

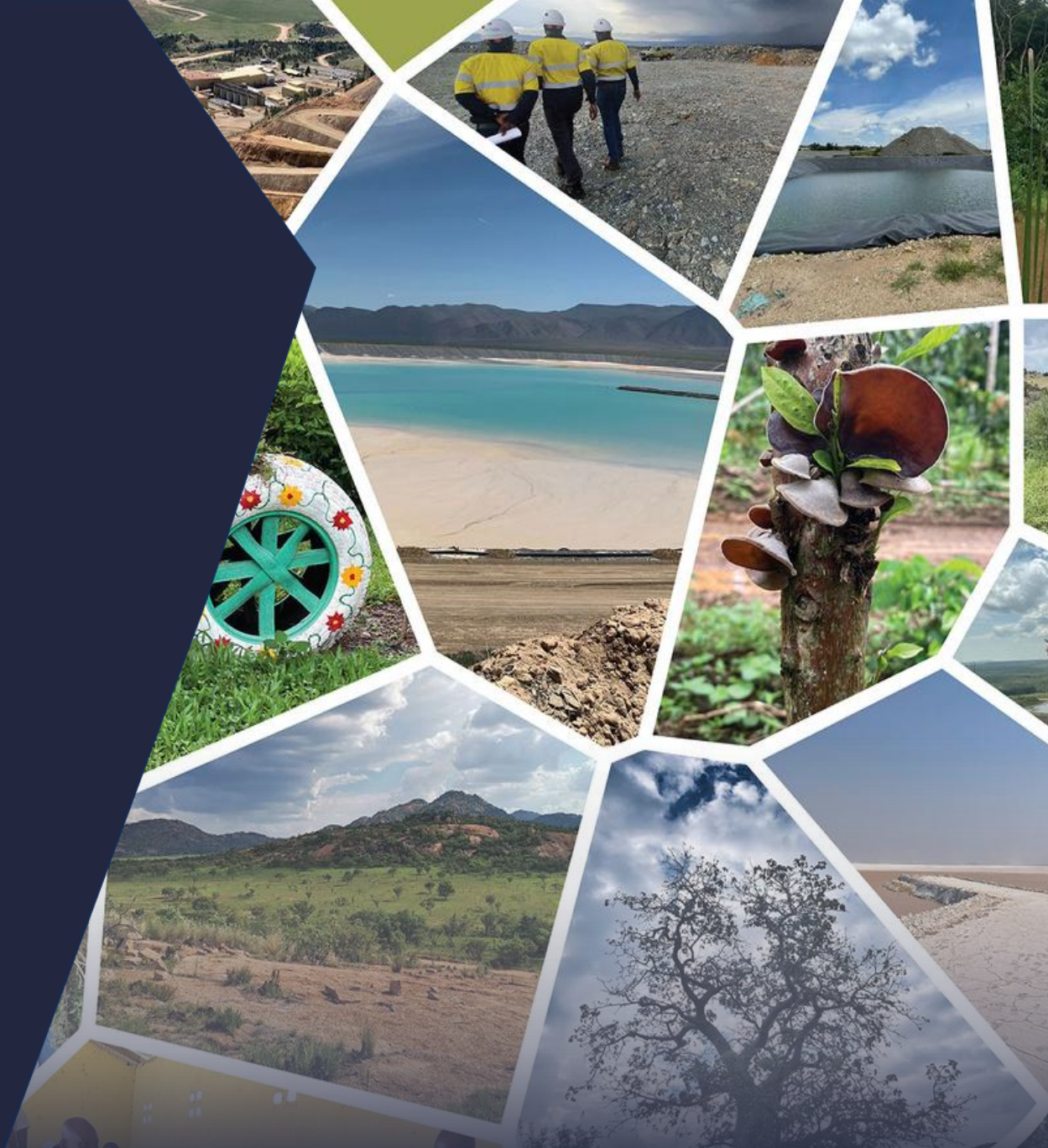


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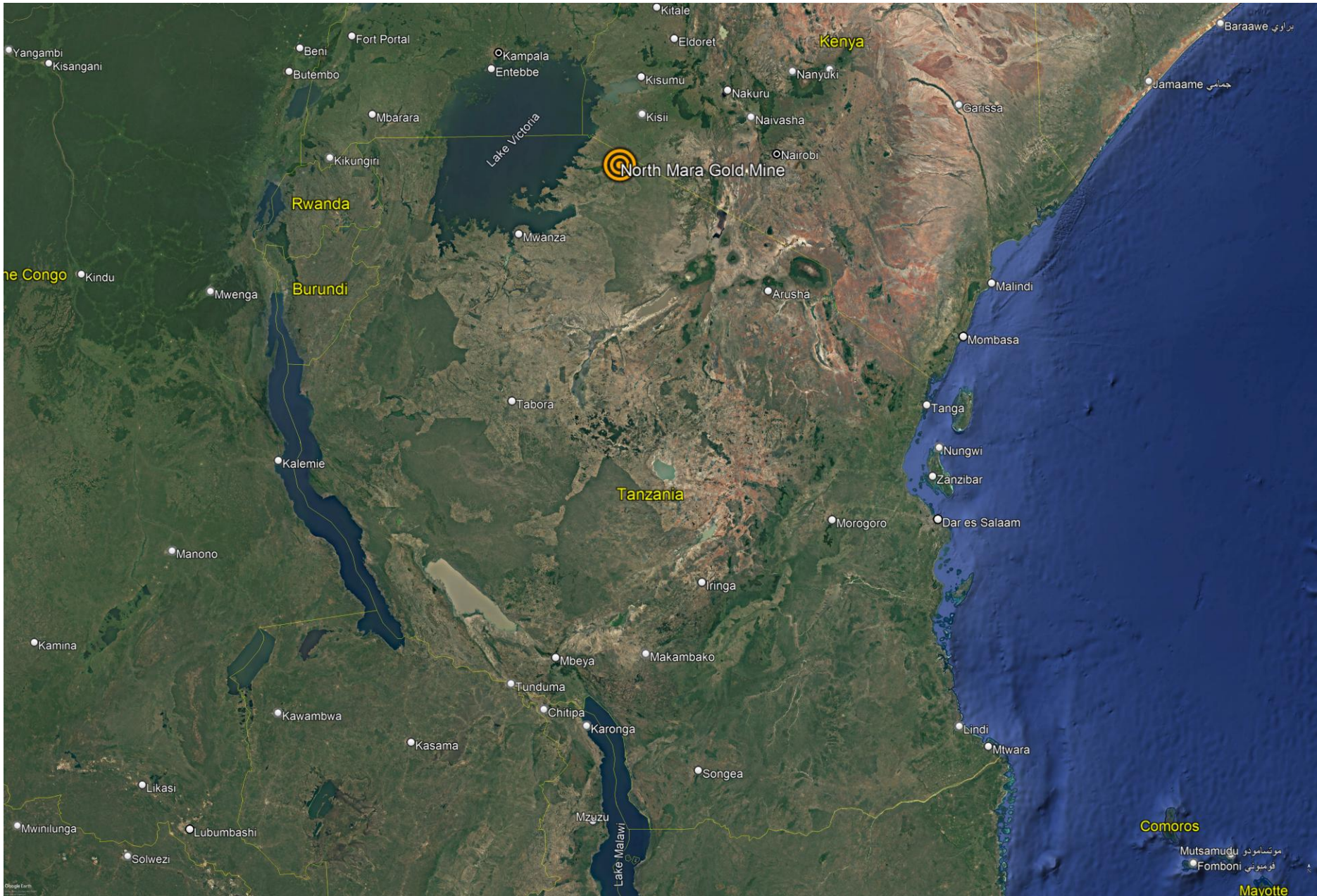




Optimising Water Management at North Mara Gold Mine: Response to Excess Water Accumulation on the Tailings Storage Facility

ASRS Presentation – 04 June 2025





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North Mara Gold Mine (NMGM)

- 2002 to 2019 – operated by Acacia Mining with Barrick owning majority shares
- End of 2018 - Barrick + Randgold Merger
- Acacia had a lengthy Tax dispute with the Tanz Gov and had various corporate and operational challenges
- September 2019 – Barrick negotiates a settlement with the Tax authorities and purchased the remaining Acacia shares to take full control of NMGM
- 2024 – 265 000 ounces produced (3.75 g/t)





Airstrip NAF Dump

Airstrip PAF Dump

Leach Pond 1

Leach Pond 2

Leach Pond 3

Gokona Pit

Skyway Pond

Gokona PAF Dumps

Gena Pit

C-Ore Stockpile

Gokona Southern Dump

Gena East

Leach Pond 1

Leach Pond 3

GWST
Leach Pond 2

Gonsara



Water Management Issues

- No water balance to guide decision making
- Mine had a philosophy of keeping water stored at the end of the wet season to get through the dry season (including water on the TSF)
- This meant a build up of volume but also a build up of dissolved salts/contaminants (TDS, SO₄ and metals)
- Very low volume discharge permit that was heavily dependent on dilution
- Process Plant preferred clean raw water rather than process return water from the TSF

