‘Namgis Closed Containment Atlantic Salmon Farm

Aquaculture Innovation Workshop
November 2012

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People of the Salmon


Bears Need
SAVE
OUR
WILD
SALMON

Who's Involved?

SOS
SAVE OUR SALMON

THE CONSERVATION FUND

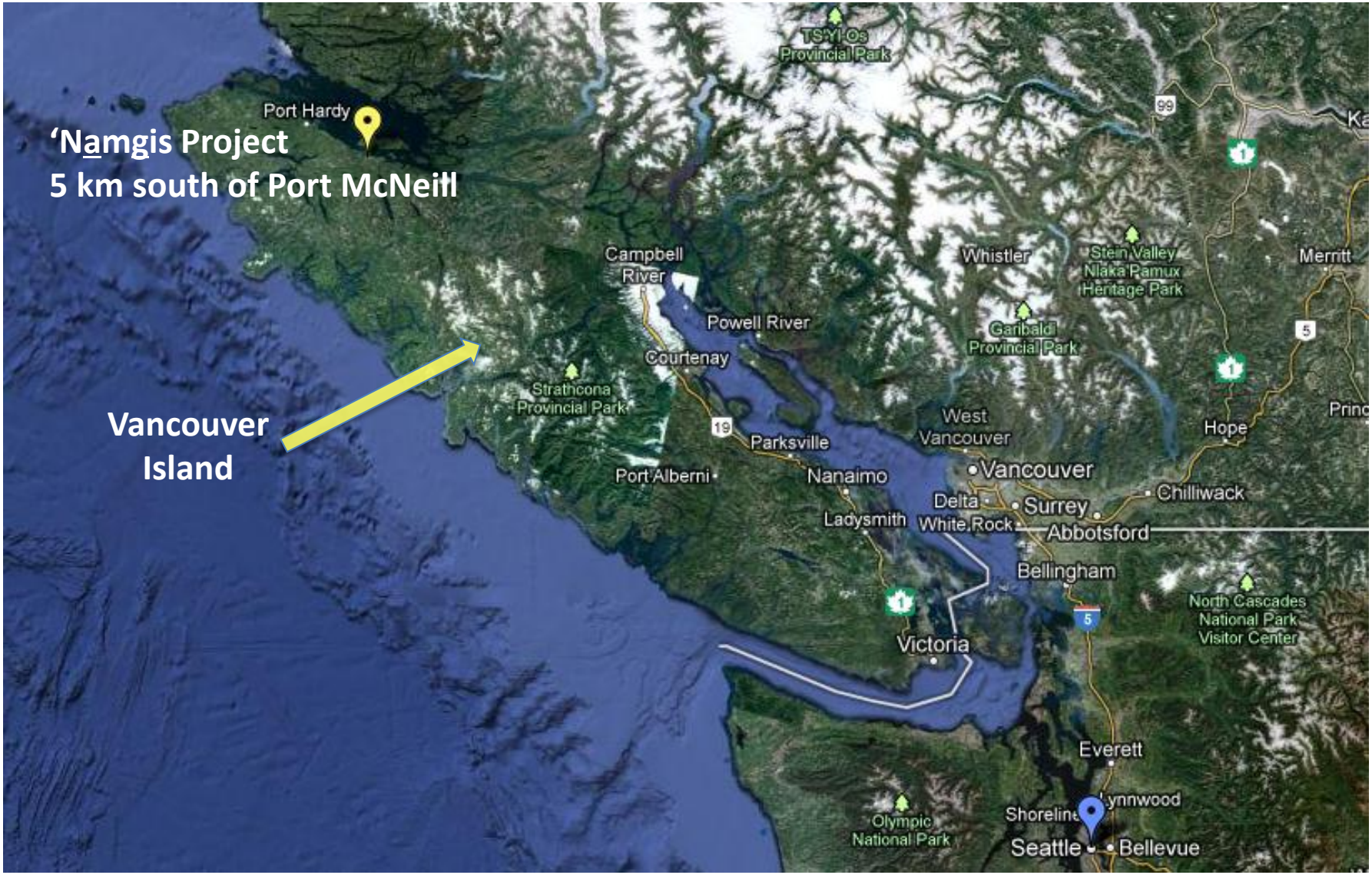
'NAMGIS
FIRST NATION

TIDEScanada
uncommon solutions for the common good

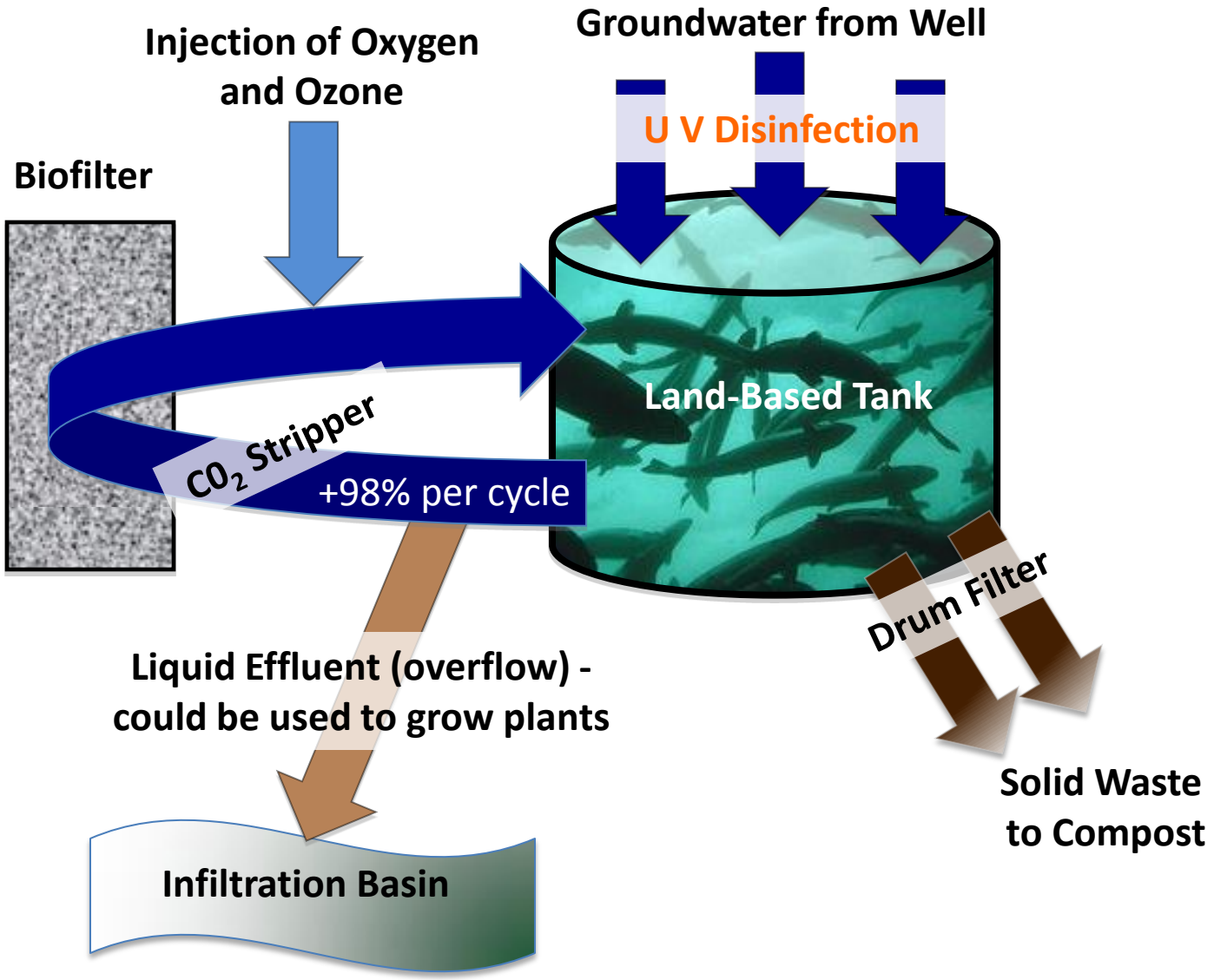
PRAqua

K'UDAS
LIMITED PARTNERSHIP

Project Location



RAS Technology



Project Objectives

Confirm the biological and technical parameters for raising Atlantic salmon.

- Optimal temperature; fish density; salinity; water quality factors; feed conversion rates; successful grilse reduction strategies, etc.

Project Objectives

Determine the optimal design and production parameters for a commercial sized facility.

- Optimal tank sizes and design; heating system size and design; use of denitrification to reduce effluent and heating costs; facility size re labour requirements;

- Confirmation of no environmental impacts and determination of how to best capitalize from the waste stream (aquaponics and/or fertilizers).

