Appendix A

Ethics Consent Form for Interviewees
Application Number
2016s0221

Rethinking Seafood Production: Developing Sustainable Communities Through Land-Raised Fish

Consent form for Interviewees

The University and those conducting this research study subscribe to the ethical conduct of research and to the protection at all times of the interests, comfort, and safety of participants.

Your signature on the last page of this form will signify that you have read this document which describes the procedures, whether there are possible risks, and benefits of this research study, that you have received an adequate opportunity to consider the information describing the study, and that you voluntarily agree to participate in the study.

Study Purpose
This particular study seeks to explore the contributions that Land-Based Aquaculture (LBA) could make to the development of sustainable communities.

This is an official invitation to participate in our study. You are invited to become an interview participant due to your knowledge of and involvement in the LBA industry. This project is being undertaken through the Mitacs Accelerate program. The project is being funded by Mitacs and the Nanwakolas Council under the funding title “Rethinking Seafood Production: Developing Sustainable Communities with Land-Raised Fish.”

Your participation is voluntary
Your participation in this study is voluntary. You are under no obligation to participate in this study. If you decide to participate, you may still choose to withdraw from the study at any time without any negative consequences to the education, employment, or other services to which you are entitled or are presently receiving. If you decide to withdraw at any moment, any data from your interview with us will be immediately destroyed and will not be considered in our research project.

If you decide to participate in the study
We will be conducting a one-hour interview with you by phone or at your place of employment. We will ask you some questions about the nature of your work and how you think LBA could contribute sustainable communities. For the sake of data
collection, the researchers may record the audio from your interview (You may specifically refuse to consent to being recorded). Our research team will use interview data to develop a comprehensive picture of the state of LBA in British Columbia, and take this knowledge to specific community development projects.

**Are there any risks to participating?**
We do not think that anything in this study could cause you harm in any way. Even so, you do not have to answer a question if you do not want to. This study is one of ‘minimal risk’; the risks encountered will be at the same level or threshold as that one would expect to encounter in their everyday life.

We would also like to note that permission to conduct this research study has been obtained from your employer / organization. There is a very small possibility that employees can face negative consequences should unfavourable statements or unpopular opinions get traced back to them.

**What will the benefits of this study?**
We do not think that there will be any direct benefits to you participating in this study. However, we expect that this study will help to advance the LBA industry in British Columbia towards a sustainable future.

**Will you receive anything for your participation?**
To thank you for your time, we will provide you with a $20 honorarium, in the form of a gift card.

**How will your privacy be maintained?**
Your identity will not be disclosed as a part of this study. During the course of our data analysis, codes will be associated with the interview data. Due to the size of the limited size of the land-based aquaculture industry, strict confidentiality cannot be guaranteed. Audio files taken from the interview will be transcribed and stored on a password-protected file within the research database at the Centre for Sustainable Community Development. Transcription files will be deleted two years after the completion of the study. All audio recordings are considered identifiable data and will be destroyed once they have been transcribed and coded.

**Study Results**
The results of the study will be used in the Master’s researchers’ theses, and in any academic publications that follow from the theses. Input from interviews may be used to construct a Site Assessment Index to assess the feasibility of future community LBA projects.

**Who can you contact if you have questions about the study?**
Any questions about the study can be directed at any one of the researchers or their supervisor.

Supervisor
Mark Roseland

Principal Investigator
Jeff Lemon

Collaborators
Jake Bastedo
Elizabeth Mosier

If you have any concerns about your rights as a research participant and/or your experiences while participating in this study, you may contact Dr. Jeffrey Toward, Director, Office of Research Ethics or

Consent to Participate

Taking part in this study is entirely up to you. You have the right to refuse to participate in this study. If you decide to take part, you may choose to pull out of the study at any time without giving a reason and without any negative impact.

- Your signature below indicates that you have received a copy of this consent form for your own records.
- Your signature indicates that you consent to participate in this study.
- You do not waive any of your legal rights by participating in this study.

Having been asked to participate in the research study named above, I certify that I have read the procedures describing the study. I understand the procedures to be used in this study and the personal risks to me in taking part in the study as described above. I understand the contributions of my participation in this study and agree to participate. (See next page)
The participant and researcher shall fill in this area together. Please print legibly.

<table>
<thead>
<tr>
<th>Participant Last Name:</th>
<th>Date (use format MM/DD/YYYY):</th>
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<tr>
<td></td>
<td>Participant First Name:</td>
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<th>Participant Contact Information:</th>
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<th>Participant Email:</th>
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<th>Participant Signature:</th>
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<tr>
<th>May the researcher contact you for additional information after the initial interview? Yes [ ] No [ ]</th>
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<th>May the researcher publish your name for the explicit purposes of this report or do you wish to remain anonymous? Yes – public [ ] No – anonymous [ ]</th>
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<th>May the researcher use the information learned from your interview for the explicit purposes of this report or would you prefer that it be kept confidential? Yes – use in report [ ] No – confidential [ ]</th>
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<th>May the information gained in the interview be used again, in a different study? Yes [ ] No [ ]</th>
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<th>Would you like a copy of the interview transcript or the final research results? Interview Transcript [ ] Final Report [ ] Both [ ] Neither [ ]</th>
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REM 699 Thesis Interview Questions

Section 1: Introduction
How did you end up getting involved in the aquaculture industry? How has it changed/evolved since you began?

When did you decide to incorporate RAS technology into your operation? Why did you?

What do you think of other innovators within the aquaculture sector? What are your perceptions of them?

Section 2: Current Industry Practices
Could you explain how your business operates? Where do you get your ‘inputs’ (smolts, feed, etc.)? How do you reach your end market?

Do you currently have any partnerships? Have you ever thought of working with other businesses in the community to maximize profits?

In your opinion, who are currently some of the biggest industry players using RAS technology? Are they strictly focusing on product grow-out or are they maximizing other parts of the production chain (processing, distribution, etc.)?

Have you ever thought of vertically and/or horizontally integrating your business?

Section 3: Current Problems Facing RAS Industry
Do you think there is a stigma currently surrounding aquaculture industry? If so, what can RAS aquaculture go about working against it?

In your opinion, what are three of the biggest barriers to having greater adoption of RAS systems? Of these 3, which do you feel is most important and why?

Do you personally face any / all of these barriers when you incorporated RAS technology into your operation? Are there any other challenges that you currently face?

Section 4: Policy & Legality
In your opinion, are any of the barriers you mentioned earlier a result of current policy regulations?

