WAUBETEK
Business Development Corporation
*Investing in the Aboriginal Business Spirit*
A Community Futures Development Corporation

# Getting Started in Aquaculture Information Session

## Overview of Technologies & Practices

CANADIAN AQUACULTURE SYSTEMS INC.
BIOENGINEERING TECHNOLOGIES & BUSINESS MANAGEMENT SOLUTIONS

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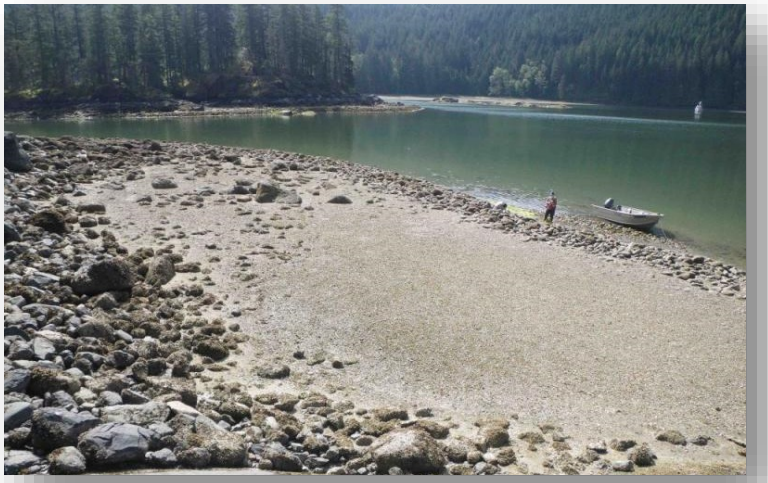
# Aquaculture – In the Beginning

- Aquaculture has been practised in some form for thousands of years primarily in freshwater ponds and impoundments with minimum technical intervention but low yields
- Culture had two purposes
  - to provide food for the producer
  - for trade
- First Nations in British Columbia built clam gardens thousands of years ago to create habitat for clam production
  - Building a rock wall at the low tide mark creates an ideal beach habitat for clams



Bottom Photo: Underwater Archeological Society of BC

# Aquaculture – Emergence of Net Pen Culture

- Modern (for-profit) phase of finfish aquaculture began in the 1970s
  - Development of large-scale net pen operations
  - Countries saw the advantage of growing fish in the oceans and in large bodies of freshwater
  - Technology and economics became favourable
- This strategy has been highly effective on a global scale; e.g.
  - Salmon in Norway, Scotland, Chile, Canada, Australia
  - Sea bream and sea bass in Mediterranean countries
  - Trout in Ontario

# Aquaculture – Evolution of RAS

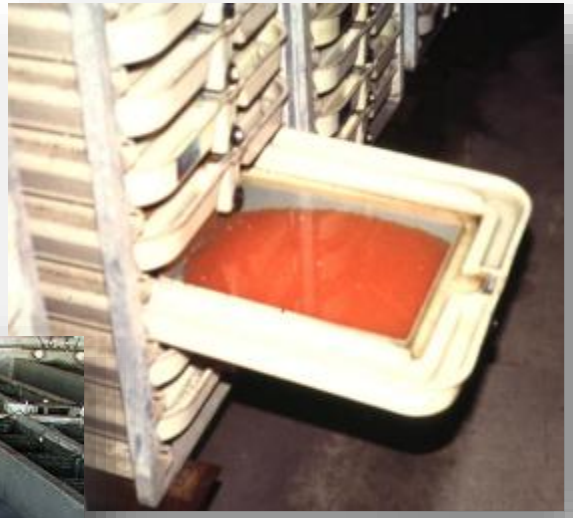
- More sophisticated rearing strategies such as re-circulating aquaculture systems (RAS) have been developed
  - Suited to production of high-value species and juveniles
  - Advantage in areas with limited water supplies
- These systems are more expensive (capital and operating costs) and some can be technically complex
- Can be deployed anywhere there is a modest supply of water and access to power and other infrastructure
- For the most part, they are isolated from the natural environment

# Egg & Fingerling Supply

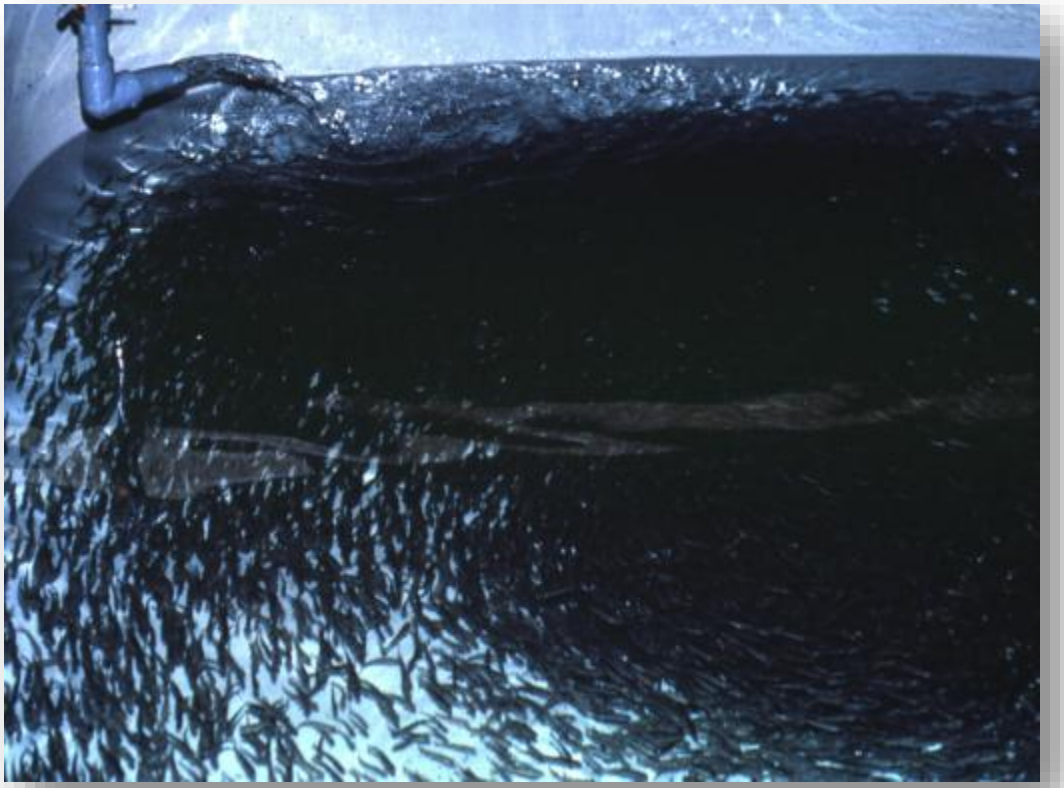
- Several commercial hatcheries throughout Canada produce eggs and fingerlings for sale to on-growers
  - Many have own broodstock
  - Some import eggs from Troutlodge, Riverence and others
  - Eggs available 12 months per year
  - Canadian rainbow trout broodstock program is being planned

