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INNOVATIVE WATER SOLUTIONS

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INVENTOR

- CHEMICAL ENGINEERING GRADUATE
- 14 YEARS OF METALLURGICAL EXPERIENCE
- GOLD FIELDS, SIBANYE AND MINERSA GROUP
- AMD IS A PLIGHT TO THE MINING INDUSTRY AND GOVERNMENT
- INNOVATIVE IDEA OF AMD TREATMENT WAS BORN
- USE OF WASTE PRODUCT (LOCALLY PRODUCED)
- LABORATORY CONDITIONS AT THE UNIVERSITY OF JOHANNESBURG IN 2014
- ASSEMBLED AND COMMISSIONED THE PROTOTYPE AT THE CSIR
- PROTOTYPE CAPACITY: 3 500 LPD IN 2016 AND 20 000 LPD IN 2019
- SEED FUNDERS: COJ, UJ, TIA, CSIR AND TIH
- IP IS EXCLUSIVELY OWNED BY THE UNIVERSITY AND LICENSED TO THE INVENTOR.
- PATENT NUMBER: 2018/06236

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AMD BACKGROUND

- SULPHIDE MINERALS HAVE BEEN EXPOSED TO OXIDIZING CONDITIONS DURING MINING
- AMD IS RECOGNIZED AS ONE OF THE MORE SERIOUS ENVIRONMENTAL PROBLEMS
- MINING OPERATIONS PROMOTE AMD GENERATION
- MARKED BY ORANGE-YELLOW SUBSTANCE WITH LOW PH

AMD THREATS

- NEGATIVE IMPACT ON MAJOR RIVERS
- CONTAMINATION OF SHALLOW GROUNDWATER REQUIRED FOR AGRIC.
- POTENTIAL TO POLLUTE GROUNDWATER
- NEGATIVE ECOLOGICAL IMPACT
- FLOODING – JEOPARDIZE URBAN INFR.
- INCREASE SEISMIC ACTIVITY

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CUSTOMER'S PAIN

- DEVIATE FROM THE CORE BUSINESS
- POWER USAGE
- LABOUR INTENSIVE
- EQUIPMENT PROCUMENT
- ENVIRONMENTAL NON-COMPLIANCE
- ANNUAL PUNITIVE FINES = R 9,062,500

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PROTOTYPE LAYOUT

GOLD SAMPLES

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LABORATORY RESULTS - GOLD

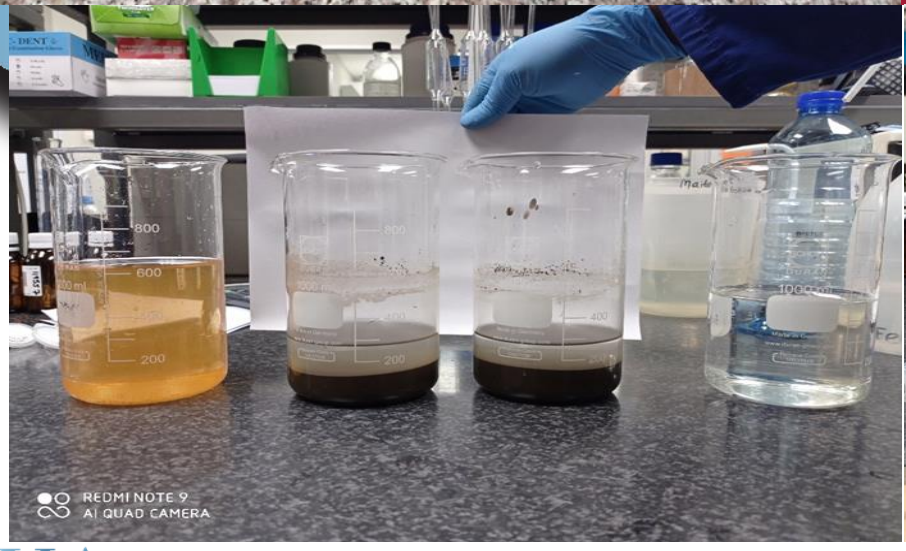
CSIR
our future through science

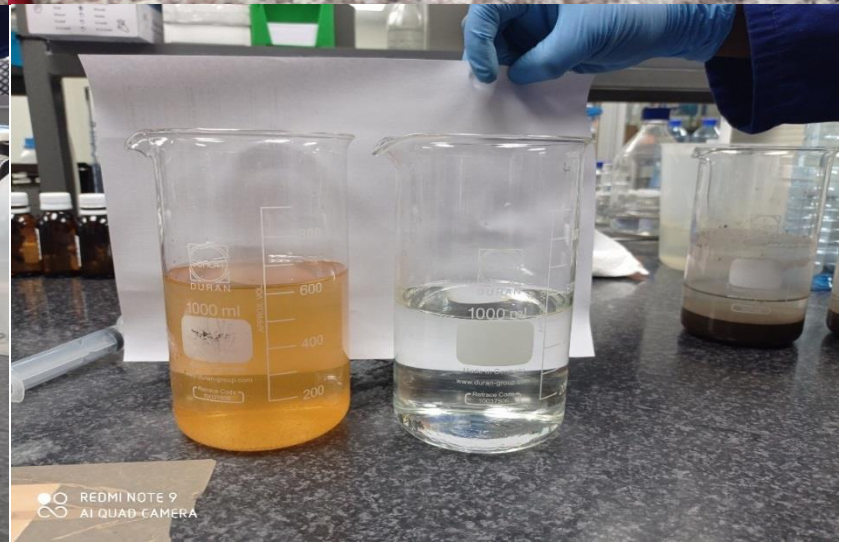
Table 2: Chemical profile of raw gold AMD, final product water and DWS/SANS water quality standards