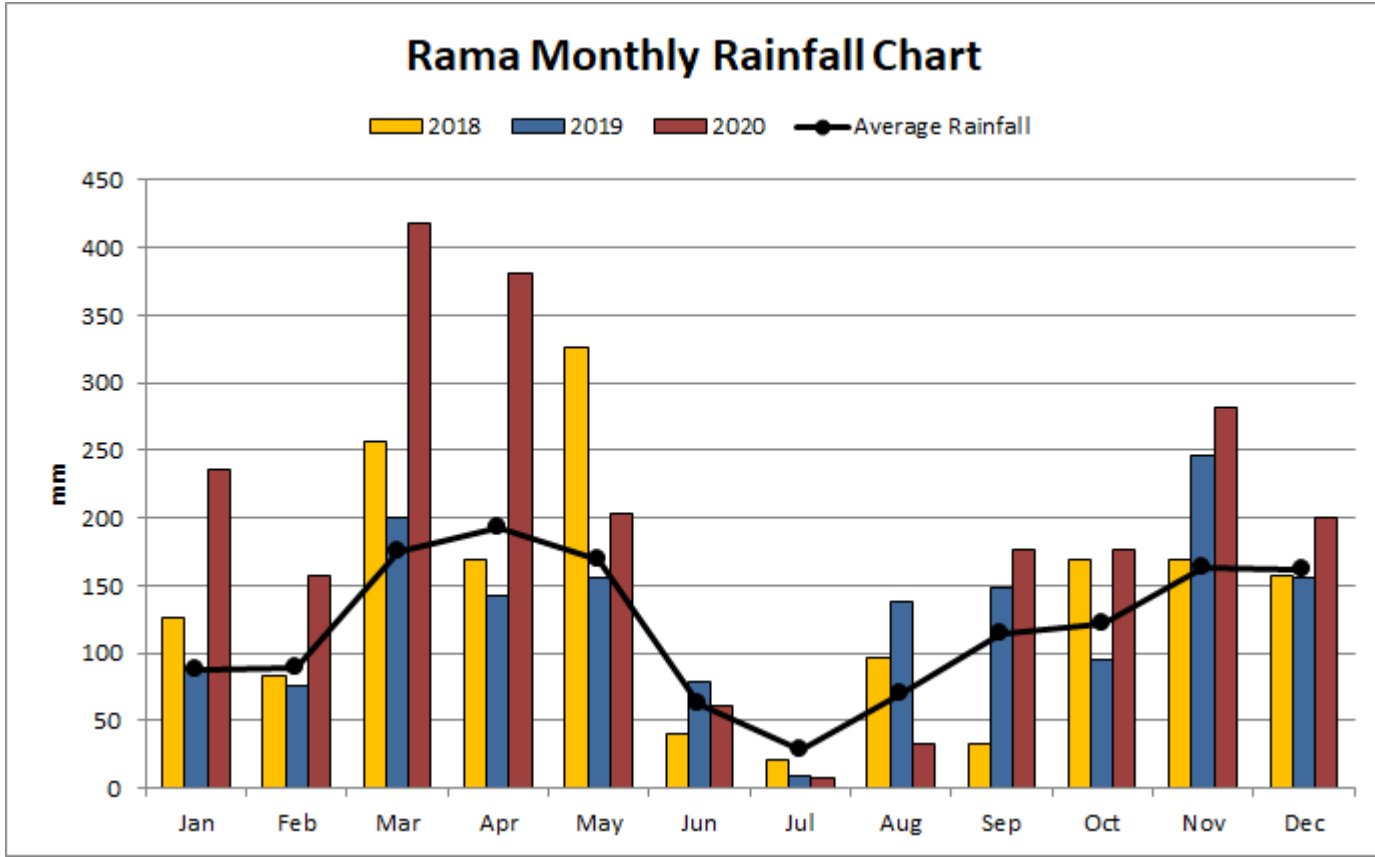
Events Leading to Emergency Situation

- Poor water management philosophy and using TSF as storage
- Above average rainfall season for 3 years in a row
- 2x Average Rainfall in first few months of 2019
- Accumulation and recirculation of contaminants over years
- Not enough pumps and pumping capacity as well as insufficient maintenance of pumps and pipes

Rainfall and Evaporation

Data	mm/a
MAP	1 417
2018	1 648
2019	1 532
2020	2 331

Lake Evaporation
= 1 166 mm/a



Result

- $\pm 8 \text{ Mm}^3$ of water on the TSF
- Super saturated TSF
- Freeboard of only 30 cm
- No designed spillway (no discharge from TSF allowed in Tanzania during operation)
- Poor planning and control of tailings deposition
- Not enough discharge capacity downstream (Ingwe Dam discharge point)
- Years of recirculating contaminants meant discharge qualities were difficult to meet

