

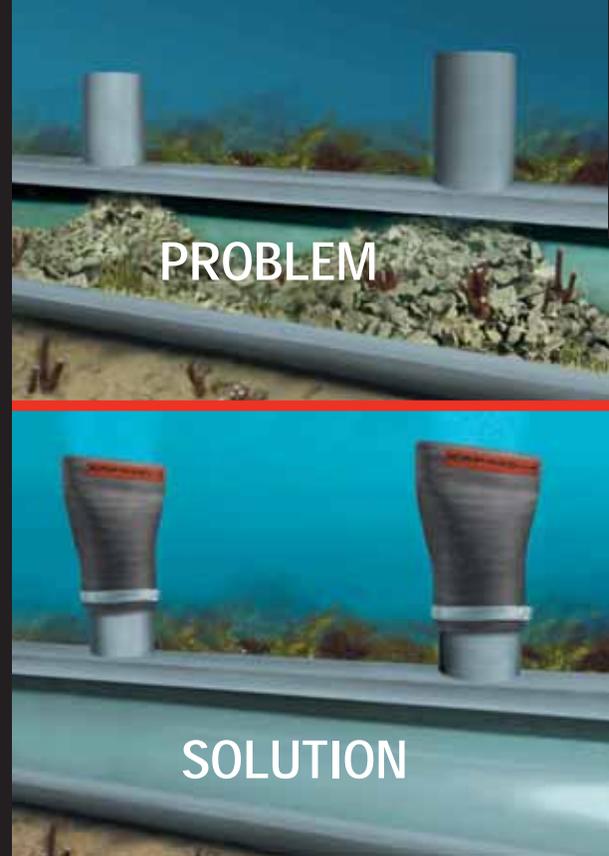
# Tideflex®

EFFLUENT DIFFUSER SYSTEMS



# Your Partner in Engineering, Design and Technical Analysis for Effluent Diffuser Systems

**Tideflex®  
Technologies**



## T I D E F L E X ® D I F F U S E R V A L V E S

**Consulting engineers worldwide specify Tideflex® diffuser valves for superior performance on effluent diffuser applications.**

Effluent outfalls typically incorporate multiport diffusers that discharge effluent over a wide area through numerous ports, rather than through one large open-ended pipe. Providing a cost-effective means of achieving high initial dilution, multiport diffusers minimize the impact of municipal and industrial discharges on the environment.

The most important item on an effluent diffuser system for controlling initial dilution is its port size. A diffuser system's ports ensure that peak flows can be dis-

charged with a limited amount of driving head, ensuring that ports are the correct size and have the proper configuration is critical.

### **LIMITATIONS OF CONVENTIONAL MULTI-PORT DIFFUSERS**

The ports of conventional diffusers are holes that were cast or drilled into the outfall pipe, or risers extending from the crown. Referred to as “fixed-orifice” ports, these holes cannot prevent the intrusion of sand, mud, debris and salt-water into the diffuser pipe.

Sediment that enters the diffuser pipe reduces the hydraulic capacity of the outfall, leading to the need for additional pumping operations or causing overflows to bypass outfalls. Additionally, if the ports become blocked — even partially — by accumulating sediment, the diffuser will operate at a reduced dilution efficiency, creating a risk for permit non-compliance and higher bacterial or constituent concentrations on the shore.

### **TIDEFLEX® MULTI-PORT DIFFUSERS**

Tideflex® diffuser valves overcome the challenges associated with conventional multiport diffusers, enabling diffusers to operate at peak performance. Tideflex® diffuser valves prevent intrusion of sediment and salt water and optimize diffuser hydraulics and, therefore, eliminate concerns of clogging. In addition, because the valves feature a non-mechanical, all-rubber construction, they will not corrode and remain unaffected by marine growth. Tideflex® diffuser valves, virtually maintenance-free, have revolutionized effluent technology for marine and inland outfall lines in municipal and industrial applications.

# Tideflex® Diffuser Valves:

- Prevent intrusion of debris, sediment, salt-water and aquatic life
- Provide proven long-term, maintenance-free service life
- Enhance jet velocity
- Improve initial dilution
- Provide a more uniform flow distribution across ports



Photo taken from Tideflex® Technologies effluent diffuser video, which reviews actual diver inspections of numerous worldwide outfalls.