Parameters	Raw AMD	Product water	Units	DWS/SANS standards
Alkalinity mg/L as $CaCO_3$	16	-	mg/L	≤120
pH (25°C)	2	7.1	-	≥5 to ≤9.7
Electrical Conductivity (EC)	260	41	mS/cm	≤170
Total Dissolved solids (TDS)	5060	138	mg/L	≤1200
Total Hardness	703	<2	mg/L	-
Aluminium	173	<25	µg/L	≤300
Iron	1070000	<25	µg/L	≤300
Manganese	23591	<25	µg/L	≤100
Sodium	189	53	mg/L	≤200
Potassium	20	1	mg/L	≤20
Calcium	650	<1	mg/L	≤300
Magnesium	53	<1	mg/L	≤400
Cobalt	40	<0.1	µg/L	≤0.2
Copper	10	10	µg/L	≤2000
Lead	2	<10	µg/L	≤10
Nickel	30	<25	µg/L	≤70
Zinc	5	<0.025	µg/L	≤5
Cadmium	4	<3	µg/L	≤3
Silicon	8	1.5	mg/L	≤6
Fluoride	<0.20	<0.20	mg/L	≤1.5
Sulphate	3056	18	mg/L	≤500

PERCENTAGE REMOVAL	
Iron	99,99766
Manganese	99,89403
Magnesium	98,11321
Sodium	71,95767
Calcium	99,84615
Sulphates	99,41099

COAL SAMPLES





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LABORATORY RESULTS - COAL

WATERLAB (Pty) Ltd
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CERTIFICATE OF ANALYSES
GENERAL WATER QUALITY PARAMETERS

Date received: 2021 - 02 - 23 **Date completed:** 2021 - 03 – 02
Project number: 1000 **Report number:** 98276 **Order number:**
Client name: BN Aqua Solutions **Contact person:** Mr. B. Nkatlo
Address: 94 Twee Riviere Montana PTA **e-mail:** BoitumeloNkatlo@gmail.com
Telephone: 066 485 0869 **Facsimile:** **Mobile:** 066 485 0869

Analyses in mg/ℓ (Unless specified otherwise)	Method Identification	Sample Identification: Acid Mine Drainage	
		Before	Treated Water
Sample Number		119774	119775
pH – Value at 25°C	WLAB065	2.5	11.9
Electrical Conductivity in mS/m at 25°C	WLAB002	848	618
Total Dissolved Solids at 180°C	WLAB003	13 306	3 798
Suspended Solids at 105°C	WLAB004	176	1 508
Turbidity in N.T.U	WLAB005	142	106
Total Alkalinity as $CaCO_3$	WLAB007	<5	100
Total Hardness as $CaCO_3$	WLAB051	2 653	2 814
Calcium Hardness as $CaCO_3$	WLAB051	1 145	2 813
Magnesium Hardness as $CaCO_3$	WLAB051	1 508	<5
Langelier Index at 25°C	WLAB053	-5.0	5.3
Chloride as Cl	WLAB046	9	14
Sulphate as SO_4	WLAB046	5 815	2 080
Fluoride as F	WLAB014	<0.2	1.4
Nitrate as N	WLAB046	<0.1	<0.1
Nitrite as N	WLAB046	<0.05	<0.05
Ortho Phosphate as P	WLAB046	<0.1	<0.1
Dissolved Oxygen as O_2 *	WLAB040	2.1	9.0
Free & Saline Ammonia as N	WLAB046	21	13
Semi Quantitative ICP Scan *	WLAB050	See Attached Report: 98276-A	

* = Not SANAS Accredited
Tests marked "Not SANAS Accredited" in this report are not included in the SANAS Schedule of Accreditation for this Laboratory.

PERCENTAGE REMOVAL	
Iron	99,9238
Manganese	99,9999
Magnesium	99,7214
Sulphates	64,2304

FUTURE PLANS

- UPSCALE THE CURRENT PROTOTYPE TO A MODULAR PLANT
- 2 MEGA LITRES PER DAY PLANT, 24/7 OPERATION
- EMPLOYMENT OPPORTUNITIES PER PLANT
    - 2 PLANT FOREMEN
    - 6 PLANT OPERATORS
    - 2 MILLWRIGHTS
    - 2 SAFETY OFFICERS
    - 1 BOILERMAKER
    - 1 INSTRUMENT TECHNICIAN
    - 1 PLANT MANAGER
- SERVES GOLD AND THE COAL FIELDS

