Aquaculture Innovation Workshop
Campbell River, BC, Canada
Sep 26-27.2011

Design and economics of a RAS farm for Atlantic Salmon in China

Idar Schei, CEO AquaOptima AS

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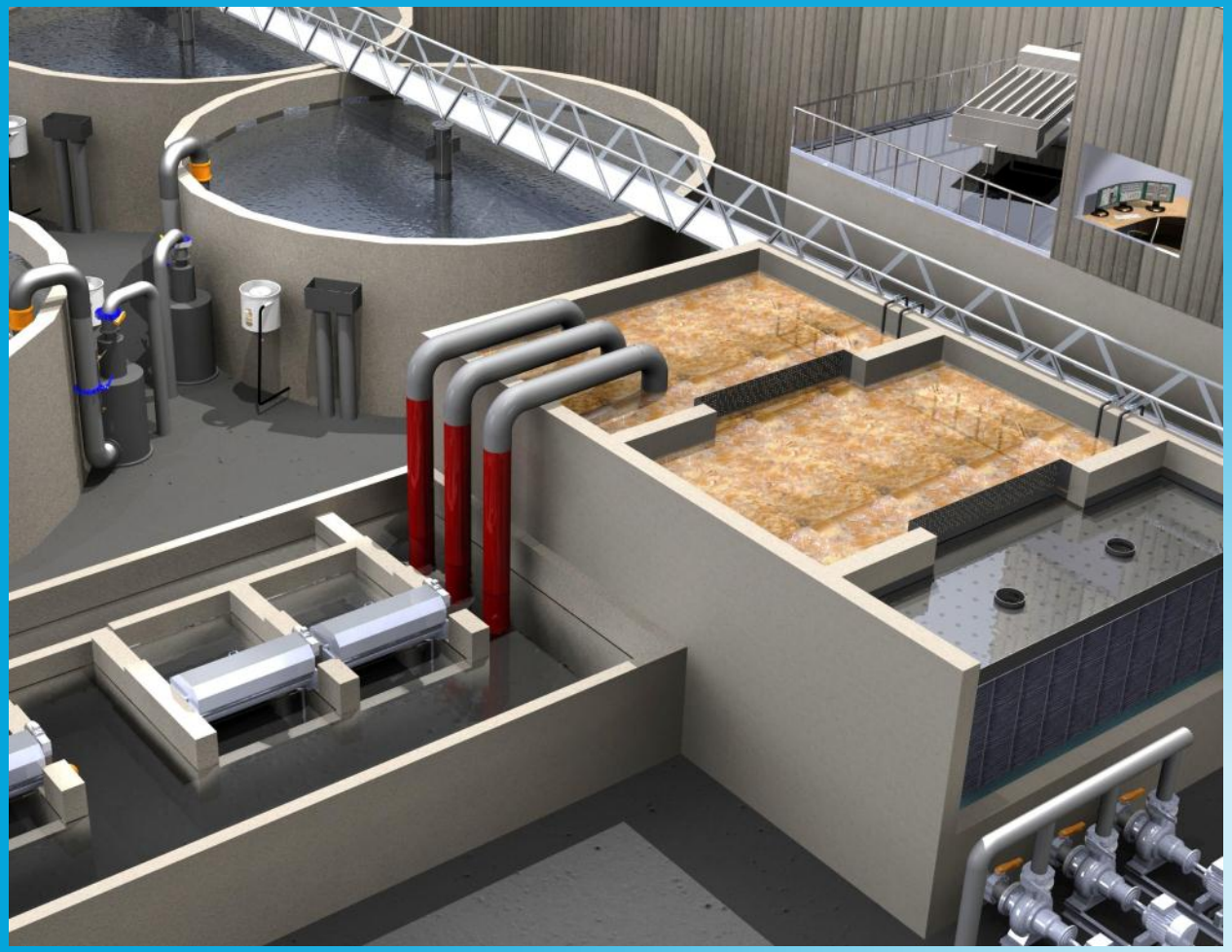
AquaOptima RAS - One step ahead!