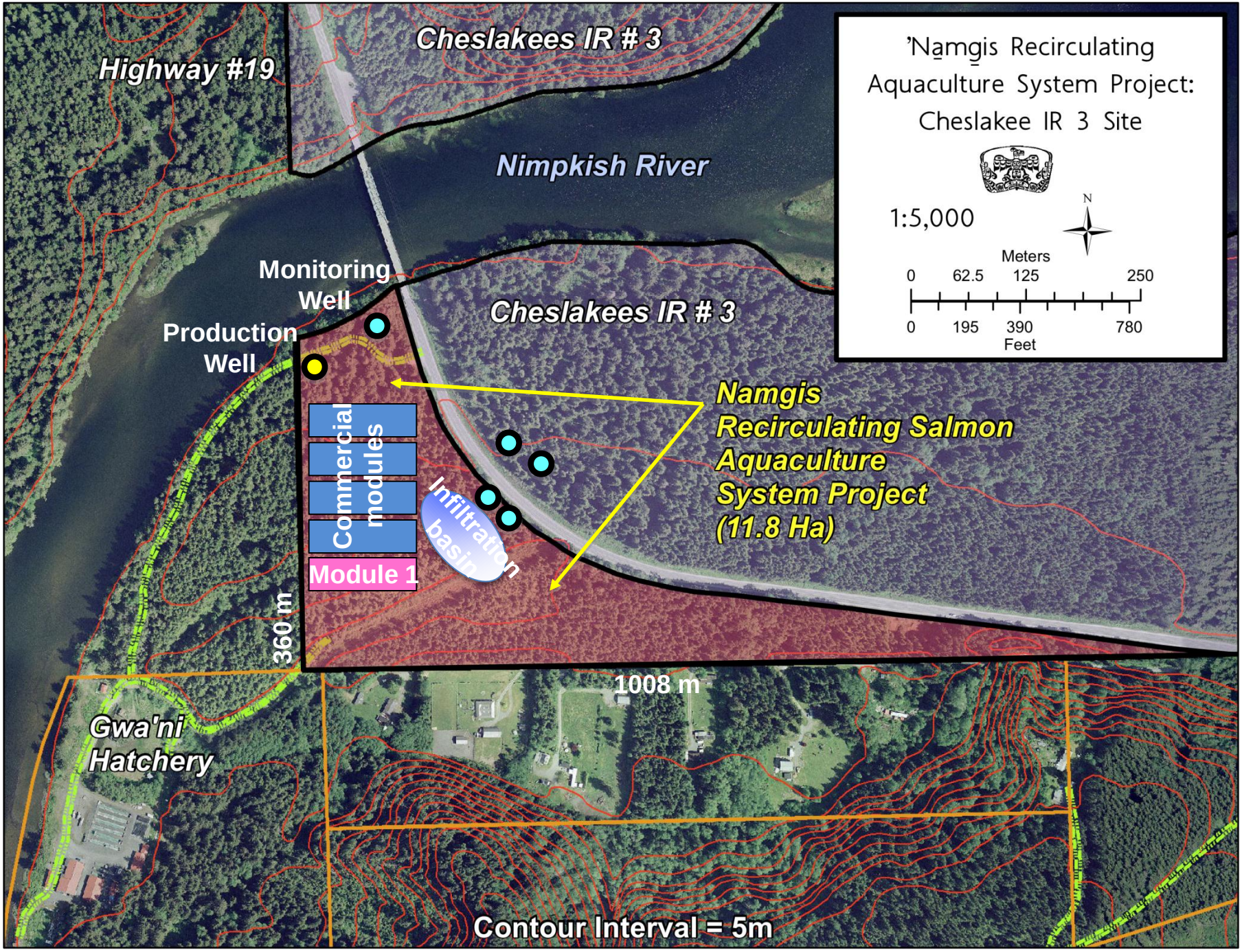
Project Objectives

- Determine the minimum site characteristics.
- Determine economic factors
    - Operating costs
    - Revenues

- Make a profit from Module One.
- **Catalyze the adoption and improvement of this technology for growing Atlantic salmon.**

Facility Layout

2,870 m^2 (35m x 82m; 116' x 270')


Highway #19
Cheslakees IR # 3
Nimpkish River
Monitoring Well
Production Well
Cheslakees IR # 3
Commercial modules
Module 1
Infiltration basin
Namgis Recirculating Salmon Aquaculture System Project (11.8 Ha)
360 m
1008 m
Gwa'ni Hatchery
Contour Interval = 5m
'Namgis Recirculating Aquaculture System Project: Cheslakee IR 3 Site
1:5,000
N
Meters
0 62.5 125 250
0 195 390 780
Feet

