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Rainwater harvesting:

Harnessing the elements

German company Wisy AG has installed a filtration system to collect and use rainwater as a resource in a major office building in Berlin.

The central associations of the German economy, the German Chambers of Industry and Commerce (DIHK), the BDI Association – Voice of German Industry, and the Federal Association of German Employers (BDA) all have offices in Mühlendamm in the Berlin-Mitte district. With 570 employees, the owners of the building decided to take an initiative and invest in rainwater harvesting.

Since 1999 collected rainwater has been used throughout the year to flush toilets in the parts of the building that are not open to the public, and also to supply water to the fire sprinkler systems.

Figure 1: Haus der Deutschen Wirtschaft, on Mühlendamm, at the corner of Berliner Str., Berlin-Mitte (Photo: Klaus W. König)

The planners' concept

The curved glass roof over the large inner courtyard allows water to be drained into the lower basement of the building via gutters running down the sides of the building and downpipes fitted to the interior. To cope with cold outside temperatures, the gutters on the edge of the glass roof are fitted with heat tracing, which is activated at temperatures lower than 3°C, protecting the drainage system from freezing up. On its way down the water passes through the filter system in the upper basement, which separates water from dirt particles. Fine-meshed sieves with pores of 0.6 mm filter the water coming from the roof, removing the clean rainwater into the storage tank. When rainfall is heavy, excess water is swilled off the filter sieves.

Figure 2: Glass roof over inner courtyard as collecting point for rainwater; the wooden facade of the inner courtyard is protected against fire by a facade rainwater sprinkler system (Photo: Klaus W. König).

Filter and storage technology

Rainwater is collected from the roof by way of syphonic drainage and fed tangentially through two filters several floors below. Following the patented principle of the vortex filter, the rainwater flows in a broad stream over the cylinder-shaped filter fabric. As a result of adhesive force, it is diverted off sideways through a vertically-positioned fine filter cloth whereupon it falls freely through drainage supports into a special container upstream from the rainwater storage tank. This produces an average annual rainwater

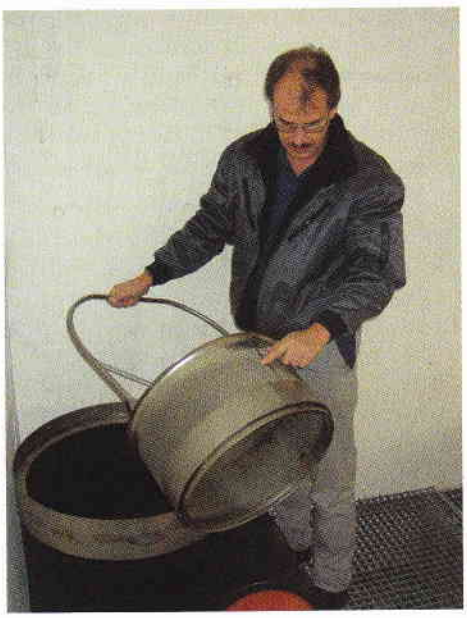

Figure 3: Rainwater filter – removal of vortex fine filter device to be cleaned (Photo: Klaus W. König)

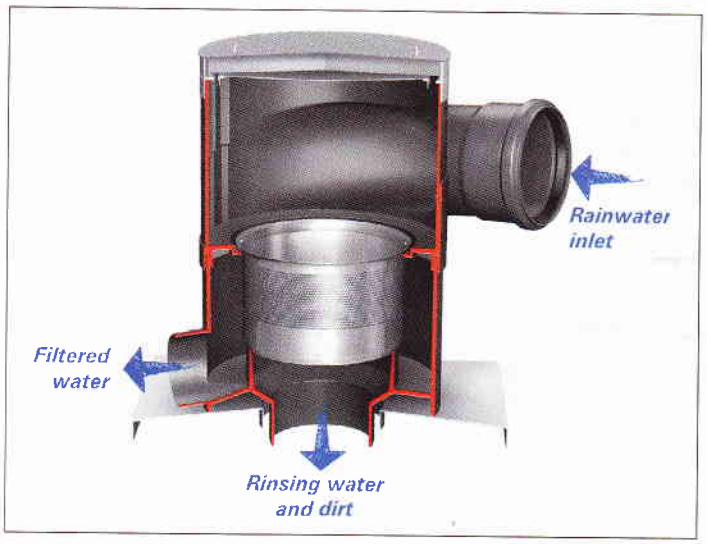

Figure 4: Cross-section of Wisy rainwater vortex fine filter WFF 300 (Photo: Wisy AG)

Figure 5: View of Wisy rainwater vortex fine filter WFF 300 (Photo: Wisy AG)

harvest of more than 90 percent, while any residual water automatically conveys filtered off particles into the River Spree by way of an overflow pipe.