What are your personal concerns in regards to this topic? What would be some of the key elements you would like see changed?

If the policies surrounding land-based aquaculture and/or RAS technologies were changed, how would this change the way you did business?

Section 5: Potential or Perceived Solutions
What do you think is the best way for trying to change people’s perceptions of aquaculture? How do you discuss your business with other people?
Appendix C

Land-based Aquaculture Scan
ABSTRACT
This document offers an initial scan of current best practices in land-based aquaculture from around the world.
Jake Bastedo, Jeff Lemon, & Elizabeth Moiser

LAND-BASED AQUACULTURE SCAN
An initial Scan of Industry Best Practices
<table>
<thead>
<tr>
<th>Group</th>
<th>Species</th>
<th>Operation</th>
<th>Location</th>
<th>Type of Facility</th>
<th>Technology Used (RAS, pen, mixed); Proven / Experiential</th>
<th>Description</th>
<th>Key Points of Operation (market, innovation, etc.)</th>
<th>Link(s)</th>
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<tbody>
<tr>
<td>Finfish</td>
<td>Arctic char, Atlantic halibut, Atlantic salmon</td>
<td>Canaqu Seafoods Limited</td>
<td>Advocate Harbour, NS</td>
<td>Hatchery, Grow out (Onsite - salmon &amp; char; Off-site - halibut [Scotia Halibut])</td>
<td>RAS; Proven</td>
<td>Annual production - 250 MT total</td>
<td>Operation supplies local markets with three species of finfish; Transitioning to full organic certification</td>
<td>Access to both fresh &amp; salt water wells</td>
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<td>Operation supplies local markets with three species of finfish; Transitioning to full organic certification</td>
<td>Supports local jobs and industry in rural NS</td>
<td>Well depth allows water to be clean, pure and pathogen-free; water is also at a constant temperature, year-round.</td>
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<td>Atlantic</td>
<td>Halibut PEI</td>
<td></td>
<td>Victoria, Prince Edward Island</td>
<td>Grow out</td>
<td>Saltwater RAS; Started experimental in 2008</td>
<td>Pilot project began in 2008 in an abandoned lobster holding facility in Victoria, PEI.</td>
<td>The location has three deep salt wells; the pure salt water requires no antibiotics and results in a low environmental footprint.</td>
<td>The facility makes use of an costly technology to develop by reusing the salt water well facility for lobster holding tanks.</td>
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<td>Salmon</td>
<td>Kuterra</td>
<td></td>
<td>Port Hardy, BC</td>
<td>Grow out; Hatchery (possible)</td>
<td>RAS; Experimental</td>
<td>One of the first land-based Atlantic salmon farms globally to achieve sales quotas.</td>
<td>Currently designed: 470 MT/year; Future expansion: potential to add 2000-3000 metric tonnes, hatchery, on-site solid waste composting, &amp; aquaponics.</td>
<td>Utilizes SCD principals for success of enterprise: the 'Namgis First Nation, project partner SOS Marine Conservation Foundation, funder &amp; advisor Tides Canada, and seafood distributor Albion Fisheries.</td>
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<td>Marine Harvest</td>
<td>Kuterra salmon</td>
<td>Hatchery, Grow out, Processing, Distribution</td>
<td>Campbell River, BC</td>
<td>Mixed (RAS/pen); proven</td>
<td>Hatchery/grow out takes place in RAS system; last stages of grow out happen in traditional pens off BC coastline</td>
<td>Kuterra salmon have achieved a green, &quot;Best Choice&quot; ranking from Monterey Bay Aquarium's Seafood Watch, designated a Best Choice by SeaChoice, and designated &quot;Ocean Wise&quot; to create 29 downstream jobs, measured with standard industry multipliers Preliminary discussions of partnerships to offer training and certification in RAS technology; need for qualified staff (&amp; training) is likely to increase as demand RAS in Canada and globally expands.</td>
<td>1. Smolts - Smolts are grown in RAS hatchery until the mature into adult salmon; for final stages of grow out (3-6 months), salmon are moved to pen enclosures off the coast 2. Harvest - After fish have reached market weight (4.5 to 5.5kg) and are then harvested and taken to a MH processing facility 3. Processing / Distribution - Processing activities take place in specialized facilities; once processed, MH uses a combination of road, rail, ship and airfreight for distribution to maintain product freshness and to minimize travel time.</td>
<td><a href="http://www.marineharvest.ca/">http://www.marineharvest.ca/</a></td>
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<td>Tilapia</td>
<td>Redfish Ranch</td>
<td>Courtenay, BC</td>
<td>Hatchery, Grow out</td>
<td>RAS; Proven</td>
<td>Started in 2000, still running in 2010 but hard to find anything since then Up for sale in 2010; no website, probably now defunct</td>
<td>Breeding program underpins Mainstream’s production process through the supply of high quality juvenile Barramundi that demonstrate rapid growth, low growth variance, high fillet yield and disease resistance.</td>
<td><a href="http://www.bcbusiness.ca/natural-resources/fish-farming-tilapia-in-bc">http://www.bcbusiness.ca/natural-resources/fish-farming-tilapia-in-bc</a></td>
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<td>Tropical Aquaculture</td>
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<td>Products</td>
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<td><a href="http://www.eattilapia.com/operations/tilapia-farming/">http://www.eattilapia.com/operations/tilapia-farming/</a></td>
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<td>Multi-trophic</td>
<td>Oysters / Algae</td>
<td>Smit &amp; Smit</td>
<td>Grow out</td>
<td>RAS; Experimental</td>
<td>Father and Son team starting world's first RAS oyster production system with full grow out Growing the algae that feed the oysters onsite. Completely isolated RAS, so substantially reduced risk of disease</td>
<td></td>
<td><a href="http://advocate.gaalliance.org/dutch-shellfish-farmers-bringing-the-sea-onto-land/">http://advocate.gaalliance.org/dutch-shellfish-farmers-bringing-the-sea-onto-land/</a></td>
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| Steelhead Salmon / Aquaponics | Steelhead Salmon / Aquaponics | Little Cedar Falls          | Nanaimo, BC       | Grow out          | RAS; Experimental                                        | Production will reach 100 MT of Steelhead annually - 3 cohorts stocked in the system at a time; 100% hormone and antibiotic free 10,000 fish stocked every 8 weeks; growth from 20gm to 2kg in 45 weeks @ 15 Celsius Operation won runner-up for innovation at Stanford's Fish 2.0                                                                                                                                 | Operation cost $1.4M to build; Atkinson suggests that building a second facility at same time would have dropped costs and decreased vulnerability of operation over the long run Worked with Tides Canada, Albion Fisheries, and other special interest groups to    | http://www.littlecedarfalls.com/steelhead-salmon.html  
VIDEO - https://www.youtube.com/watch?v=olBvXMwwwzY                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                       |
| Sturgeon / Aquaponics | Sturgeon / Aquaponics | Target Marine Products Inc. | Nanaimo, BC       | Hatchery, Grow out, Processing | RAS; Proven                                               | Sturgeon & caviar production; facility has hatchery, grow-out sites, & processing plant Aquaponics system grows watercress to filter out nitrates & effluent                                                                                                                                                                     | Sells product to Albion Fisheries Products are Certified Organic, recommended by Ocean Wise, and recognized BEST CHOICE by SeaChoice and SeafoodWatch Watercress is shipped and sold to Vancouver restaurants |                                                                                                                                                                                                                                                                       | http://www.northerndivine.com/  
VIDEO - https://www.youtube.com/watch?v=gueSq_E1Gik                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                       |
<p>| Tilapia / Aquaponics | Tilapia / Aquaponics | Blue Ridge Aquaculture      | Martinsville, Virginia, US | Grow out          | RAS; Proven                                               | Largest RAS tilapia operation in the world; 4 million pounds per year Entire system is closed loop; adding only feed for the tilapia. Aquaponics utilize: traditional hydroponic techniques (nutrient film and gutter systems), raft (floating                                                                                                                                 | Designed as a multi-purpose facility for research into the science, technology, and economic potential of fish and shellfish production using RAS | <a href="http://advocate.galliance.org/dutch-shellfish-farmers-bringing-the-sea-onto-land/">http://advocate.galliance.org/dutch-shellfish-farmers-bringing-the-sea-onto-land/</a>                                                                                                                                                                                               |                                                                                                                                                                                                                                                                       |</p>