# Hatching

- Eggs are typically hatched in troughs, tray incubators or bell jars

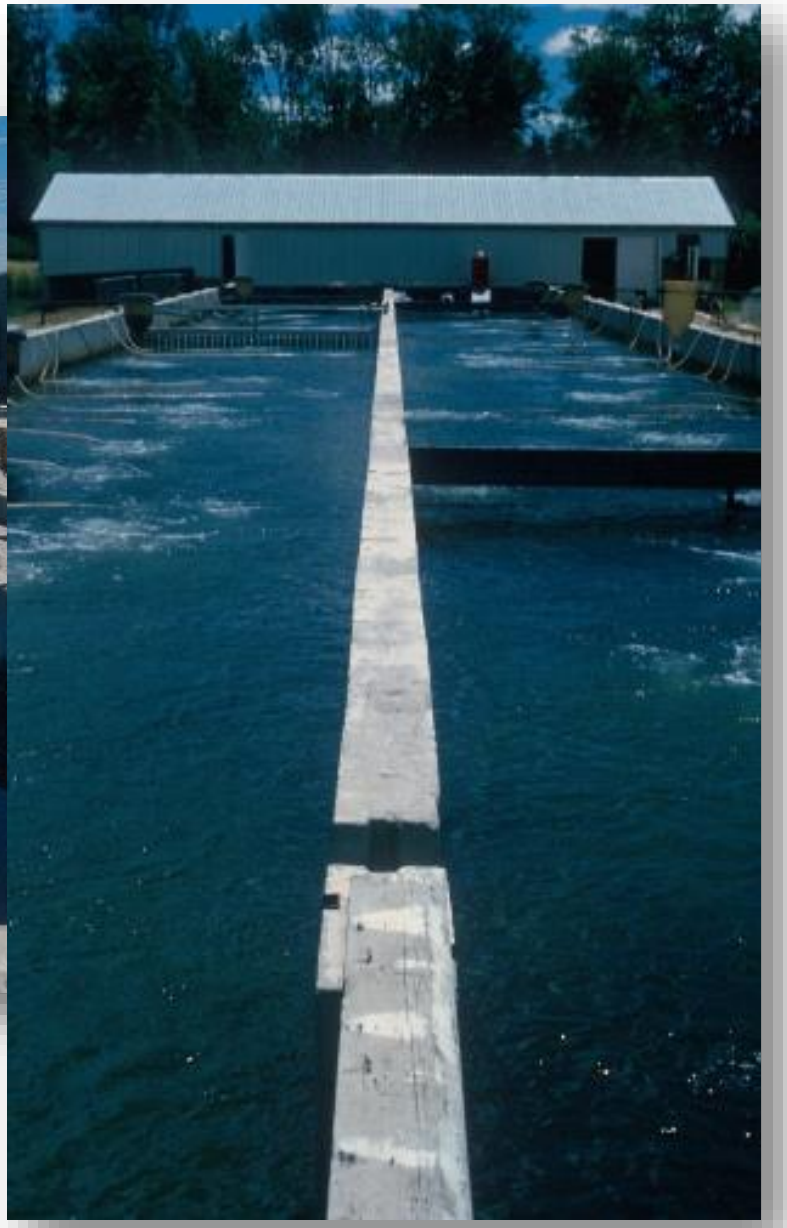



# Fingerlings

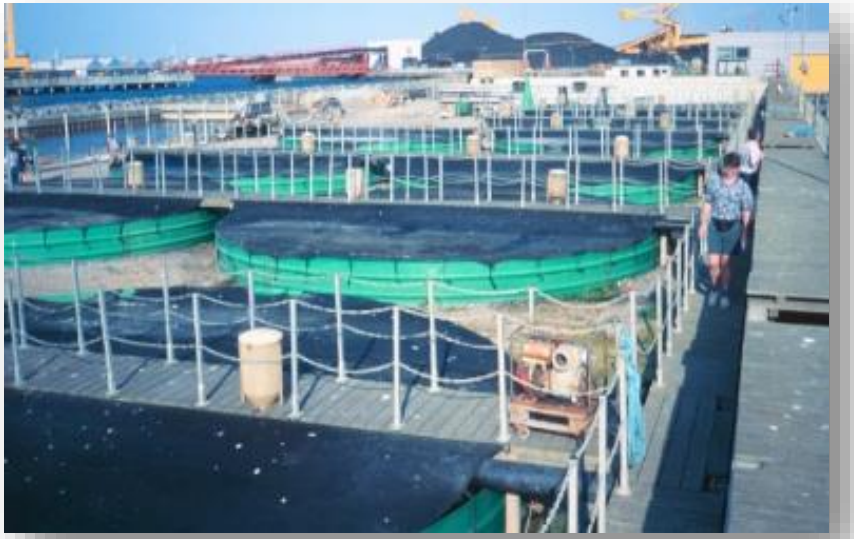


# Pond Production

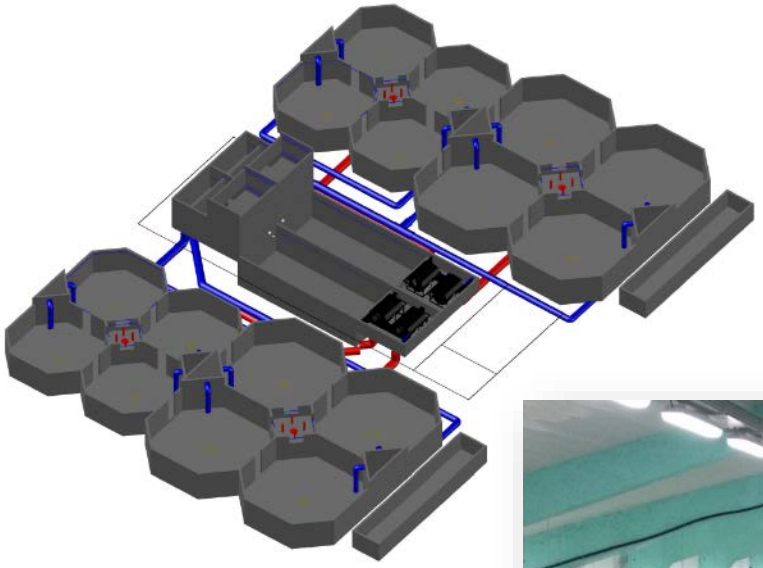
# Raceway Culture



# Circular Tanks



# Octagonal Tanks



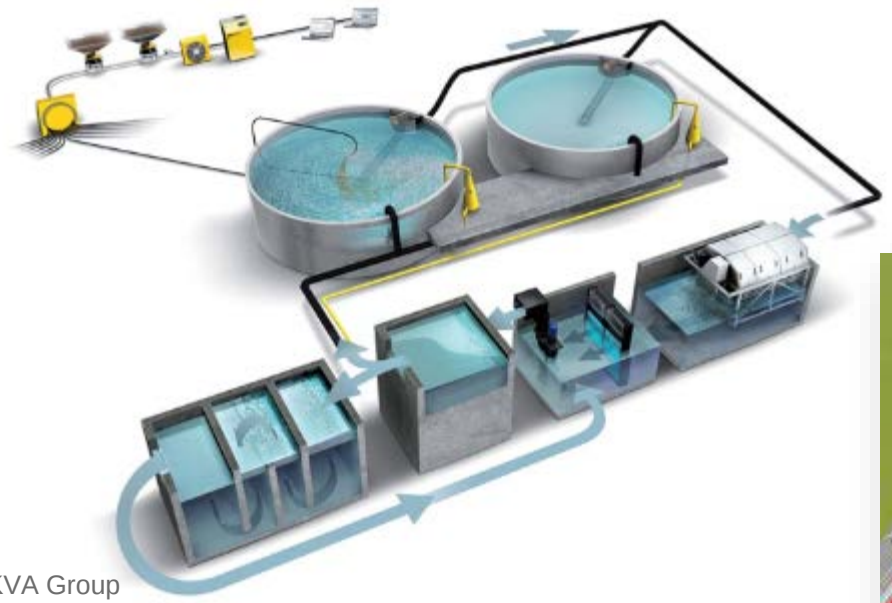
