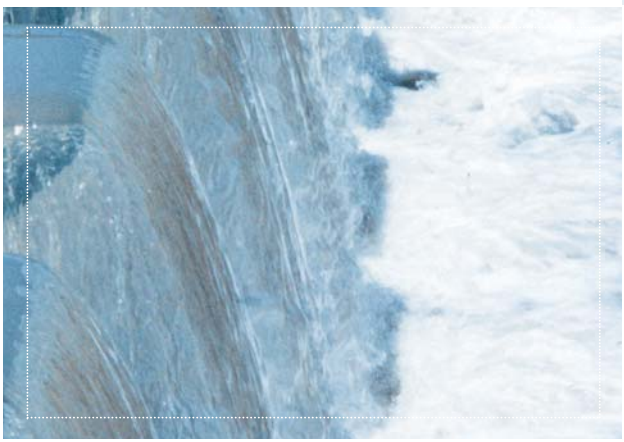
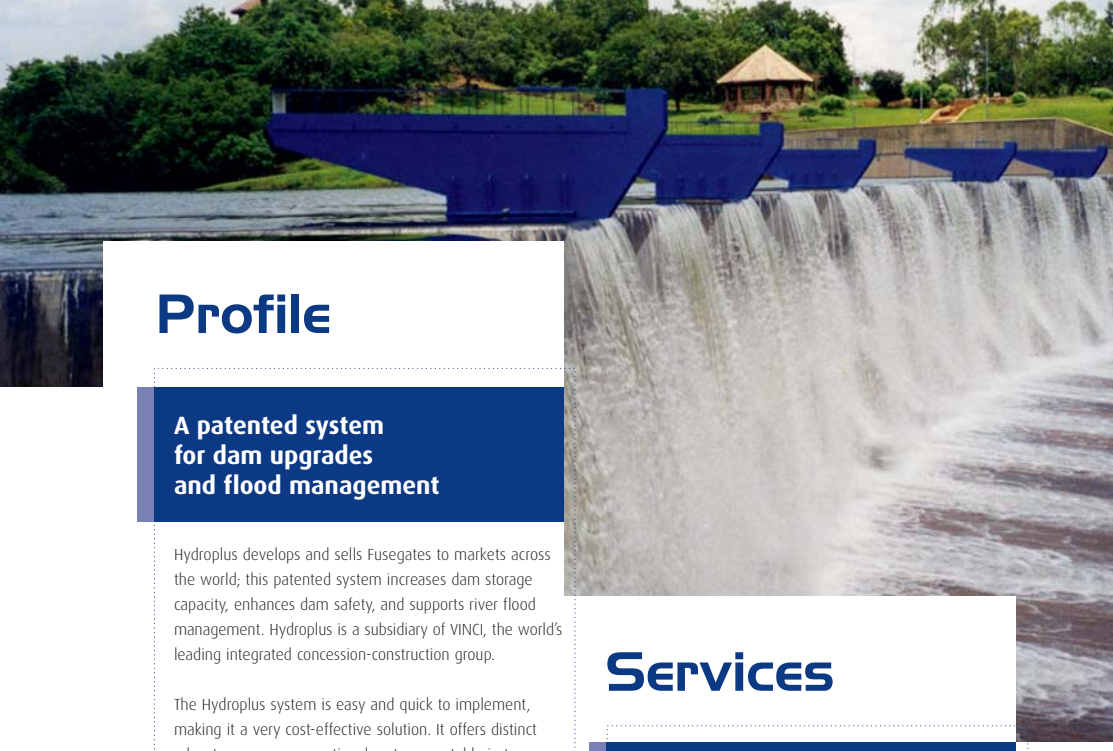
The Hydroplus system





Profile

A patented system for dam upgrades and flood management

Hydroplus develops and sells Fusegates to markets across the world; this patented system increases dam storage capacity, enhances dam safety, and supports river flood management. Hydroplus is a subsidiary of VINCI, the world's leading integrated concession-construction group.

The Hydroplus system is easy and quick to implement, making it a very cost-effective solution. It offers distinct advantages over conventional systems, notably in terms of reliability, durability, and ease of maintenance.

Hydroplus's technology is emission-free and contributes to sustainable development. It consumes no form of energy other than the natural force of water. Further, by optimizing existing dams, the Hydroplus system is an environmentally friendly and ecologically sound alternative to new dam construction.