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<tr>
<td>Shellfish</td>
<td>Abalone</td>
<td>Connemara Abalone</td>
<td>Galway, Ireland</td>
<td>Hatchery, Grow out</td>
<td>RAS; proven facility operating since at least 2009</td>
<td>Grow Ezo (haliotis discus hannai) Japanese variety. Facility is located on the shores of Galway Bay and uses sea water, abalone are fed locally harvested seaweed</td>
<td>One of two abalone operating producers in Ireland. Abalone was first introduced to the area in 1980.</td>
<td><a href="http://www.abalone.ie/our-location.html">http://www.abalone.ie/our-location.html</a></td>
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<td>Pure Australian Abalone</td>
<td>Australia; Bicheno, Bremer Bay, Kangaroo Island, Port Lincoln, Portland</td>
<td>Hatchery, Grow out, Processing, Distribution</td>
<td>RAS; Proven Australian abalone aquaculture industry pioneers; grow premium (sashimi grade) species including Greenlip (Haliotis Laevigata) and Tiger (Haliotis x Rubra) abalone</td>
<td>Distribute IQF (individually quick frozen) abalone to wholesalers &amp; distributors across the globe; live abalone pack &amp; hand delivered to Australian customers 1. Baby abalone start their lives attached to layered vertical sheets. These are covered with algae (food source) for these growing creatures as they are in their juvenile stage. Trials are carried out to ensure abalone are receiving the best diets to aid health and growth 2. RAS tech circulate fresh seawater in the tanks; tanks cleaned regularly to ensure the abalone have the best possible environment in which to thrive 3. Abalone are hand fed daily on a 100% natural diet with</td>
<td><a href="http://www.ausab.com.au">http://www.ausab.com.au</a></td>
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<td>Tower Aqua Products</td>
<td></td>
<td>Grow out</td>
<td>Cork, Ireland</td>
<td>RAS</td>
<td>Grow Eso Awabi (Haliotis discus hannai) Japanese variety &amp; Haliotis Tuberculata. Facility is computer controlled and fed organic sustainable seaweed (fed by hand). Provides end to end consultancy services (primarily in Europe) for farmers that need assistance developing a farm. Farm has build out capacity to 80 tonnes; currently operating at 45 tonnes. 20,000 sq.ft purpose built facility with sea water heat exchange and gravity fed water make up. Current activities are aimed at developing the business model and increasing operational efficiency.</td>
<td>essential nutrients until they reach maturity and commercial size [3 yrs.] 4. Harvest team removes each abalone by hand from the tanks; abalone are then taken to the processing room where they are snap frozen before being packaged and delivered to customers around the world.</td>
<td><a href="http://www.toweraqua.com/">http://www.toweraqua.com/</a> <a href="http://www.fishtech.com/qa.html">http://www.fishtech.com/qa.html</a></td>
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<td>Wild Coast</td>
<td></td>
<td>Hatchery, Grow out</td>
<td>East London, South Africa</td>
<td>RAS (unconfirmed)</td>
<td>Grow abalone (Haliotis discus) in land-based tanks. Also grow all of the seaweed (kelp?) necessary to feed the abalone in open air raceways. Seems that breeding, hatching, grow out and processing are all done on site, as well as feed production. In the video [see link(s)], a program is described that releases some spawn to restock wild populations.</td>
<td></td>
<td><a href="https://www.youtube.com/watch?v=Id6248PXzkY">https://www.youtube.com/watch?v=Id6248PXzkY</a> (this is a decent little doc about SA abalone crisis, start at 17:35 for content specific to this farm) <a href="https://theweekendpost">https://theweekendpost</a>.</td>
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<td>Clams, geoduck, mussels, oysters</td>
<td>Taylor Shellfish</td>
<td>Hatchery, Grow out (?)</td>
<td>Seattle, WA</td>
<td>RAS; South Pudget Sound sandy beaches, muddy tide flats, rocky shorelines, mussel rafts</td>
<td>Started in the mid-1980's, now over 500 employees and still largely a family business.</td>
<td>Started in the mid-1980's, now over 500 employees and still largely a family business.</td>
<td>Grow about 600 tonnes of seaweed a year, processing about 130 tonnes abalone a year.</td>
<td><a href="https://www.taylorshellfishfarms.com/about-us/our-story">https://www.taylorshellfishfarms.com/about-us/our-story</a>, wordpress.com/tag/richard-clarke/</td>
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<td>Lobster</td>
<td>Norwegian Lobster Farm</td>
<td>Hatchery, Grow out</td>
<td>Norway</td>
<td>RAS; Experimental</td>
<td>Lobster are cannibal throughout lifecycle; must be kept separated throughout entire lifecycle. Fishing for berried lobsters was protected in 2008; Norwegian Lobster Farm began as a project to developing a living gene bank for restocking purposes Tech is patented; provides lobster w/ optimal growth conditions, animal welfare &amp; biosecurity throughout production cycle.</td>
<td>European lobster is considered to be a high-end seafood; price is high and stable, both nationally and internationally Demand outstrips market supply; estimated market potential is more than 50,000MT and price generally increases with demand throughout the year</td>
<td><a href="http://www.norwegian-lobster-farm.com/en/">http://www.norwegian-lobster-farm.com/en/</a></td>
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<tr>
<td>Shrimp</td>
<td>First Ontario Shrimp Farm</td>
<td>Grow out</td>
<td>Campbellford, ON</td>
<td>RAS; Experimental</td>
<td>Shrimp come from a pathogen free hatchery in Florida RAS most sustainable way to farm shrimp</td>
<td>Shrimp is the most consumed seafood in North America Retrofitted hog farm; RAS offered alternative uses for their empty barns</td>
<td><a href="http://firstontarioshrimp.com/about-us.php">http://firstontarioshrimp.com/about-us.php</a>, VIDEO - <a href="http://www.cbc.ca/news/business/shrimp-farm-cocchio-1.3371804">http://www.cbc.ca/news/business/shrimp-farm-cocchio-1.3371804</a></td>
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<tr>
<td>Oceanic Institute (Hawaii)</td>
<td></td>
<td>Grow out</td>
<td>Hawaii, US</td>
<td>Grow out</td>
<td>RAS; Experimental</td>
<td>An intensive grow out trial produced 5.7 kg/m² of market-size shrimp in 14 weeks</td>
<td>Alternative management strategies allowed the elimination of costly external bio filters and other system, thereby reducing production costs.</td>
<td><a href="http://pdf.gaalliance.org/pdf/GAA-Otoshi-July06.pdf">http://pdf.gaalliance.org/pdf/GAA-Otoshi-July06.pdf</a></td>
</tr>
<tr>
<td>Planet Shrimp</td>
<td></td>
<td>Grow out</td>
<td>Aylmer, ON</td>
<td>Grow out</td>
<td>RAS; Experimental</td>
<td>Massive shrimp farm in a former Imperial Tobacco plant</td>
<td>Starting with four production modules, each about the size of a football field</td>
<td><a href="http://www.planetshrimp.com/">http://www.planetshrimp.com/</a></td>
</tr>
<tr>
<td>Virginia Shrimp Farms (subsidiary of Blue Ridge Aquaculture)</td>
<td></td>
<td>Brood stock, Hatchery, Nursery, Grow out</td>
<td>Martinsville, Virginia, US</td>
<td>Brood stock, Hatchery, Nursery, Grow out</td>
<td>RAS; Experimental</td>
<td>Working with Virginia Tech to develop large-scale shellfish production Infrastructure necessary to develop production technologies for fish and shellfish species in RAS. Facility includes dedicated spaces for grow out systems, a hatchery and nursery room, brood stock tanks and laboratories. Nursery &amp; hatchery rooms</td>
<td>Shrimp is top seafood species consumed in the US, it represents the largest potential market Designed as a multipurpose facility for research into the science, technology, and economic potential of fish and shellfish production using RAS</td>
<td><a href="http://www.blueridgeaquaculture.com/research.cfm">http://www.blueridgeaquaculture.com/research.cfm</a></td>
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<tr>
<td>Group</td>
<td>Species</td>
<td>Operation</td>
<td>Location</td>
<td>Type of Facility</td>
<td>Technology Used (RAS, pen, mixed); Proven / Experiential</td>
<td>Description</td>
<td>Key Points of Operation (market, innovation, etc.)</td>
<td>Link(s)</td>
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<td>- live feed production, including an algae culture room, live feed tanks, and distribution systems. Brood stock rooms include a separate filtration system &amp; darkened rooms with photo-manipulation capabilities</td>
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Closed System Land-Based Aquaculture: Description of Technology & Species

