WAENS Water Environment Services

WAENS BUBBLE CURTAINS

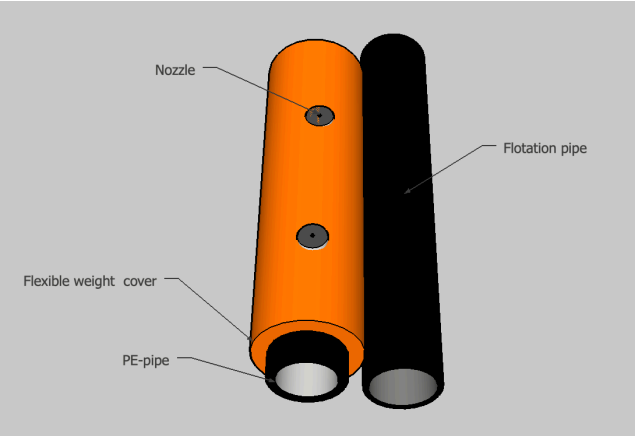
Technical information:

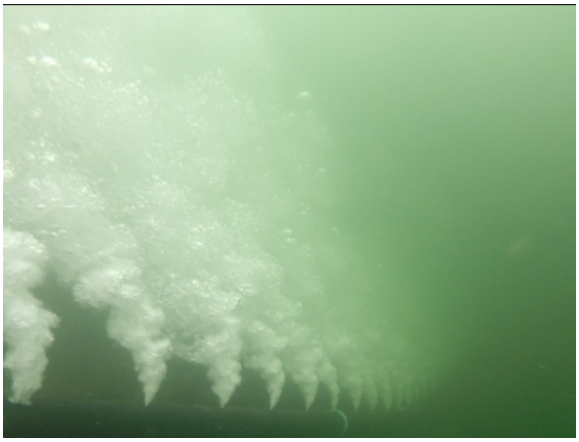
Length:	50 – 500 m
Construction:	Diffuser with specific gravity >1,0 air-filled. For mobile installations; attached to flotation pipe/hose for lifting and repositioning of the installation. The flotation pipe will be air-filled to float the installation.
Dimensions:	Ø63-Ø110 diffuser med 4 - 6 nozzles pr. m.
Air capacity:	Theoretical <30 m deep: 0,6 l/s pr. nozzle, 2,4 – 3,6 l/s pr. m. Theoretical 30-60 m deep: 0,5 l/s pr. Nozzle, 2,0 – 3,0 l/s pr. M.
Purpose:	Reduce underwater noise and shockwaves by blasting and pile driving. Reduce spreading of silt and floating debris. Reduce surface ice by increasing surface temperature (and salinity in sea/ocean sites)

Air supply:

Capacity:	To requirement.
Air Quality:	Class Zero certified (oil-free acc. to ISO8573-1
Power:	Diesel or electric

The bubble curtain is constructed by 2 pipes, one diffuser and on flotation pipe. By installation the flotation pipe are air-filled, and the installation can be floated into the right location. When located the flotation pipe will be water filled and the installation will sink to the bottom. Additional anchoring will be provided if necessary.





When service is needed, or if the installation shall be dismounted or moved to a new location, the flotation pipe will be air-filled and the installation will float to the surface.

NOISE REDUCTION IN WATER

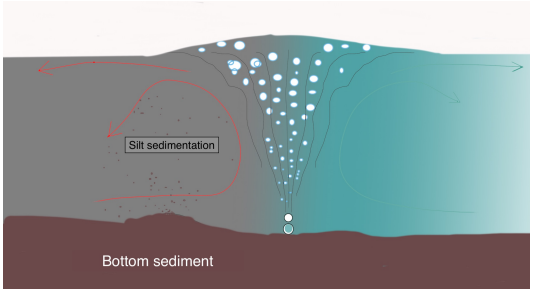
Bubble curtains will prevent mitigation of noise/shockwaves form underwater blasting, piledriving or other noisy underwater activities. This use of bubble curtains are well known and thoroughly documented. Vital to a good function for this purpose are the total amount of air present at all times in the water column between the source and the area to be protected. It is also important that there is a complete ”wall” of air bubbles from seabed to surface and wide enough to cover the area to be protected.

Shockwaves and underwater noise might find their way around the curtain by reflection/refraction or travel in bedrock, but the noise reduction will nevertheless be significant. The effect might be increased by using double bubble curtains.

From test installation for Kystverket Ålesund (Norwegian Coastal Administration). Effects documented by french specialist company "Quiet Waters".

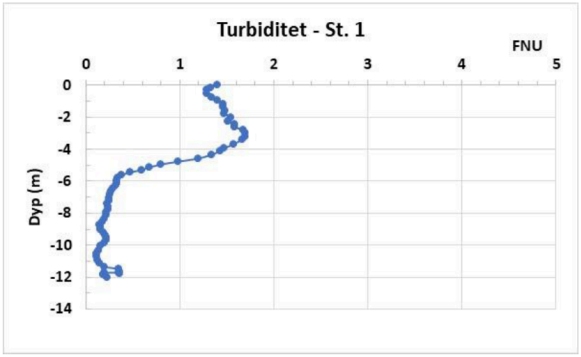
WAENS Water Environment Services

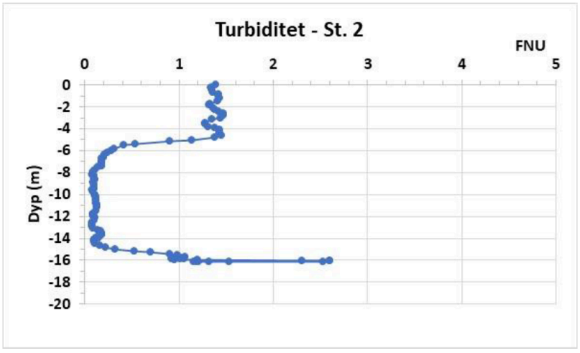
BUBBLE CURTAIN TO REDUCE THE SPREADING OF SILT

