

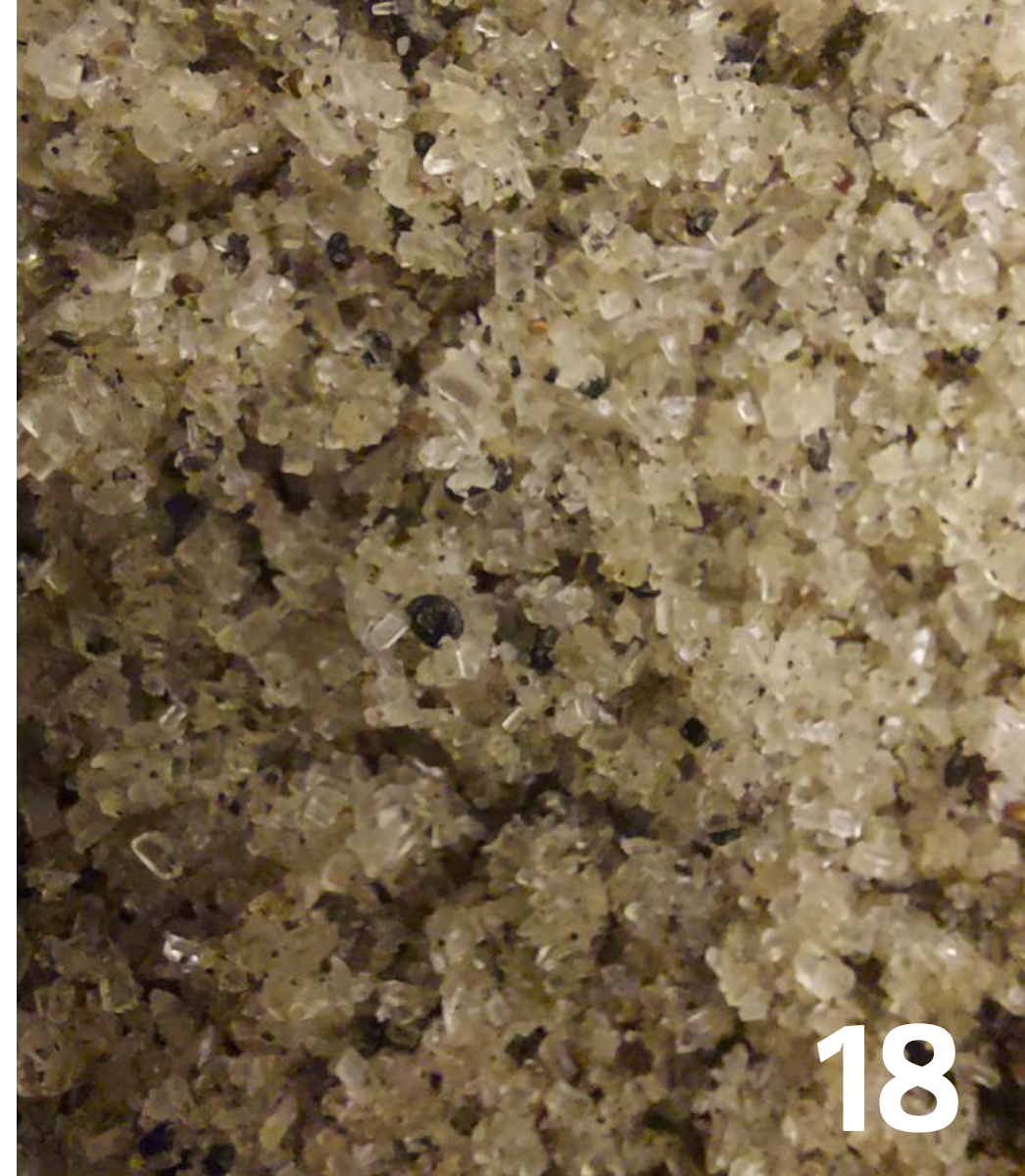


aqua
minerals

Annual Report

2022





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In this Annual Report we look back on the raw materials crisis. But we don't do it alone. A number of participants also share their experiences of last year.

Foreword

The winners of today and of the future

2022 is a year not soon to be forgotten. As a result of the corona pandemic and the war in Ukraine, energy prices fluctuated strongly, and for a long period just kept on rising. There was an acute shortage in the transport sector, partly because many East European drivers headed for home on account of the war. And because many industrial activities were put on hold in response to the high energy prices, certain raw materials became scarce. We were just coming out of the corona crisis when the next crisis came along: the raw materials crisis.

The major shortages prompted a search for alternative raw materials sources and suppliers – closer to home, because farther away was hardly possible any more. AquaMinerals was increasingly approached. Demand grew, and sharply. The combination of price fluctuations, operational service-provider shortages, and a strong demand for raw materials forced us to remain constantly on high alert. Every day brought with it new challenges. Making the right choices, keeping up with changes and anticipating events, while also bearing continuity and longer-term objectives in mind. In 2022,

I myself moved to a house that was not energy efficient. Plans to enhance its sustainability have barely gotten off the ground because of the shortage of labour and materials.

But last year also offered some new insights. The raw materials crisis demonstrated more than ever before the importance of circularity. The panic of 2022 is – for the time being at least – over. At AquaMinerals we are very aware that such a crisis could happen again. This certainly applies in other sectors; many companies now have a raw materials strategy and no longer want to rely on a single supplier. That leaves one too vulnerable. The year 2022 showed that high prices and raw materials scarcity meant that certain companies had to close their doors. Although activities had to focus on the here and now over the last year, there was also time to look at the medium and long term. Those who had earlier already bet on circularity are the winners of today – and of the future.

A holistic view and approach is called for in that transition to the circular application of raw materials. It's not only a matter for instance of

more money, continuity, technology, logistics and regulation, but also of the context and collaboration. Perseverance is called for when things get difficult; the search for connections, both within and outside the sector, helps in making new chains possible. In any event, I see that there is a lot more (transition) energy in the market than ever before. This also applies to our participants, the government and, of course, also to ourselves. We are pleased to play the role of stimulating, and ultimately realising, new developments, whether they concern new chains, creative ideas or even entirely new material streams.

Looking back on a troubled and unusual year, my main feeling is one of pride. We confronted the challenges of the crisis together and sought solutions for the moment and for the future. I am extremely grateful for the flexibility, the thought-sharing and empathy of our participants, suppliers and, most of all, our colleagues. We are getting it done together!

Olaf van der Kolk
Managing Director

This is who we are

AquaMinerals seeks and identifies destinations for the residuals generated in water treatment. We prefer to find these destinations in the water sector. To this end, we develop suitable chains, which are then supplied and/or operated in a qualitatively high-value manner. Our organisation was set up in 1995 for and by all the drinking water companies in the Netherlands. Over the course of time, the Flemish drinking water company, De Watergroep, and six Dutch Water Authorities also became members (on 1 January 2023, they numbered eight).

Although our organisation was created to solve the 'waste problem', we have long ceased seeing the generated residuals as waste, let alone as a problem. As things stand today, we have developed functional applications for most of the materials, and have

made significant progress, both in our financial and sustainability performance. Circular working is our ultimate objective; we are increasingly able to reuse the materials in processes in the water chain, or supply them to other circular chains.

We do not do this on our own. We work closely with our participants in research and development projects, and frequently brainstorm about how we can make chains even more circular. Research institutes share their knowledge and thinking with us. Our service providers operate as links between supply and demand. And we examine with the clients how we can best meet their desires, and how we can organise the right, sustainable chains for them.



AquaMinerals is a not-for-profit, shared service centre for the participants. For the market, we are a commercial raw materials supplier. The proceeds go to the participants, research and development.

This is what we do

For, and in the name of, our participants we

- ✓ direct the chain
- ✓ procure logistical services
- ✓ sell the residuals and raw materials
- ✓ innovate and valorise through joint research with participants, clients and research institutes
- ✓ scout interesting technologies by participating in (international) knowledge networks and projects
- ✓ carry out the quality management
- ✓ arrange and maintain the required certificates and declarations
- ✓ monitor, lobby and advise in areas of policy, and legal and regulatory frameworks
- ✓ provide transparency in financial and product flows, as well as in the CO₂ footprint and the degree of circularity of chains

Our core values

Social entrepreneurship

Reliability



Joint pursuit of shared interest



Innovation

Our participants



On 31 December 2022, AquaMinerals had nineteen shareholders: the ten Dutch drinking water companies, the Flemish drinking water company, De Watergroep, and eight Water Authorities. On 1 July 2022, the Delfland Water Authority joined the collective. Per 1 January 2023, the Dommel Water Authority and the Limburg Water Authority Company also became participants; these shares were issued on 30 December 2022.

We have two types of shares: 'WS' shares (Water Authorities) and 'DWB' shares (drinking water companies), so that specific decisions, proposed by the Supervisory Board (SB), relating either to specific drinking water or Water Authority materials, can be made by the shareholders concerned.

Drinking water companies

Organisation	Shares	Share number	Interest
Vitens	DWB	2,808	20.5%
Brabant Water	DWB	1,968	14.4%
Evides	DWB	1,242	9.1%
De Watergroep	DWB	1,028	7.5%
PWN	DWB	802	5.9%
WML	DWB	614	4.5%
Dunea	DWB	574	4.2%
Waternet (DWB)	DWB	527	3.8%
WB Groningen	DWB	354	2.6%
Oasen	DWB	275	2.0%
WMD	DWB	252	1.8%
<i>Subtotal DWB</i>		<i>10,444</i>	<i>76.3%</i>