# Floating Containment Systems

# Land-Based Facility Design

- Unlike in traditional animal production systems and in net pen aquaculture, there is a lack of standardization in land-based aquaculture

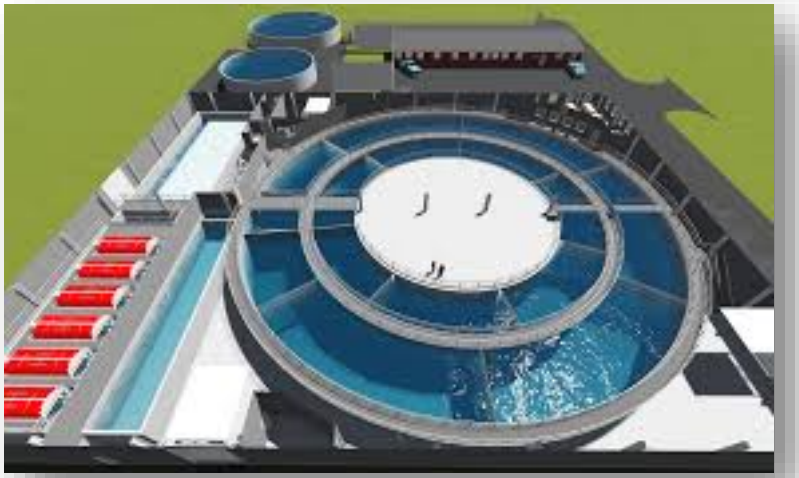
# Various Land-Based Designs

- Most systems will grow fish, but...
- The objective is to grow fish and make money.....



