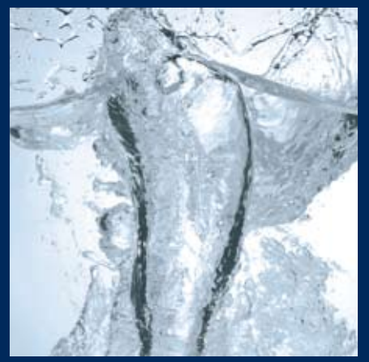
Our Climate Proof and Sustainable Approach

Grontmij

planning connecting
respecting
the future



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Introduction

Sylvo Thijsen - Chief Executive Officer

Climate has a direct impact on the way we live and work. Effects of climate change can be seen everywhere, especially in delta regions such as the Netherlands.
Increasing river discharges, droughts, floods and extreme weather conditions occur worldwide. Although the process is slow, its effects can be felt already and immediate action is required. Fresh ideas and innovative solutions are needed to cope with these challenges. Grontmij is on the forefront regarding climate projects. These include projects for adaptation as well as mitigation in connection with climate change, both at a regional, national and international level.

Effects of climate change can be seen in various aspects in our surroundings, it will effect the way we live, work and recreate in the future. Grontmij deals with these aspects from different angles and approaches these challenges with a birds-eye view. By integrating adaptation and mitigation measures we create sustainable and climate proof solutions for the urban and rural environment. Examples are climate proof cities, energy neutral buildings and greenhouses, new sanitation concepts. Our approach is to work in a close dialogue and cooperation with the clients and we attempt to stimulate the active participation of stakeholders and beneficiaries including local communities in problem identification and solution.

Grontmij is a flexible, dynamic network organisation, encouraging an intensive exchange of expertise, know how and capacity. This enables us to carry out sizable, complex and multidisciplinary projects. For over ninety years, we have been working on our environment: land and water, urban and rural areas. Sustainable development and providing a safe living environment is in our genes. We transfer our knowledge and experience, also across borders. Together we must and we can cope with the effects of climate change and generate new opportunities. Grontmij supports government and companies in their search for sustainable solutions, using our motto: **planning, connecting, respecting the future!**

Photography: Els Bax

Realisation of reinforcement of 'Zwakke Schakel' in Noordwijk (NL)

An inspection by the supervisory body, the Rijnland District Water Board, learned that an approx. 125 m strip of dunes near the promenade in Noordwijk was not sufficiently safe. The 'Strategische Visie Hollandse Kust 2050' (Strategic Vision on the Coastline of Holland in 2050), drawn up by the Provinces of North and South Holland in February 2002, also pointed out that measures for securing the safety of the coast near Noordwijk aan Zee would be necessary in the long term. The 'zwakke schakel' (weak link) strip along the coastline of Holland had to be reinforced as quickly as possible, within the framework of the Flood Defence Act. This is why the reinforcement procedure was started up.

Reinforcing the Weak Link in Noordwijk

The Rijnland District Water Control Board commissioned Grontmij to draw up the final design and execution plan for the reinforcement of the dunes. The reinforcement is a so-called 'dike in dune' construction, supplemented by a widened range of dunes of some 50 m on the side of the sea. Grontmij prepared the tender documents and supervised the entire tendering procedure.

Due to the nature of the work, this process was divided in two. Part of the work, the so-called 'dike in dune' protection, went through a traditional tendering procedure. The other part, the sand suppletion, was put to the market as a Design & Construct agreement. This resulted necessarily in a close collaboration between the two different parties. Grontmij manages this and supervises the realisation of the work.

Photography: Henk de Jong

EIA introductory memorandum for ‘Zandmotor’ pilot (NL)

The Province of South Holland took the initiative to develop and realise the ‘Zandmotor’ pilot project on the coast of Delfland in the short term. ‘Zandmotor’ (sand motor) is an innovative solution to improve the safety of the coast and simultaneously provide more space for nature and recreation. The name refers to a large quantity of sand in a single location (in much larger quantities than in the current annual maintenance suppletion).

The sand was dispersed along the coast naturally, by the tides. This resulted in a wider beach and eventually also in a wider strip of dunes, as ‘dry’ sand from the beach was further transported to the dunes by the wind. The pilot is a gauge for the success of follow-up projects along other stretches of the coast.

