

# Geological Society of Zimbabwe Presentation to AGM

24<sup>th</sup> February 2023

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# Disclaimer

- This is a personal journey travelled over 3 decades and not meant to be a template for everyone.
- Walk your own path
- Information disclosed herein is in the public domain

# The Journey

- UZ 1987
- Geological Survey Department
- Rio Tinto Inc
- Delta Gold
- Metallon Gold
- Falcon Gold
- Trillion Resources
- Geo Associates

The Message – Be well cooked in what you do

# Geo Associates in Consultancy

- Trillion Resources spring board
- Audacity to approach the same company that relieved you
- Supportive mentors (Mr DH Murangari-MHDSRIP)
- Build networks
- Growth into executive management
  - Falcon Gold
  - Metallon Gold
  - Board Appointments
    - Hwange Colliery
    - Forestry Commission
    - Mining Affairs Board
  - Small Scale Miners
- Build networks
- The sunny days will soon disappear
- Adapt and change business model

# Mindset

- Understand and speak the language of investment
- Know your numbers
- Be amongst people that make you feel small
- Think big
  - Same stress levels for different prizes
- Run away from negativity
- No cutting corners
- Expect failure and rejection
  - It's a stepping stone and not a stumbling block
- Stay healthy
  - Eat well
  - Exercise regularly
  - Sleep well
  - Remember to play

# Arcadia Lithium Mine

- Purchased the prospect for \$100k
- Farmed-In to Prospect Resources
- Romped in farmer
- Sunk US\$22million
- +25000m of drilling (RC and Core)
- Scoping study to Pre-feasibility to Bankable feasibility
  - Resource of 72million tonnes at 1.12% Li<sub>2</sub>O
  - Largest drilled hard rock lithium resource in Africa
- Pilot plant to produce Lithium Carbonate
- +200 million Capex requirement for 240kt final product (petalite and spodumene)
- Struggled with fundraising due to Zim fundamentals
- Disposed to Huayou Cobalt for US\$420 million

## **Lesson learnt**

- Eye good niche assets
- Bring in big brother
- 10% of an elephant better than 100% of a rat
- Manage your landowner/stakeholders well
- Learn to let go

## Resource Drilling (+ 25000m)

- Spodumene
- Petalite
- Tantalite
- Aggregates





## Multiple stacked flat lying pegmatites





# Pilot Plant



# Global Peer Comparison

Company	Ticker	Country	Measured Kt/%Li2O	Indicated Kt/%Li2O	Resource M+I Kt	Inferred Kt/%Li2O	Cut-Off %Li2O	EV A\$M	M. Cap A\$M	Stage	Resource Valuation (A\$/t)	
											EV / M+I	EV/ Li2O
Hard Rock												
Global Strategic Metals	GSZ AU	Austria	3,700/1.5	3,200/1.5	6,900	10,000/1.6	0.75	7.8	5.2	Explorer & Developer	1.13	55.7
Canada Lithium	CLQ CN	Canada	6,914/1.18	26,325/1.19	33,239	13,757/1.21	0.8	130.7	150.9	Explorer	3.93	647.9
Glen Eagle Resources	GER CN	Mexico & Canada	2,239/0.95	5,145/0.98	7,387	572/0.98	0.5	10.0	10.3	Explorer	1.35	153.4
Critical Elements	CRE CN	Canada	-	26,500/0.98	26,500	10,700/0.86	-	16.8	17.2	Explorer	0.63	52.5
Nemaska Lithium	NMX CN	Canada	10,197/1.53	9,442/1.45	19,639	-	0.4	15.0	16.0	Explorer	0.76	57.9
Reed Resources	RDR AU	Australia	2,015/1.45	4,770/1.39	6,785	8,082/1.3	0.3	12.8	13.1	Explorer	1.89	215.9
Brines & Hard Rock												
Talison Lithium*	TLH CN	Australia	600/3.2	117,900/2.4	118,400	2,100/2.0	0.7	-	-	Producer		
Galaxy Resources	GXY AU	Australia	3,139/1.17	10,613/1.06	13,752	4,382/1.08	0.4	268.4	75.2	Explorer		
Altura Mining	AJM AU	Australia	-	17,288/1.25	17,288	7,869/1.2	0.7	40.4	54.5	Explorer & Producer		
Clays												
Western Lithium	WLC CN	USA	14,937/0.4	12						Explorer		
Average									36.8		2.41	197.2

Arcadia  
Greenbushes- Western Australia

72.7Mt @ 1.1% Li2O  
179.6Mt @ 2.0% Li2O

# Global Reserves and Production as at 2021

Country	Mine Production (metric tons)	Reserves (metric tons)
Australia	55,000	5,700,000
Chile	26,000	9,200,000
China	14,000	1,500,000
Argentina	6,200	2,200,000
Brazil	1,500	95,000
Zimbabwe	1,200	220,000
Portugal	900	60,000
United States	Withheld	750,000
🌐 Other countries	—	2,700,000

# Arcadia Sale (\$422m) April 2022





# Prospect 2.0

- Step Aside Lithium deposit- Zimbabwe
- Omaruru Lithium project – Namibia
- The search for battery minerals continues

# Muzarabani-Mbire Oil and Gas Project-SG 4571



**GEOASSOCIATES**  
PRIVATE LIMITED

100%



**INVICTUS**  
ENERGY LIMITED

80%



**ONE GAS RESOURCES**  
WE OIL AND GAS THE ECONOMY

20%

# Muzarabani-Mbire Oil and Gas Project

## Project genesis

- SG application in 2004
- Licence issued 2017 (13 years)
- Farmed-In to Invictus
- New skills set alien to Zim
- Mobil legacy data decoding and re-interpretation
  - Getech
  - Netherlands Sewell and Associates
  - Brent Barber
- New computer power and software revealed new targets
- In-fill seismic surveys at 3km intervals vs old 16km interval
- Key Parameters
  - Source rocks
  - Migration (porosity and permeability)
  - Trap sites (Muzarabani anticline)
  - Seal (clays/mudstones)
  - Timing
- Mukuyu-1 is a staked target

# Petroleum industry value chain

## Upstream

- Exploration & production
- Companies explore for oil and gas fields
- Discovered fields developed and petroleum produced

## Midstream

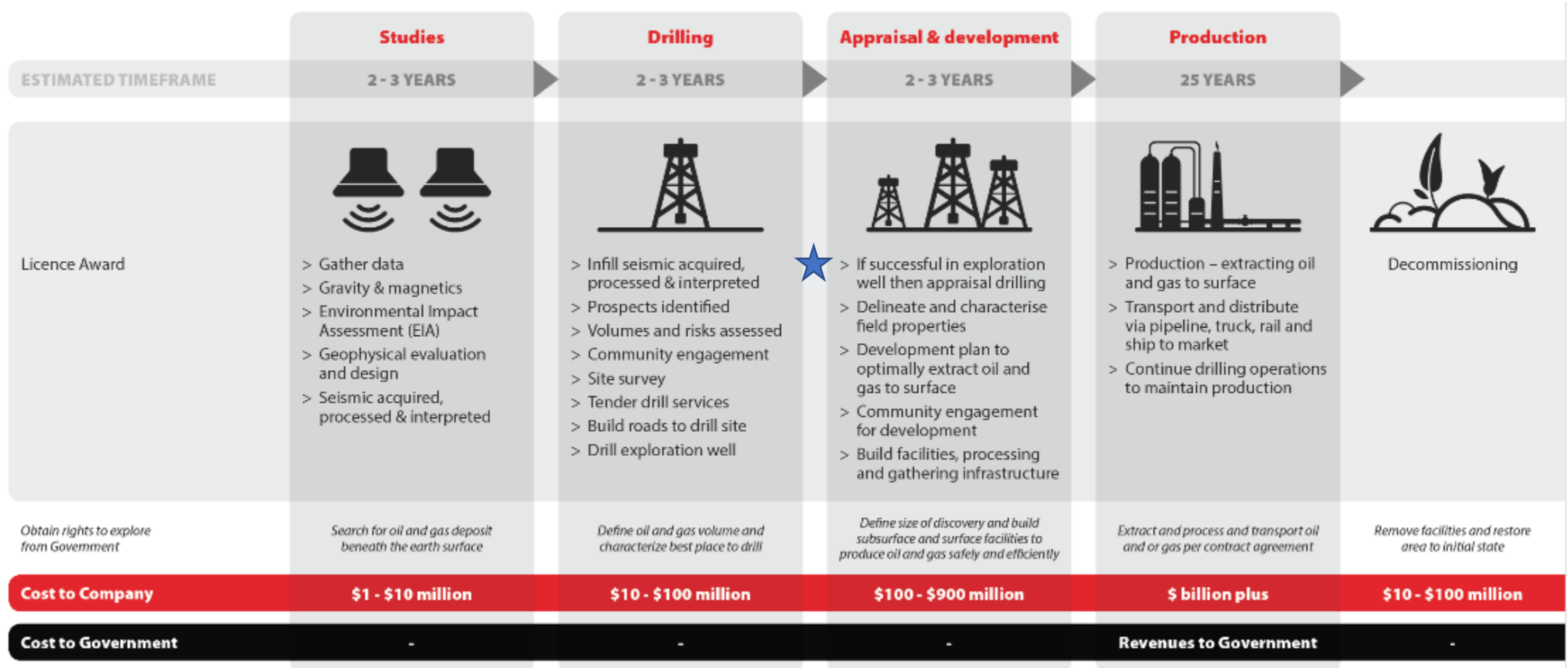
- Transportation of oil and natural gas
- Shipping
- Pipelines
- LNG terminals

