Water Treatment Plants Using Large Stainless Steel Filters: New Perspectives

The Norwegian municipality of Bamble with headquarters in Langesund (Telemark) uses surface water from the inland lake "Flåte" to supply drinking water to approximately 12,000 people (water level approx. 53 m above sea level) (**figure 1**). The water is drawn by a pumping station (**figure 2**) and a supply line erected on the lake itself for extraction of subterranean water. The water treatment currently in use comprises a coarse preliminary purification by means of a plane sieve with subsequent chlorination and water glass dosing to raise the pH-value. After the water treatment the water is pumped into the elevated tank located about 85 m higher.

***Figure 1**. Raw water source inland lake „Flåte".* © Source HydroGroup

An entirely new water treatment system is currently being set up to reduce the colour and the TOC, and to increase the hygienic safety. The new system with a treatment capacity of 680 m^3/h includes the processing stages

Ozonation – CO_2 dosing – Marble filtration – Bio-filtration – UV treatment – Chlorination

During the preliminary planning phase, the consulting office SWECO with headquarters in Seljord had looked into and compared different variants. A system entirely made of stainless steel components has turned out to be the most advantageous solution. The system of two treatment lines comprises two horizontal ozone reaction tanks, two upstream filters with filter vessels made of stainless steel for hardening, two downstream filters with filter vessels made of stainless steel for bio-filtration and a pure water tank also made of stainless steel. The primary reasons for deciding in favour of stainless steel included the distinctly shorter construction periods, the easily achievable high standards of design and safety at the calculated building costs. The latter is crucial, because the building structure can be completed during the summer months and the on-site production of the tanks and filters can be completed inside the building during the severe Norwegian winter.

***Figure 2**. New water treatment works with existing power house.* © Source Sweco

The companies Hydro-Elektrik GmbH and Hydro-Elektrik AS with their systems based on HydroSystemTanks jointly turned out to be the most efficient bidders in the competition when tenders were invited in the year 2012.

In addition to the new construction (**figure 3**) the existing power house has also been completely refurbished and integrated in the unit. It is to be noted that this must be done while maintaining operations so that water supply is ensured. The new unit with additional rooms for operation and monitoring is linked to the existing power house by means of a sealed pipe canal measuring approx. 3 x 3 m in size. An oxygen producing unit and an ozone producing unit with ozone-mixing system are also installed in the existing power house. The ozonized water is allowed to flow through the pipe canal into two parallel low pressure contact tanks made of stainless steel 1.4571/316 Ti measuring 10 m in length and 2800 mm in diameter. Distributor plates are welded at the inlet as well as the outlet of the contact tank to achieve a uniform plug flow. Carbonic acid is added to the water after it is discharged from the contact tank and then using an

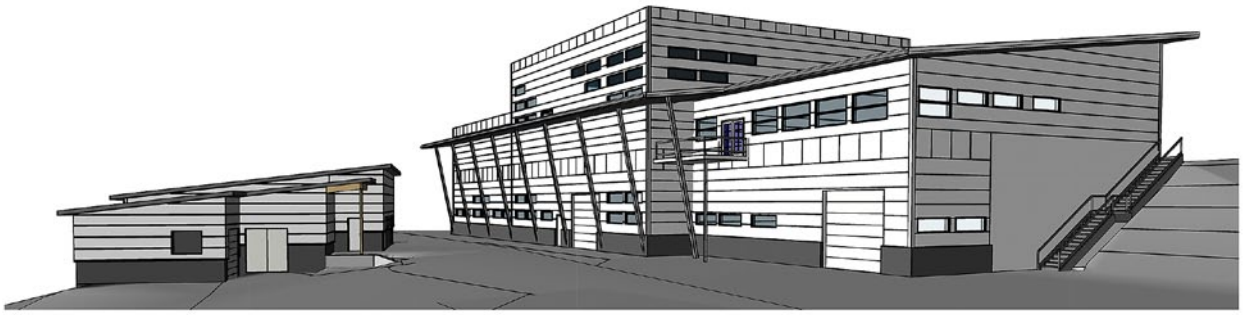

***Figure 3**. New water treatment works refurbished.* © Source Sweco

upstream filter it is made to flow over a material containing calcium carbonate to achieve the desired mineralization. The alkaline upstream filters having a diameter of 5.50 m and a height of 7 m work with an upstream velocity of about 15 m/h. The filters are provided with compression-resistant nozzle plates and complete internal piping of the filter for distribution of flushing air, discharge of backwash water and filter overflow. The filters are completely sealed and are operated by gravity. They are vented or aerated using special filter systems (**figure 4**).