A number of possible alternatives were proposed during the project stage. These were assessed on various aspects.
The assessment was partly based on hydromorphological calculations, and partly also on the specialised contributions of hydraulic engineers and marine ecologists. Grontmij will eventually not only deliver the introductory memorandum, but also a recommendation with regard to the decision for (one of) the alternatives.

Agriport A7: Sustainable Green Houses (NL)

Important points for attention in the development of Agriport A7 are:

- both the greenhouse construction and the agribusiness estate must be high-quality and sustainable;
- the project must fit in well with the landscape features of Wieringermeerpolder;
- intensive cooperation with 'Het Grootslag' in the development of the logistics concept and in the establishment of greenhouse companies.

Agriport A7 BV is developing an agribusiness complex in Wieringermeer. The development includes:

- a project site for large-scale greenhouse construction (approx. 410 ha);
- an industrial estate for agribusiness and logistics (approx. 95 ha)
- other functions (approx. 45 ha).

This development is laid down in a zoning plan for the industrial estate and in another zoning plan for the greenhouse construction. For entering the greenhouse construction into the zoning plan, it is obligatory by law that an Environmental Impact Assessment (EIA), while for entering the industrial estate the authorities decide whether an EIA is required. It was decided to draw up an EIA for the entire project. Agriport A7 BV has commissioned Grontmij to carry out and supervise the EIA process.

Hammarby Sjöstad (SE)

The comprehensive environmental goal in the Hammarby Sjöstad environmental program is that the environmental loads from the district would be "twice as good" compared to corresponding construction quality levels in the early 1990's. For follow-up and reporting purposes the Environmental Load Profile (ELP) was developed.

The ELP is built on defining the most relevant activities from an environmental perspective, and that the environmental loads originating from these activities, such as emissions to air, soil and water as well as use of non-renewable energy resources and water, are quantified.

The ELP is a is a lifecycle based tool and comprises activities such as materials, transports (materials, supplies and personal), machinery, electricity, heating and material recycling. The follow-up of the environmental loads from Hammarby Sjöstad contributes to increased technical and economical understanding of suitable societal and financial environmental measures for the continued development of the district as well as for other similar projects.

Infographics: Fabiënne de Lange / Source: Grontmij

Bavelse Berg Climate Park (NL)

The sustainable climate proof redevelopment of a former landfill into a multipurpose leisure park calls for a permanent quest for technically feasible and socially acceptable measures. A 65 ha piece of land on the outskirts of Breda will be given a new future based on efficient use of space and in accordance with the Cradle to Cradle ideal.
An area oriented approach guarantees a conscientious blending of the landscape with the urban tissue of the dynamically growing city. Overall site management will operate as an innovator in the long term.

The application includes a rough outline of various options in the field of innovative construction, sustainable energy, mobility, the water system and waste awareness. These inspirational items constitute guiding principles for further plan development and the final realisation as from 2011.
The project provides Grontmij and ING Real Estate with an opportunity to shape their ambition to be perceived as being trendsetting and socially committed area developers.

WWTP Kayseri (TR)

WWT Branch Management carries out its work with 44 personnel. The duty of this branch is to treat and discharge the waste water collected from the city of Kayseri through trunk sewer line without causing any environmental problems. Operation of the treatment plant, treatment and transportation of sludge without causing environmental problems are the other duties.
Almost all of the wastewater produced in Kayseri and nearby populated zone is collected at the trunk sewer.
The facility which is built in accordance with the WWTP regulations published in the official paper numbered 25.687 and dated 31.12.2004 has started to work to collect the waste water of the city of Kayseri and nearby populated zones on 07.08.2003. Since that day, wastewater collected has been treated and discharged without causing any environmental pollution.
The operation of all the units, which is beginning of operation and maintenance period started on 20.02.2004 by Vatech- Wabag Consortium. This operation and maintenance period for one year lasted on 20.02.2005. Since 20.02.2005 KASKİ has been operating the plant with its own staff.