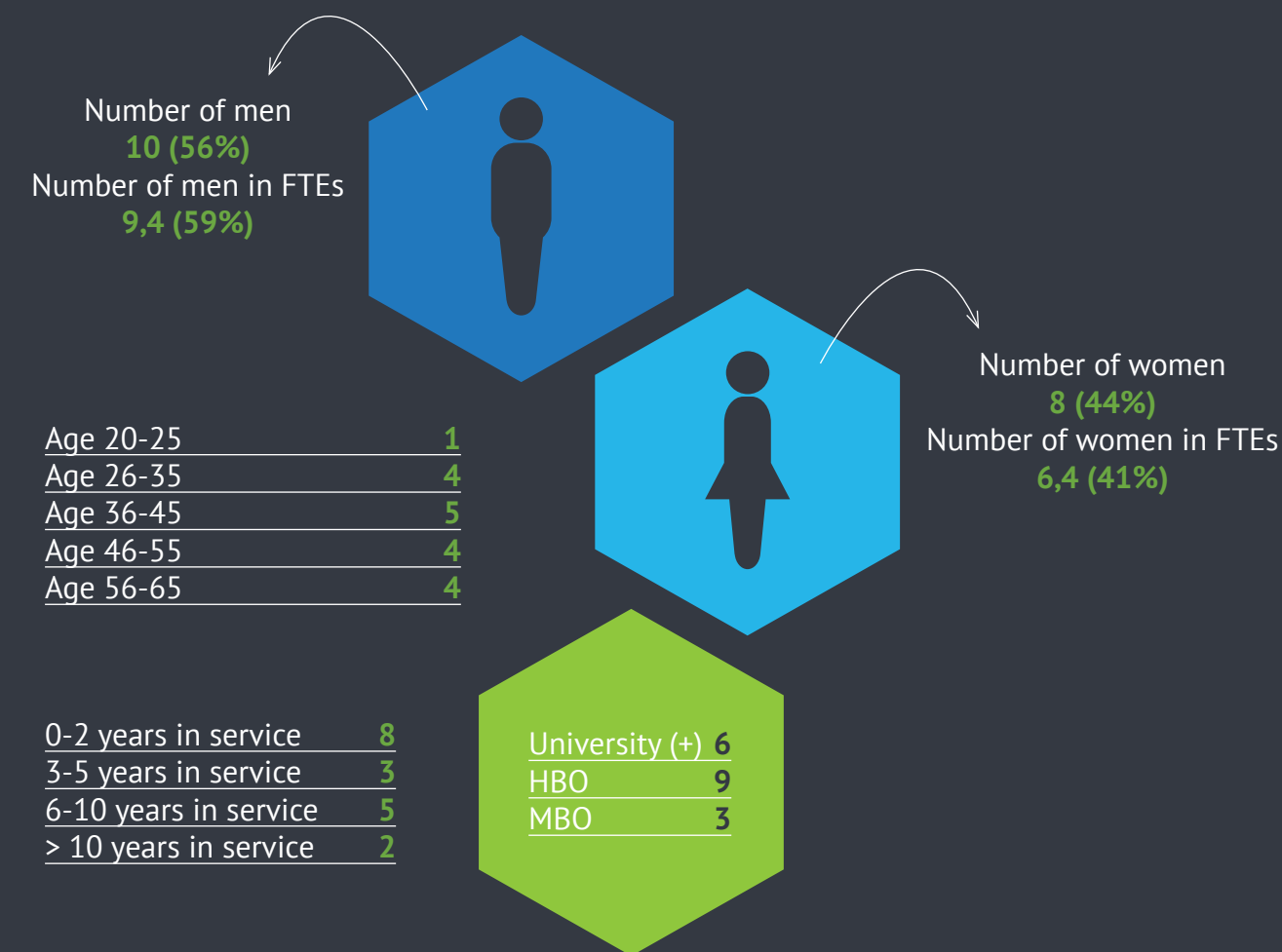
Water Authorities

Organisation	Shares	Share number	Interest
Hoogheemraadschap Amstel, Gooi en Vecht	WS	773	5.6%
Hoogheemraadschap van Delfland*	WS	653	4.8%
Waterschap Aa en Maas	WS	546	4.0%
Waterschap Hollands Noorderkwartier	WS	537	3.9%
Hoogheemraadschap De Stichtse Rijnlanden	WS	479	3.5%
Waterschap Zuiderzeeland	WS	257	1.9%
<i>Subtotal WS</i>		<i>3,245</i>	<i>23,7%</i>
Total		13,689	100%
Waterschap De Dommel**	WS	607	-
Waterschapsbedrijf Limburg**	WS	751	-

* Shares issued 1 July 2022. ** Shares issued 30 December 2022.

Staff member structure year-end 2022

Number of staff members in service **18**
 Number of FTEs **15,8**



Highlights of 2022

The numbers for 2022 were more or less as anticipated:

- ✓ AquaMinerals disposed of more than 301,000 tonnes of residuals for the participants in 2022: 7.7 % (25,000 tonnes) less than in 2021. In particular, less aluminium sludge (-9,600 tonnes) and iron-lime sludge (-18,700 tonnes) was disposed of.
- ✓ The sales value for materials with a positive economic value climbed to € 4,121,000, which is € 132,000 (+3%) more than the previous record of € 3,989,000 (2021).
- ✓ Because of the lower volume, combined with the increased costs, the shareholders' contribution, expressed in euros per tonne, increased to € 6.20 per tonne.
- ✓ The disposal and acceptance expenses increased to € 14,000,000, mostly because of the higher transport costs due to the sharply increased price of diesel.
- ✓ The average transport distance dropped to 114 kilometres, mostly because fewer calcite pellets were transported to the United Kingdom.
- ✓ The recycle percentage increased. This was partly because of increased functional applications, but also because relatively fewer materials, for which no satisfactory applications as yet exist, were disposed of.
- ✓ Sick leave increased in comparison with 2021, from 2.4 percent to 4.7 percent, because of the long-term illness and absence of one employee.

Key figures

	2022	2021	2020	2019	2018
Results					
Turnover residuals and consulting	€ 17.960.796	€ 17.278.904	€ 15.792.924	€ 11.134.219	€ 8.670.780
Turnover non-shareholders in %	5,7	5,1	10,8	7,4	7,2
Total disposal and acceptance expenses	€ 13.975.345	€ 13.281.052	€ 12.064.083	€ 7.715.865	€ 5.588.800
Sales value (pos.-value materials)	€ 4.121.011	€ 3.988.703	€ 3.745.849	€ 3.446.367	€ 3.002.328
Acceptance (neg.-value materials)	€ 6.899.594	€ 6.786.926	€ 5.991.862	€ 2.137.179	€ 819.567
Operating result (before taxes)	€ 48.266	€ 54.548	€ 18.910	€ 158.650	€ 203.800
Shareholders' contribution in €/t ¹	€ 6,20	€ 5,38	€ 5,59	€ 5,63	€ 5,82
Assets					
Balance sheet total	€ 5.191.933	€ 3.860.230	€ 5.718.834	€ 4.773.586	€ 3.354.400
Shareholders' equity	€ 1.700.174	€ 1.433.884	€ 1.315.587	€ 1.298.711	€ 1.117.300
Liquidity (quick ratio)	1,5	1,6	1,3	1,4	1,4
Materials figures					
Supply in tonnes ²	300.801	326.026	298.634	260.792	247.800
Recycle percentage ³	81 (90)	73 (78)	75 (80)	81 (82)	87 (87)
Average transport distance	114 km	125 km	126 km	132 km	113 km
Personnel					
Number of employees FTE per report year	15,8	13,8	13,6	10,0	8,6
Absenteeism in % ⁴	4,7	2,4	6,0	7,0	5,4
Average turnover per FTE	€ 1.136.759	€ 1.252.095	€ 1.161.244	€ 1.117.103	€ 1.008.230

¹ For 2018, including retention of 10% sales value.

² Tonnage of shareholders, including third-party tonnage. In 2022, 312,449 tonnes disposed of.

³ Material recycling. Parenthetic figures incl. upcycling into biofuel.

⁴ 2019 and 2020: incl. long-term sick leave of 2 employees.

Welcome to new participants

In 2022 the decision-making was concluded for no less than three new accessions. We are very happy with our new participants: Hoogheemraadschap van Delfland Water Authority (acceded on 1 July 2022), De Dommel Water Authority and Limburg Water Authority Company (per 1 January 2023). This not only strengthens the collective purchasing, sales and innovation position, but with these participants AquaMinerals can – besides the existing material streams – also get to work for instance on the valorisation of CO₂ and dewatered sludge.



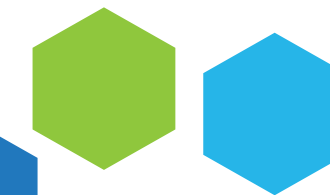
Continuity in a dynamic environment

We succeeded again in providing continuity in 2022, but this was more of a challenge than in any other year in our history. The year was marked by constraints due to the corona pandemic (first quarter), fluctuating and, most of all, rising fuel prices, staff shortages and a strengthening economy – thus growing

demand. The fluctuating diesel prices meant that the prices in the systems had to be adjusted practically every day. This not only made the organisational processing challenging, but it was also difficult to arrange for any non-contractual transport services whatsoever.

A circular beer as a statement

To familiarise the general public with all that can be recovered and used from the water chain, we jointly developed with the Energy and Resources Factory a circular beer: 'Ontboezeming'. We got a long way in making it circular. You can read how we did it on page 20. Although brewing beer is fun, we'll hand the task back to others from now on.



Experiencing works

AquaMinerals played an important role in the organisation of the feel-good market at the World Water Congress and Exhibition in Copenhagen. For the occasion, we chose to physically show what materials can be recovered and applied. There are after all already many inspiring examples worldwide – and in the Netherlands and Belgium in particular. The feel-good market attracted an exceptional number of visitors; at times, there wasn't even enough room for people to walk by and check out the examples. From the high number of visitors and the positive feedback, we can say that experiencing is better than telling!

3D-printing with residuals

Together with the Omlab company, a 3-D print paste was developed using ground calcite, Kaumera, cellulose and (optional) colouring with aquafer or powdered carbon. To attract attention to the print paste, AquaMinerals and Omlab launched a competition for suitable applications. A number of interesting ideas were submitted. The jury declared René de Lincel, Strategic Purchaser at PWN, to be the winner. Based on his idea – following advice from 'Vogelbescherming' (the Dutch partner of BirdLife International) – swallow nests are now being made for the threatened house martin (of the swallow family).

Water Authorities Roadmap expanded

The Water Authorities Roadmap was created in collaboration with no less than ten aspiring and actual participants. A Roadmap had already been created in 2019, but it needed to be updated in light of rapid developments and of the experience gained over the last years. This earlier Roadmap was therefore expanded with an implementation programme for 2022-2024. This part consists of factsheets for the 11 priority materials and for 3 over-arching themes, which are decisive for the realisation of the collective ambitions: professionalisation as a supplier, development of circular chains, and from business case to value case. This created a broad support base, also for the capacity required to carry out the activities. The implementation was budgeted in 2023. The possibility of creating a single Roadmap, by combining the Roadmaps of the drinking water companies and of the Water Authorities, is currently being explored with all the participants.