The filter guarantees safe drainage in accordance with the DIN standard 1986-100:2008-05, *Drainage systems for buildings and properties*. There are no cross-sectional constrictions in the device that could cause blockages of dirt and water, which is particularly important in the event of extremely heavy rainfall.

System optimisation

The filter manufacturer developed and integrated the current directive into both vortex filters. They provide the maximum amount of yield and security. Each one is capable of draining up to 3,000 m² of roof surface without any build-up being incurred. Because they are integrated on the inside of the building, the size of the filters was doubled; the initial draft by the housing technology engineers originally incorporated 20 smaller individual filters.

"In comparison, the time required for maintenance and servicing is now less than 10 percent," said Norbert Winkler, developer of these products and founder of Wisy, Winkler Systeme AG. "The clip included in delivery is used to lift out the filter device. An innovatively attached seal means that inserting and removing the filter device is a simple procedure."

Over time, the facility managers have optimised the collection system and its technology at various points of use. During regular inspections and services, details worthy

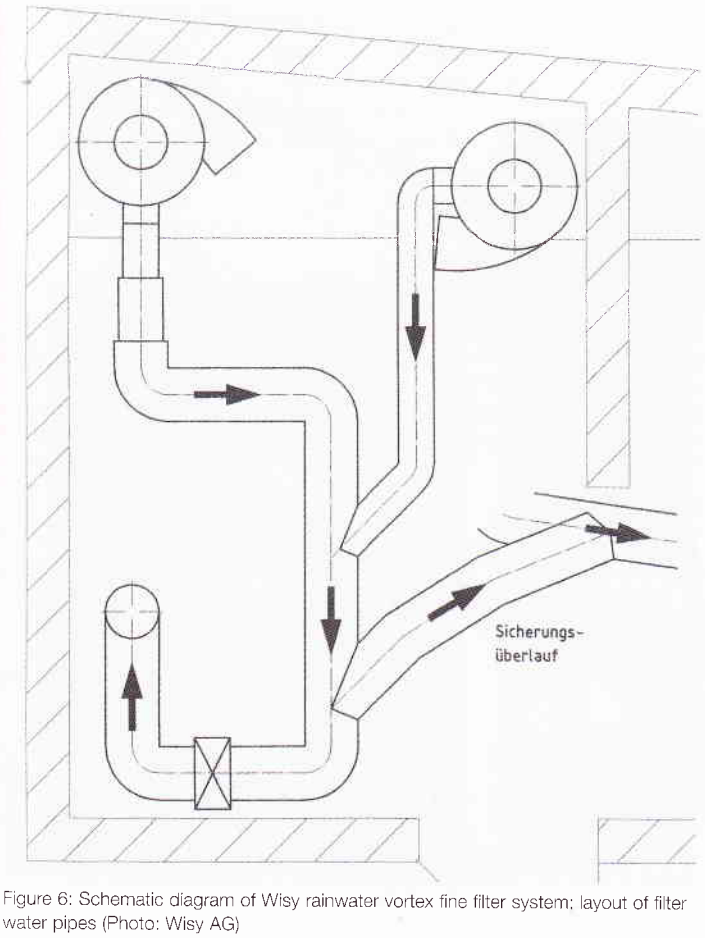

Figure 6: Schematic diagram of Wisy rainwater vortex fine filter system; layout of filter water pipes (Photo: Wisy AG)