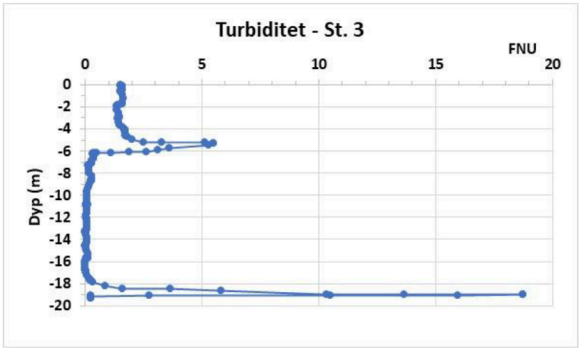


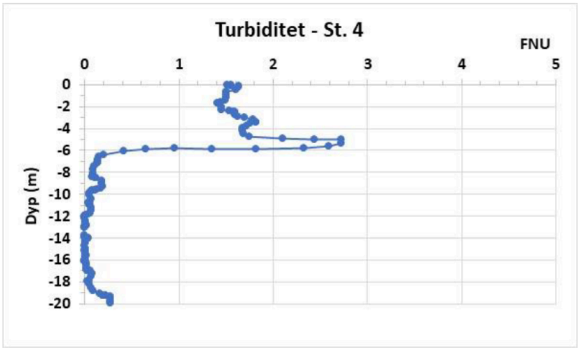
Bubble curtains will reduce the spreading of silt from construction, shoreline excavations or dredging. The rising airflow (plume) produced by the curtain will produce a current that rises to the surface and divert to both sides of the plume. This current stops weaker currents that normally would spread silt. Schematic figure on the left.

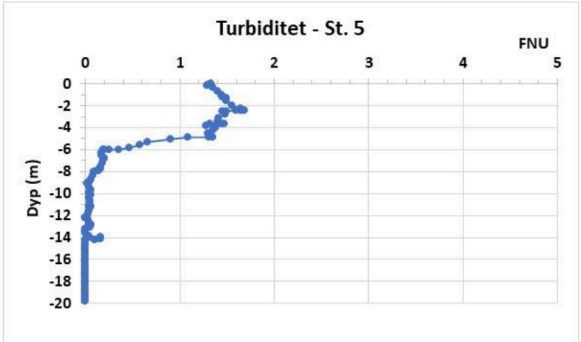
The following figures show automacially measured turbidity inside (st. 1,2,3,4 where 2 and 3 were closes to work area), and outside (st. 5,6) WAENS bubble curtain in Drammen Harbour. The curtain was installed in a fjord with to large river inlets creating a top surface layer of 5 m freshwater with a turbidity of 1.5 FNU over clean saltwater. Then rock from a railway tunnel project was dumped inside the curtain. The charts show how the dumping lead to increased turbidity along the bottom and the salinocline inside the bubble curtain, while no increase in turbidity was observed outside the curtain. The effect of the bubble curtain on the spreading of silt seems to be good.

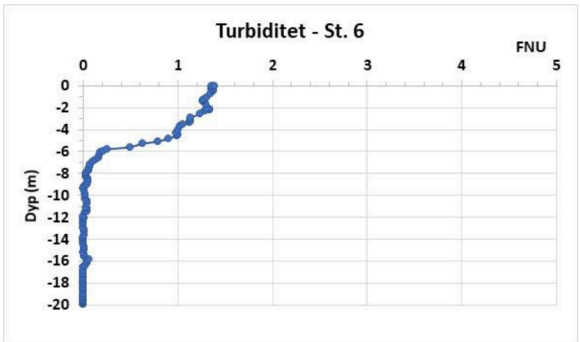




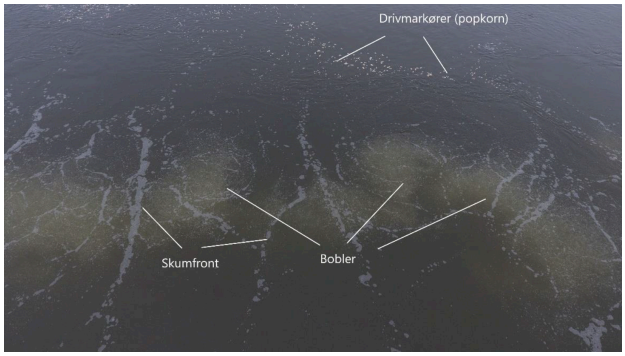








The current created by the bubble curtain plume will also prevent floating debris crossing the bubble curtain. In pictures below we show how markers (popcorn) is poured on the surface upstream/upwind from the bubble curtain. The current from the plume stops the popcorn a couple of meters from the plume. Larger and lighter



objects might be more affected by wind and could cross the plume

Bubble curtain as siltscreen has some important pros compares to traditional sheet curtains:

- No obstacles to ship traffic.
- Will not be damaged by propeller currents, wind, waves or currents. Sheet silt screens are easily damaged by currents, ships and severe weather.
- Can be used in streaming rivers and water with currents.
- Can be used in deep waters at minimal cost increase, while sheet silt screens in deep water are expensive.

All illustrations in this document are from projects with bubble curtains calculated and constructed by Nil Paul Mehren, Water Environment Services.