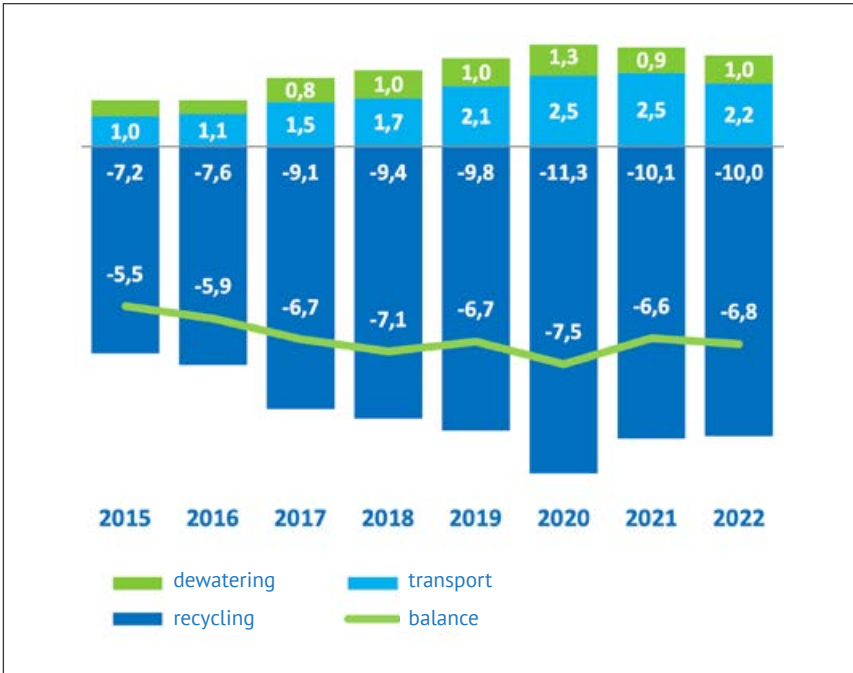
Sustainability results

Fewer residuals disposed, but climate benefit achieved

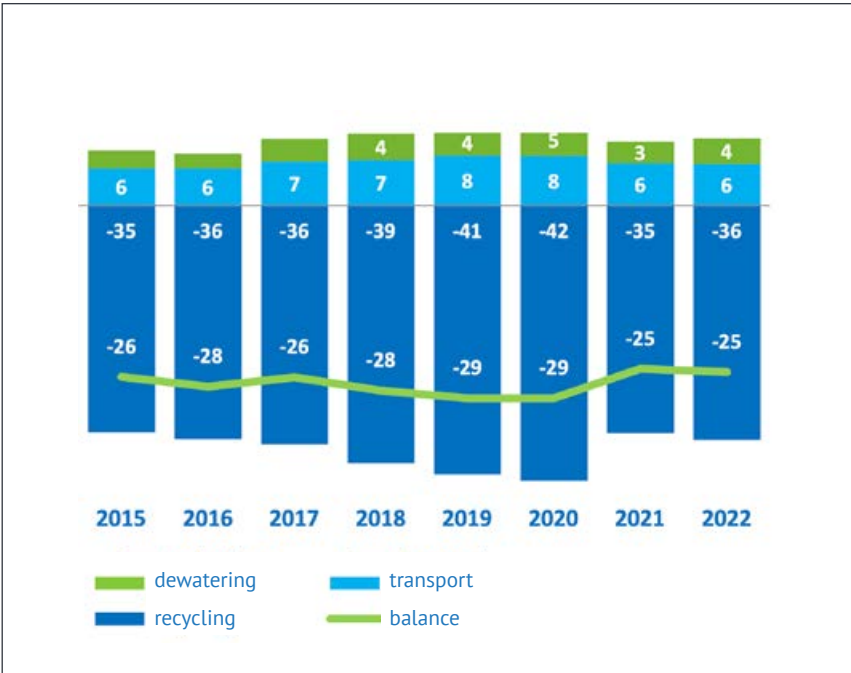
Every year we apply a lifecycle analysis to determine the footprint of the residuals chain, from the production process through to the application by the buyers. This footprint is negative. The climate benefit due to recycling is in fact far greater than the impact of the transport and the dewatering. The net result is that the residuals provide for fewer CO₂ emissions. The goal is to increase the

climate benefit by 35 percent in 2030 compared to 2015. In 2022, fewer residuals were disposed of for the shareholders and third-parties. Nevertheless, the climate benefit increased a little. This is because of the reduced transport kilometres, and because a part of the treatment sludge we dispose of for our Water Authority participants went to an application where it produced more energy.

Total footprint (mln kg CO₂-eq)



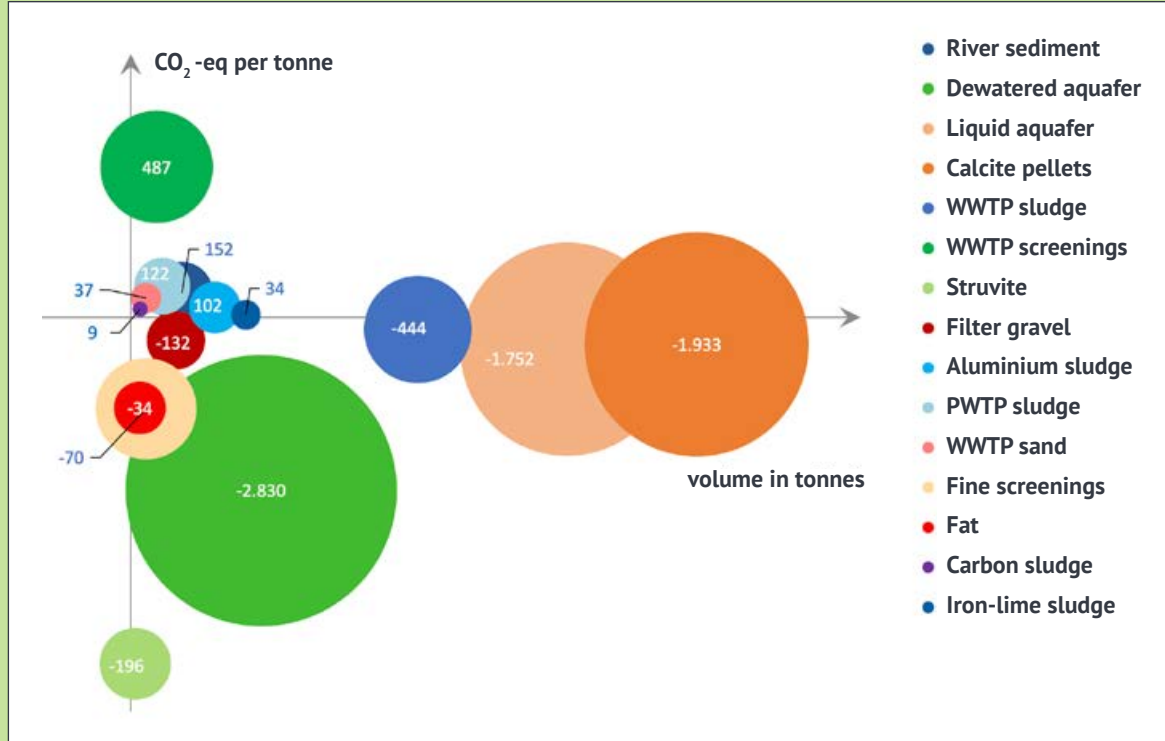
Footprint per tonne, only drinking water company shareholders (kg CO₂-eq)



Climate-positive materials

Calcite pellets, aquafer, filter gravel, struvite, fine screenings and WWTP sludge have a negative footprint on balance and therefore produce a climate benefit. Dewatered aquafer in particular generates a benefit. The other residuals have a negative balance: the impact of the transport and processing is greater than the benefit from the reduced use of primary raw materials by the buyers. Our goal is to have all residuals become climate-positive.

Climate benefit per material (negative = climate benefit) tonnes CO₂-eq



The bubble graph shows how far we have come. The size of the bubble indicates the climate impact or climate benefit for each material. On the vertical axis, the materials are ordered according to their climate impact per tonne. On the horizontal axis, the materials are ordered according to volume. Everything below the horizontal axis is climate-positive



More than 175,000 tonnes of primary raw materials saved

The residuals and recovered materials from the drinking water companies and Water Authorities replace primary raw materials and fossil fuels, such as limestone from quarries, iron salts, sand, gravel and various chemicals. In this way, we contribute to resource security. Considerable volumes are involved: 4 percent of the lime imported by the Netherlands, and about 25 percent of the quantity of iron salts used by the water sector itself. The use of treatment sludge and fine screenings in waste-to-energy plants, and in making energy pellets, results in energy production. This represents a gas saving equivalent to the energy use of 6,400 households.

At the moment, aquafer and calcite pellets are still mostly sent to clients outside of the water sector. By reusing these materials as raw materials in the water sector, we close the chain and ensure their availability. In recent years a big number of drinking water production locations have begun using their own calcite for water softening, a number of WWTPs are using aquafer as a sulphur-binding agent, and ferrous sand is being applied to remove phosphorus from surface water. We are working hard on the development of new chains: coagulant from aquafer for use in wastewater treatment plants; liquid CO₂ from green-gas production for use in drinking water production; deacidification and remineralisation using calcite pellets; powdered carbon from drinking water production for the removal of pharmaceutical residues at the WWTP; and slaked lime from calcite pellets. Read more on page 20.

