



GRANDER[®]
REVITALIZED WATER



GRANDER[®] MINING JOURNAL

A different approach to one of mining's most important resources: **water**.

Exploring applications in mining, quarrying and mineral processing.

WATER AT THE HEART OF MINING



EVERY WATER SYSTEM HAS AN OPERATING COST.

Water connects the process plant, cooling systems, storage tanks, workshops and accommodation. Its condition matters wherever equipment must run reliably and water must remain suitable for its intended use.

The business question is practical: where does the water system create avoidable work, expenditure or interruption?

Deposits can restrict flow and heat transfer.

Corrosion can contribute to leaks and premature component replacement. Suspended material can increase cleaning and filtration demands. Biological fouling can create further problems in susceptible systems.

These issues carry costs beyond the water itself: chemicals, labour, replacement parts, waste handling and lost operating time.

Four challenges to examine:



DEPOSITS AND FOULING

Where do deposits build up, and how often must equipment be cleaned?



SUSPENDED SOLIDS

How much effort goes into filtration, settling and managing accumulated material?



CORROSION

Which components fail, and what does repair or replacement cost?



BIOLOGICAL ACTIVITY

Where do biofilm, odour or unstable water conditions require intervention?

MEASURABLE RESULTS. PRACTICAL SAVINGS.

GRANDER has delivered measurable improvements across several areas of industrial operating cost: chemical consumption, filter replacement, cleaning, maintenance interruption and fuel use. The following case studies show where these savings occurred and how similar opportunities can be evaluated within a mining operation.



GRANDER K40 circulation unit. Application and sizing depend on the water system.

48% COD REDUCTION WITHIN 48 HOURS

Compared with 15% in the untreated control during the Lagos evaluation.

94.6% LOWER MEASURED IRON

From 755 to 41 micrograms per litre at ACSM Primiero.

400% INCREASE IN FILTER SERVICE CYCLES

The same filter was previously replaced after three or four uses and was subsequently used up to 20 times.

7.5% LOWER DIESEL CONSUMPTION

Recorded during the first month at the Cemento Melón limestone mine in Chile.

WHERE SAVINGS CAN ACCUMULATE

- Chemical purchasing, storage and handling
- Filter and component replacement
- Cleaning labour and maintenance intervention
- Production interruption and downtime
- Fuel expenditure across heavy-equipment fleets
- Waste, sludge and discarded-filter handling

NIGERIAN WASTEWATER EVALUATION

SIGNIFICANT CHANGE WITHIN 24 HOURS. SUSTAINED RESULTS THROUGH DAY 23.

A February 2026 evaluation compared two 50-litre wastewater containers: one untreated control and one fitted with a submerged GRANDER® WEZK rod. No aeration, chemical dosing or biological additives were introduced. Both containers were manually mixed once daily before sampling.

WITHIN 24 HOURS

54% NITRATE REDUCTION.

Nitrate in the GRANDER® container fell from 13 mg/L to 6 mg/L. During the same period, nitrate in the untreated control increased by 40%, from 5 mg/L to 7 mg/L.

SIGNIFICANT REDUCTION IN ODOUR

A significant reduction in odour was observed in the GRANDER® container within the first 24 hours.

WITHIN 48 HOURS

48% COD REDUCTION.

Despite beginning with the higher organic load, COD in the GRANDER® container fell from 552 to 287 mg/L. The untreated control fell by 15%, from 448 to 380 mg/L.

60% PHOSPHATE REDUCTION

Phosphate with GRANDER® fell from 20 to 8 mg/L. The untreated control fell by 25%, from 12 to 9 mg/L.

BY DAY 6

100% NITRATE REDUCTION.

The GRANDER® container reached zero measured nitrate by Day 6. Nitrate remained measurable in the untreated control until Day 18.

