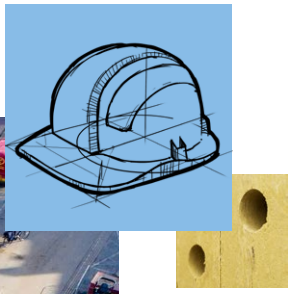
Rockflow attenuation and infiltration systems

High absorption capacity



A high water absorption capacity is important when choosing an infiltration system, particularly where there is a lack of space. Rockflow is an ideal choice due to the unique material properties of stone wool.

Rockflow consists of up to 95% voids ratio

This allows Rockflow to store large quantities of water. By its nature, an infiltration system made of Rockflow takes up less space than, for example, a tank comprising granular filter media. Almost all of the buffer's space is available for the storage of rainwater: once the Rockflow buffer has emptied after a rainfall event, a small volume remains (between 1-6%, on average 3%) depending on the design. This is known as retained water.

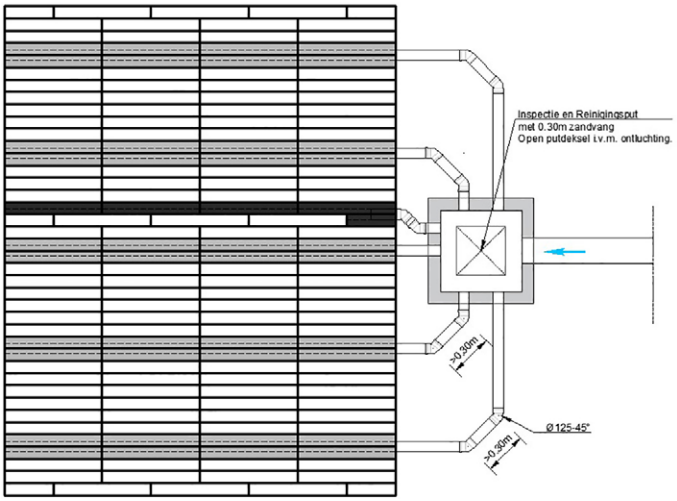
Rockflow can retain almost its own volume in water.

A Rockflow buffer completely fills with water within 15 minutes

The filling speed of stone wool is rapid and absorption into the stone wool itself is not the limiting factor for filling the system. Internal research into the transport speed of water within the stone wool shows that, in practice, stone wool does not delay the incoming water.

The Rockflow system's maximum filling speed depends on the capacity of the inlet pipes. In the Netherlands, these transport the water via Ø125mm PVC connections into the stone wool elements and ensure the water is optimally distributed over the entire system. With an adaptor, Ø100mm and Ø150mm pipes (minimum sizes used in the UK) can be easily connected to the Rockflow system. Larger diameters are incorporated using multiple inlets.

