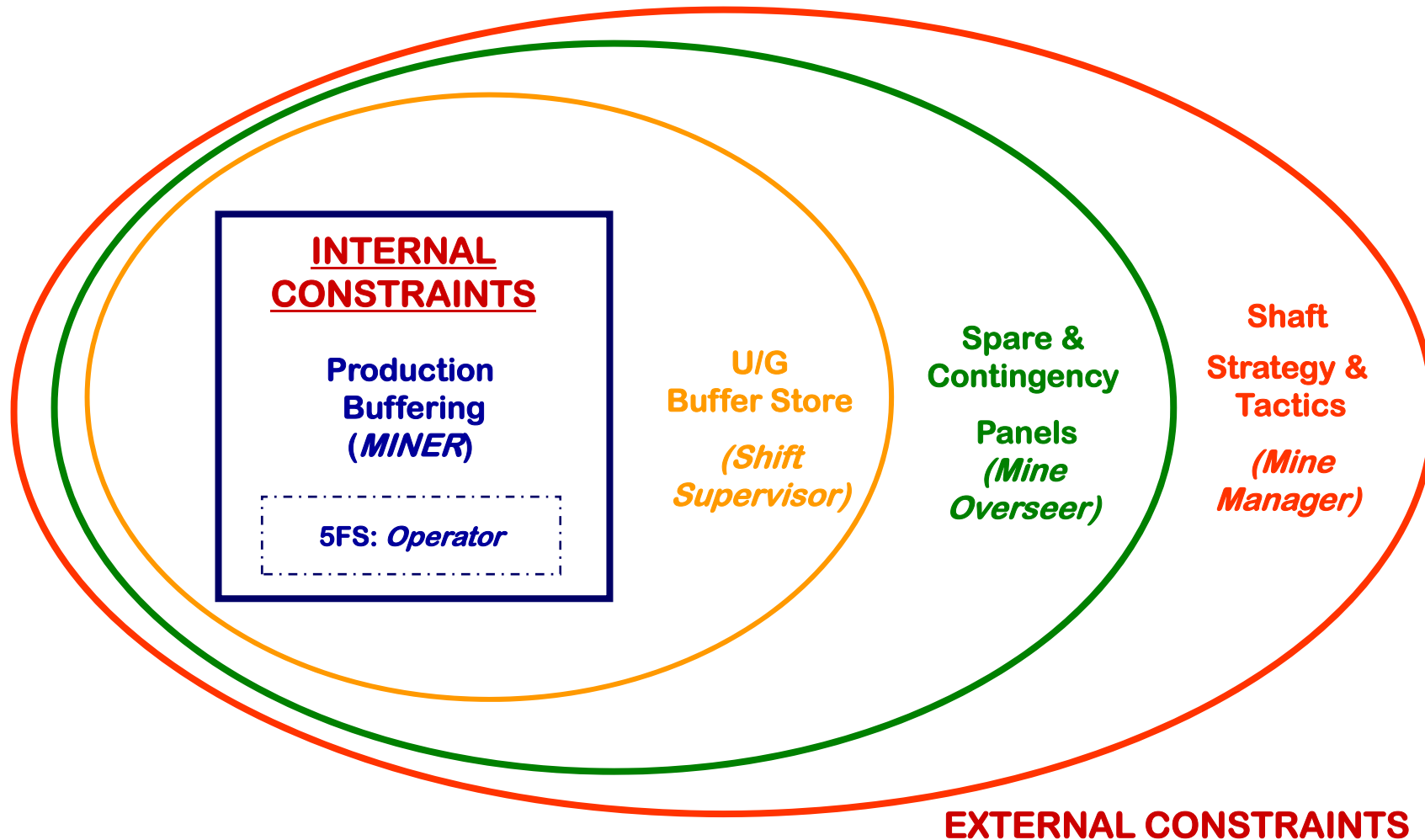
Planning Buffer Management - CCPM & Concerto

	Footwall Haulage	Lay-Bye	Boxhole Cubby	Crosscut	Timber Bay	Travel Way	Step Over	Winze / Raise	Boxhole Drop-Raise	Green	Yellow	Red	Ventilation Hoing (milestone)	Ledging	Equipping	Green	Yellow	Red	Stoping	Vamping / Sweeping
										Buffer						Buffer				
Block 1 (Mo)	8.0	2.0	0.3	2.0	0.7	2.0	0.5	9.0	2.0				◇	9.0	2.0				75	2.0
Block 2 (Mo)	8.0	2.0	0.3	2.0	0.7	2.0	0.5	9.0	2.0				◇	9.0	2.0				75	2.0