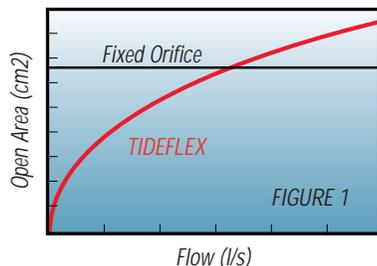
## THE TIDEFLEX® VARIABLE ORIFICE VS. FIXED-DIAMETER ORIFICE

### VARIABLE AREA

In addition to preventing intrusion, backflow and clogging, Tideflex® diffuser valves also enhance the hydraulics of multiport diffusers. Unlike fixed-diameter ports, in which the open area remains constant, Tideflex® diffuser valves are inherently variable orifice by design. As Figure 1 illustrates, the open area increases as flow increases, and decreases as flow decreases.

### ENHANCED JET VELOCITY

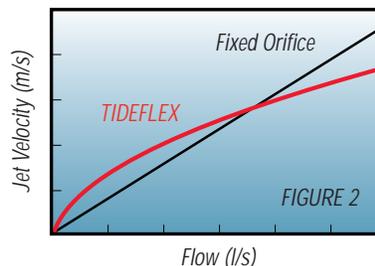
As Figure 2 illustrates, the Tideflex® diffuser valve's variable orifice improves jet velocity, or momentum, providing as much as three times the jet velocity of fixed orifices at low flow. This is important because the jet velocity of the flow through each port is a key component for optimizing dilution.



### REDUCED HEADLOSS

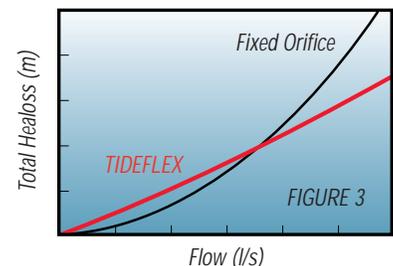
Figure 3 shows the headloss comparison of a fixed-diameter port and the Tideflex® diffuser valve. The headloss of a fixed orifice is a function of the flow rate squared. The Tideflex® diffuser valve's variable orifice generates less headloss at peak flow, increasing the peak capacity of the outfall, reducing the number of overflows and minimizing energy costs associated with pumps.

Able to meet jet velocity requirements often mandated by environmental agencies, Tideflex® diffuser valves still generate an acceptable headloss at peak flow. Sizing fixed-orifice ports to generate a similar jet velocity at low plant flow, on the other hand, typically results in excessive headloss at peak flow.



### ELLIPTICAL PLUME

Another advantage the Tideflex® diffuser valve offers is its elliptical rather than circular-shaped plume. Independent testing in Oregon and Hong Kong found that this slot-type geometry is proven to provide superior dilution because the receiving water body can disperse the elliptical plume much more quickly than the circular plume. This benefit may be especially desirable for diffusers with stringent water quality standards at the Zone of Initial Dilution (ZID) or other mixing zone boundary.





Twenty 250mm Tideflex® diffuser valves on a 1.5 km outfall in Viña Del Mar, Chile.



Eighty 200mm Tideflex® diffuser valves installed on multiport riser caps in Hong Kong.

## MARINE OUTFALLS

**Effluent diffusers that discharge to oceans, estuaries and bays are faced with challenges of strong currents, waves, tides, sediment transport and boat traffic.**

These conditions can result in intrusion of sediment and salt water into the outfall, which reduces the hydraulic capacity and dilution efficiency of the diffuser. Since salt water is usually heavier than effluent, it can intrude through the ports even while effluent is discharging.

Once salt water has entered the outfall, it can block numerous ports, imbalance the hydraulics, introduce sediment into the diffuser, promote marine fouling and cause effluent particles to floc and deposit on the bottom of the pipe.

Evacuating sediment from an outfall and rehabilitating the diffuser pipeline typically costs thousands, or even millions, of dollars for large ocean outfalls. Even more of a problem, however, than the expensive repairs is that, with conventional fixed-orifice diffusers, intrusion can recur, requiring continual, costly service.

Tideflex® diffuser valves, however, with an all-elastomer “duckbill” design, prevent intrusion of salt water, sediment and debris and keep the outfall operating at peak hydraulic capacity and dilution efficiency. In addition, independent tests in Hong Kong have established that diffusers fitted with Tideflex® diffuser valves purge salt water even at extremely low plant flow, allowing all ports to consistently flow. This is beneficial both for the commissioning of a new outfall and for an outfall that has been retrofitted with Tideflex® diffuser valves.



Series 35-D

### Industrial Discharge

- Pulp & Paper Mills
- Textile Mills
- Chemical Plants
- Dye Plants
- Food Processing Plants
- Power Plants



Twelve 6" Tideflex® diffuser valves with integral three-foot- long rubber risers discharging to a shallow river.



A 30° orientation from the horizontal discharge angle enhances dilution from this pulp mill diffuser.

## INLAND OUTFALLS

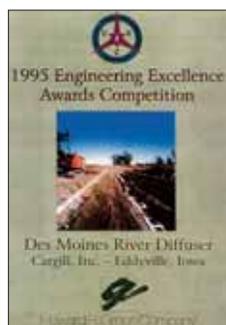
Outfalls that discharge to inland waters, such as rivers, streams and lakes, often exhibit problems with intrusion of sediment and debris into the diffuser. Incorporating Tideflex® diffuser valves on new diffusers or retrofitting existing diffusers, prevents backflow and ensures the outfall will operate as initially designed.

In addition, the effluent typically is the same density as the receiving water body, meaning there is no buoyancy difference to assist in increasing dilution. The receiving body in inland outfalls often has a limited assimilative capacity and a limited depth. Jet velocity, therefore, is critical, since it alone can optimize initial dilution.

The Tideflex® diffuser valve's variable orifice enhances jet velocity throughout the range of flows. This, along with the elliptical plume of the Tideflex® diffuser valve, improves overall dilution.

Tideflex® diffuser valves assist municipal and industrial dischargers in meeting stringent typical water quality

standards established by regulatory agencies. This not only includes bacterial standards for municipal wastewater, but toxic standards for industrial discharges as well. In addition, diffusers with Tideflex® diffuser valves have also been installed at textile, pulp and paper, and dye plants specifically to disperse colored effluent to eliminate unsightly "slicks."



Forty-four 4" Tideflex® diffuser valves installed on this award-winning diffuser system for a food processing plant discharging to the Des Moines River. ▶



One hundred, twenty nine 4" Tideflex® valves with 16" square flanges were retrofitted over original 2" fixed-orifice ports on a reinforced concrete outfall in California.

The four-hole, square-flanged 35-SQ Tideflex reduces installation costs and minimizes stress on the outfall pipe.



## RETROFITTING EXISTING DIFFUSER PIPELINES

Available with slip-on, circular-flanged and square-flanged fabricated connections, Tideflex® diffuser valves can accommodate almost any effluent diffuser system.

The slip-on valves can be clamped to the outside diameter of riser pipes, and circular-flanged valves can be fastened to any flange, including ANSI and DIN drillings. The square-flanged valves can be fastened directly to the outside diameter of an out-

fall pipe. Common for outfalls that rest on the riverbed or seabed unburied, the square-flanged valves have a four-hole arrangement, compared to an eight- or twelve-hole pattern, that minimizes localized stress and makes installation easier.

### FLEXIBLE RISERS AND ELBOWS

The risers incorporated in buried diffusers are usually metal or plastic and, therefore, prone to being sheared from the outfall by impacting debris, anchors, nets, etc. These breaks allow considerable amounts of riverbed or seabed bottom material to backflow into the outfall.

Tideflex® diffuser valves can be integrally fabricated with all-rubber risers and/or elbows. They are flexible, durable and designed to deflect and

return when subjected to impact loads such as those from anchors and nets. Having Tideflex® diffuser valves fabricated with rubber risers and elbows ensures only flexible components are above the seabed or riverbed, eliminating physical damage to the diffuser.

Tideflex® diffuser valves can be retrofitted to any diffuser system operating at a reduced efficiency. They prevent backflow of sediment and salt water and optimize the hydraulics by generating higher jet velocity at low flow and providing a more uniform flow distribution. Tideflex® diffuser valves are especially suited for emergency overflow outfalls or decommissioned outfalls since they are susceptible to severe intrusion and marine fouling.



TF-D



35D with 90° elbow



35D with 45° elbow



35D with rubber riser



300mm rubber risers with two 200mm Tideflex® diffuser valves. Multiport risers achieve dilution while minimizing the number of risers.



Eighteen 8" series 35D valves with integral 90° elbows for effluent diffuser in Georgia.