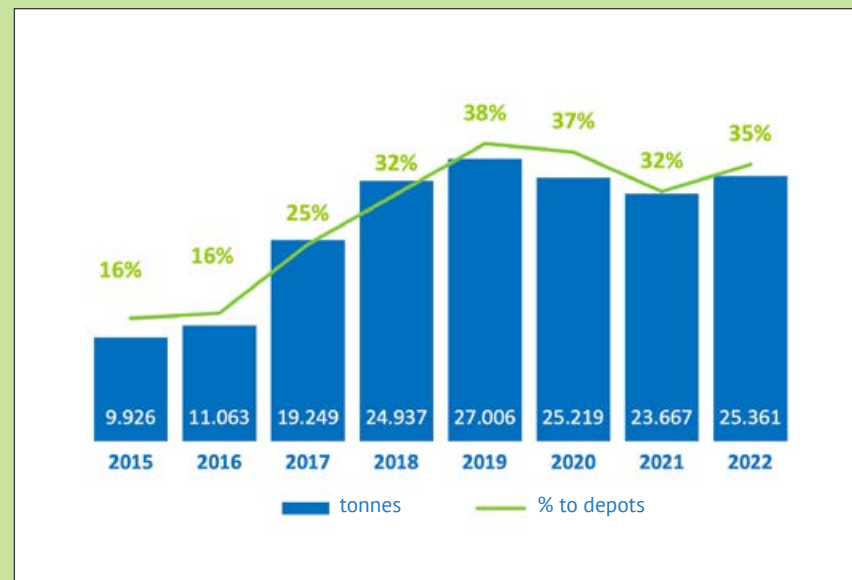
Savings of raw materials and energy

natural gas (and coal)	MJ	53.248.095
	m ³	1.682.404
calcium carbonate (from limestone)	tonnes	57.046
iron(II)chloride (20%)	tonnes	50.928
iron(III)chloride (40%)	tonnes	23.189
sand (construction sand, seeding sand)	tonnes	18.358
gravel	tonnes	14.278
clay	tonnes	4.877
shells	tonnes	1.329
ferric sulphate	tonnes	1.071
garnet sand (seeding sand)	tonnes	898
hydrogen peroxide (50%)	tonnes	828
phosphate ore	tonnes	614
phoslock (bentonite with lanthanum)	tonnes	531
sulphuric acid	tonnes	356
bitumen	tonnes	257
ammonium sulphate	tonnes	160
phosphoric acid (70%)	tonnes	61
paraffin	tonnes	35
poly aluminium chloride PAC (9%)	tonnes	27
lubricating oil	tonnes	25
magnesium sulphate	tonnes	25
resin	tonnes	17
urea	tonnes	5
polypropylene (PP)	tonnes	2

Reduce transport climate-impact

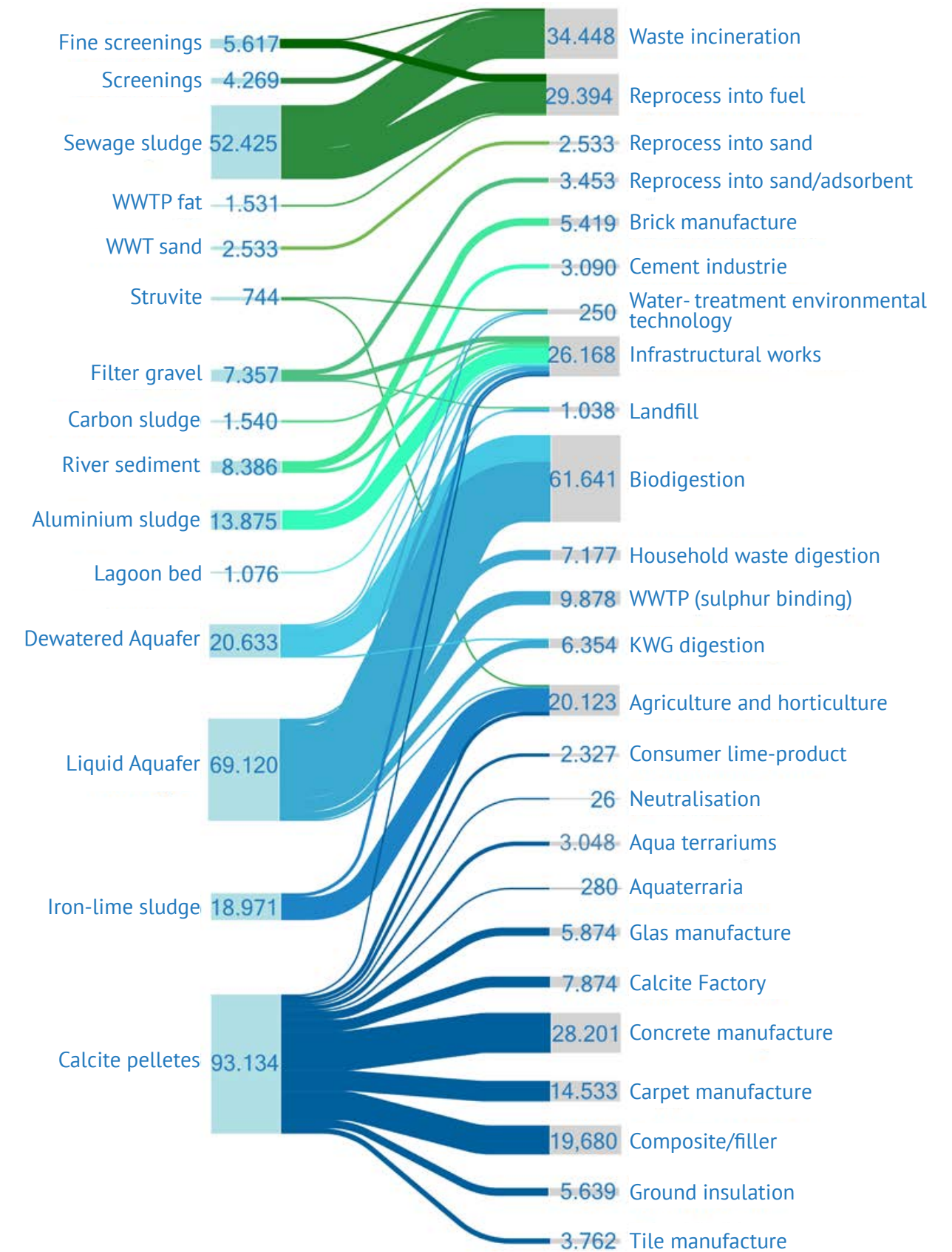
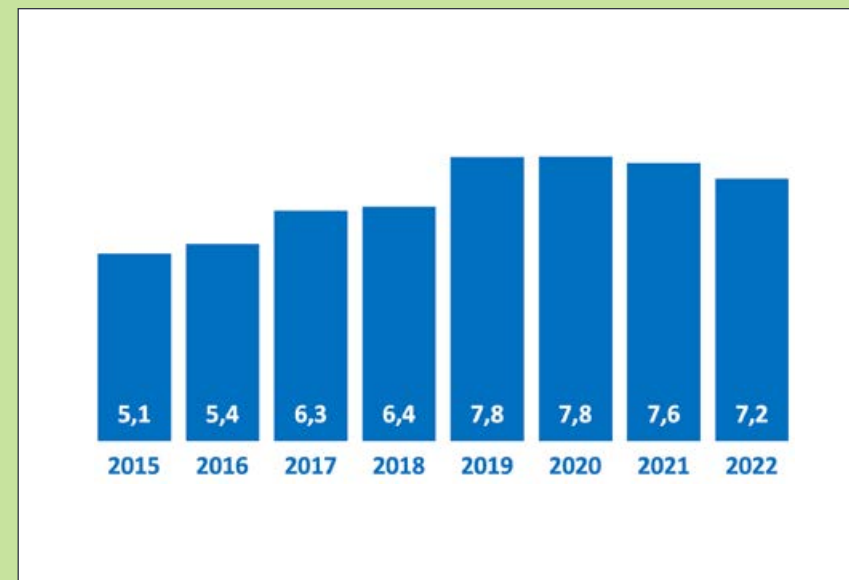
With more than ten thousand transports by lorry and ship annually, we have a considerable environmental impact. We are trying to reduce this impact by planning efficiently, reducing the use of storage depots, making use of ship transport for long distances, and by selecting transport companies with sustainable lorry fleets. The use of depots has been a concern for years; they are needed to provide the desired delivery quality, but they also imply more transport. The proportion of liquid aquafer that was transported via depots in 2022 was 46 percent. A considerable part of this, however, concerned unplanned removal of aquafer that is normally dewatered on location, but which in these cases we performed at the depots. When corrected for this, the proportion is 35 percent, which is a little higher than in 2021 and in line with previous years. The transport climate-impact

Use of liquid-aquafer interim storage



decreased further. One part of the transport is powered by fully renewable diesel (HVO100), and the transport distance decreased: from 125 kilometres in 2021 to 114 kilometres. The main reason for this is that less was delivered to the United Kingdom. Our objective is, between 2020 and 2024, to reduce the transport kilometres for the drinking water residuals by 10 percent and CO₂ emissions by 25 percent. We have already amply succeeded with regard to the transport kilometres (-22%), and we are almost there for the climate impact (-17%). One challenge in further enhancing sustainability is the procurement of HVO100 or electric transport. The prices of HVO are high and variable. The associated extra costs when compared with normal diesel are more than double the internal CO₂ price of 113 euros per tonne that we now apply.

Transport climate footprint (kg CO₂-eq per residuals tonne)



This Sankey diagram shows where the different residuals are applied (in tonnes). The width of the line indicates the volume of the relevant material.

Calcite pellets

Volume, disposal and transport

In 2022 the drinking water companies supplied a total of 93,134 tonnes of calcite pellets from their water-softening locations; an increase of 4 percent over 2021 (89,713 tonnes). Two new locations were added: WPC Bilzen in Bilzen and Weerseloseweg in Enschede. Ships transported 1,597 tonnes of calcite: 2 percent of the total volume, which was a sharp decrease compared to 7.2 percent in 2021. The disposal of calcite pellets in 2022 was impacted by the energy crisis and boycott of Russian gas due to the war in Ukraine. The transport costs to the United Kingdom rose by more than 100 percent because of the absence of Russian ships. We were therefore only able to make limited sales to the United Kingdom. A further problem is that a number of locations in Belgium don't have the right raw materials certifications. Belgian depots now hold about 2,000 tonnes that can't be sold. This also impacts earnings.

Continuity of seeding material production

In 2022 the first step was taken for the continuous production of seeding material, which is used in the softening process of drinking water. The material's production meets the requirements of Kiwa Water Mark. Aqua-

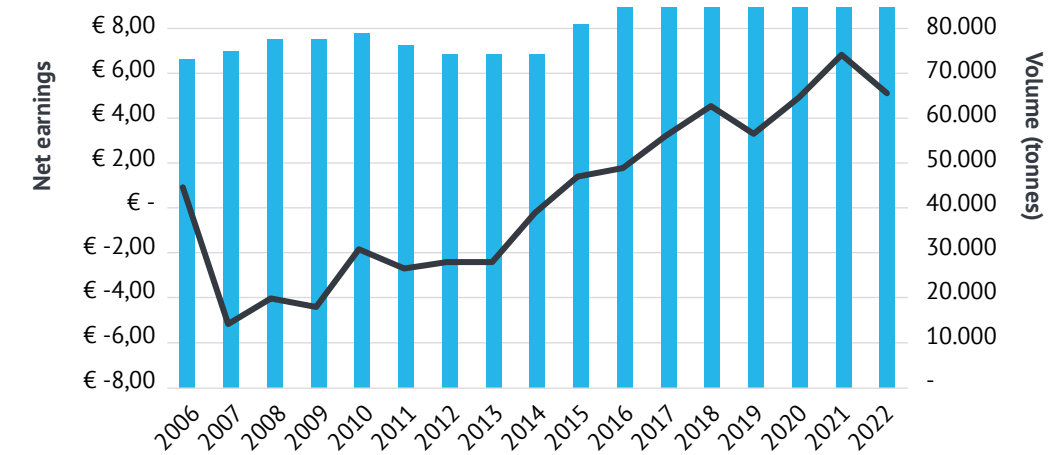
Minerals and Van Zutven Loon en verwerkingsbedrijf B.V. signed an agreement in 2023 to realise a new production line in Veghel. The calcite pellets from Brabant Water's Loosbroek and Veghel sites will be used for the purpose. The sites are at a stone-throw's distance away. This is a great collaboration for the continuity of this circular stream in the water chain. We look forward to the official opening in 2023.