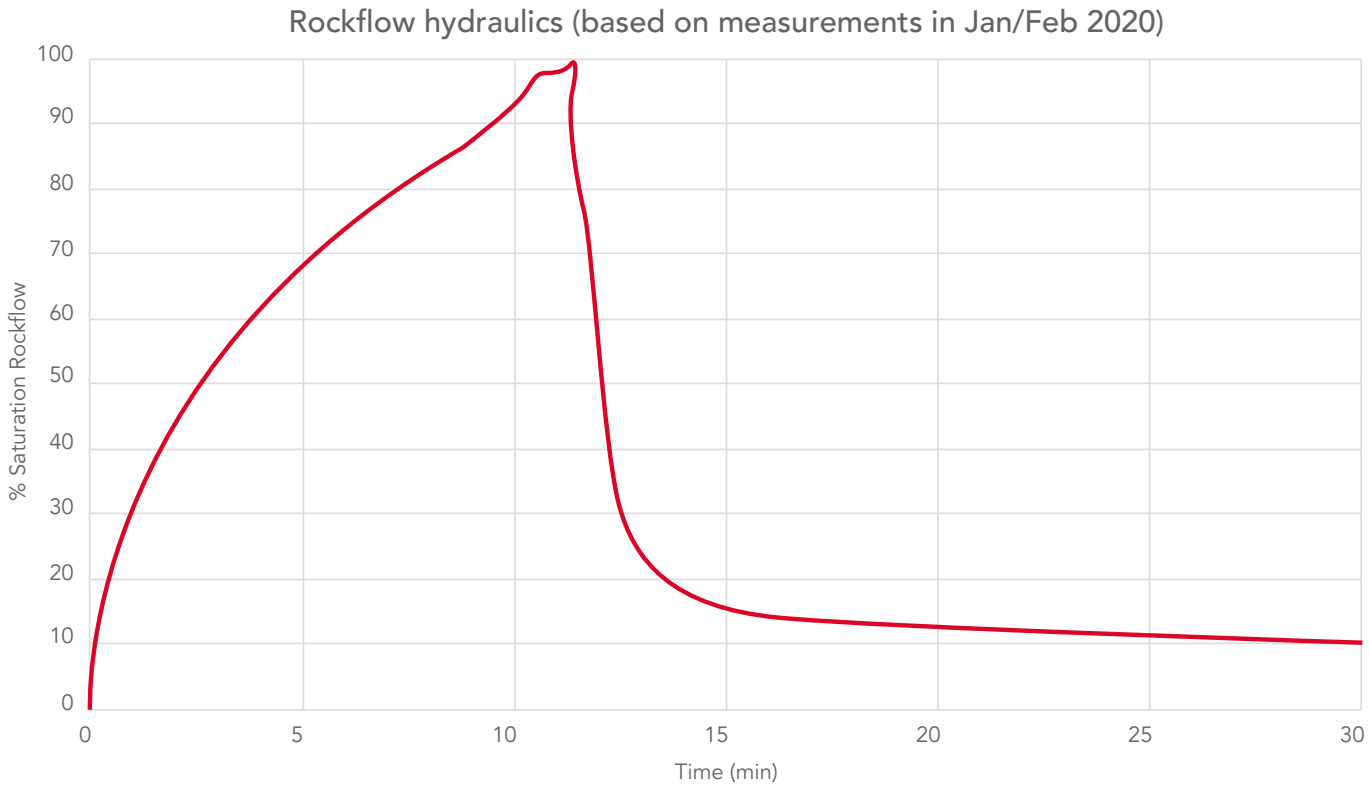
By following our design principles your Rockflow system will always have enough inlet connections. The system can cope with a peak inflow from heavy rain equal to 100mm/hr.



Rockflow becomes available for the next extreme downpour within 24 hours

Rockflow systems are designed so that they can be completely empty and available again within 24 hours. The speed at which a system empties depends partly on the material properties of the system and of the surrounding substrate and its infiltration rate. Emptying of the Rockflow buffer occurs using gravitational forces and capillary action. The system may also drain to a pipe at a lower level.

The fuller the system is, the faster the water drains away due to the head of pressure in the upstream components/ network.



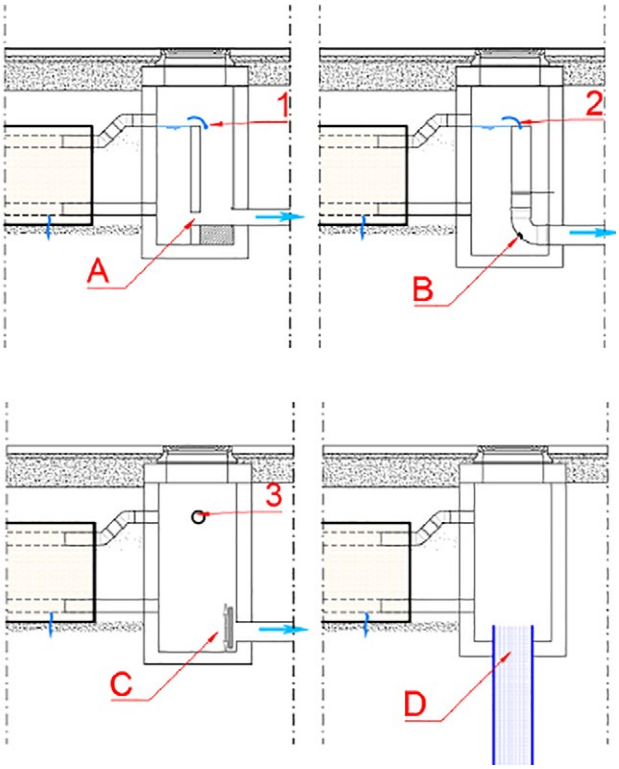
This graph shows the filling and emptying behaviour of a Rockflow buffering system with 5m³ stone wool, a water column of a maximum of 1 metre and free drainage.