THROUGH DAY 23

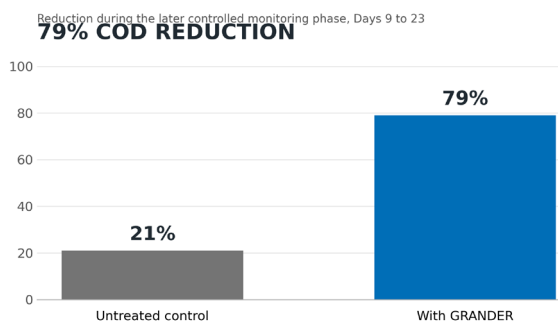
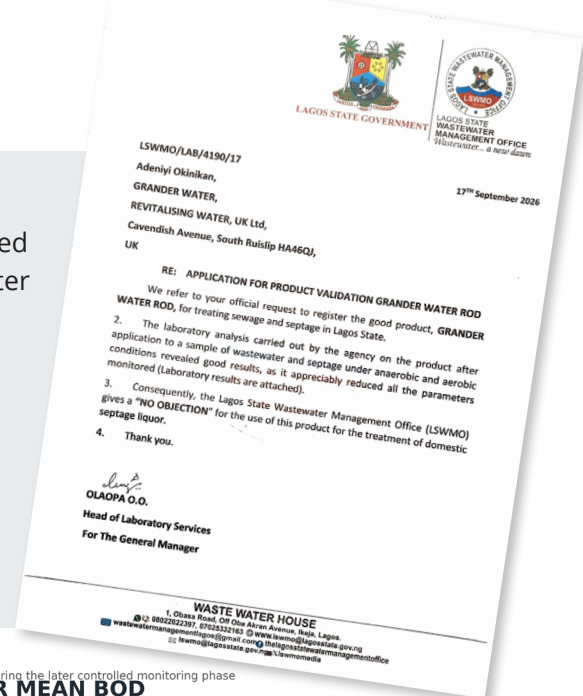
79% COD REDUCTION.

During the later controlled phase, COD fell by 79% in the GRANDER® container compared with 21% in the untreated control. Mean BOD was 72% lower, at 19 mg/L with GRANDER® compared with 67 mg/L in the untreated control.

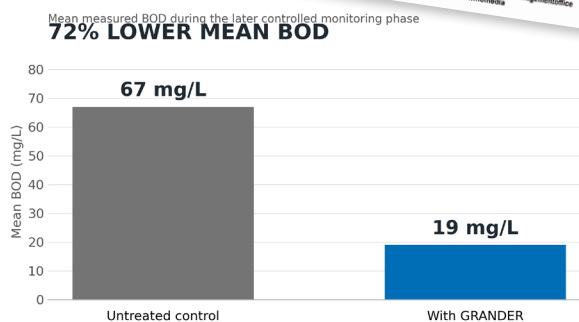
LAGOS STATE SUPPORTING LETTER

The Lagos State Wastewater Management Office's letter dated 17 September 2026 reports favourable laboratory results after application of the GRANDER® Water Rod to wastewater and septage under aerobic and anaerobic conditions. It states that the monitored parameters were appreciably reduced and issues a no-objection for use in treating domestic septage liquor.

Lagos State Wastewater Management Office, 17 September 2026. Ref. LSWMO/LAB/4190/17. No-objection for use in treatment of domestic septage liquor.



Source: GRANDER Bench-Scale 50 L Wastewater Evaluation, Lagos, February 2026. Days 9 to 23.



Source: GRANDER Bench-Scale 50 L Wastewater Evaluation, Lagos, February 2026. Measured days in Days 9 to 23.

SUSTAINED PERFORMANCE THROUGH DAY 23

79% COD REDUCTION

During the later controlled phase, COD fell by 79% in the GRANDER container compared with 21% in the untreated control.

72% LOWER MEAN BOD

Mean BOD was 19 mg/L with GRANDER compared with 67 mg/L in the untreated control.

TESTED BY LAGOS STATE WASTEWATER MANAGEMENT OFFICE

Laboratory evaluation by LSWMO reported appreciable reductions in the monitored parameters and resulted in a no-objection for using the GRANDER Water Rod in treating domestic septage liquor.

WHY THIS MATTERS FOR MINING

Mine camps and remote operations need wastewater systems that respond quickly and remain stable. Significant changes in nitrate and odour within 24 hours, followed by continued reductions in COD, phosphate and BOD, point directly to treatment load, aeration demand, chemical use, sludge handling, maintenance and reuse potential.