Treated wastewater achieves the standards of the Water Pollution Control Regulation. Although it is not

required by regulations, the plant is removing nitrogen and phosphorus to have an EU standard effluent wastewater. While stabilizing the sludge to use it in an ecological way, biogas is produced. With that biogas, electricity is produced and part of the electricity consumed in the plant is utilized from it. In 2005 27 % percent of the electricity used in the plant is generated from biogas. In the plant approximately 5000 m^3/day biogas is produced and 10000 kWh/day energy is produced from it. Additionally produced heat energy is used for heating of the buildings in the plant.
Treated sludge (biosolid) contains organic constituents and macro, micro nutrients which is necessary for plant development. Nitrogen, phosphorus content shows the fertilizer value of the sludge and organic content shows that the sludge has an importance for soil rehabilitation. It is possible to use the biosolids in land application, agriculture, for soil rehabilitation, green areas and forestry.

In America 33 % of the produced biosolid is used in land application. This percentage is around 50 % in Denmark, France, England, Norway, Sweden and Spain. From wastewater treatment plant around 220 m^3 of biosolid, 10 m^3 of grit and screening is produced daily. Therefore 230 m^3 of treatment product is not discharged to Karasu which is connected to Kızılırmak. Kayseri Metropolitan City Municipality Water and Sewerage Administration have done its duty to avoid environmental pollution.

Hybrid WWTP Ootmarsum (NL)

Grontmij carried out a feasibility study in 2003 on the options for modifying the Ootmarsum WWTP to meet capacity demands and effluent limits. Based on the study's findings, the Regge and Dinkel Water Board decided to convert the existing treatment plant to a hybrid system for treatment, made up of a membrane bioreactor (MBR) running parallel to a conventional treatment system with a recirculating sand filter.

After being pre-treated, the wastewater is distributed evenly between the conventional system and the MBR. Effluent from both sand filter and MBR flows through a wetland filter before being discharged into surface waters. The water board wanted to compare the performance of the MBR with that of the conventional system.
Grontmij drew up a technological reference design, which was used as the basis for selecting the suppliers and contractors for the delivery, execution and start-up of the membrane extraction unit and the recirculating sand filter. And then together with those suppliers, the final designs for the systems were combined into a final design for the total system. Construction began at the end of 2005 and is completed in 2008.
The design, engineering, delivery, execution and start-up of a membrane extraction unit for an MBR with a capacity of 150 m^3/h is part of the complete upgrade of the existing plant. This MBR system constitutes one of the first actual uses of membrane technology in the Netherlands for large-volume treatment of domestic wastewater.

Buôn Ma Thuôt Sanitation Sub-Component (VN)

Buôn Ma Thuôt is the capital of Dak Lak Province and the largest town in the central highlands of Vietnam with a total population of 260,000 including the urban and peri-urban areas. The surrounding land has high agricultural value and sees a massive expansion of the coffee growing industry. Economic growth is some 50% higher than the national average. In 1999, DANIDA and the Government of Vietnam jointly agreed on the establishment of a Sector Programme Support (SPS) for the Water Sector in Vietnam. The Buôn Ma Thuôt Wastewater Sub-Component is one of the interventions contained within the SPS. It includes:

- Detailed Design and Construction Supervision (DCS) component including the rehabilitation of the sewerage system, new wastewater treatment plant, house connections and rehabilitation and extension of the stormwater collection system:
  a) new separated sewerage system, totallength 26 km (uPVC and HDPE) serving 65,000 people.
  b) installation of 5,500 new house connections.
  c) stormwater collection network, total length: 20 km consisting of Reinforced Concrete pipes of diameters 300 are 2000 mm.
  d) main pumping station.
  e) wastewater treatment plant for the biological treatment of domestic wastewaters from 65,000 people. WWTP Design Flow rate = 8,125 m^3/d, WWTP Organic Loading = 3,250 kgBOD/d.
- Institutional Development (ID) component for strengthening the capacity of the BMT water company
- Information, Education and Communication (IEC) component

The treated water is used for irrigation of coffee plantations. Our services covered feasibility study, design, supervision and institutional development. In a previous project we developed the water supply side for the town and faced resistance from coffee farmers fearing that the new boreholes would deplete the water resources they relied on. Therefore the reuse of treated wastewater for irrigation was a good solution. "Closing the chain" is the key here.