High groundwater level or poor soil permeability?

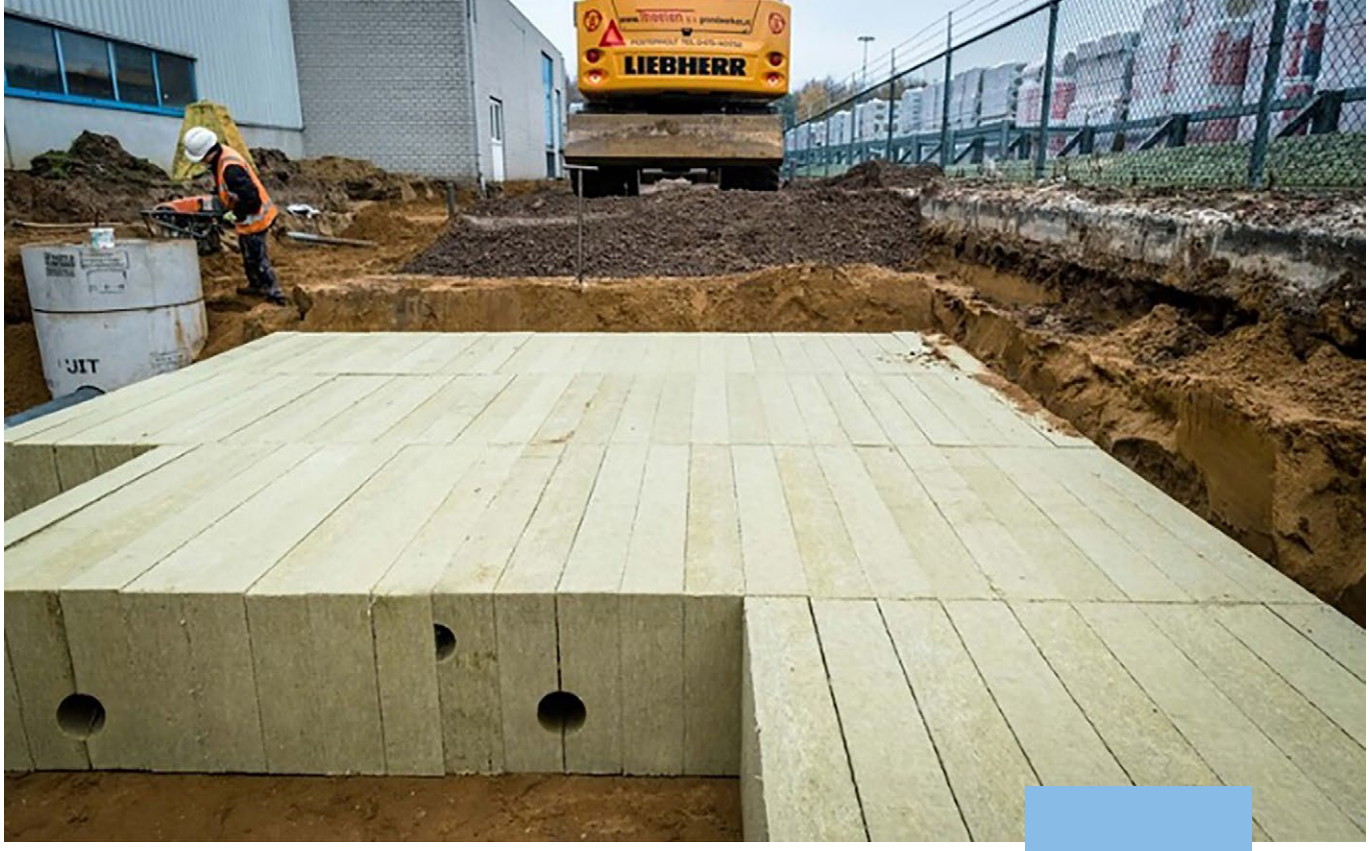
Even high groundwater levels do not preclude the use of stone wool. At our infiltration system at a supermarket in Zevenaar, groundwater levels regularly rise to just below the underside of the buffer or during extreme events partially into the buffer. In spite of this, measurements taken by engineering consultants IB Land, reveal that infiltration occurs within a matter of hours.

