

Applications & Solutions

5th Edition

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The perfect solution for each application.

The NIVUS group is a worldwide leading developer, manufacturer and supplier of measurement systems for the water economy.

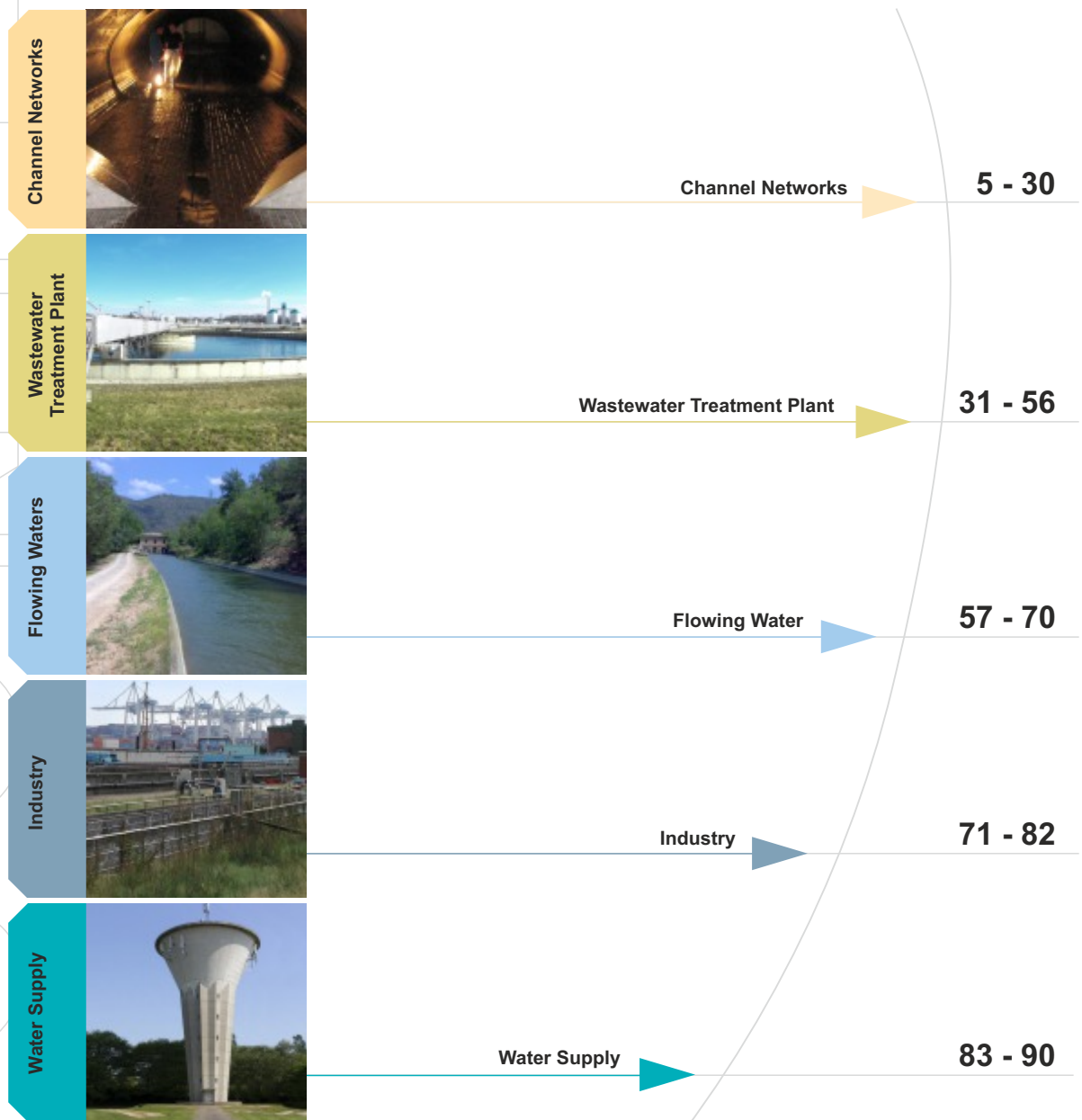
Our product range comprises measuring systems for flow and level measurement. Furthermore we carry out challenging urban drainage monitoring projects.

This collection of applications is intended to give you an overview on our fields of operation.

If you should not find your application in this collection - please contact us.

Our experienced application engineers gladly will assist you finding your solution.

Give us a call - Phone +49(0)7262-91 91-0



Channel Networks



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Flow Measurement in Channel with Dry Weather Flume

Application

- Segmented rectangular channel, 3 m width,
- Made of concrete
- Part filled
- Channel with dry weather flume and side space



View of measurement place

Definition of Task

- Accurate detection of dry weather discharge and combined water discharge

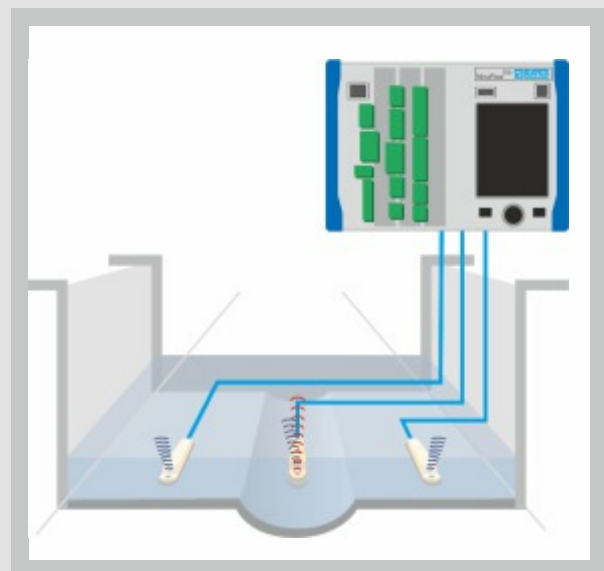


Solution

- A measurement system Type NivuFlow 750 M3 with several flow velocity sensors has been used.
- To detect low volumes, the first sensor has been installed in the dry weather flume. Sensors 2 and 3 have been installed left and right of the dry weather flume on the side step. In combination with sensor 1 they detect flow velocities at higher levels or the discharge of combined water.

Advantages:

- Quick and easy programming due to pre-set channel shapes.
- Utilisation of 2 analog outputs using appropriate scales for dry weather and rainy weather and hence high resolution of readings.



Installation principle

Flow Measurement in Channel that could not be shut down

Application

- The need to replace the existing Time of Flight without shutting down the flow.
- 4m deep channel
- Application required to be installed in just 1 day



View of measurement place



Definition of Task

- To be able to measure Flow without shutting down the works.

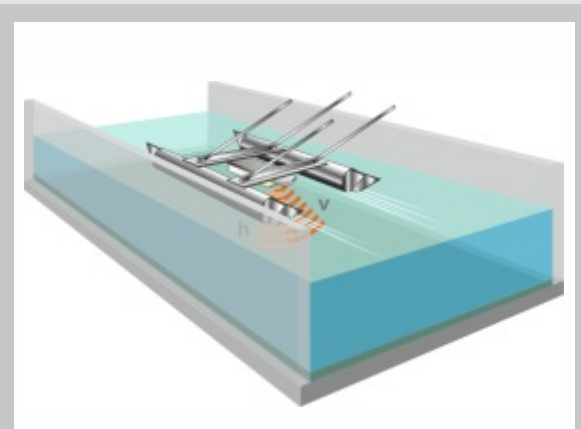


Solution

- A measurement system Type NivuFlow 750 has been used.
- Rather than mounting the sensor on the floor of the channel we used a catamaran boat system and mounted the sensor to look top down into the channel.

Advantages:

- No disruption to the works.
- No need to shut down the flow.
- Complete NIVUS system was installed within one day.



Installation principle

Flow Measurement in Pipe that could not be shut down

Application

- To supply high accuracy flow meter on a new works application, cost was an issue and maintaining a Mag meter was another issue.



View of measurement place

Definition of Task

- The task was to find savings by not installing a Mag meter in a chamber size of 4.5 m x 4.2 m as the cost was circa 120k due to the flowmeter size and size of chamber.

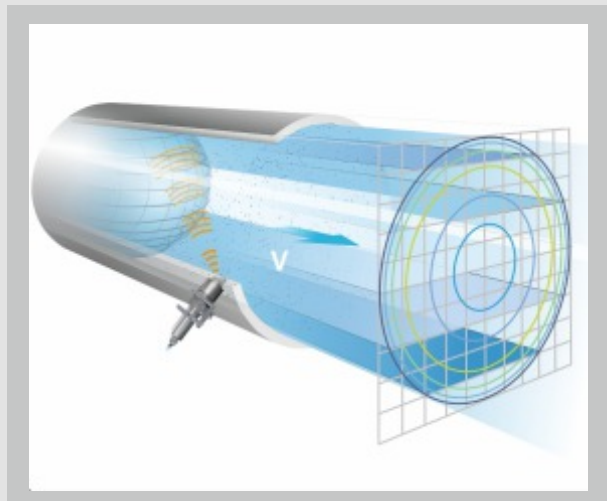


Solution

- A measurement system Type NivuFlow 750 has been used.
- We were able to install the NIVUS Pipe sensor without shutting down the flow using live under pressure tapping.

Advantages:

- Cost saving on project was 108k.
- No need to shut down the flow.
- Complete NIVUS system can be installed in half a day and is very easy to maintain



Schematic diagram

Flow Measurement in large Collector Duct

Application

- Trapezoid canal with dry weather flume and sloping bottom, 10 m x 2.5 m (w x h)
- Part filled
- Old concrete
- Lateral inflow upstream of measurement place



Situation on site

Definition of Task

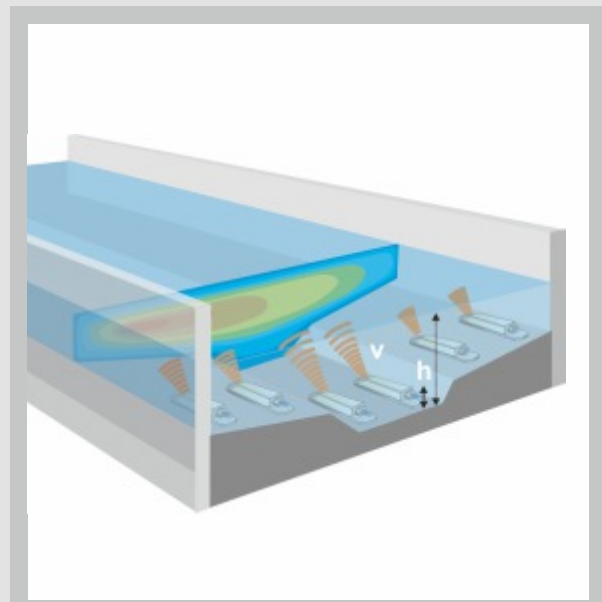
- Detection of combined sewage discharge between 200 l/s and 20.000 l/s (nighttime discharge - rainfall)
- High accuracy of the system despite curved canal and lateral inflow upstream of measurement place
- System should be insensitive to soiling

Solution

- An ultrasonic cross correlation system type NivuFlow 750-M9 was used which can be used in connection with up to 9 flow velocity sensors.
- Two wedge sensors installed on the bottom of each the dry weather flume as well as the left and right berm reliably detect the heavily distorted velocity distribution within the special profile.

Advantages:

- Scientifically proven hydraulic models which have been implemented in the transmitter ensure high accuracy
- The cross correlation method and the flow-optimised sensors guarantee high resistance to soiling



Measurement Setup

Precipitation Measurement with GPRS Transmission

Application

- Investigation of precipitation volumes for billing purposes within a water association consisting of several communities
- Setup of 7 precipitation measurement spots to detect stormwater volumes
- Transmission of detected data to central access point via GPRS desired



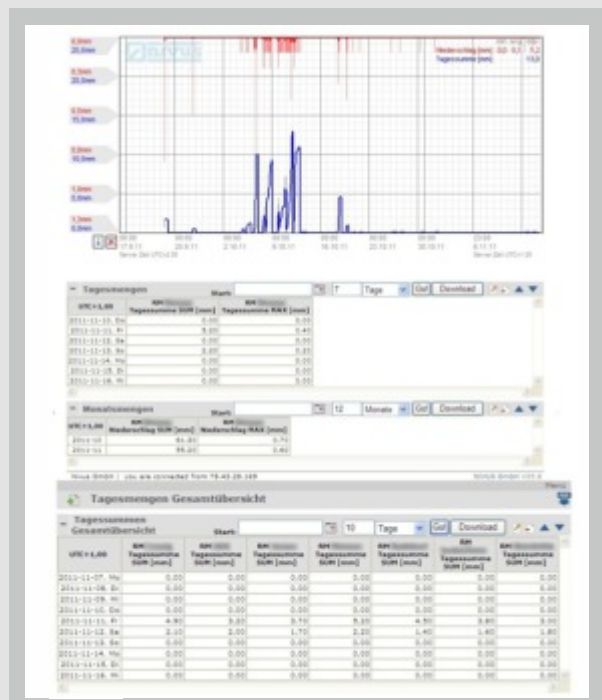
Rain Gauge with NivuLog Easy

Definition of Task

- Four rain gauges have been available for the detection of precipitation volumes so far which however had to be read out manually. The data then had to be put together manually as well
- For more accurate detection of precipitation distribution 3 additional measurement spots are to be set up

Solution

- Three new rain gauges have been installed additionally. Then each of the 7 measurement stations has been equipped with a NivuLog Easy unit for data storage and GPRS transmission.
- The data loggers are supplied by using the power supply of the rain gauge heating.
- The "Device-to-Web" data portal independently creates all required statistics as daily and monthly values and gathers the data in a common spreadsheet. This significantly facilitates overall evaluation.
- The communities connected additionally get separate access to their readings so that the previously required manual data exchange is no longer necessary.



Graphical representation and D2W statistics

Replacement of Measurement with inverted Syphon

Application

- Rectangular concrete channel, approx. 2.5 x 2.5 m (w x h)
- Part filled
- Impoundage shield installed later in the channel with inverted syphon and EMF DN 800



Old EMF system

Definition of Task

- Detection of very low to very high flow rates
- Highly reliable system without formation of backwater and aerosols
- Resistant to sludge formation

Solution

- The installed EMF, which failed to measure at low flow rates due to sludge formation and detected only parts of the flow rates due to impoundage and emergency discharge, was removed.
- The channel was equipped with a float fixed to the ceiling. The float includes a flow velocity sensor which, immersed into the medium, detects the velocity distribution based on the cross correlation principle.

Advantages:

- No backwater in the channel
- No unpleasant odours due to aerosols
- No sludge formation within measurement pipe
- High accuracy at very low as well as maximum flow rates



Installed Float

Hybrid Flow Measurement in Main Collector

Application

- Hood profile 2200 x 1980
- Part filled and full
- Precast concrete parts
- Sedimentation and temporary overflow



View of Measurement Place

Definition of Task

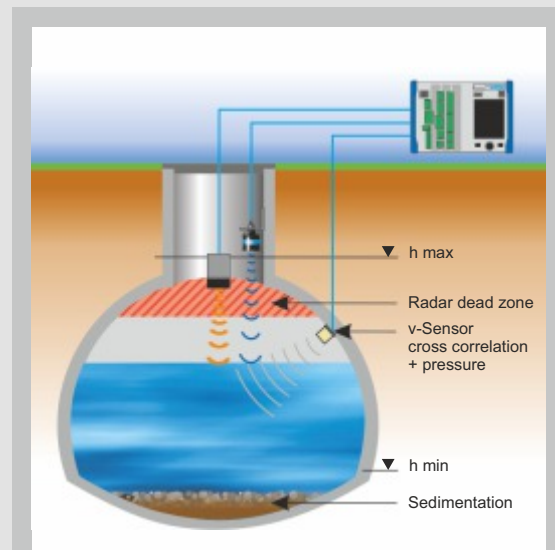
- Detection of flow rates in a large main collector of a combined sewage channel network ranging from low nightly discharge to flood events
- Due to sedimentation, stones and debris sensors cannot be installed on the channel bottom
- At rainfall events the collector may be completely flooded and may build up pressure

Solution

- The newly developed NivuFlow 7550 hybrid system with combined flow velocity measurement using contactless surface radar and a laterally installed medium-contacting cross correlation sensor was used.
- The part filled level is detected using ultrasound from top down, high levels and flood are detected by the pressure cell integrated in the cross correlation sensor.

Advantages:

- Contactless detection of flow rates in dry weather and at nighttime.
- Reliable flow measurements even under extreme discharge conditions and overflow.



Representation of Application

Flow Rate Monitoring on Pumps

Application

- Cast iron pipe DN 200
- Full filled
- Old existing line (condition unknown), installed pipe system cannot be modified



Installed Clamp-On System

Definition of Task

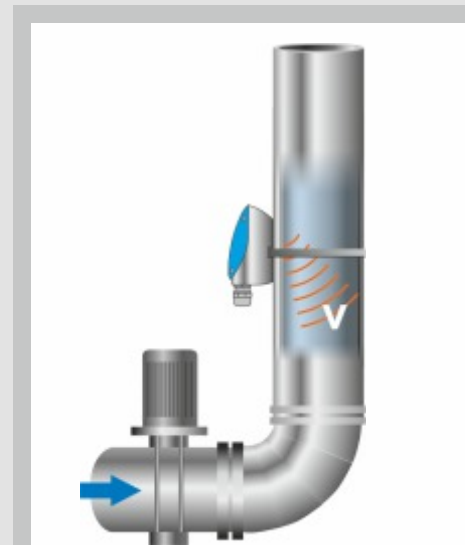
- Flow rate monitoring of feed pump to detect clogging and dry run
- Tendency monitoring of feed pump to detect wear and tear
- Optimisation of repair and maintenance intervals
- No high accuracy required (permissible error higher than 10 %)
- Good reproducibility

Solution

- A clamp-on) Doppler sensor Type NivuGuard 2 was used.
- The sensor provides a flow-proportional 4-20 mA signal as well as a digital error message signal directly to the telecontrol substation installed on site.