AKVA Group

Atlantic Sapphire



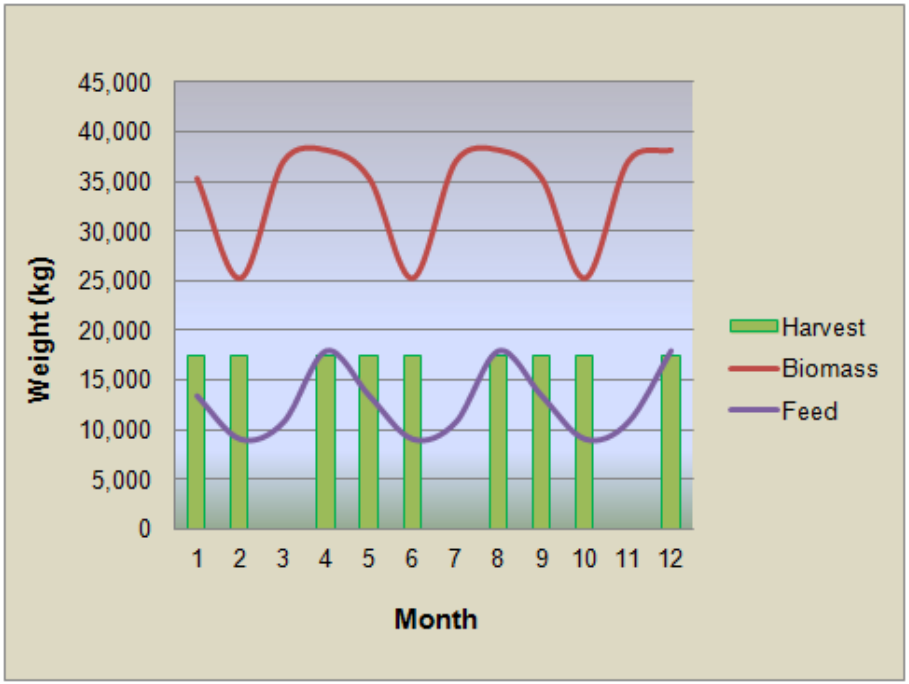
Veolia Water Technologies

# Key Factors

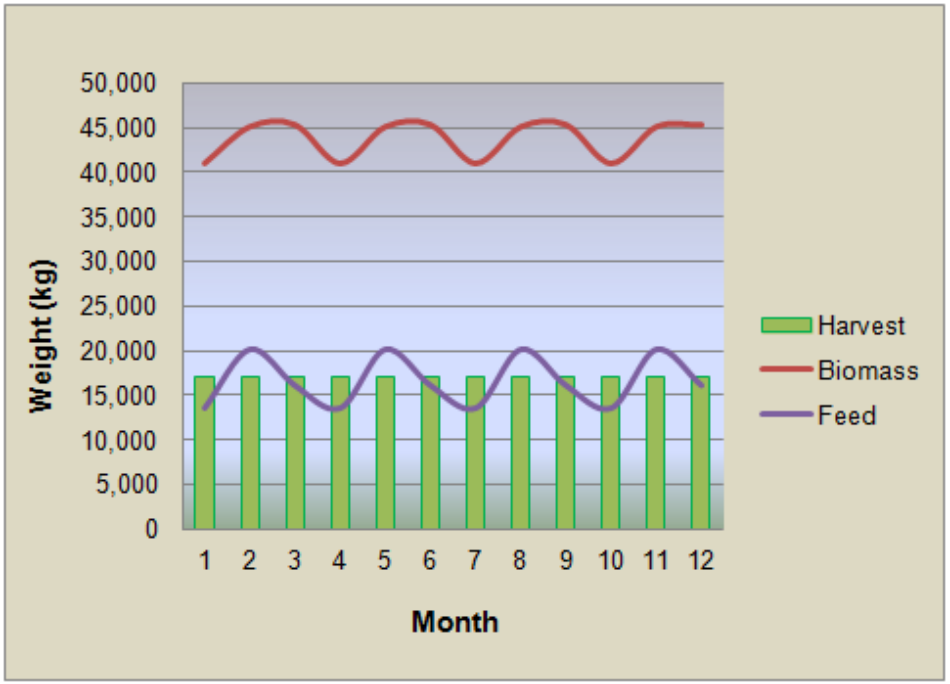
- Capital cost matters
  - These vary widely according to design and location
- Maximum daily feed ration is fundamental
  - RAS units are designed to process metabolic by-products
- It really doesn't really matter what kind of fish you're feeding
  - FCR
- Inventory turnover does matter
  - Time to reach market size
  - Number of cohorts per year
- Average annual selling price does matter
  - Atlantic salmon
  - Rainbow trout
  - Salmon smolts

