Operational changes enable Namdeb’s Southern Coastal Mining Team to Reduce Risk and Increase Productivity as we advance deeper into the Atlantic Ocean.

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AGENDA

• Introduction to Namdeb
• How the diamonds got here
• SCM Production Pipeline
• Mining Method
• Theory of Constraints
• SCM Process Flow
• Planning and Execution
• L&H Improvements
• Bedrock Improvements
• Stripping Improvements
• Conclusion
INTRODUCTION TO NAMDEB AND SCM

A Namibian company...

- Wholly owned subsidiary of Namdeb Holdings
- A 50:50 joint venture between De Beers and the Government of Namibia
- Southern Coastal Mine (SCM) stretches 120km north from the Orange River
- Only 30km of active mining areas
- Started in 1929
- Exposed to aggressive Atlantic Ocean storms.

...with a rich history and a challenging environment.
GEOLOGY – HOW THE DIAMONDS GOT HERE?

Diamonds created inland and transported by the Orange River...

- Created in Kimberlite pipes.
- Erosion and transport by Orange River to the coast
- Deposited in the Atlantic Ocean
- Upgrade diamond concentrations:
  - Wave action,
  - Longshore drift and the
  - Rise and fall of sea level
- Diamonds trapped in gullies and potholes
- Overlain by over 30m of marine and accretion sand

...then deposited in unique deposits in Namibia.
SCM PRODUCTION PIPELINE

Pushing the sea back...

Accretion → Stripping → Bedrock Cleaning → Load & Haul → Processing → Final Recovery

...to mine down to 30m below sea level.
MINING METHOD - ACCRETION

Accretion has shown positive results...

- Mining west of the high water line started in 1977
- We have now progressed between 300 - 1,000 meters west from original HWL
- Beach nourishment - new accretion technique used since Feb 2017
- Beach nourishment has improved accretion progress and protects seawalls against storm events

  3 Conveyors  
  Accretion Stripping  
  Conventional Stripping  
  Processing plant tailings  
  Total

  12.3 Mt per year  
  8.6 Mt per year  
  33.1 Mt per year  
  +/- 2 Mt per year  
  +56 Mt per year

...and beach nourishment is assisting accretion and providing storm protection.
MINING METHOD - STRIPPING

Initially building the seawall to protect workings....

....then accrete the beach to create future mining area.
MINING METHOD - BEDROCK

Bedrock Bulking removes the majority of the diamondiferous gravels...

Gullied, potholed and undulating footwall with some cemented material.

Two interdependent but linked processes:

- **Bulking** - removal of most material in the gullies/potholes

- **Transvac Cleaning** - cleaning the bedrock including cracks

...while Bedrock Cleaning ensures no diamonds are left behind.
LOAD AND HAUL

Load and Haul tram material from the mining sites to the plant...

- Tram diamondiferous material from mining sites to 3 Plant
- Sites are situated:
  - 9km north (U100)
  - 14km south of the plant (GN006)
- Long hauls reduce efficiencies and compromise required plant feed rates.

...long tramming distances and low efficiencies constrain direct plant feed capacity.
THEORY OF CONSTRAINTS

System output is limited by one or more constraints....

- The Theory of Constraints was first introduced by Eliyahu Godratt in 1984
- The system output is limited by one of more constraints and that an optimum system runs the constraint or bottleneck at maximum capacity
- All other processes therefore need to be focused on maximising throughput at the bottleneck

...maximising throughput at the bottleneck optimises the system.
PROCESS FLOW FOR SCM

SCM process flow assisted in defining focus areas....

Buffers:
- Accreted Beach
- Strip Reserve
- Bulking Reserve
- 3# Buffer Stockpile

Other Bottlenecks:
- Stripping
- Accretion

Focus Area:
- Load and Haul Capacity
- Bulking – create material

Primary Bottleneck:
- Feed material to the plant

....and ensuring improvement focus was on the right functions.
PLANNING AND EXECUTION

Start with a solid Mine Plan....