Even if the type of soil or other factors hinder complete infiltration within 24 hours, a suitable Rockflow system can be designed. The unreleased water may be conveyed away to a system which does have sufficient capacity. This is done either by delayed discharge to a watercourse or using a vertical infiltration outlet to below the poorly draining layer. This allows the system to be emptied within 24 hours in accordance with typical design criteria.

An emergency overflow is desirable for every attenuation system. Although the size of the system is designed to accommodate more than the anticipated flow, in the event of extreme rainfall, the emergency overflow is used (subject to an acceptable point of discharge).



Solutions for Rockflow systems in soils with poor permeability. Options A-C use different methods to connect to the water course. Option D has a deep infiltration pipe allowing the water to reach a deeper water-permeable layer.



Stone wool has a large infiltration surface.

Stone wool has a greater infiltration surface area than alternative systems

The greater the infiltration surface area, the faster and more reliably a water retention system will be emptied after rainfall. With stone wool the infiltration surface area consists of half of the sides as well as the complete underside of the stone wool element. In alternative systems made of plastic or using granular media, and wrapped in a geotextile, the side walls are the only infiltration surfaces as the base is taken to block with silt over time.

Using Rockflow, the channels are the only place where sediment can accumulate. Due to the fibrous structure of stone wool, particles larger than 45µm are prevented from passing. This means limited silt enters the stone wool matrix and the underside of the buffer remains available for infiltration. The channels themselves can be rinsed clean using normal jetting methods if inspection reveals cleaning is necessary (see fact sheet 'Durable and easy to mainain' and Rockflow's maintenance and cleaning guide).

Due the increased infiltration surface area, Rockflow allows the collected water to infiltrate more rapidly than in other solutions. This is a particular advantage for soil types with poor permeability (i.e. a low k-value of 30-50cm per day). These superior performance characteristics mean it is often not necessary to discharge water by any other method other than via attenuation and infiltration.

ROCKWOOL: Your partner in design

Rockflow offers versatility, design freedom and high capacity for water absorption and infiltration. Our team will support you during the design phase. Our in-house consultants and local technical representatives will provide whatever advice you require during the design stage. This may include checking soil permeability calculations, and checking that the proposed system is the correct shape and dimensions to ensure optimum throughput and ease of maintenance. We will verify that the design meets your requirements and specifications.

Appendix: Reliable infiltration capacity: Multi-year monitoring results of a Rockflow system in Zevenaar (NL) by IBland