The following descriptions highlight and used in closed system, land-based aquaculture. A list of reared species has also been added for the convenience of the reader.

FinFish

Raceways (recirculating or flow-through)
Description: Modern raceway systems are made from a variety of materials: concrete, plastic, steel; can be either outdoor or indoor; gravity fed by a stream; partially or fully recirculating.

Species & Country
Channel catfish (Ictalurus punctatus); USA
Seabass (Centropristis striata); France
Sole (Solea solea), Japanese flounder (Paralichthys olivaceus); Spain, Denmark
Trout (Oncorhynchus mykiss); US, Spain, France

Recirculating Aquaculture Systems (RAS)
Description: Tanks can come in a variety of forms. Circular formats have been preferred in many cases because of the self-cleaning properties they provide. Polygon shapes, however, have advantages in being more space efficient. These systems are often modular and scalable, allowing producers to scale-up systems at their own pace and without having to interrupt operations to add greater capacity. Inland recirculating tanks are often located where there is both limited land and water availability, as they can be located in industrial areas and achieve high degrees of water reuse.

Species & Country
African catfish (Clarias gariepinus); Benin
Barramundi (Lates calcarifer); Australia, USA, Russia, Netherlands, Israel, Denmark, UK
Black rockfish (Sebastes schelegeli); Korea
Eel (Anguilla anuilla); Denmark, Croatia & Netherlands
Golden perch (Macquaria ambigua); Australia
Jade perch (Scortum barcoo); Australia
Murray cod (Maccullochella peelii peelii); Australia
Pike perch (Sander lucioperca); Netherlands
Seabass (Centropristis striata); Greece
Seabream (Sparus aurata); Greece
Sleepy cod (Oxyeleotris lineolatus); Australia
Sturgeon (Acipenser transmontanus); Greece
Tilapia (Oreochromis niloticus); El Salvador, Israel
Tilapia (Oncorhynchus mykiss); Chile
Turbot (Scophthalmus maximus); Netherlands

Flow-through Tanks
Description: Flow-through tanks come in similar formats as recirculating tanks. These however are more commonly found where reliable water sources are available and used to harvest species that require certain conditions (i.e. trout).

Species & Country
Arctic char (Salvelinus alpinus): Canada (Icy Waters), Iceland.
Trout (Oncorhynchus mykiss); Europe, N. America, Chile, Latin America
Island Ponds & Channels

**Description:** Ponds - analogous to tanks but dug in the ground (natural). Channels – analogous to raceways but in the ground (natural). Occasionally, these can be lined with membranes or mud but this is generally not the case.

**Species & Country**
- Barramundi (Lates calcarifer); Australia
- Channel catfish (Ictalurus punctatus); USA
- Golden perch (Macquaria ambigua); Australia
- Jade perch (Scottum barcoo); Australia
- Salmon (Oncorhynchus nerka); Canada
- Tilapia (Oreochromis niloticus); Belize, El Salvador, USA, Australia
- Trout (Oncorhynchus mykiss); Europe, Australia, N. America

Experimental / Development Stage

**Flow-through Tanks: Open-Water Systems**

**Description:** These can be found made from a range of materials, in circular as well as square shapes. Hard walled systems are generally made from reinforced plastic, concrete, aluminium. Soft walled are made from plastic.

**Species & Country**
- Arctic char (Salvelinus alpinus); Canada
- Barramundi (Lates calcarifer); Western Australia
- Black cod (Notothenia microlepidota); Canada
- Bluefin tuna (Thunnus thynnus); Australia
- Chinook salmon (Oncorhynchus tshawytscha); British Columbia
- Cod (Gadus morhua); Denmark
- Coho salmon (Oncorhynchus kisutch); British Columbia
- Gilt-head seabream (Sparus aurata); Baltimore, US
- Mulloway (Sciaena Antarktica); Western Australia
- Ocean trout (Oncorhynchus mykiss); Western Australia
- Rainbow trout (Oncorhynchus mykiss); Nova Scotia
- Walleyed pike (Sander vitreus vitreus); USA (Michigan)
- Yellowfin tuna (Thunnus albacares); Panama
- Yellowtail kingfish (Seriola lalandi lalandi); Western Australia

**Flow-through Tanks: Land-Based Systems**

**Description:** Tank systems on land pumping seawater.

**Species & Country**
- Atlantic salmon (Salmo salar); British Columbia
- Chinook salmon (Oncorhynchus tshawytscha); British Columbia
- Coho salmon (Oncorhynchus kisutch); British Columbia

**Recirculating Raceways**

**Description:** Recirculating raceways are operated as land-based (inland) systems. These can be composed of a single level or can be stacked to increase production per floor area of a given occupied space.

**Species & Country**
- Blackspotted seabream (Pagellus bogaraveo); Norway
- Cod (Gadus morhua); Norway
- California halibut (Paralichthys californicus); Spain
Appendix D

Meeting Primer: Rethinking Seafood Production
Meeting Primer for Nov. 7, 2016 Working Group in Campbell River

Around the world, aquaculture is gaining attention as a sustainable method of protein production in time of increased population pressure and compromised seafood stocks. Land-based Aquaculture (LBA) is unique in that it’s closed contained nature isolates it from surrounding ecosystems and can be established in a range of locations. The leading technology for LBA is Recirculating Aquaculture Systems (RAS) in which up to 99.6% of water is treated and reused (see Figure 1). The primary research focus around this emerging method of seafood production has focused on technological and engineering issues and their environmental and ecological impacts. We at Simon Fraser University’s Centre for Sustainable Development (CSD) noticed a lack in the consideration of the socio-economic impacts of this new technology and aimed to expand this area of research.

The Nanwakolas council expressed interest in learning about land-based aquaculture as development projects for their member nations. A partnership was established between the Nanwakolas and the CSD through Mitacs (a non-profit research federal research funding organization) to explore the possibilities of LBA development for member nations. We invite you to read the following pages as a primer for the meeting to take place on November 7. A brief synopsis of our research and observations will inform participants for dialogue sessions to discuss our research and next steps for the project. Enjoy!

Project Plan

The research team set out to learn all they could about land-based aquaculture and the aquaculture industry on Northern Vancouver Island by visiting Land-based Aquaculture operations and talking to facility operators, undertaking a literature review of current aquaculture practices and putting together a LBA scan for interesting facilities on a global scale. The SFU research team, with expert guidance from the Nanwakolas council, engaged with Member Nations through a project initiation meeting in June 2016 and followed up with formal research interviews with five representatives from Nanwakolas Member Nations.
Interviews with Representative from Member Nations

The research team interviewed five representatives from Member Nations and summarized the interview themes using NVivo analysis software. The team focused in on the three research themes of regulation and planning, food sovereignty, and business entrepreneurship.

Regulation and Planning

Satisfying regulatory requirements and coordinating resources to implement aquaculture operations are critical factors in the development of aquaculture endeavours. With respect to regulation and policy, the most common themes discussed were DFO and process. DFO top down regulations and processes for acquiring licenses and fishing permits affected First Nation goals to maintain cultural and historical fishing grounds. In addition, the regulations and process affected First Nation’s decisions related to cooperation and partnerships for aquaculture business opportunities; for example allowing fishing tenures of large organizations, such as Marine Harvest, within traditional waters.

The major barriers for planning and implementation of projects discussed included costs and people. Costs are related to licensing processes such as ground-truthing and collecting information for the government agencies, and start up capital costs. When barriers were discussed in relation to people, the theme was centered on having people that are knowledgeable in aquaculture, willing to live and work in remote locations and feel that they are adequately compensated for their working conditions.
Food Security

A variety of interest was expressed surrounding issues of food security in the communities of member nations’. Comments about the health impacts of western diets and around a lack of access to traditional food sources led to interesting discussions about what role an LBA system could play. Would a traditional food produced in a non-traditional way serve any purpose to the community? While land-based aquaculture is a food production method, a potential facility might not necessarily have a connection to food security. With several members, a discussion emerged between the potential conflict and balance between an LBA project being for economic returns or for community food; this spectrum is discussed in greater detail later on. Asserting rights to manage food resources within territories was mentioned by several members, and it seemed that an involvement in the aquaculture industry would help guide it towards sustainability. Members shared experiences of the aquaculture industry and expressed concern over the availability of seed supply as an impediment to successful farm operations.

Business Entrepreneurship

All five interviewees noted that they see definite opportunities for council nations to work together in partnership and cooperation, for the betterment of their individual nations and the council as a whole. Strategic partnerships within both the production and processing sectors offer potential for diversification and vertical integration. With most of the interest in LBA surrounding various nodes of the food system value chain, namely developing a regional hatchery, expanding local processing, and producing a diversity of both finfish and shellfish species, the underlying importance for any potential enterprise is that it should focus on fostering the economic, social, ecological and cultural well-being of the member nations involved. Many of the discussions during the interview process concentrated around the dichotomy between an enterprise maximizing economic returns and producing traditional food sources (such as abalone) for the local community. Although a venture must be profitable, comments suggested that secondary and tertiary markets can offer flexibility in order to help remedy this division for the benefit of the community.
**Site Visits**

The research team visited several aquaculture facilities covering a range of species, business models and locations.