Advantages:

- Direct connection to the PLC available on site (no transmitter required)
- No modification of old pipeline necessary



Principle of contactless Flow Rate Monitoring

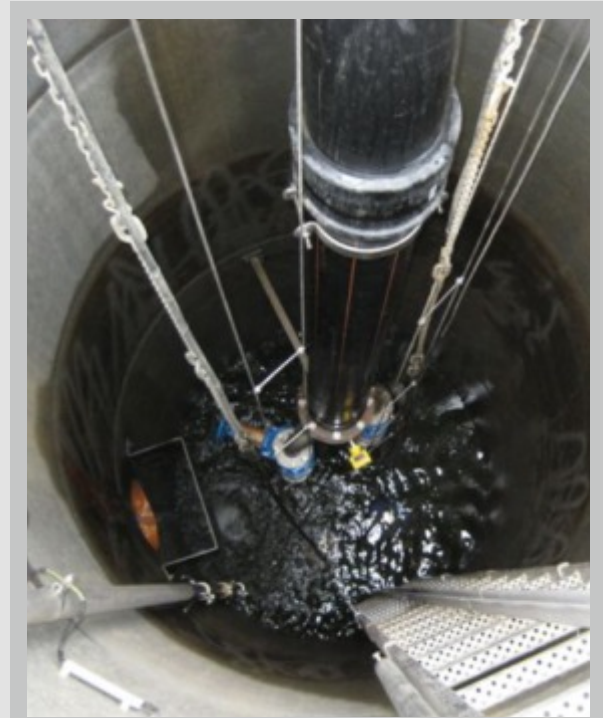
Level Measurement in Pump Well

Application

- Well diameter 1.8 m
- Depth of well 6.5 m
- Two wet installed pumps
- Pressure pipe installed in the centre

Definition of Task

- Pump control in alternate duty assist mode
- Switching points at levels of 2 m and 4 m
- Maximum level report
- Dry run protection
- Transmission of levels to control system



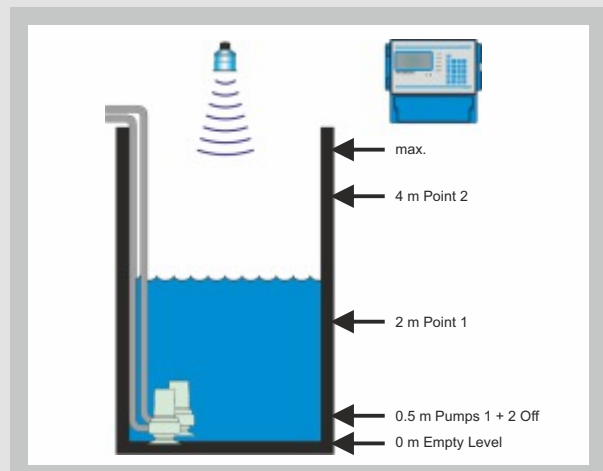
Pump well with two pumps

Solution

- An ultrasonic measurement Type NivuMaster Ultra has been used.
- The implemented variable pump mode provides a great number of options such as the alternate duty assist mode desired by customer.
- Obstacles on the sides of the sonic lobe such as ladders, steps, cables, pipes, pumps and other constructions can be covered using the built-in agitator avoidance.

Advantages:

- Contactless
- Measuring and controlling in one unit
- No PLC required

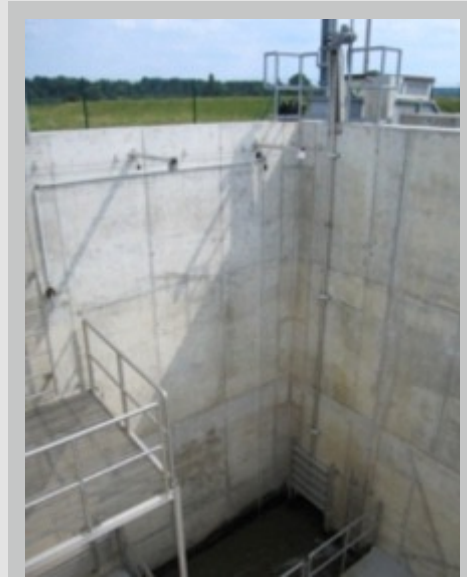


Schematic diagram of two pumps in alternate duty assist mode

Level Measurement Spiral Pump Control

Application

- Wastewater lifting facility with three spiral conveyors
- Delivery head approx. 9.00 m



Inlet area of lifting facility

Definition of Task

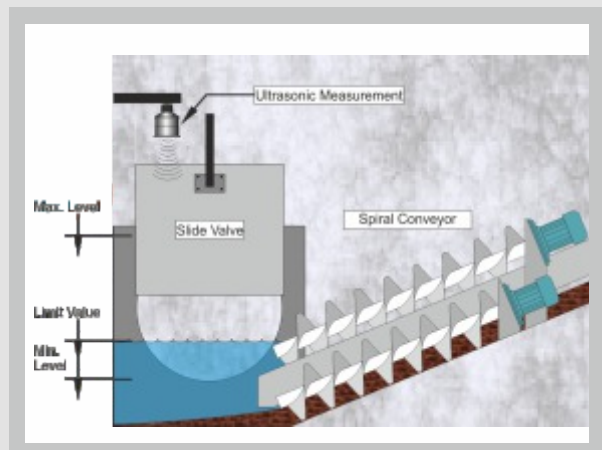
- Contactless level measurement for alternating control of spiral conveyors
- Redundant
- Panel mount enclosure unit

Solution

- An ultrasonic measurement transmitter Type NivuMaster Ultra 5 panel mount enclosure has been installed as contactless measurement. This unit not only serves as alternating control for the spiral conveyors, but also supplies min./max. messages
- The redundant measurement is engaged using an error message contact.

Advantages:

- Sensor installation and transmitter programming carried out by operator
- Therefore independent of PLC programming through third party



Schematic diagram of a wastewater lifting facility

Flow Measurement for Pump Efficiency

Application

- Pipe diameter 0.15 m, made of steel
- Full pipe
- Wet pumps



Pump shaft with built-in measurement system

Definition of Task

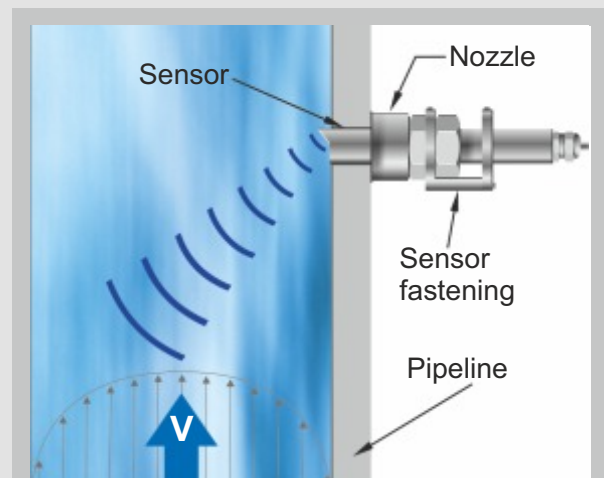
- Quick and cost-efficient upgrade of a wastewater pump station with a flow measurement
- Measurement insensitive to grease and films
- Existing pumping line should remain in place if possible

Solution

- The flow measurement system Type NFP has been used.
- The existing riser has been complemented merely by an additional nozzle and a hole has been drilled.

Advantages:

- Easy, straightforward and quick upgrading within 2 hours.
- High accuracy and reliability.
- Measurement without electrodes and independent of conductivity.



Sensor mounting principle

Discharge Measurement and Discharge Control on Stormwater Overflow Tank

Application

- Pipe diameter 0.3 m, made of stainless steel
- Part filled
- Low filling levels during nighttimes



View of Measurement Place

Definition of Task

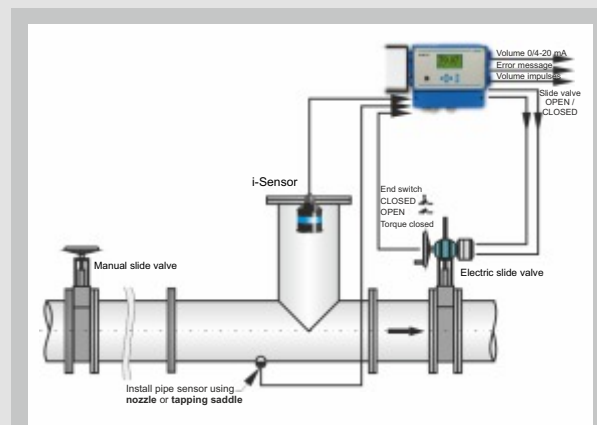
- Continuous measurement and flow rate control on a stormwater overflow tank
- Detection of low nightly discharges to evaluate extraneous water volumes
- Not more than one additional unit can be installed due to few space available in the switching cabinet

Solution

- A flow measurement using the Doppler method Type OCM FR with tube-shaped flow velocity sensor has been used.
- In order to measure even lowest levels a Type i-Series 2-wire ultrasonic sensor from the pipe top down has been selected.

Advantages:

- No need to install an additional controller in the switching cabinet due to transmitter-integrated 3-step controller with surge detection
- The sensor placement allows flow measurement from zero to maximum (full filling)



Schematic diagram of a pipe measuring section with slide valve control

Throttle Monitoring with Transmission of Data and Alarms via GPRS

Application

- Stormwater overflow tank with discharge control using mechanic throttle equipment
- Throttle volume: 185 l/s
- No power supply available



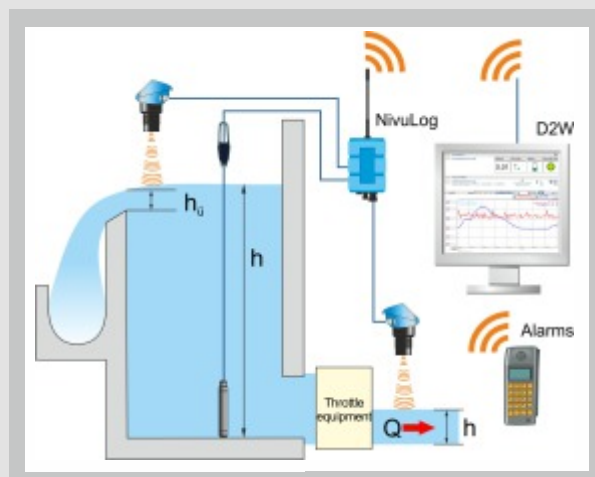
Throttle Equipment

Definition of Task

- Measurement equipment and data transmission shall be powered by rechargeable battery
- Detection of throttle discharge, tank level and discharge volume
- Alarm message shall be sent to control centre in case of undershooting the specified discharge volume at simultaneous tank impoundage (plausibility check)
- Recording of discharge frequency

Solution

- A battery-powered GPRS data logger Type NivuLog Easy has been used.
- Data from an existing level probe are logged additionally in order to detect the tank level .
- Ultrasonic echo sounders Type NivuCompact have been used at the throttle discharge as well as on the discharge edge. The echo sounders are directly powered by the data logger.
- Throttle discharge as well as discharge volumes are calculated using a setpoint table stored in the "Device to Web" (D2W) online portal
- Alarms are triggered using an instruction list stored in D2W as soon as the pre-set alarm requirements have been fulfilled



Principle of measurement and data transmission

Flow Measurement Overflow Multi-Chamber Stormwater Overflow Tank

Application

- Rectangular channel, 6 m width
- Part filled
- Simultaneous overflow from several chambers into one common channel
- Short calming section upstream of measuring point



Measurement point to recipient

Definition of Task

- Detection of overflow volumes to recipient
- Readings shall be transmitted to control system via analog and digital outputs
- High accuracy at varying overflow volumes per chamber



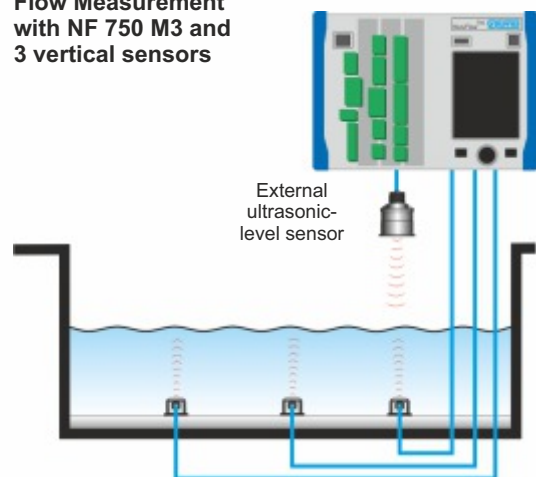
Solution

- Providing highest measuring dynamics and accuracy, a cross-correlation-based system Type NivuFlow 750 M3 has been used. By using 3 flow velocity sensors simultaneously it is possible to detect and to consider existing asymmetric flow conditions.
- The sensors have been installed on the channel bottom. Protective metal sheets prevent the sensors from being damaged.

Advantages:

- Low installation costs
- Complies with requested accuracies by utilising 3 velocity sensors
- Maintenance-free

Flow Measurement with NF 750 M3 and 3 vertical sensors



Installation principle

Logging of Stormwater Overflow Tank without Mains Power

Application

- Stormwater overflow basin in main sewer
- Discharge over concrete sill on basin
- Remote location without mains power supply



Evaluation of stormwater overflow

Definition of Task

- Detection of basin level events as well as basin discharge including frequency and duration
- Storage and automatic transmission of data
- Unobtrusive measurement system with long lifetime
- Easy and quick creation of month and year protocols, sufficient for presentation at authorities
- Low acquisition and operation costs with high system availability

Solution

- Due to the risk of vandalism a small battery-buffered data logger Type NivuLog Easy with integrated GSM modem and a high protection level was used instead of a solar-powered system.
- Levels are detected by using a contactless 2-wire low power echo sounder with quick response (4 sec.) which is supplied directly by the data logger.
- Die Datenübertragung erfolgt direkt vom Datenlogger mit integriertem netzvariablem SIM-Chip und Modem ins Internet.
- The D2W cloud solution permits to create, print and save protocols on any PC.

Advantages:

- Low acquisition costs
- Unobtrusive solution with >2 years of battery life
- Independent of installed control systems
- Variable service network without affecting costs

Niederschlag		Überlauf		Überlauf	
mm	h	mm	h	mm	h
0	00:00	0	00:00	0	00:00
0	00:00	0	00:00	0	00:00
0	00:00	0	00:00	0	00:00
0	00:00	0	00:00	0	00:00

Event protocol

Discharge Measurement with GPRS Transmission

Application

- Closed stormwater overflow in channel network
- Manhole entry in the middle of a road, difficult accessibility conditions
- Ex zone 1
- No mains power supply available



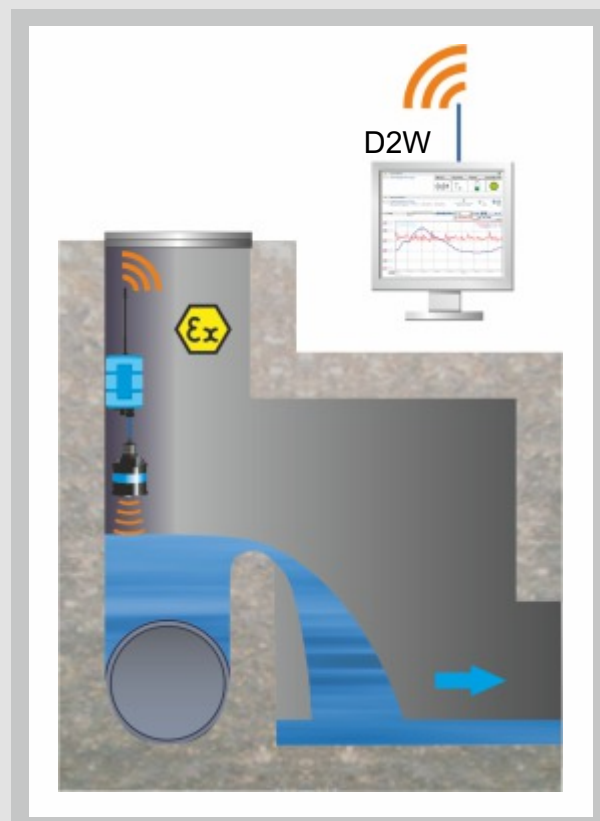
Stormwater overflow sill

Definition of Task

- Investigation of discharge volume using level measurement and calculation according to Poleni
- Extended constructional measures such as connection to public electricity supply shall be avoided
- Data transmission via GPRS out of the closed manhole shaft
- Long system lifetime

Solution

- By using the battery-powered GPRS data logger Type NivuLog 2 Ex extensive building operations were not necessary. Thanks to IP 67 protection it was possible to install the logger directly in the manhole shaft of the building.
- The discharge sill has been equipped with a level measurement which is directly supplied by the data logger.
- The discharge volume is calculated in the "Device to Web" (D2W) online portal utilising a saved breakpoint chart.
- The automatically transmitted readings are password-protected and can be viewed as tables or graphs from any workplace featuring Internet access.



Principle of measurement and data transmission

Discharge Measurement in confined Spaces

Application

- Stormwater overflow tank with cover
- Maximum overflow head 0.35 m
- Very low distance between weir crest and ceiling (0.50 m)



Ultrasonic level measurement with tilted mirror

Definition of Task

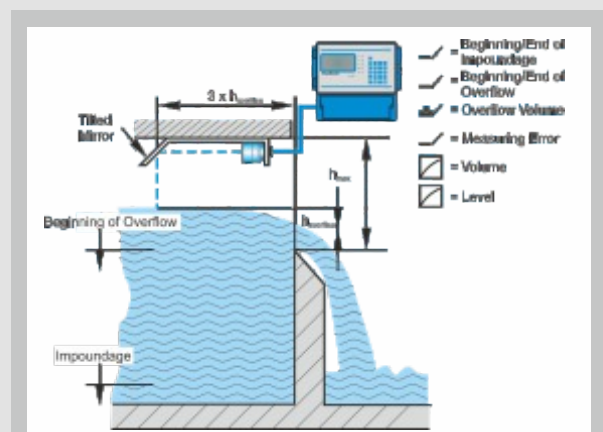
- Detection of impoundage (beginning and end)
- Output of tank overflow (beginning, end and overflow volume)
- Reliable non-contact measuring at lowest distance between ceiling and maximum water level

Solution

- An ultrasonic measurement transmitter Type NivuMaster LF-5:2 has been installed. Thanks to comprehensive programming options and numerous outputs it is possible to calculate and to output the parameters "Tank Impoundage", "Tank Overflow" and the overflow volume (as requested by German DWA organisation) by using only one unit.
- Using an innovative tilted mirror allows to install the ultrasonic sensor close to the maximum water surface level.