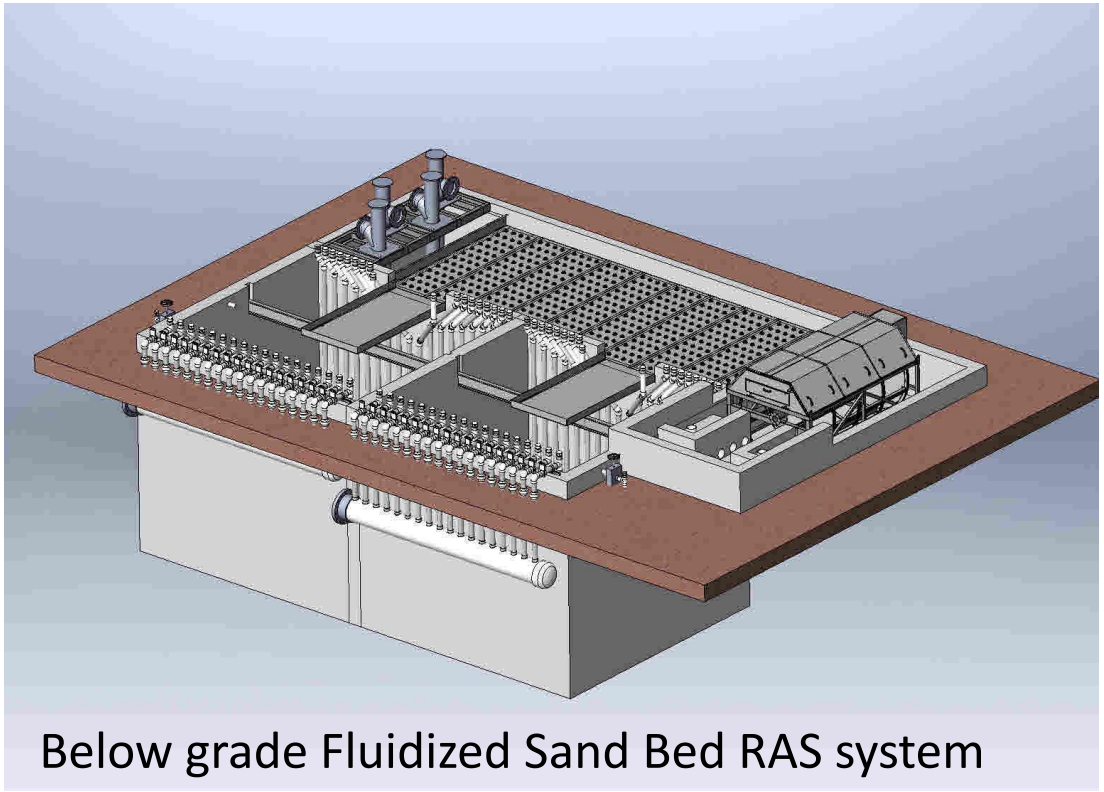
Project Timeline

- Construction complete December 2012
- Smolts into facility January 2013
- First harvest January 2014

Project site – September 18, 2012

Project site – November 1, 2012

Process Innovation



Below grade Fluidized Sand Bed RAS system

Above grade FSB RAS system

Future Innovation

- Introduce:
  - Denitrification
  - Chilling
  - Other operating innovations
- Turning waste into profits.
- Methods to reduce grilsing.
- Other design innovations to reduce capital costs.

Funding for Construction & Operations

Tides Canada	3,166,533
Sustainable Development Technology Canada	2,650,000
Department of Fisheries and Oceans – Aquaculture Innovation & Market Access Program	800,000
Aboriginal Affairs and Northern Development Canada	497,575
Coast Sustainability Trust	113,111
Ritchie Foundation	130,000
BC Hydro Power Smart	143,000
Total Grant Funding secured	**7,500,219**
‘Namgis First Nation Investment (in addition to contribution of land)	1,000,000
Total Funding	**$ 8,500,219**

Capital Costs of Pilot

RAS Equipment	$ 5,006,288	$12.84/kg HOG
Site Develop. & Bldgs.	2,025,610	$ 5.19/kg
Other Equipment	525,599	$ 1.35/kg
Total Capital Costs	**$ 7,557,497**	**$19.38/kg HOG**
		$ 8.81/lb

470 Metric Tonnes of production per year live weight. 390 tonnes HOG per year.

Costs to First Harvest

Inventory Buildup:	
Feed & Smolts	$ 583,791
Labour	280,450
Other Prod'n Costs	294,607
Processing & Marketing	83,546
Pre-production salaries, etc.	287,870
Administration & Overhead	449,115
Total Op. Costs to 1st Harvest	**1,979,379**
Total Capital Costs	**7,557,497**
Total Costs to 1st Harvest	**$9,536,876**

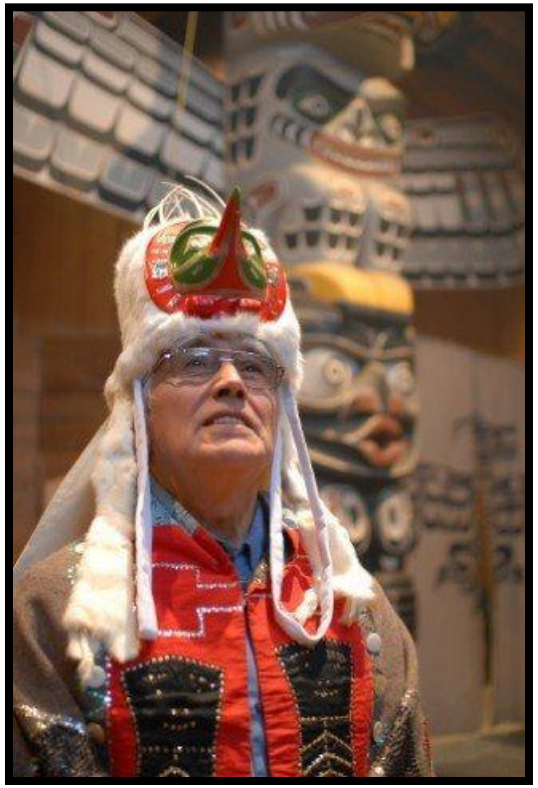
Capital Costs – Pilot vs. Commercial

	Cost Per Module ($'000)	
	First Module	**Commercial Scale**
Engineering	501	130
RAS Equipment	2,477	2,200
RAS Installation	2,029	1,500
Civil Works	1,045	570
Main Building	980	880
Other Equip.	525	220
Cost Per Module	**7,557**	**5,500**
Permanent Inventory	1,979	7,200
Hatchery		1,500
Total Capital Cost	**9,536**	**30,700**

