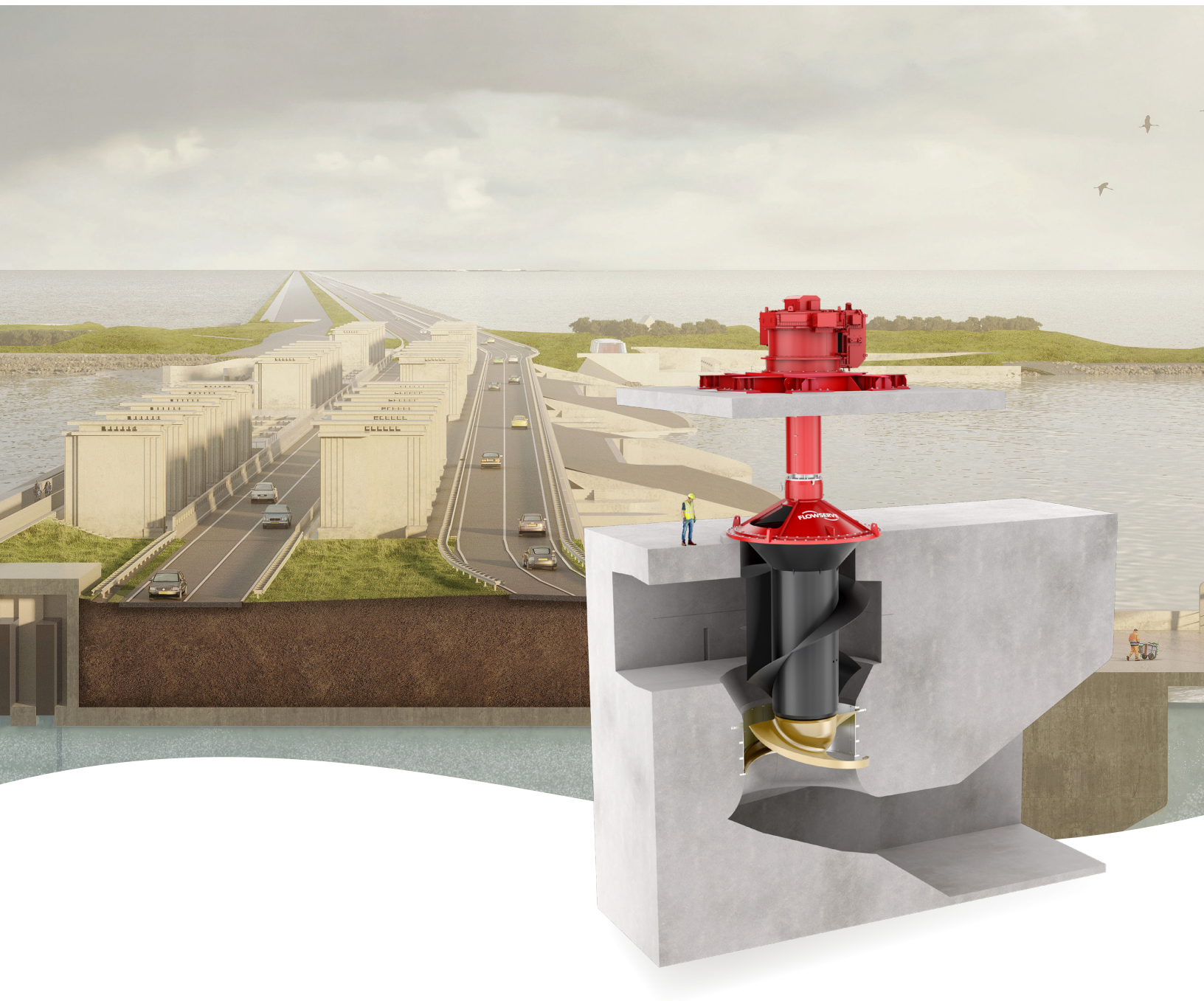




# Pumps for Flood Control and Drainage Applications



*Experience In Motion*

## The flood control landscape

Flood control and drainage applications present many unique challenges. Whether it's the daily security of a major city or the ongoing reclamation of a nation's low country, not meeting these challenges could be catastrophic and lead to lost lives and livelihoods. We understand these challenges, and we are here to partner with you to address them head-on. We can help you develop solutions that address the most pressing concerns of the industry, including:





## Equipment reliability

When it comes to flood control and drainage applications, equipment failure is not an option. Because pumps are a critical part of a complete flood control system, their reliable operation affects the system's overall performance. Pump failures in one part of the system can lead to other downstream failures that could compromise entire communities.



## Climate change

The climate is changing; as a result, the sea level is rising and extreme weather conditions are occurring more frequently. Climate change is also leading to more rainfall, leading to greater intensity of regional and local flooding. Extreme weather events that produce quick bursts of heavy rain over a short time frame can overwhelm your flood management system, leading to flooding. This can cause infrastructural damage, including disruption to roads, rail lines, airports, electricity supply systems, water supplies and sewage disposal systems.



## Aquatic life protection

You must also manage seawater and fresh water in ways that are safe for aquatic life. Pumping stations are a significant threat to fish and eels; to mitigate this threat, you should incorporate pumps with fish- and eel-safe hydraulics developed specifically to maximize safe passage of aquatic life in accordance with the latest directives.



## Regulatory requirements

Performance, efficiency and power consumption must be balanced to comply with regulatory requirements. This can be increasingly difficult, as regulations differ in various regions of the world and can also change quickly. But sacrificing pump performance or efficiency is not an option; you must consider pumps that meet demanding performance requirements and the energy use, CO<sub>2</sub> emissions and fish/eel requirements of environmental regulations. This balance can be even more complicated when retrofitting existing facilities that were not developed with sustainability in mind.



## A long flood control history

Our flood control experience with massive water projects dates back to 1928, when we installed the first pumping station with concrete volute pumps in Gemaal Lely, the Netherlands. Since then, hundreds of concrete volute pumps have been installed for flood control, drainage, irrigation and cooling water (power generation) applications worldwide.

The environmentally friendly nature of these applications requires pumps that use efficient hydraulics and fish-safe technology. Further, in these applications, pumps serve as part of an entire system, and their operation is a critical factor that affects the system's overall performance. Therefore, pumps must be reliable, as failures or unplanned downtime of a single pump can have far-reaching effects, compromising the entire operation.

For this reason, Flowserve has always worked closely with customers to generate solutions that are fully integrated with the complete system. With more than 100 years of experience in flood control management, including legacy brands like BW/IP and Stork Pompen B.V. as well as numerous applications in the Netherlands, Flowserve is considered the most recognized supplier for flood protection pumping solutions in the industry.

No other company has our depth or breadth of expertise in pre-engineered, engineered, and specialized pumps and systems for drainage and flood control. With our extensive water management experience and industry-leading product portfolio — including Worthington®, Byron Jackson® and IDP® — we can help you overcome the most complex challenges and do it in an efficient, sustainable and cost-effective way.



## Engineering expertise

Flowserve is no stranger to large-scale flood management projects and has a long history of solving massive fluid motion challenges. Whether it's the daily security of a major city or the ongoing reclamation of a nation's lowland, our equipment and application expertise can tackle the biggest flood control projects.

We understand the unique issues flood management projects face and work directly with customers to develop custom configurations built for their specific needs. And with world-class engineering and technical resources in more than 55 countries, customers have easy access to local engineering resources.



## Environmentally friendly design

Our hydraulic expertise has led to pumps that offer customers a total environmentally friendly solution by meeting aquatic life preservation requirements and helping them reduce CO<sub>2</sub> emissions.

Polder water levels are managed with pumping stations and other drainage or flood control systems installed in natural environments. These pumping stations threaten fish migrating upstream or downstream, as fish and eels are unable to pass through the pumps without injury or death.

Regulations, including the European Directive 92/43/EEG EU (The Habitats Directive) and Council Regulation (EC) No. 1100/2007, have been created to ensure the conservation of a wide range of rare, threatened or endemic animal and plant species, particularly fish and the European eel. These regulations exemplify the need to develop fish- and eel-safe pump designs.

Flowserve flood control pumps incorporate a variety of fish- and eel-safe designs to specifically meet these environmental regulations. Our pumps meet the highest fish survival rate requirements per the NEN 8775 standard while still maintaining optimum pump performance and efficiency.

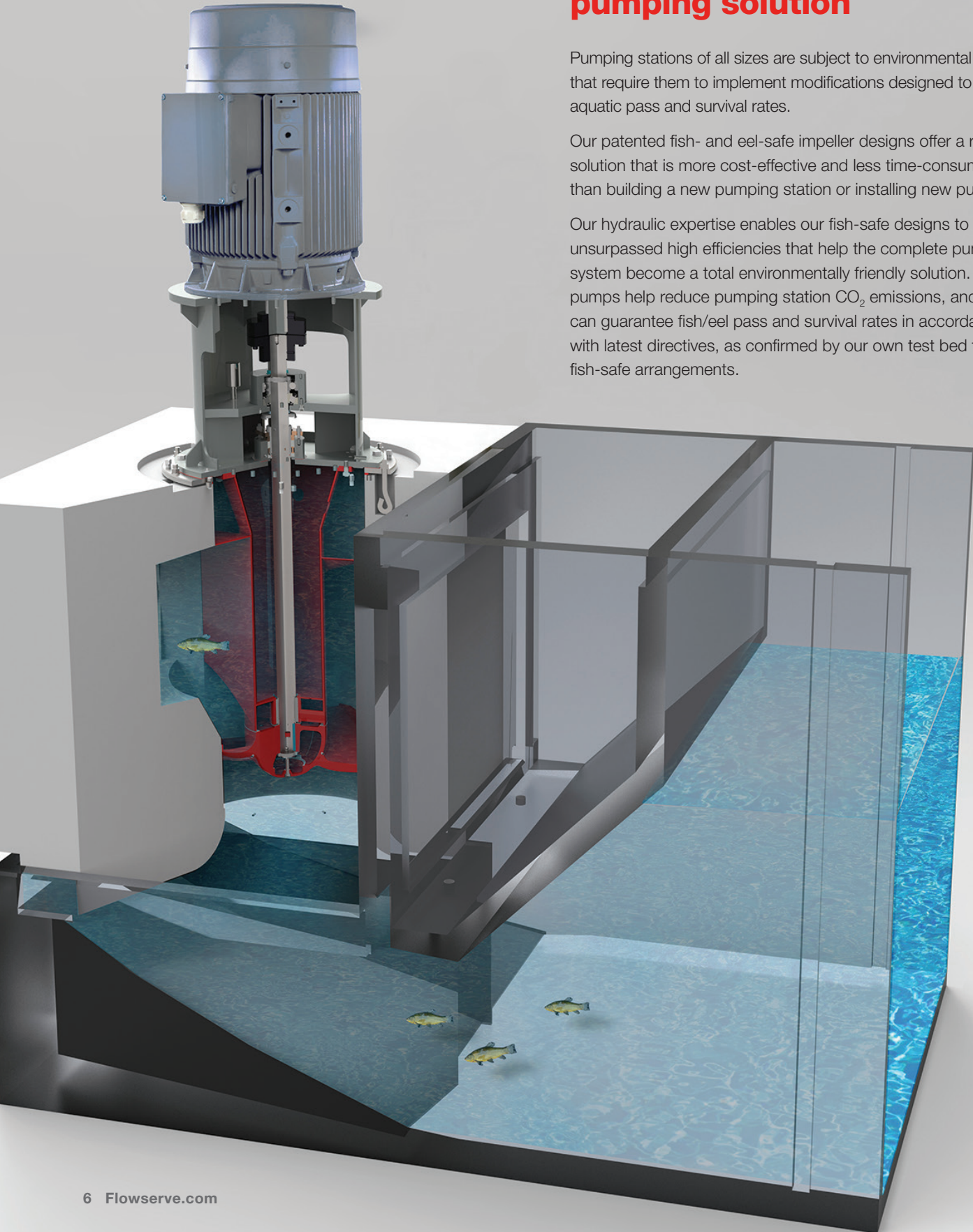


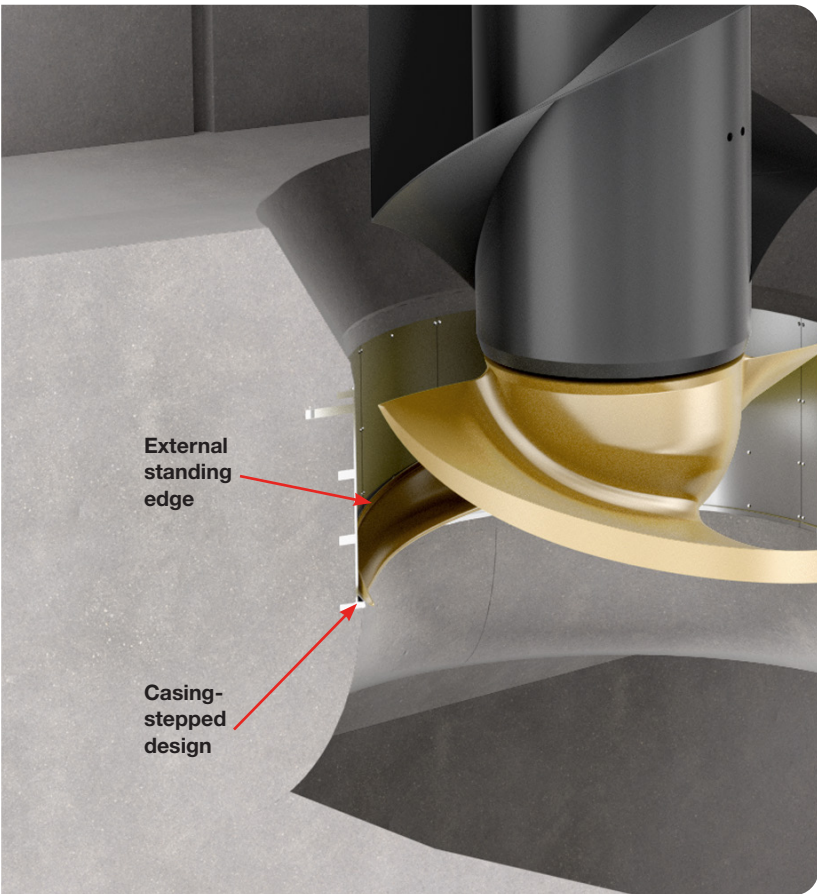
## Environmentally friendly pumping solution

Pumping stations of all sizes are subject to environmental regulations that require them to implement modifications designed to increase aquatic pass and survival rates.

Our patented fish- and eel-safe impeller designs offer a retrofit solution that is more cost-effective and less time-consuming than building a new pumping station or installing new pumps.

Our hydraulic expertise enables our fish-safe designs to reach unsurpassed high efficiencies that help the complete pumping system become a total environmentally friendly solution. Our pumps help reduce pumping station CO<sub>2</sub> emissions, and we can guarantee fish/eel pass and survival rates in accordance with latest directives, as confirmed by our own test bed for fish-safe arrangements.





## Patented fish-safe designs

Our hydraulic engineers have developed and tested patented fish- and eel-safe pump designs to maximize pass and survival rates according to the Dutch Standard Institute (NEN) 8775, while maintaining the optimum pump performance and efficiencies.

Flowserve patented features include:

- An impeller with an external standing edge all along the vane
- A casing-stepped design, which keeps aquatic life from becoming trapped
- A diffuser elbow with diffuser vanes swept forward, which avoids snipping/cutting fish or eels when they leave the impeller. See image on page 25.

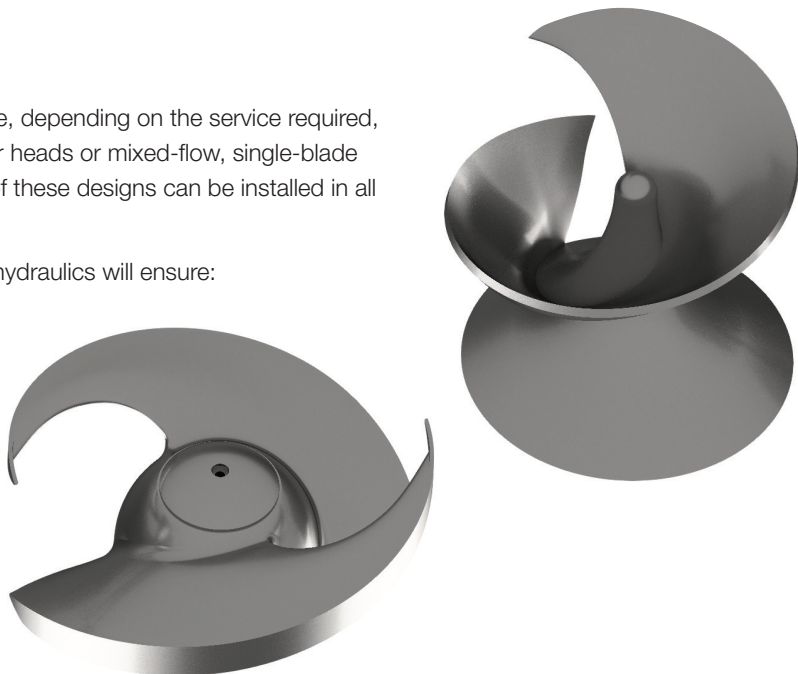
Flowserve specialists have also been an active part of the team in charge of writing the NEN 8775 standard that defines the scope of fish safety for pumps and the formula used to predict a pump's fish safety level.

## Two fish-safe impellers

Two innovative impeller designs are available, depending on the service required, including axial dual-blade impellers for lower heads or mixed-flow, single-blade impellers for higher head installation. Both of these designs can be installed in all of our mixed-flow/axial pumps.

Our highly engineered and tested fish-safe hydraulics will ensure:

- Highest achievable efficiency
- Highest achievable fish pass rate
- Reduced cavitation risk



## Engineering and testing capabilities

Flowserve tests its equipment in various ways to ensure it stands up to real-world conditions, so customers can rest assured that pumps will work as expected, even in the most aggressive applications. We can test all sizes of vertical and horizontal pumps, including large water pumps with flows up to 100,000 m<sup>3</sup>/h (440,280 gpm). With open loop testing capabilities of nearly 9 m (29.5 ft) depth, we can install vertical pumps and test them at full size and under real-world conditions.

At our campus in Etten-Leur, the Netherlands, and manufacturing facility in Madrid, Spain, engineers apply state-of-the-art design and testing capabilities to validate equipment developed to meet the most demanding water management challenges.

These extensive testing capabilities ensure long-term performance and reliability and include:

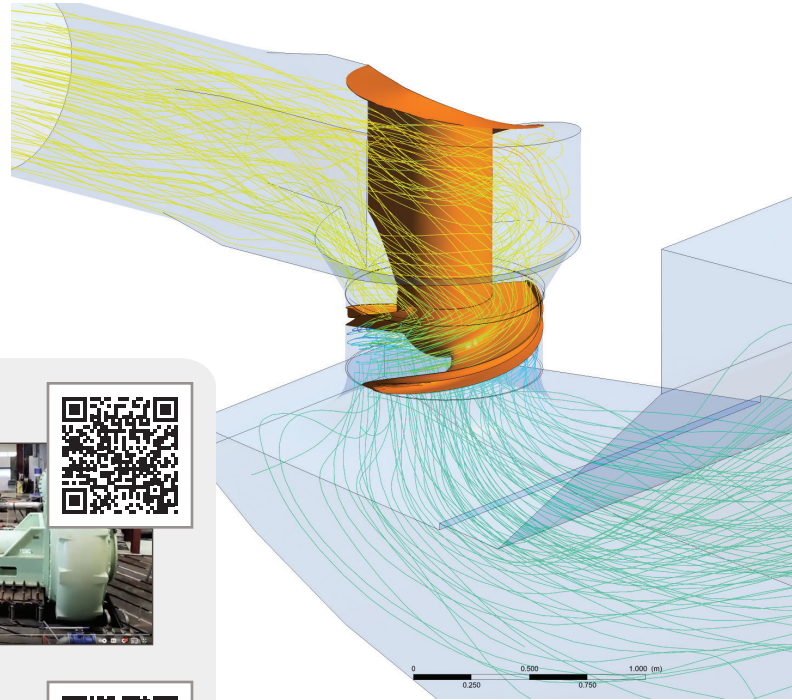
- Computational fluid dynamics (CFD)
- Finite element analysis (FEA)
- Transient pumping system analysis
- In-situ performance testing
- Vibration and acoustic diagnostics





## Cavitation visualization and scaled model testing

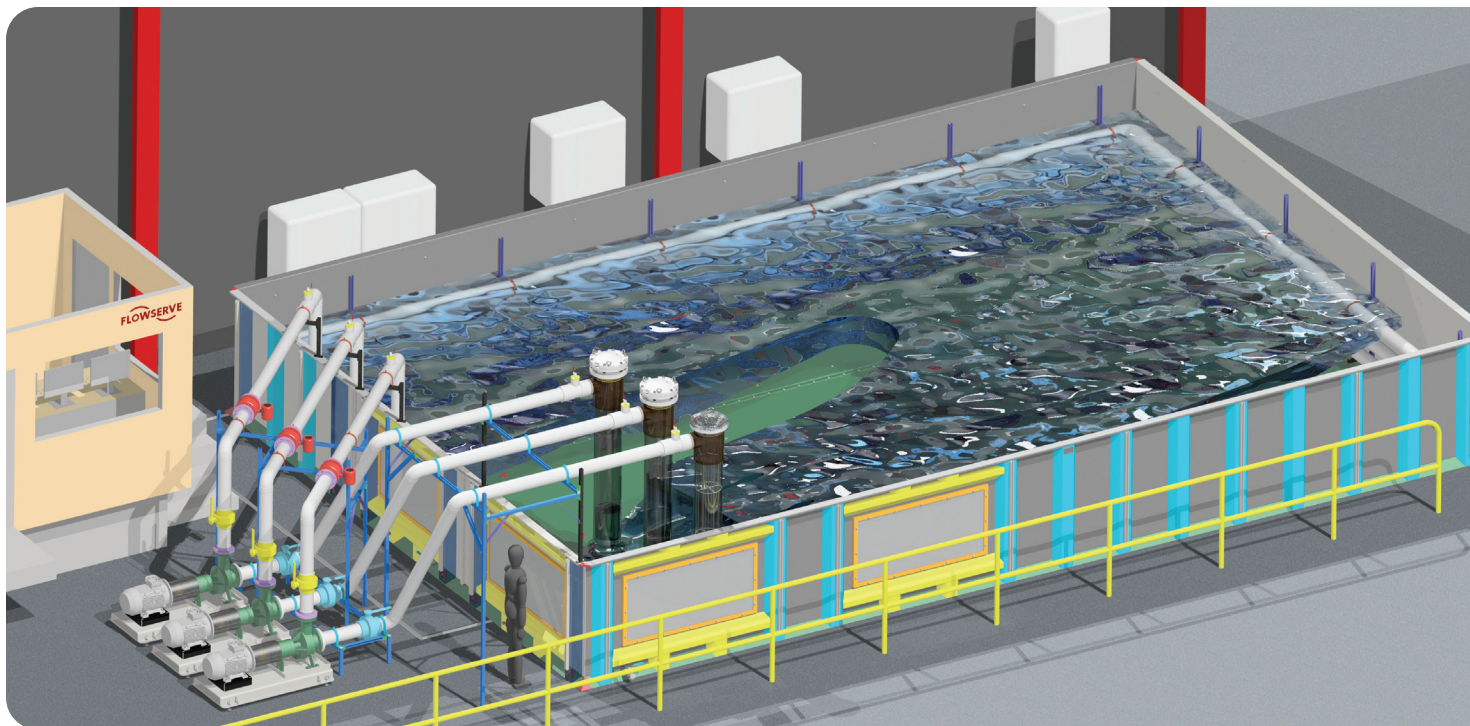
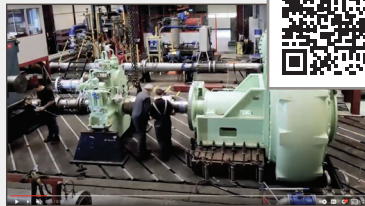
For large, high-specific speed pumps and critical NPSH applications, the Etten-Leur facility provides cavitation visualization and scaled model testing. Scaled model testing includes a dedicated loop for product and experimental tests and fully stainless-steel piping and a vacuum tank to ensure the highest cleanliness level and visibility.



## Pump intake testing

The facility provides Froude scaled pump intake testing for cooling water intake channels and sumps, surface water pumping stations and drainage stations. Free surface intakes are prone to issues related to submergence, air entrainment and vortex formation, directly impacting operational reliability.

Hydraulic engineers can improve performance and reliability by analyzing and addressing adverse approach flow conditions, free surface and submerged vortices, overall hydraulic conditions and local areas of high turbulence.





## Aftermarket capabilities

Flowserve specializes in upgrading and repairing existing water pump stations to maximize system efficiency, productivity and uptime. By revitalizing older pumps, we can help water plants lower operating costs, reduce power consumption, downtime and maintenance costs.

Our hydraulic experts can upgrade pumps to improve performance, efficiency and environmental sustainability to help even older facilities with aging infrastructures comply with new environmental regulations.

Many of our legacy brands, such as BW/IP and Stork Pompen B.V., have more than a century of experience in the Netherlands and dedicated know-how in water management. When these brands became part of the Flowserve family, they brought this intellectual propriety and specialized expertise. We also expanded our pump portfolio with other heritage brands, including Worthington®, Byron Jackson® and IDP®.

## Upgrading existing pumping stations into fish-safe alternatives

Flowserve hydraulic experts can turn any mixed/axial flow pump into a fish-safe solution, ensuring that any pumping station can be adapted to new environmental regulations.

This expertise in hydraulic development, together with the latest CFD and test experience, and our comprehensive pump portfolio make Flowserve the right choice to renew, optimize or adapt existing pumping stations to the latest fish-safe or environmental regulations.



## Dedicated water industry team

Flowserve has a specialized team with extensive flood management expertise to help customers meet unique flood management challenges. This team focuses on proposal solution development, forecasting, planning and engineering, manufacturing and laboratory testing. Having access to this expertise means customers can be assured they will get the right equipment for their needs and be confident it will perform as expected.



## Working with public entities

Because of our experience working with public entities, we can help customers navigate complex processes, from the early engineering solution development phase through the long-term maintenance requirements of their equipment.

## Project management support

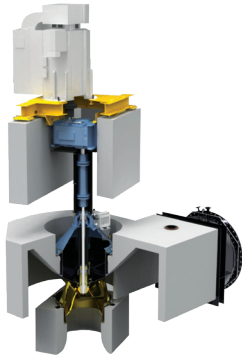
We provide a project manager who oversees all aspects of the project for large-scale projects, from start-up to final equipment delivery and commissioning. Having this resource simplifies project management and ensures equipment is delivered on time and on budget.



## Pump portfolio: At-a-glance

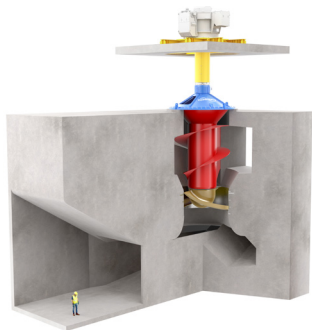
Flowserve offers a wide range of complementary pump types, from pre-engineered process pumps to highly engineered and special purpose pumps and systems. Our comprehensive pump portfolio provides a solid foundation for our specialized flood control solutions. We have engineered our flood control pumps to help you move water economically, sustainably and reliably.

We have a range of pumps ideally suited for the flood control market, including pumps engineered for low maintenance, high efficiency and minimal energy consumption. They include:



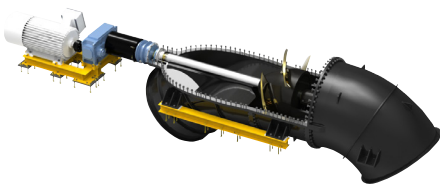
### CVP mixed-flow concrete volute pumps

CVP mixed-flow concrete volute pumps, which use prefabricated concrete volute housing and intake suction bell elements, are used in various high-capacity water applications in flood control, power generation and desalination.



### CVPS axial-flow concrete volute pump

CVPS axial-flow concrete volute pumps are optimized for very high flows and lower heads. They combine trouble-free operation with minimal maintenance.



### SHG axial-flow, horizontal elbow pumps

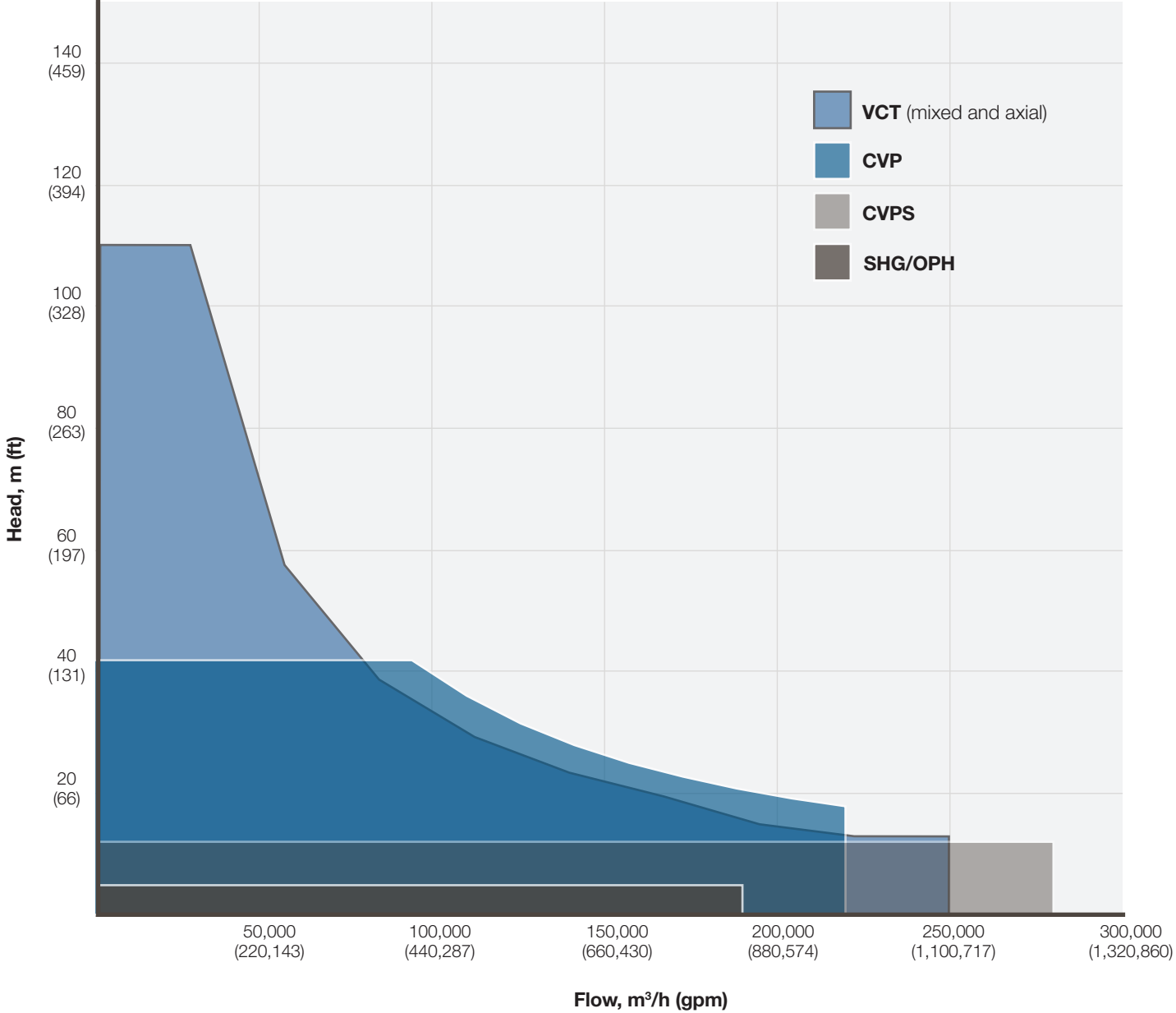
SHG single-stage, axially split, axial flow pumps are used where low heads and high capacities are needed. These pumps are often used to bring polder water over a dike or dam.



### VCT vertical wet-pit, metal casing pumps

VCT vertical wet-pit pumps are mixed- or axial-flow pumps designed for continuous duty applications requiring large capacities at relatively low pressures. They are often used in power plants, desalination, cooling water, drainage, flood protection and water supply applications.

# Range chart\*



\*For extended limits, please consult with Flowserve.

## Concrete volute pumps — Flood control giants

Flowserve is a driving force in the global engineered pump marketplace, and our comprehensive pump portfolio provides a solid foundation for our specialized flood control solutions. Having developed the first concrete volute pump in 1928, we are the global leader in designing and manufacturing these specialized flood control giants.

### Prefabricated elements

Made of prefabricated concrete segments for the volute housing and intake suction bell, concrete volute pumps are used in various high-capacity water applications for the water resources, power generation and desalination industries. These pumps have a well-earned reputation for trouble-free operation with minimal maintenance. Because they have fewer metal parts that contact water, they are ideally suited for corrosive applications, such as those involving saltwater.

### Benefits of design

**No corrosion.** Only the pump's impeller and wear ring contact water, reducing the likelihood of corrosion in seawater applications.