SHARON New York (USA)

Grontmij, who is the owner of the proprietary SHARON technology, is responsible for design, commissioning and process start-up. New York City has developed a Comprehensive Nitrogen Management Plan to reduce the aggregate effluent nitrogen loading from Water Pollution Control Plants (WPCPs) to the Upper East River and Jamaica Bay. Separate centrate treatment has been identified as an integral part of this plan, since up to 40% of nitrogen loading at WPCPs with centralized dewatering facilities is directly attributable to centrate loading.
Pilot research by the New York City Department of Environmental Protection related to nitrogen removal and other related operational issues, showed SHARON to demonstrate significant potential as a highly efficient, cost effective and environmentally sound process for the removal of high levels of nitrogen from centrate.

The SHARON Process

SHARON is high active process for N-removal operating without sludge retention. Due to differences in growth rate nitrite oxidisers are washed out of the system while ammonia oxidisers can be maintained, resulting in N-removal over nitrite instead of nitrate.

N-removal with SHARON via nitrite has several advantages:

- oxidation to nitrite saves 25% on aeration energy;
- denitrification of nitrite saves 40% on BOD addition;
- denitrification of nitrite at high temperatures reduces sludge production by 50%;
- simple process with high process stability.

Under the Management Plan, New York City is currently building a demonstration plant for the SHARON system at Wards Island WPCP.
This SHARON will treat centrate produced at the plant in the sludge dewatering facility. This facility dewaters anaerobically digested sludge produced at Wards Island and at two other WPCPs.
The SHARON for Wards Island WPCP, with a capacity of 5.000 kg NH3-N per day, will be operational in 2009.

SHARON is also being realized in amongst others Paris, Manchester and Geneva.

DOW Chemicals effluent reuse (NL)

During the mid-nineties, Dow Chemical - one of the biggest powerhouses in the chemical industry - has expanded the capacity of its nafta crackers at its production site in Terneuzen. As a consequence of this expansion of the production capacity the expansion of the energy production and cooling water facilities were mandatory. This marked the moment to replace also some of the less efficient production plants for demineralised water. All of these modifications and expansions were driven by durability and sustainability.

Since 2001 DOW has outsourced the supply of proces water, for cooling tower, demineralised water and ultra-pure water to third parties.
In 2005 it was decided to prepare part of the required demineralised water from effluent from a nearby municipal WWTP. Grontmij supported the technological design, produced the basic engineering and tender documents, supervised the construction and supported the start-up.

The effluent of municipal WWTP "De Drie Ambachten" in Terneuzen is treated in two steps. First process step is "continuous microfiltration" (CMF). Very small particles are filtered out of the effluent by means of this CMF. The second step is a double Reverse Osmosis Membrane Filtration. Here the effluent is desalinated.
The permeate of the second step has reached the quality standards of demineralised water.

Modern Sanitation (NL)

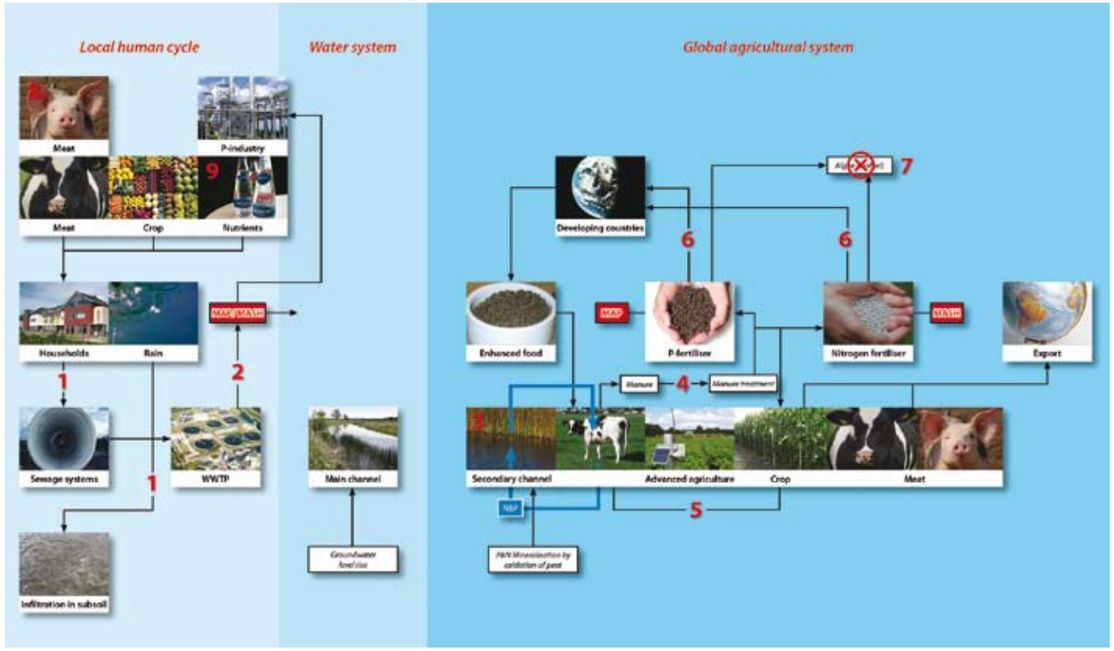
Since the early 1900's people think wastewater contains dangerous substances that are a threat to human health and to a sustainable environment. Back than people considered wastewater to be an annoying and dangerous flow, which should be neutralized in a quick and proper way. The idea was to remove this stream from human settlements and discharge it after removal of pollutants.