Operating Expenses – Pilot vs. Commercial

Key Variables	First Module	Commercial-Scale & Optimized	
	$/kg HOG		% Improve
Feed	2.10	1.77	16%
Labour	0.75	0.45	40%
Power	0.31	0.28	10%
Smolts	0.85	0.64	25%
Maintenance	0.09	0.09	0%
Fish Health Treatments	0.30	0.27	10%
Other Operating	0.49	0.37	25%
Process, Pkg, Freight	0.78	0.70	10%
Marketing, Sales Adm.	0.51	0.46	10%
Corporate Overhead	0.050	0.045	10%
Total Production Costs	6.22	5.08	18%

Marketing and Sales



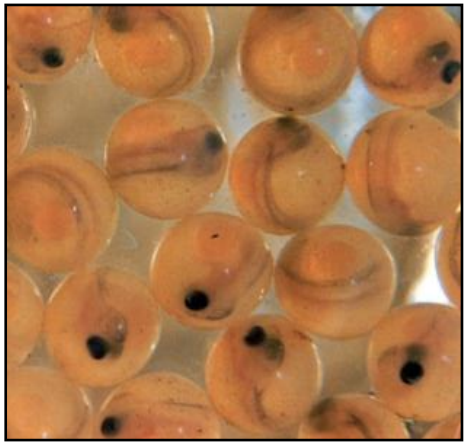
- Demand for seafood that meets ENGO sustainability ranking criteria is currently greater than the supply
- Strategic partnership with Albion Fisheries to process and market the product is currently being negotiated
- Branding program is under development
- Ensuring production method, including feed formulation and supply, meets Monterey Bay Aquarium's "SeaChoice" sustainability ranking criteria

Future Potential

The experience gained from Module 1 = significant economies of scale in capital and operating costs as additional modules are added.

Build, operate, and optimize the facility through 4 to 6 grow-out cycles.

Add Value-Added Businesses
Hatchery; aquaponics; organic fertilizer; custom processing; transportation services; salmon processing & marketing company



Expand Facility to Commercial Scale 2,000 to 3,000 MT

Monetize the Intellectual Property (IP)

Key Issues to Date

- Regulatory and permitting
- Engineering (design)
  - Heating
  - Structural
  - Energy efficiency
- Capital Costs
- Lender and investor lack of knowledge
- Bioplan
  - Density
  - Grilse rate
  - Grading and handling
- Marketing and sales
  - Processing
  - Pricing / quality premium
  - Market development

Contact Information

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Slides With More Detailed Information

Who's Involved?

- **'Namgis First Nation** - 100% owner (K'udas GP Inc.).
- **The SOS Marine Conservation Foundation** (Save Our Salmon) – Project Partner providing funding and business expertise.
- **Tides Canada** - with the support of the **Freshwater Institute**, provides funding, technical and project management support.
- **PR Aqua** – Aquaculture system supplier.