**Vancouver Island University**

Vancouver Island University (VIU) in Nanaimo, British Columbia, operates the International Centre for Sturgeon Studies (ICSS), which brings together research activities at the regional, national and international levels for the preservation of white sturgeon. Through the ICSS, VIU has also created an aquaponics program; the combination of *aqua*culture and *hydro*ponics (water-based plant production). Both systems run on a freshwater recirculation aquaculture system.

**Marine Harvest Canada**

In 2015, Marine Harvest Canada (MHC) announced a $40-million-dollar infrastructure investment at the company's hatchery facilities in Big Tree Creek and Dalrymple which are slated to be finished in 2017. Designed to raise parr and smolts (juvenile salmon prior to seawater entry), MHC's new RAS hatchery lines are reported to help cut down the marine grow out stage by about 6 months, while using about one-hundredth of the freshwater as a traditional flow-through aquaculture system.
Little Cedar Falls

Little Cedar Falls is the first RAS facility to successfully reach continuous production with steelhead trout in Canada. Over 2 tonnes of fish are harvested each week, which reach markets across Vancouver Island the following day. In 2015, Little Cedar Falls won runner up at the Fish 2.0 Sustainable Seafood Business Competition held at Stanford University, for their sustainable business design - the entire aquafarm reuses 99.6% of its water inputs. The other .4% is recirculated through their aquaponics system where they grow vegetables and leafy greens by harvesting the natural wastes of the farm.

You Grow Food Aquaponics

You Grow Food Aquaponics is a small social venture working to solve issues of local food security and economic development through education, capacity building, and public engagement. Two tanks house approximately 40 tilapia, which produces nutrient rich water for the more than 20 types of fresh herbs and greens they sell locally through a community supported agriculture (CSA) subscriptions. Additionally, they are working with Kwantlen Polytechnic University in Vancouver, to turn the excess ammonia rich water into an organic fertilizer to be sold to local farmers and gardeners as a secondary market.

First Ontario Shrimp Farm

Similar to finfish and shellfish, crustaceans can do well in RAS systems; especially when compared to Asian counterparts grown in traditional net aquaculture. The ability to fully monitor the environment, feeding levels, and tank carrying capacity allow the shrimp to excel in terms of size and taste. As a testament to the excellence in product quality, First Ontario Shrimp Farm is currently selling almost half of their weekly output (approx. 50kg) directly to high-end restaurants across the Greater Toronto Area (GTA), before the product even leave the farm.
Komoka Trout Farm

This is a land-based aquaculture enterprise that is currently transitioning from a traditional raceway style of aquaculture to a RAS facility. The reason for switching to RAS aquaculture is that it offers the opportunity of being easily ramped up whenever the operation wants to expand. Although the primary focus of the farm is tourism – where people from the surrounding area can come and catch their own fish to take home – trout are also grown for stream and pond restocking. During the off-season, full-grown stock are taken to a local processing facility for sale in local markets.

Canada Banana Farm

The Canadian Banana Farm was visited because it demonstrates the potential secondary market for fish-based fertilizers (an output of RAS aquaculture). Using 100% fish-waste fertilizer taken from a local aquaculture facility, the farm grows a wide variety of fruits and vegetables, including: bananas, papaya, citrus (lemons/lime) & pineapple alongside with traditional crops, such as tomatoes, bell peppers, cucumber, squash, & potatoes. The farm’s produce is not only larger and tastes better than anything found locally, but the use of aquaculture fertilizer allows for an organic certification by the Canadian Food Inspection Agency (CFIA), which offers a higher ROI, sometimes up to double, than non-organic products. Seeing how beneficial aquaculture fertilizer is to their operation, the farm will be adding an aquaponics facility as part of their expansion plans.

The Range of Possibilities with LBA

The interviews and site visits demonstrated that there is an enormous range possibilities for the development of a land-based aquaculture operation.

Regulation and Planning

Regulation and licensing procedures become more arduous with the complexity of the project. Small backyard facilities for educational or individual food production require little licensing and regulation, while large scale commercial aquaculture facilities require significant regulating procedures.
are many government regulations, acts and agencies involved in the management of wild and cultivated marine stocks including land based aquaculture. DFO is the federal lead for ensuring sustainable management of aquaculture activities under the Fisheries Act including where the provincial government is in charge of licensing. The regulating process becomes more complex with vertical integrations of business models, such as inclusion of a processing or hatchery facility.

**Food Security**

With several members, a discussion emerged on the spectrum between consumption and commodification; on one hand an LBA project could entirely produce food for the community, where on the other had any seafood produced could be entirely marketed for economic gain to generate funds for community development. Our research on food systems suggests that there can be alternatives outside of this simple spectrum however, related to the integration of aquaponics or the use of system wastes as fertilizer. Furthermore, there is a diversity of species being cultivated with LBA/RAS systems around the world. Further discussions around species choice will need to include considerations of community taste/uptake if the intent is consumption, as well as markets and market prices if the intent is commodification. The research lenses of Community Food Security and Food Sovereignty could inform future advancements for the Nanwakolas and potential LBA ventures.

**Business Entrepreneurship**

As the interview participants suggested, a viable business needs to be profitable. But what does that look like? Where traditional business would argue that profitability should be maximized no matter the cost; the social economy would contest that by working together, we can attain higher levels of economic development & social welfare for all those involved. As we look toward a better understanding of the potential and feasibility of land-based aquaculture, the lenses of regional and community economic development offer a way to balancing the view of traditional economic development with the interests of local and regional communities. The benefits of enabling the development of more vibrant and inclusive local economies extend beyond the opportunities of employment and short-term influxes of capital investment, to an increase in social cooperation and collaboration, a greater retention and recirculation of currency in the local economy, and a stronger resiliency to the boom and bust cycle of the global economy.
In 2013, a working group orchestrated by the Nanwakolas set out to discuss Community Wellbeing with member nation representatives. In prioritizing wellbeing goals, participants were struck by how interconnected the goals were and proposed a wheel to illustrate this interconnectedness. As a possible research direction, we propose utilizing this the Community Wellbeing Wheel (CWBW) to represent Nanwakolas’ community values and use the CWBW to narrow the range of proposed LBA possibilities.