## Downstream

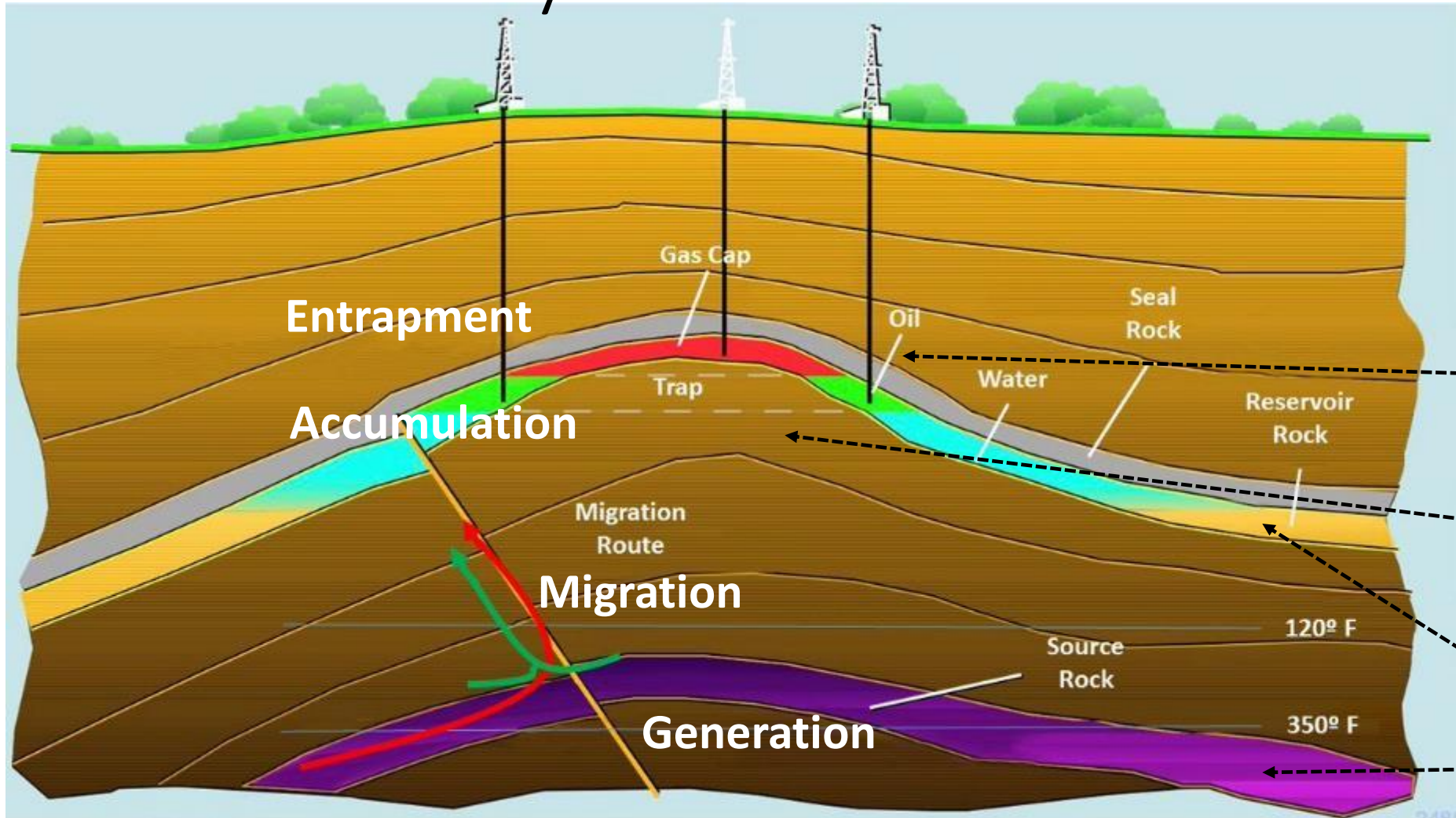
- Refinery processes crude oil to produce different products
- Petrochemical plants, gas to liquids, gas to power, fertiliser
- Petrol, diesel, jet fuel, gas, polymers, plastics and other products



# Oil & Gas Exploration & Production (E&P) explained



# Petroleum System Overview



## Petroleum System Elements

5. Timing – all these elements need to work together

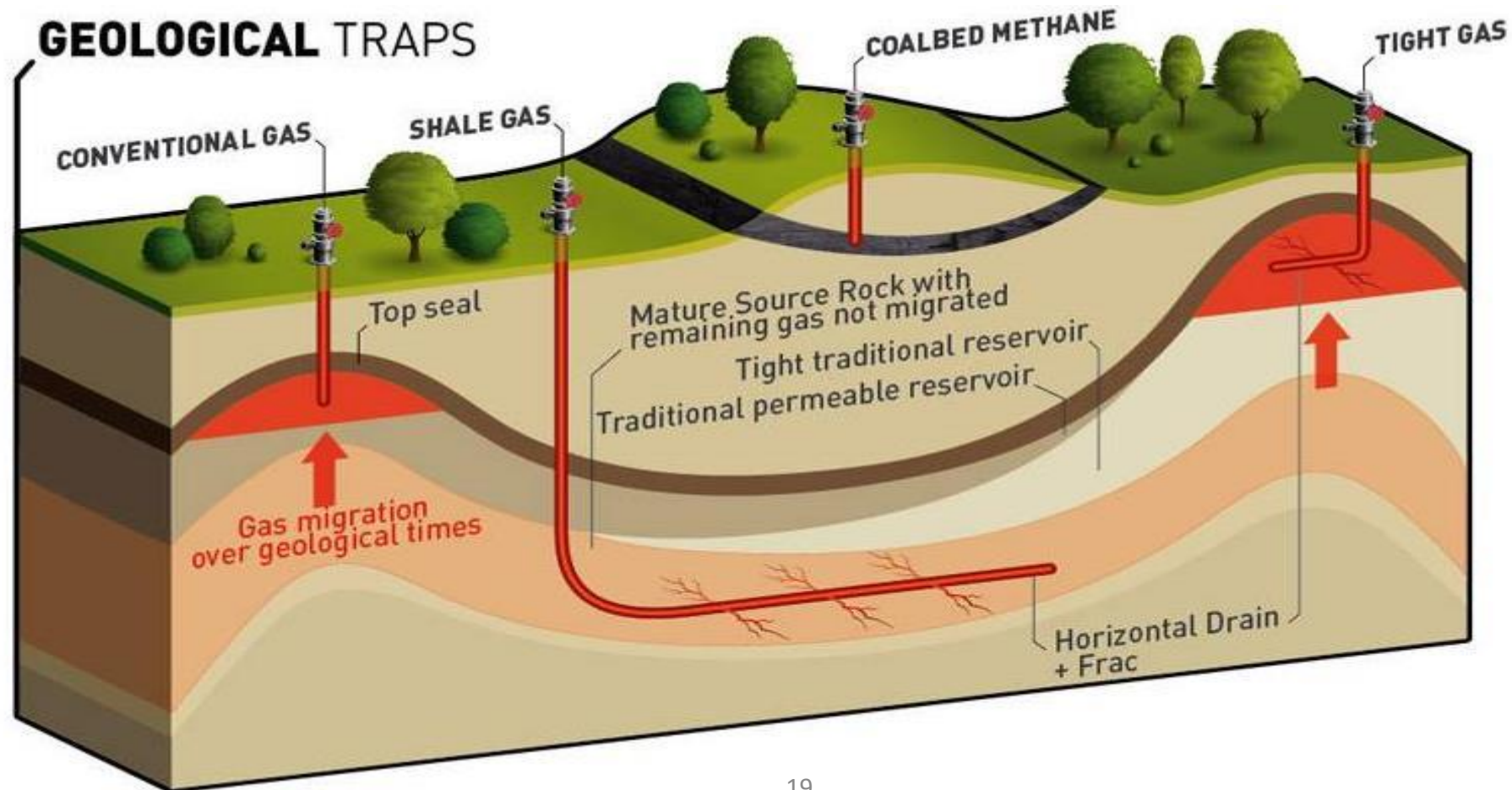
4. Seal – impermeable layer to prevent migration to surface

3. Trap – structure for oil/gas to accumulate in

2. Reservoir – porous rock to host oil/gas

1. Source – organic matter to generate oil/gas

# Oil & Gas Classification





# Seismic Tape Transcription - ZGS

Seismic tapes stored at ZGS



Seismic tapes transcription to digital format  
Specialised team and equipment brought in from Europe





# PEDPA signing ceremony

Congratulations to the Team for putting together the first ever exploration agreement for oil and gas in Zimbabwe. Special mention to His Excellency the President of the Republic of Zimbabwe, Dr. E.D. Mnangagwa, Hon. Minister Chitando, Joe Mutizwa, Douglas T. Munatsi, Scott Macmillan, Chimbodza Paul, Rainor Robinson for all the guidance in making this happen. #ZIDA #ZIMBABWEINVESTMENT