INTERNATIONAL WASTEWATER EXPERIENCE | AUSTRIA



Fahren-Gaertner introduced GRANDER into its production-water recycling system in 2004. The facility was already recycling approximately 70% of its production water. The company reported improved odour and lower bacterial levels after the installation.

For a mine already recovering water, the important question is not simply whether water can be reused, but whether its condition can be improved enough to increase confidence in reuse, reduce treatment effort and support a more stable water circuit.

Sources: GRANDER® Bench-Scale 50 L Wastewater Evaluation, Lagos, February 2026; Lagos State Wastewater Management Office letter LSWMO/LAB/4190/17, 17 September 2026; GRANDER® published industrial account, Fahren-Gaertner, Austria.



BENTONITE-AFFECTED WATER

AN AUSTRALIAN EXPERIENCE

CLEARER WATER. CLEANER LINES. REDUCED CHEMICAL USE.

Australian farmer Ted Marshall faced heavily muddy, bentonite-affected dam water. After approximately one month using GRANDER®, he reported substantially clearer water, progressive clearing of deposits from pipework and improved results in grain grown for cattle feed.

THE CHALLENGE

Ted described his original water as mud soup. Years of using this water had left mud in the distribution lines. Grain prepared for cattle feed suffered from poor sprouting, unpleasant odour and rot.

He had tried alum, but reported that it produced a slimy, lumpy material without resolving the water problem.

CHEMICAL USE: FROM ROUTINE DOSING TO NONE

Before GRANDER®, Ted used a peroxide product during grain preparation to control microbial growth. He stated that it cost A\$100 per 20 litres. After approximately one month using GRANDER water, he reported that he no longer used the product, identifying this as a direct cost saving.

AFTER APPROXIMATELY ONE MONTH

Ted Marshall reported:

- Substantially clearer water
- Progressive clearing of mud from pipework
- Improved grain sprouting and root development
- Peroxide dosing discontinued

Source: operator video testimonial.

WHY THIS MATTERS FOR MINING

Clay-rich water, suspended fines and accumulated deposits are relevant challenges for mining and mineral processing. This farm experience provides a practical reason to investigate GRANDER in comparable water systems, measuring changes in clarity, suspended solids, deposits and chemical consumption.

WHAT COULD THIS MEAN FOR YOUR OPERATION?

Does clay-rich water create extra work for your pumps, filters and water systems?

What does that mean for cleaning, chemical expenditure, maintenance and production downtime?

Could clearer water and fewer accumulated deposits reduce those operating costs?

A GRANDER® site assessment can identify suitable applications and establish the measurements needed to evaluate the benefits.



Original bentonite-affected water.



Ted Marshall pours the clearer water after approximately one month using GRANDER®.

CASE-STUDY BASIS AND SOURCE

Results reported by the operator in a video testimonial at approximately one month. Agricultural application; mining performance remains to be assessed.

Ted Marshall, "Grander Bentonite Muddy Dam Solution". AI-enhanced stills from the original video testimonial.

<https://www.youtube.com/watch?v=f2seRBcNQ7Q>

PLANT RELIABILITY AND OPERATING COSTS

LARGE WATER CIRCUITS. MEASURABLE CHANGES.

ACSM PRIMIERO, ITALY

This district-heating installation demonstrates GRANDER equipment operating across a large recirculating water network: 47.8 kilometres of network, 1,166 heat exchangers and five K40/ DN100 GRANDER units.

94.6% LOWER MEASURED IRON

Laboratory analysis approximately ten months after installation recorded iron at 41 micrograms per litre, compared with 755 micrograms per litre before installation.

Copper fell from 222 micrograms per litre to below 10, while total organic carbon fell from 3.53 mg/L to below 1.5 mg/L.

THE MINING QUESTION

Where iron, corrosion products and deposits circulate through pumps, heat exchangers, cooling systems and pipework, what is the combined cost of cleaning, restricted flow, heat-transfer loss, component replacement and interruption? This case shows why water condition should be treated as an operating-cost issue, not simply a water-quality issue.