Community Well Being Wheel and Community Capital Framework

In 2013, a working group orchestrated by the Nanwakolas set out to discuss Community Wellbeing with member nation representatives. In prioritizing wellbeing goals, participants were struck by how interconnected the goals were and proposed a wheel to illustrate this interconnectedness. As a possible research direction, we propose utilizing this the Community Wellbeing Wheel (CWBW) to represent Nanwakolas’ community values and use the CWBW to narrow the range of proposed LBA possibilities.

Proposed Project Next Steps

Our research so far suggests that because of the breadth of possibilities within LBA and the implications of decisions around scale, species, location, etc., a tool or framework to refine these possibilities based on the Nanwakolas’ interests would be highly valuable. We envision a Community Site Assessment Toolbox (CSAT); a substantive decision support tool meant to help community leaders among the Nanwakolas Council who are interested in development of an LBA enterprise to better understand the feasibility of such a business venture. Made up of three distinct tools to determine project feasibility, the suite would identify the technical, social and organizational indicators needed to assess the risks and benefits of constructing a RAS facility within a community; including consideration of mechanical systems, energy requirements, human capacity, market analysis, and community infrastructure. The long-term value of the CSAT is to aid community leaders who are interested in developing competitive businesses and cultivating community resiliency through Sustainable Community Development practices.
The toolbox would be comprised of three separate modules: the Community Site Index, a technical site feasibility assessment, and a business feasibility study. Brief descriptions of each of the proposed modules are below:

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<tr>
<th>The Community Site Index</th>
<th>Technical Checklist</th>
<th>Business Study</th>
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<tr>
<td>The Community Site Index, will be utilized by community leaders to gauge the long-term effects a prospective RAS facility could have on their community, in terms of the economic, environmental, and social impacts. By integrating the measurable indicators offered by the CCF with the well-being goals from the CWBW, the Community Site Index will be a rigorous decision-support tool for Nanwakolas’ member nations.</td>
<td>The technical site feasibility assessment is a technical checklist developed by the Freshwater Institute that includes resource input and technical requirements for LBA projects. The Freshwater Institute specializes in the production technology and design of aquaculture systems and shares latest technological advancements through publications and targeted workshops.</td>
<td>A business study will be developed to help community leaders to better understand the underlying factors that could lead to the success or failure of a business idea. By analyzing the strengths, weaknesses, opportunities and threats of a potential RAS aquaculture venture, a community leader will be able to assess the viability of the market and proposed location prior to investing any time and money into its development.</td>
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Our aim is to use our time with you on November 7 to better understand if and how such a decision support tool would be useful to the Nanwakolas Council.

**Working Group Meeting**

On November 7, 2016, community members and stakeholders of the Nanwakolas Council will come together to discuss what we’ve learned about land based aquaculture as an industry and from members of the Nanwakolas Council. The goals of the Working Group are:

- Present findings of industry wide land based aquaculture scan of available technologies
- Present stories from site visits of operating land based aquaculture facilities
- Present and discuss what was heard from interviews about aquaculture from member nation representatives
- Dialogue on the spectrum of possibilities within the research themes: regulation and planning, food, business development
- Dialogue on what a useful tool for aquaculture development provides

We look forward to working with you on November 7 and exploring Land-based Aquaculture together. If you have any questions, please feel free to contact Chris Roberts (chrisroberts@nanwakolas.com) or any member of the research team: Liz emosier@sfu.ca, Jeff idla@sfu.ca, or Jake jbastedo@sfu.ca.
Developing Sustainable Communities with Land Raised Fish
Nanwakolas & SFU Research Partnership
Phase 1 Report
December 12, 2016
Summary

In June of 2016, a research engagement was initiated between the Nanwakolas Council, a committee of Vancouver Island First Nations, and Simon Fraser University's Centre for Sustainable Development. The project investigated the potential for leveraging land-based aquaculture to develop sustainable communities. The engagement is the result of a Mitacs Accelerate Cluster Grant. The following document summarizes the progress made during Phase 1 of the engagement, and points forward to the steps that might be taken in Phase 2. The Background to the engagement is detailed, followed by the Project Research that the interns completed in Phase 1. The Initial Findings are presented as a range of possibilities for LBA. A Working Group Meeting concluded Phase 1, a summary of which is provided. Finally, Directions for Phase 2 are discussed.
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1 - Introduction

Around the world, aquaculture is gaining attention as an alternative method of protein production in time of increased population pressure and compromised seafood stocks. Land-based Aquaculture (LBA) is unique in that its closed contained nature isolates it from surrounding ecosystems, and modular systems can be located in a range of locations. The leading technology for LBA is Recirculating Aquaculture Systems (RAS), in which up to 99.6% of water is treated and reused (figure 1). Furthermore, such systems can include aquaponics – the combination of aquaculture and hydroponics (water-based plant production) – in which plants are grown to filter fish wastes and re-oxygenate water (figure 2). Initial research around these emerging methods of seafood production has focused on technological and engineering issues and associated ecological impacts. Simon Fraser University’s Centre for Sustainable Development (CSD) noticed little consideration of the socio-economic impacts of this new technology: a scalable food production technology that can be established in a range of locations has potential for developing sustainable communities.

1.1 Community Engagement

The coastal First Nations of Vancouver Island are experiencing the challenges of diminishing fisheries first-hand. Growing settler populations and the rise of commercial fisheries in the area have placed greater pressure on marine resources and contributed...
to complex and prohibitive regulatory regimes. The Nanwakolas Council, a tribal council representing six of these Nations in the Campbell River area, expressed interest in learning about land-based aquaculture for community development for their Member Nations. A partnership was established between the Nanwakolas Council and the Centre for Sustainable Development (CSD) through Mitacs, a non-profit research federal research funding organization, to explore the possibilities of LBA development for member nations.

### 1.2 Frameworks for Community Development

In 2013, a working group orchestrated by the Nanwakolas set out to discuss Community Wellbeing and strengthening with member nation representatives. In prioritizing wellbeing goals, participants were struck with how interconnected the goals were and proposed the idea of a wheel to illustrate interconnectedness of issues (figure 3) (Aweenak’ola newsletter, 2014). The researchers proposed using this Community Wellbeing Wheel (CWBW) as a representation of Nanwakolas’ member First Nation (NMFN) community values that could narrow the range of proposed LBA possibilities.