The system's superior design and performance have earned it various international prizes that have added to the company's renown, including ASDSO National Rehabilitation Project of the Year Award (USA, 2002), USCOE SPD Project Delivery Team of the Year for Terminus dam optimization (USA, 2005) and the Legambiente prize (Italy, 2002).

The Hydroplus system is a reliable and cost-effective solution that can be easily and quickly put in place

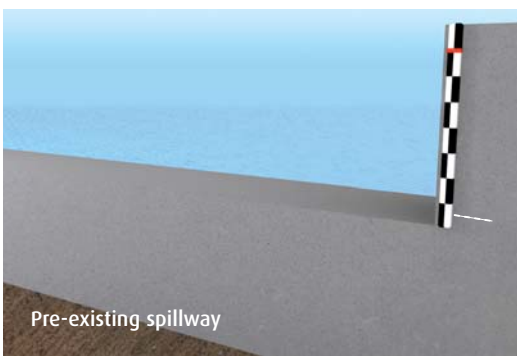
Services

Supporting enlightened decision-making

Hydroplus works closely with clients on each and every single optimization project. To ensure that all expectations in terms of quality, environment and safety are met, the company is certified ISO 9001, ISO 14001 and ILO-OSH.

Hydroplus delivers complete customer satisfaction by adjusting its services to specific project and client needs. The company is involved in projects anywhere from start-up to implementation and delivers turnkey solutions as required. Hydroplus also offers ongoing maintenance services through regularly scheduled onsite visits and operations recommendations.

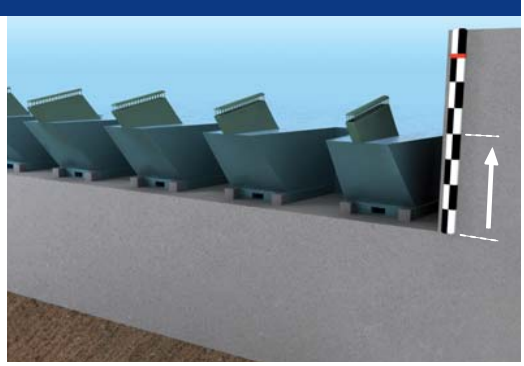
Applications



Fusegates enhance spillway performance. They may be included in the design and construction of new dams or integrated into existing dams. There are four different types of Fusegate applications.

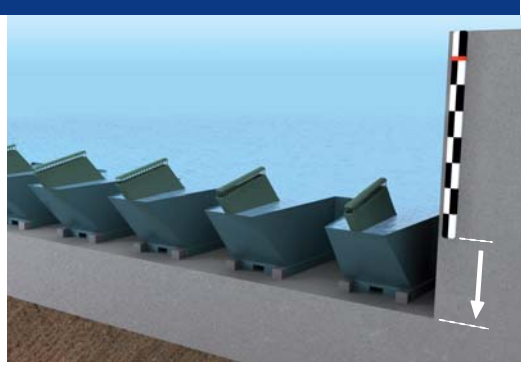
Hydroplus works closely with clients on all optimization projects

Increasing storage capacity



Installing Fusegates on the spillway sill increases the normal reservoir level while maintaining the dam's safety level.

Enhancing safety



Installing Fusegates on lowered spillway sill maintains initial storage capacity while ensuring the discharge of the revised design flood.

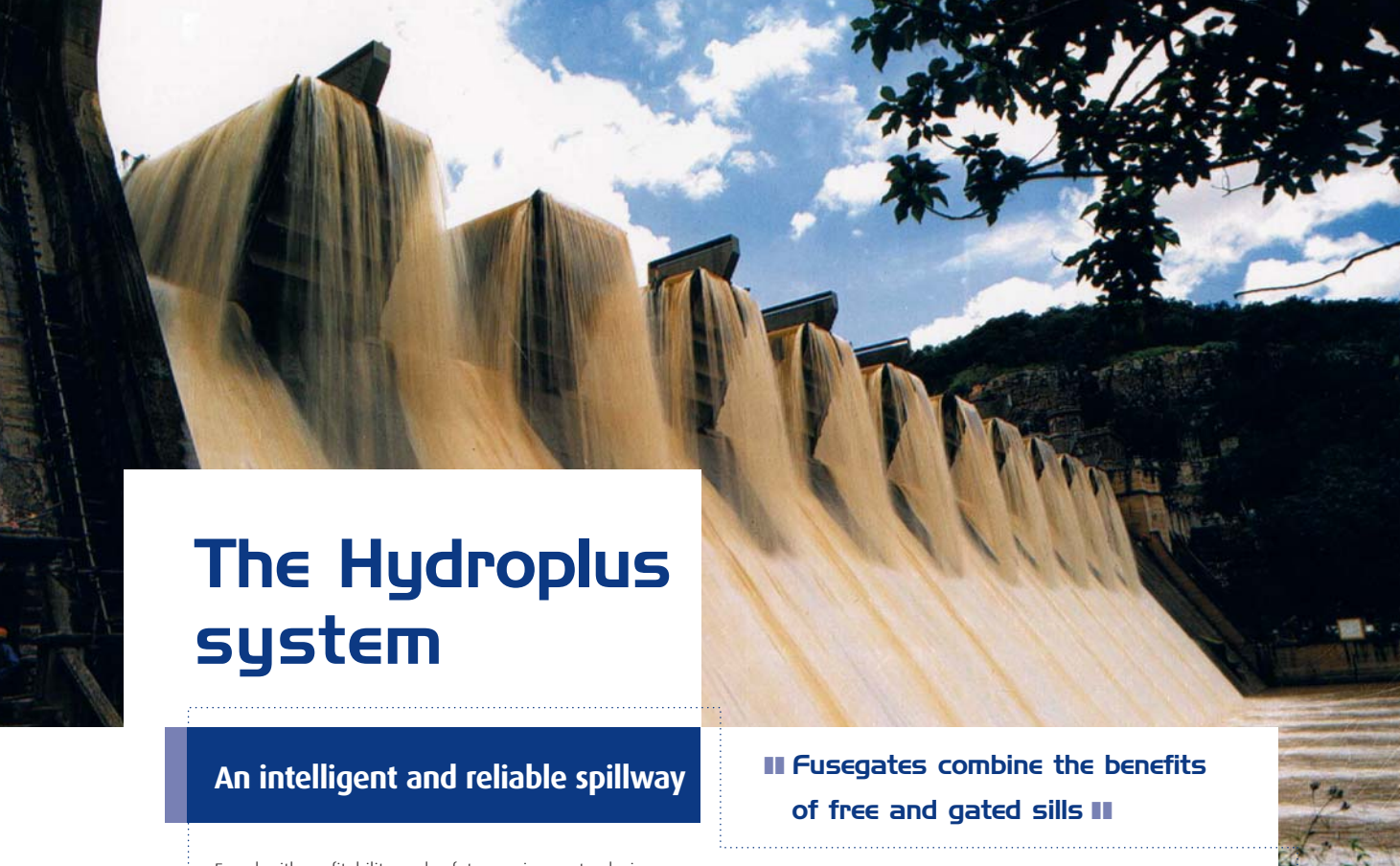
Hydroplus Fusegates can also be used for:

Securing a gated system

When installed as a complement to a gated system, Fusegates make the dam more secure by enhancing its capacity to discharge major floods and by providing support in case of human or technical error resulting in gate malfunction.

Managing river floods

In the event of major flooding, Fusegates installed on river spillways provide protection for populated areas by redirecting floodwaters into temporary holding basins (polders).



The Hydroplus system

An intelligent and reliable spillway

Faced with profitability and safety requirements, designers traditionally had two conventional options:

> a free sill, which offers total safety but with a considerable loss in operational capacity,

> a gated sill, which supports full operational capacity but is vulnerable to system malfunction (human or technical error, or problem with the energy source).

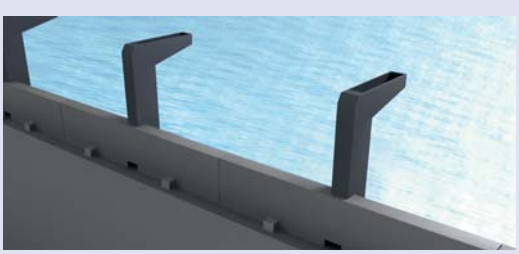
Fusegates combine the benefits of free and gated sills

Hydroplus's technology brings together the benefits associated with free (ungated) sills and gated systems. Fusegates installed atop spillways increase the dam's storage capacity. In the event of extreme flooding, Fusegates overturn sequentially on the downstream side, thus reducing water pressure on the dam and protecting the structure from damage. This is a completely reliable and standalone system, whose operation is triggered solely by water pressure.