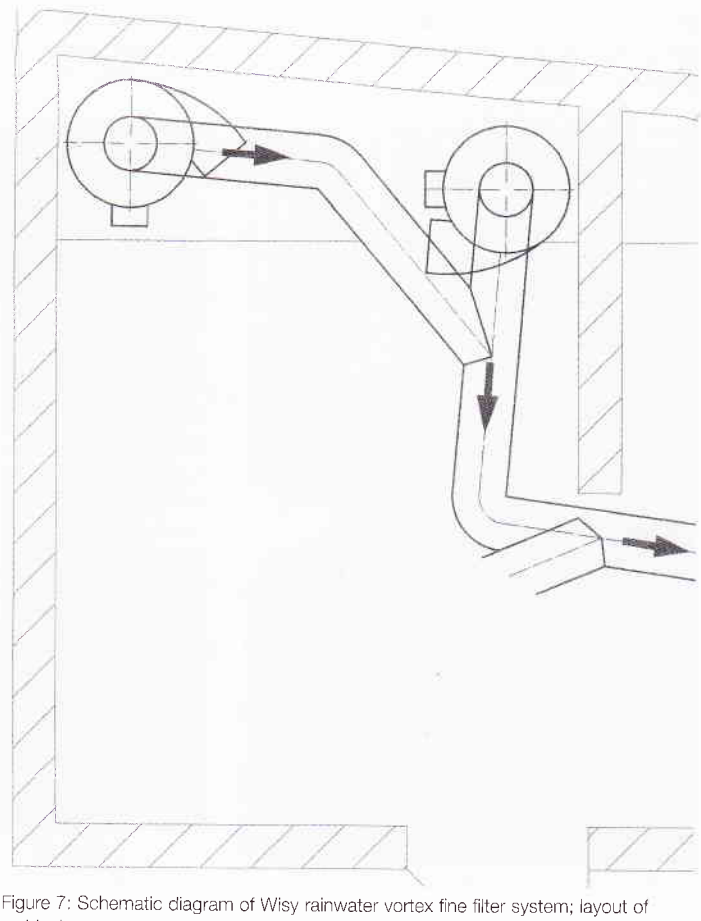

Figure 7: Schematic diagram of Wisy rainwater vortex fine filter system; layout of residual water pipes - overflow to River Spree. (Photo: Wisy AG)

of improvement were noted and the following measures were applied:

- March 2000: replacement of magnet valve for drinking water supply, as the magnet was too weak and unable to close at a water rate of 10 l/s. This minimises the operating costs in the event that drinking water has to be added occasionally and reduces the risk of water damage in the lower and upper basements.
- August 2007: replacement of existing filter device for particles up to a fineness of 0.38 mm with an alternative 0.6 mm device by the manufacturer. This minimises operating costs for cleaning, but contributes to particulate matter in the water storage tank.
- August 2008: removal of the save-water button from 8-litre WC flush-cisterns, as the wastewater pipes were blocked every one to two weeks as a result of the toilets being flushed too economically. Even if the demand for water increases, it is possible to reduce the operating costs considerably because external companies are not required as frequently to clean out the pipes, which is expensive.

Figure 8: View of building from River Spree. Overflow of rainwater system in bottom right of picture -stainless steel pipe. (Photo: Klaus W. König)

Water balance

Between the beginning of 2006 and the end of 2009 the amount of cistern water required to flush toilets (170 m³) increased to 197 m³, partly caused by the temporary removal of the save-water button on the flush units. This is an additional requirement of 16 percent more water.

The collected rainwater was able to cover 54 percent of the required amount of 170 m³ in the first 21 months, while 46 percent was supplied by adding drinking water whenever the tank was empty. In this period, the rainwater tank overflowed only once.

This indicates that almost all the harvested rainwater was able to be used (an estimated 98 percent). The annual yield, calculated from average rainfall over a 30-year period confirms this: at 86 m³ this largely corresponds to the difference in the actually used yield of 91 m³ determined by counter readings.

In the last two months of the period under examination, at the end of 2009, the amount of required drinking water determined by the counter fell significantly and the difference of used rainwater of 169 m³ per month accounted for almost double the estimated and statistically possible average monthly value of 86 m³. Accordingly 86 percent of the 197 m³ was able to be covered by the collected rainwater and only 14 percent had to be supplemented by drinking water.

The fact that rainfall was double the normal level during two months was taken as a possible and probable occurrence. The counter readings indicate that even then almost all the harvested rainwater can be used (estimated at 98 percent). This is, on the one hand, due to the optimal efficacy of the vortex filter and is also a result of the continuous improvements made to the system by Facility Management at the Haus der Deutschen Wirtschaft.

The performance of this 10-year old system, which incorporates a filter and storage tank overflow to the River Spree, corresponds to the directives that have been imposed since the amendment to the German Water Resources Act and the current DIN standard 1986-100: 2008-05. According to these regulations, rainwater should first and foremost be harvested decentrally, e.g. storage and utilisation or discharge to above-ground watercourses. ●

Project data	
Project address	Breite Straße 29, 10178 Berlin
Facility management	Gegenbauer GmbH
Rainwater technology put into operation	2000
Employees in building	570
Designated use of rainwater	Flush units, water for fire sprinkler system
Annual rainfall Berlin-Mitte 1961-90	574.4 mm
Area for collecting rainwater glass roof, projection	2,000 m²
Rainwater tank, cast-in-place concrete, volume, of which 70 m³ is used for fire extinguishing	280 m³
Filter housing PP, type	2 × vortex fine filter WFF 300
Filter fabric stainless steel, fineness	0.6 mm
Manufacture and assembly of rainwater filter system	Wisy AG, Kefenrod

Contact:
Wisy AG
Tel: +49 7551 61 305
E-mail: kwkoenig@koenig-regenwasser.de
www.klauswkoenig.com