SAVE OUR SALMON

TIDES canada
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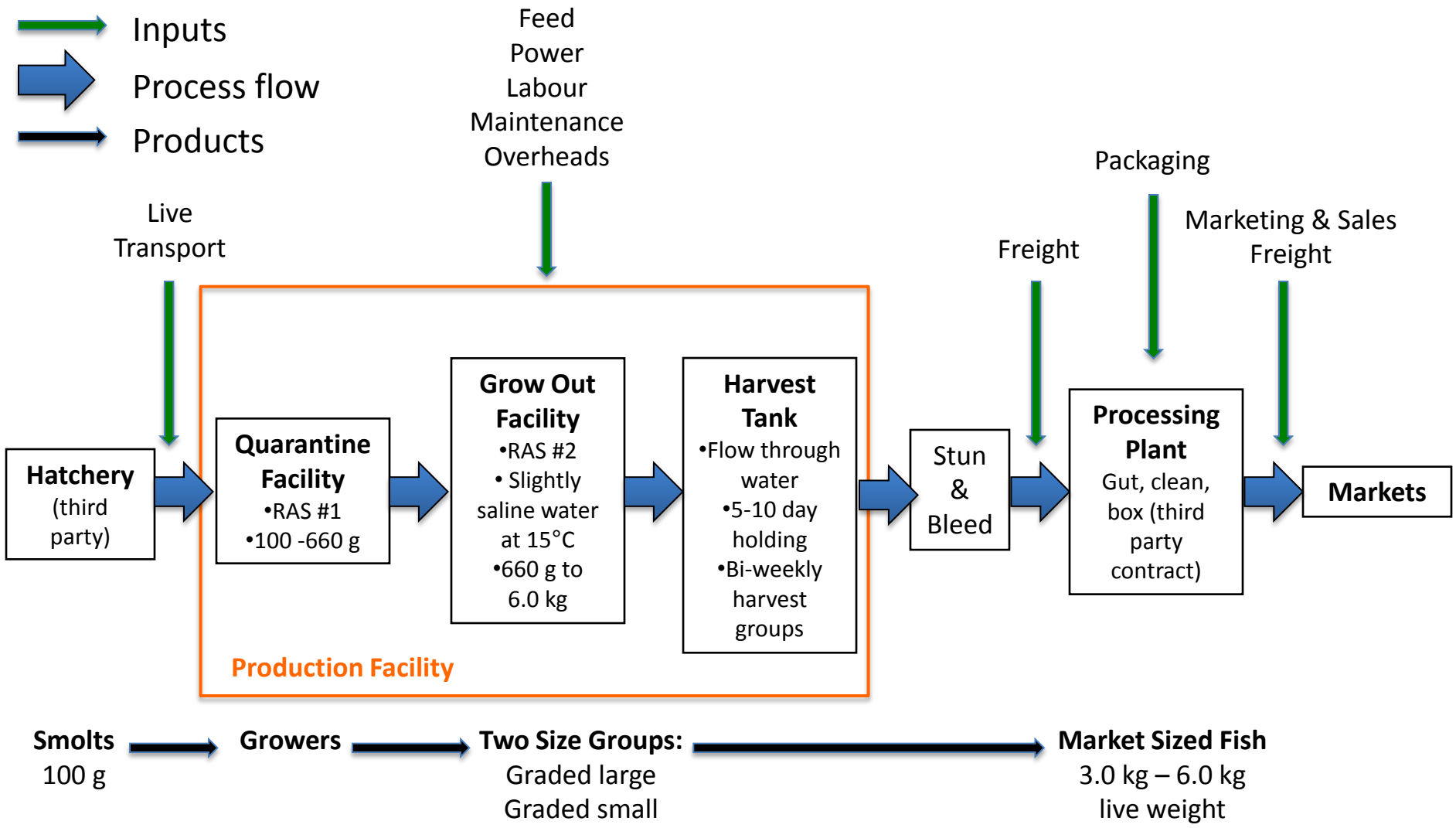
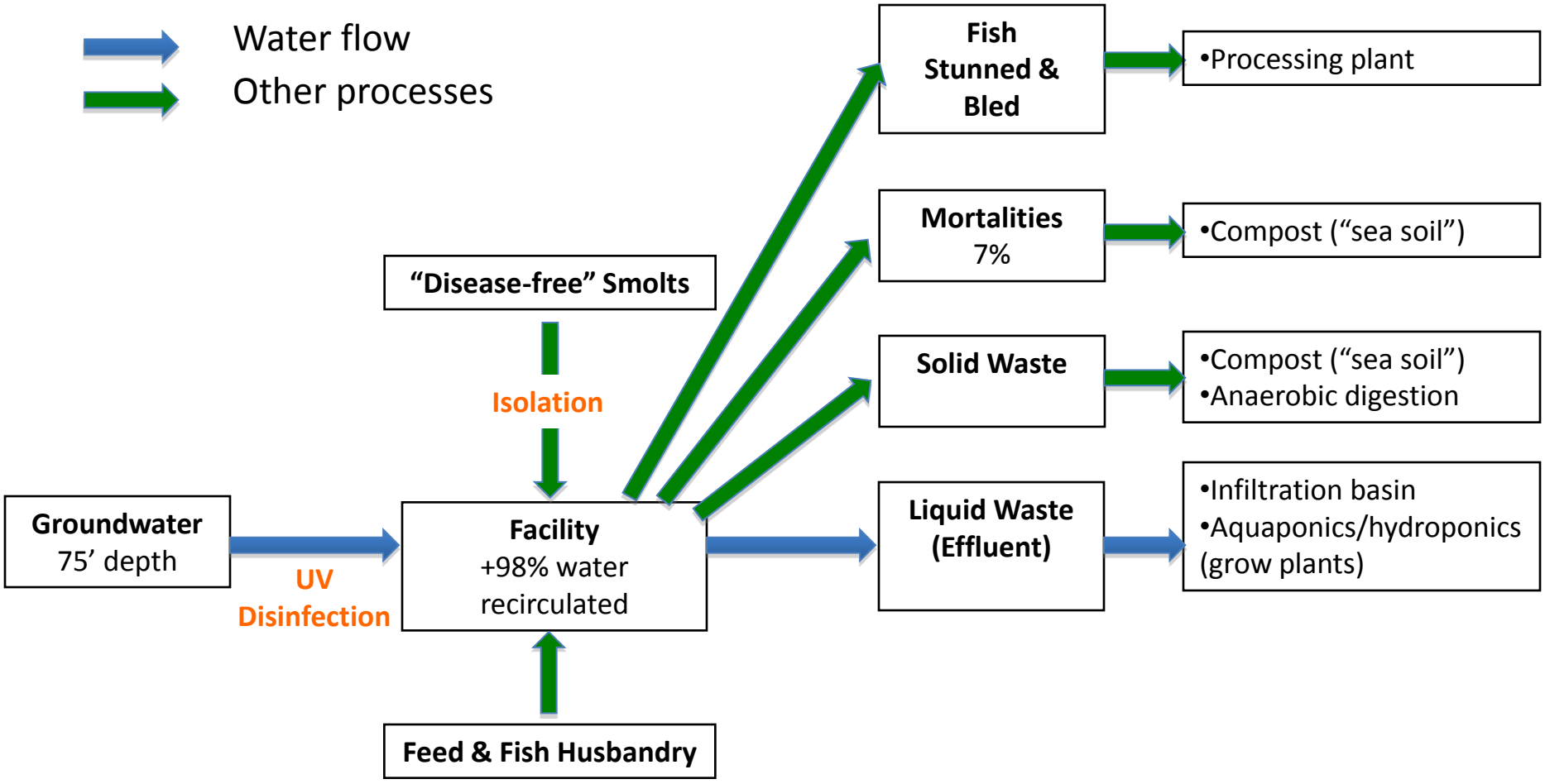
PR Aqua