# Production Modeling

- It is more productive and efficient to schedule multiple cohorts per year




3 cohorts / year

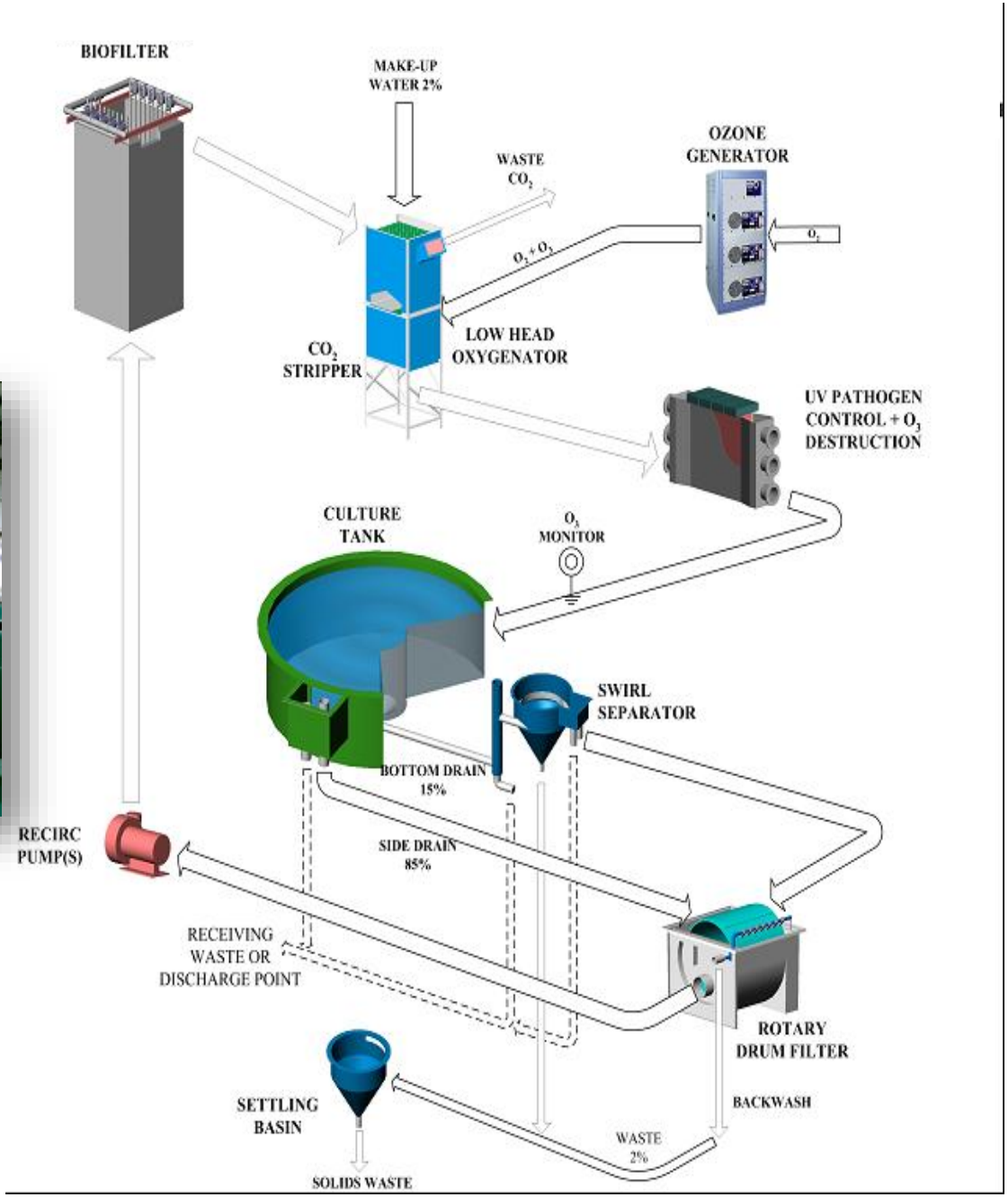



4 cohorts / year

- Approximately 30% more production in the same system with 4 cohorts per year
- More stable loading on the systems

# Recirculating Aquaculture Systems

PRAqua

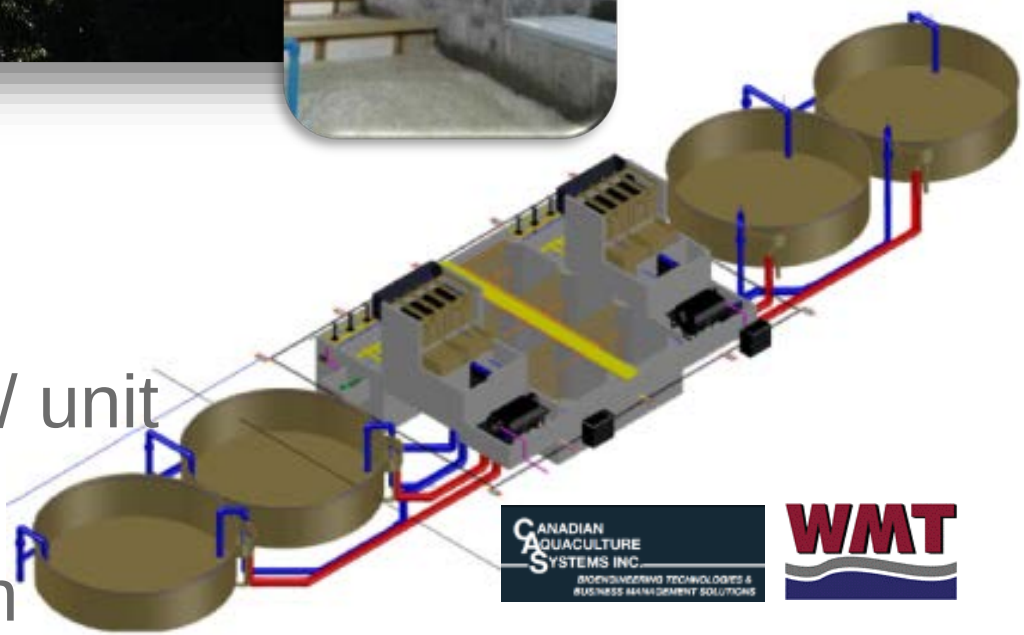


# Sand Plains AquaCulture


# Smolt Production

## Production

- 14 million smolts / year
- Up to 850 kg feed / day / unit
- 99% recirculation
- Simple, low-head design



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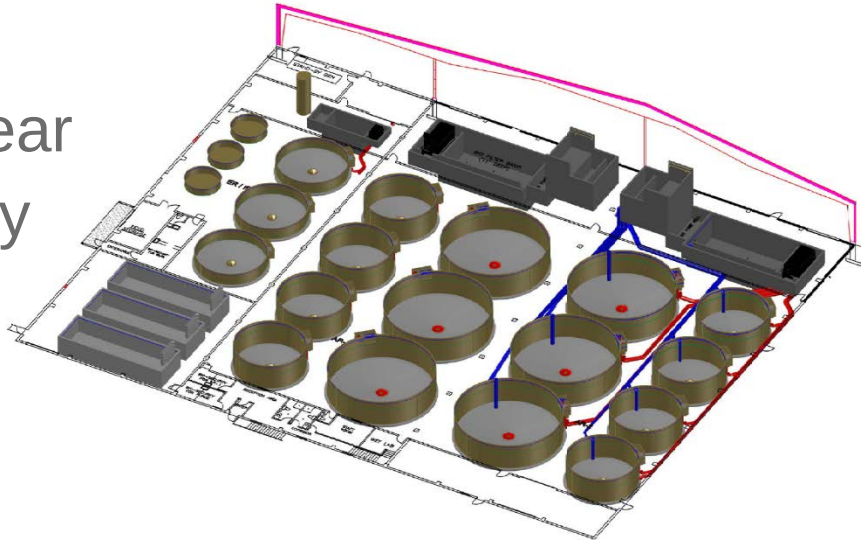
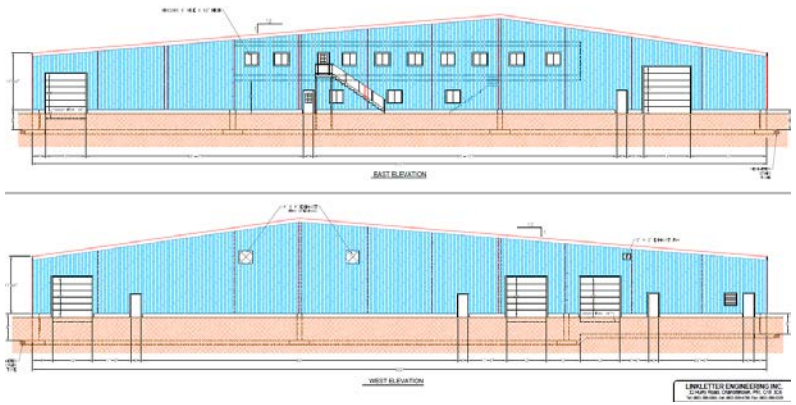
WMT