# Seismic Vibes loading





# Seismic Vibes loaded





# Seismic Vibrators

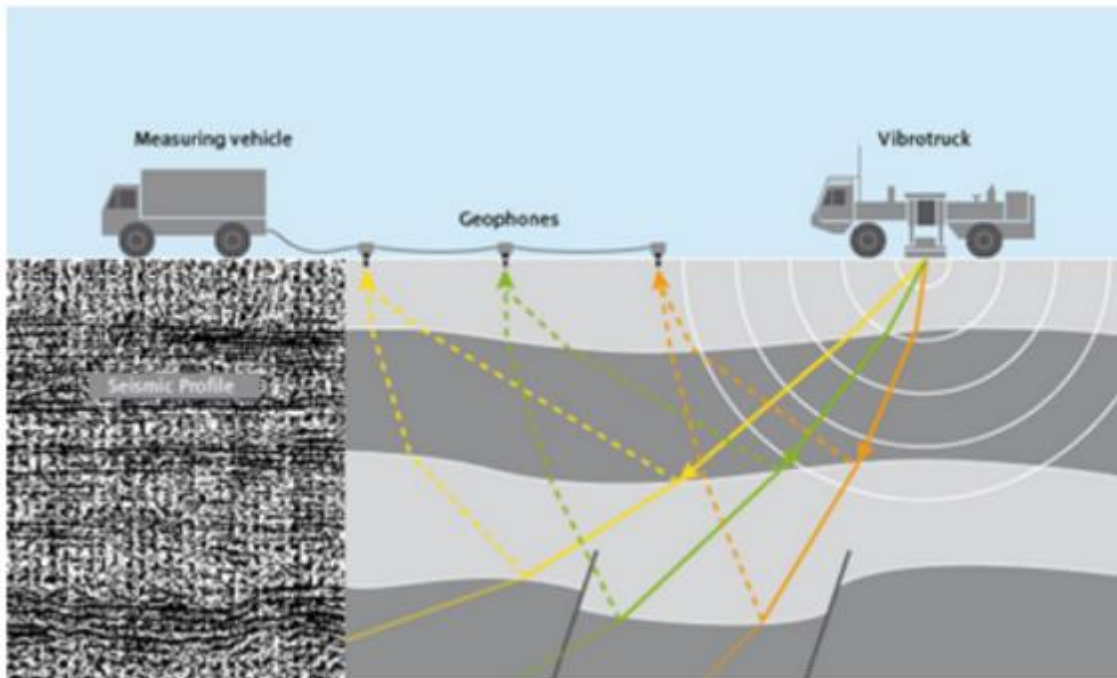




# Seismic Acquisition

Sound waves are captured using advanced sensors as the waves pass through, or bounce off, the rock and sediment deep underground.

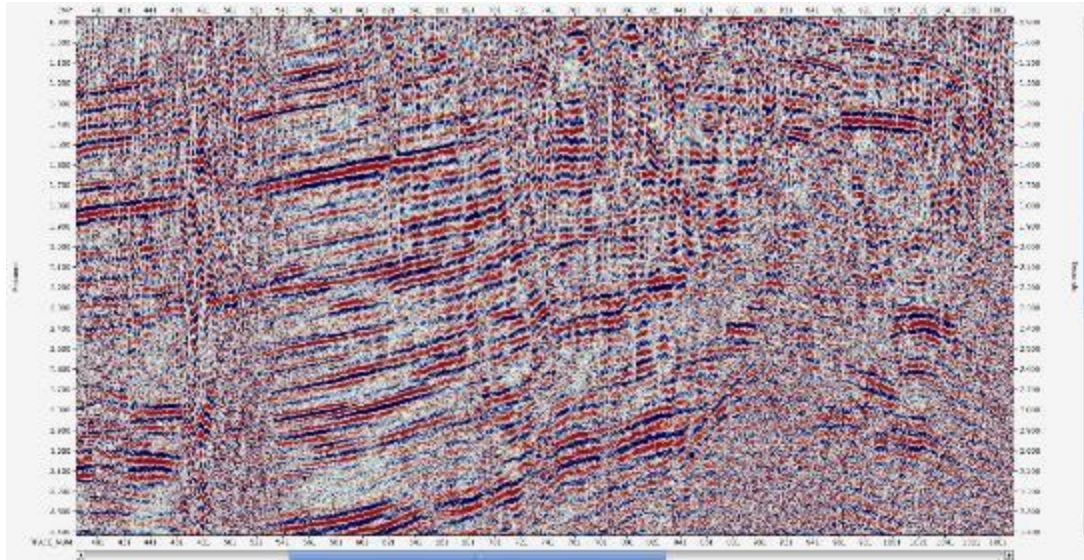
We place many sensors over a wide area to record waves from different angles to provide the best picture from beneath the surface in the site we are surveying.



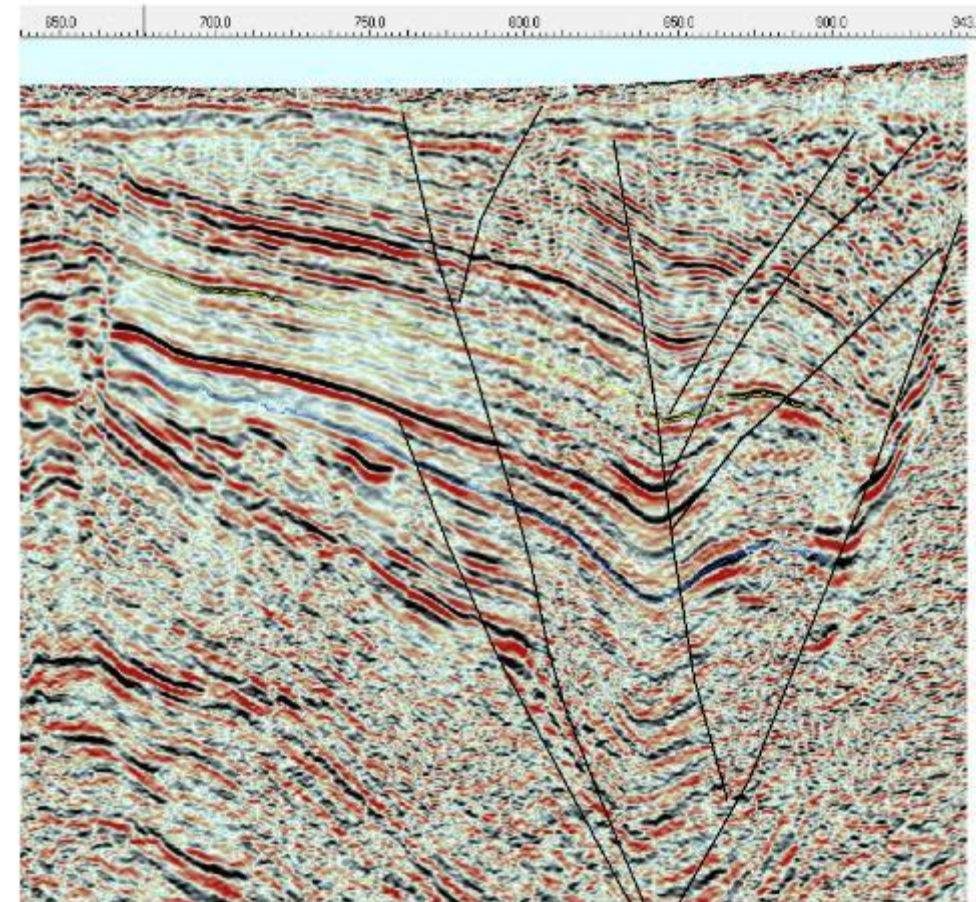


# Seismic Processing & Interpretation

Seismic processing using algorithms and filtering

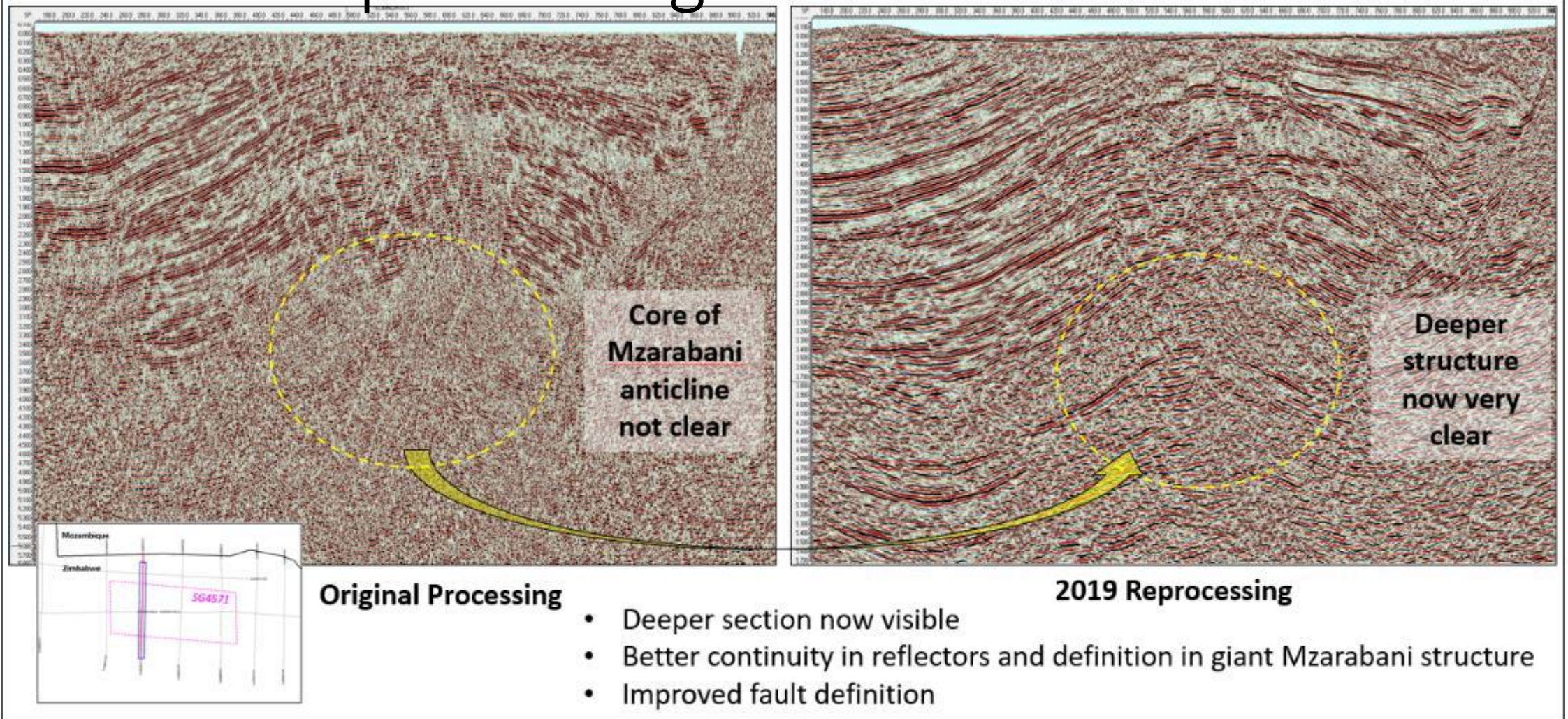


Seismic interpretation of faults, horizons and amplitudes etc.