Lead time = 9.5 years; 51 Crews @ 3 Crews/block = 17 Blocks



RSA Mining: Holistic Approach





Postmodern RSA Mining Industry

- Re-entry – Production vs. Consultant (internal/external)
 - Verbalize the core problem (“Juggling”)
- Mine manager - current reality
 - Weaknesses: “Comfort Zones”
 - Pre-disposition for technical complexity vs. dynamic complexity
 - Events overtake you (time creep):
 - MHSI – Section 54 / 55
 - Fatal incident (6 March 2013) & inquiry
 - Geological complexity
 - Strengths: “Authority”
 - Organizational Maturity
 - Chain of command
 - Logistics
 - Code of practice



RSA Mining Industry: Maturity model

Anglo SHE Risk Management Journey Guidance

PEOPLE

- P1. Personal Risk Attitude
- P2. Caring & Recognition
- P3. Management Leadership and Commitment
- P4. Safety Accountability
- P5. Employee Involvement and Consultation
- P6. Coaching and Mentoring



SYSTEMS

- S1. Risk Management Adoption
- S2. Strategic Planning
- S3. Project & Process Design Management
- S4. Major Hazard / Priority Risk Identification and Management
- S5. Change Management
- S6. Job and Task Planning
- S7. Hazard Identification and Reporting
- S8. Training and Competency
- S9. Communications
- S10. Knowledge Management
- S11. Maintenance
- S12. Procurement
- S13. Contractor Management
- S14. Incident Investigation and Analysis
- S15. Emergency Response
- S16. Safety Performance Measurement
- S17. Auditing and Monitoring