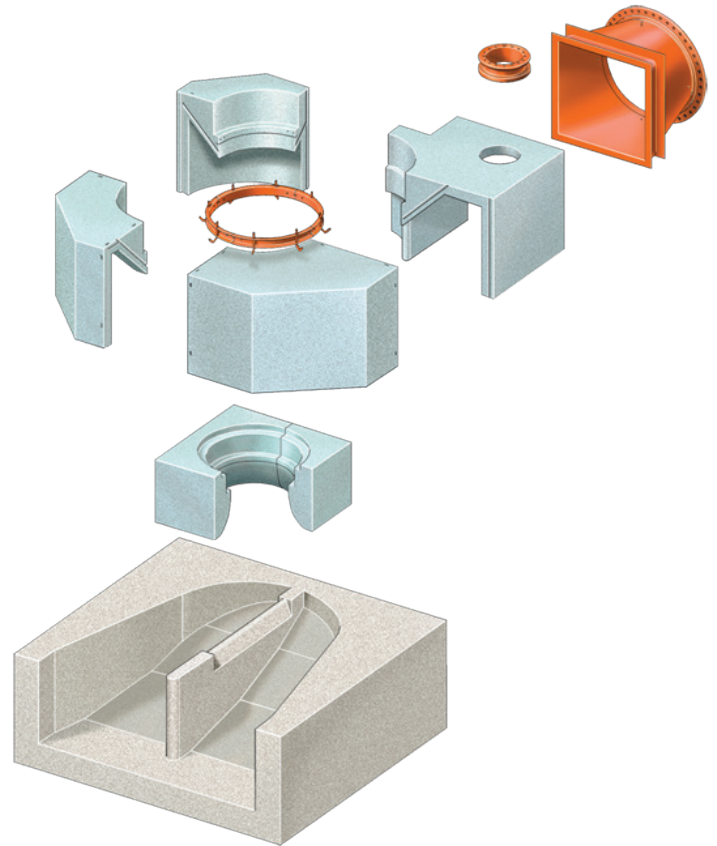
**Clog-resistant.** The pump's statically balanced impeller is clog-resistant. The impeller is flanged to the impeller hub, which is shrink-fitted to the shaft.

**No intermediate bearings.** The short, sturdy pump shaft is not wetted and does not require intermediate bearings.

**No leaks.** The shaft sealing system is leak-free, which provides long life and requires very little maintenance, increasing pump reliability.

**Easy maintenance.** CVP pumps are nearly maintenance-free. An inflatable static seal guarantees replacement of the radial bearing and lip or mechanical seal without removing the pump unit.

**High efficiency.** CVP pumps can achieve operating efficiencies higher than 90%.





## Benefits of prefabricated elements

**Longer pump life.** The concrete volute casing and suction bell substantially reduce vibration, provide excellent corrosion and erosion resistance, and significantly increase pump life while lowering materials costs and minimizing maintenance.

**Reduced construction time and costs.** Prefabricated elements significantly reduce on-site construction time and costs.

**Easy installation.** Compact design of the prefabricated elements and the pullout unit reduce excavation work and lifting heights and weights.

	Cast in situ – Other manufacturers’ pumps	Pre-fabricated elements – Flowserve CVP pumps
<b>Cost</b>	<ul style="list-style-type: none"> <li>• More expensive</li> </ul>	<ul style="list-style-type: none"> <li>• Up to 50% less cost</li> </ul>
<b>Quality Standard</b>	<ul style="list-style-type: none"> <li>• Risk in pump performance after installation</li> </ul>	<ul style="list-style-type: none"> <li>• Guaranteed pump performance (hydraulic shapes are as designed)</li> </ul>
<b>Quality Assurance</b>	<ul style="list-style-type: none"> <li>• Delays at site</li> <li>• Difficult problem resolution</li> <li>• Pump performance affected by civil execution</li> <li>• Pump supplier not having full responsibility</li> <li>• Wood affected by site condition</li> </ul>	<ul style="list-style-type: none"> <li>• Delivery times are met</li> <li>• Constant shape as design</li> <li>• Smoother surface finish</li> <li>• Best resistance to water</li> <li>• Predictable pump performance</li> <li>• Flowserve takes responsibility for volute performance</li> </ul>
<b>Construction Time</b>	<ul style="list-style-type: none"> <li>• 56 days (for four-pump station)</li> </ul>	<ul style="list-style-type: none"> <li>• 5 days (for four-pump station)</li> </ul>



## High-quality prefabricated elements

Because concrete volute pumps use high-quality prefabricated components, customers can expect higher quality, faster delivery and lower construction costs.

At a minimum, the prefabricated concrete elements of the volute and suction bell are made of grade C45/55, environmental class XS2 of NEN-EN 206-1 concrete and reinforced with FEB 500 HWL/HKN weldable steel rods. Blast furnace cement according to EN 197-1/CEMIII-A is used to resist sulfate attack, alkali aggregate reactions and chloride penetration in tropical seawater services.

The prefabricated elements are poured around a steel form to ensure a smooth surface.

American standards for concrete, like ACI 301 and ASTM C33, are also met.

## Flowserve formed suction intake

Flowserve uses a proven design for our CVP and CVPS formed suction intakes, which offer several benefits compared to a suction bend or turbine bend design, including:

- Easier installation
- Less excavation
- Less submergence
- More uniform flow and equal velocity distribution at the impeller eye

### Suction bends versus formed suction intake

#### Suction bends used

- Complex shuttering
- Deeper excavation
- Risks of vortices and non-uniform flow

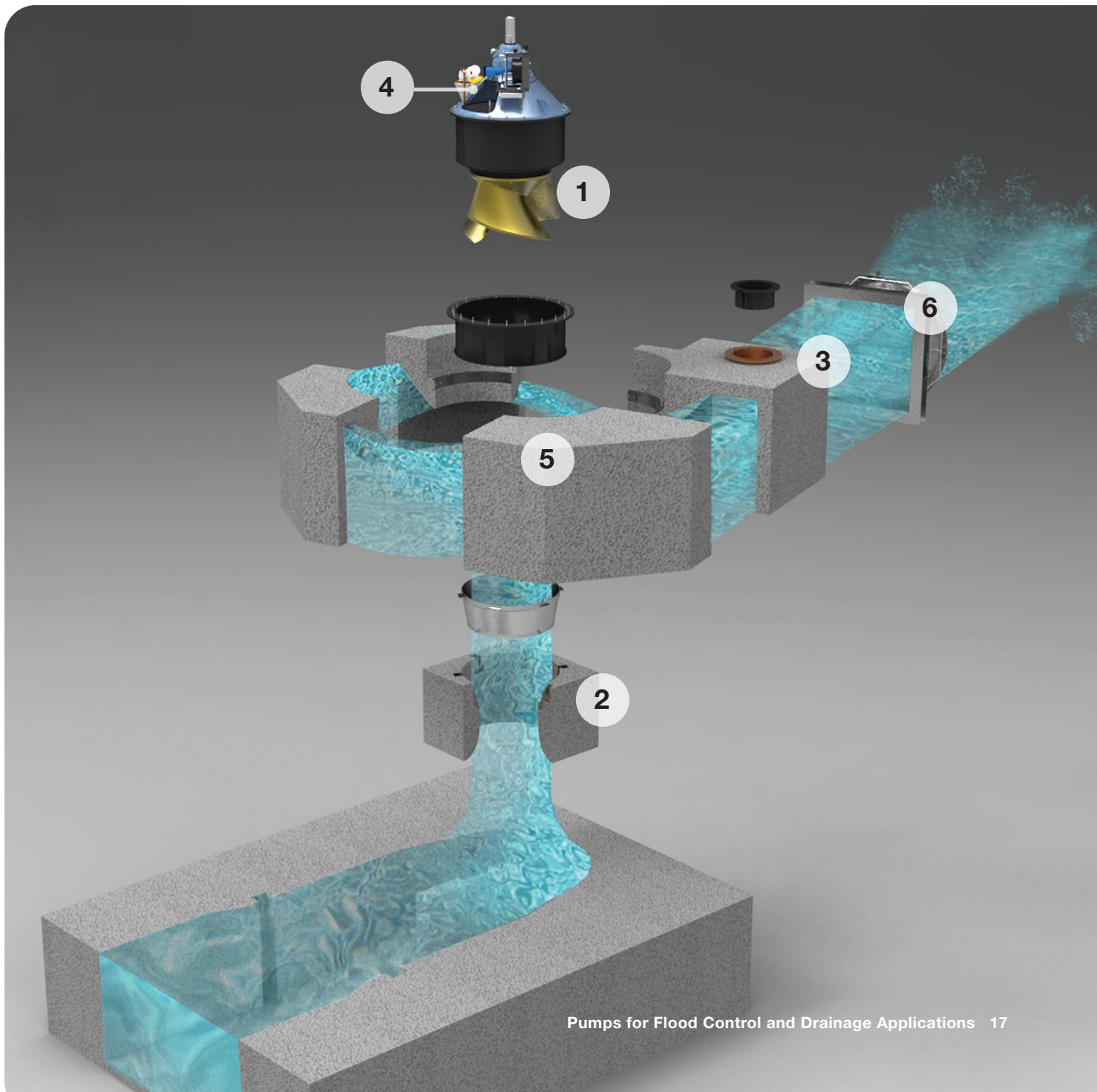
#### Flowserve formed suction intake

- Easier installation with straight walls
- Less excavation required
- Perfect fluid approach with no vortice



## Typical construction (CVP and CVPS pump models)

1. A removable, metallic pump pullout unit is located within a concrete volute.
2. Below the volute, the suction bell is connected to a preformed intake suction box.
3. A manhole permits impeller inspection without removing the pump unit.
4. The bearings and sealing systems are easily accessible via the space under the motor-gear support.
5. The square volute discharge connection is designed into the discharge channel or connected to a discharge pipeline through a transition piece.
6. The transition piece is grouted into the surrounding concrete of the pumping station.