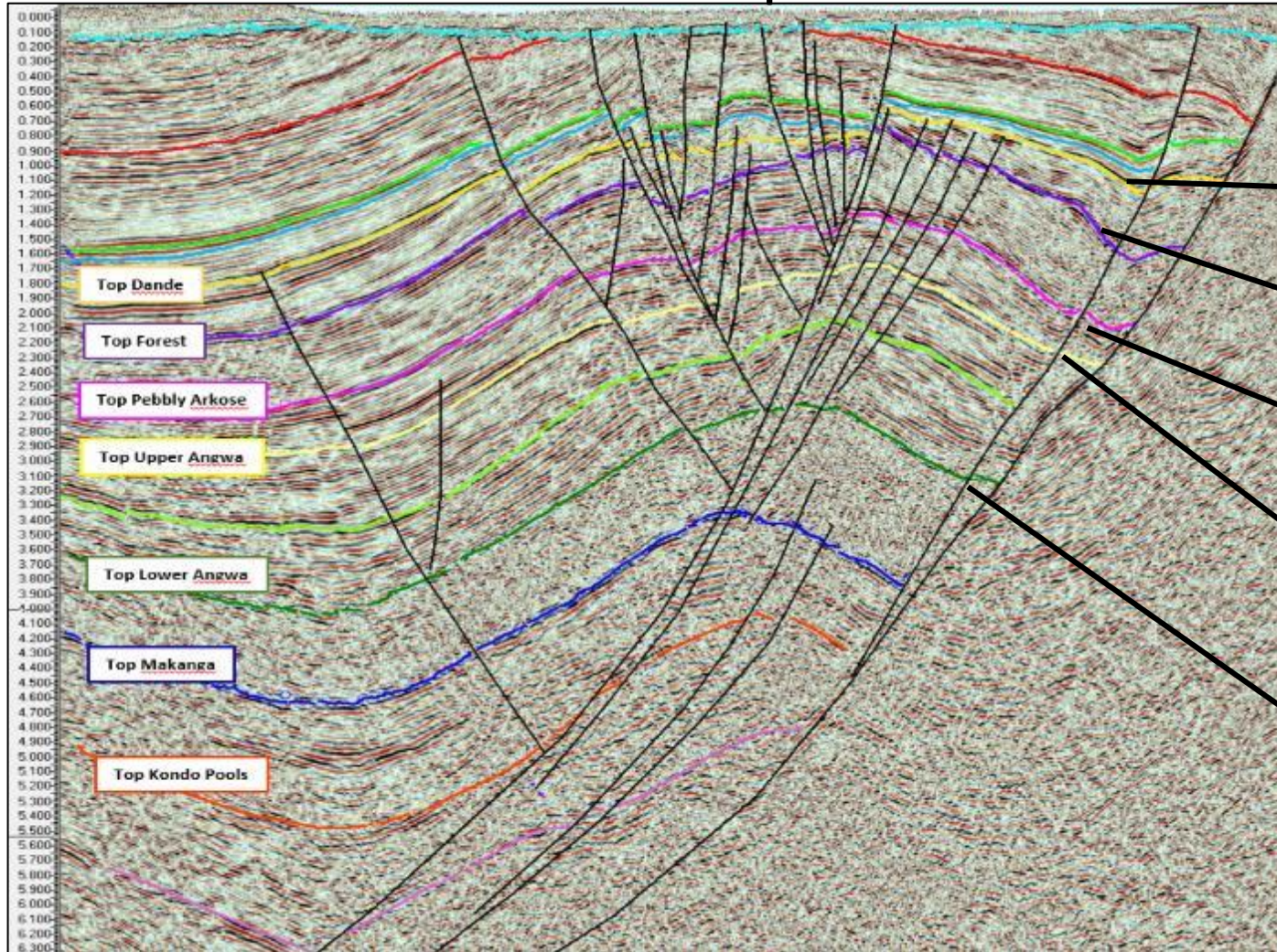


# Seismic Reprocessing Results – Line 013

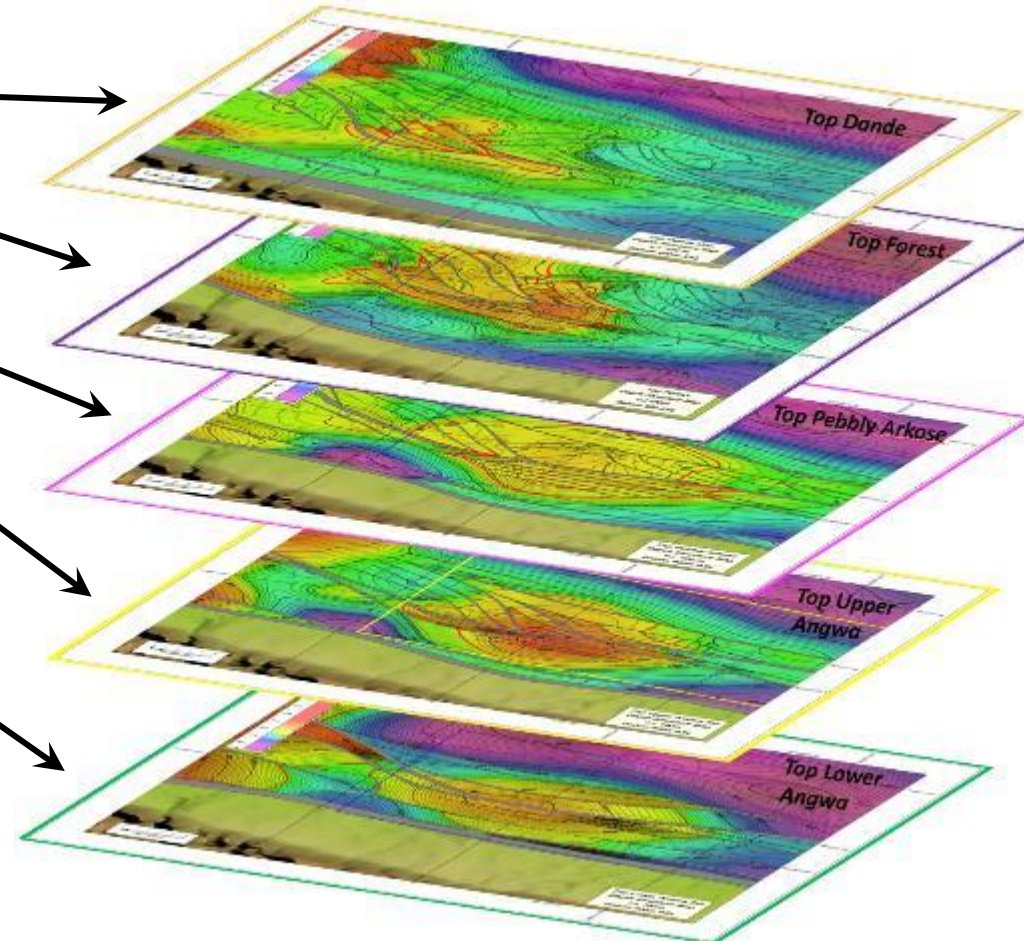




# Mzarabani Prospect – Massive Stacked Potential

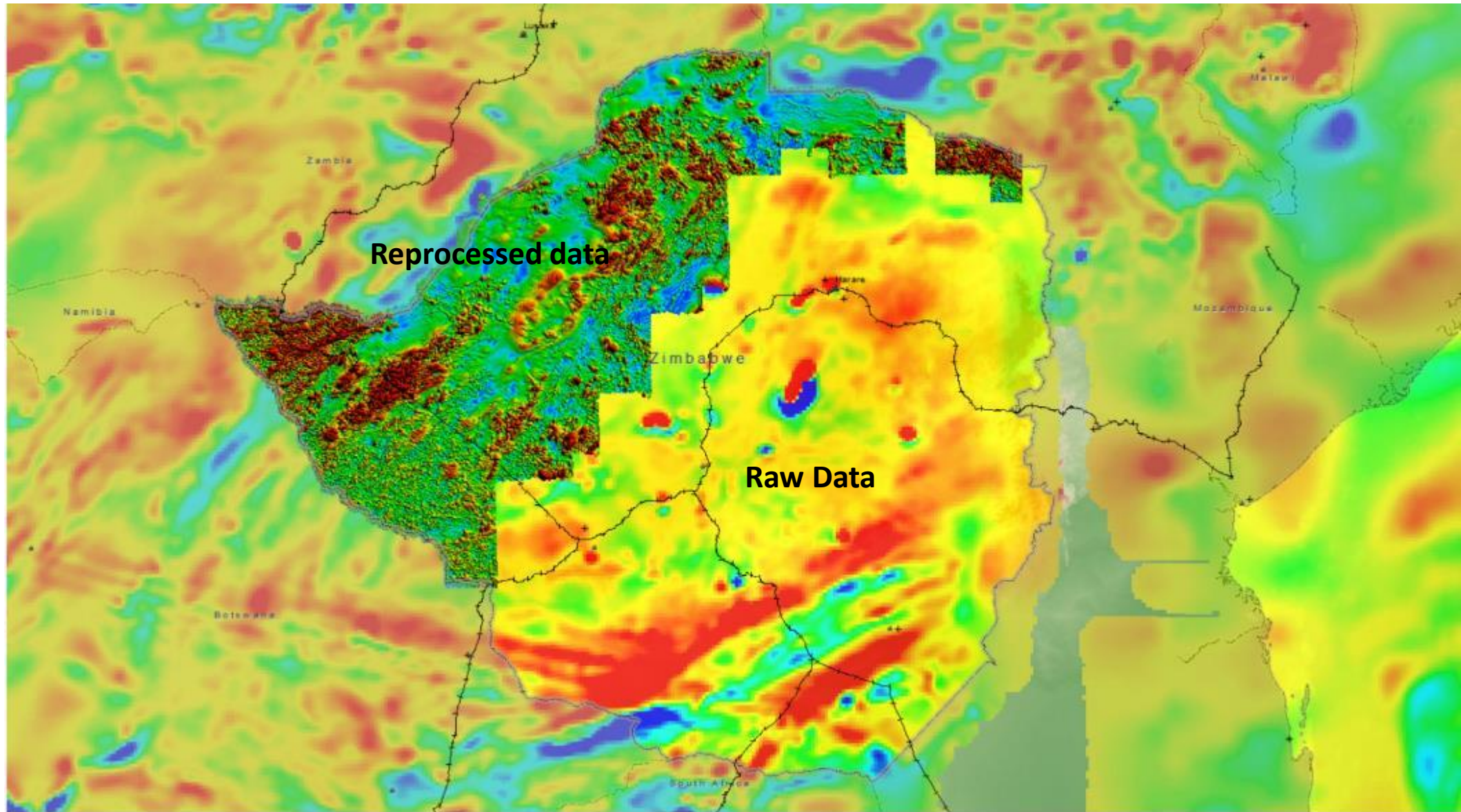


Top structure maps showing stacked, multi-target, 4-way dip anticline





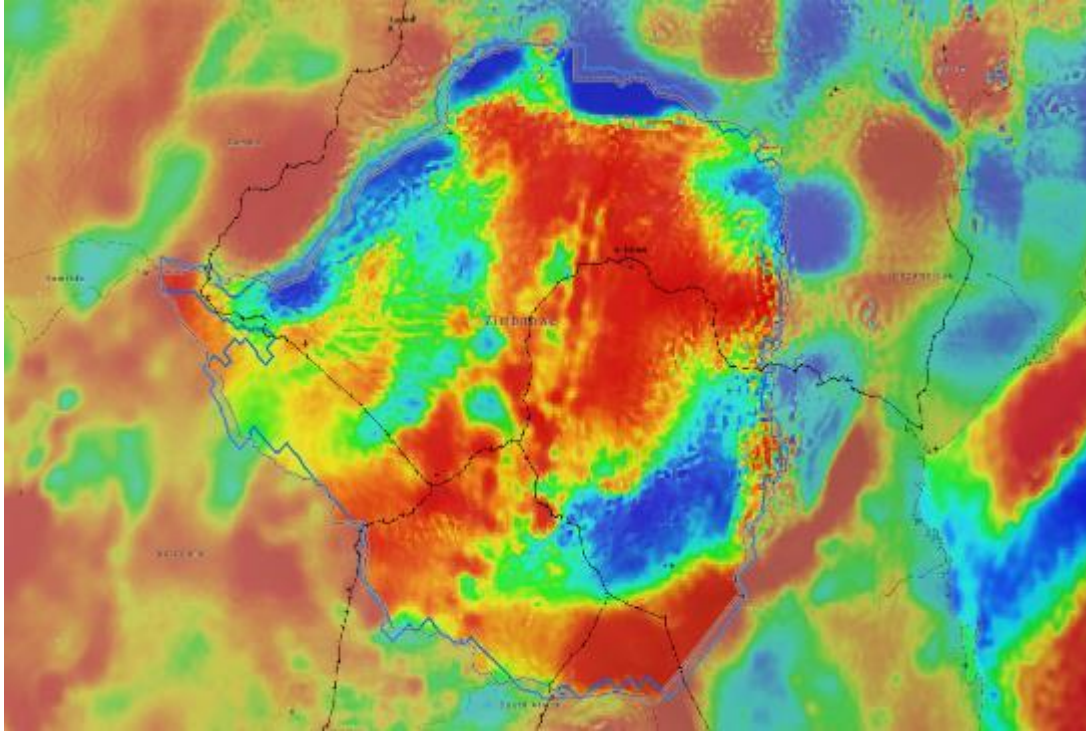
# Magnetic Reprocessing Example



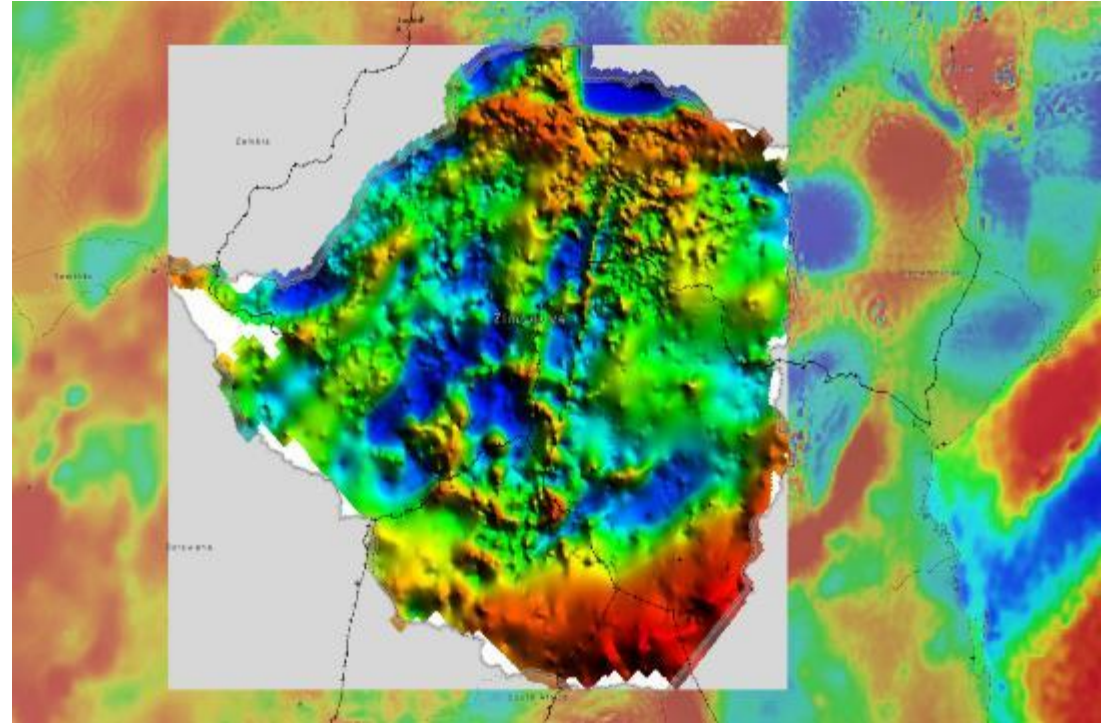