Advantages:

- Saves time and costs since only one device is required



Schematic Diagram

GPRS Data Transmission In Customer Network

Application

- Open stormwater overflow tank
- No power supply available
- No telephone connection or data lines in close proximity



Tank with installed level sensor and data logger

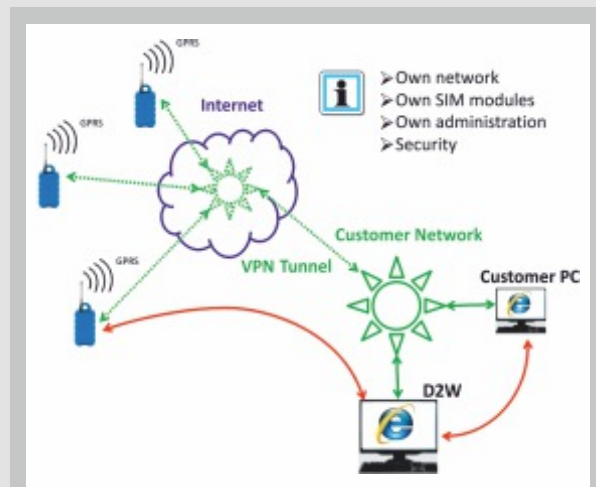


Definition of Task

- Network-independent tank level monitoring
- Transmission of readings, status information and error message to existing process conducting system
- Utilisation of customer-supplied Virtual Private Network (VPN) for data transmission

Solution

- The tank level is investigated using an ultrasonic compact echo sounder Type NivuCompact. Its extremely low startup time of only 3 seconds and the resulting extremely low power consumption allow very long lifetimes.
- For detection and transmission of readings an independent battery-powered GPRS data logger Type NivuLog Easy has been used.
- The readings are transmitted from the GPRS data logger via the VPN to the customer's D2W server. This server then transmits the current data via OPC interface to the existing process conducting system (WinCC).



Principle of data transmission

Flow Measurement to create a Sewage Master Plan

Application

- Concrete pipe DN 500
- Part filled
- High discharge dynamics
- Risk of sedimentation



Sensor installation

Definition of Task

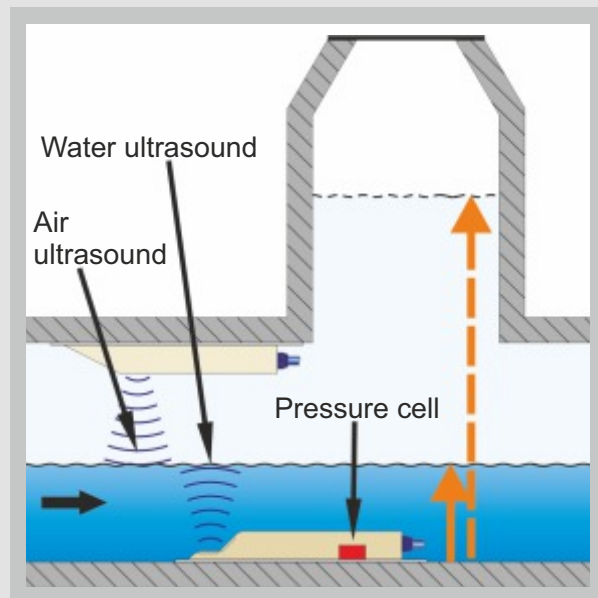
- Detection of precipitation, flow, level and flood covering a minimum period of 3 months to create a Sewage Master Plan
- No mains power available
- High discharge dynamics from lowest levels up to complete flood of the channel system
- Sound waves due to pump activities
- ASCII a preferred data format

Solution

- By using the portable Type PCM Pro measurement system using multiple sensors it is possible to measure over longer periods without mains power.
- The high measurement dynamics are reliably detected by using a 1-minute measurement cycle.
- Data storage on CF card in ASCII format.

Advantages:

- Accurate flow detection even with varying levels thanks to the combined use of different level sensors utilising different measurement principles.
- Measurement results are easy to evaluate in all common applications thanks to using the standard ASCII data format.

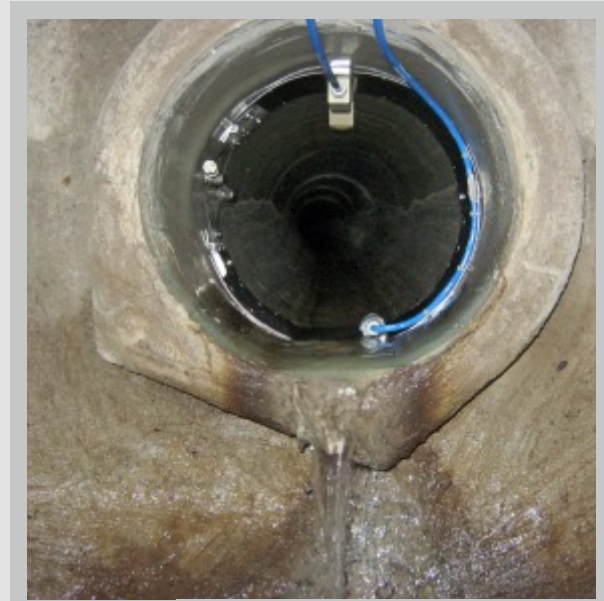


Combined use of different level sensors

Determination of Infiltration Water in small Pipelines

Application

- Concrete pipe DN 250
- Part filled, low level
- Very low flow rates
- Ex Zone 1
- No mains power supply available



Installation with Pipe Mounting System

Definition of Task

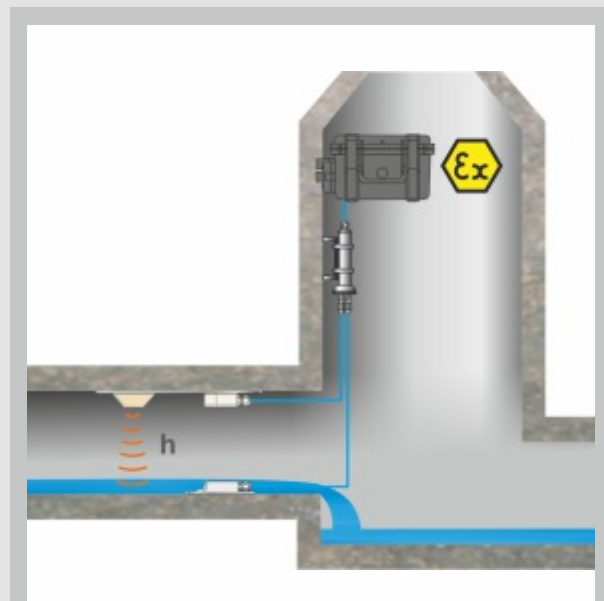
- Continuous flow rate measurement to determine the extraneous water volumes
- Reliable detection of lowest flow rates during night hours
- Quick and easy installation
- Long system battery life

Solution

- The portable, Ex-protected flow meter Type PCM Pro was used.
- To detect even lowest flow rates the mini sensor Type CSM with a height of merely 21 mm was used.
- The low flow levels within the small pipe diameter are detected by using a small Type DSM special air-ultrasonic sensor.

Advantages:

- Quick and straightforward installation by using a special pipe mounting system
- High accuracy and reliability
- Long battery life of several months without the need to replace the rechargeable battery



Installation principle

Flow Measurement under poor hydraulic Conditions

Application

- Drainage line DN 300 of leisure park
- Part filled
- Concrete drainage line in ailing condition
- High discharge dynamics and turbulent discharge due to upstream feed pump
- Ex Zone 1



Temporarily installed flowmeter

Definition of Task

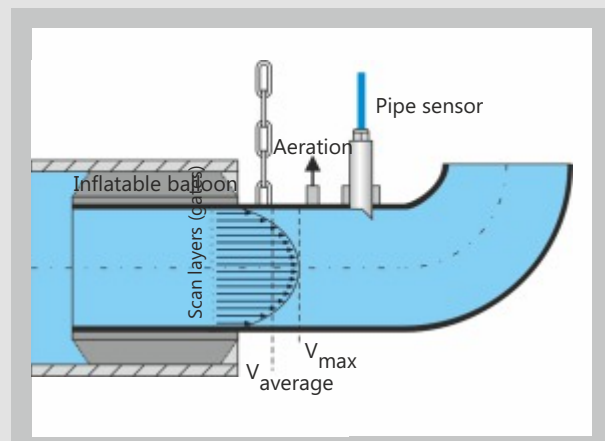
- Determination of channel capacity and costs allocation for the planned expansion of the leisure park
- Accurate detection of flow rates to determine the dimensions of a newly planned wastewater line
- The poor hydraulic ambient conditions and the high discharge dynamics should not affect the demanded measurement accuracy of the system used.

Solution

- To improve the poor hydraulic discharge conditions a mobile Type NPP measuring pipe was inserted into the approaching pipe by using a bubble.
- Thanks to the aid of a 90° elbow the pipe was full filled resulting in optimum measurement conditions.
- The flow velocity detection was carried out based on the ultrasonic cross correlation principle.
- Power supply and data storage were implemented through a battery-powered PCM Pro transmitter.

Advantages:

- Easy, quick and safe installation through lightweight plastic pipe.
- Exactly defined cross section
- Homogenised flow conditions at the measurement point and therefore highest system accuracy.

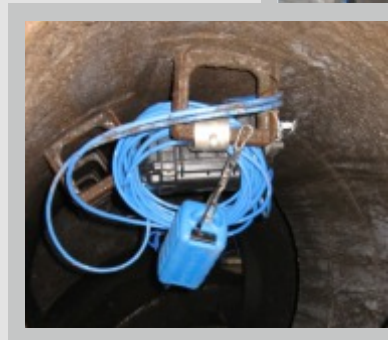


Installation principle of measurement system

Efficiency Measurement and Ex-proof GPRS Data Transmission

Application

- Concrete pipe DN 1200
- Part filled
- Levels temporarily tending to zero
- No power supply available
- Ex Zone 1



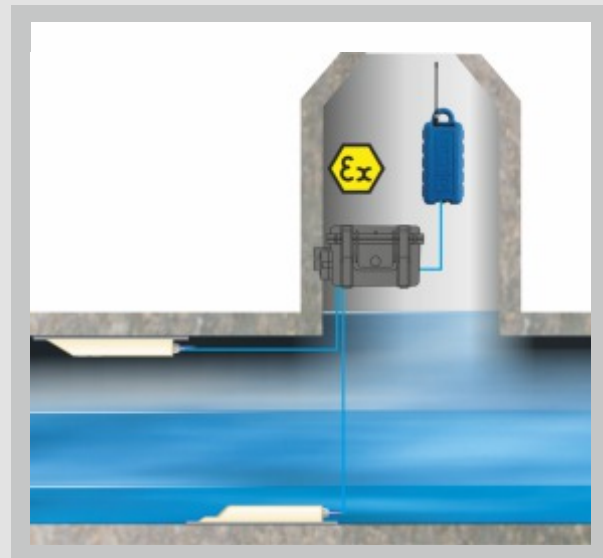
Measurement place in channel
Transmitter with data logger in manhole

Definition of Task

- Temporary Installation of a flow measurement system to investigate precipitation discharge and channel capacity utilisation
- Reliable detection of lowest levels during the night
- Automatic data transmission and error messages/remote maintenance via GPRS

Solution

- The portable flow measurement system PCM Pro with an Ex-proof GPRS data logger Type NivuLog Ex have been used.
- The built-in pressure measurement cell of the flow velocity sensor allows to detect the channel overflow.
- Using an additional air-ultrasonic sensor (LUS) ensures reliable measuring of even lowest discharge during the night.
- Highly efficient data compression as well as the particular transmission behaviour guarantee reliable data transmission despite massive channel walls and metal manhole covers. The NIVUS "Device to Web" data portal allows direct access to the measurement system as well as to the connected sensors.



Installation principle

Determination of Infiltration Water in larger Diameters

Application

- Pipe with 0.6 m diameter, made of concrete
- Part filled
- Ex zone 1



Measurement point in channel

Definition of Task

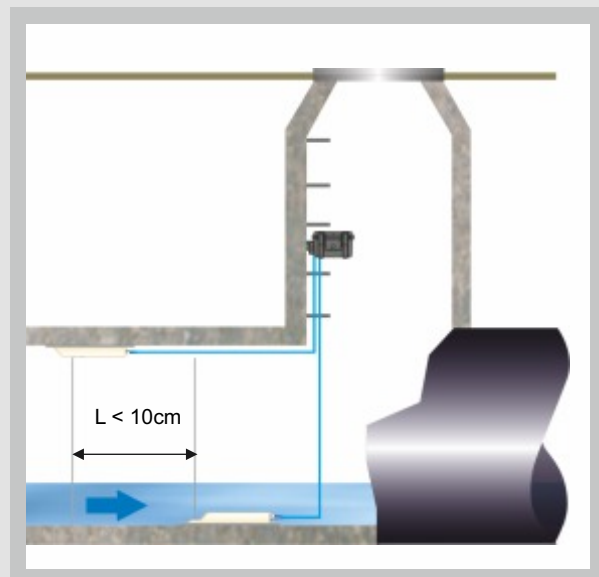
- Continuous flow rate measurement in dry weather conditions to detect extraneous water volumes within the channel system
- Prioritisation of accurate detection of even lowest flow rates during night time
- Quick and easy installation of required sensors
- Easy and straightforward operation of the portable transmitter

Solution

- The portable flow measurement system Type PCM Pro has been used.
- A pipe mounting system (RMS) has been used for quick and secure sensor fastening.
- An air-ultrasonic sensor (LUS) has been used to even detect lowest flow levels.

Advantages:

- Easy, straightforward and quick installation
- High accuracy and reliability
- Transmitter can be easily operated thanks to intuitive user interface

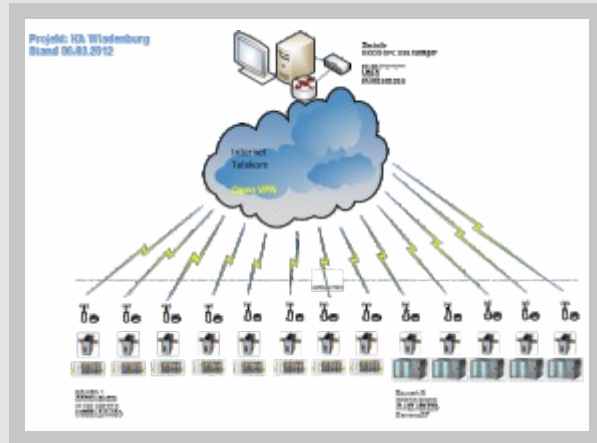


Installation principle

Centralised Logging of Events within a Channel Network

Application

- Centralised operation, viewing, logging and alerting of special construction
- Automated creation of protocols and reports according to DWA M260
- Viewing via mobile terminal devices (tablet, smartphone)
- Alerting of personnel on duty via on-call schedule



Definition of Task

- Networking of the telecontrol substations via Ethernet standard (DSL or GPRS)
- Creation of the data model
- Connection to various PLCs
- Creation of the process visualisation for the constructions

Solution

- Installation of NICOS with Telecontrol Server for integration of special constructions
- Installation of telecontrol gateway and NivuLink data loggers in the special constructions
- Creation of event reports and special reports in NICOS - Reporting Module

Advantages:

- Low data volume through DeltaEvent
- Automated creation of reports
- Entire facility can be operated and viewed via mobile application

Monatsbericht: April 2016		Kläranlage Kleeback	
Parameter	Einheit	Monats-	
Abwasserfall (gesamt)	m³	3.808.000	
Abwasserfall	m³	2.758.000	
Abwasserfall (Behandelt)	m³	3.808.000	
Abwasserfall (abgeschickt)	m³	0.000	
Abwasserfall (Pflanz)	m³	1.200	
Abwasserfall ges.	KWSt	9.230	
Abwasserfall	m³	0.000	
Abwasserfall	m³	2.000	
Abwasserfall	m³	1.000	
Abwasserfall	l/WSt	25.1	
Abwasserfall	kg PFM	585.0	
Abwasserfall	t	115.7	
Abwasserfall	t	89.3	
Abwasserfall	l/TSt	976.0	
Abwasserfall	l/TSt	439.8	
Abwasserfall	l/TSt	1.586.3	
Abwasserfall	m³	603.000	

Abwasserkonzentrationen (Flockungs-Fällf.)		
Parameter	Minimum	Maximum
CSSt ₅₀₀	25	40
Mittelwert	35	
BSSSt ₂₀	2	9
Mittelwert	6	
NH ₄ -N	0.2	11
Mittelwert	1.2	
NO ₂ -N	4.5	7.5
Mittelwert	6.5	
NO ₃ -N	0.03	0.45
Mittelwert	0.40	
N _{org}	0.3	21.0
Mittelwert	9.0	

NivuLink Control

Wastewater Treatment Plant



Stormwater Treatment Facilities

- Flow Measurement at Overflow Sill Page 32

Intake Area

- Open Channel Flow Measurement Page 33
- Contactless Flow Measurement Page 34
- Level Measurement Screening Debris Container Page 35
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Preclarification

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Sludge Treatment

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Secondary Clarification

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Flow Measurement at Overflow Sil

Application

- Pipe with 1.5m diameter, overflow on the side
- Part filled
- Concrete construction



Stormwater overflow

Definition of Task

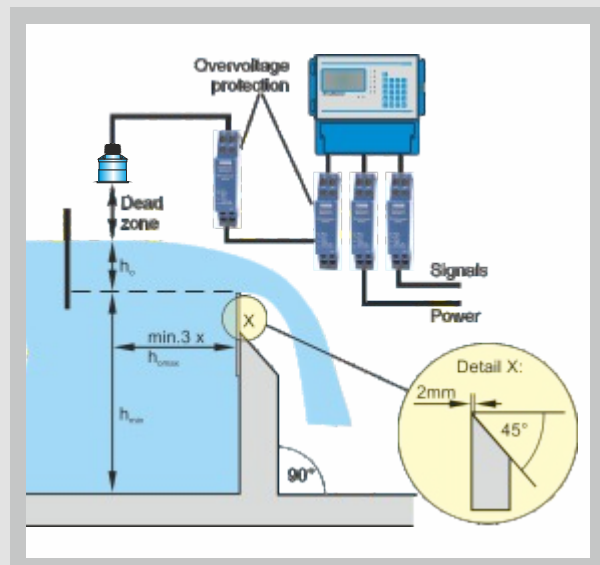
- Stormwater overflow measurement in intake area of a WWTP according to EC self-monitoring regulation
- Detection of overflow volume, overflow time and duration according to German DWA directives

Solution

- The non-contacting ultrasonic measurement system NivuMaster has been used.
- All established discharge characteristics, which may be selected depending on the shape of the sill, are stored in the transmitter.

Advantages:

- No additional PLC required, since daily volumes and total volumes are detected and saved internally
- Quick and easy system programming thanks to clear text menus in dialog mode



Measurement principle at overflow weir

Open Channel Flow Measurement

Application

- Rectangular channel made of concrete, width 1m
- Part filled
- Strong fluctuation between daily and nightly inflow



View of measurement place

Definition of Task

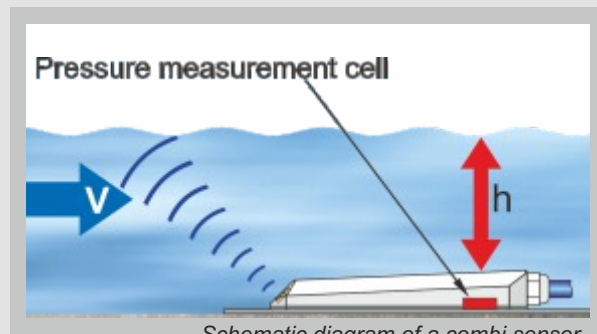
- Continuous flow rate measurement in a WWTP intake area
- Additional external level measurement shall be avoided
- Cost-efficient, for monitoring only
- No high accuracy is required
- Quick and easy sensor mounting

Solution

- The flow measurement system Type OCM F operates based on the Doppler principle. A wedge-shaped flow velocity sensor has been installed in the center of the rectangular channel.
- The flow velocity sensor has been equipped with a pressure measurement cell to avoid the need for an additional external level measurement.

Advantages:

- Easy, quick and robust installation
- Cost-effective measurement
- Velocity and level measurement in one sensor



Schematic diagram of a combi sensor with pressure measurement cell in a rectangular channel

Contactless Flow Measurement

Application

- Concrete channel, width 1.2 m
- Part filled
- Measurement point upstream of screen and grit trap
- High sedimentation loads



View of measurement place

Definition of Task

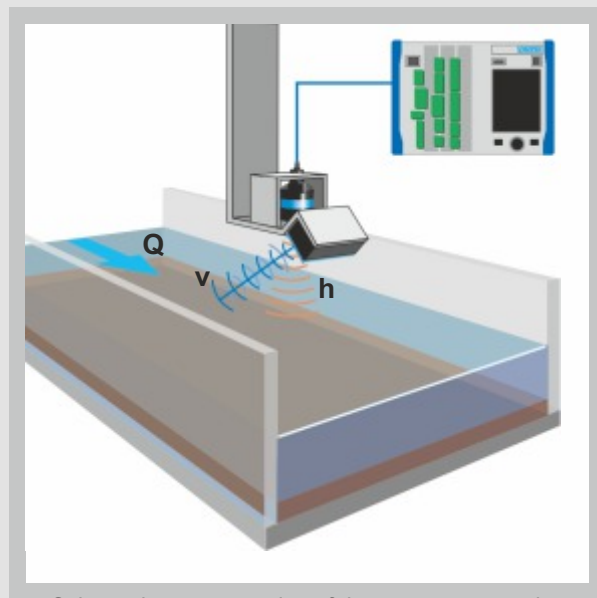
- Intake measurement as control measure to avoid WWTP flood
- Contactless measurement system due to partially high pollution loads
- Easy installation
- No Ex required (open, aerated channel)

Solution

- No sensors can be installed on the channel bottom or in floats due to high pollution loads or foam on the surface.
- The surface radar measurement system Type NivuFlow 550 has been used since the measurement is for control purposes only without the need for certification.
- The system measures the velocity of the surface waves and calculates the current flow rate from this velocity, the measured level and the defined rectangular channel shape.

Advantages:

- Contactless
- Insensitive to soiling
- Easy to install



Schematic representation of the measurement place

Level Measurement Screening Debris Container

Application

- Screenings container, 2.5 x 2.5 x 4.0 m (w x h x d)
- Medium: solid mixture
- Bulk cone with undefined angle
- Ex-Zone 1

Definition of Task

- Level detection inscreenings container for overflow monitoring and to control container exchange
- Contactless measurement
- Sensors connected directly to PLC without extra transmitter and separation barrier
- Cost-efficient and reliable solution

Solution

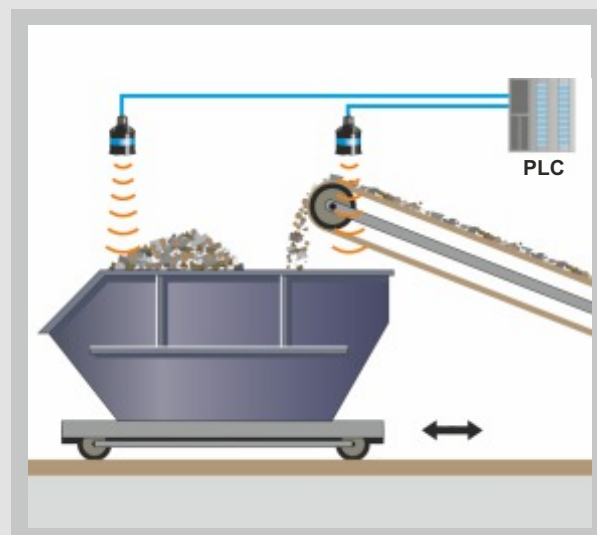
- The contactless intelligent ultrasonic 2-wire sensor Type i-06 Ex was used.
- Due to the deep container and the mostly steep bulk cones it was necessary to install 2 sensors with alignment aid at both ends of the container.

Advantages:

- Direct connection without transmitter or Ex barriers
- Cost-efficient and reliable sensor



Container with Sensors



Schematic representation, direct connection of sensors to PLC

Flow Measurement in small WWTPs

Application

- Continuous pipeline with 200 mm diameter made of HDPE
- Partially filled
- Low flow levels of 4-5 cm
- Limited space at the desired measurement spot



Measurement place in standard shaft

Definition of Task

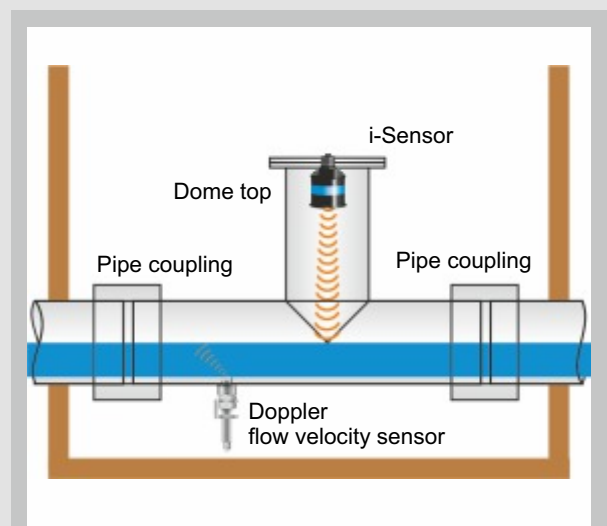
- Permanent measurement of very low flow rates in a small WWTP
- Subsequent installation of measurement in existing continuous pipeline in a standard shaft
- Quick and easy installation
- Cost effective measurement
- No high accuracy is required

Solution

- A flow measurement system using the classic Doppler method (OCM FR) including pipe sensor has been used.
- The low levels have been detected using an external ultrasonic level sensor.
- A part from the continuous pipe has been removed. This part has been equipped with a dome top for level measurement and a nozzle for the flow velocity sensor. Then this part has been inserted again using pipe couplings to avoid joints.

Advantages:

- Cost-efficient implementation under own direction
- Quick and easy installation of measuring section without flanges



Installation principle

Flow Measurement in large WWTP Intake Area

Application

- Structured U profile made of concrete, 2.5 x 2.5 m (w x h) with dry weather channel
- Part filled
- Very high discharge dynamics
- Risk of sedimentation during nighttime



View of measurement place

Definition of Task

- Detection of flow rate to WWTP
- Highest possible accuracy despite very high discharge dynamics featuring levels from 40 to 200 cm

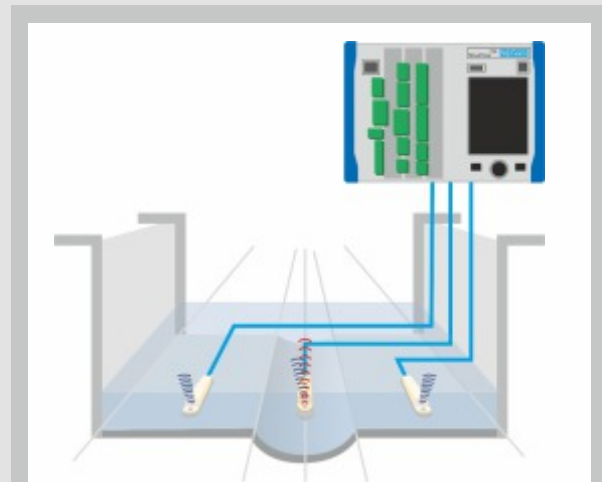


Solution

- The measurement system Type NF 750 M3 with three CS2 flow velocity sensors has been used.
- The sensors have been installed on wedge supports due to the risk of sedimentation.
- A cable protection mounted directly on the sensor prevents damages through rat bites or similar.

Advantages:

- Easy programming thanks to internal channel shape presets
- Required accuracies are met thanks to the use of 3 velocity sensors
- High resolution of readings through 2 analog outputs with different scales for dry weather and rain weather



Installation principle

Flow Measurement – Replacement of defective EMF

Application

- Steel cast pipe with 700 mm diameter
- Full filled
- Existing EMF in pipeline defective



View of measurement place

Definition of Task

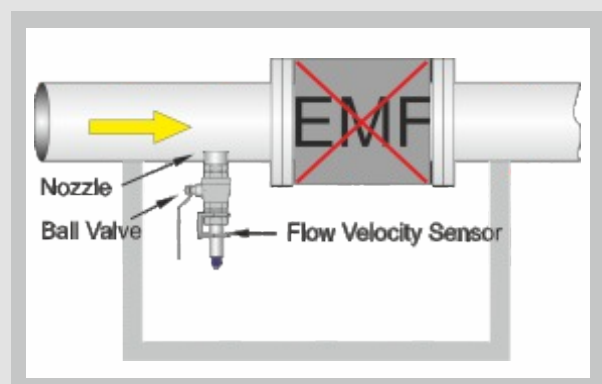
- Cost-efficient installation of the new flow measurement
- Defective EMF should not be removed if possible (costs)
- No interruption of running processes

Solution

- A permanent flow measurement transmitter Type NivuFlow 750 in combination with a flow velocity pipe sensor using the ultrasonic cross correlation method has been used.
- Upstream of the defective EMF a clamping system with nozzle and ball valve has been fastened on the pipeline.
- A hole has been drilled into the pipe through the nozzle of the clamping system, which then has been used to screw the sensor in.

Advantages:

- Quick and easy retrofitting within very short time
- Saves costs since the old measurement system does not need to be removed
- No interruption of running processes
- High accuracy and reliability



Principle of measurement place

Flow Measurement behind Grit Chamber

Application

- Two pipes with 0.6 m diameter, made of stainless steel
- Full filled
- Pipes previously installed



Measurement pit behind grit chamber

Definition of Task

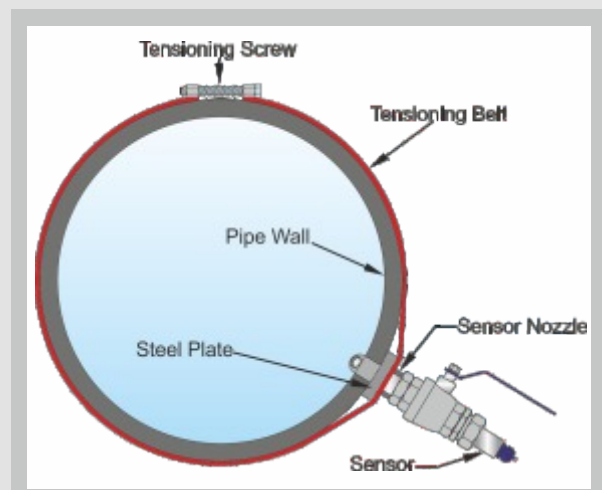
- Continuous measurement of single volumes to achieve even distribution of partial volumes and hence the best possible sedimentation behaviour in both parallel grit chambers by using both upstream control valves.
- Existing pipes shall not be dismantled for installation of measurement system.
- Welding works within the pit shall be avoided.

Solution

- The particularly for full pipes developed flow measurement system Type NFP has been used.
- Sensor nozzles have been fastened on existing stainless steel pipe lines by using tensioning belts.

Advantages:

- Easy, simple and quick upgrading without the need for welding works.
- High accuracy and reliability.
- No process interruption for installation

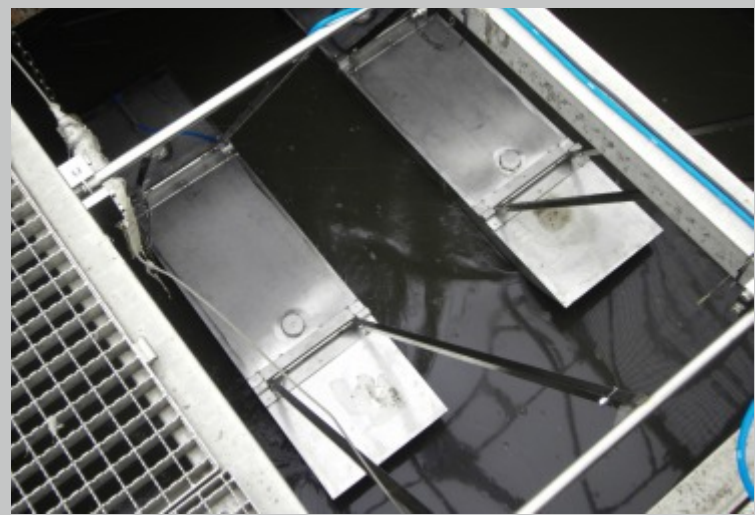


Installation principle

Flow Measurement with Pontoon

Application

- Rectangular concrete channel 1.4 x 1.2 m (w x h)
- Part filled
- Sedimentation on channel bottom due to low flow velocities



Pontoon with holding bar

Definition of Task

- Continuous measurement of intake volumes to wastewater treatment plant
- Consideration of varying sedimentation levels on the channel bottom to ensure a maximum measurement deviation of 5%
- Measurement shall be installed and maintained under process conditions

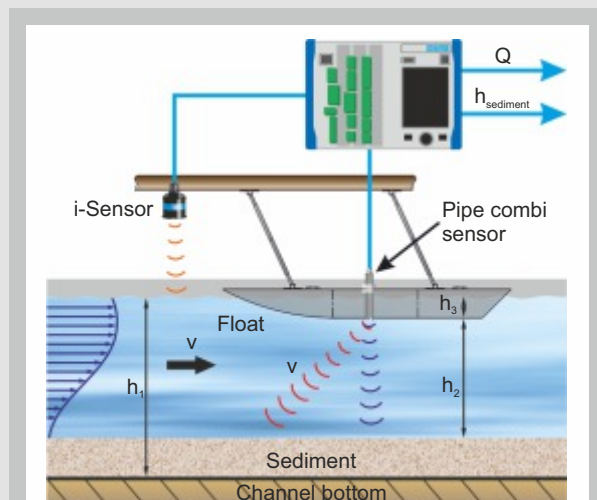


Solution

- This task has been solved using a floating measurement array. The flow here is detected by using the cross correlation measurement method (NF 750).
- The floating sensor calculates the flow volume from the detected flow level and the flow profile. Sedimentation layers are detected and compensated automatically.

Advantages:

- The mechanical components have been manufactured at reasonable costs on behalf of the customer according to NIVUS specifications.

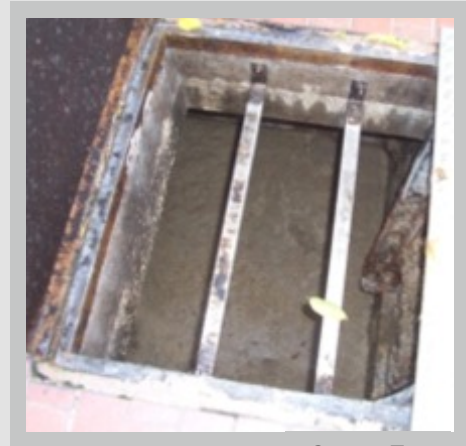


Construction principle of floating measurement

Level Measurement in Grease trap

Application

- Depth of pit: approx. 4 m
- Medium: wastewater with grease contents and temporary foam formation



Grease Trap

Definition of Task

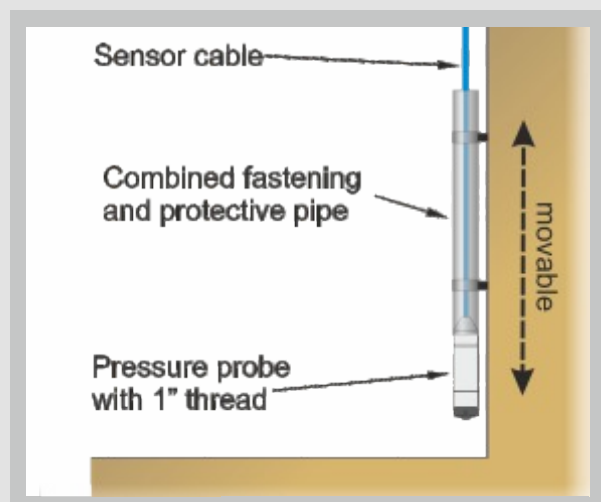
- Reliable measurement of the wastewater-grease mixture level in the pit
- A pressure measurement probe should be used since non-contact ultrasonic sensors would fail due to occasional foam formation on the surface
- Grease accumulation should not damage the sensor cables
- Maintenance and cleaning should be possible in a quick and easy manner

Solution

- Utilisation of a submersible probe (special version of NivuBar Plus II) with integrated G 1" outer thread for direct installation of a protective pipe.

Advantages:

- Protective tube to protect the sensor cable against incrustation and mechanical stress
- Easier removal for regular cleaning
- Safe fastening as well as easier and more accurate depth adjustment (0-point) thanks to the protective tube



NivuBar Plus in special version „G“

Flow Measurement Preclarification Bypass

Application

- Pipeline DN 800 made of reinforced concrete
- Full filled
- Little overpressure of 0.1 Bar



Measurement shaft with extraction tool installed

Definition of Task

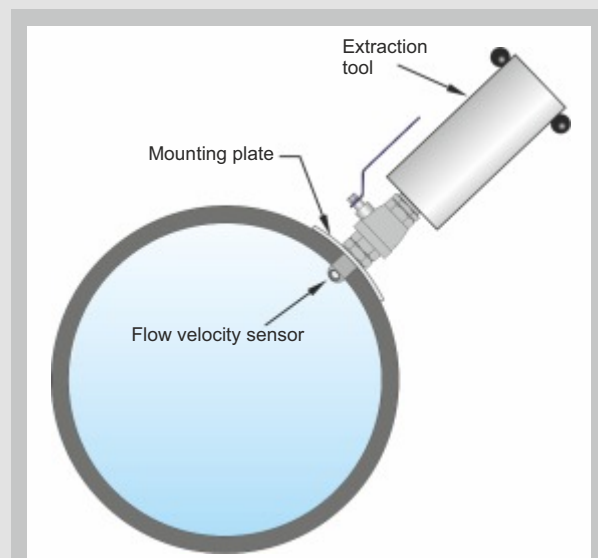
- Detection of bypass volume to optimise and to control denitrification
- Cost-efficient installation without major construction works and process interruption
- High accurate and reliable measurement
- Measurement place can be maintained under process conditions

Solution

- A high-accurate cross correlation flow meter Type NivuFlow 750 with pipe sensor was used for this task.
- a standard shaft was installed around the existing pipeline and the sensor was inserted through a drill hole by using a pipe collar.
- Using the extraction tool ensures easy sensor maintenance under process conditions.