Keep it out of sight and the problem was solved. Nowadays we have transportation systems which consist of a network of sewerage pipes that transport wastewater from the city towards centralised wastewater treatment plants.
Today the world is facing new challenges due to the ever growing population. Lack of fresh water, fertile lands and energy are becoming ever more critical for maintaining a considerable standard of living. Solutions are not always so easy to find. Therefore it is strange that people have qualified wastewater as pollution, where in fact it is also a source of water, nutrients and energy:

- urine is rich on nutrients (like phosphorus, which has limited global reserves)
- faeces are rich on energy
- treated wastewater can be reused.

Grontmij has developed new ways for collection and treatment of wastewater in order to be able to harvest this richness. These non-conventional techniques are focussing on separation at source so it becomes easier to extract these values from wastewater.
We have developed fully operational solutions with a capacity varying from one household up to a whole street. Currently we are using our knowledge to develop systems for entire neighbourhoods. In close cooperation with the authorities and citizens we have been able to develop tailor made, good working solutions.

There is still a lot to discover and to improve, but with these innovative techniques we are sure that we are one step closer to a safe and sustainable environment. We can actively contribute to the closed-loop concepts of wastewater management. Grontmij is looking forward to discover this future together with you!



Our view on the phosphorus cycle

Phosphorus Cycle (NL)

Phosphorus (P) is a vital element for life on earth and essential for plant growth. To sustain our way of life we use more and more P to grow crop and feed ourselves and our animals. In recent times natural P-cycles in the world have been disturbed. This requires addition of P by means of P-artificial fertilizers in order to maintain soil fertility. Nowadays the awareness grows that P-containing are deposits, the source for the P-fertilizer industry, get depleted. This finite and non-renewable resource and its scarcity might become a threat for our future.

Together with stakeholders Grontmij is looking for new approaches and solutions in order to reuse as much P in the P-cycle as possible . We are developing new techniques and are implementing new methods for a sustainable P-system. We would like to share our view with you referring to adjacent scheme. Nine points can make a difference!

1. Separation at source
In ultimo we should separate our wastewater in four streams: urine, feces, grey water and storm water. This separation enables us to recover the richness of each of these streams in an optimal way.

2. Recovery instead of removal
In stead of focusing on removal of pollution a WWTP should be designed as a recovery installation, which produces nutrients, energy and water. The nutrients can be used for producing fertilizers as MAP (P-fertilizer) and MASH (N-fertilizer).

3. Water management
With other water management we can avoid that P dissolves into channels by oxidation of peat and by washing away from soils used for agriculture. In this way P is not leaking away from the cycle, but instead will still be available for growing crop.

4. Manure treatment
Like wastewater manure is rich on nutrients and thus a similar approach is required: recovery of nutrients and separating manure in a P and an N rich stream instead of removal of these components to obtain clean surface water.