End 2019



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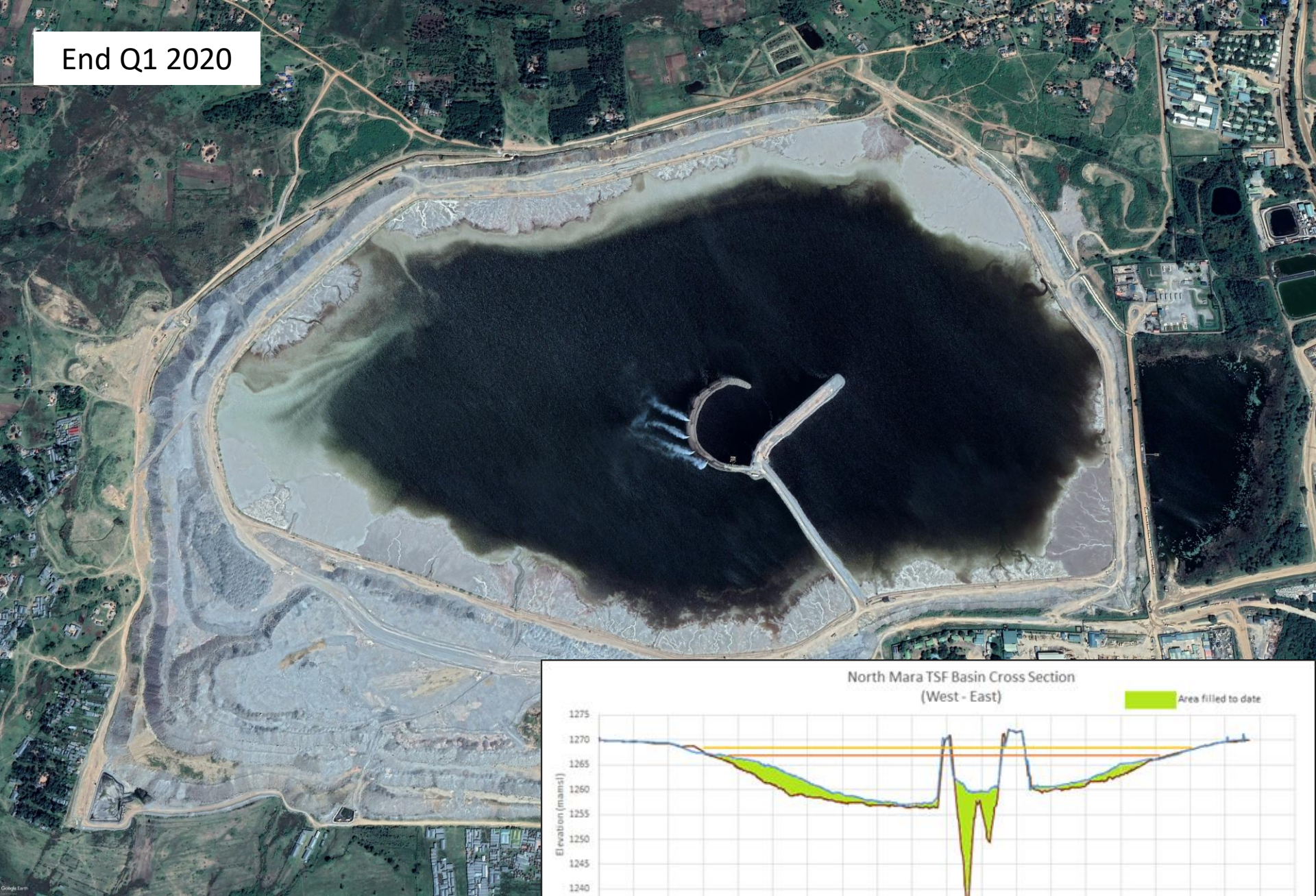
Tanzanian Authorities

- Temporary stopped operations to understand the water management issues and get an emergency plan together
- Imposed a timeline on NMGM:
 - TSF at or below 800 000 m³ by end Dec 2021
 - Rama Pit empty by end April 2022
- Worked with the NMGM team to allow fast approval of any mitigation options requiring sign off