# Gravity Data Reprocessing

## Raw Data

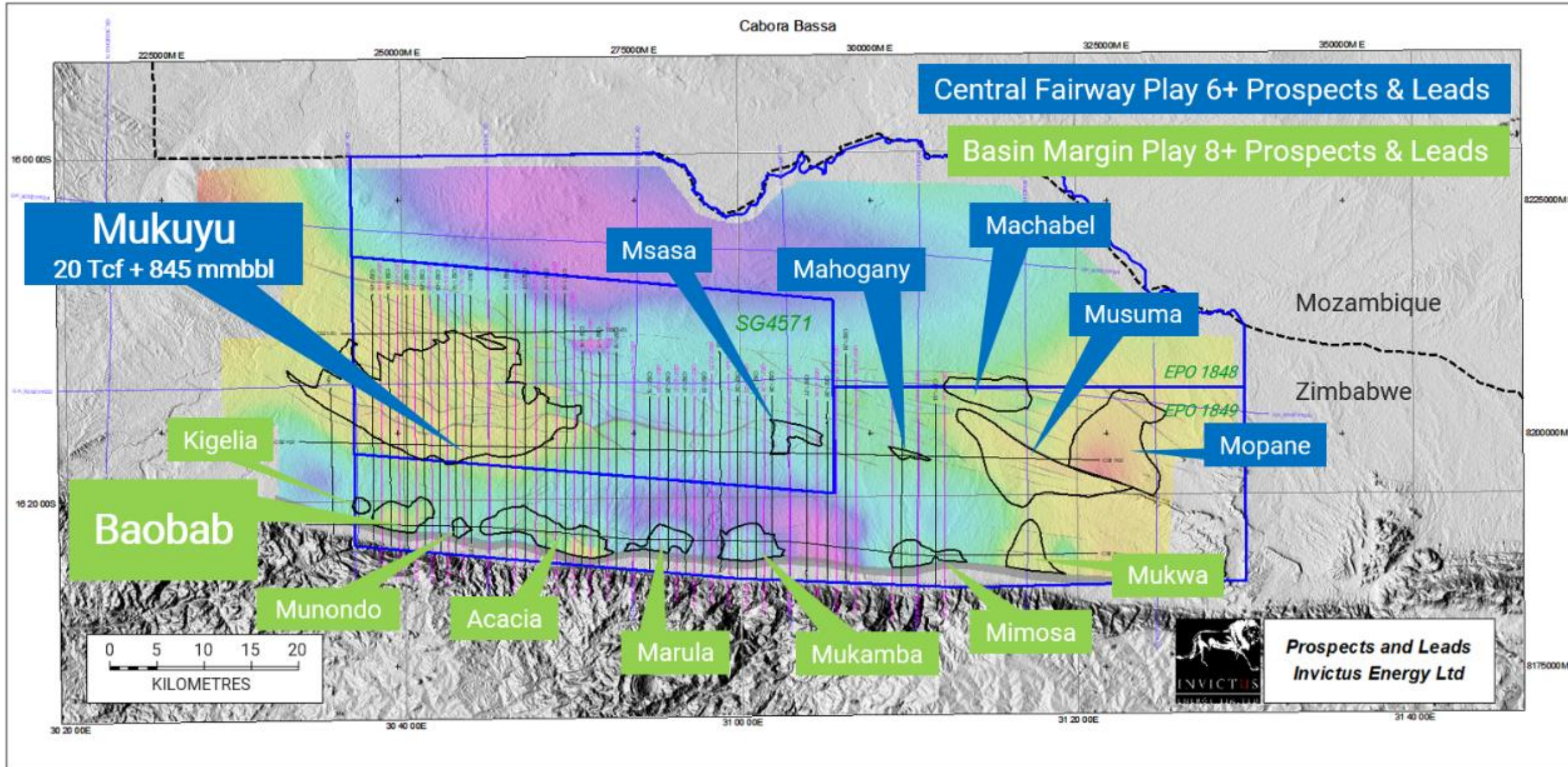


## Reprocessed data





# Generated Prospect Leads







A map of Mozambique showing a blue route from Gurue to Beira. The route passes through Harare, Mutema, and Beira. A callout box indicates a travel time of 19 hr 7 min and a distance of 1,761 km.

1151km.