THE ROAD TO 'ZERO HARM' – CREATING A CARING CULTURE IN ANGLO



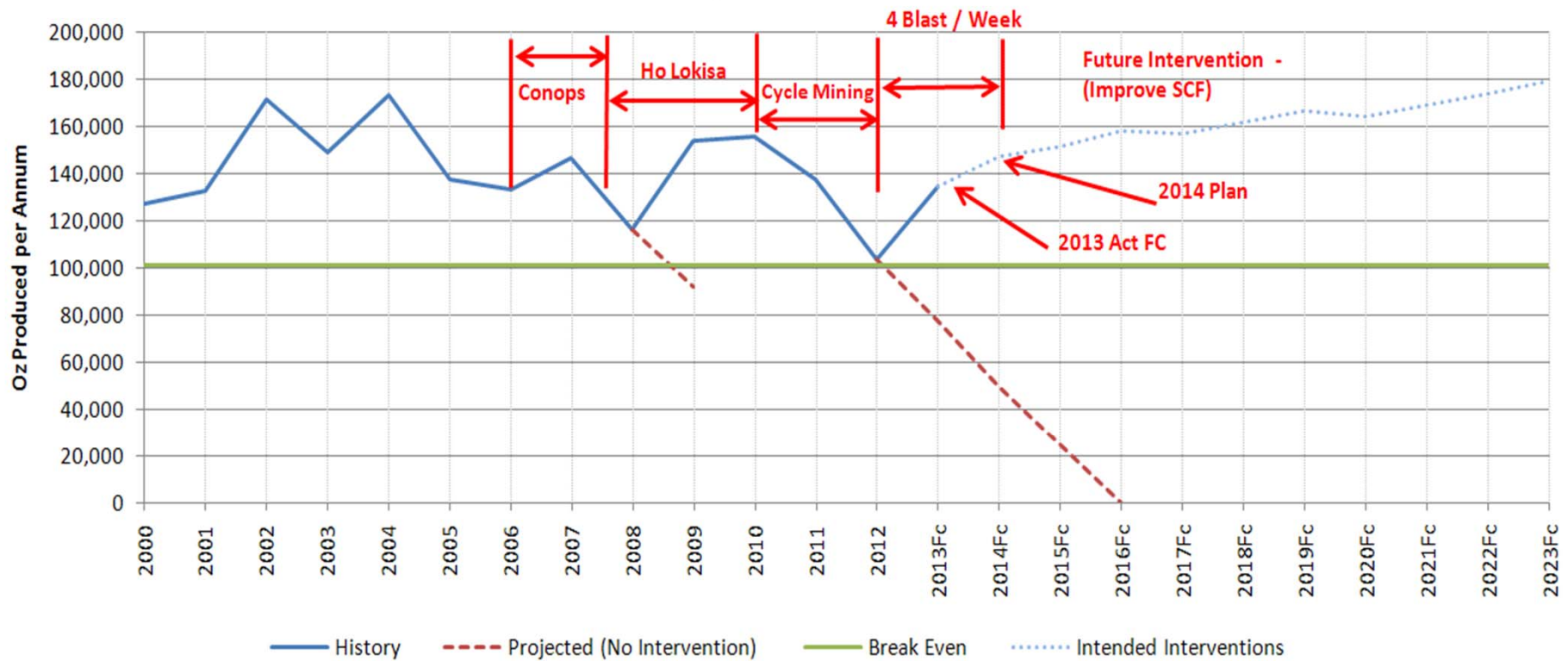
Harmony – Masimong Mine

- Strategic Assessment
 - Benchmark: “Art of War” (Sun Tzu)
- Assessment of “The Way” – *Resilient Maturity*:
 - Vision, Mission & Values
 - Leadership credibility based on turnaround legacy
 - Leadership Coaches (one-on-one; GM, MM, MO, & SB)
 - Ho Lokisa Culture
- “The Weather” – Assessment of mining cyclic nature
 - LOM, Annual, Quarterly, Monthly, Weekly, & Daily cycles
 - Last quarter is used recover shortfalls, if any
 - Last quarter is a quarterly bonus opportunity
 - Last quarter is the preparation period for next fiscal cycle



Legacy & direction

Projected LoM



Note: For demonstration purpose only



Masimong Mine – Strategic Assessment

- Assessment of mining “Terrain”:
 - Mine Health & Safety
 - Organizational Maturity
 - Antagonistic pairs mindset - MHS & Production
 - MHSI
 - Difficulty of ease of mining
 - Geological anomalies causes material change in strike direction
 - Mining of Basal Reef (Undercut method) & B-Reef
 - Wide range of flat to steep dipping reef
 - Adequate Engineering & Logistics design capacity
 - Distance
 - Working Places increase from shaft - mined out areas



Masimong Mine – Strategic Assessment

- Leadership assessment:
 - Intelligence
 - Annual Strategic Planning (2-yr – LOM)
 - Monthly Preplanning (Preparation planning)
 - Daily control & weekly forecast
 - Trustworthiness
 - Clear acceptance & understanding of Bonus Incentives
 - Fair & Timely Discipline Action
 - Humaneness: Leadership are compassionate with its people
 - Courage:
 - Passionate & relentless drive of the Mission without vacillation
 - Timely address of anyone driving another agenda
 - Sternness: Chain of command with a single agenda



Masimong Mine – Strategic Assessment

- Assessment of “Discipline”:
 - Organization
 - Senior Management
 - Middle Management
 - Front-line Management or Mine Overseers
 - Supervisors or Shiftbosses
 - Mining units known as Crews
 - Chain of command
 - Entrenched order in which authority and power is wielded and delegated from top management to every employee
 - Logistics
 - Line function: Material management – Consumables
 - Specialist function: Equipment management – Assets



Getting mining unstuck – a viable vision

- Strategy & tactics (Mine Manager):
 - Ability to empathize with Management
 - Pitch varies at different levels (segmentation)
 - Maturity is inauspicious & has been taken lightly
 - Leadership **resilience**, it's a long haul (4 years)
 - Single agenda
 - Code of practice
 - Staffing, Equipping & Training – alignment
 - Visible Felt Leadership (“make a visible & felt difference”)
 - Miner Organization
 - Shiftboss Utilities & Materials Supply (Buffer Stores)
 - Mine Overseer Investigation & Organization
 - Going beyond comfort zones is a condition of service



Conclusion

- Coal Mining:
 - Mechanized Mining
 - Sasol Mining Complex
 - Organizational Maturity (*Code of Practice*) & POOGI Infrastructure
 - Driven by MD and senior management
- Platinum Mining
 - Conventional Mining
 - Impala Platinum Complex
 - Organization Maturity
 - Driven by Operations Executive
- Gold Mining
 - Conventional Mining
 - Harmony Gold Mine
 - Organizational Maturity (*Miner Schedule*) & POOGI Infrastructure
 - Institutionalized & a condition of service

Discussion:

