HydroStyx®

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CLEARLY WASTEWATER

Flow Brake

Key Features & Benefits:

- Optimises the potential storage capacity of the pipe system
- High peak flows are attenuated
- Discharge flows are decelerated
- Reduce hydraulic & ecological stress
- Ability to retrofit into existing systems

How We Create Value:

- Low maintenance
- No external power source or control required
- Optimising existing storage capacity in the system

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Jacopa / Steinhardt HydroStyx® system is installed to reduce hydraulic peaks at overflows and pollution / flooding at residential areas. The HydroStyx® discharge brake enables an efficient and sustainable sewer system management using uncomplicated mechanical principles. At the same time existing drainage facilities remain in use.

This non-powered mechanical sewer system management tool is an attractive and cost-effective method compared to the more commonly recognised regulation provided by computer-based measurement, control and remote control technology.

HydroStyx® equipment is suitable for installation in shafts of large diameter trunk sewer systems prior to combined sewer overflows which tend to prematurely discharge and thus not operating in accordance with good engineering principles.

HydroStyx® discharge brakes are a stainless steel technical solution intended for installation in sewer chambers; retrofitting within exiting manholes is also possible. For new construction, discharge brakes can be designed to suit pre-cast chamber rings.

The basic principle of HydroStyx® discharge brakes is based upon the retention of the water (combined, surface water) in a sewer system or a stretch of a sewer network by means of installing a cascade arrangement. This method can utilise unused or partially used volume. HydroStyx® also delays the outflow of storm-water into the receiving structure.

HydroStyx® discharge brakes are mechanically operated and require no external energy source (exceptions are the SPS-controlled models). The equipment is distinguished by its long-life as well as by a permanent high degree of operational reliability. The HydroStyx® system is always designed to accommodate the maximum discharge of the sewer whilst maintaining the efficiency of the sewerage network.

A basic difference must be noted between the fixed weir brake and the moveable swinging brake. Fig 1 shows examples of both types. In the following sections, the basic features of both types of brake are outlined.

Fig 1

Weir Brake With float controlled bottom outlet.

Swing Brake

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HydroStyx® weir brakes are fixed elements made of stainless steel which act to hold back the discharge at a fixed 'surcharge' level. Depending upon the site characteristics, the gate panels can be straight, profiled or curved and of varying dimensions. A bottom outlet with the function of a flow regulator is mounted on the front of the gate. A flow of higher value than the dry water flow is discharged through this cross-section ($Q_{out,Brake} \geq Q_{dw}$). In order to modify the bottom flow outlet, a cross-section with an adjustable throttle plate can be fitted.

The weir brake is overflowed when (i) the inflow exceeds the outflow at the bottom outlet and (ii) when the storage volume is full. The retention volume is defined by the volume which results when the water level reaches the height of the overflow weir upper edge. The maximum water level reached when the weir is overflowed will be determined at the scheme planning phase. It is important that the sewer's design overflow volume can be released over the discharge brake without danger in an emergency in the event that the bottom outlet should become blocked.

The overflow weir can be height-adjustable. This enables a later adjustment of the surcharge height according to sewer network's requirements.

Any changes to the settings following installation - whether to the throttle plate at the bottom outlet or to the discharge brake itself - should only be carried out under the supervision of competent personnel in order to prevent adverse consequences for the operation of the sewer system. All subsequent changes to settings must be recorded and a protocol issued as proof. Regular checks are required.

HydroStyx® discharge brakes can be installed in existing or newly constructed manhole chambers. The equipment can be delivered in sections to accommodate existing smaller access openings. Additional adapters are then used to enable a flexible fitting to the side walls or transom.

The HydroStyx® weir brake

The HydroStyx® weir brake consists of a stainless steel retaining wall with a flow opening for the bottom outlet discharge. The technical design and dimensioning of the brakes are established in accordance with the results of the hydraulic calculation and take into consideration the individual receiving construction. The length of the brake depends on the required length of the internal overflow at maximum hydraulic load. The brake can be manufactured straight-edged, semi-circular or polygon-curved as well as in units on request. The equipment is systemised but can be adapted to local conditions on request as long as a specially designed model is not required.

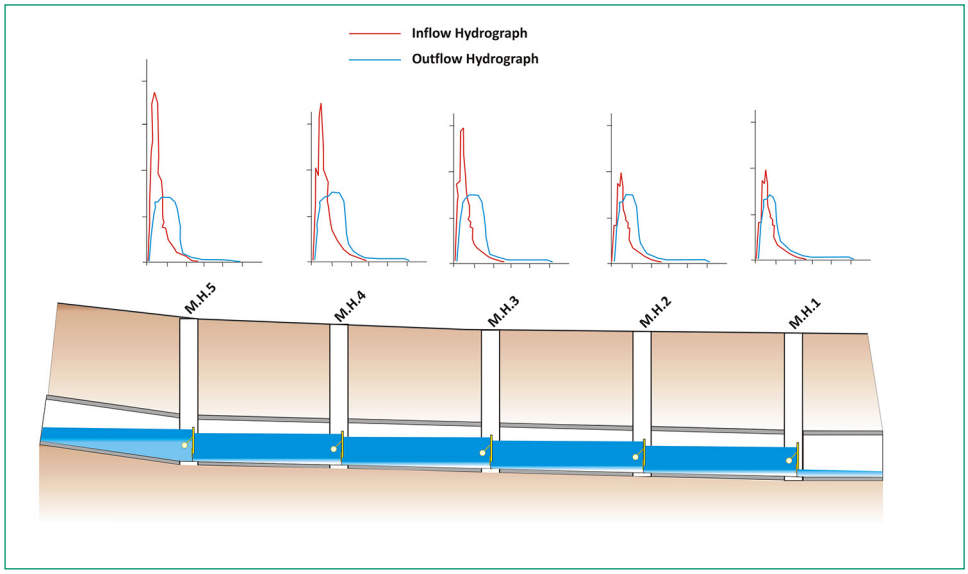

Fig 2 - This shows the utilisation of the pipe capacity to attenuate the peak of the storm flow.

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The HydroStyx® swinging brake

The HydroStyx® swinging brake consists of two swing gate elements that open with the flow direction. The swinging gates are fastened to hinged, vertical axles. These hinges are dowelled into the concrete wall. The axles of the swinging gates are coupled via a gearbox to a counterweight which ensures that the gates can withstand the water pressure (hydrostatic and impulse force) from the impounded water column. The counterweight keeps the gates closed up to a pre-defined upstream water level and then allows them to open gradually as the water level increases. When the upstream water level sinks, the counterweight causes the gates to shut against the water pressure. The variable angled positioning of the discharge gates enables differing heights of flow through the HydroStyx® whilst retaining the maximum backwater level.

For security reasons a float control is installed below the water surface. When backwater occurs from downstream the float rises and forces the swinging gates to open. This avoids a reduction in the performance of the outflow which would otherwise result and the danger of flooding is averted.

A hand-wheel on the gear box can be used to open the swinging gate manually in case of an emergency or in dry weather when maintenance work is to be carried out. The emergency hand-wheel can be installed above ground but must be installed above the maximum possible water level.

Basic method of operation of the discharge brakes

The method of operation of a HydroStyx® discharge brake can be described as follows:

Illustrations 1 and 2 show the conditions schematically

The dry weather flow or another defined flow rate such as 2 x DWF for example passes unhindered through the specially calculated and adjusted cross-section of the bottom outlet opening. Depending on the layout, a defined discharge (e.g. Q Design) passes through. The cross-section must be designed to correspond at least to the rate of dry weather flow. (Illustration 1)

When the flow increases during a storm event, the brake creates an upstream surcharge condition in the sewer. The surcharge is permitted to rise to a defined level (overflow weir top edge / for the swinging gate set at a defined level). The sewer volume is used as retention space. The bottom outlet remains active (Illustration 1; Illustration 2).

The designed surcharge volume corresponds to the volume resulting from the water level up to the top edge of the overflow weir. With swing gates the backwater level does not necessarily correspond to the upper edge of the swinging gate; rather it is set by the counterweight.

After the surcharge level has been reached (designed attenuation volume), the water flows over the overflow weir into the next cascade or flows through the swinging gate. The maximum water level for such a case must be taken into consideration in the planning phase.

Illustrations 3 and 4 show where the inflow exceeds the bottom outlet flow and the surcharge volume has reached its maximum level; the swinging gates open ensuring that the maximum permitted water level is not exceeded.