Calcite 0-0,4mm



Calcite 0-0,6mm



Frank Schoonenberg is Process Technology Specialist at the Vitens drinking water company in Zwolle, where he is occupied with research, optimisation and valorisation of the residuals.

The importance of circularity

'We have become our own supplier'

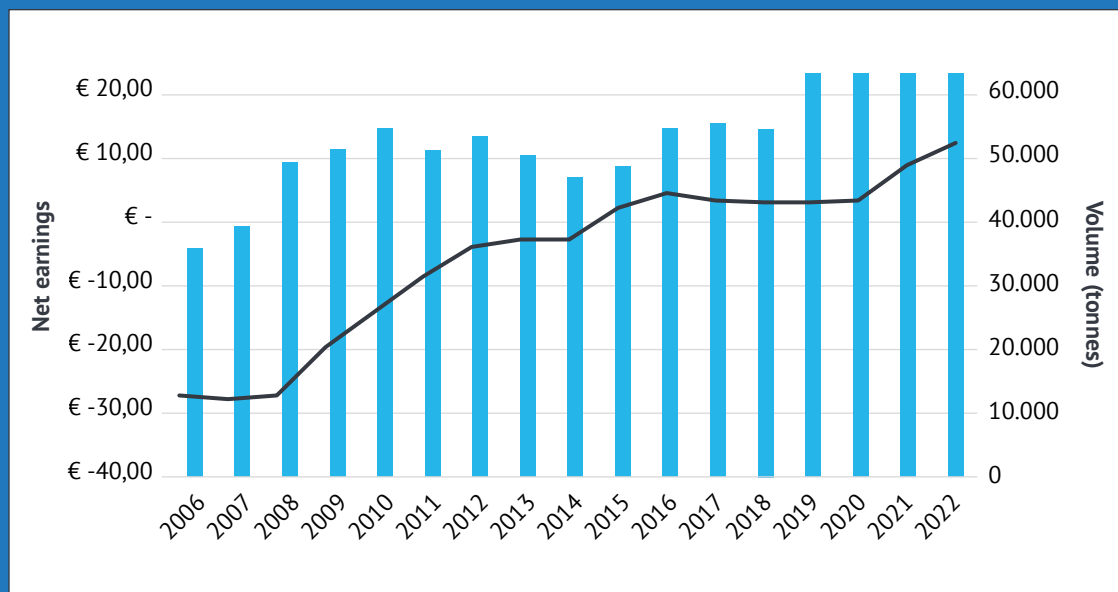
'The drinking water at a number of Vitens locations is too hard. The process of softening this water generates calcite pellets. In contrast, at other locations, such as the Veluwe, the water is naturally too soft. In these cases, we harden the water by having it flow over a filter with calcite pellets. In the past we used to buy marble pellets, which came from a quarry, for the filters. Research into the matter showed that it was possible for us to take the calcite pellets that we generated at one location and reuse them at another. The idea was not prompted in the first instance by scarcity, but by sustainability considerations. And there are more potential locations for the reuse of calcite pellets. But adjustments will first have to be made at these locations, before we can implement circular water-hardening there as well. The logistical operation has been turned over to AquaMinerals. The pellets that we generate at the one location need to be able to be transported upon demand, in a manner that is suitable for drinking water materials. AquaMinerals is very good at this. By drawing the pellets from our own sources we depend less on others. We have become our own supplier. For the Wierden and Eibergen locations, where we generate the calcite pellets, we have now even received Kiwa Water Mark certification. It is moreover a sustainable alternative, and it also saves us money. AquaMinerals is also involved in other circular initiatives that Vitens is focussing on. We are for instance looking into whether we can process iron sludge in such a way that it can be used as a processing agent in wastewater treatment plants: a nice contribution to the water chain. We incorporate circularity in every choice we make. "Every drop sustainable", is how we put it. Our goal is a climate-neutral water chain. That's the future, and it has already begun.'



Liquid aquafer

Volume, disposal and transport

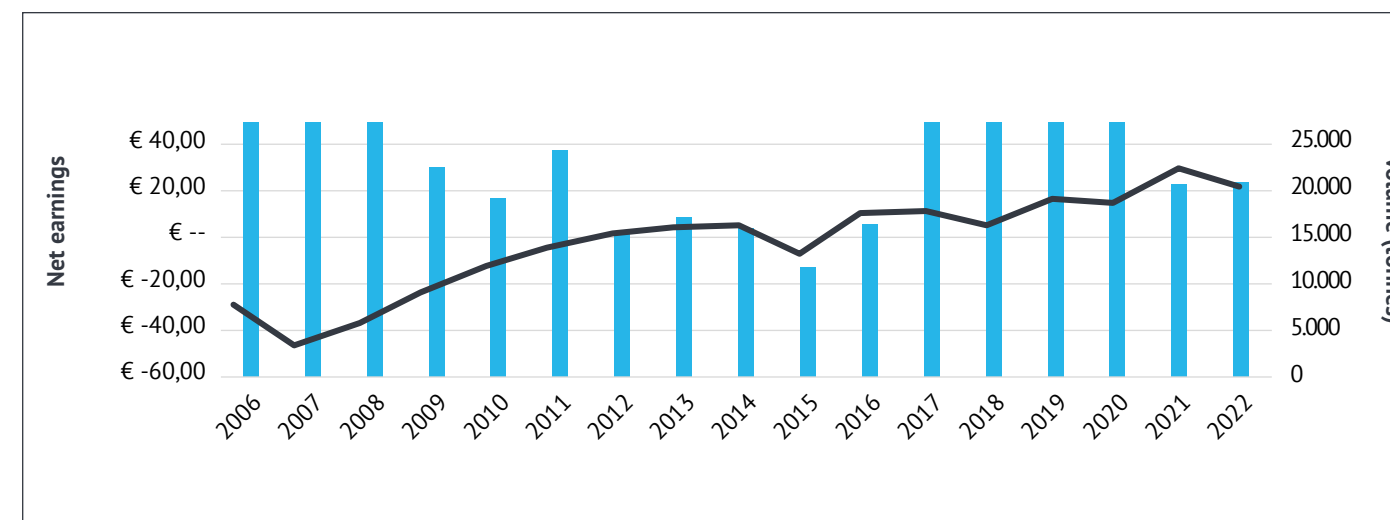
In 2022, 65,151 tonnes of liquid aquafer was supplied by the participants. This is more than 5 percent than was budgeted, but less than in 2021 (see chart). Because of current events, the disposal costs increased, so that AquaMinerals raised the aquafer charge. The lower earnings figure is misleading for two reasons. We found a buyer for aquafer with a higher arsenic content. This aquafer now is included in the earnings, but since these are significantly lower than the usual aquafer, the average earnings figure is brought down.



Satisfied clients

A satisfaction survey conducted with a number of regular aquafer buyers showed that they are satisfied with our service. AquaMinerals is seen as a reliable supplier. The delivery speed and reaction time in particular scored highly. Some buyers felt that the dry-matter percentage could be improved. And deliveries were sometimes subject to changes. These issues are receiving full attention in the Aquafer Optimisation project.

Dewatered aquafer



Volume, disposal and transport

In 2022, 20,633 tonnes of aquafer was disposed of, which is comparable to the 2021 volume. The budgeted volume was 28,773 tonnes, so that the total disposed volume was 28 percent lower. Of the total volume, 20 percent was transported by ship. The dewatered aquafer earnings were lower because the material's supply was significantly delayed. The 2022 dewatering campaigns were concluded in March 2023. For this reason, the supply fell short of the budgeted amount. Since the delivery peak occurred in the fourth quarter, relatively large volumes were transported to depots, where the unsold material was dried. The dewatered aquafer calculations are carried out afterwards, so that the material in the depots is reflected in more volume, but not in earnings.

HerCauWer

The HerCauWer project was successfully completed. The objective – to research the possibility of producing new coagulant from aquafer – was achieved through a successful pilot test. As a follow-up, a pilot plant will be realised at one or more locations. The article about the project, titled 'Reuse of aquafer from drinking water treatment for phosphorus removal', was published in the journal H2O, and earned the H2O Award in 2022. [↗](#)



INTERVIEW

Kenneth Jochems is Supply Chain Manager at AquaMinerals, where he ensures that the residuals from the drinking water companies and Water Authorities reach the buyers on time.