## CVP mixed-flow concrete volute pumps

Made of prefabricated concrete segments for the volute housing and intake suction bell, CVP mixed-flow concrete volute pumps are used in various high-capacity water applications in water resources, power generation and desalination. Since they are manufactured using prefabricated components, these pumps reduce total lifecycle costs, lower construction time and costs, simplify inspection, and excel in harsh conditions such as seawater.

### Mixed-flow hydraulics

The pumps are available with two impeller types. BSV (open impeller) pumps are applicable for lower flow ranges, while BCV (closed impeller) pumps are used when a higher head is required.

### High efficiency

We design these pumps to be more than 90% efficient. Their high efficiency combined with nearly maintenance-free requirements make them an ideal solution for applications that require continuous operation, such as condenser cooling applications in power plants or flood control drainage applications.

### Fish-safe design

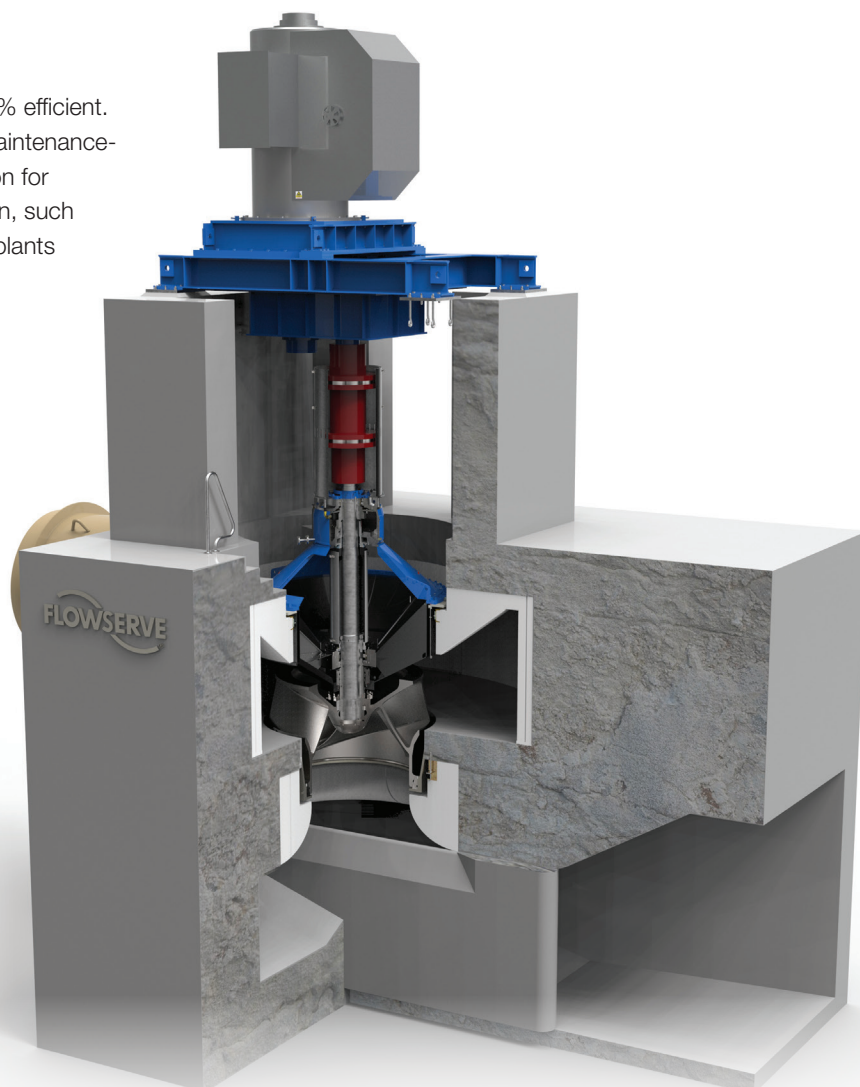
All our concrete volute pumps are available with fish- and eel-safe impellers to minimize the potential impact on aquatic life.

### Advanced bearing design

The pump's bearing design consists of a spherical roller thrust bearing and a radial roller bearing. The spherical roller thrust bearing is oil-lubricated and provided with an oil level gauge; if necessary, an oil-water or oil-air cooler can be applied. Both radial bearings are grease-lubricated.

### Pump drive

Pumps may be driven directly or through a gearbox. In the latter case, the pump shaft is connected via two spacer-type teeth couplings to the driver, thereby avoiding misalignment. The electric motor and the pump each have an axial thrust bearing.



## Design features

### 1. Short, sturdy and dry shaft design

Shaft not in contact with water → No wear or corrosion

### 2. Pump cover

Is dry and allows easy access to sealing and bearing without pump removal

### 3. Shaft sealing

Lip seal offer → Low wear and maintenance

### 4. Inflatable static seal

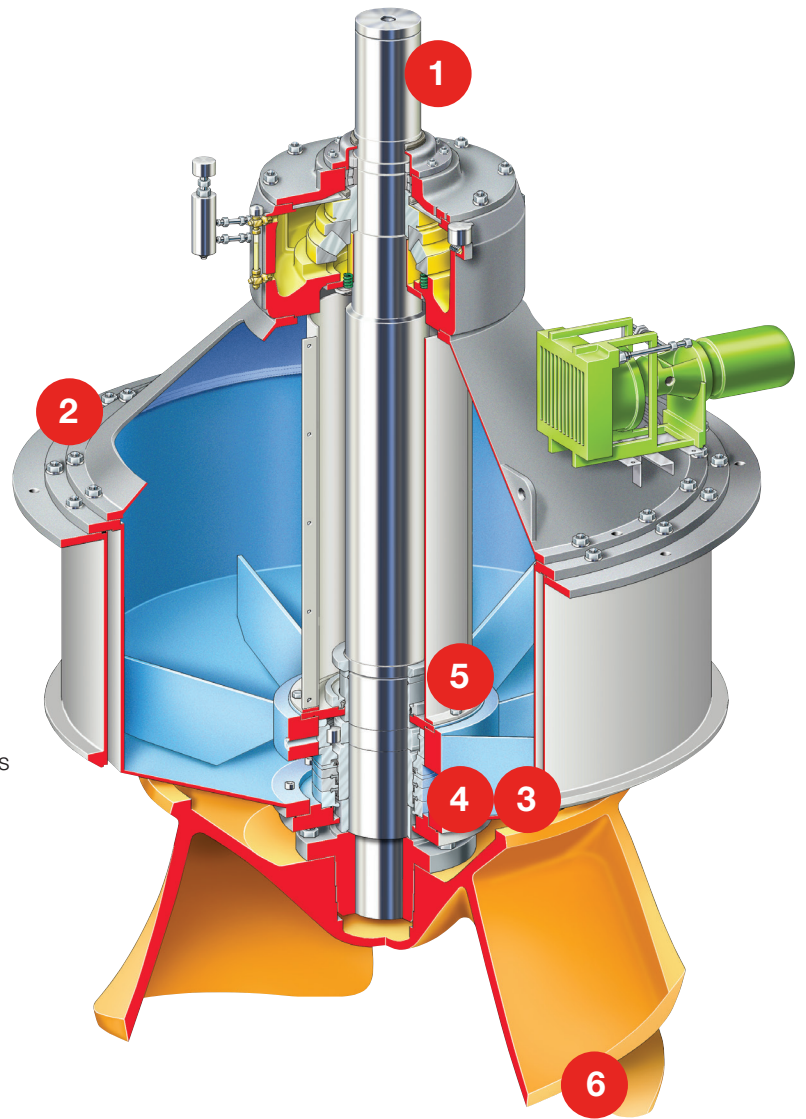
Allows removal of radial bearing or lip seal without pump removal