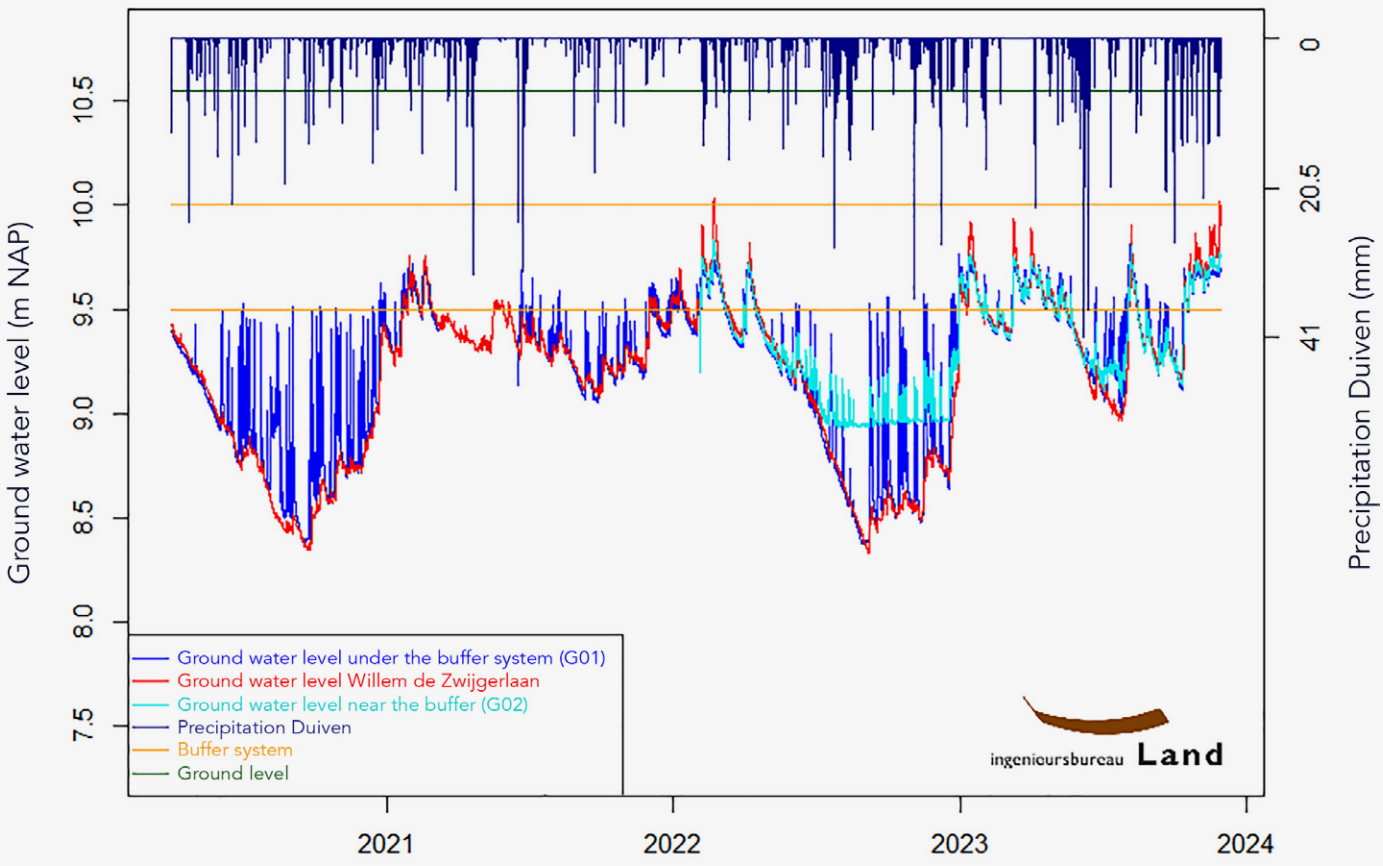
ingenieursbureau Land

SUMMARY

The Rockflow system was installed in 2018, and to assess its performance over time, a monitoring program was set up from 2020. On several occasions, the Rockflow system was exposed to rain showers larger than the design / attenuation requirement (35.7mm).

Based on the data from the monitoring wells installed in 2020, it can be concluded that the Rockflow system is still functioning well; the infiltration capacity of the buffer remains stable over time. The graph below (G01 blue line, monitoring well under the buffer) clearly shows that the groundwater level under the buffer temporarily rises when it rains and then, through infiltration, eventually drops to the groundwater level of the surrounding area, measured through the monitoring well of the municipal monitoring network at Willem de Zwijgerlaan (red line in the figure below).

The groundwater at the monitoring well next to the buffer (G02) does not subside to the surrounding groundwater level in the second half of 2022, unlike monitoring well G01. This can be explained by the fact that monitoring well G02 is located in the clay layer while monitoring well G01 is in contact with the sand layer underneath. The monitoring well at Willem de Zwijgerlaan is in contact with the same sand layer.



The proper functioning of the buffer 5 years after installation can also be seen from the rise in water level in the buffer after rain events. Looking at the design showers in detail, we can see that the showers of around 32 mm in August 2023 result in a water level rise in the buffer of 40 cm. This roughly corresponds to the design requirement of 40 mm/hour.

As the system was installed just above the average highest groundwater level, groundwater has entered the Rockflow system several times (water levels between the Rockflow lines, coloured orange). From the data, we can conclude that during the times when groundwater is in the Rockflow system and a rain event occurs at the same time, the water level rise in the Rockflow system was lower than we would expect based on the design. These results confirm the conclusion about the lateral distribution of infiltrating rainwater over the groundwater surface.

Nearly 6 years after installation and without intermediate maintenance, the infiltrating effect of Rockflow is still unambiguous. Based on the analysed data, we can conclude that the emptying time of the buffer by infiltration has hardly changed. This stable infiltration capacity applies to both summer and winter periods.

Based on this long-term monitoring, we can conclude that the Rockflow system is functioning as expected and there is no decrease in infiltration capacity. This project will continue to be monitored to assess effects on an even longer term.

More information about the hydraulic behaviour of Rockflow.

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