We specialize in recirculation aquaculture systems (RAS), and offer hatcheries and grow-out landbased farms to the world market, based on our unique technology.

-Feasibility studies
-System design and engineering
-Supply of equipment

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Design of 1,000 tons/y farm for Atlantic Salmon

Step 1: Production plan, based on growth-tables of feed-companies

Step 2: Lay-out, as number of tanks and number of departments,
based on when to move fish and harvest plan

Step 3: Design of water treatment systems, piping etc.
based on max feeding, to meet water quality criteria

TAN < 1.5mg/l
CO2 < 15 mg/l
Water exchange : 10 % per day
Freshwater / Seawater
12-14˚C

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Design of 1,000 tons/y farm for Atlantic Salmon

General challenge of operation of fresh water departments:

All in – all out ------ stability and efficiency of biofilter

Contradiction between
minimizing the risk of spreading disease between generations
and a good working biofilter(s)

One solution can be:
Startfeeding - quarantine department
One common WT for fingerlings up to smolt

(to be discussed with the operational manager)

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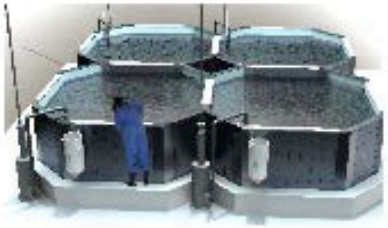
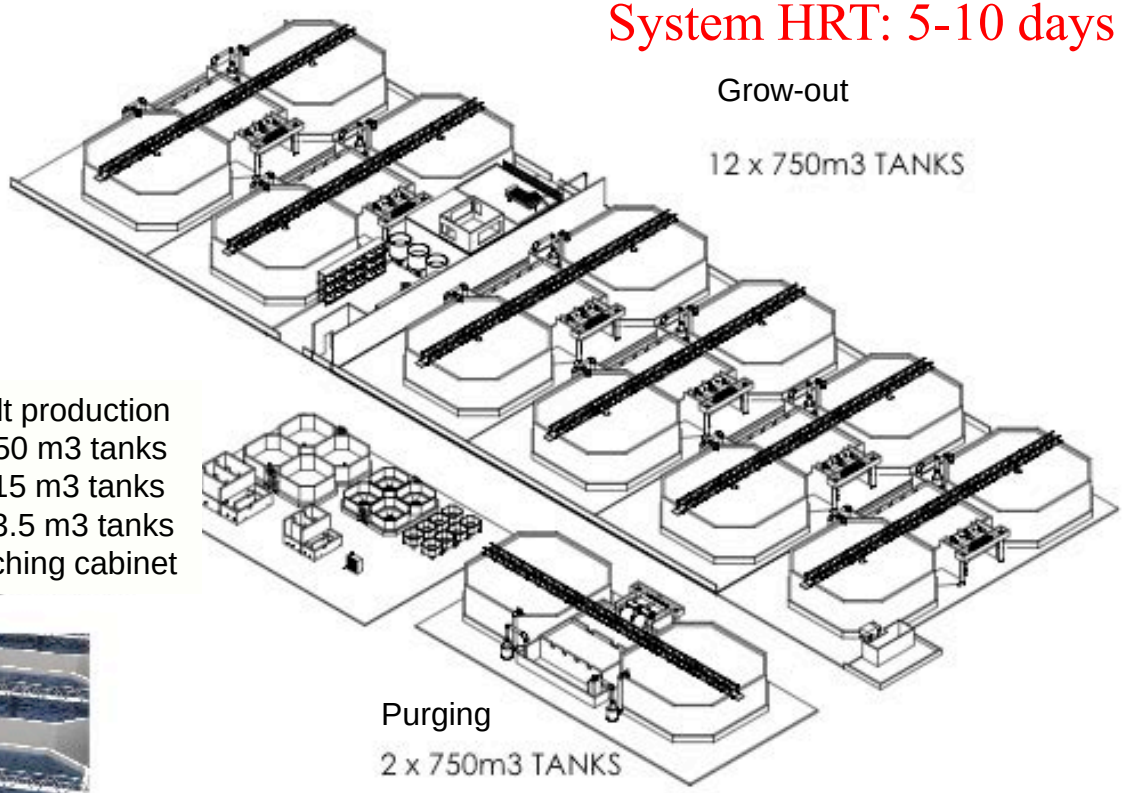
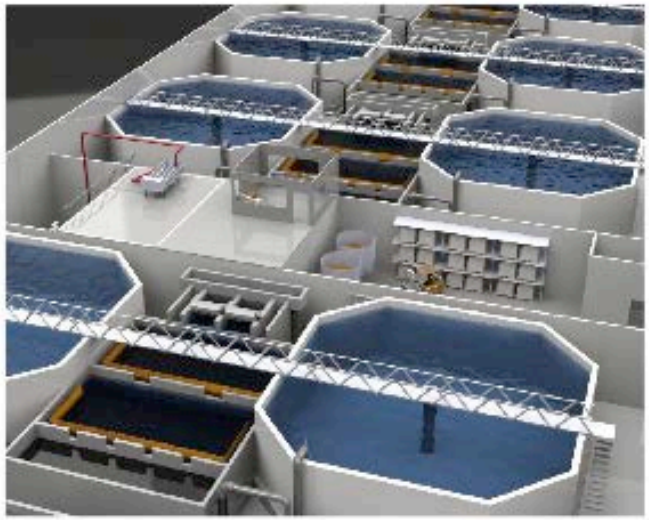
General lay-out

Culture tank HRT: 30-60 min
System HRT: 5-10 days





Smolt production
4 x 50 m3 tanks
4 x 15 m3 tanks
6 x 3.5 m3 tanks
Hatching cabinet



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	NAME	SIGNATURE	DATE
DRAWN	Rune Eriksen	RE	2011.02.13
CHK'D			
APPV'D			

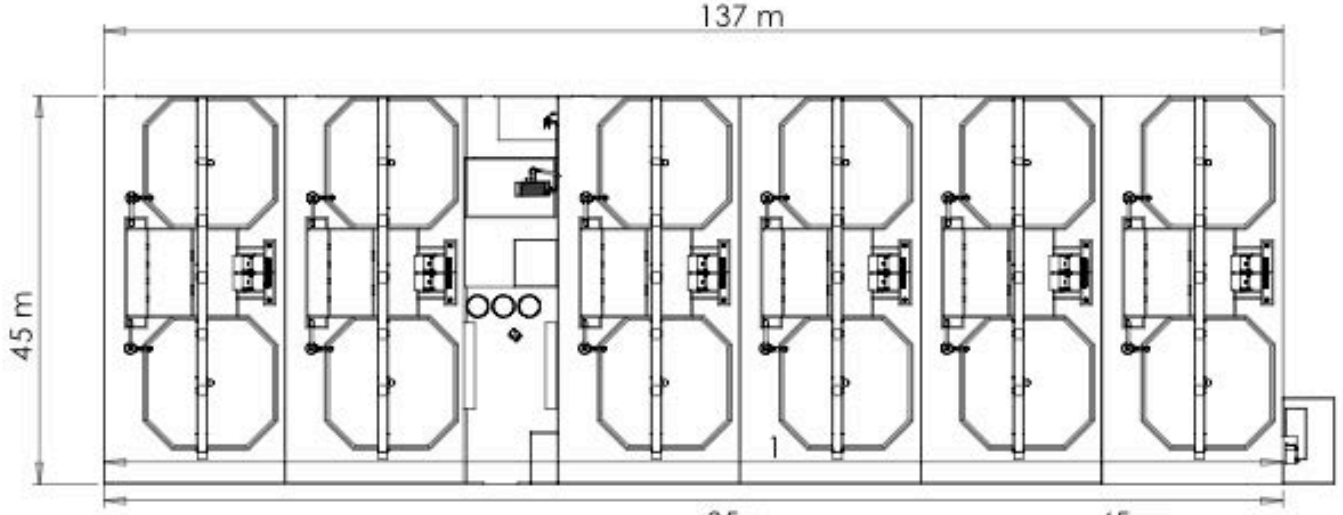
TITLE: 1000T SALMON 3D

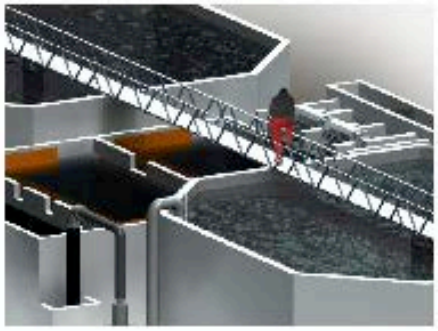
DWG NO: T2 A4

UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MILLIMETERS

SCALE:

SHEET 1 OF 1





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TITLE: 1000T SALMON

DWG NO. T1

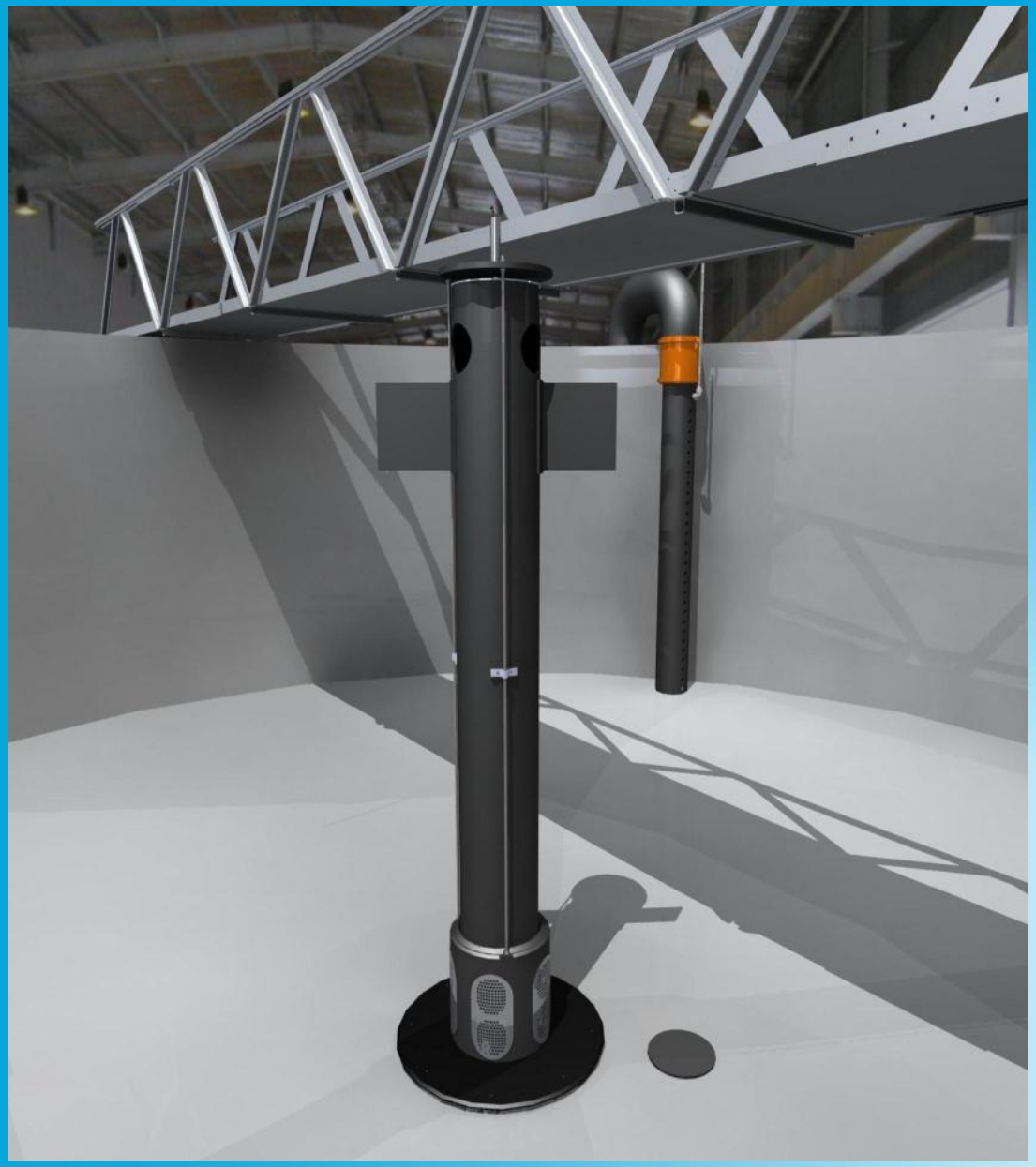
A4

SCALE: 1:750

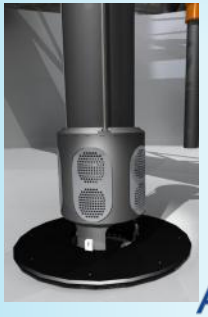
SHEET 1 OF 1

Key elements in AquaOptima design

ECO-TRAP



Particle trap with dead fish removal.