The importance of circularity

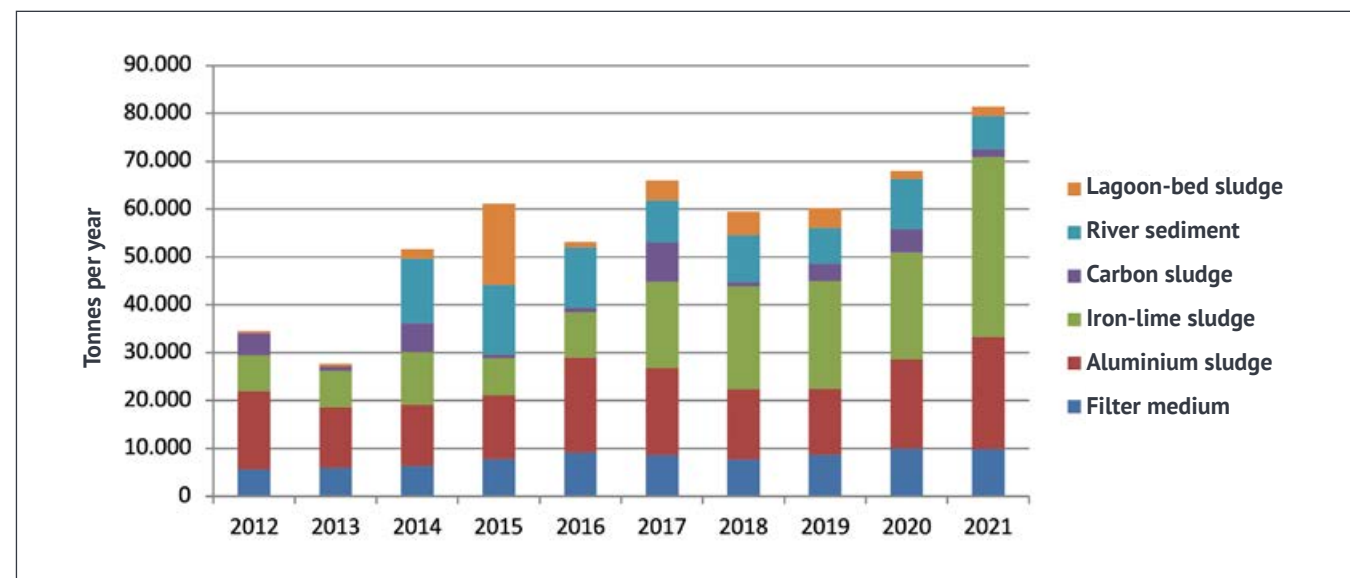
'The needed raw materials are closer at hand than often used to be thought'

'Half way through the year I realised that we were dealing with a real raw materials crisis. It was a time when we were getting a great number of requests from various sources, like the Water Authorities, the agricultural sector and waste processing. These weren't one-off requests. We saw a pattern in the kind of companies involved and the specific products they were asking for. And the new requests? These were practically all for short-term delivery. That was the moment of realisation: there is really a serious shortage of raw materials. This led my colleagues and I to work together even more intensively. Together, we reviewed the many requests. Helping everyone – a goal that we, as AquaMinerals, strive for – was unfortunately not always possible in times of shortages. 'We'll get it done' became 'We'll see if we can do something'. We made choices: we could commit to a one-off load of a specific residual more quickly than to larger volumes divided into several loads. We assessed these trade-offs together, and considered the short term but mostly also the long term. The contact with the sector also became more intensive. Was it possible to bring forward certain activities and projects, so that that the disposal could go ahead more quickly?

Although many of the requests were ad hoc, we are still making deliveries to the new clients of that time. We therefore reached agreements for a longer period. But we also saved clients in critical situations with several loads, for instance to ensure the continuity of a production process. That was really great. Products that some label as waste, are seen as highly valuable by others. The needed raw materials are closer at hand than often used to be thought.'

Other drinking water company residuals

In 2021 the drinking water companies supplied 146,090 tonnes of other residuals; in 2022 the amount was only 118,073 tonnes. This is a positive development, because these residuals usually have a negative value. Less waste represents a cost reduction because of this negative value.



Filter gravel

Filter gravel binds to the phosphorus in the water, thus preventing the growth, among others, of algae, and keeping the water nice and clear. In 2022 the supply of this filter gravel dropped by more than 25 percent compared to 2021. Filter gravel was delivered to Green XL, which uses the material as a substrate for pond floors, and distributes it through various gardening centres.

Iron-lime sludge

The biggest residuals saving was achieved with iron-lime sludge, because of the improvements in the stream separation. As a consequence, iron sludge can be disposed of as iron sludge and lime sludge as lime sludge. This reduces the volume of iron-lime sludge; in 2021, 37,667 tonnes of iron-lime sludge was supplied, whereas in 2022 the volume was 18,971 tonnes. Lime sludge is used among

others by farmers as slaked lime fertiliser, and also often generates a positive return for the drinking water company. If the lime sludge has a dry-matter content that is too low, and thus has too little acid-binding value, the residual must first be blended with other lime streams.

Aluminium sludge

In 2022 less aluminium sludge was disposed of than in 2021, at a level lower than was budgeted. The increase in 2021 was entirely due to the higher production by Waterbedrijf Groningen. The water company had to increase the aluminium dosing at the De Punt

production location because of a higher level of suspended (organic) matter in the water from the Drentsche Aa river. In 2022 less aluminium sludge was disposed of: a total of almost 10,000 tonnes. This was primarily a result of the optimisation of the project in Groningen, but also because De Watergroep supplied 1,000 tonnes less than budgeted. In total, a decrease of about 25 percent.

Carbon sludge

Carbon sludge is one of the most difficult residuals to dispose of for AquaMinerals. Powdered carbon is used at various production locations in the last stage of the drinking



water production process. It removes all organic matter that has not previously been degraded in the process. These are generally toxic substances. This removal process works well, but these substances accumulate in the powdered carbon. This concentration of toxic substances is extremely small, but legal and regulatory provisions make it increasingly difficult to make useful use of the carbon sludge. Carbon sludge's share of the total waste supply is so small, it needs to be considered within a general framework. We are looking for solutions for carbon sludge together with our participants. Currently, its application in wastewater treatment is being further elaborated. The carbon sludge from the drinking water companies has lots of

residual absorption capacity, which can be used to remove pharmaceutical residues from wastewater. We expect that in 2023 it will be clear whether this can become a new application for carbon sludge.

PWTP sludge

A number of our participants, besides their regular drinking water production, conduct commercial activities as industry water companies. This could, for instance, involve the production of process water for an entire industrial park or for a single company. The production of process water is very similar to the production of drinking water. Some industry water companies are also involved in the treatment of the wastewater for companies. This activity generates process water treatment plant (PWTP) sludge. The disposal of this sludge has recently also become part of AquaMinerals activities. We have plenty of experience with the disposal of wastewater treatment plant (WWTP) sludge; the disposal of the PWTP sludge is a fine addition to the activities we carry out for the drinking water companies.

The role of Purchasing during the raw materials crisis

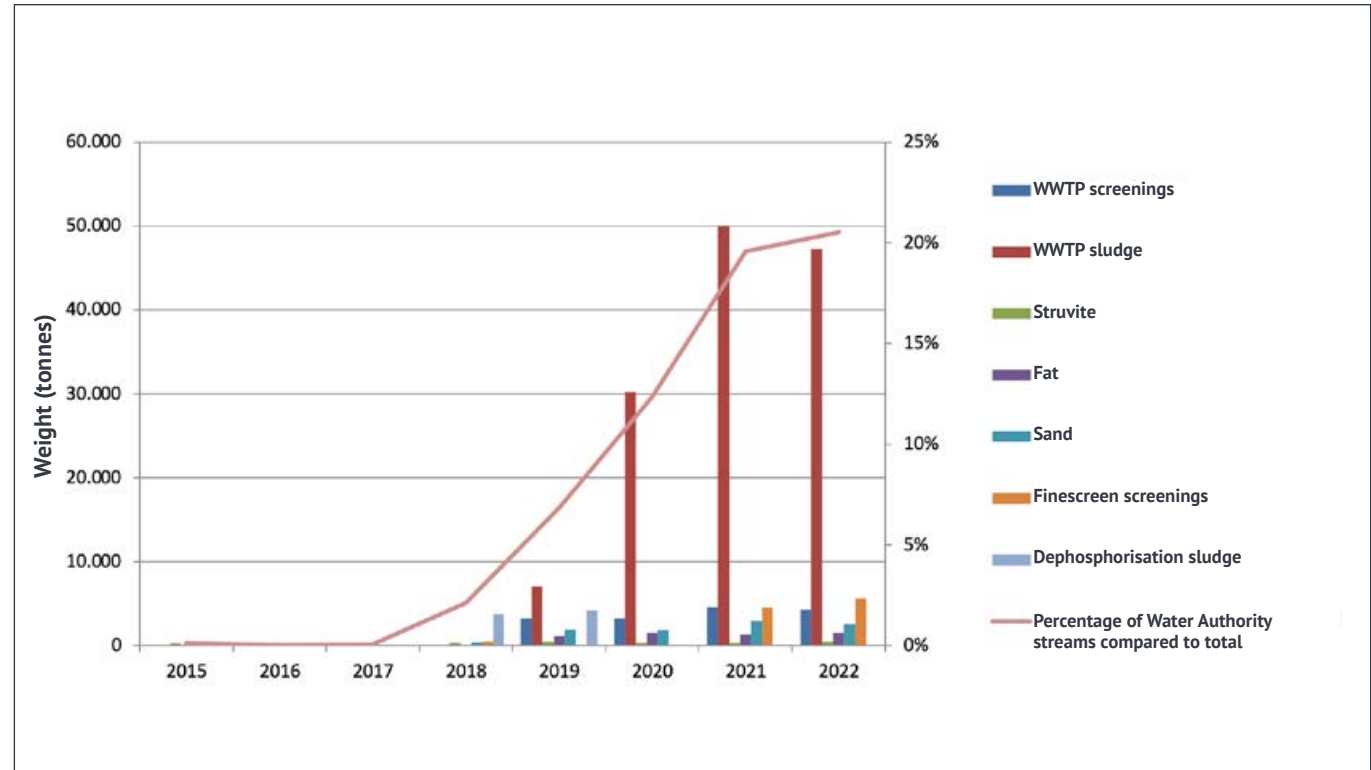
Many things are uncertain. But one thing we can say with certainty: raw materials are finite and will (one day) run out. The raw materials crisis is a consequence of our consumption model: we produce, use and throw away. As a result, raw materials are incinerated or we create a waste problem, that is, cradle-to-grave. If we want to prevent the total depletion of raw materials, we must switch to a circular economy in which raw materials are recovered and reused. This is not only good for the environment; it is also cheaper. Raw materials are becoming more scarce, and therefore also more expensive. In this context, our purchasing department plays a

crucial role by, among others, conducting good and targeted market consultation, so that new solution paths can be created. The market is explored and surveyed in the search for circular applications. We and our participants have therefore agreed that AquaMinerals may, when the occasions arise, purchase circular raw materials on behalf of its participants. In this way, we bundle the powers of circular purchasing and return the residuals (following processing) back to the chain, with the objective of giving a new function to, or reusing, the existing residuals. In this manner we prevent the total depletion of raw materials and make a contribution to a circular economy.



Water Authority residuals

In 2022 the disposal of residuals from the Water Authorities was stabilised in relative terms. In absolute terms, the supply decreased by about 2,000 tonnes. In 2021 AquaMinerals disposed of 63,000 tonnes of residuals for these participants; in 2022, the amount dropped somewhat to 61,000 tonnes. In relative terms, the impact of the Water Authorities' residuals actually increased from 20 percent of the total in 2021 to 21 percent in 2022. The largest disposal volume is still made up of WWTP sludge from the Amstel, Gooi en Vecht Water Authority. This WWTP sludge volume will probably increase in 2023, because in 2023 – besides a small volume from the Amstel, Gooi en Vecht Water Authority – we will also dispose of a large volume from the Limburg Water Authority Company.