# Danish Model Farm Program

# Land-Based Salmon Farm

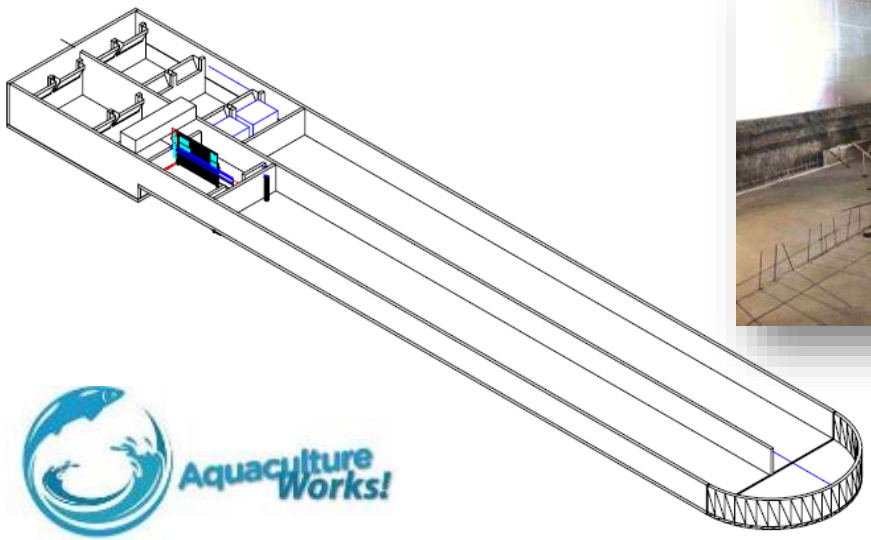
- 250 tonnes Atlantic salmon / year
- Independent brood stock facility
- 7 RAS units with up to 890 kg feed / day
- >99% recirculation





# Canadian Model Aqua-Farm

- 130 tonne trout farm
- 99% recirculation
- Simple, low-head design
- 430 kg feed / day



# Canadian Model Aqua-Farm Program

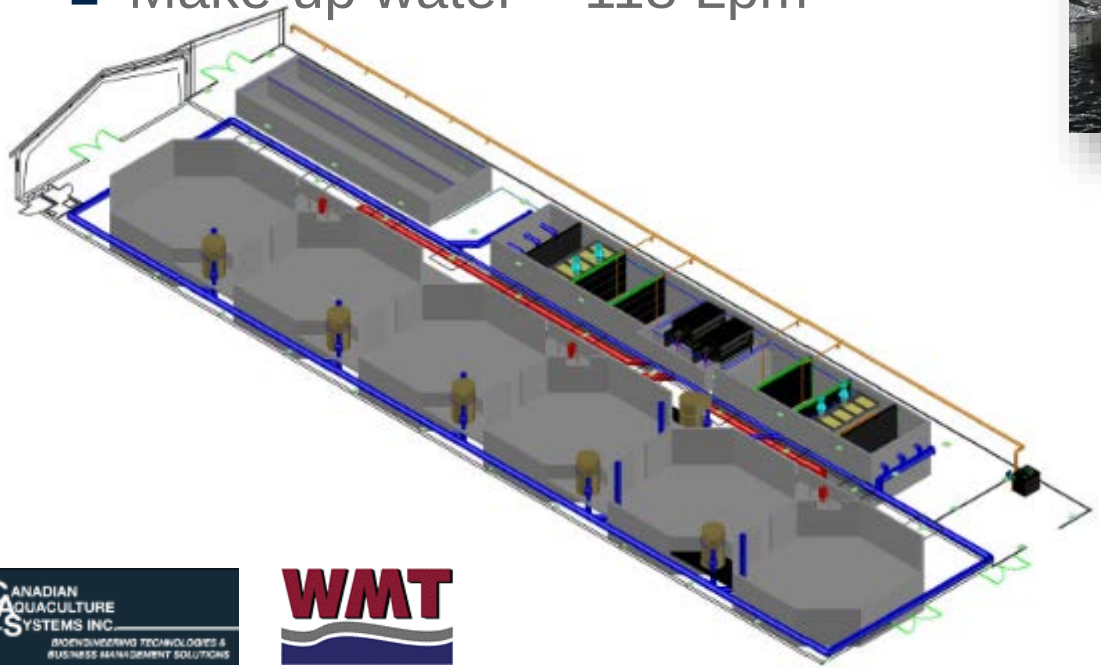
TASTE OF BC
Aquafarms Inc.

LITTLE CEDAR FALLS

# Commercial RAS

## Production

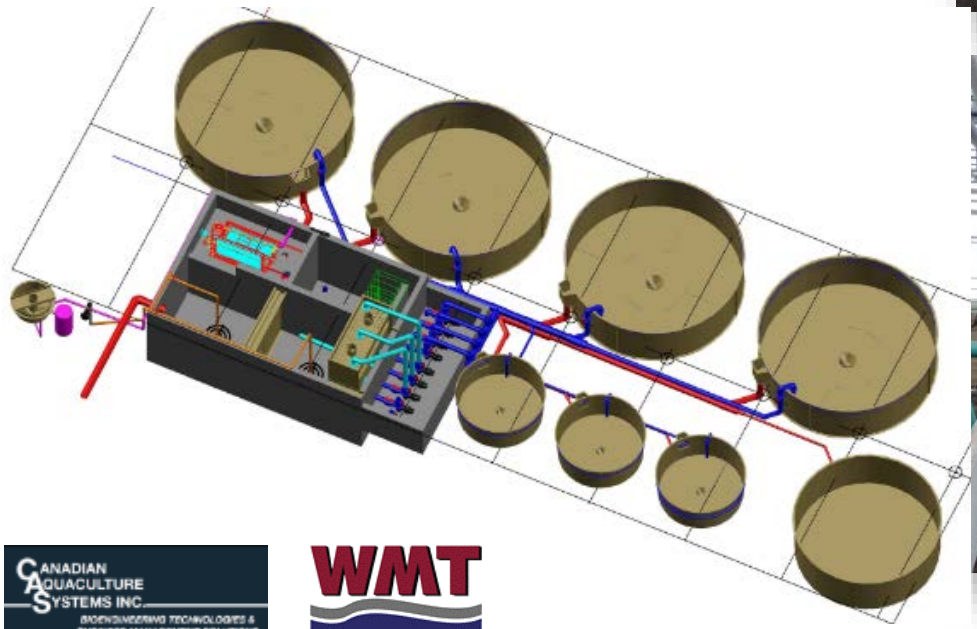
- Hatchery, early rearing & grow-out
- 200 tonnes coho / year
- 725 kg feed / day
- 99.7% recirculation
  - System flow = 34,000 Lpm
  - Make-up water = 118 Lpm