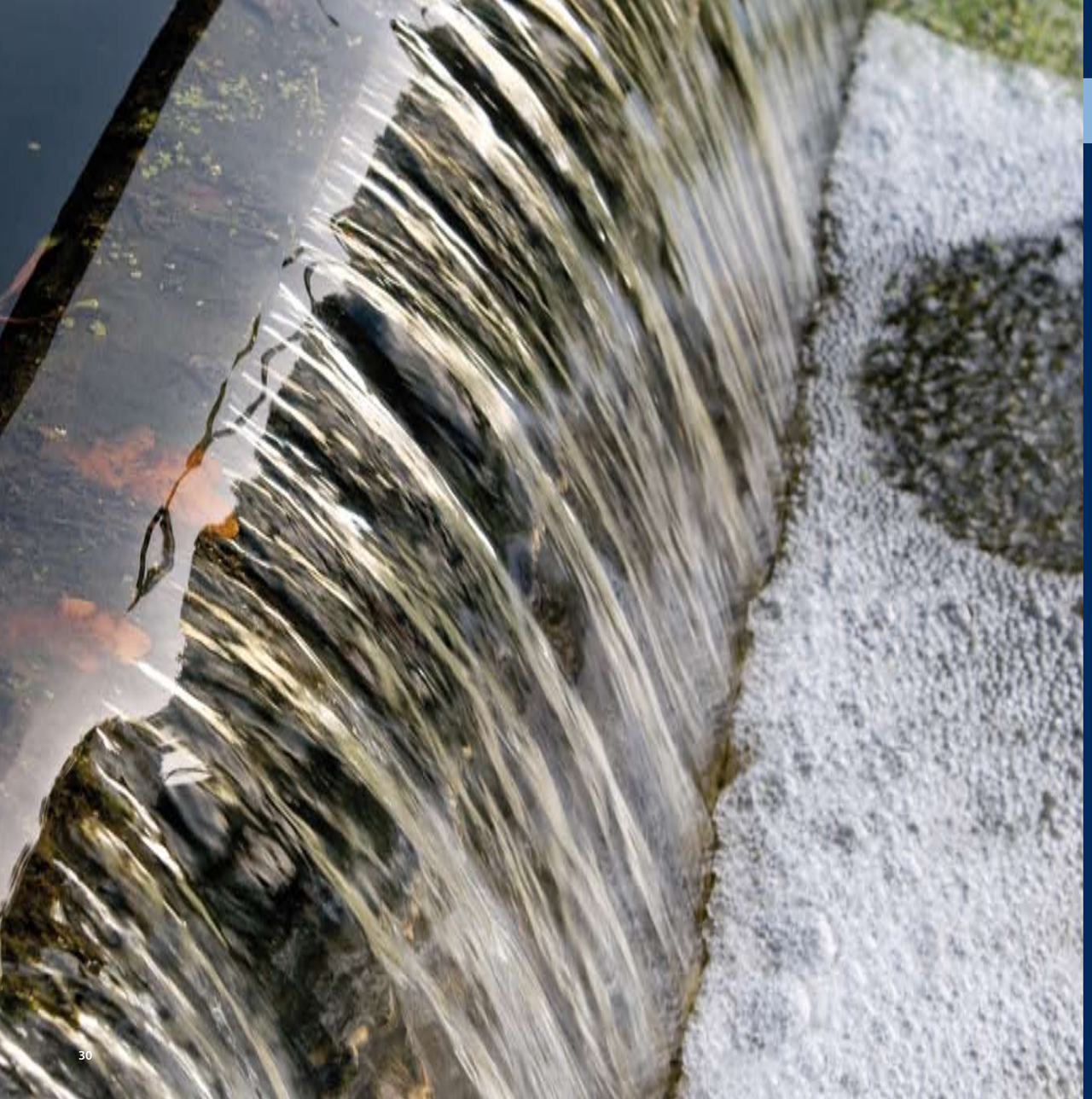
5. Advanced Precision Agriculture
A demand-based approach is required. Based on the actual needs of crop for nutrients fertilizers should be dosed, instead of a main stream approach where inefficiency is the key word. Look for optimal combinations between agriculture and husbandry, so they will support each other instead of being competitors.

6. Closing global agricultural loop
Products from manure treatment should (partly) be returned to the producing countries of enhanced food in order to balance the P-cycle.

7. No energy from P
Energy can be harvested from many sources; food however is depending on P.

8. Less meat
For producing one kilo of meat a disproportionate amount of crop is needed. Reducing our meat consumption will decrease our use of P (and water) enormously.

9. Less phosphoric acid containing
food and beverages Beverages such as cola contain high amounts of P-acid and therefore play a significant role in the P-cycle.

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