## Alpha 5K barge at Port – Total of 65 loads over 1324km



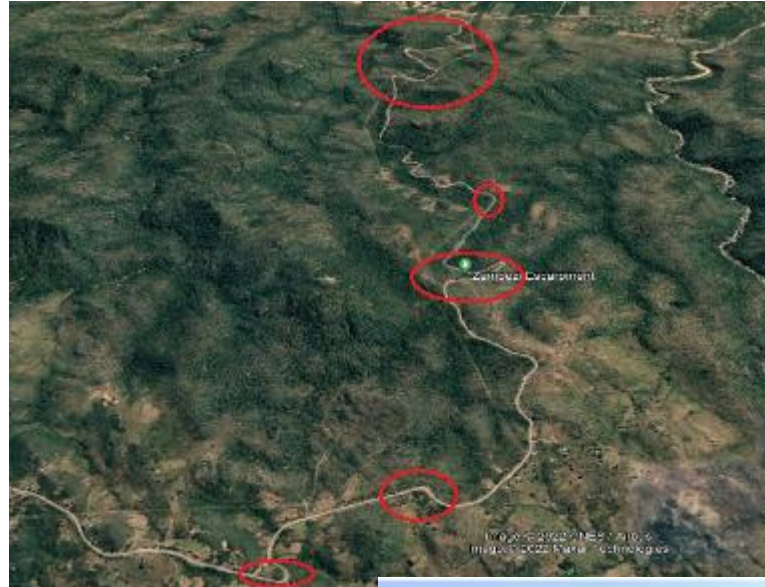


## Road haulage - +200 trucks (1151km)





## Escarpment terrain challenge –The notorious Mudzimundiringe Pass





## Drill pad site





Mukuyu 1 Site

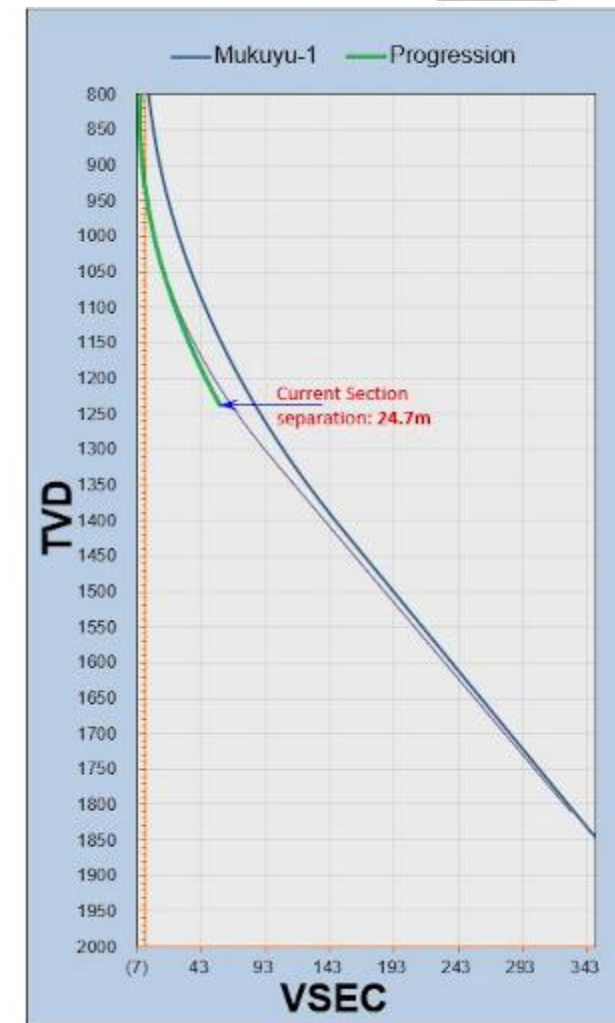
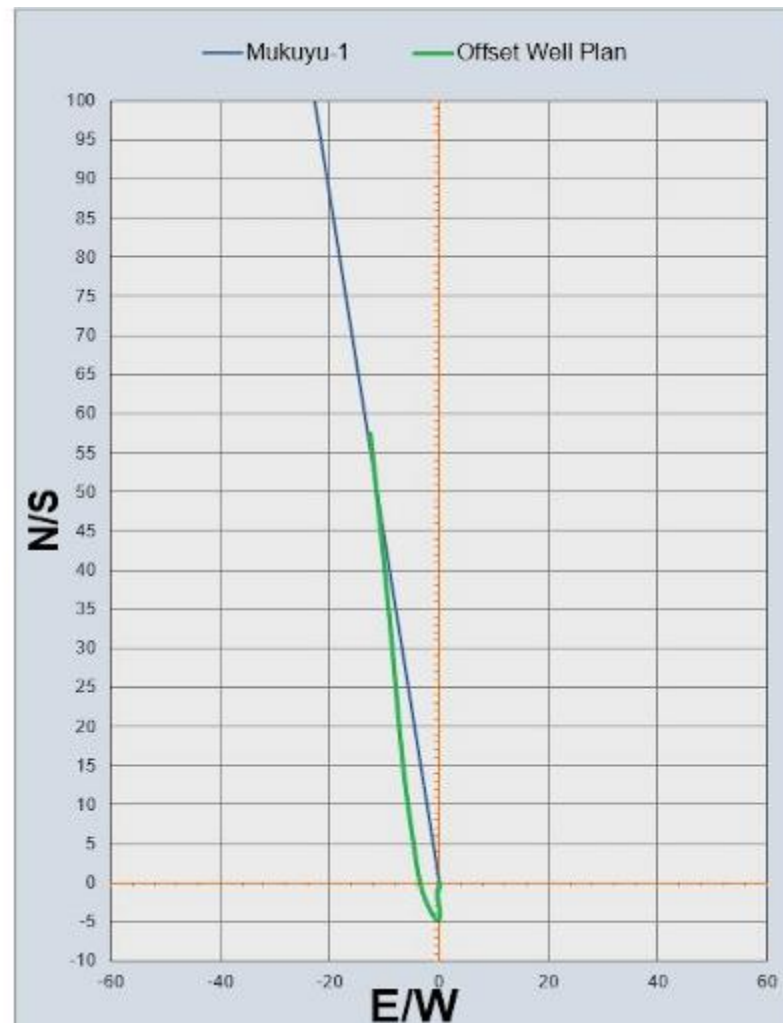
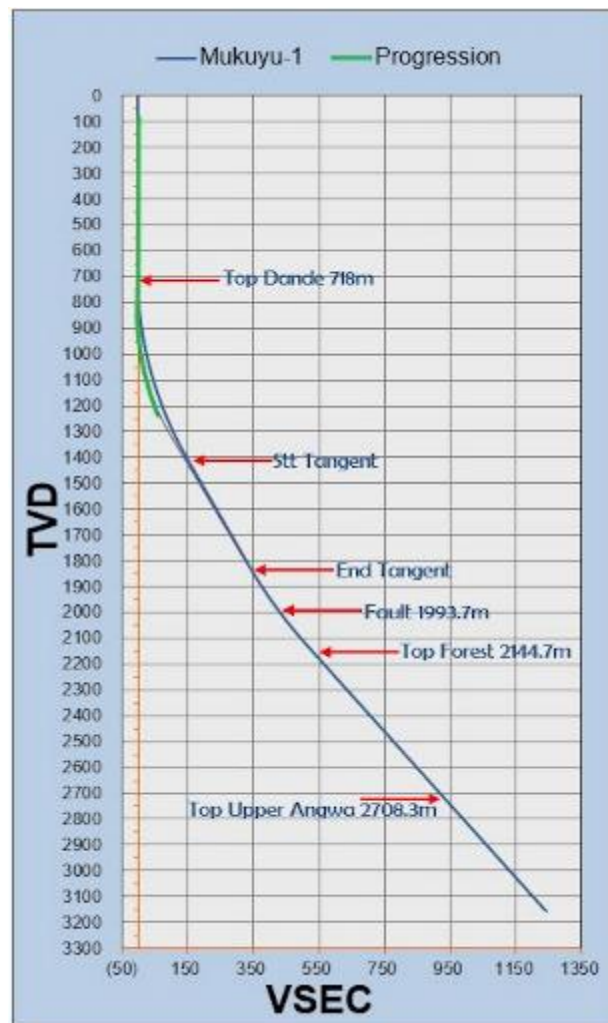