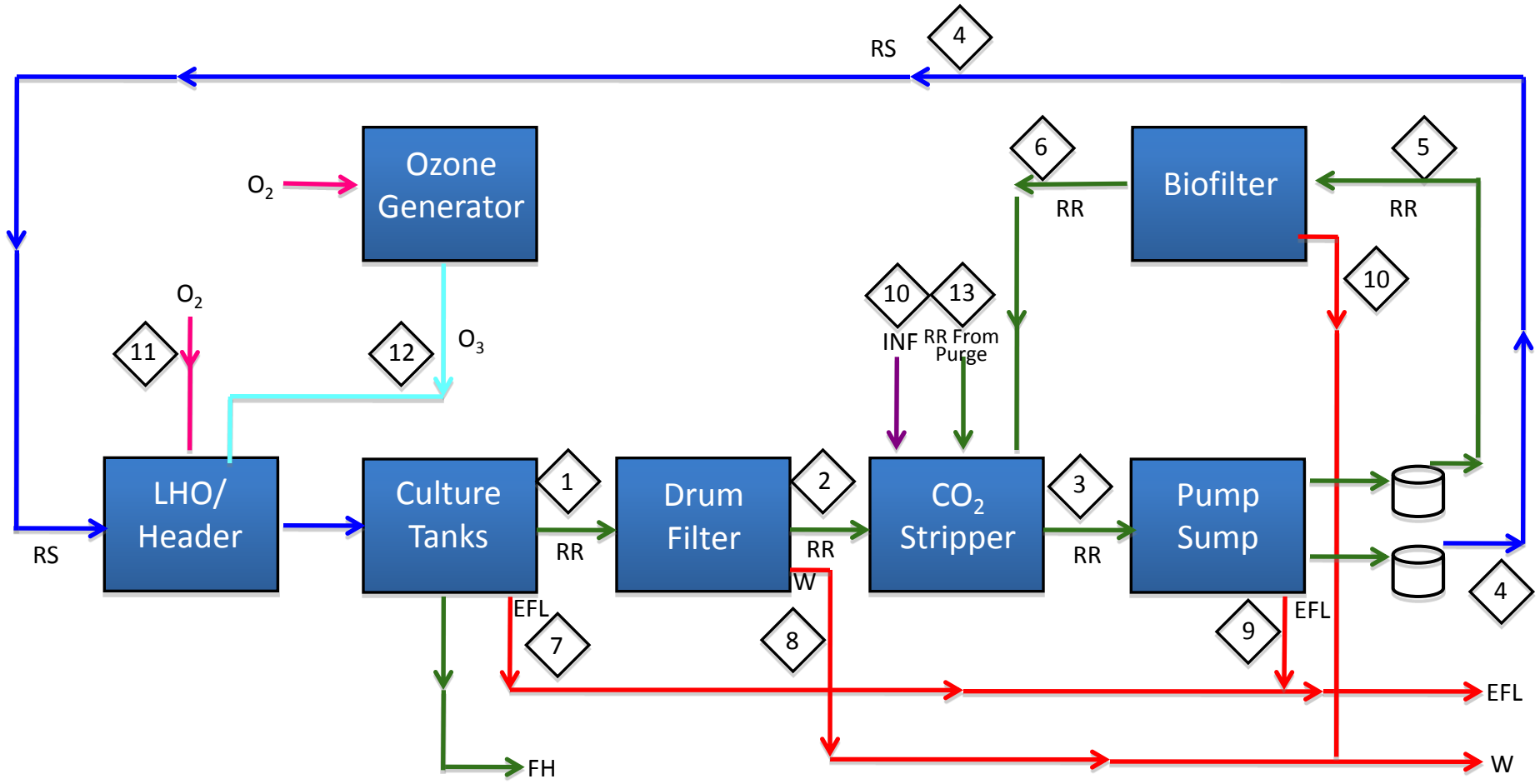
'NAMGIS FIRST NATION

Process Flow



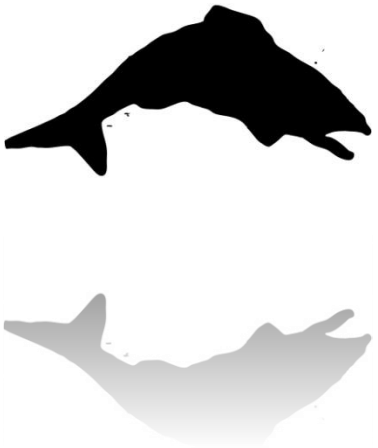
Input and Outputs




RS
4
Ozone Generator
O_2
O_3
Biofilter
6
RR
5
RR
10
10
13
INF
RR From Purge
11
12
O_2
LHO/ Header
RS
Culture Tanks
1
RR
Drum Filter
2
RR
W
CO_2 Stripper
3
RR
Pump Sump
4
EFL
7
8
9
EFL
EFL
FH
W

Project Overview

- Module 1 of a 5 module farm;
- Covered, biosecure facility
- +98% recirculation rate
- Groundwater disinfected on entry
- Slightly saline water at 15° C
- 3 cohorts of Atlantic salmon smolts/year
- Target density = 90 kg/m^3
- Smolts from Canadian broodstock, “disease free”, will undergo rigorous third-party additional disease testing and be quarantined for 4 months
- Module 1 = 470 tonnes/year
- Growout in 12 -15 months; no use of antibiotics or pesticides
- Harvest sizes 3 to 6 kg; continuous supply
- Capital cost $7 million
- Independent environmental monitoring through PSF funded by Tides Canada



Key Site Characteristics

- Ample supply of fresh and brackish groundwater
- Three phase power nearby
- Soil characteristics good for infiltration basin
- Adjacent to Island Highway
- Within 5 km of Port McNeill
- Close to processing plant and composting facility
- Room for expansion

Technologies & Equipment Summary

- Facility housed within 1 building divided into 2 sections: quarantine & growout
- **Water** supplied from ground + UV disinfection
- **Tanks:** 5 @ 500m^3; 2 @250m^3; fiberglass; dual drain Cornell style
- **Biofilter:** PRAqua fluidized sand biofilter, below grade installation
- **Gas exchange:** Tank LHO's & CO_2 stripping tower
- **Feeding:** Central feeding system (pneumatic)
- **Inventory control:** Electronic counting at transfer (e.g. Aquascan), bio-scanner frame weight monitoring
- **Fish transfer:** Central pump & grading station
- **Particulate filtration:** Microscreen drum filter (80micron)
- **Heating system:** Heat pump (1 to start) using groundwater as heat source and culture tank based heating coils as destination; Energy Recovery Ventilator (ERV) used to recover heat from vented air