### 5. Low radial bearing

No contact with fluid → Standard bearings, easy access

### 6. Non-clog impeller

Closed or open impeller design prevents from an easy clogging



## Flowserve concrete volute pumps (CVPs): the backbone of today's major flood control systems



Available in English, German and Dutch

## Flowserve CVP installation process



Available in English

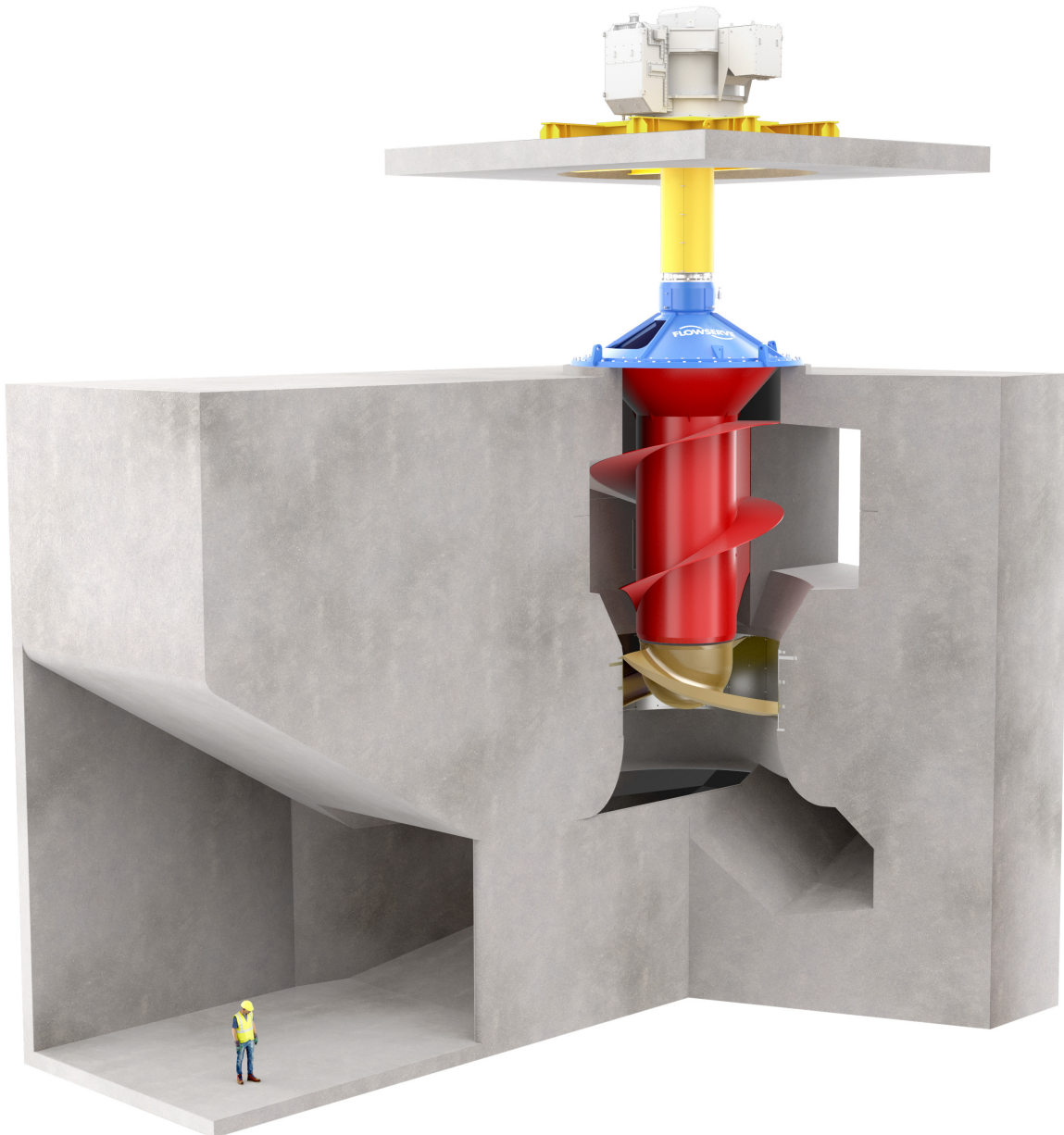
## CVPS axial-flow concrete volute pumps

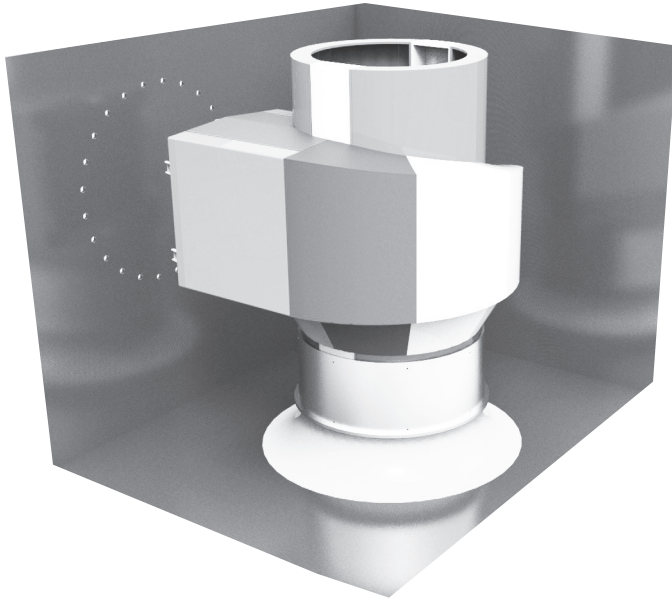
CVPS axial-flow concrete volute pumps are optimized for very high flow rates and lower heads. As with all our concrete volute pumps, the volute housing and intake suction bell of the pump are made from prefabricated concrete, and the pump assembly is integrated into the civil construction to reduce installation costs and ensure manufacturing accuracy.

### Design features

These pumps follow the same building principles as other Flowserve concrete volute pumps:

- The removable, metallic pump pullout unit is located within a concrete housing.
- Below the spiral casing, the suction bell is connected to the preformed intake suction box.
- Technicians have easy access to the sealing system via space under the motor-gear support.
- The square volute discharge connection is designed into the discharge channel or connected to a discharge pipeline through a transition piece.





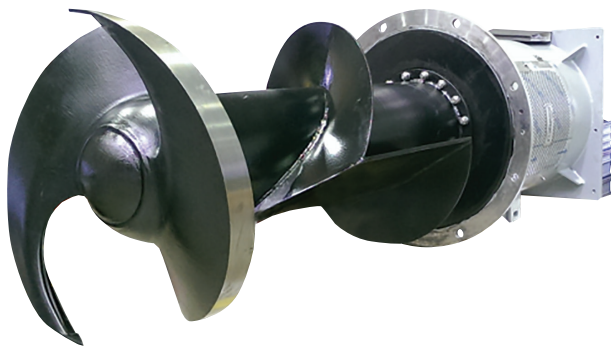
### Spiral casing

The pumps have a spiral casing that allows for smooth and efficient flow guidance from the axial impeller outlet to the radial concrete volute. The spiral vane profile matches perfectly with the volute ceiling profile, as they are both designed as one single hydraulic element, ensuring a virtually seamless transition for the water path.



### Adjustable vanes

When fish-safe technology is not required, traditional four-blade impellers are used. Furthermore, pumps may be fitted with adjustable vane impellers that can be fixed at installation and modified, if required by the system, by easily extracting the pullout unit.



### Fish-safe impellers

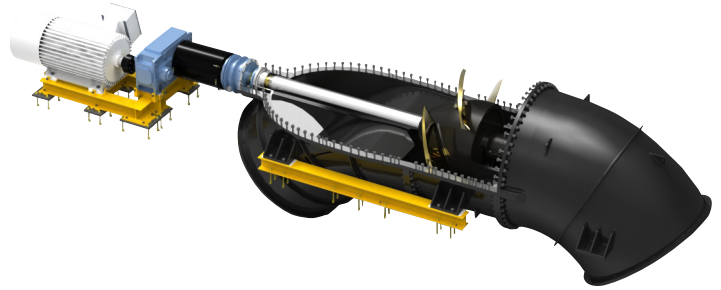
CVPS pumps are available with fish- and eel-safe impellers to minimize the potential impact on sea life. An example of these engineering masterpieces is the six CVPS-F pumps in the Afsluitdijk in the Netherlands. The largest and most advanced concrete volute pumps ever built, they include 4.6 m (15.1 ft) diameter fish- and eel-safe impellers.

## SHG axial-flow horizontal elbow pumps

The SHG pump is a single-stage, axially split, axial flow pump. Within Flowserve, this pump is called a “cat’s back pump” and is used where low heads and high capacities are needed, mostly to bring polder water over a dike or a dam.

When the pump is not used, the system is not filled. To prime the pump at start-up, a vacuum system is used to prevent reversed flow. A vacuum breaker valve is opened at shutdown, making the pump safe and not necessitating the damming or draining of a channel for pump inspection and maintenance.

The unique suction box design improves water inlet and flow distribution, allowing for increased capacity without cavitation problems. If necessary, these pumps can use fish-safe impellers.



## VCT vertical wet-pit, metal casing pumps

VCT vertical wet-pit metal casing pumps are designed for extended operation in services where large capacities are required at relatively low pressures. Ideal for wet-pit installations, they offer multiple hydraulic combinations and design features to suit a range of application needs. Additionally, they provide trouble-free, high-capacity capabilities with outstanding operating efficiency.

### Assembly of 71APM VCT vertical circulating water pump

In 2013, the Flowserve operation in Coslada, Spain, assembled one of the largest vertical circulating pumps in that location's history.