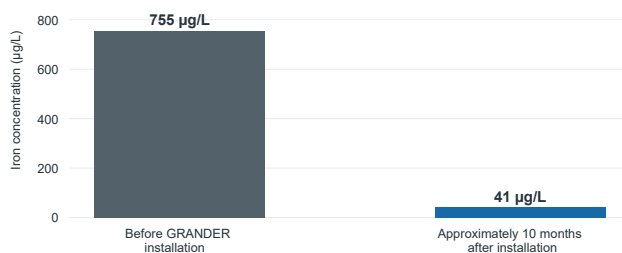
ACSM Primiero district-heating water, Italy. Before and approximately ten months after GRANDER® installation. Source: Heating Journal case material, referencing Eco Center Test Report 20241100-01, June 2024. Calculated iron decrease: 94.6%.

94.6% LOWER MEASURED IRON

755 to 41 micrograms per litre after approximately ten months.

ACSM PRIMIERO: TOTAL IRON

94.6% lower measured concentration after approximately ten months



Source: GRANDER Heating Journal; Eco Center report 20241100-01, June 2024. District-heating water, Italy. Lower concentration alone does not measure corrosion rate.

WHAT IS WATER CONDITION COSTING YOUR MINE?

The cost of difficult water rarely appears in one budget line. It accumulates through replacement filters, chemicals, cleaning water, labour, waste handling, maintenance intervention and lost production time. Documented industrial results show where a mine can begin looking for measurable savings.

400% INCREASE IN FILTER SERVICE CYCLES

ECKELT GLAS, AUSTRIA

The same filter previously required replacement after three or four uses. With GRANDER, it was reportedly reused up to 20 times before replacement. This represents an increase of at least 400% in service cycles from each filter.

At mining scale, longer filter life can reduce purchasing, replacement labour, stockholding, discarded-filter waste and maintenance interruption across multiple water circuits.

UP TO 70% LOWER ANNUAL MAINTENANCE COSTS

MANNER, AUSTRIA

Across a production site with 35 cooling machines, two cooling towers and 400 cubic metres of water circulating each hour, chemicals were discontinued after two weeks. The company reported investment payback in nine months and annual maintenance costs reduced by up to 70%.

For a mine, the equivalent cost stack may include chemical dosing, descaling, cleaning crews, contractors, spares, shutdown preparation and production interruption.

50% LOWER CHEMICAL USE. 20% LOWER CLEANING-WATER USE.

ALLGÄULAND, GERMANY

The operator reported a 50% reduction in chemicals and a 20% reduction in water used for cleaning, together lowering annual operating costs by approximately EUR 7,000. Nitric-acid cleaner concentration fell from 1.3% to 0.7% over eight to nine months.

In mining, the same cost categories arise in washdown, workshops, cooling systems, process equipment and water-treatment plant. The value increases wherever water and chemical use are repeated across shifts, assets and sites.

9-MONTH REPORTED PAYBACK

Manner's reported payback shows why the right question is commercial: identify a costly water circuit, establish the baseline and measure the result against real operating expenditure.

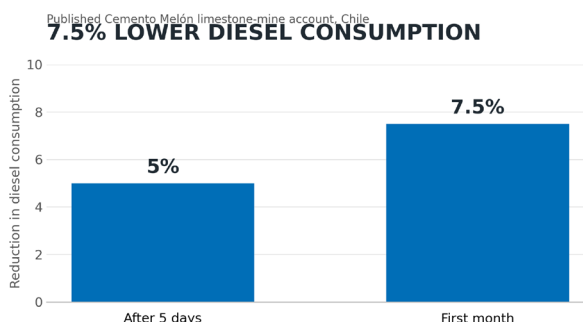
Sources: GRANDER published industrial operator accounts for Eckelt Glas, Manner and Allgäuland.



FUEL & HEAVY EQUIPMENT

WHEN FUEL COSTS MILLIONS, EVERY PERCENTAGE POINT MATTERS

Diesel is one of mining's largest and most immediate operating costs. It powers haulage, loading, drilling, pumping and generation. Unlike a distant efficiency target, a measurable reduction in litres consumed produces a saving every operating day, across every treated machine.