- **Head:** 16 feet
- **Fish harvest:** Purge tank

Bio-Programming Facts

- Smolt entry at 100 g
- Smolts quarantined for 4 months
- 3 crops/year
- Thermal Growth Coefficient of 2.5
- Slightly saline water at 15° C
- 6 kg target size
- Harvest every two weeks
- Incorporate overstocking and early harvest
- Up to 2 week depuration period
- Initial design density of 50 kg/m^3 increasing to 90 kg/m^3
- 470 MT production

RAS Performance Metrics (Projected)

Water flow:

- Makeup water flushing:
  - Per unit system volume – 150 gpm; 25% of system volume/day
  - Per recirculating flow basis – 99.5% recirculation rate
- Culture tank exchange rate at different stages:
  - Growout – 30 min
  - Quarantine – 45 min
  - Purge – 45 min

RAS Performance Metrics (Projected)

In tank water quality targets*:

- Temperature - 15°C average
- Salinity – 6 to 8 ppt (influent water supply)
- Alkalinity – 75 mg/l min (controlled with NaOH)
- CO_2 - 12 mg/l max
- Oxygen – 100%

*at 90 kg/m^3

Biological Metrics (Projected)

- Smolt size – 100 g (supplied by third party)
- Maximum Density - 50 (1st cohort), 75 (2nd cohort), 90 (3rd cohort) kg/m^3
- FCRb - 1.05
- TGC – 2.5
- Mortality- 7.6% (including 3% cull)
- Harvest size – 3 to 6 kg

- No antibiotics nor pesticides will be used

Process Innovation

Two process loop strategy

- Matches flow rates to the requirements of the individual processes
- Reduced flow and power use when demand allows without affecting flow dependent processes

Two passes through CO_2 stripper

- Allows for a significant reduction in system dissolved CO_2 concentrations and reduced flow rates

Process Innovation

Equipment is low profile

- Lower profile building with reduced air volume
  = reduced energy for air handling and heating
- Easy access to equipment without stairs or elevated platforms
  = reduced labour

Use of low head oxygenation technologies

- Allows for the use of low cost, low pressure generated O_2 without the risk of elevating total dissolved gases

Oxygen control on a tank-by-tank basis

- Improved efficiency of oxygen use = lower operations cost