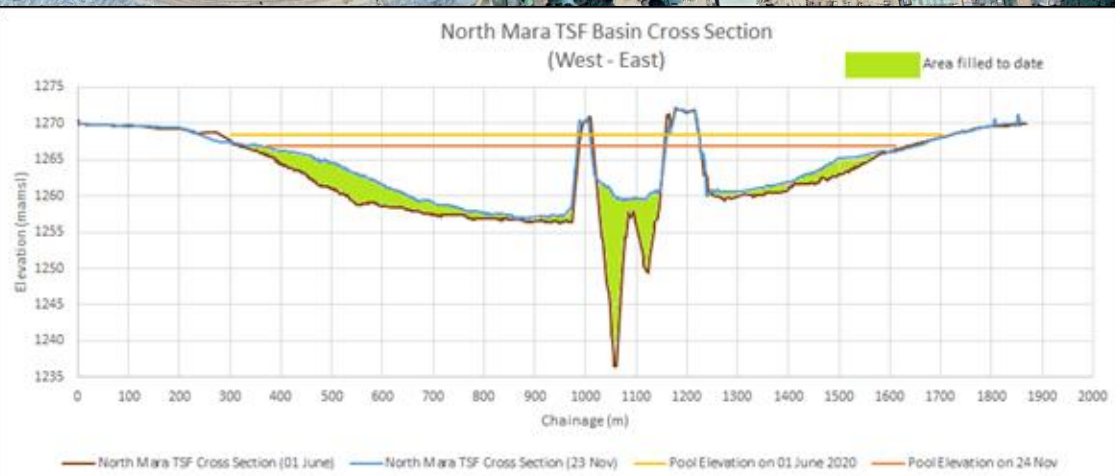
Actions taken in Q1 2020

- Move 4 Mm³ into the Rama open pit
- Mechanical Evaporators (total of 12)
- Dilute and discharge through Ingwe dam at the highest volume possible under current permit (20 000 m³/d)
- Apply for an additional discharge permit (increase to 100 000 m³/d)
- Source additional pumps (new and old) and put in place emergency maintenance plan
- Develop excel water and salt balance to assist with decision making
- Source water treatment plants based on calculated capacity
- Fill in the Turkeys Nest

End Q1 2020



North Mara TSF Basin Cross Section
(West - East)



Water and Salt Balance

- The site did not have a water balance (site wide or TSF)
- Engineer of record who took over in 2019 developed a simplified model for the TSF circuit to determine the water treatment requirements
- This model assisted with the initial decisions around volumes but did not balance completely and did not include any chemistry
- Digby Wells then took over in Q2 2020, redeveloped the model (excel), calibrated with available information and expanded it into a salt balance

Water and Salt Balance

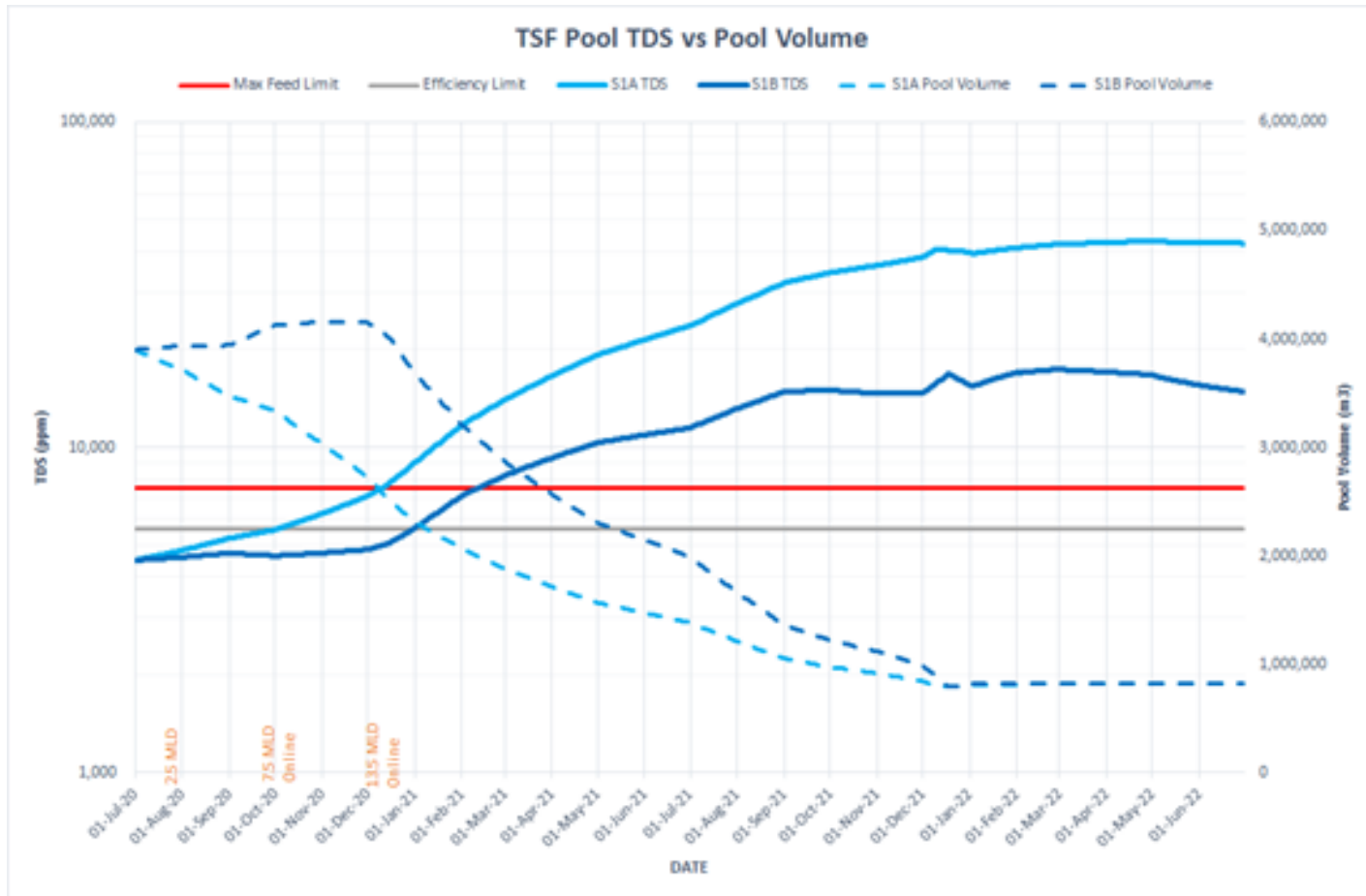
Parameter	Discharge Limit (mg/L)
TDS	1200
Sulphate	500
Nitrates	45