Removes ca 95% of settleable solids from the tank in few minutes .
Solids are collected outside the tank in a sludge collector.



Open position for removal of mortalities.
Pneumatic operation

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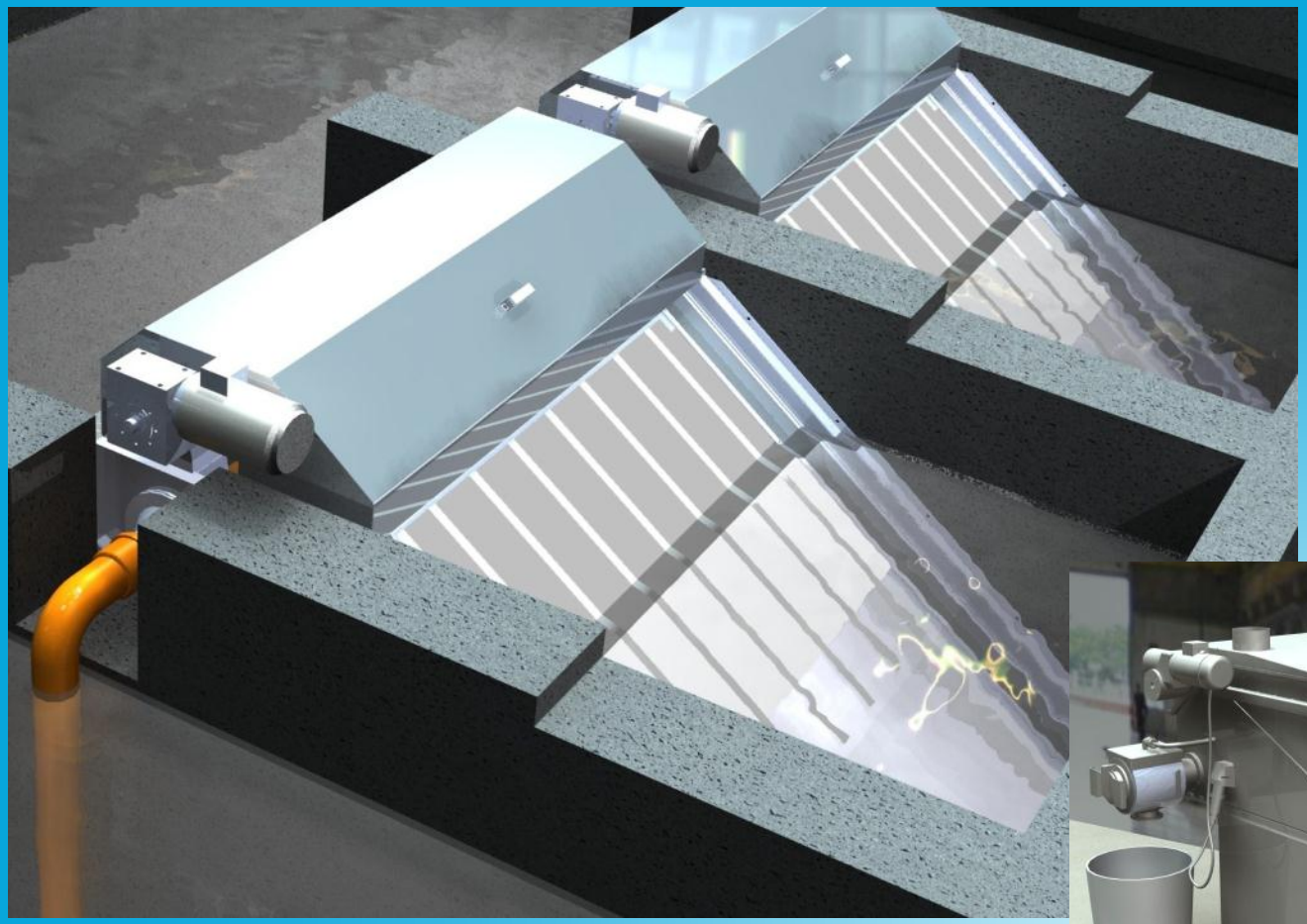
Key elements in AquaOptima design