Advantages:

- Saves approx. 40.000,- € compared to the construction of a new measurement shaft with bypass, attached steel pipelines and magnetic-inductive flow meter.



Schematic representation of installation

Separation Layer Measurement in Primary Clarifier

Application

- Rectangular basin 30 m x 8.5 m with two draw-off hoppers
- Basin depth 2.8 m
- Hopper depth 5.8 m



Zulauf und Vorklärung

Definition of Task

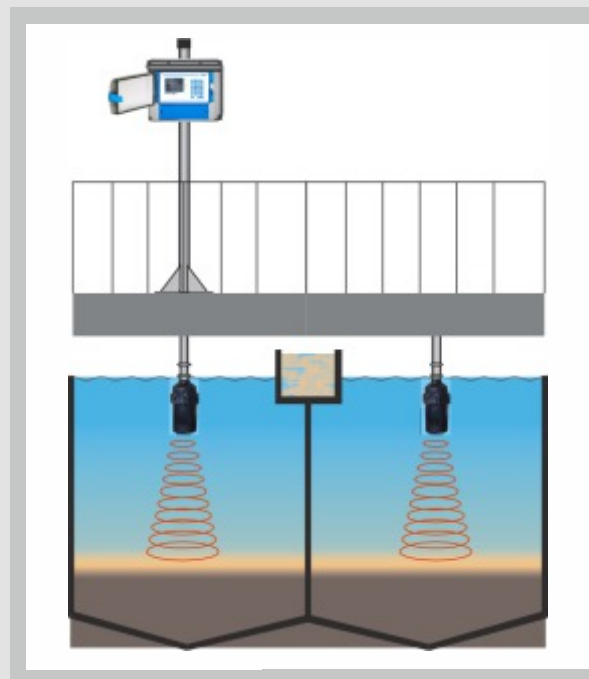
- Sludge outlet control by using the sludge level
- Continuous detection of both sludge levels and analog transmission to control system
- Cost-efficient solution

Solution

- The 2-channel version of the NivuScope 2 was used to detect two separate sludge levels.
- Transmission of both different sludge levels to the control system is carried out the current outputs.

Advantages:

- Holding a defined sludge level will increase the concentration of dry substances and hence the efficiency of the following digestion tank.



Measurement of two separate sludge hoppers

Return Sludge Control through Slide Valve with Triangular Weir

Application

- 2 rectangular, part filled concrete shafts approx. 1.2 x 1.2 m each
- Gravity feed, return sludge from bottom
- Part filled
- Discharge over lowerable knife gate valves



View of measurement place and flow conditions

Definition of Task

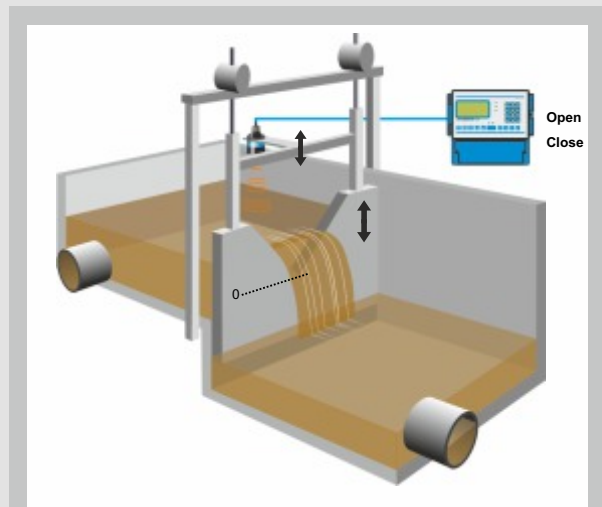
- Continuous measurement of return sludge feed
- Flow rate control by changing the slide valve positions
- Solution not too costly without the need for major construction measures

Solution

- The customer equipped knife gate valve with a cutout and a triangular weir plate. Moreover, the slide valve was equipped with a boom and an echo sounder, which alters its level together with the slide valve and hence guarantees a stable zero point related to the weir tip.
- By using the variably programmable NivuMaster transmitter it was possible to implement a straightforward return sludge control utilising the transmitter's limit value functions for triangular weirs.

Advantages:

- Low construction efforts on site
- Cost-efficient measurement solution
- Easy access for maintenance and cleaning



Installation principle

Sludge Flow Measurement in Recirculation Line

Application

- Pipe with 0.4 m diameter, made of stainless steel
- Full filled
- High pollution load, up to 1 % dry solids



View of measurement shaft

Definition of Task

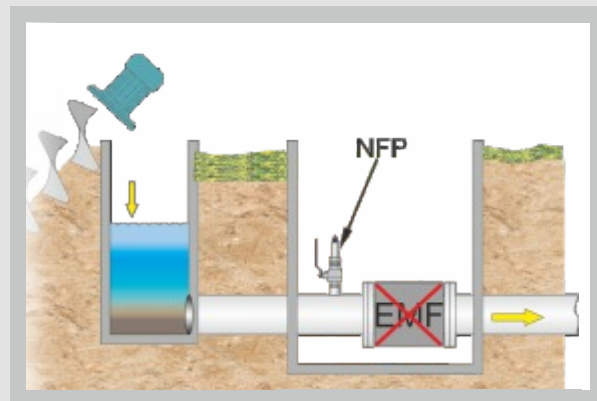
- Failsafe and stable measurement of the return sludge conveyed using screw pump lifting equipment in the horizontal line downstream of the transfer chamber
- Both existing measurements (EMF + clamp-on) did not work reliably or did not work at all due to high pollution and gas loads
- Low installation expenses

Solution

- The flow measurement system Type NFP has been used.
- Upstream of the non-functioning EMF a hole has been drilled and a nozzle has been welded onto the existing pipeline. Subsequently a ball valve for sensor removal under process conditions has been installed and the sensor has been adjusted and fixed.

Advantages:

- Easy, simple and quick upgrading of existing facilities
- Old measuring devices did not necessarily need to be removed
- Reliable measurement despite high dry solid contents



Setup of measurement place

Return Sludge Flow Measurement

Application

- Pipe with 0.7 m diameter, made of stainless steel
- Full filled
- Point of installation in telescopic pipe



Telescopic pipe in operation

Definition of Task

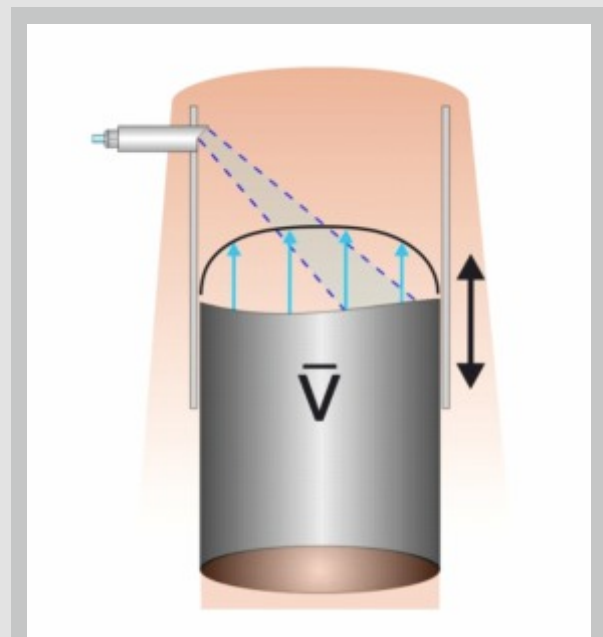
- Detection of sludge volumes to monitor and to control even sludge discharge from the secondary clarification tanks
- The only possible access to the volume flow is the vertically retractable telescopic pipe
- Maintenance-free operation and a measurement uncertainty of less than 5% shall be guaranteed
- Implementation without major reconstruction measures

Solution

- The flow measurement system Type NFP for full pipes has been used.
- The fully submersible sensor Type POA has been installed in the top section of the telescopic pipe.
- Flow profile detection enables accurate flow measurement. Dry solid contents higher than 1% do not affect the measurement.

Advantages:

- Easy and cost-effective upgrading
- High reliability and reproducibility
- Insensitive to pollution
- Maintenance-free



Measurement principle

Hot Sludge Flow Measurement

Application

- Pipe with 0.15 m diameter, made of stainless steel
- Full filled
- Medium contains oil and hot sludge
- High dry substance contents up to 30 g/l



Heat exchanger

Definition of Task

- Continuous measurement of sludge coming from a digestion tower and being pumped through a heat exchanger. Required to detect possible blockage or reduced pump performance and to ensure permanent heat supply for the WWTP social areas.

Solution

- The flow measurement system Type NFP has been used.
- A hole has been drilled into the existing stainless steel pipe line and a nozzle has been welded. Subsequently the flow velocity sensor has been adjusted and fixed.

Advantages:

- Easy, straightforward and quick upgrading of existing facilities.
- High measurement accuracy and reliability despite heavy pollution.



Measurement place with installed sensor

Separation Layer Measurement in Pre-Thickener

Application

- Diameter 15 m
- Depth 9.50 m
- Volume approx. 1500 m³



Pre-thickener in front of digestion tower (bottom right)

Definition of Task

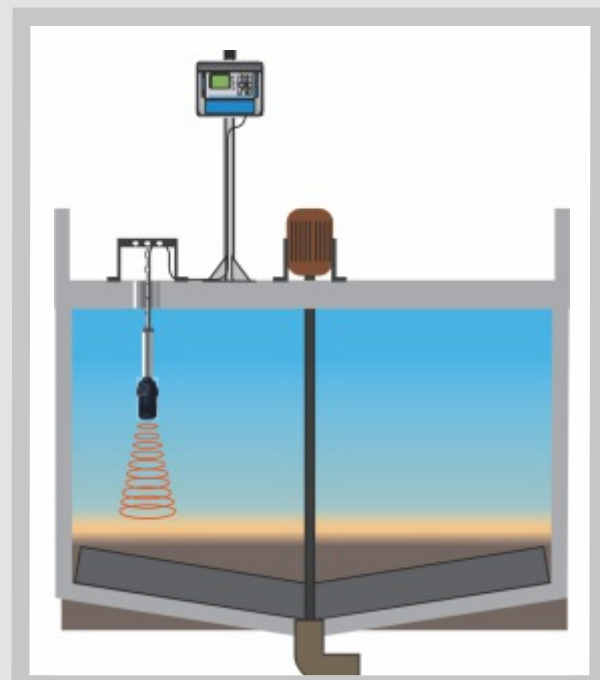
- Replacement of defective interface measurement without the need to modify the buildings
- New sensors should be installed by hanging them through the existing holes in the ceiling into the medium to measure
- Transmission of interface levels as 4 - 20 mA signal via available lines to control system

Solution

- The interface measurement unit NivuScope 2 has been used
- The transmitter has been installed on the pre-thickener and the sensor has been suspended through an existing hole in the ceiling into the medium by using a chain.

Advantages:

- Easy, uncomplicated and quick retrofitting without the need to modify the building



NivuScope 2 with radio transmission

Separation Layer Measurement in Two-Chamber Round Basin

Application

- Two-chamber/combi basin
- Diameter 10 m
- Depth 3.2 m
- No more lines/slip rings available on the scraper bridge



*Two-chamber combi basin
(activated sludge and secondary clarification)*

Definition of Task

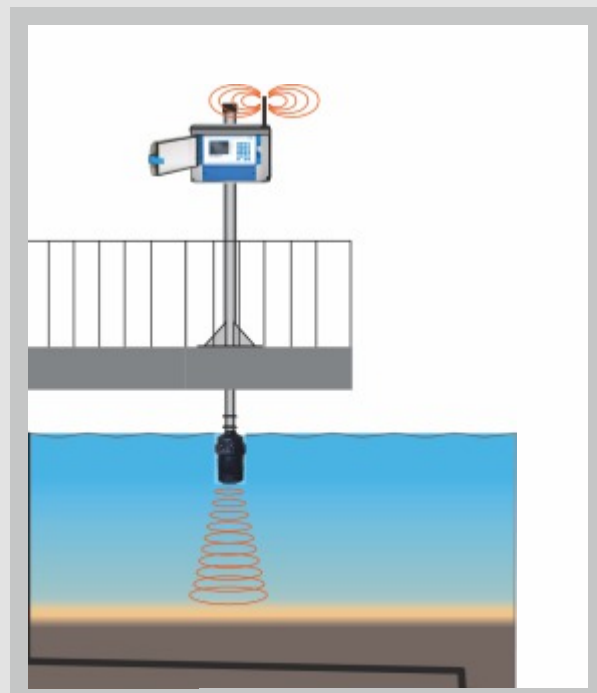
- Detection and control of sludge layer in secondary clarifier
- Self-sufficient sludge level control directly via transmitter
- Transmission of analog output signal to control system

Solution

- The interface measurement unit NivuScope 2 has been used. The transmitter activates the sludge discharge in case of exceeding 160 cm and de-activates in case of falling below 120 cm.
- The unit was installed on the existing scraper bridge. Readings are transmitted using a separate radio connections since no more lines or slip rings were available.

Advantages:

- Easy, straightforward and quick retrofitting without welding works
- The analog signals can be transmitted to the process control system via the radio connection.



NivuScope 2 with radio transmission

Receiving Water Flow Measurement

Application

- Fortified rectangular channel 2.0 x 5.5 m (h x w)
- Mixture of surface water and clarified wastewater from large WWTP
- Risk of vandalism



Mounting situation below bridge

Definition of Task

- Detection of total flow rate
- Flow rate shall be forwarded via radio transmissions to a following surface water treatment plant for quick response in case of rainfall events and sudden loads

Solution

- The ultrasonic transit time method used by the NivuFlow 650 was chosen.
- Rod sensors Type NOS V300 were laterally installed in the sheet pile walls .
- 2-path version, each one in different heights with both paths in crossed direction.
- A contactless sensor Type P06 was installed under a bridge as level measurement.

Advantages:

- Reliable and robust measurement unaffected by floating debris or ice
- "Invisible" sensors, vandal-proof
- Quick and easy installation and commissioning
- System easy to check



Transmitter installation in control cabinet

Flow Measurement Using Inverted “Goose Neck” Syphon

Application

- Pipe DN 150, made of stainless steel
- Full filled
- EMF, faultily installed



Installed measurement

Definition of Task

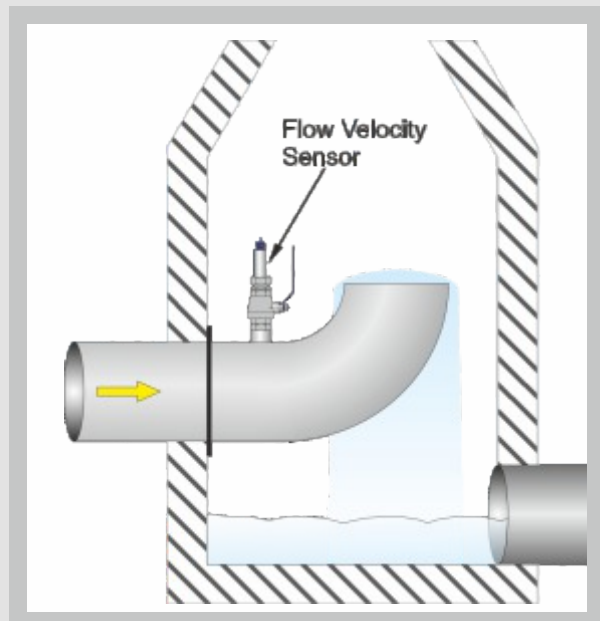
- Accurate measurement with high operational reliability required, which currently cannot be guaranteed due to the installed EMF, air within the pipeline and a much too short calming section
- Quick, easy and cost-efficient retrofitting

Solution

- A measurement system Type NFP has been used.
- The pipe reaching into the discharge manhole has been equipped with an additional pipe section, an elbow (“goose neck”) and with a welding nozzle for flow velocity sensor installation.
- The elbow renders a constantly filled pipe.

Advantages:

- Easy, straightforward and quick upgrading of existing facilities
- Saves costs for pipe section and gate valve



Measurement Setup

Bypass Flow Measurement

Application

- Stainless steel pipes with 80 mm and 200 diameters
- Full filled
- Existing EMF with reduced diameter
- Backwater formation under full load



Top view on measurement place

Definition of Task

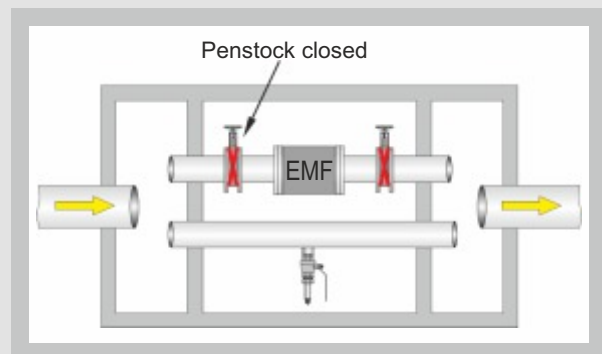
- Cost-efficient and accurate measurement even at low flow rates in the 200 mm bypass line and elimination of EMF due to frequently flooded facility
- Implementation without major modifications and additional flanges, stop valves and similar

Solution

- The existing emergency bypass has been replaced by a pipe with 0.2 m diameter and a nozzle. The NFP sensor is installed in the nozzle.
- It is not necessary to use a stop valve if a ball valve is used. This allows to exchange or to control the sensor under operating conditions.
- Old measurement remains on site without being dismantled.

Advantages:

- Easy, straightforward and quick upgrading of existing facilities



Top view on schematic measurement setup

Partial Discharge Section Flow Measurement

Application

- Pipe DN 500, made of stainless steel
- Full filled
- Service water tapping and feeding point



Pump room with discharge line on rear wall

Definition of Task

- For secondary clarification control a partial discharge of the WWTP needs to be measured
- Recorded values shall be forwarded to control system

Solution

- A transit time measurement system Type NivuFlow 600 using 2 measurement paths has been used.
- The sensors have been installed in a measuring pipe with integrated ball valves. This allows to replace sensors under process conditions at any time.
- Crosswise path arrangement virtually eliminates crossflow during calculation.