- 40 000 m³/d (40 MLD) of RO plants treatment capacity delivered in cells (containers)
- The W&S Balance had to consider the timing of the water treatment plants as well as the mixing of different sources of water
- No time to plan detailed SoW or studies and the decision was made to use TDS as the main parameter
- No site visit or sampling ourselves (Covid lockdowns)
- Starting TDS for both TSF and Rama = 4500 mg/L

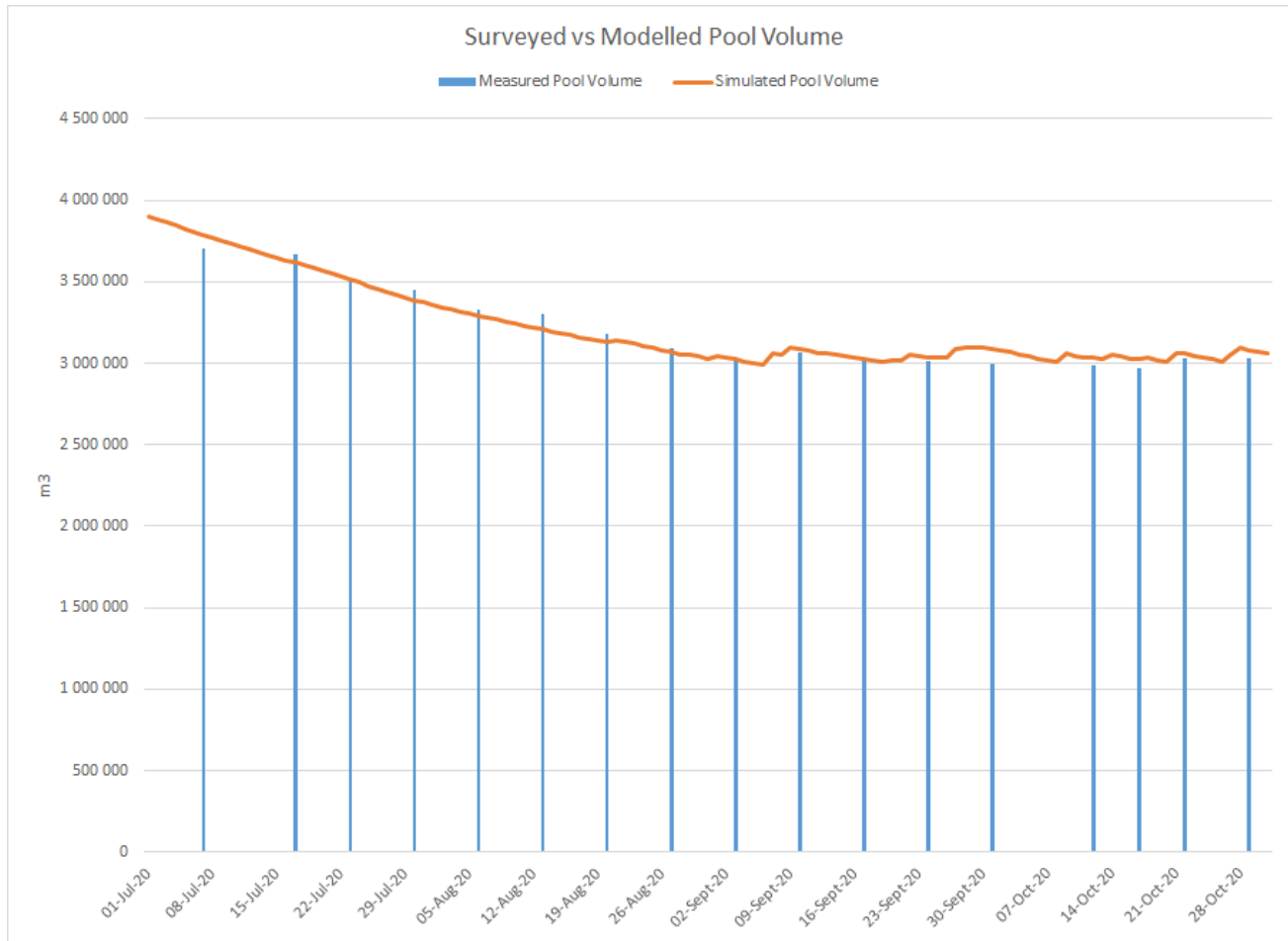
Water and Salt Balance

- WTP installation
 - July 2020 – 5 000 m³/d permeate production;
 - August 2020 – Additional 2 500 m³/d permeate production
 - October 2020 – Additional 7 500 m³/d permeate production
 - December 2020 – Additional 13 500 m³/d permeate production
- If WTPs operated at their optimum efficiency (70%) the reject (brine) stream = 11 000 to 12 000 m³/d
- Brine goes back onto TSF = TDS increases as pool decreases
- Salt balance showed we are working against ourselves in terms of chemistry