# Trend AquaFresh

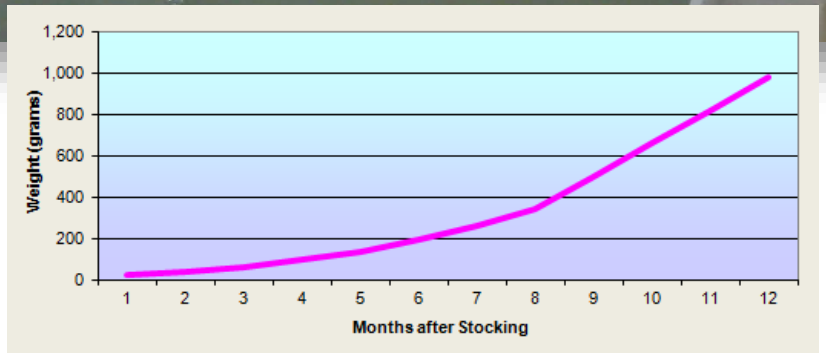
Production

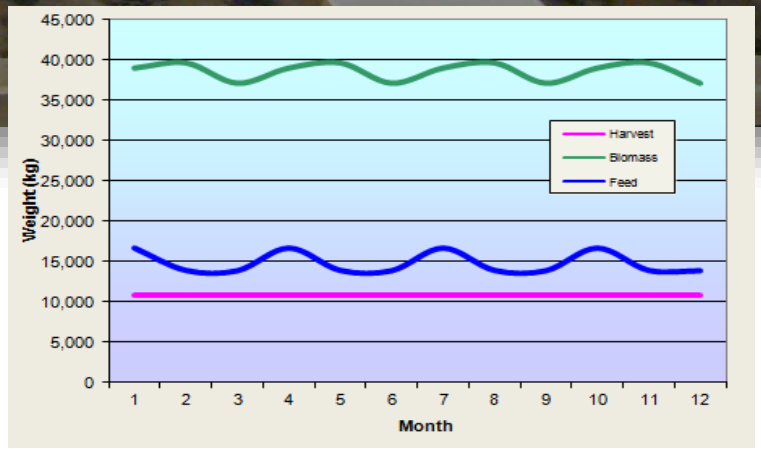
- 50 tonnes fish / year
- 200 kg feed per day