Advantages:

- Easy and robust installation using calibrated pipe segment
- No bypass required
- High accuracy and reproducibility



Sensors installed in pipe line

Flow Measurement in Venturi Flume

Application

- Rectangular channel 0.5 x 0.6 m (w x h), made of concrete
- Part filled
- Upgrading an existing Venturi flume with a measurement system



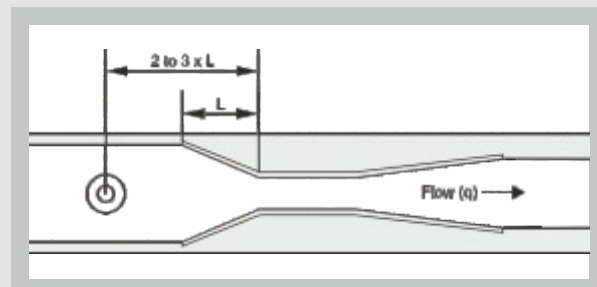
Venturi flume measurement in outlet

Definition of Task

- Detection of wastewater treatment plant discharge using existing Venturi flume
- Output of flow volume to control system
- Output of volume-proportional m³-impulses for on-site counter

Solution

- A Q/h related ultrasonic volume measurement Type NivuMaster has been installed.
- In order to maintain the measuring uncertainty as low as possible, an ultrasonic sensor with a very low dead zone (Type P-M3, dead zone 0.07m) has been selected to detect impoundage level.
- All signals requested by the customer are transmitted from the transmitter to the control system and the on-site counter.
- The sensor has been installed above the Venturi flume by using a standard wall installation angle.



Schematic diagram of Venturi flume and correct sensor position

Flow Measurement using Impoundage Shield

Application

- Pipe DN 400, made of stainless steel
- Part filled
- Only short measuring section available
- Low nightly discharge



Discharge pipe with impoundage shield

Definition of Task

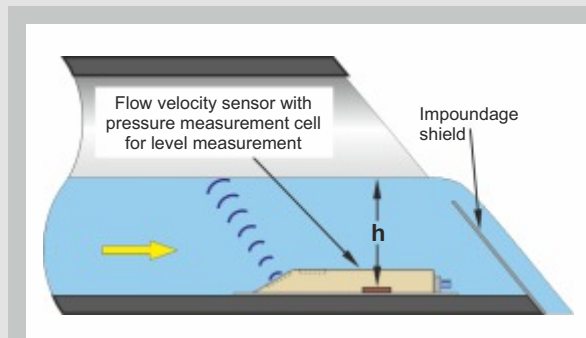
- Implementation of discharge measurement to replace flat-rate billing using the existing inlet measurement and to save costs
- Reliable and accurate detection of low flow volumes during the nights
- Low efforts and expenses for measurement installation

Solution

- The task has been solved using a NivuFlow 750.
- The discharge pipe into the recipient has been left unmodified. It now is used as new measuring section
- A flow velocity sensor with integrated pressure cell for level measurement has been installed using a pipe mounting system.
- To detect even lowest volumes, an impoundage shield has been installed to constantly create a minimum water level.

Advantages:

- No facility modification required
- Sensor fastening without drilling or similar
- High measuring dynamics between nightly discharge and rainy weather can be measured



Setup of measuring section

Flowing Water



Power Plants

- Flow Measurement in Turbine Intake Page 58
- Dam Intake Measurement Page 59

Irrigation & Drainage Systems

- Flow Measurement in Service Reservoir Page 60
- Contaminated Groundwater Flow Measurement Page 61
- Sludge Level Measurement Groundwater Treatment Page 62
- Irrigation Channel Flow Measurement Page 63
- Flow Measurement to ensure Minimum Discharge Page 64

Flood Protection

- Flow Measurement on Flood Polder Page 65
- Seepage Measurement in Dam Page 66
- Flow Measurement Protected Area Drainage Page 67

Special Constructions

- Contactless Flow Measurement on Fish Ladder Page 68
- Flow Measurement on Sluice Page 69

Flow Measurement in Turbine Intake

Application

- Rectangular channel
7.8 x 2.0 m (w x h)
- Part filled
- Concrete walls due to bridge
- Natural bed



Measurement point at bridge

Definition of Task

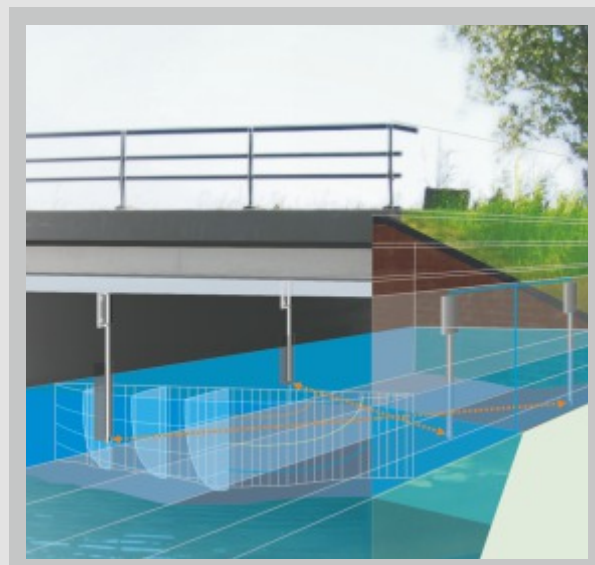
- Continuous detection of turbine intake volumes to ensure the minimum water flow of the river and to prevent the turbines from underload operation without shutdown
- Easy installation of measurement system

Solution

- A transit time measurement Type NivuFlow 650 has been used due to water quality and low suspended solids content.
- A measurement point underneath a bridge has been selected in order to obtain the best possible profile shape.
- The natural bed is tending to crossflow effects. Two measurement paths have been installed crosswise to compensate these effects.

Advantages:

- Easy and robust installation
- High accuracy
- Reproducibility of readings
- Reliability under all process conditions



Installation of rod sensors

Dam Intake Measurement

Application

- Rectangular channel 1.80 x 3.00 m (h x w), partially concrete, partially dry-stone walls
- Part filled
- Rainwater and surface water
- Short calming section
- Manual detection of flow rates (level reading and Q/h-table) destroyed after flood



Measurement point with sensors

Definition of Task

- Continuous, automated flow measurement of turbine intake
- High measurement accuracy despite short and unfavourable calming section for optimum use of the turbine for energy production
- Maintenance-free system required since no personnel available

Solution

- Ultrasonic transit time measurement with NivuFlow 650 was chosen due to the relatively clean medium.
- A section of the channel bottom was planed with concrete improving the hydraulic conditions at the measurement point.
- To achieve high accuracy after compensating skew flow behind the bend a crosswise 2-path measurement with transit time sensors mounted in different heights were installed.

Advantages:

- Einfache Montage, leichte Zugänglichkeit, hohe Genauigkeit, Zuverlässigkeit und Wartungsfreiheit



Flow Measurement in Service Reservoir

Application

- Special profile, approx. 2.5 x 2.0 m (h x w)
- Part filled
- Channel made of natural stone and concrete
- High flow dynamics



Storage lake

Definition of Task

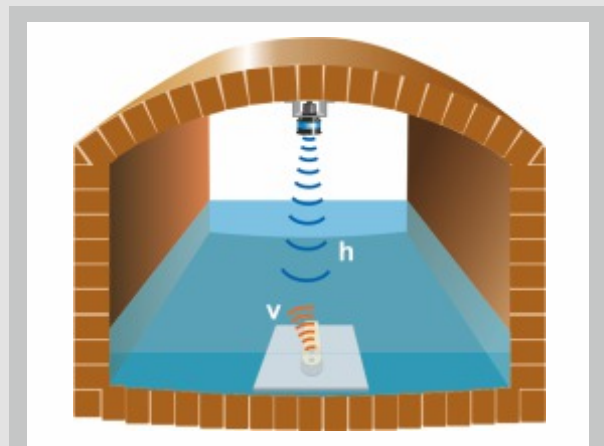
- Detection of readings of a service reservoir intake for volume control and water management
- The measurement systems must ensure reliable handling of high flow dynamics from very low inflow up to a maximum inflow of up to 2000 l/s

Solution

- A flow measurement system Type NivuFlow 750 has been used. The level is detected by a separate compact echo sounder.
- The sensor has been installed on a stainless steel plate to prevent the sensor from obstruction and to avoid vorticity on the channel bottom.

Advantages:

- The particular profile can be easily programmed thanks to the user-friendly programming structure of the transmitter
- The high measurement dynamics can be reliably handled thanks to specially adjusted sensor systems



Measurement point

Contaminated Groundwater Flow Measurement

Application

- Trapezoid channel 1.5 x 0.5 m (w x h)
- Part filled
- Concrete channel bottom, embankment reinforced with water engineering stones
- Remote measurement place



Measurement point with gauge staff

Definition of Task

- Flow measurement in partially contaminated groundwater from former tar factory site for proof purposes
- No power supply available
- No solar power supply or open sensors possible due to the risk of vandalism
- Long readout cycles of saved measurement data

Solution

- The portable flow measurement system Type PCM 4 with rechargeable battery and memory card data storage has been used.
- Due to the slow fluctuation of readings a measuring interval of 30 minutes has been selected.
- A combined flow velocity / level sensor has been mounted on the channel bottom.

Advantages:

- Easy and quick sensor installation
- No visible sensors
- Long-life measurement without battery replacement or data backups



Open control cabinet with transmitter

Sludge Level Measurement Groundwater Treatment

Application

- Multi-stage container plant
- Chamber size 2.4 x 2.9 x 12.2 m (w x h x d)
- Aerated, limed groundwater with approx. 80 mg/l iron ochre contents
- Built-in lamella filters



Lamella filter plant with installed sensors

Definition of Task

- Continuous detection of iron hydroxide sedimentation level from 10 filter chambers
- Robust measurement system, insensitive to pollution, operating well and reliable in high iron ochre concentrations
- Variably adjustable limit values for automatic sludge discharge control

Solution

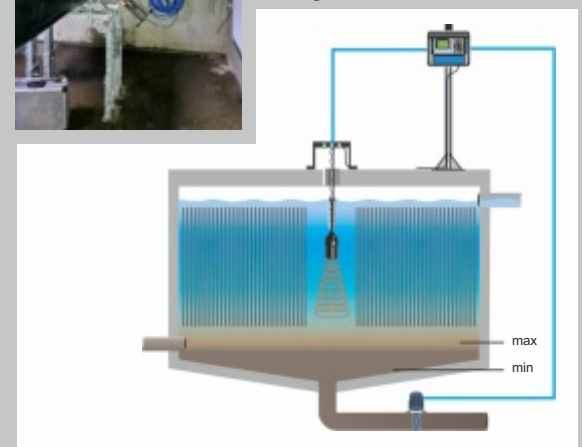
- An ultrasonic system with separation layer measurement based on the detection of density layers was selected.
- The NivuScope Ns2 with 2-channel transmitter and large graphic display was selected.
- The sensors were inserted into the single chambers from the top using variable immersible fittings made of stainless steel.

Advantages:

- One transmitter for 2 measurement points
- Large graphic display for optimum signal analysis during measurement setup



Sludge tank outlet



Installation principle

Irrigation Channel Flow Measurement

Application

- Trapezoid concrete channel 9.5 x 2.5 m (w x h)
- Part filled
- Very high volumes and velocities from time to time



Planned measurement point

Definition of Task

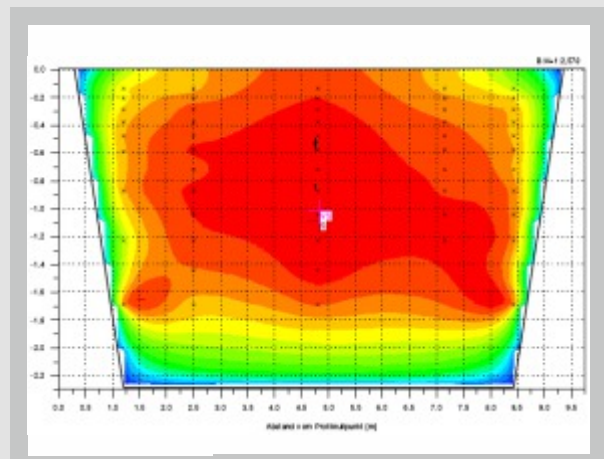
- Detection and control of the volumes removed for irrigation purposes
- Transmission of measurement data to center via existing network (Ethernet)
- Highly dynamic measurement required (flow velocities from 0 – 200 cm/s)

Solution

- The flow measurement system Type NivuFlow 650 has been used.
- The economically most cost-efficient solution was to use two measurement paths. Excellent accuracy has been achieved by calibrating the system under varying operating conditions.

Advantages:

- Reliable and stable measurement covering the entire flow range up to velocities higher than 2m/s
- Cost-efficient measurement even in large channel dimensions



Recorded flow profile for calibration

Flow Measurement to Ensure Minimum Discharge

Application

- Trapezoid channel 7.0 x 3.0 m (w x h)
- Partially filled
- Concrete channel bottom, embankment reinforced with water engineering stones
- Upstream adjustable water separator



Measurement place under construction

Definition of Task

- Flow measurement to ensure a minimum flow volume of 150 l/s for feeding into the drinking water production area of a city of over a million inhabitants
- Highly dynamic low-maintenance system for reliable detection of flow rates even in case of flood

Solution

- The flow measurement system Type NivuFlow 750 has been used.
- Two flow velocity sensors have been used to achieve redundancy and to improve accuracy.

Advantages:

- Easy and quick sensor installation
- High accuracy and reliability
- Easy to verify



Measurement place in use

Flow Measurement on Flood Polder

Application

- Concrete duct 6 x 3.5 m (w x h)
- Part filled
- 3 parallel ducts
- Very high flow dynamics featuring flow rates up to 82 000 l/s



View of the 3 part flooded polder gates

Definition of Task

- Detection of flood polder flow volumes of a large European river
- Control of storage volume utilisation (12 000 000 m³ on 5.8 km² flooding area) to reduce flood damage
- Highly dynamic and maintenance-free measurement insensitive to sedimentation

Solution

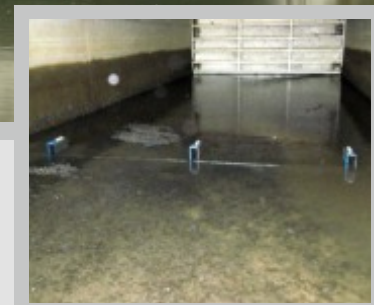
- Three flow measurement systems Type NivuFlow 750 M3 with each using 3 flow velocity sensors have been used.
- The sensors have been arranged according to a calibrated hydraulic model to achieve maximum possible accuracy.
- Sensors have been installed on profiles in order to prevent them from soiling.

Advantages:

- Cost-efficient sensor installation in existing construction
- Quick and easy commissioning
- High accuracy and reliability



Polder gate and installed sensors



Seepage Measurement in Dam

Application

- Dam wall 130 years old, approx. 500 m length, made of quarry stone with clay core
- Gallery inside of dam wall to check seepage volumes
- Seepage volumes ranging from ml/s to l/s
- Currently seepage water volumes are manually determined once per week



Outside and inside views of dam wall

Definition of Task

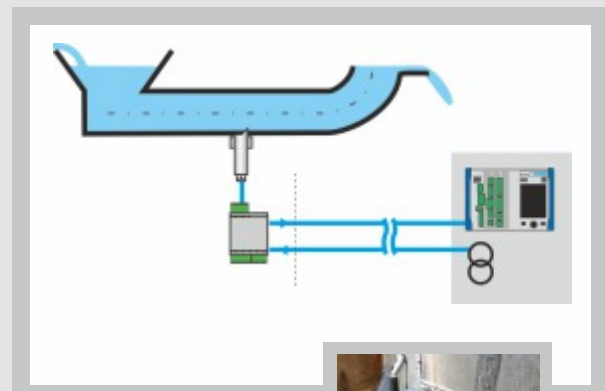
- Detection of low volumes of seepage water within the dam gallery for continuous monitoring and early warning prior to dam break in case of increasing seepage volumes
- Sensor installation in dam interior with 100% humidity
- Continuous evaluation of flow rates and monitoring outside of the dam area in a distance of approx. 1000 m in control cabinet

Solution

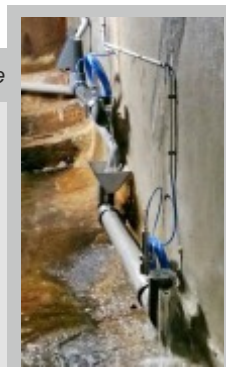
- A flow measurement system Type NivuFlow 750 was used.
- The low flow volumes were combined using a pipe DN 100. A cross correlation pipe sensor detects the very low flow volume inside of the full pipe within a few mm.
- A water-proof installed MPX preamplifier transmits the flow velocity signals measured on site to the transmitter in a distance of 1000 m.

Advantages:

- Reliable transmission of signals to the transmitter over a distance of 1000 m
- Permanent monitoring of the old construction ensures the safety of the people living behind the dam



Installation principle



Flow Measurement Protected Area Drainage

Application

- Steel pipeline DN 500
- Fully filled
- Groundwater without any pollution
- Measurement system permanently immersed due to short calming section



Shaft with immersed pumps and measurement systems

Definition of Task

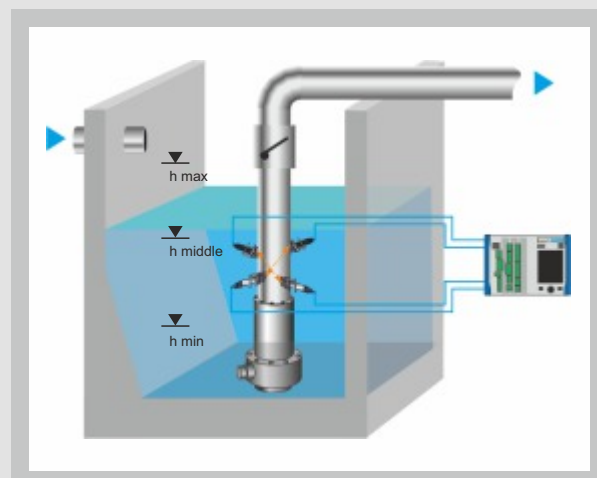
- Detection of drained volumes in the low-lying protective dyke area of a large German river
- High measurement accuracy despite short calming section
- Immersed pumps and permanently overflowed calming section require IP 68 for the sensors used
- Maintenance-free measurement system required due to inaccessible measurement point

Solution

- Due to the lack of reflecting particles in the medium the ultrasonic transit time measurement Type NivuFlow 600 was used.
- To achieve high accuracy and to compensate the swirl downstream of the pumps a crosswise 2-path measurement with 4 sensors was installed.
- To avoid maintenance measures the velocity sensors were installed directly inside of the pressurised line using welded nozzles and clamping elements.