Fine screenings

In 2021, for the first time, AquaMinerals disposed of fine screenings for the Hoogheemraadschap Hollands Noorderkwartier and the Hoogheemraadschap De Stichtse Rijnlanden Water Authorities. In the first year, we processed a little less than 5,000 tonnes of fine screenings for them. As mentioned in Annual Report 2021, working with De Stichtse Rijnlanden, we studied the possibility of building an installation at their location for reprocessing the material into cellulose. The installation has now been built and will begin operating over the course of 2023.

Screenings

The disposal of screenings will increase further in the years ahead. This particularly offers prospects for the further optimisation of the disposal. In the first instance, this will take the form of the optimisation in the procurement for the processing of this residual. Because of the increase in the supply, AquaMinerals hopes to reach new agreements with one or more end-processors.

WWTP sludge

The volume of sludge from wastewater treatment plants did not increase in 2022. AquaMinerals disposed of this residual for a variety of both participants and non-participants. A number of Water Authorities made direct and indirect calls to have sludge disposed through us. Because of the war in Ukraine, the use of Russian gas by European public companies was restricted. Consequently, as of 1 January 2023, the Limburg Water Authority Company could no longer make use of the sludge dewatering installation in Susteren, which used Russian gas in its processes.

Struvite

The disposal of struvite over the last few years has been low because of its unclear regulatory status. However, in 2022, the public authorities gave the green light and struvite received end-of-waste status, which provided a boost to sales. We expect that demand will increase further. Although there are plenty of market opportunities for this material, struvite production still falls short of the existing recovery capacity. The evolving market will hopefully open up sufficient opportunities for the further optimisation and expansion of the struvite recovery.



Coert Petri is Senior Policy Advisor at the Vallei en Veluwe Water Authority; he is involved in several national initiatives aimed at bringing water treatment to a higher level.

The importance of circularity

'We need to move away from our dependence on sources of raw materials from abroad'

'The worst thing that the Vallei en Veluwe Water Authority had to deal with last year was a shortage of ferrous chloride for the removal of phosphorus from the wastewater. Less and less of it was available, to the point where Water Authorities had problems meeting the discharge standards. During the raw materials crisis, the Association of Wastewater Management Organisations (VvZB) set up a working group, of which I became the chairperson. The prices were in the meantime soaring and I was in regular contact with the working group members to talk about the situation. I expected that the production of raw materials would get back on track because of the falling gas prices. But then it became apparent that a number of plants were not going to restart operations. That shocked me. The raw materials shortage was turning into a structural problem. The VvZB called on AquaMinerals to provide a clear picture of the alternatives. All buyers affected by the impact of the crisis were involved. We are now busy with AquaMinerals examining the possibilities of using aquafer, generated by drinking water production, more extensively in WWTPs; a circular solution. It is very useful to have an organisation like AquaMinerals that can freely approach the market. We need to move away from our dependence on large batches of raw materials from abroad, which are brought in by ship. We can solve this closer to home, with local materials and companies. This is good not only for our own economy, but also for the future. We need to commit ourselves not only to the climate and energy, but also to nature and biodiversity. We need to get to work on circularity immediately. We can solve many problems in this way.'



Product and market development of Water Authority residuals



Caleyda

The decreasing availability of raw materials, and the consequential demand for residuals, increases the urgency for product and market development for residuals. In 2022 we took further steps with regard to new market development, starting up pilot installations, end-of-waste status, and Water Authority decision-making aimed at building full-scale installations. Together, we made significant advances for the different residuals. What follows is a list of the progress made for a number of them.

- At the site of HVC, a demo plant for the production of Caleyda, a natural plastics substitute, was opened. We provide support in the search for markets for **Caleyda**, and active input into means of further upscaling in collaboration with the market.
- Within the Wetsus consortium, of which AquaMinerals is a member, a pilot for the production of **vivianite** was launched at the end of 2022. AquaMinerals began working on finding new markets for the produced vivianite.
- In recent years intensive work has been done on the recovery of cellulose from wastewater. Different technologies were tested in several pilots. In 2022 the Hoogheemraadschap De Stichtse Rijnlanden Water Authority decided to set up a full-scale reprocessing installation, which will be able to deliver **cellulose** to the market in 2023.
- At the end of 2022, the De Dommel Water Authority commissioned its green-gas plant with the expectation of supplying liquid CO₂

to the market in 2023. With the plant of the Hoogheemraadschap van Delfland Water Authority, this is the second CO₂ liquefaction installation of its kind. The Water Authorities are thus on the road to becoming serious suppliers of **green CO₂**.

- It looks as if the stronger demand also leads to an acceleration of the end-of-waste status for residuals. In 2022 the end-of-waste status was granted to **struvite**. A two-track strategy has been developed to accelerate future end-of-waste processes. In the short term, this involves an improvement of today's system.



In this regard, it is important that the Ministry of Infrastructure and Water Management, the National Institute for Public Health and the Environment (RIVM), AquaMinerals, and the Water Authorities embrace the lessons learned from the struvite process, and apply them so as to optimise the processes. The second track is aimed at reforming the current system. This involves the development of a rapid and effective work method, in which the roles and responsibilities of the chain partners are clear, and circularity and safety, for humans and the environment, are ensured. In order to realise this, an experiment was set up with all of the chain partners.

- To show that it is possible to use residuals in daily products, we presented, in collaboration with the Energy and Resources Factory, a circular beer: 'Ontboezeming'. The water (effluent from the Emmen WWTP), the label (grass clippings), the ink (vivianite), the glue (Caleyda), the crate (3-D print paste with calcite, Kaamera, aquafer and cellulose), and the glass (calcite) all had their origins in renewable sources.



Cellulose

Expectations for 2023



Shortages continue (ongoing), uncertainties less significant



2022 was characterised by shortages in all sorts of areas, but also by great uncertainties concerning pricing and availability. It is expected that in 2023 shortages will continue in the areas of materials, human resources and energy. This means that the (purchase) prices will not return to the old levels. Scheduling and purchasing need to be done in good time to guarantee that certain activities can be performed. The big fluctuating uncertainties are however gone. The expectation is that with timely planning – and at a higher cost than previously – activities can be performed on time.

Next steps in circular chains

An important priority for AquaMinerals and our participants is the circular application of the sector's own residuals. In 2023, the production of 100 percent circular seeding material was further scaled up and professionalised. In addition, we took the next steps towards the use of calcite pellets from the softening process at locations where the water actually needs to be hardened. We also presented a pellet made from aquafer

that is capable of removing arsenic from water, without itself releasing substances or degrading again into sludge. And that's not all: we are scaling up projects for the use of used powdered carbon from drinking water production in the removal of pharmaceutical residues; and to make coagulant from the aquafer of the drinking water companies, to be used in phosphorus removal at the Water Authorities.

Treated water as raw material

Recent years – 2018 and 2022 in particular – have shown that the availability of freshwater is not (any longer) self-evident. But freshwater is essential for many elements of the economy. Nature, too, suffers great damage as a result of lengthy drought. The water sector is studying how best to deal with periods of scarcity. The reuse of treated water offers one possible solution. Before this is implemented on a large scale, the technical, regulatory, acceptance, business-model, and other aspects still need to be studied. Together with the sector, we are investigating how we can contribute to this exploration and future implementation.



GMS sounding board set up

As of 1 January 2023, we have nineteen participants: eleven drinking water companies and eight Water Authorities. The participants meet twice a year in the General Meeting of Shareholders (GMS). Previously, complex decision-making was agreed in advance with the participants. This is no longer feasible with the current (growing) number of participants. For this reason, in consultation with the GMS, we have set up a sounding-board group with which the manager can discuss business. This group, which is made up of five shareholder representatives, is a fair reflection of the GMS. The sounding-board group does not have an established statutory role. The mandate remains with the GMS.



INTERVIEW

Tom Jansen is Coordinator, Logistics and Raw Materials, at the Hoogheemraadschap Hollands Noorderkwartier Water Authority, where he works daily on protecting the land against water, against flooding and water shortage, for clean and healthy surface water, and for safe roads and waterways.

The importance of circularity

'Something needs to be done'

'Things became critical when the ferrous chloride started running out. The Hoogheemraadschap Hollands Noorderkwartier Water Authority has a discharge requirement of 1 or 2 milligrams phosphorus per litre. At a number of locations, we are not allowed to discharge more than 1 milligram. We remove the excess phosphorus from the water using ferrous chloride. The phosphorus binds to the sludge. We then remove the sludge from the water, after which we centrifuge and dry it in a sludge dewatering installation. Our supplier had a shortage of hydrochloric acid, which meant that there was also a shortage of ferrous chloride. To continue meeting the discharge requirement, I quickly started looking for alternatives. I ordered a stock from another supplier. I also contacted AquaMinerals for aquafer, a residual product from drinking water treatment. This is also perfectly suited to bind H₂S in fermentation tanks, and its environmental impact is also a lot smaller. There is lots of aquafer to recycle. But there are also lots of buyers, so that it is also scarce. In any case, we are buying a load of ferrous chloride every month, which helps us enormously. Circularity is a great and important process. What one company considers waste, is for us more than a raw material. We are going to increasingly consider waste as products. The added value of AquaMinerals is here considerable. They collaborate with parties all over the country. You no longer need to reinvent the wheel yourself. The Netherlands extracts raw materials from the Earth, but by 12 April we have in fact already used all that the Earth can regenerate in a whole year. We are all depleting the resources. Something needs to be done. That's why the shift to a circular economy is very positive.'



Governance, financial policy and risk management

Governance

According to the statutes of the AquaMinerals company, the most important powers are vested in the management and the Supervisory Board (SB). The General Meeting of Shareholders (GMS) appoints the SB members upon the recommendation of the SB; the SB appoints the managing director.

The management leads the company, is responsible for achieving its objectives, the strategy and associated risk profile, the financial results and the societal aspects. In this regard, the management is accountable to the SB in its role as supervisor, and to the GMS as the economic proprietors of the company. The management provides both entities, in a timely manner, with all information they need to exercise their tasks.

