Client: Marine Harvest Steinsvik AS  
Startup: 2015  
Challenge: To deliver a compact, efficient and modern smolt Grow-out unit to produce fish up to 250g with a total feeding capacity of 9.2 tonnes/day.  
Solution: Three Grow-out units optimized to achieve minimum energy consumption and the best possible utilization of site area, with a high level of automation for easy operation and control. All the three departments with Kaldnes® RAS consist of Hydrotech™ drumfilters, Kaldnes® MBBR biofilter, CO₂ and N₂ degassing, deep shaft oxygen cones and recirculation pumps. All instruments in the fish tanks and the RAS are controlled in the technical room. The sludge is dewatered and dried for efficient transportation and disposal. The entire facility is monitored and controlled by the VA-Operator control program.  
Design Capacity:  
Production: 5.3 million smolt of size up to 250g  
Design feeding: 9.200 kg per day  
Fish tank volume: 11.365 m³  
Water Quality in fish tank: CO₂ in fish tank effluent: 12-14 mg/L, TAN: 0.5 - 1.5 mg/L, NO₂-N: 0.1 - 0.4 mg/L, NO₃-N: < 70 mg/L, Nitrogen saturation: ≤100%, Salinity up to 30%.
Major components

The Kaldnes® RAS water treatment system consists of four major process components:

Mechanical Particle Separation
The Hydrotech™ drumfilters remove particles and suspended matter from the water, both from fish feed and fish feces.

Biological Filtration
Dissolved and particulate organic matter and ammonia are degraded by bacteria and microorganisms in a two-stage Kaldnes® MBBR biofilter.

Degassing
Carbon dioxide produced by fish respiration is removed in a centralized CO₂ degasser.

Oxygenation
The recirculating stream is oxygenated in deep shaft oxygen cones before being returned to the fish tanks.

Automation
The entire facility, including water treatment systems, lighting, oxygen and heat, is monitored and controlled by Veolia’s operating control system.

Ancillary systems

Sludge dewatering and drying
The sludge from the drumfilters is dewatered using beltfilters and centrifuges before being dried in an electric heater, to facilitate sludge disposal.

Alkalinity control
Alkalinity in the RAS is regulated using a central dosing system for calcium carbonate.
Footprint

The three Kaldnes® RAS systems together have a capacity of 8,900 kg feed/day. In each department, the RAS occupies approximately 20% of the total footprint.

Key data

<table>
<thead>
<tr>
<th>Parameter</th>
<th>RAS 1</th>
<th>RAS 2</th>
<th>RAS 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total fish tank volume</td>
<td>1.500 m³</td>
<td>4.700 m³</td>
<td>4.700 m³</td>
</tr>
<tr>
<td>Maximum biomass</td>
<td>52 t</td>
<td>238 t</td>
<td>300 t</td>
</tr>
<tr>
<td>Maximum feeding</td>
<td>1.200 kg/d</td>
<td>3.900 kg/d</td>
<td>3.800 kg/d</td>
</tr>
<tr>
<td>Maximum makeup water</td>
<td>385 l/min</td>
<td>1.251 l/min</td>
<td>1.219 l/min</td>
</tr>
</tbody>
</table>

Project Implementation

The project contract was signed in December 2012. The building layout and design were optimized in collaboration with Marine Harvest and Akvator. This was revised in June 2013 to make the design yet more compact.

The dimensioning and selection of ancillary systems like the energy reuse, sludge treatment and alkalinity control was also carried out in collaboration with the client.

Several new technical and automation solutions were implemented along the way. The first eggs were introduced in the facility in January 2015 and the other departments were started up consecutively. The final department, RAS 3 was started as early as September 2015.
For more information visit www.krugerkaldnes.no or contact us directly:

HEIDI KYVIK
Sales Director Aquaculture
+47 97 42 18 08
heidi.kyvik@krugerkaldnes.no

FREDERIC GAUMET
Sales Manager Aquaculture, GLOBAL
+47 94 13 19 19
frederic.gaumet@krugerkaldnes.no

KRÜGER KALDNES
Nordre Fokserød 9 • 3241 Sandefjord, Norway
tel. +47 91 60 80 00 • fax +47 33 48 50 01 • postnorway@krugerkaldnes.no
www.krugerkaldnes.no | www.veoliawatertechnologies.com