Salsnes Filter™



SalsnesFilter ™ microscreen for
removal of fine solids.
More gentle removal of particles
Than drumfilters

Salsnes Filter™ with dewatering unit
gives sludge of ca 25% TDM

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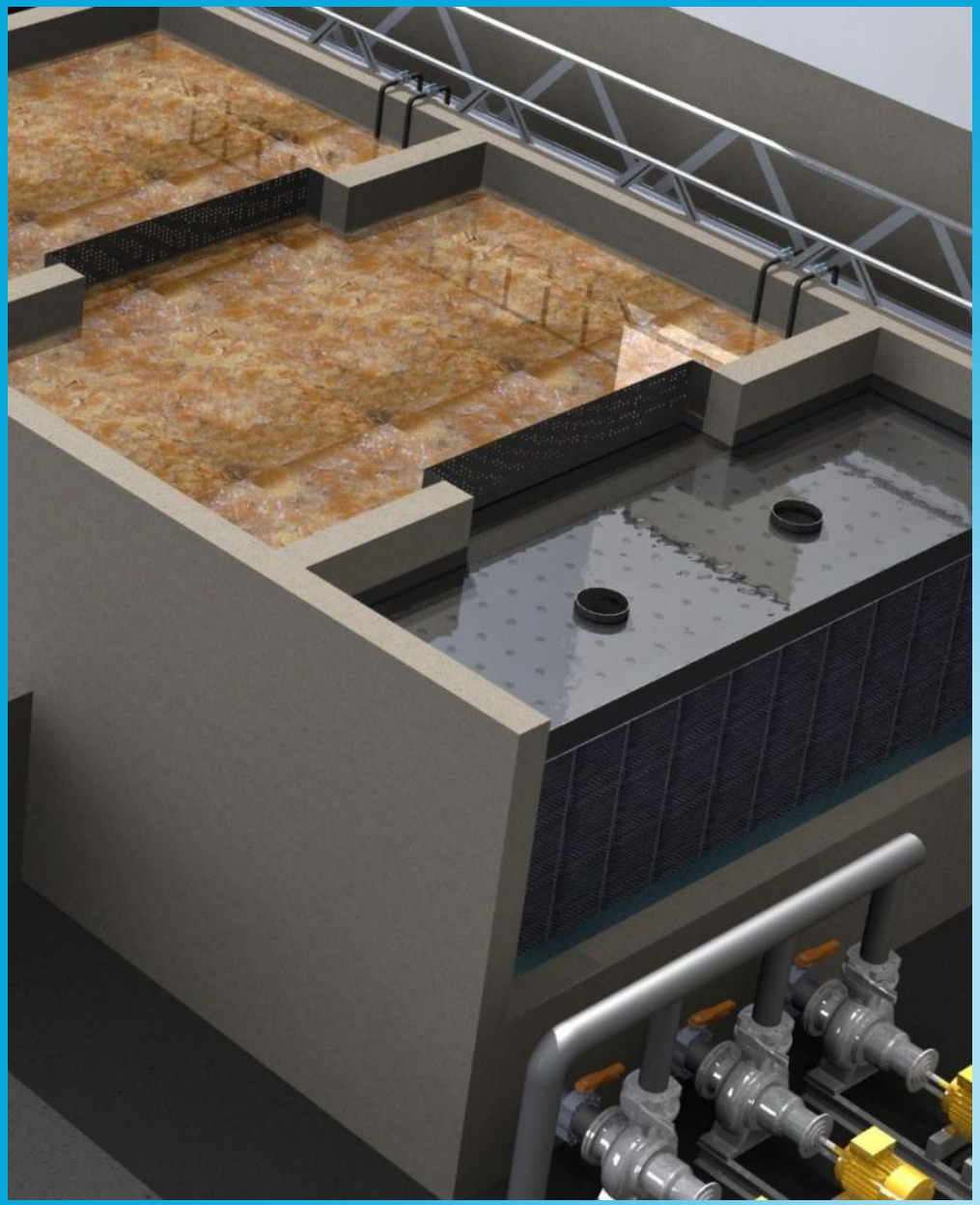
Key elements in AquaOptima design