# Directional Drilling

## Polycrystalline Diamond Compact bits (PDC)



## Common Oil & Gas Drilling Rig Acronyms

AC-	Alternating current	ID-	Inner Diameter	RIH –	Run in hole (connect pipe in the hole and lowering it)
BHA–	Bottom hole assembly	IADC-	International Association Of Drilling Contractors	ROP–	Rate of penetration
BBL-	barrel	ICP-	Initial Circulating Pressure	RSS–	Rotary steerable system
BHP-	Bottom Hole Pressure	KMW-	Kill Mud Weight	SCR-	Silicon controlled rectifier
BOP–	Blow out preventer	LCM-	Loss Circulation Material	SCR-	Slow Circulation Rate
COC-	Certificate of Conformance	LWD-	Logging While Drilling	SICP-	Shut In Casing Pressure
CRT-	Casing Running Tool	LOT-	Leak Off Test	SIDPP-	Shut In Drill Pipe Pressure
DC–	Drill collar	MAASP-	Maximum Allowable Annulus Surface Pressure	SPP–	Stand pipe pressure
DP -	Drill pipe	MD-	Measured Depth	TD-	Total Depth
DSV-	Drilling Supervisor	MOC-	Management of Change	TDS–	Top drive system
EMW-	Equivalent Mud Weight	MWD-	Measurement While Drilling	TOC-	Top Of Cement
ESD-	Emergency Shutdown	MW-	Mud Weight	TVD-	True Vertical Depth
ERD-	Extended Reach Drilling	OB-	Over Balance	UB-	Under Balance
FCP-	Final Circulating Pressure	OBM-	Oil Base Mud	VFD –	Variable frequency drive
FOSV-	Full Open Safety Valve	OD-	Outer Diameter	WBM-	Water Base Mud
GPM–	Gallon per minutes	POOH–	Pull out of hole ( also POH)	WOB-	Weight on bit
HCR –	High Closing ratio	PPG –	Pound Per Gallon	WOC –	Weight On Cement
HTHP-	High Temp High Pressure				
HWDP–	Heavy weight drill pipe				



# Mukuyu 1 and sidetrack

- Mukuyu 1 drilled to approx. 4000m
- Gas and light condensate encountered in the Upper Angwa formation
- Poor downhole geotechnical conditions precluded downhole wireline logging
- Drilled sidetrack from about 3000m to TD
- Encountered 13 zones of elevated gas and condensate (fluorescence)
- Wireline logging tool, the \$4.5m straddle packer jammed
- Successfully fished out straddle packer and decision made to abandon hole and plug it
- Coincident rainy season break for the team and rig maintenance
- +\$22m expenditure to date

# Resource Volumes - Rules of Thumb

## Natural Gas

1 trillion cubic feet (tcf) of natural gas can provide:

- 800 MW Gas to Power for 20 years
  - Generation facility can be built in 18 months vs. 4 years for coal fired power
- 36,000 barrels per day of petrol/diesel for 20 years from Gas to Liquids
  - Zim consumption 40,000 bpd (6.3 million litres per day)
- Gross value at \$4 per thousand cubic feet = US\$4 billion (gas value lower than oil)

## Crude Oil / Condensate

100 million barrels of crude oil/condensate can provide:

- 36,000 barrels per day of petrol/diesel (6 million litres per day) for 7.5 years
- Gross value\* at \$60/barrel = US\$6 billion

**Mzarabani Prospect Potential Estimate: 20 trillion cubic feet + 247 million barrels of condensate**

- **US\$100 billion gross value; estimated profit ~US\$60 billion (post capex & opex);**



# Forward Plan

- Cabora Bassa Basin now de-risked as a working hydrocarbon system has been confirmed
- The basin sediments of the Pebbly Arkose and the Upper Angwa formation contain Oil and Gas (+/-1500m thickness)
- Move from Exploration to Appraisal by drilling Mukuyu 2 in 2023
- More seismics around in target spots
- Integrate seismics with Mukuyu-1 data to fine tune well design
- Continue with appraisal
- Basin margin targets consideration



# Earn your cultural licence





## Traditional Ceremonies



# Science meets Culture

- *Dear Paul*

*“With black mamba and spitting cobra patrolling the well site and elephant running amok 2km away who would have guessed that bees would interrupt progress. Fortunately one of the crew is now known as the Bee Whisperer”*

*Regards*

*Craig*

---

- Dear Craig

The paramount Chief Matsivo is actually elated that the cultural scriptures have been fulfilled as they were promised during the traditional ceremony.

- You will all recall the Chiefs demanded that we undertake a Traditional Ritual Ceremony at site before site pad preparation during which a traditional overnight wake was undertaken with a lot of traditional beer brew flowing. Barry and I attended partook of the brew. It was a successful event and from which we earned our “cultural operating licence”
- The swarm of bees signifies acceptance of the project and protection against any misfortune. The bees also bring honey sweetness with them.
- The patrolling black mamba and spitting cobra were prophesied by the medium spirits during the traditional ceremonies and we were advised not to panic as they sittings have been the traditional “gatekeepers” to the Mukuyu site since time immemorial
- The marauding elephant signifies the “night club bouncer” fending off uninvited party guests

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*A great story Paul. When I wrote of the bees snakes and elephant I had no idea that there had been a prophesy that was being fulfilled. There is much to the world that they don't teach in university.*

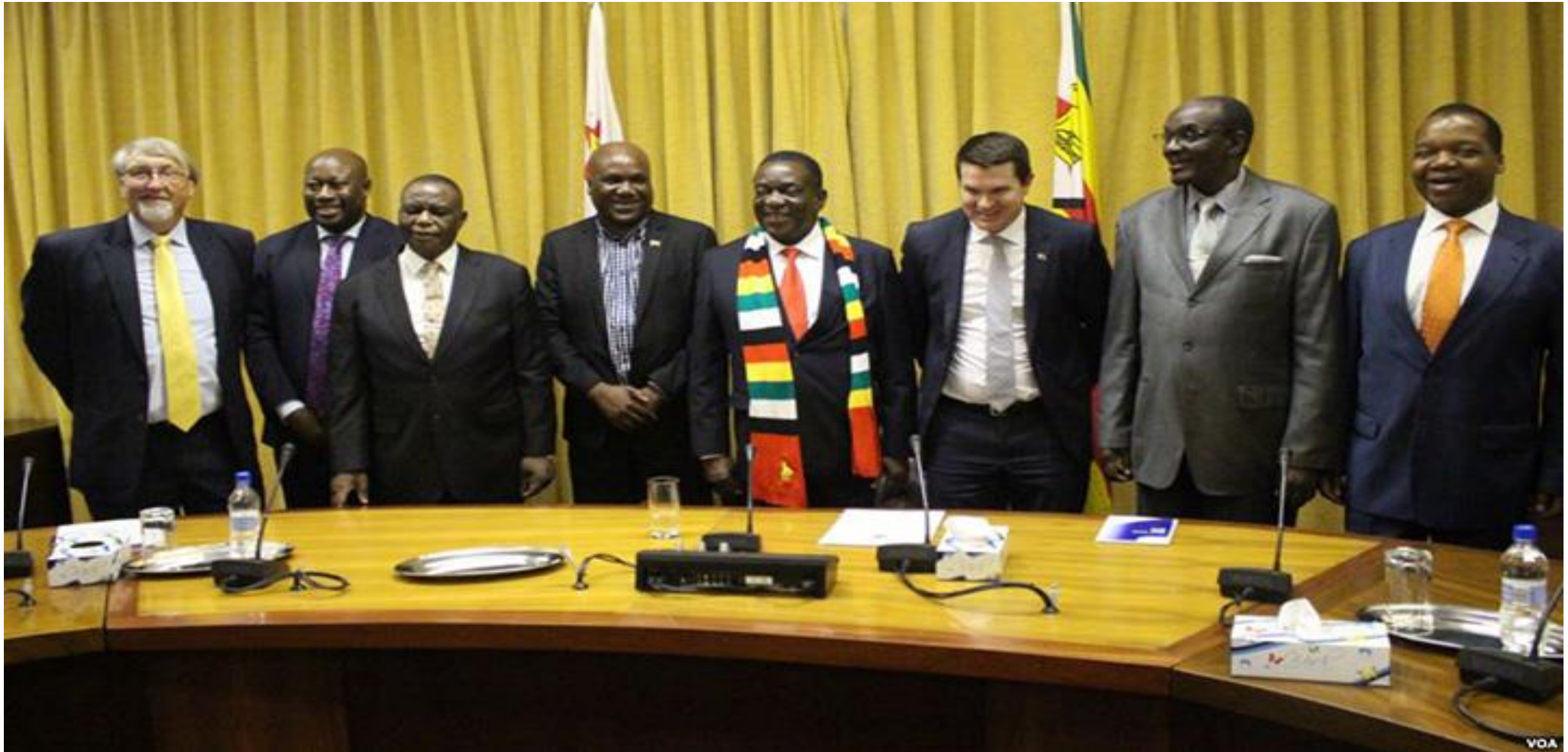


# Stakeholder Consultations

- Consult widely and across all society spectrum
- Listen to concerns
- Multi lingual communications
- Local Community Liaison Officers
- Anticipate “road blocks”
- Manage the media
- Manage the politics
- Manage socio-cultural dynamics
- Manage expectations