[Watch here.](#)



### Pump advantages

The pumps offer numerous advantages over other pump types, including:

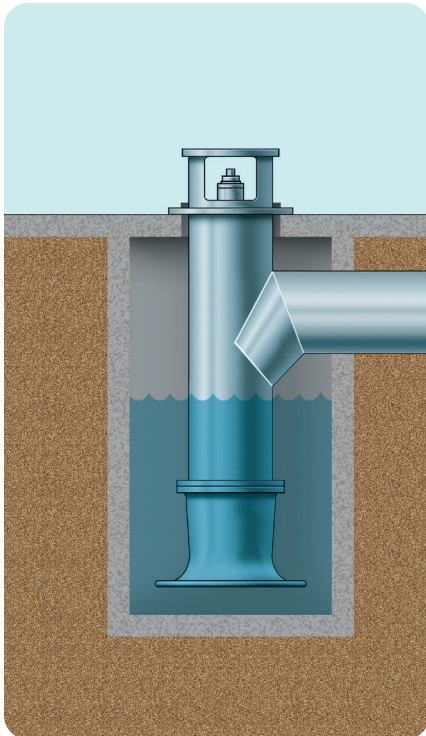
- Efficient operation over the entire speed range
- First-stage NPSHA can be increased by extending the column length
- Possibility of reaching higher heads with more than one stage and specific hydraulics
- Tailored for the application, thus able to fit existing sumps
- Widest hydraulic coverage in the pump market due to more than 200 years of incorporating legacy brands
- Accurate alignment due to male and female rabbit fits at all critical flanged joints

## Engineered solutions

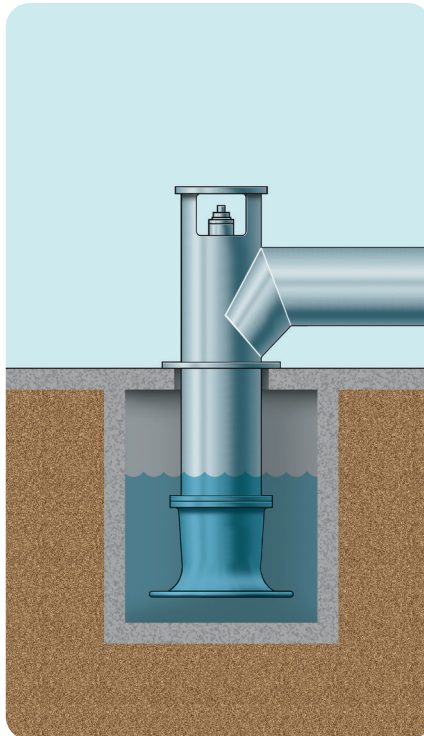
VCT vertical wet-pit pumps offer a high degree of design flexibility and are engineered to customer specifications to meet performance and installation requirements. Custom elements include:

- Mixed- or axial-flow hydraulics
- Suction bells with straightening vanes
- Open or closed impellers
- Fabricated or cast columns
- Above- or below-grade discharge configurations
- Pullout or non-pullout construction
- Inner columns available
- All motor configurations (directly coupled, double deck, long spacers)
- Discharge heads with integral bearing housings
- Grease, freshwater or self-lubricating column construction
- Mechanical seal or soft packing
- Fixed or variable pitch blade impellers

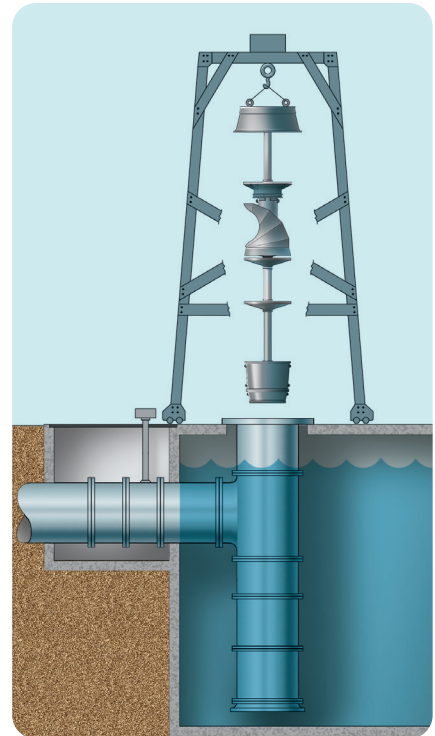
To ensure the proper pump design for your application, we offer extensive testing and analytical capabilities, including intake scale model testing as well as FEA and torsional, lateral, seismic and vibrational modeling.



*Below ground discharge*



*Above ground discharge*



*Pullout design*



## Mixed-flow models

Mixed-flow VCT pumps, including VOA, KX, VX, RX, APM, APH and WX models, are designed for continuous duty in medium to high capacity and low- to medium-pressure services. These pumps are available in single or multistage heavy-duty configurations. They are typically used in various water transfer, desalination, power, chemical, liquefied natural gas (LNG), and oil and gas applications.

## Axial-flow models

The VCT vertical wet-pit, metal casing pump portfolio also includes a wide range of axial-flow legacy models designed for continuous duty at higher capacities and low to very low pressures. These include the VOP and AFV models. These pumps are often used in drainage, flood control, water transfer and river intake applications due to the lower heads required. Axial-flow impellers, like those on VOP models, have adjustable vanes that can be set at assembly and fixed in a specific position to optimize performance.

## Fish- and eel-safe impellers and diffuser elbows

VCT mixed- and axial-flow pumps also are available with fish- and eel-safe impellers. These impellers reduce the pump's impact on aquatic life and further sustainability. Other pumps can be upgraded to include fish- and eel-safe impellers and diffuser elbows.

Diffuser elbows assist flow to improve its path through discharge, reducing losses and improving the pump's fish safety performance.



*VOP axial-flow pump*



*Fish- and eel-safe impeller and patented diffuser elbow*

## Proven successes

### The Netherlands' Afsluitdijk causeway

Flowserve's concrete volute pumps play a vital role in the Netherlands' Afsluitdijk causeway, which protects the country from catastrophic flooding.

The Afsluitdijk causeway dams off the Zuiderzee, a saltwater inlet of the North Sea, and turns it into the IJsselmeer, a freshwater lake. At 32.2 km (20 mi) long and 91.4 m (300 ft) wide, the causeway is an engineering marvel and a symbol of the country's constant struggle against flooding from the sea.

When the Netherlands decided to renovate and improve the causeway, the country opted for Flowserve CVPS pumps because they offer a reliable, efficient, environmentally friendly and cost-effective solution to protect the country and its citizens for decades to come.

Flowserve has been the supplier of choice to install six CVPS pumps, capable of pumping 846,000 m<sup>3</sup>/h (3,724,769 gpm) in total, or nearly six Olympic-sized swimming pools per minute.

The pump's rugged, compact concrete construction virtually eliminates corrosion and vibration problems, which reduces maintenance labor and costs. And the pump's pullout design simplifies installation and enables the pumps to be installed once the civil work is completed, reducing installation costs.

Flowserve CVPS pumps not only meet the Afsluitdijk's performance needs, but they also meet its environmental requirements. These pumps are among Flowserve's most

environmentally conscious pumps; they combine efficient hydraulics and pumping capabilities with a fish-safe hydraulic design, making them non-destructive and safe for aquatic life, and a perfect addition to the Afsluitdijk's new pumping stations.

With flood control, failure is not an option. Countless lives and livelihoods depend on reliable flood protection, which is why the Netherlands trusts Flowserve equipment and application expertise when tackling the most critical flood control projects.





## Dallas' Trinity River Corridor project

When Gulf Coast hurricanes, severe storms and a surge in rainfall increased the flood risk for Dallas, Texas, the city decided to upgrade its flood control infrastructure. The Dallas Floodplain Management Team installed 11 Flowserve CVP pumps in its upgrades to the city's pump stations. The team selected the CVP pumps because of their history of reliability and proven performance in large-scale European flood management projects.

Flowserve CVP pumps protect the city of Dallas from flooding, prevent loss of life, and alleviate infrastructural and environmental damage. By using the pumps, the city has increased its pumping capacity by 117%.

The city also lowered its cost of ownership. Traditional metal pumps require annual refurbishing, but Flowserve CVP pumps can operate for years with minimal maintenance, reducing the city's total cost of ownership (TCO). Lower maintenance requirements stem from the pump's design, which limits vibration and resists corrosion and erosion.

Dallas also increased flood control reliability. Pump reliability is crucial in flood management projects. Unexpected repairs and downtime can not only drive up operating costs but can put citizens at risk. With its continuous operation and minimal maintenance requirements, the Flowserve CVP pumps can achieve 100% uptime.





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