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SALEABLE MINERALS

MINERALOGY ANALYSIS SHOWS:

- **GYPSUM**
  - BUILDING MATERIAL FOR CONSTRUCTION
  - CEMENTITIOUS BINDER FOR ROAD CONSTRUCTION
  - SOIL FERTILIZER FOR AGRICULTURAL PURPOSES
- **MAGNETITE**
  - DENSE MEDIUM SEPARATION IN A COAL WASHING PLANT
  - WASHING COAL INCREASE THE EFFICIENCY AND QUALITY, SUBSEQUENTLY THE PRICE
- **SYNTHESIZED LIME**
  - INCREASE pH IN DRINKING OR WASTE WATER

CAPITAL COSTS

CAPITAL COSTS	QUANTITY	EQUIPMENT	PRICE
	2	Baffled Reactor	R 1,457,142
	8	Lamella clarifiers	R 3,309,304
	1	Lime dosing system	R 477,990
	6	De-sludge and interconnecting valves	R 87,638
	1	Steel storage tank	R 235,000
	2	Reverse Osmosis membrane	R 7,662,470
Feed and product pumps	2	Slurry pumps	R 518,252
Stage pumps	6	Water pumps	R 1,166,067
		Pipes and fittings	R 444,150
		Electrical connections	R 280,800
		Laboratory equipment	R 112,800
		PPE	R 65,424
		Site Preparation	R 253,800
		Housing structure	R 225,600
		Assembling and Commissioning	R 480,729
		Project Management	R 140,400
		Plant automation and control	R 154,395
		Contingency @ 10 %	R 1,707,196
Sub total			**R 18,779,157**

RUNNING COSTS

RUNNING COSTS			
Consumables (Tons)	30	Metallurgical Slag	R 55,500
	10	Calcium hydroxide	R 30,000
	13	Sodium Carbonate	R 52,000
Laboratory Analysis			R 30,000
Electricity			R 40,000
Labour	2	Plant Foremen	R 40,000
	2	Millwrights	R 30,000
	6	Plant Operators	R 42,000
	1	Boilermaker	R 15,000
	2	Safety Officers	R 30,000
	1	Instrument Technician	R 15,000
	1	Plant Manager	R 40,000
		Waste Management	R 21,000
Sub Total			**R 440,500**
		Operating cost for 2 months	**R 881,000**
Total Project Costs			**R 20,100,657**

PROJECT SUSTAINABILITY

SCENARIO 1: 100 % OWNERSHIP BY FUNDER

	BN-AQUA SOLUTIONS	
	DAILY	**MONTHLY**
Plant Capacity (L)	2,000,000	50,000,000
Days in a month	1	25
Price to produce a kilo-litre	R 9	R 9
Selling price per kilo-litre	R 13	R 13
Revenue	R 26,000	R 650,000
Expenses	R 17,620	R 440,500
Profit	R 8,380	R 209,500
Annual Profit	R 2,514,000	
Invested Amount	R 20,100,657	
Annual repayment @ 0%	R 0	

PROJECT SUSTAINABILITY

SCENARIO 2: 50 % OWNERSHIP BY FUNDER & BN-AQUA

	BN-AQUA SOLUTIONS	
	DAILY	MONTHLY
Plant Capacity (L)	2,000,000	50,000,000
Days in a month	1	25
Price to produce a kilo-litre	R 9	R 9
Selling price per kilo-litre	R 15	R 15
Revenue	R 30,000	R 750,000
Expenses	R 17,620	R 440,500
Profit	R 12,380	R 309,500
Annual Profit	R 3,714,000	
Invested Amount	R 10,050,328	
Annual repayment @ 55%	R 2,042,700	
ROI in 5 years	R 10,213,500	

PROJECT SUSTAINABILITY

SCENARIO 3: 100 % OWNERSHIP BY BN-AQUA SOLUTIONS

	BN-AQUA SOLUTIONS	
	DAILY	MONTHLY
Plant Capacity (L)	2,000,000	50,000,000
Days in a month	1	25
Price to produce a kilo-litre	R 9	R 9
Selling price per kilo-litre	R 18	R 18
Revenue	R 36,000	R 900,000
Expenses	R 17,620	R 440,500
Profit	R 18,380	R 459,500
Annual Profit	R 5,514,000	
Invested Amount	R 20,100,657	
Annual repayment @ 74%	R 4,080,360	
ROI in 5 years	R 20,401,800	

PROJECT IMPACT

- ENVIRONMETAL

  - COMPLIANCE
  - DRINKING WATER FROM AMD
  - GREEN AND CIRCULAR ECONOMY

- FINANCIAL

  - PUNITIVE FINES
  - DRINKING WATER SAVINGS
    BN-AQUA: R 13 PER KL
    VS
    MUNICIPALITY: R 25 PER KL

- CORPORATE SOCIAL INVESTMENT

  EXCESS WATER CAN BE USED FOR:
  - LOW-INCOME COMMUNITIES
  - AGRICULTURAL PURPOSES (FOOD SECURITY)
  - SCHOOLS & HOSPITALS

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QUESTIONS & COMMENTS

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