7.5% LOWER DIESEL CONSUMPTION

CEMENTO MELÓN LIMESTONE MINE, CHILE

The published Cemento Melón account records an underground diesel vehicle fitted with GRANDER ECO-KAT achieving 5% lower diesel consumption after five days and 7.5% during the first month. Management subsequently decided to extend the application across its diesel-powered heavy machinery.

5% LOWER DIESEL CONSUMPTION AFTER FIVE DAYS

7.5% LOWER DIESEL CONSUMPTION DURING THE FIRST MONTH

LOWER EXHAUST EMISSIONS

- 80% lower carbon monoxide at low engine speed
- 77% lower carbon monoxide at high engine speed
- 83% lower nitrogen oxides

Lower consumption is a direct operating saving. Lower carbon monoxide and nitrogen oxides are also highly relevant around diesel equipment, particularly underground where engine emissions contribute directly to the ventilation burden and working environment.

THE SAVING SCALES WITH THE FUEL BILL

At annual fuel expenditure of 1 million, a 5% reduction represents 50,000 and a 7.5% reduction represents 75,000. At 10 million, the figures become 500,000 and 750,000. At 50 million, they become 2.5 million and 3.75 million, in the same currency.

A 7.5% REDUCTION ON 50 MILLION ANNUAL FUEL SPEND = 3.75 MILLION

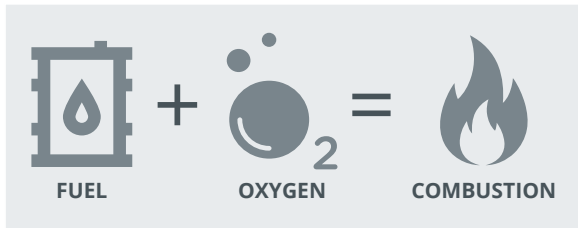
That is why even a carefully controlled trial on one generator, haul truck or underground vehicle can carry strategic value. Prove the change against useful output, then calculate what it could mean across the fleet.

Source: ENERGIS 24 seminar material, Brno, 18 May 2017, p. 4, published Cemento Melón account.

FUEL. OXYGEN. USEFUL ENERGY.

WHY OXYGEN DYNAMICS MATTER

Combustion is the rapid reaction between fuel and oxygen. The more effectively the fuel interacts with oxygen in the combustion air, the more of its stored chemical energy can be converted into useful engine output. Where combustion is incomplete, part of that energy is lost and more products of incomplete combustion can remain in the exhaust.



WHAT GRANDER ECO-KAT DOES

GRANDER ECO-KAT is fitted externally in close proximity to the fuel as it passes through the fuel-feed line. Nothing is added to the fuel,

the fuel remains contained and the device requires no electricity. GRANDER revitalisation is designed to influence the physical behaviour of the fuel so that it can interact more effectively with oxygen during combustion.

The purpose is not to add oxygen to the fuel. It is to improve the conditions under which the fuel meets and reacts with the oxygen already supplied to the engine. This provides the practical connection between fuel treatment, useful energy, consumption and exhaust quality.

THE REPORTED MINING PATTERN

At Cemento Melón, the reported reduction in diesel consumption was accompanied by lower carbon monoxide and nitrogen oxides. The commercial opportunity is therefore wider than fuel purchasing alone: it reaches operating cost, underground air quality and the burden placed on ventilation systems.

PROVEN ON MINING-SCALE EQUIPMENT

CHUQUICAMATA, CHILE

The published Chuquicamata account describes GRANDER ECO-KAT application to mining haulage equipment with engines rated at 2,700 horsepower and vehicles carrying loads of up to 300 tonnes.

2,700 HORSEPOWER

Mining haulage equipment described in the published account.

UP TO 300 TONNES

Vehicle carrying capacity described in the same account.

RESEARCH HISTORY DATING BACK TO 1989

Johann Grander's European patent publication EP0389888A1 describes an arrangement for reducing fuel consumption and exhaust emissions in internal-combustion engines.