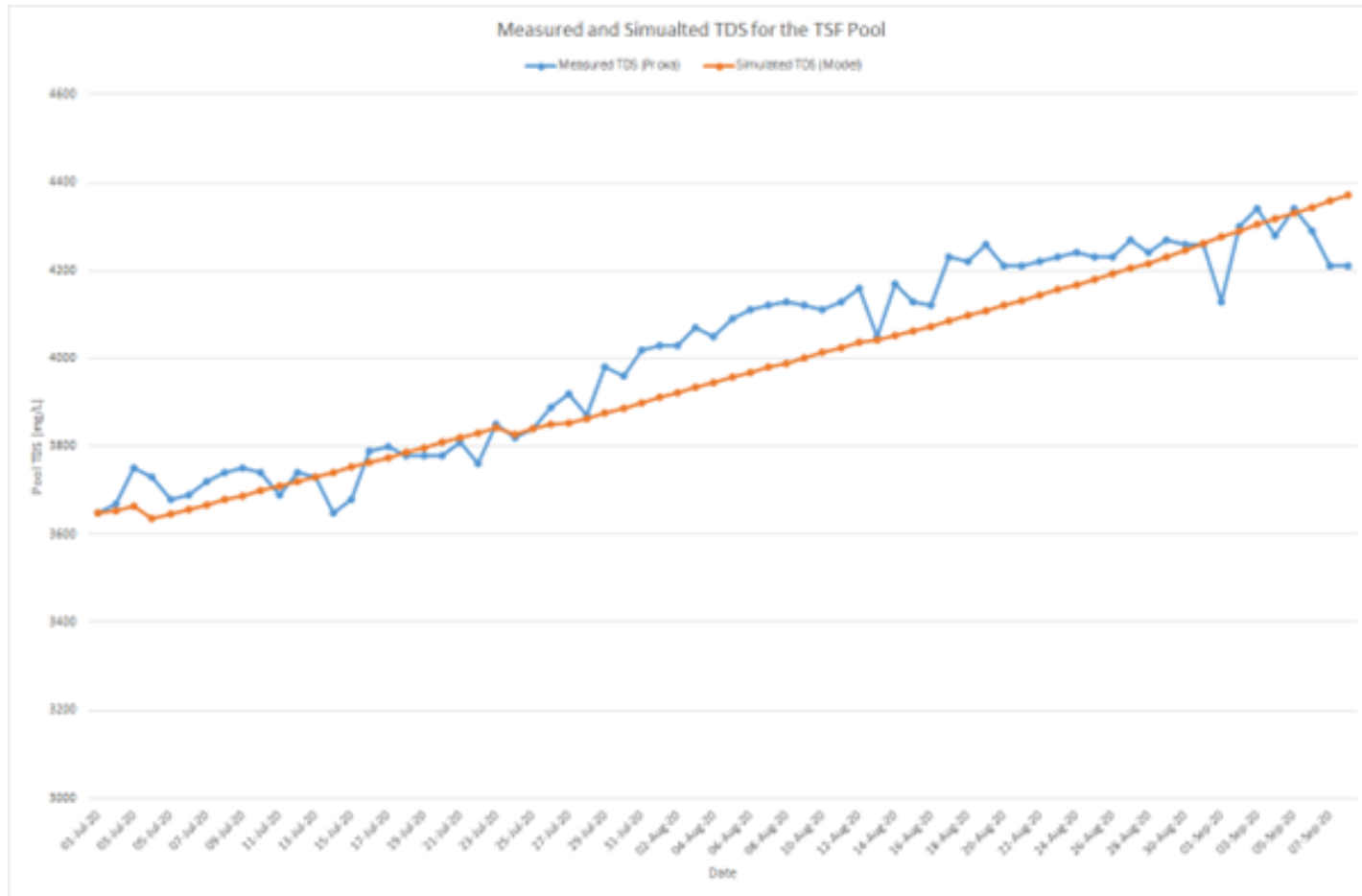
Water and Salt Balance



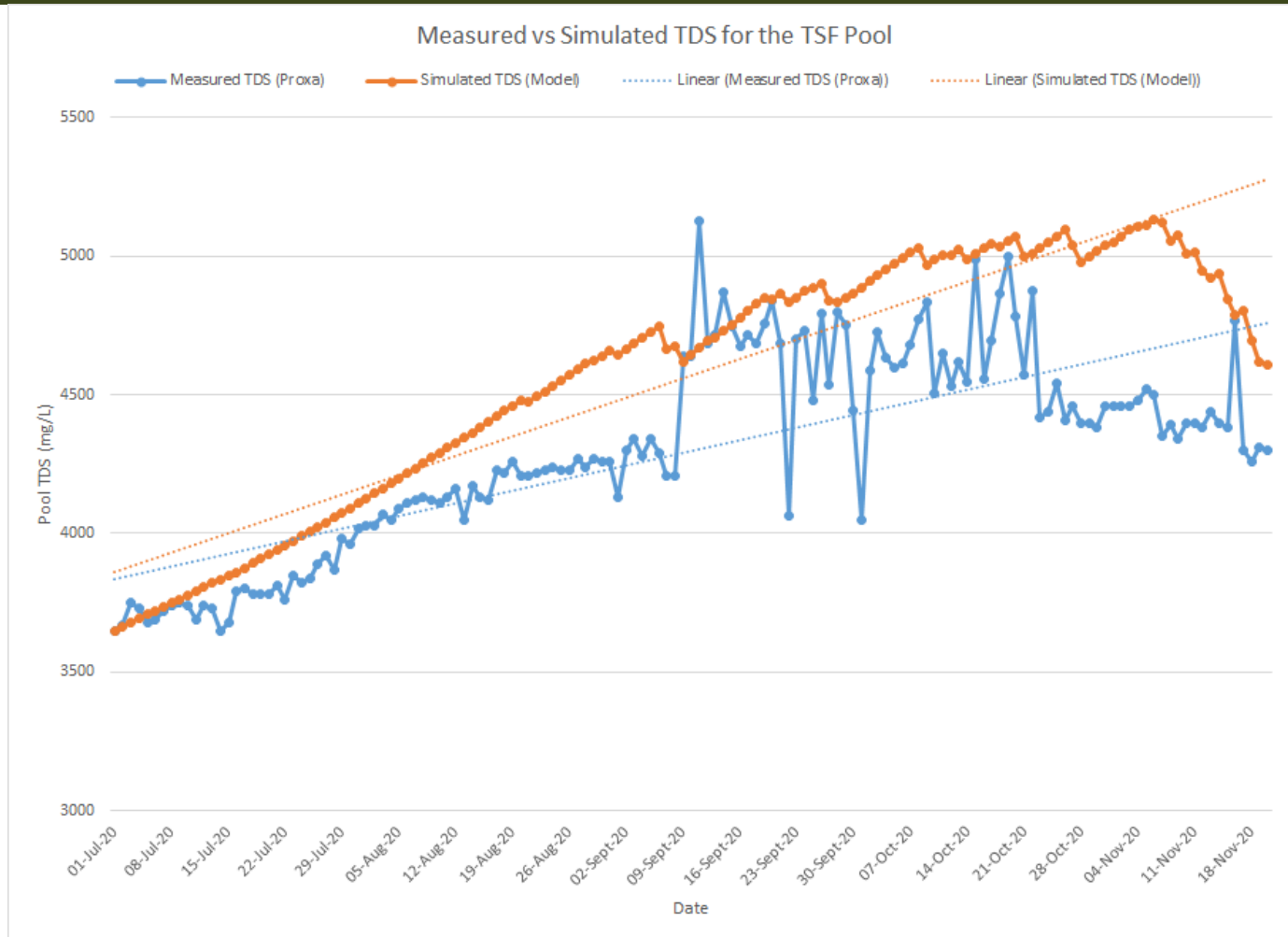
Water and Salt Balance



Water and Salt Balance



Water and Salt Balance



Water and Salt Balance

- Blend less polluted sources in with Ingwe Dam (permeate) and discharge
- From October 2020 start blending TSF and Rama water to dilute the feed water into the existing WTP
- Include a Gypsum stage in the treatment process
- Irrigate portion of the brine (1 000 m³/d) onto Eucalyptus plantation
- May 2021 - Prentec HD plant to treat brine stream at high efficiency
- Reduced brine stream from 12 000 m³/d to 250 m³/d on average
- Construct brine ponds to evaporate smaller brine stream

Focus on TSF and Rama and blend/dilute what we can



End 2019



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Feb 2020



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Aug 2021



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July 2022



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Recent



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Lessons Learned

- A TSF is not a water storage facility
- You cannot operate a mine without a water balance
 - Mining means you are in the water business
- Dilution can be the solution (sometimes)
- Don't forget about the chemistry!!!

Closure Problem?

- Saturated TSF that is seeping – SO_4 , As
- Unknown drain down timeline – Over time drops to $200 \text{ m}^3/\text{d}$ based on current models
- Will require continuous treatment that could have been avoided



Contributions and Thanks

- Barrick Mining Corp
- North Mara Gold Mine and Site Team
- Digby Wells Environmental





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