# National Stakeholder Consultations

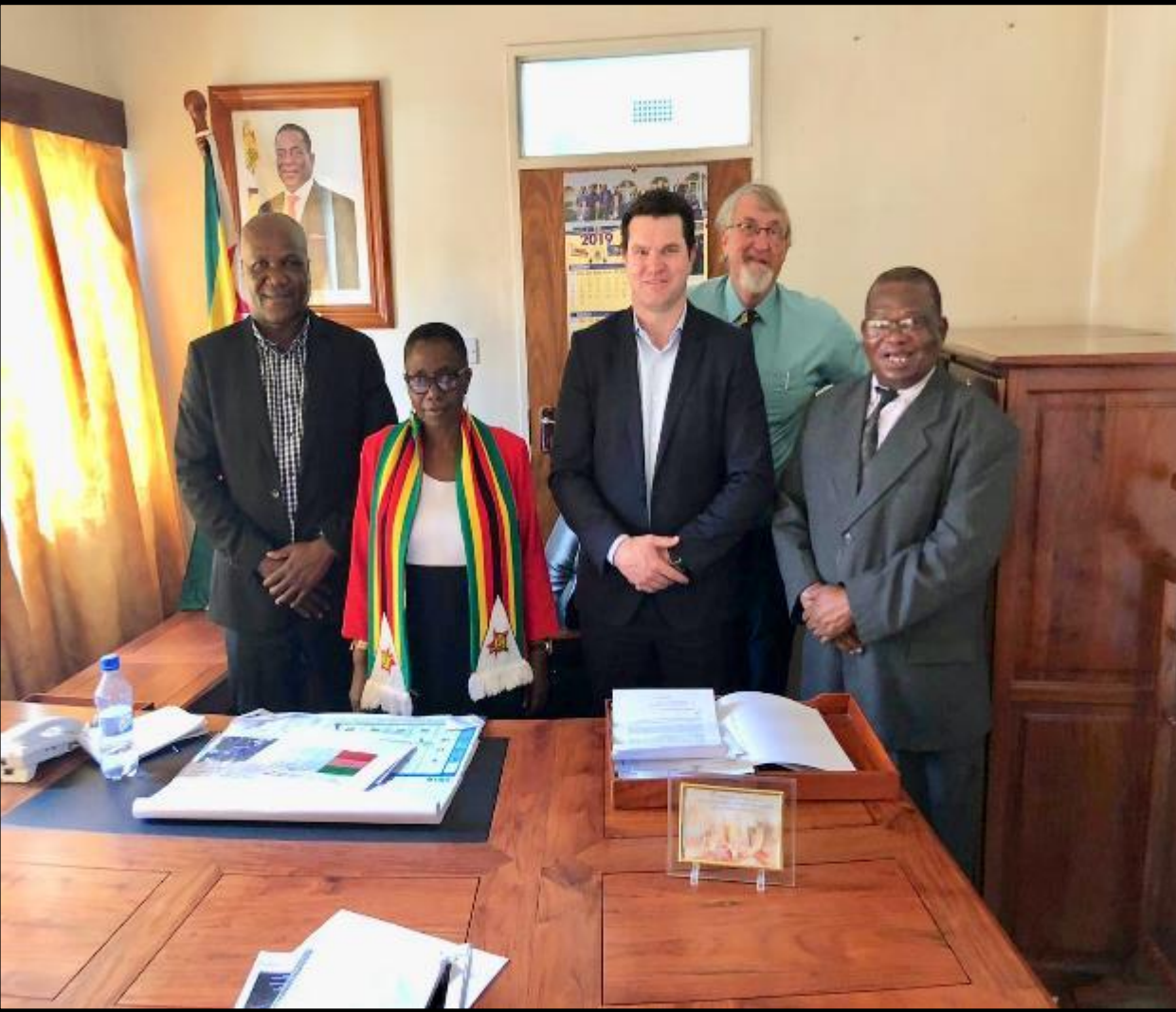
His Excellency ED Mnangagwa, VPs Chiwenga & Mohadi, Minister Chitando, Dr Mangudya and Geo Associates/Invictus Team





# Provincial Stakeholder Consultations

Hon Senator M Mavhunga, PDC & Provincial JOC



# District Stakeholder Consultation

## Local Government & Political Leadership





# Chief's Stakeholder Consultation

Traditional Leaders



**Chief Hwata, Mr Chihobo (DDC) , Chief Chiweshe, Headman Muzarabani and Centenary District Team**



# Village Consultations





# CORPORATE SOCIAL RESPONSIBILITY

COMMUNITY EXPECTATIONS)  
(EIA PUBLIC CONSULTATIONS)

IMPLEMENTATION	ACTION
SHORT TERM	Dip Tank - Rehabilitation & Building + Insecticide
	Water boreholes for domestic and livestock
	Refurbishing Community Boardroom
	Food distributon vunerable members community
	Scholarships best students
	Clinics upgrade and ambulance support
	Upgrading communications - phone / radio / tv
MEDIUM TERM	Upgrading Gravel Roads
	Funding Small & Medium Enterprises
	Employment Creation
	Improvement Primary & Secondary Schools
	Vocational Training Centres
LONG TERM	Tarred Road - ARDA Estate to Chadereka
	Clinic upgraded to referral hospital
	Irrigation Schemes

# CSR DONATIONS

(Community Boardroom)





# Covid interventions





## Earn your CSR Licence

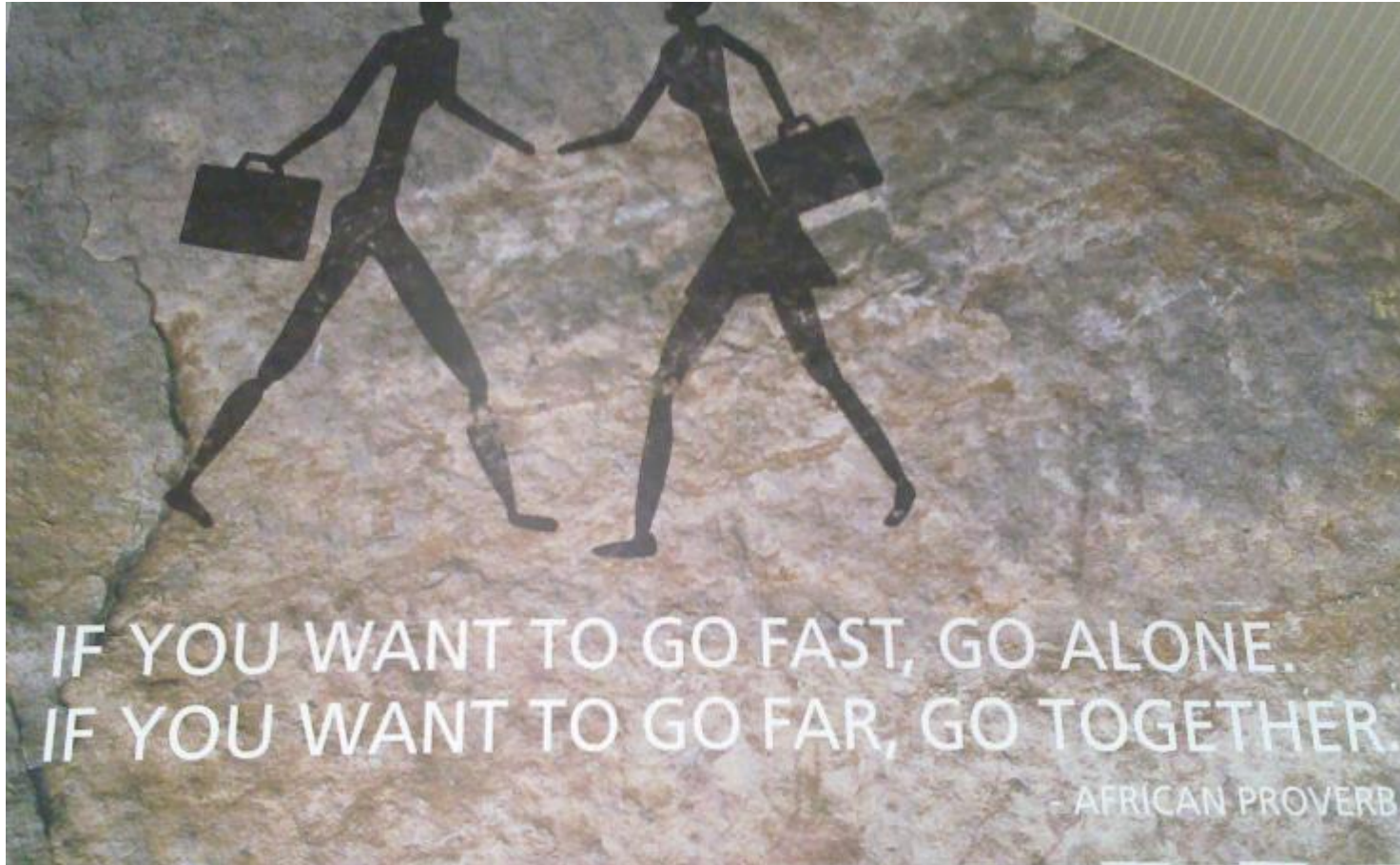
Conduct a community needs analysis by ward to avoid white-elephant projects

- Education
- Health
- Water and sanitation





# Teamwork and collective responsibility



“None of us is as smart as all of us”