Sources: Herbert Renner and Radovan Šejvl, TVIP 2019, pp. 1-2; Johann Grander, European patent publication EP0389888A1.



THE MINE-WATER COST MAP

WHERE IS WATER COSTING YOUR MINE THE MOST?

Water moves through a mine as a connected operating system. A problem at one stage can reappear as chemical demand, deposit build-up, blocked filtration, lost heat transfer, extra cleaning, maintenance intervention or restricted reuse elsewhere.



SOURCE AND STORAGE

Clay-rich water, suspended fines, odour and unstable stored water.



PROCESS WATER AND FILTRATION

Filter replacement, flocculants, sludge handling and interrupted flow.



COOLING AND CLOSED CIRCUITS

Iron, corrosion products, scale, deposits and reduced heat transfer.



WORKSHOPS AND WASHDOWN

Repeated chemical use, cleaning-water demand, labour and waste.



MINE CAMPS AND WASTEWATER

Odour, organic load, aeration, chemicals, sludge and compliance.



RECOVERY, REUSE AND DISCHARGE

The condition of recovered water determines how confidently and economically it can be reused.



ONE WATER CIRCUIT. MULTIPLE COST CENTRES.

The strongest opportunity may not be the largest water volume. It may be the circuit creating the most replacement, chemical, maintenance or downtime cost.

FROM OPERATING PROBLEM TO MEASURABLE PROJECT

TURN ONE RECURRING COST INTO A MEASURABLE PROJECT

Start where the mine already spends money. Select one defined water or fuel application, establish the present cost and measure whether GRANDER® changes the result.

1

IDENTIFY THE COST

Choose a recurring problem with a visible operating impact: filters, chemicals, deposits, cleaning, maintenance, downtime, water use, wastewater load or diesel consumption.

2

ESTABLISH THE BASELINE

Record consumption, replacement frequency, labour hours, maintenance events, downtime, water chemistry and production impact before installation.

3

SELECT THE APPLICATION

Match the GRANDER equipment to a defined circuit, flow, pipe size and operating objective.

4

MEASURE THE RESPONSE

Use a timetable suited to the application. Early wastewater indicators may be measured within 24 and 48 hours. Water circuits, deposits and service intervals should be monitored over the operating period in which the existing cost normally occurs.

5

CALCULATE THE VALUE

Convert the measured change into purchasing, labour, waste, maintenance, downtime, water, chemical, energy or fuel savings.

WHAT WOULD MAKE A TRIAL COMMERCIAL FOR YOUR MINE?.

One avoided shutdown? Fewer replacement filters? A reduction in chemical dosing? Longer equipment-cleaning intervals? Lower wastewater-treatment demand? A measurable reduction in fleet fuel consumption? Define the target before the trial and let the operating data answer the question.

LONG-SERVICE EVIDENCE

RESULTS THAT CONTINUED FOR YEARS

Fast response matters, but mining assets also demand stability. Published GRANDER® installations provide long-cycle evidence across cooling systems, industrial water circuits and closed-loop infrastructure.

15 YEARS - MANNER, AUSTRIA

The company reported that its GRANDER® installation was still working as it had on the first day. The same account records chemicals discontinued after two weeks, nine-month investment payback and annual maintenance costs reduced by up to 70%.

MORE THAN 8 YEARS - ISO-TECH, AUSTRIA

The operator reported more than eight years without maintenance of the cooling-water system. Previously, heat exchangers required cleaning two or three times each year, with approximately 48 hours of maintenance and interrupted production for each event

SINCE 1998 - ISOSPORT, AUSTRIA

Isosport initially reported a 20% reduction in cooling-water chemicals. One year later, it reported operating the system without the chemicals previously used.

THE MINING QUESTION

When a mine evaluates a water-treatment investment, the value is not confined to the first laboratory result. It may continue through longer service intervals, avoided maintenance events, lower chemical dependence and improved operating continuity over many years.

Sources: GRANDER published industrial operator accounts for Manner, ISO-Tech and Isosport. Retain the existing source for the UK closed-circuit laboratory result.