## HYDRAULIC DIFFUSER ANALYSIS

### Your Partner in Engineering Design and Technical Analysis for Effluent Diffuser Systems.

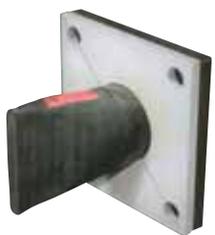
Each diffuser system is unique. Tideflex® Technologies has conducted extensive hydraulic tests on Tideflex® diffuser valves from 2" (50 mm) to 48" (1200 mm) and has developed an exclusive computer program to assist engineers in designing multiport diffusers. The program includes data analysis on headloss, total headloss, jet velocity and effective open

area. This data can be compared to conventional fixed-orifice diffuser designs to illustrate the hydraulic advantages of Tideflex® valves.

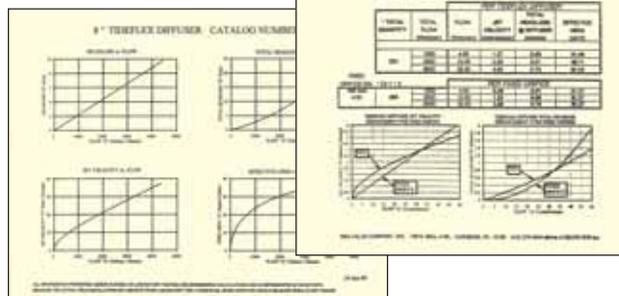
Also available for individual Tideflex® valves are graphs of headloss, total headloss, jet velocity and effective open area organized in a "4-pack" format.

For a diffuser nozzle hydraulics analysis, please contact our engineering department.

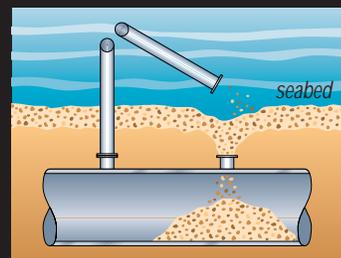
Your special diffuser valve design is our standard.



35 SQ square flange

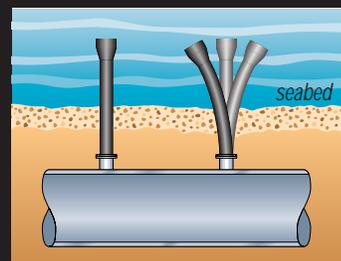


### PROBLEM

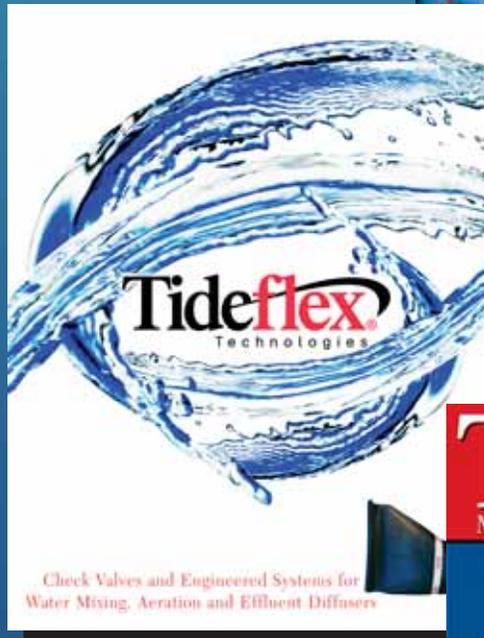
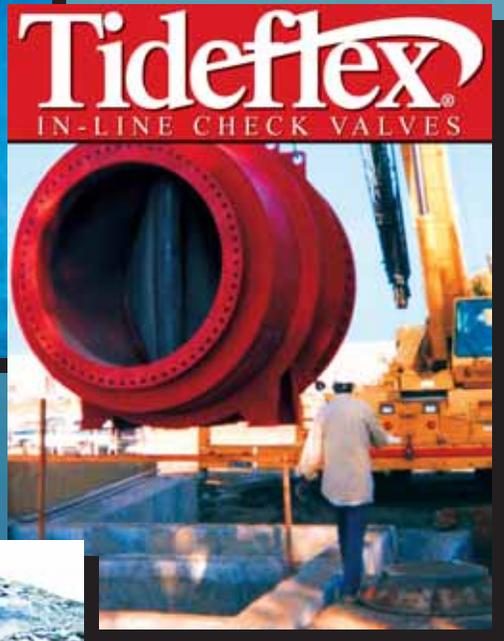


Plastic and metal risers are rigid and are prone to being broken from diffuser pipeline.

### SOLUTION



Tideflex® check valves with integral rubber risers and elbows are flexible, eliminating damage from boat anchors, nets and debris.



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