Hydroplus's range of Fusegate systems

To address specific project needs, Hydroplus has developed several types of Fusegates that vary in terms of height, weight and configuration.

Labyrinth-crest Fusegates
Thanks to their labyrinth-shaped crest, these Fusegates triple the length of the sill, and thus increase its discharge capacity, and help delay Fusegate overturning.

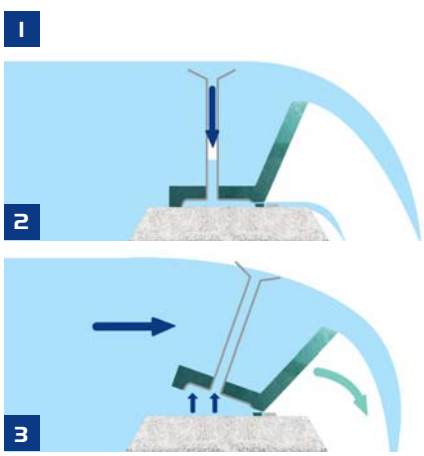


Straight-crested Fusegates
These Fusegate units are designed to withstand high headwaters up to 4 times their height. Generally, they are made of concrete and are designed to optimize the flow rate.

How do Fusegates work?

Fusegates are stable standalone structures secured on the downstream side by toe abutments.

Each Fusegate is made up of three parts: a water-retaining structure, a pressure chamber on the underside, and a water inlet stack (inlet well). Sealing joints ensure the structure's impermeability. Drain holes empty the pressure chamber if it is accidentally filled.



Normal operation

Installed atop the spillway, Fusegates form a watertight screen and raise the dam's crest. For most floods, water is discharged over the Fusegates, which act as a free-sill spillway **(1)**.

Major flooding

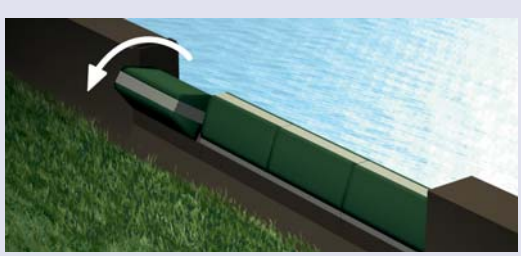
A Fusegate's pressure chamber starts to fill when the water level exceeds the crest of the inlet well **(2)**. As soon as drain holes reach their saturation point, pressure under the Fusegate lifts the unit and tips it in the downstream direction **(3)**.

As water rises, Fusegates overturn in sequence. Their tipping points are carefully set to produce this controlled, sequential action.

It is important to note that Fusegates begin to overturn only in the event of low-probability floods. First Fusegate overturn will generally occur in the following range: 100-year to 1,000-year flood events.

Folding Fusegates

Folding Fusegates do not overturn in the event of flooding. They fold away to allow headwater discharge over the crest and can be redeployed in their initial position post-flooding. An ideal solution for sites with a high probability of Fusegate overturning. However, they require more maintenance than traditional Fusegates.



River Fusegates

These straight-crested Fusegates are designed for river flood management. They are easily integrated into existing leeves and designed to accommodate moderate overtopping.

Research & development

A culture of innovation

Hydroplus systems are the result of an R&D-driven culture of innovation. The company devotes 7% of annual revenues to research and development in order to enhance the reliability and performance of its Fusegate systems.

In addition to their real-world application, Hydroplus's R&D findings appear in scientific publications and international technical conference and symposium proceedings.

Hydroplus carries out regular laboratory testing to expand its range of technical solutions

Expanding the range of applications

Thanks to studies conducted at its technical testing centre and in partnership with international scientific laboratories, Hydroplus has developed a range of new applications that addresses specific projects needs. Folding and river gates are the latest developments.

Laboratory studies have determined the system's resistance to a variety of extreme conditions, including resistance to:
- floating object impact,
- extreme cold (ice pressure, ice run-off),
- waves.

These studies have led to regular performance upgrades of the Hydroplus system.

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