Moving Bed Biofilm Reactor



The most advanced, efficient and stable biofilter process, with lowest operating and maintenance cost

CO2 removal

CO2 is removed by type of packed column, following the MBBR

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ECO-FLOW, water inlet, current inducer and flow-meter

O_2 - Saturator located at each tank. Makes it easy to control and regulate oxygen level according to fish consumption

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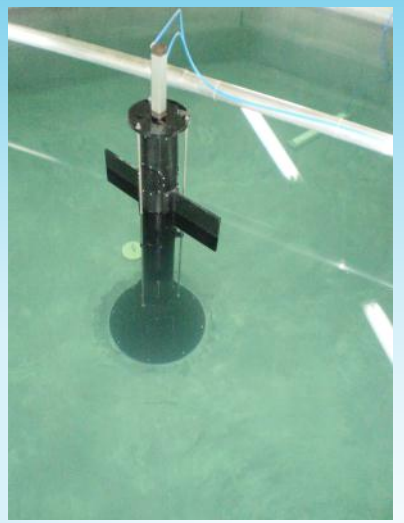

Yantai Salmon Farm

Shandong Oriental Ocean Sci-Tech Co.

Yantai, Shandong Province, China

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Growth and water quality results

-limited data provided from customer

Typical data 15.11.2010, fish size ca 20g, stock.density 31 kg/m3:
TAN: 0.6, NO2-N: 1.9, NO3-N: 21 mg/l, CO2: 8 (all in mg/l)
[water quality collected at 50% max feed capacity]

"Hard" facts:

- Eggs imported in May 2010
- Start feeding: from mid June 2010
- Smolts to sea water: mid January 2011 (ca 75 g)
- First harvest, ca 1.5 kg: September 2011

(~16 months from 1st feed to 1.5 kg harvest)