Advantages:

- High accuracy, reliability and free of maintenance



Measurement principle

Contactless Flow Measurement on Fish Ladder

Application

- Concrete intake channel
3.0 x 2.0 m (w x h)
- Part filled
- Gravel bed



View of measurement place

Definition of Task

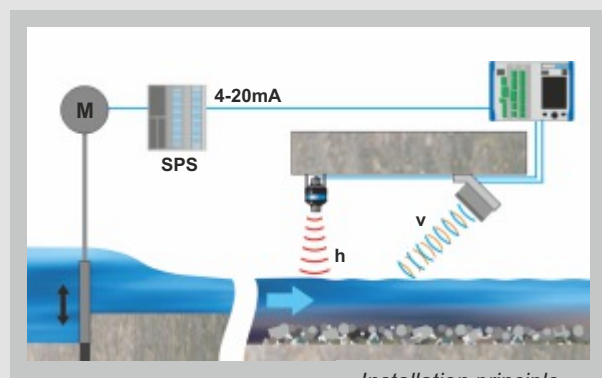
- Flow measurement to ensure a minimum water volume required for the fish ladder
- No sensors can be installed on the channel bottom
- Contactless measurement if possible on inaccessible point (risk of vandalism)
- Medium accuracy requirements

Solution

- A contactless surface radar system Type OFR was installed in the fish ladder approach under a bridge.
- The System measures the speed of surface waves resulting from the rough channel bottom (gravel bed). The current flow rate is calculated from this velocity and the current flow level which is measured contactlessly as well.
- The flow rate is passed on as mA signal to a PLC on site which controls the position of a slide valve upstream of the measurement point

Advantages:

- Contactless measurement system
- "Invisible" sensors
- Low installation and commissioning efforts



Installation principle

Flow Measurement on Sluice

Application

- Rectangular channel 5 x 5 m
- Part filled
- Concrete lining
- Flow in both directions possible



View of sluice

Definition of Task

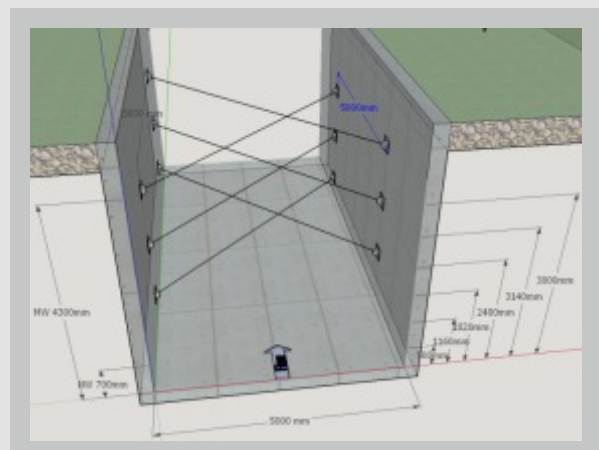
- Measurement of feed and drain volumes in the system channel to sluice chambers
- High accuracy required to create a water balance of the channel system
- Proven and reliable low-maintenance measurement system

Solution

- The bidirectional NivuFlow NF650 flow measurement system was used.
- 3 measuring levels with 2 crossed paths each and the positions of the hemisphere sensors used as well as the evaluation of the individual velocity paths according to DIN EN ISO 748 ensure high accuracy.

Advantages:

- Reliable measurement with high accuracy
- Accepted by authorities since recording and evaluation of readings are based on international standards



Measurement scheme

Chemical Industry

- Flow Measurement in Cooling Water Tap Page 72

Food Industry

- Flow and Analysis Measurement Page 73

Power Plants

- Flow Measurement Cooling Water Discharge Page 74
- Critical Flow Measurement in large Plastic Pipe Page 75
- Turbine Intake Flow Measurement Page 76
- Flow Measurement in 8 Cooling Water Intakes Page 77

Steel Plants

- Slag Water Intake Measurement Page 78

Surface Mining

- Mine Water Flow Measurement Page 79
- Power-Independent Flow Measurement with GPRS Transmission Page 80
- Flow Measurement in Gold Ore Processing Plant Page 81

Landfill Sites

- Landfill Leachate Flow Measurement Page 82

Durchflussmessung Kühlwasserentnahmestelle

Application

- Closed concrete rectangular channel, 3.8 x 3.5 m (h x w)
- Part filled



Montage der Sensoren im Kanal

Definition of Task

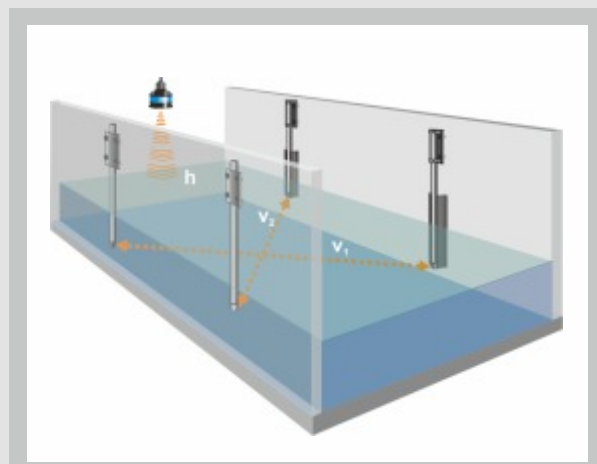
- Pump control as well as the cooling process require to permanently control the flow within the cooling water channel
- The inflow must be controlled due to the limited volume of the downstream sand separators
- Continuous flow detection even in case of fluctuating water levels

Solution

- A transit time measurement Type NivuFlow 650 has been used due to the clean medium.
- Rod sensors have been used, allowing to select holders which enable sensor removal from the outside under operating conditions. The sensor holders have been installed in the top area since the water level cannot be lowered for a longer period. This allows to remove the sensors from above for maintenance purposes.

Advantages:

- High accurate flow detection
- Easy and robust installation
- Sensors can be removed or maintained under operating conditions



Rod sensor installation

Flow and Analysis Measurement

Application

- Pipe with 0.3 m diameter, made of HDPE
- Part filled
- Shift production
- Heavy flow fluctuation
- Low sedimentation



NPP in operation

Definition of Task

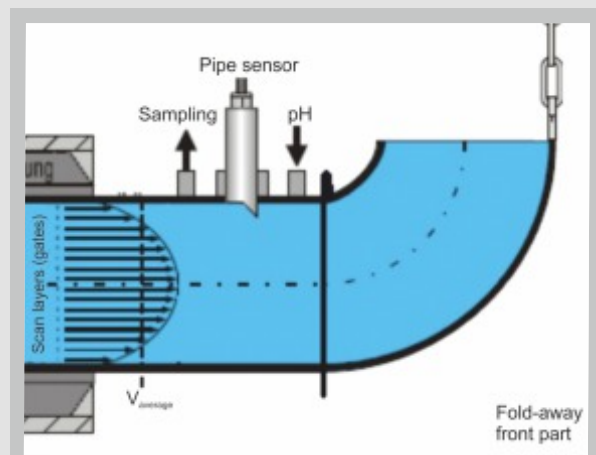
- Installation of a measurement place for billing purposes including flow rate and pH measurement as well as sampling point upstream of the junction into the municipal channel
- Accurate measurement of extremely low volumes up to maximum discharge
- The existing transfer shaft shall be used to install the measurement system
- Cleaning and control shall be carried out by one single person

Solution

- Using the NIVUS Pipe Profiler (NPP) creates a high accurate flow measurement which furthermore is able to reliably detect and to compensate sedimentation and obstructions.
- pH sensor and sampling point have been integrated into the measurement pipe.
- The elbow segment of the measurement pipe may be folded away for cleaning purposes.

Advantages:

- Compact and robust combined measurement place
- Cost effective measurement from the top of the manhole.



Schematic diagram of NPP including sampling and pH sensor

Cooling Water Flow Measurement

Application

- Rectangular channel 20 x 5 m (w x h)
- Part filled
- Walls and bottom made of concrete
- High oxygen content up to 10 mg/l and temperature layers in the medium



Measurement place

Definition of Task

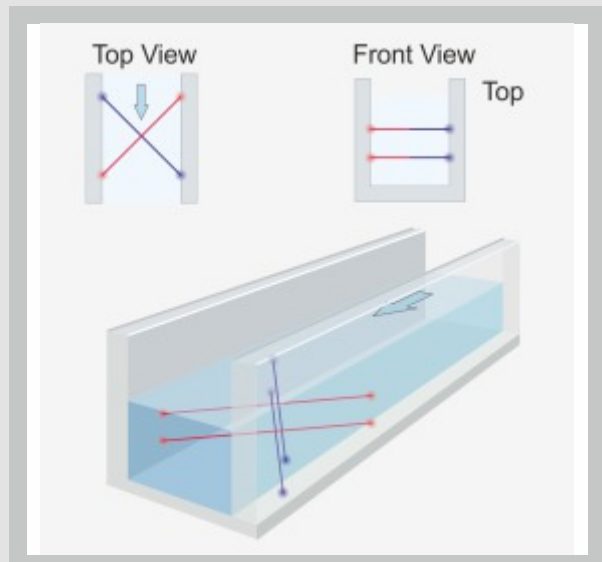
- Investigation of cooling water volumes required for cooling of several large gas generators for waste heat balancing
- Installation during operation without the need to employ divers
- No sensor installation on the channel bottom allowed due to the risk of sedimentation

Solution

- The flow measurement system Type NivuFlow 650 has been used.
- A system with 4 crossed paths ensures high reliability and accuracy.
- Rod sensors installed on the channel walls ensure easy installation, adjustment and maintenance accessibility.

Advantages:

- Quick installation at short notice of the complete system during operation without the need for divers
- High accuracy and reliability



Installation principle

Critical Flow Measurement in large Plastic Pipe

Application

- Pipe DN 2400 made of wrapped GRP
- Part filled
- Cooling water (seawater) with max. flow rate of 60.00³/h from power plant



Outside view of measurement place

Definition of Task

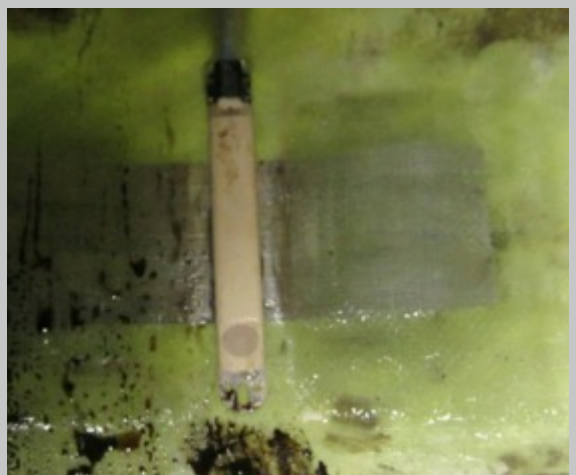
- Accurate flow detection at flow velocities up to 6 m/s
- No holes must be drilled into the plastic pipe

Solution

- A permanent flow transmitter Type NivuFlow 750 with wall mount enclosure has been used. As accompanying sensor the high-performance flow velocity sensor Type CS2 utilising the ultrasonic cross-correlation method has been selected.
- The sensor has been fastened on the pipe bottom using a mounting sheet and a special synthetic resin adhesive.
- An external ultrasonic level measurement using a NivuNaster L2 with a p10 sensor has been installed additionally as redundant level system.

Advantages:

- Low installation expenses
- Reliable and stable measurement in all measurement ranges



Installed CS2 sensor (combi sensor)

Turbine Intake Flow Measurement

Application

- Steel pipeline with 1400 mm diameter
- Remotely situated and hence no power supply available
- High flow velocities



Pipeline down to valley downstream of turbine

Definition of Task

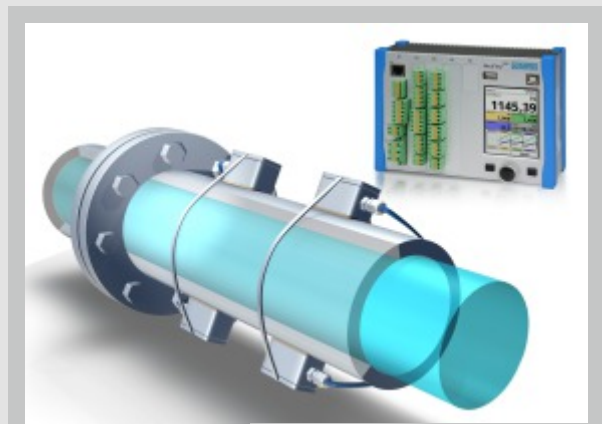
- Installation of flow measurement to verify the turbine performance in the pipeline down to valley
- No holes must be drilled into or mechanical parts must be welded onto the pipeline
- System cannot be shut down for installation works

Solution

- The portable measurement system NivuFlow 600 CO using the ultrasonic transit time method has been used for this application.
- No need to interrupt the running process thanks to attaching the sensors on the pipeline outside by using tensioning belts (clamp-on).

Advantages:

- No interruption of running processes
- Easy installation
- Temporary measurement with long lifetime
- Stable and reliable measurement



Principle of transit time method

Flow Measurement in 8 Cooling Water Intakes

Application

- 8 rectangular concrete channels, partially operating parallel
- Dimensions between 2.0 x 2.0 m and 3.0 x 2.0 m (w x h)
- Permanently full filled at measurement spot
- Surface water taken from large river
- Control slide gates downstream



View of installation place

Definition of Task

- Flow Measurement for proof of cooling water withdrawal for responsible authorities
- Control of maximum permissible withdrawal volume at low water levels
- Detection of distribution of partial volumes

Solution

- All measurement places were equipped with flow measurements based on the transit time (time of flight) principle.
- Transmitters Type NivuFlow 650 and Type NIS-V300 wedge sensors were used.
- Each measurement spot was set up as double measurement path with both paths positioned in different heights within the rectangular channel.

Advantages:

- Reliable measurement
- Maintenance-free



Installed sensors

Slag Water Intake Measurement

Application

- Cup-shaped concrete channel, 0.8 x 1,0 m (w x h)
- Part filled
- High content of sharp-edged slag, partially risk of sedimentation
- High flow velocities



View into intake channel

Definition of Task

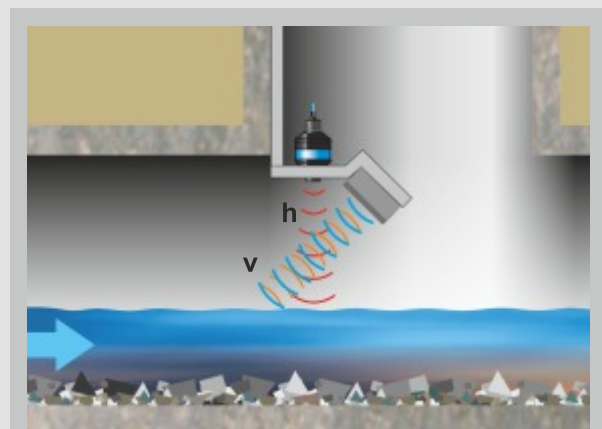
- Wear-free measurement system
- Uncomplicated installation

Solution

- Due to partially high slag contents with high potential of abrasion a contactless surface wave radar system Type OFR was chosen.
- High flow velocities ensure formation of surface waves almost proportional to the flow velocity which can be detected by the measurement system without any problems.
- The measurement does not need to be calibrated due to the operator's low accuracy requirements.

Advantages:

- Easy and uncomplicated installation of contactless sensors
- Free of maintenance and wear
- Easy to clean at any time



Schematic representation

Mine Water Flow Measurement

Application

- Rectangular concrete channel 2.5 x 1.5 m (w x h)
- Part filled
- Pit water purification system of a brown coal surface mining plant
- Medium with high solid contents (iron ochre)



Measurement point with level sensor

Definition of Task

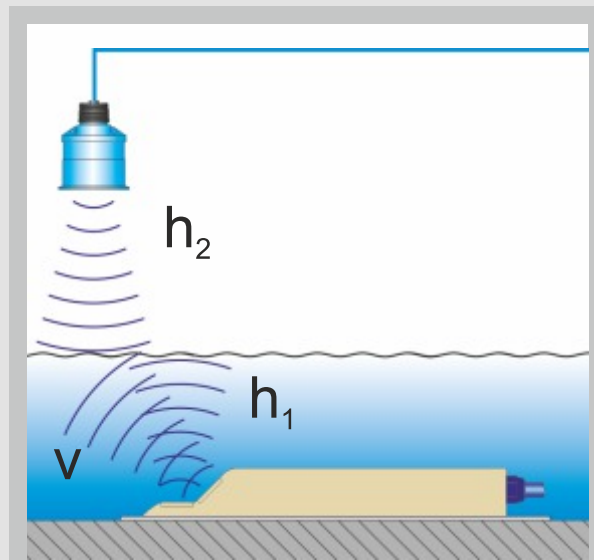
- Continuous volume measurement for subject-to-control hydraulic plant efficiency
- Iron oxide (ochre) contained in the pit water shall not influence the measurement system
- Redundant water level measurement

Solution

- The planned expensive solution using a Venturi flume has been replaced by the cost-efficient and more accurate NivuFlow 750 measurement system.
- Apart from flow measurement, the application has been equipped with 2 different level measurements to ensure redundancy. An air-ultrasonic as well as a water-ultrasonic sensor have been used.

Advantages:

- Higher accuracy and measurement dynamics than the planned Venturi measurement
- Higher flow velocities and less sedimentation than Venturi measurement with backwater
- Construction costs reduced by 60%



Measurement setup

Power-Independent Flow Measurement with GPRS Transmission

Application

- Rectangular concrete channel, 2.4 x 1.0 m (w x h)
- Part filled
- No power supply

Definition of Task

- Detection of the discharge volumes from pit water purification system
- Automated regular remote data transmission
- Installation without additional constructions in existing channel
- No switching cabinet desired (risk of vandalism)



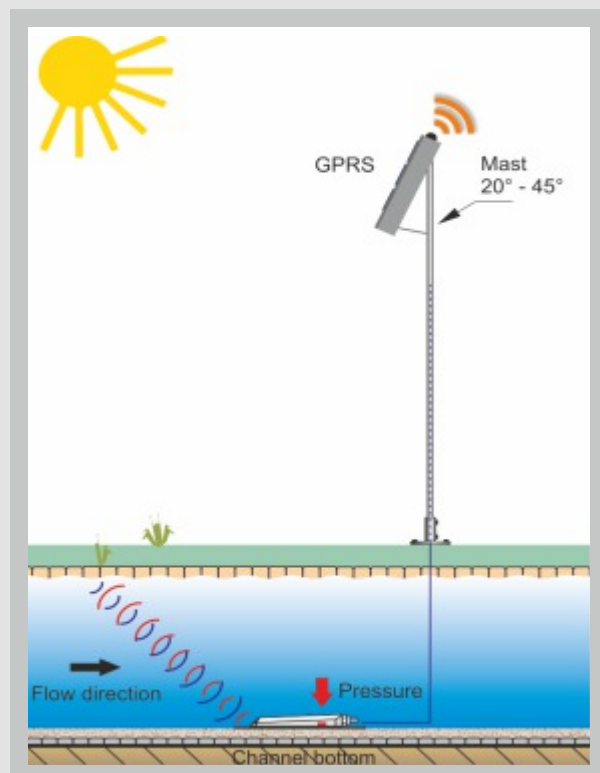
Installed NivuLog SunFlow

Solution

- The compact solar-powered measurement station Type NivuLog SunFlow with integrated solar controller, rechargeable battery and GPRS modem has been selected.
- The flow velocity Doppler sensor with integrated pressure cell for flow level detection has been installed on a plate on the channel bottom and was directly connected to the measurement station without using additional clamping connections.
- The values recorded (flow velocity, level, temperature and the flow rate calculated on site) are transmitted to the D2W Internet portal via GPRS to save the data.