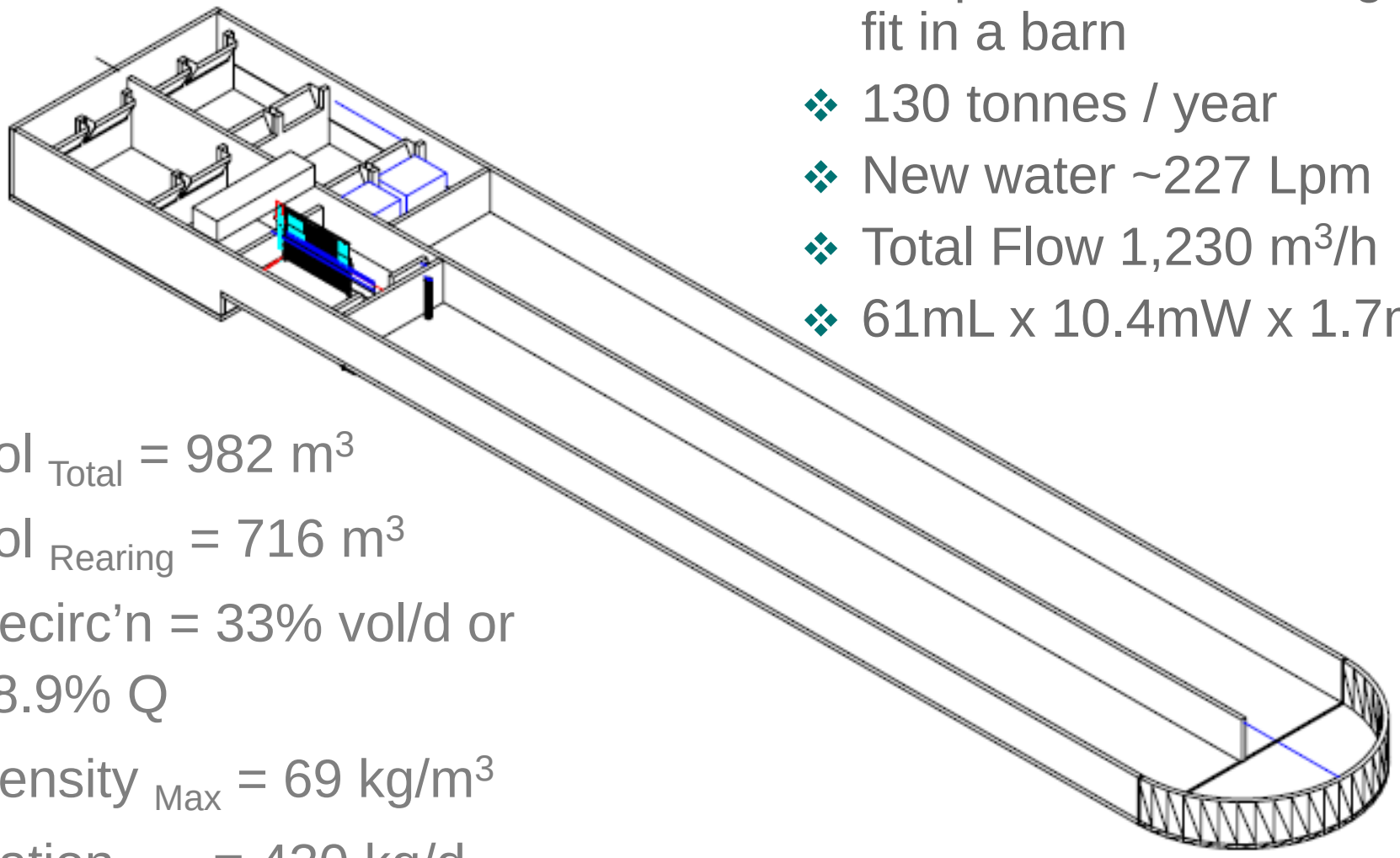
# Canadian Model Aqua-Farm

- Year-round production
  - 40,000 20g fry every 3 months
  - 12 months to ~1200g @ ~10°C
  - Harvest ~10,800 kg per month
  - Harvest at 900 – 1000 g



# Model Farm Layout



- Simple, efficient design to fit in a barn
- 130 tonnes / year
- New water ~227 Lpm
- Total Flow 1,230 $m^3/h$
- 61mL x 10.4mW x 1.7mD

- Vol $_{Total}$ = 982 $m^3$
- Vol $_{Rearing}$ = 716 $m^3$
- Recirc'n = 33% vol/d or 98.9% Q
- Density $_{Max}$ = 69 $kg/m^3$
- Ration $_{Max}$ = 430 kg/d

# Financial Metrics

- Capital Cost
  - Does not include barn, well, manure lagoon (sunk costs)
    - $6,317 per tonne of production capacity
  - Total investment and financial results will vary according to site-specific factors

| | Budget | Actual | Variance | Rationale |
|---|---|---|---|---|
| Infrastructure | $ 46,200 | $ 127,047 | $ 80,847 | Upgraded electrical supply |
| Raceway & Purge Tank | $ 173,000 | $ 157,243 | $ -15,757 | |
| RAS Equipment | $ 405,000 | $ 464,901 | $ 59,881 | Sludge cones, microparticle filter, inflation, currency exchange |
| Fish Culture Equipment | $ 30,360 | $ 30,360 | $ 0 | |
| Other Equipment | $ 38,500 | $ 46,746 | $ 8,246 | Over-tank walkways |
| Total Capital Cost | $ 693,080 | $ 826,296 | $ 133,216 | D = 19% |

# Financial Metrics

- Working Capital
  - Feed, Fingerlings, Power, Supplies, etc.

| | Budget | Actual |
|---|---|---|
| Feed ($/tonne) | $1,582 | $1,416 |
| Electricity ($/ month) | $4,185 | $3,300 |
| Fingerlings ($/ 20g) | $0.28 | $0.335 |
| Selling price ($/ kg) | $3.97 | $4.18 |

  - Notes:
    - Selling price in 2017 is $5.40 / kg
    - Feed cost in 2017 is $1,866 / tonne

# Cost of Goods Sold (2017 Update)

| | | $/kg | % Sales |
|---|---|---|---|
| Harvest (kg) | 130,800 | | |
| **TOTAL REVENUES** | **$706,320** | $5.40 | 100.0% |
| **Cost of Production** | | | |
| Opening Inventory | $136,727 | $1.05 | |
| Feed | $317,352 | $2.43 | 44.9% |
| Fingerlings | $62,212 | $0.48 | 8.8% |
| Electricity | $50,224 | $0.38 | 7.1% |
| Labour | $31,200 | $0.24 | 4.4% |
| Maintenance & Repairs | $11,574 | $0.09 | 1.6% |
| Supplies | $5,556 | $0.04 | 0.8% |
| Stock Insurance | $7,157 | $0.05 | 1.0% |
| | $622,001 | $4.76 | |
| **Closing Inventory** | $136,723 | $1.05 | |
| **Cost of Sales** | **$485,279** | $3.71 | **68.7%** |
| **Gross Margin** | **$221,041** | $1.69 | **31.3%** |

# Indirect Costs (2017 Update)

| | | | |
|---|---|---|---|
| **Indirect Costs** | | | |
| Depreciation | $52,718 | $0.40 | 7.5% |
| Professional Services | $6,000 | $0.05 | 0.8% |
| Insurance | $3,600 | $0.03 | 0.5% |
| Interest | $24,547 | $0.19 | 3.5% |
| Telecommunications | $2,400 | $0.02 | 0.3% |
| Office Expense | $600 | $0.00 | 0.1% |
| Vehicle Expenses | $6,000 | $0.05 | 0.8% |
| **Total Indirect** | **$95,866** | $0.73 | **13.6%** |
| **Profit/(Loss) before taxes** | **$125,176** | $0.96 | 17.7% |
| **Taxes** | **$19,403** | $0.15 | 2.7% |
| **Profit/(Loss) after taxes** | **$105,772** | $0.81 | 15.0% |

Total CF = Labour + Net Cash Flow = $137,380

EBITDA = 28.7%

# Financial Metrics


- Capital Cost
  - ~$10,000 to $15,000 per tonne of production
- Working Capital
  - Feed, Fingerlings, Labour, Power, Supplies, etc.
  - ~$2,000 to $5,000 per tonne of production
- Revenue
  - ~$5,000 to 7,000 per tonne (round weight, farm gate)
- Return
  - Net Cash Flow ~$1,100 to $1,800 per tonne (before tax)
  - EBITDA = 23% to 28%

## *Creating Prosperity – One Client at a Time*

- ✓ Understanding the circumstances
- ✓ Developing innovative solutions
- ✓ Delivering results – on time, on budget, no surprises

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