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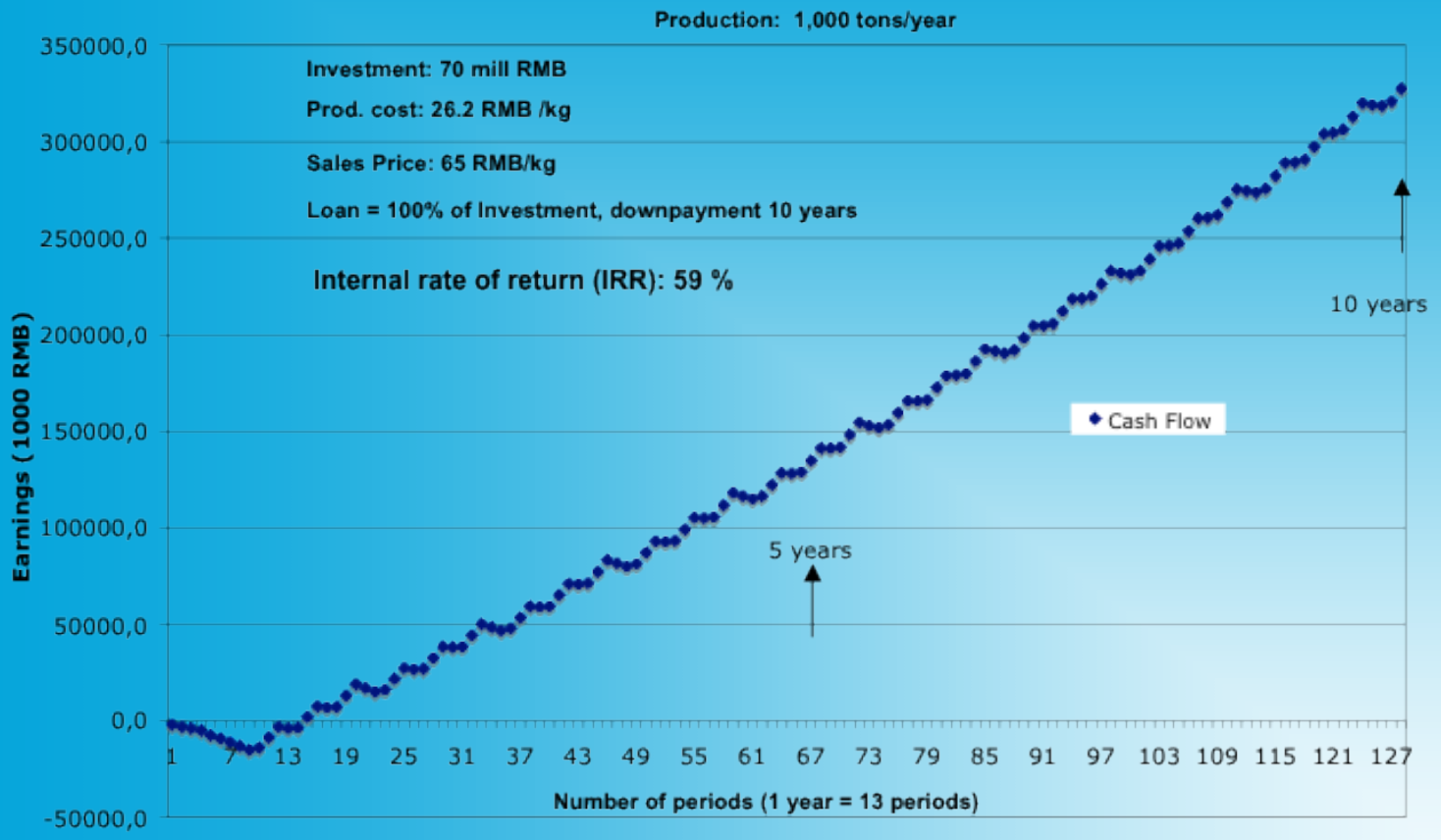
Fish Transfer & Harvest

- AquaOptima supplied a fish pump and grading machine for fresh water systems
  - tanks emptied by pipe under tanks to central sump where fish pump and grading machine were localized
- Uncertain what was used for growout, possibly a larger version

Economic analysis, 10 years - Atlantic Salmon



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Sensitivity analysis for some parameters:

Investments mill. NOK	Sales price	Feed cost	Energy cost	IRR (%)	Prod. cost NOK/kg
70	65	16	0,6	59,3	26,2
77 (+10%)	65	16	0,6	53,0	26,2
63 (-10%)	65	16	0,6	67,1	26,2
70	59 (-10%)	16	0,6	47,5	26,2
70	52 (-20%)	16	0,6	34,1	26,2
70	65	14,4 (-10%)	0,6	63,3	24,5
70	65	12,8 (-20%)	0,6	67,5	22,8
70	65	16	0,66 (+10%)	59,1	26,3
70	65	16	0,72 (+20%)	58,8	26,4

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Thanks for your attention!

-and enjoy!

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