The ozonized and mineralized raw water flows through the filter overflow channel into the downstream bio-filter. The bio-filters that are piled as multi-layer filters have a diameter of 6.70 m and a height of 7 m and work with a maximum filtration rate of about 10 m/h. The filters are provided with compression-resistant nozzle plates and complete internal piping of the filter for distribution of flushing air, discharge of backwash water and regulation of filter overflow. The gravity-driven filters with a layer of sand and with a bio-filter layer made of Filtralite are completely sealed and are vented or aerated using special filtration systems.

The treated drinking water is stored temporarily in the 800 m^3 pure water storage tank having a diameter of 13 m and a height of 6.3 m. The pure water is supplied by the pipe canal to the UV systems in the power house, chlorinated and then carried by pumps to the distribution system.

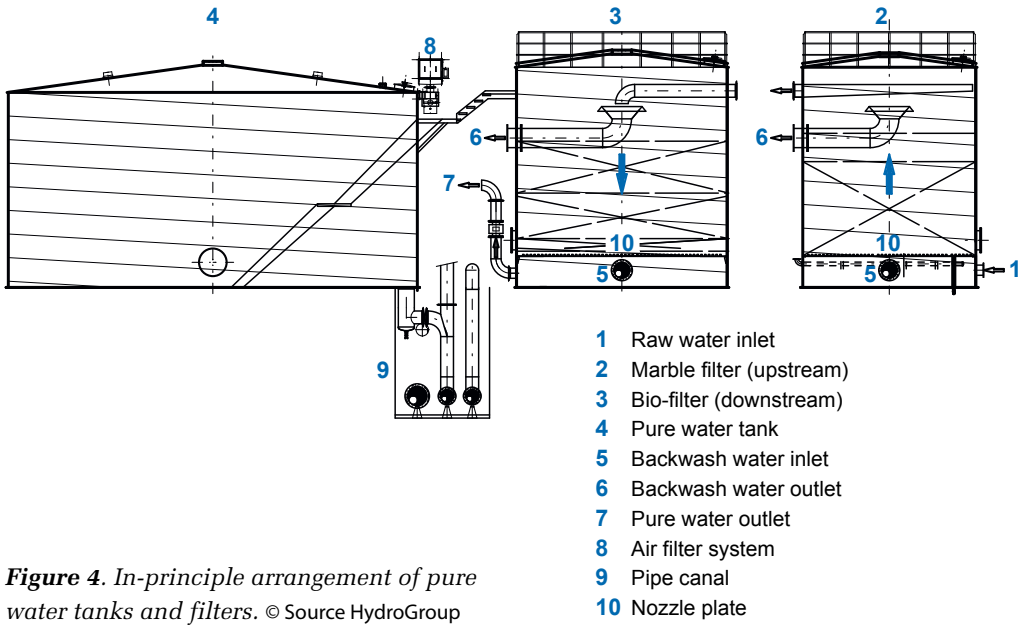

***Figure 4**. In-principle arrangement of pure water tanks and filters.* © Source HydroGroup

All system components necessary for the operation can be safely accessed from the operator platform. The condensation on the stainless steel surfaces is avoided, because of climate control and the fact that the water-conducting systems are completely sealed. The ambient temperature in the operating areas is adjusted to the temperature of water, because the large stainless steel surfaces serve as radiators or heat sinks.

The project is being implemented on time as per the planned schedule: Work on the 20 m wide and 50 m long building is planned for completion in October and production of the tank systems shall commence immediately thereafter. The trial run of the fully operational system is planned to commence at the end of May 2014, which is merely 13 months after commencement of construction work.

Contact:
Peter Paskert,
Hydro-Elektrik AS,
Litleåsveien 49,
NO-8132 Nyborg / Norway,
Phone +47 55259300,
E-Mail: bergen@hydro-elektrik.no,
www.hydrogroup.no

Svein Forberg Liane,
Sweco Norge AS,
Vekanvegen 10,
NO-3835 Seljord / Norway,
Phone +47 3506 4444,
E-Mail: SveinForberg.Liane@sweco.no,
www.sweco.no