Planning:
• Solid mine plan – realistic targets and sufficient detail
• Inclusion of all relevant stakeholders
• Considered numerous options and associated risk

Execution:
• Weekly drive through planning session
• All relevant stakeholder involvement
• Alignment of the plan
• Communication, Communication, Communication

....and using short interval control ensure you execute according to plan.
LOAD AND HAUL

Building stockpiles has been a change in mindset at SCM....

SCM has traditionally been reluctant to build stockpiles as this generates additional cost.

But:
Plant Feed Rates  >  L&H Fleet efficiencies
Plant Hours < L&H Fleet Hours

Result:
A significant number of mining delays

Looking at ToC the bottleneck was the ability of L&H to achieve required plant feed rates. This justified the creation of a buffer stockpile ahead of the tipping bin. Resulted in reduced delays and increased overall throughput rates.

Revenue generation significantly greater than the additional stockpiling and rehandling costs.

....resulting in higher throughput rates and positive financial return.
PLANT THROUGHPUT

Improvement projects have increased the average throughput rate by 24%.

Average Hourly Plant Throughput Rates Per Half Year

- 2015 H1: 755
- 2015 H2: 793
- 2016 H1: 732
- 2016 H2: 865
- 2017 H1: 901
- 2017 H2: 936

Increasing plant capacity and reducing unit costs.
Backshift bulking:  
- Bulking the bottleneck  
- Additional bulking created bulk reserve  
- Increasing operating hours and m²  
- Breakout if gullies increasing cleaning rates

...introducing a backshift has increased overall production by 32%.
INCREASED CLEANING RATES & BIG HAMMER

Additional bulking has impacted positively on bedrock cleaning rates...

Cleaning Rates:
• Additional bulking capacity meant bulking teams broke open narrow gullies
• Increased transvac cleaning rates

Big Hammer:
• Previously no solution to conglomerate (more hours of hydraulic hammers)
• Bigger hammer provided a solution

...and the big hammer has provided a tool to break out conglomerate.
Improvement projects have increased average daily production by 32%....

....and has a direct impact on the Namdeb bottom line.
Previous mining method was to take material out on the east....

....dropping the whole cut at the same rate.
A change in mining philosophy with temporary ramps on the east ...

...reduced haul distances and increased efficiencies.
New layout improved water management and allowed for more efficient ‘top-loading’.

- New Layout also improved water management and loading set-up
- Increase in top loading
Greedy boards increased ADT payload.

Greedy Boards:
- Effective 20% increase in payload
- Low maintenance
- Maintained loading through the tailgate

Redundant Excavator
- Maintain 3 excavators in production at all times
- Better maintenance scheduling
- 4th excavator used for digging channels (non-production tasks) occasionally
- Big hammer for bedrock option

....while increased excavator redundancy increased operating hours.
ACCRETION AND BEACH NOURISHMENT

Newly implemented Beach Nourishment reduced tramming distances....

What changed:
• Change from tipping on the groynes to...
  dumping along the length of the beach.
• Create a platform and advance westwards

Results
• Reduced tramming distances when combined
  with new mining philosophy
• Increased dumping area – less queuing
• Accelerated accretion
• Provided a buffer to protect against storms

....while also protecting workings against the risk of storms.
Improvement projects have increased average daily production by 49%....

....increasing strip reserve and opening up new opportunities to increase bedrock production.
The Theory of Constraints puts focus on key bottlenecks....

- ToC highlighted focus areas across the mine.
- Developed a stable mine plan and execution methodology (Drive Through)
- Developed and Implemented Improvement Projects
- Subsequently we have ramped the bedrock cleaning from 3 to 5 teams improving Primary Bottleneck
- SCM have achieved more carats in 2018 YTD than in 2017

....to ensure value adding improvements are made in the right areas.
Thank You and Questions...