14-YEAR SYSTEM WATER - ACTUAL LABORATORY RESULTS

pH	7.8
DISSOLVED IRON	<0.10 mg/L
DISSOLVED COPPER	<0.10 mg/L
DISSOLVED ZINC	<0.080 mg/L
DISSOLVED ALUMINIUM	<0.030 mg/L
TOTAL HARDNESS AS CaCO ₃	42 mg/L
TOTAL VIABLE COUNT — 22°C / 72 HOURS	49 CFU
SULPHATE-REDUCING BACTERIA — 21 DAYS	NOT DETECTED
NITRATE/NITRITE-REDUCING BACTERIA	NOT DETECTED

Results reproduced from Dynamika UK Certificate of Testing 5533484 in the Commercial Heating Journal. UK heating-system sample, 4 November 2025. The sample records water condition after long service; it is not a before-and-after comparison or a measurement of mining performance.



THE BUSINESS CASE STARTS WITH YOUR EXISTING COSTS

A 2007 University of Graz empirical survey examined 32 industrial GRANDER users in Austria, Germany and Switzerland. The sample included a mining operator, placing mining within the surveyed industrial experience rather than outside it.

84%

REPORTED SAVINGS

Twenty-seven of the 32 businesses reported savings attributable to GRANDER®.

EUR 10,200

AVERAGE ANNUAL SAVING

Among the businesses providing detailed figures, average annual savings were approximately EUR 10,200 and the median was EUR 4,200. Savings were divided almost equally between chemicals and other operating costs such as maintenance, cleaning, water changes and disposal.

47%

PAID BACK WITHIN ONE YEAR

Among the companies with sufficient cost and benefit information, 47% achieved payback within one year and 84% within four years. The calculated median payback was 1.3 years and the mean was 1.8 years.

MINING WAS REPRESENTED IN THE SURVEY

This matters because the commercial logic was tested across real industrial operations, including mining. The reported benefits arose where businesses began with an identifiable problem and measurable cost: chemical use, maintenance, cleaning, fluid life, water changes, corrosion, deposits or process performance.

BUILD THE CASE AROUND YOUR OWN COSTS

Record chemical expenditure, fuel consumption, replacement filters and components, cleaning labour, waste and sludge handling, water consumption, energy, planned maintenance and unplanned downtime. Compare these operating costs with the installation cost and measured results over an agreed period.

NEXT STEP.

SO START WITH YOUR SITE.

The business case begins with the individual system: its water, its operating conditions and its recurring costs.

An initial assessment identifies the most suitable application and the evidence needed to evaluate it.

THE ASSESSMENT CONSIDERS:

- Which water system is causing the problem?
- What treatment and equipment are already in place?
- How often are cleaning, repairs or chemical interventions required?
- What does the problem cost in labour, materials and downtime?
- Which measurements would demonstrate a useful improvement?

For technically complex systems, water analysis and operating records can establish a baseline. Equipment selection considers system configuration, pipe diameter, water volume, flow, temperature and existing treatment requirements.

LET'S MEASURE IT

Select a suitable system. Agree the baseline. Monitor the result.



START WITH AN INITIAL ASSESSMENT

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REFERENCES / EVIDENCE

1. GRANDER Bench-Scale 50 L Wastewater Evaluation, Lagos, February 2026, Phase 2, Days 9-23.
2. Lagos State Wastewater Management Office, LSWMO/LAB/4190/17, 17 September 2026.
3. Ted Marshall, Grander Bentonite Muddy Dam Solution, YouTube video f2seRBcNQ7Q.
4. ACSM Primiero case and Eco Center Test Report 20241100-01, June 2024, reproduced in the GRANDER Commercial Heating Journal.
5. GRANDER Industrial Journal, MFL total-iron chart, printed p.16; Isosport case, printed p.13.
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7. Johann Grander, European patent publication EP0389888A1, 3 October 1990; priority 28 March 1989.
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9. Katrin Zunkovic, University of Graz, empirical survey among industrial GRANDER users, 2007, summarised in the Heating Journal.
10. GRANDER manufacturer product information for inline, circulation and immersion devices.