AquaMinerals is not obligated to implement the principles and best practice provisions of the Dutch Corporate Governance Code. Nonetheless, the levels of transparency and responsibility established by the Code fit seamlessly with our objectives and operational management. To reflect in more detail the principles of the Governance Code, in 2011 various regulations and statutes were implemented or adjusted and, in 2012, the treasury statute was added.

Financial policy

Treasury

In accordance with the treasury statute, the final dividend test has been instituted. On this basis, the management will assess whether the company, following a distribution made to the shareholders, is able to continue paying its due debts. On the basis of this assessment, a maximum amount of € 62,520 is deemed responsible. With this maximum amount, AquaMinerals remains within the financial standards it has set itself. Nevertheless, the decision was made, primarily in light of the uncertain macro-economic situation, not to distribute any dividend for 2022, and to add the positive cash flow from business operations to shareholders' equity. In 2022 AquaMinerals had no deposits or investments, nor did it lend any funds to third parties.

Liquidity risk

The quick ratio per 31 December 2022 was 1.5, compared to 1.6 in 2021, and thus remains above the standard target of 1.2. The solvency at the reporting date was 33 percent, that is, 4 percent lower than year-end 2021 (37%). The solvency ratio therefore meets the minimum standard target of 30 percent. The average settlement period by clients of 37 days remained the same as in 2021. The average settlement period by AquaMinerals in 2022 was 30 days, a 4-day decrease compared to 2021 (34 days).

Shareholders' Equity Lower Limit

The Shareholders' Equity Lower Limit of AquaMinerals is set at one annual salary of full-time employees, with a minimum of € 100,000. Per 31 December 2022, this amounted to € 1,637,654. At the same time, shareholders' equity amounted to € 1,700,176, whereby the Shareholders' Equity Lower Limit was respected.



Risk management

Risk management forms part of the AquaMinerals management model, and is discussed on a regular basis with the SB. We apply a risk-inventory system aimed at providing a clear, transparent and reproducible picture of priority risks. The following were identified as the key risks for 2022:

RISK 1 Monitor rapid price developments

Since year-end 2021, the sector, as well as the rest of the economy, has faced significant price fluctuations, and price increases for the most part. Excessive fluctuations can have a big impact on the stability and financial reliability of AquaMinerals. After all, we buy and sell in the name of our participants, and wrong choices can lead to (overly) high costs, or (overly) low returns, but also for instance to cash flow problems, if changes are not passed on in good time.

In order to reduce our vulnerability, AquaMinerals has taken the following measures:

- estimating the impact of the inflation on operational management, P&L, and costs and benefits for its participants (carried out in the first quarter of 2022);
- monitoring price developments closely, and rapidly and accurately incorporating them into the systems, so that the correct costs and benefits are passed on;
- making agreements, when possible, with service providers and buyers, in which energy prices are made volatile within the

contractual terms; in this way, a service provider can only temporarily raise prices due to fluctuating energy prices, but we can also pass these on in (disposal) contracts;

- making plans in the purchasing and sales department for 2023 with a specific focus on managing price fluctuations.
- As a result of these measures, AquaMinerals was able in 2022 to pass on higher costs, but also charge higher sales rates in good time. In addition, because of the purchasing and sales policy, we were able, with a few exceptions, to avoid major price-rise spikes. This did however require greater (personnel) capacity, which was resolved internally.



RISK
2

A client, service provider or product (chain) receives negative news coverage, thereby damaging the image of AquaMinerals and/or our participants

AquaMinerals is a reliable partner for all our stakeholders. This means that we have an advantage over possible competitors, but also that our participants know that their materials are in trusted hands with AquaMinerals. Image damage can betray this trust. This risk was also a high priority in 2021. In that year, two important initiatives were launched. To begin with, (1) testing the reliability of commercial partners. To this end, (I) an integrity test was created for the buyers of residuals; (II) a purchasing policy was developed which incorporates quality requirements for service providers; (III) the purchasing policy was incorporated into the quality manual; and (IV) a sales procedure was set up which also incorporated quality elements for potential buyers of the residuals. Moreover, (2) emergency communications was incorporated into the communications manual.

RISK
3

Too few qualified personnel

This risk also had a high priority a few years ago and has been included again for 2022, primarily because of the increasing staff shortage. AquaMinerals staff are usually sought after. They are highly educated, have practical and technical knowledge, are generally enterprising and flexible. Some staff change is not undesirable, but the concern is that, in the event of the departure of one staff member, the market is too limited and overstretched for a good replacement to be found. The following measures have been taken:

◆ **Staff satisfaction survey.** At year-ends 2021 and 2022, AquaMinerals conducted a staff satisfaction survey so as to gain insight into the satisfiers/dissatisfiers, and to respond accordingly. The results were discus-

sed with the staff members to explore the question in more depth. This led to concrete actions.

- ◆ **Internship and research assignments** with higher vocational (HBO) entities and/or universities. Every year AquaMinerals offers one to two internship or research assignments for HBO or university students. In this way we focus on recent and relevant knowledge, but also come into contact with young people who could possibly pursue a carrier at AquaMinerals.
- ◆ **Creation of a trainee function.** Per 1 September 2022, a trainee began working at AquaMinerals for a period of two years. He had conducted a research assignment at AquaMinerals, and demonstrated that he fit in well within the organisation. He will carry out work activities in three periods of eight months in different departments.

The importance of circularity

'AquaMinerals is indispensable in circular Netherlands'

'The importance of circularity has been further underlined by the corona epidemic and the war in Ukraine. It's no longer simply a matter of sustainability, but also of availability. Are the raw materials we need actually available? Price also plays a big role. If the raw materials are already available, then they are often pricey. This has accelerated the progress of thinking about circularity. It has become a part of the strategy of many companies. If there isn't enough certainty about the availability and price of materials, the operational continuity of the company is affected. The developments of recent years are irreversible. We need to make ourselves – countries and companies – independent and self-sufficient, so as to close the chains. This is also becoming more prominent on the political agenda. And there is also the need to preserve the planet. The price pressure is driving the search for alternatives to traditional raw materials, while through innovations and research it is already clear that circular business is perfectly feasible. It is already true today that there doesn't need to be any more waste. Everything can be converted into a usable raw material. A scenario in which the Water Authorities and the drinking water companies have no residuals left over, and in which they generate biogas, is within reach. Making the chain fully circular, extracting biogas and capturing CO₂: that is the ultimate outcome. This is what we are working hard on. The challenge now is to take the final steps.

The number of participants is growing rapidly. This pleases us greatly. But this growth also raises questions. For example: are we also going to participate in start-ups? We have become vital to the world of the drinking water companies and Water Authorities, to making chains circular, and to the reuse of materials. AquaMinerals is indispensable in circular Netherlands, and that is remarkable for a lean and mean organisation. I am enormously proud that AquaMinerals has managed to achieve this.'



Supervisory Board

The Supervisory Board (SB) oversees, among other things, the policy of the management and provides the latter with advice. Its supervision also concerns the financial performance and developments, regulatory compliance and risk management.

Activities of the SB in 2022

- monitoring the results of the company in light of the budget and the Business Plan 2022-2024;
- accession of Hoogheemraadschap van Delfland Water Authority, De Dommel Water Authority, and Limburg Water Authority Company;
- determination and monitoring of actions related to priority risks;
- determination of the 2021 annual figures and profit appropriation of that year;
- budget and annual plan for 2023;
- periodic self-evaluation;
- organisational development in relation to the growth in volume, turnover and activities;
- Water Authorities Roadmap 2030;
- statutory modifications (specifically related to the shareholders' target description and quality requirements);
- external accountant evaluation;
- introduction of threshold contribution to cover organisational costs;
- establishment of the procedure and profiles of new supervisors (to be recruited in 2023);
- formalisation of the role of AquaMinerals as a supplier of circular raw materials to participants.



Activities of the GMS in 2022

- approval of the Annual Report and Financial Statements for 2021;
- discharge of the managing director for his management, and of the members of the SB for their supervision during fiscal year 2021;
- the profit appropriation for 2021;
- approval of the accession of Hoogheemraadschap van Delfland Water Authority, De Dommel Water Authority, and Limburg Water Authority Company to AquaMinerals, and the issuance of new shares in the name of these new participants;
- ratification of the annual plan and budget for 2023;
- approval of introduction of threshold contribution to cover organisational costs;
- approval of statutory modifications (specifically in relation to the shareholders' target description and quality requirements).

Composition of Supervisory Board on 31 December 2022



Mr G.J. van Nuland
(1956), Chairperson

Profile: Managerial
Appointed: 1 January 2021
Reappointed: (possible) 1 January 2025
Functions and other positions: Chairperson SB, VB Groep (Building and Project Development); Chairperson SB, Stichting Neos (Healthcare); Chairperson SB, Rabobank 's-Hertogenbosch e.o.; Advisor of National Register; Member Advisory Council, Gubbels BV (Infra); Treasurer, Central Administration, Brabants Landschap; Arbitrator at the NAI.



Mr J.E. Janssen
(1969), Vice-Chairperson

Profile: Legal
Appointed: 1 July 2016
Reappointed: 1 July 2019
Resigned 1 July 2023
Functions and other positions: Lawyer/Partner, Stek Advocaten.



Mevrouw M. Demmers
(1967), lid

Profile: Business and innovation
Appointed: 1 January 2017
Reappointed: 1 January 2020
Resigned 1 January 2024
Functions and other positions: Director, Stichting Natuur en Milieu; Member SB, FMO; Member SB, DRIFT; Executive, SKAO; Member SB, Strategic Advisory Council, TNO SA&P, Sustainable Pension Investments Lab (SPIL, UU), Sustainability Advisory Board, Van Oord, Member Advisory Council, Environmental Sciences Group (ESG, WUR).



Mevrouw J.H.P. Spoeltman
(1969), lid

Profile: Financial
Appointed: 15 March 2019
Reappointed: (possible) 15 March 2023
Functions and other positions: Manager, Businesspool Bedrijven, Audit Rabobank; Member SB, Stichting De Nieuwe Arbeid Noord-Oost Brabant.



aqua
minerals

Colophon

Publication

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Groningenhaven 7
Postbus 1072
3430 BB Nieuwegein
Tel: +31 30 60 69 721
website: www.aquaminerals.com
e-mail: info@aquaminerals.com
Entered in the Commercial Register of the
Chamber of Commerce in Utrecht under
number 30130247.

Editing, design and production

Vrhl Content en Creatie
www.vrhl.nl

Photography

FMD works, Dirk van Straaten,
De Beeldredacteur / Own photos of
participants, clients and suppliers.