Advantages:

- Low installation and commissioning expenses



Flow Measurement in Gold Ore Processing Plant

Application

- Stainless steel pipe DN 500
- Partial filling with heavy fluctuation
- Acidified, very turbid water (approx. 50 NTU)



View of open pit mine

Definition of Task

- Replacement of a non-functioning clamp-on measurement
- Continuous flow measurement to control a processing plant for acidified water
- Reliable measurement at fluctuating level, variable turbidity and acid contents

Solution

- The cross correlation method with digital pattern detection has been used. Here the pollution load does not affect the velocity evaluation.
- The corrosion-proof pipe sensor Type POA was installed directly from the outside using a welding nozzle bottom upwards flush with the channel bottom. The sensor provides readings on level and flow velocity directly to the transmitter.
- The transmitter computes the current flow rate and transmits the data via ModBus to the processing plant control system.

Advantages:

- Easy and uncomplicated retrofitting without dismantling works on existing pipeline
- Reliable and failure-free measurement, even under heavily fluctuating intake conditions
- Quick and easy installation and commissioning
- Programming and commissioning in the national language



Sensor Installation

Landfill Leachate Flow Measurement

Application

- Pipe DN 200 made of HDPE
- Part filled
- Maximum discharge flow rate 1.5 l/s
- Risk of formation of mineral deposits



Measurement place

Definition of Task

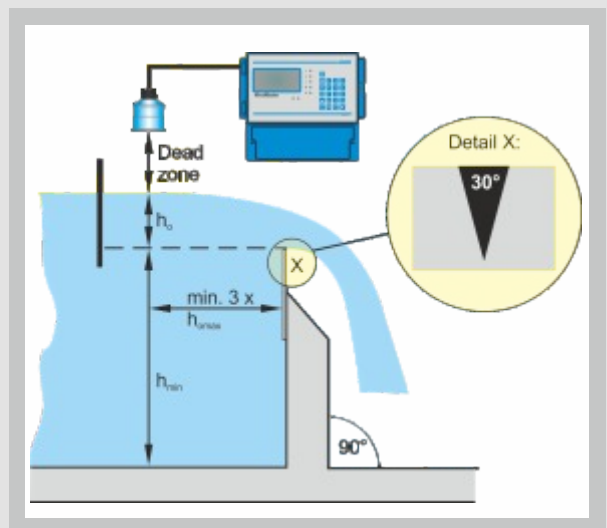
- Detection of deposits from a groundwater well within a landfill site area for water balance detection
- Accurate, long-term stable and low-maintenance measurement
- Measurement shall be installed without major reconstruction measures in the proximity of an existing collector

Solution

- Due to low flow volumes it was necessary to use weir measurement according to Thomson (V weir).
- The non-contact ultrasonic measurement system Type NivuMaster is used to detect overflow height.
- Collector trough and weir opening have been constructed to obtain the best possible accuracy.

Advantages:

- Maintenance shall be reduced to regular visual inspections and occasional removal of incrustation building up.
- Easy adaption to possible higher flow rates through exchangeable weir plates featuring greater angles.



Measurement on V weir

Water Supply

Groundwater

- Deep Well Level Measurement Page 84
- Level Measurement with Data Transmission via GPRS Page 85

Drinking Water

- Flow Measurement on Delivery Point from national to regional Supplier Page 86
- Nighttime Supply Flow Measurement Page 87
- Overhead Tank Intake and Discharge Measurement Page 88

Telecontrol

- Visualisation and Logging of several Waterworks Page 89

Channel Networks

Wastewater
Treatment Plant

Flowing Water

Industry

Water Supply

Deep Well Level Measurement

Application

- Deep drilling 150 m
- Bore diameter 30 mm



Photo: Henry Mühlhölzer

Water level measurement in deep well

Definition of Task

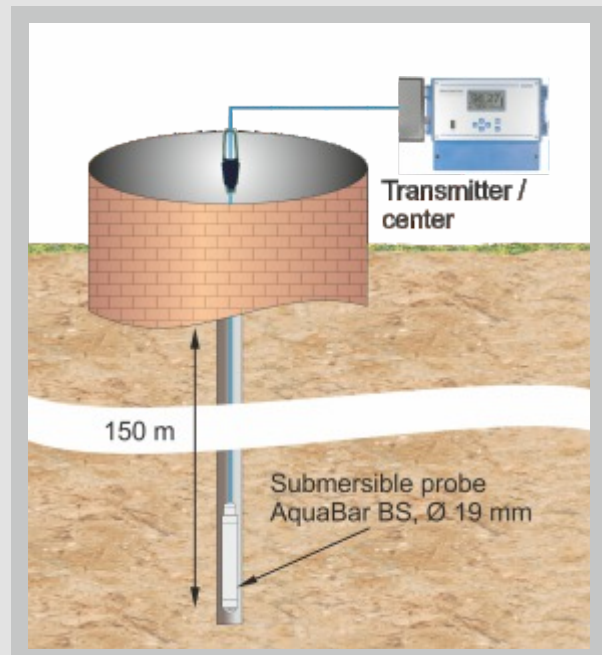
- Continuous detection of groundwater level
- Detection using suspended pressure probe
- Pressure probe appropriate for small bore diameters of 30 mm
- Easy installation and removal for maintenance purposes

Solution

- A submersible well probe Type AquaBar BS with fixed cable has been used for continuous detection of the groundwater level.

Advantages:

- Universal use of probe due to low outside diameter of 19 mm.
- Long-life and corrosion-proof sensor body and diaphragm thanks to using stainless steel 1.4571 (AISI 316Ti).
- Easy installation and removal for maintenance due to lightweight probe.



Deep well with core drilling

Level Measurement with Data Transmission via GPRS

Application

- Measuring tube with 150 mm diameter
- No power supply available on site

Definition of Task

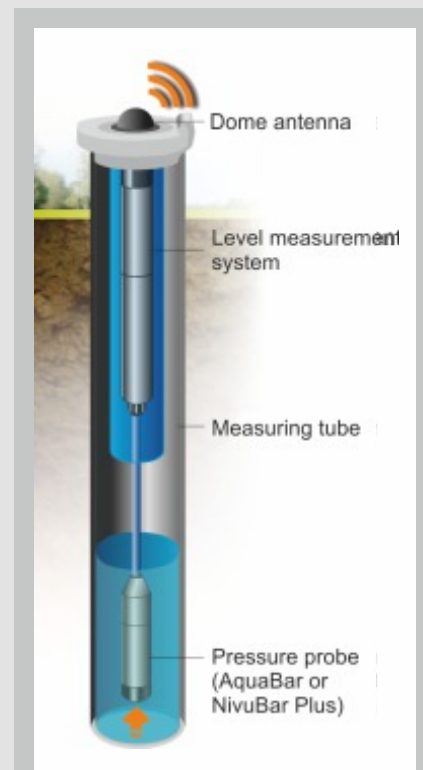
- Groundwater level measurement at multiple level measurement spots
- Data logger installed in measuring tube
- Stable and reliable data transmission
- Extremely long lifetime without the need to replace the battery
- Forwarding of measurement data to higher control system



Measuring tube with mast cap and dome antenna

Solution

- A battery-powered GPRS level data collector with a directly connected pressure probe Type AquaBar has been used.
- The very powerful battery and a very short measurement duration of less than 1 sec. per measurement allow a battery life of approx. 10 years.
- Thanks to very compact dimensions and the high protection degree it was possible to place the data logger directly within the measuring tube.
- Effective data compression as well as the special transmission method ensure uninterrupted transmission of readings. The connection to the customer process control system is carried out using the NIVUS data portal "Device to Web".



Installation principle

Flow Measurement on Delivery Point from national to regional Supplier

Application

- Cast iron pipeline DN 400
- Full filled
- High measurement dynamics



Flow Measurement using clamp-on sensors

Definition of Task

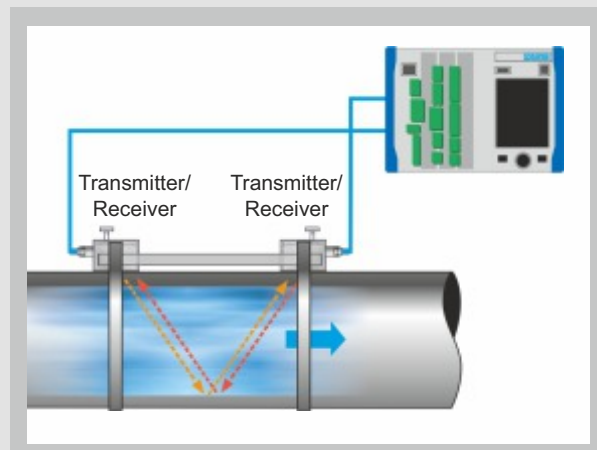
- Flow measurement for billing of delivery volumes to regional supplier
- No mechanical intervention in existing pipeline allowed
- No medium contact (drinking water)

Solution

- A flow measurement system Type NivuFlow 600 based on the transit time (time of flight) principle was used.
- The pipeline was equipped with clamp-on sensors on the outside.
- The rail system used enables easy maintenance due to the sensor fixation.

Advantages:

- No modification of the existing pipeline (pressure surges)
- Quick and easy retrofitting
- Cost-efficient



Schematic representation

Nighttime Supply Flow Measurement

Application

- Pipe with 0.1 m diameter
- Full filled
- Low water volumes of approx. 3 l/s



Nighttime supply measurement point in bypass pipeline

Definition of Task

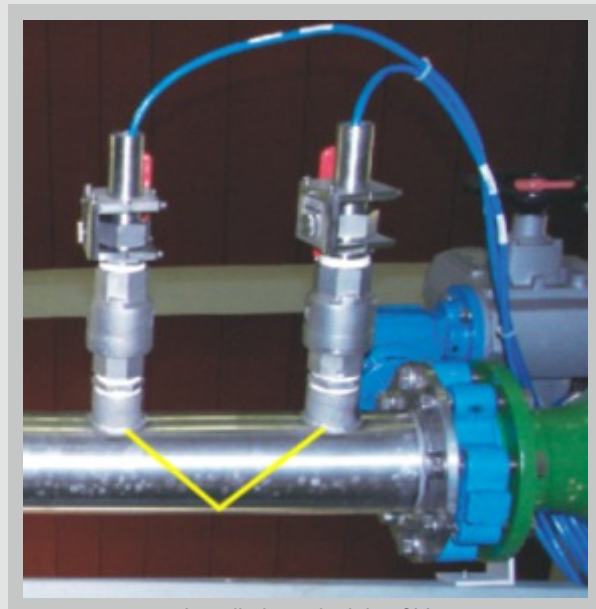
- Detection of low issue quantities from a drinking water overhead tank during nighttimes
- Replaces the EMF not working properly due to low flow velocities
- Data transmission via GPRS to center

Solution

- The flow measurement system Type NivuFlow 600 has been used.
- The measurement has been installed as v-shaped single path measurement due to the narrow diameter.
- Using the transmitter-integrated GPRS modem allows direct connection as web server.

Advantages:

- Easy, straightforward and quick upgrading
- No additional adapters and constrictions required
- High accuracy and reliability at low flow velocities



Installation principle of V-measurement

Overhead Tank Intake and Discharge Measurement

Application

- Pipe with 0.25 m diameter, made of cast iron
- Full filled
- Overhead tank featuring one single pipeline and flow in both directions



Filling and drain pipe with installed sensors

Definition of Task

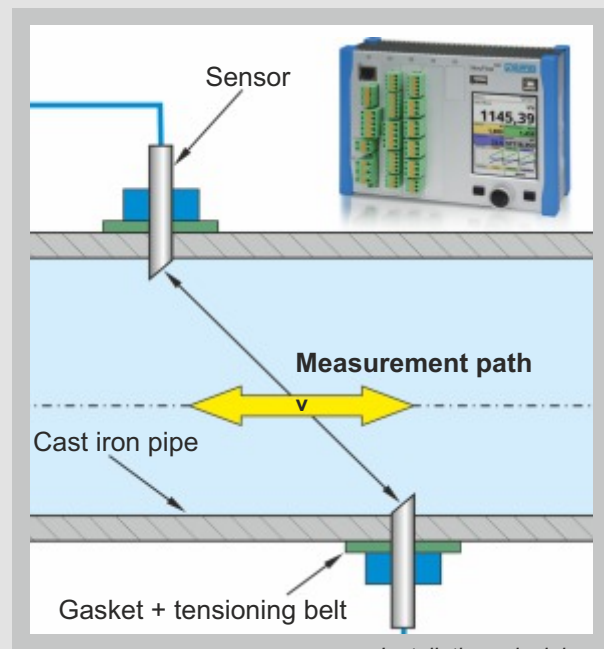
- Comparison between water volumes consumed within the supply network during daytime and the water volumes refilled during nighttime to detect pipeline breaks or leakage
- Measurement on a single pipeline featuring bidirectional flow
- Sensors shall be installed in permanently full iron cast pressure pipelines (no shut-off or draining devices available)

Solution

- A transmitter Type Type NivuFlow 600 has been selected to solve the task.
- One pair of wetted sensors has been used. These sensors have been screwed into 2 pressure-proof tensioning clamps under operating conditions using a drilling device.

Advantages:

- Easy, straightforward and quick upgrading without the need to drain the pipe
- High accuracy and reliability

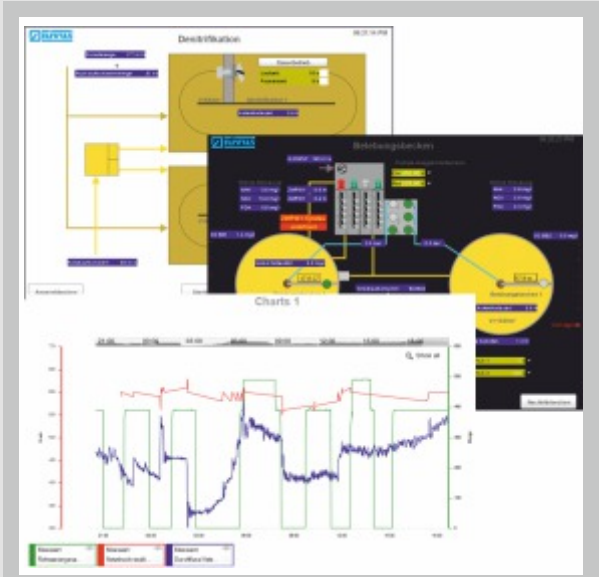


Installation principle

Visualisation and Logging of several Waterworks

Application

- Modernisation of the procedural infrastructure by introducing a centralised SCADA system for operating, monitoring, logging and alerting
- Uniform and centralised operation of five waterworks, six wastewater treatment plants and 80 special constructions



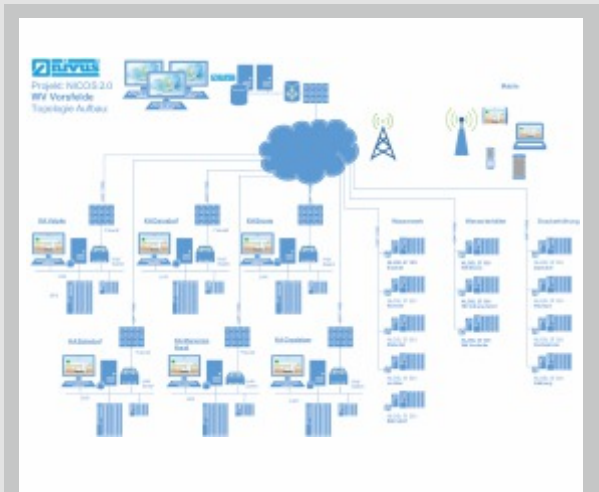
NICOS process charts

Definition of Task

- Self-sufficient operation of waterworks and WWTPs on site
- Increased operating reliability through redundant center and alternative alarm paths
- Web surface for independent operation of the SCADA system
- Connection to programmable logic controllers from various manufacturers

Solution

- Installation of NICOS Business Edition on facilities with direct connection to programmable logic controllers
- Redundant installation of NICOS Enterprise Edition in the center
- Connection of facilities to centerised control station server using Ethernet standard
- Connection of special constructions using NivuLink data loggers
- Alarm manager for individual alerting configuration
- Reporting module for automated creation of protocols and plant reports



Topology of facility with NICOS

NIVUS - Instrumentation for Water Industry



The NIVUS group is a leading developer, manufacturer and supplier of measurement instruments for water industry. Since 1967 our company has been pointing the way ahead by setting new standards and by continuously developing high-quality products and solutions. Today NIVUS is in the position to be a full-range supplier on the water industry market.

Our product portfolio comprises metering devices for flow, level, pressure, water quality, density and turbidity. NIVUS furthermore provides devices and software for detection, transfer, recording and evaluation of data. A high-performance telecontrol system with multiple functions particularly for water industry completes the product range.

The “Urban Drainage Monitoring” division provides measurement campaigns for wastewater channel networks to detect flow and water quality/load as well as to evaluate the measurement data.

Specialised knowledge in hydraulics and many years of experience with measurement technology is required in order to achieve top results in the variety of urban channel systems: we have them both. Our engineers fully meet these tough requirements and have been well-experienced in this area for many years.

The transfer of knowledge and service is part of our top priorities. We aim to provide specific knowledge on our units, appropriate installation and commissioning to each customer at an early stage. For that reason we constantly hold trainings in our premises as well as with our distributors and customers. Our experienced engineers will be glad to give you any available advice regarding your intended applications.

Due to constantly increasing requirements to measurement technology NIVUS is focused on providing both high-quality and economic products and solutions. To reach this goal we continuously invest in technology and the know-how of our staff. The NIVUS group currently consists of more than 100 employees.

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