The CSD has developed a decision support tool called the Community Capital Framework, which itemizes six community capitals: natural, physical, economic, human, social and cultural (figure 4). The framework allows decision makers to visualize how decisions might jointly affect different community aspects. This knowledge could be adapted to guide the development of the CWBW beyond a set of ideals and into a more robust decision-support tool by integrating measurable
indicators. By applying this methodology to future LBA projects, we envision a tool that will guide development of LBA that is in line with the NMFN’s values.
2 - Project Research

The research team set out to gather information about land based aquaculture and the aquaculture industry on Northern Vancouver Island by visiting land based aquaculture operations and talking to facility operators, undertaking a literature review of current aquaculture practices and developing a LBA scan to identify interesting facilities on a global scale. The SFU research team, with expert guidance from the Nanwakolas council engaged with Member Nations through a project initiation meeting in June 2016 and followed up to some of the discussion and comments from the project initiation meeting with formal research interviews with five representatives from Nanwakolas Member Nations.

2.1 Interviews with Representatives from Member Nations

The research team interviewed five representatives from Member Nations and summarized the interview themes using NVivo software. This allowed the team to identify the main topics of discussion for three research themes: Regulation & Planning, Food Security and Regional Development & Social Economy.

2.1.1 Interview Findings: Regulation & Planning

Satisfying regulatory requirements and coordinating resources to implement aquaculture operations are critical factors in the development of aquaculture endeavors. With respect to regulation and policy, the most common themes discussed were DFO and process (Figure 5). DFO top down regulations and processes for acquiring licenses and fishing permits affected First Nation goals to maintain cultural and historical fishing grounds. In addition, the regulations and process affected First Nation's decisions related to cooperation and partnerships for aquaculture business opportunities; for example, allowing fishing tenures of large organizations, such as Marine Harvest, within traditional waters.
The major barriers for planning and implementation of projects discussed included costs and people. Costs are related to licensing processes such as ground-truthing and collecting information for the government agencies, and startup capital costs. When barriers were discussed in relation to people, the theme was centered on having people that are knowledgeable in aquaculture, willing to live and work in remote locations and feel that they are adequately compensated for their working conditions.

2.1.2 Interview Findings: Food Security
A variety of interest was expressed surrounding issues of food security in the communities of member nations’. Comments about the health impacts of western diets and around a lack of access to traditional food sources led to interesting discussions about what role an LBA system could play. Would a traditional food produced in a non-traditional way serve any purpose to the community? While land-based aquaculture is a food production method, it will not necessarily have a connection to food security and was not necessarily established in the interview process. With several members, a discussion emerged between the potential conflict and balance between an LBA project being for economic returns or for community food; this spectrum is discussed in greater detail later. Asserting rights to manage food resources within territories was mentioned by several members, and it seemed that an involvement in the aquaculture industry would help guide it towards sustainability. Members shared experiences of the aquaculture industry and expressed concern over the availability of seed supply as an impediment to successful farm operations. The main themes are represented in a word cloud (Figure 6).

2.1.3 Interview Findings: Regional Development & the Social Economy
All five interviewees noted that they see definite opportunities for council nations to work together in partnership and cooperation, for the betterment of their individual nations and the council (figure 7). Strategic partnerships within the production and processing sectors offer potential for diversification and vertical integration. With most of the interest in LBA surrounding various nodes of the food system value chain, namely developing a regional hatchery, expanding local processing, and producing a diversity of both finfish and shellfish species, the underlying importance for any potential enterprise is that it should focus on fostering the economic, social, ecological and cultural well-being of the member nations involved. This importance becomes even more apparent, as many of the discussions during the interview process concentrated around the dichotomy between an enterprise maximizing economic returns and producing traditional food sources (such as abalone) for the local community. Although a venture must be profitable, comments suggested that secondary and tertiary markets can offer flexibility to help remedy this division for the benefit of the community.

### 2.2 Site Visits
The interns travelled to several sites throughout BC and Ontario to understand the breadth of possibilities for land-based aquaculture. To capture as much of the production chain as possible, the team visited hatcheries, growout facilities, aquaponic farms and processing/distribution facilities.

#### 2.2.1 Vancouver Island University
Vancouver Island University (VIU) in Nanaimo, British Columbia, operates the International Centre for Sturgeon Studies (ICSS), which brings together research activities at the regional, national and international levels for the preservation of white
sturgeon. Through the ICSS, VIU has also created an aquaponics program that runs on a freshwater recirculation aquaculture system and has partnered with the Culinary Institute at the university to demonstrate the potential of aquaculture and aquaponics production to the chefs and opinion makers of the future.

2.2.2 Marine Harvest Canada
Marine Harvest Canada (MHC) produces over 40,000 tonnes of farm-raised Atlantic salmon each year from farm-raised salmon farms on the coast of British Columbia and Vancouver Island. In 2015, they announced a $40-million-dollar infrastructure investment at the company’s hatchery facilities in Big Tree Creek and Dalrymple which are slated to be finished in 2017. The six-metre system at Dalrymple was the first of seven new lines to be built, which was completed in 2016. Designed to raise parr and smolts (juvenile salmon prior to seawater entry), MHC’s new RAS hatchery lines are reported to help cut down the grow out stage by about 6 months, while using about one-hundredth of the freshwater as a traditional flow-through aquaculture system.

2.2.3 Little Cedar Falls
Also operating in Nanaimo, British Columbia, is Little Cedar Falls is the first RAS facility to successfully reach continuous production with steelhead salmon in Canada. Over 2 tonnes of fish are harvested each week, which reach markets across Vancouver Island the following day. In our site visit, owner/operator Steven Atkinson attributed the exceptional quality, color, and fat content of his product to benefits of RAS technology, the feed used, and ensuring the proper depuration of the fish. In 2015, Little Cedar
Falls won runner up at the Fish 2.0 Sustainable Seafood Business Competition held at Stanford University, for their sustainable business design - the entire aquafarm reuses 99.6% of its inputs. The other .4% is recirculated through their aquaponics system where they grow vegetables and leafy greens by harvesting the natural wastes of the farm.

2.2.4 Salish Sea Foods Processing Plant
Salish Sea Foods is a processing plant owned by the K’omoks First Nation. It is the main processing plant for K’omoks owned Komo Gway oysters and performs processing of salmon and shellfish for other local seafood producers. The processing facility was bought by K’omoks and grandfathered into a licensing allowing value added processing including smoking for shellfish and salmon in a single facility - a license that would not be possible under the current Canadian Food Inspection Agency regulations. The processing facility also includes a retail store selling a variety of the products produced at the processing plant. The 7,000 square foot plant provides over 20 employment opportunities and is operating at capacity since just after its take over by K’omoks First Nation Economic Development in 2013.

2.2.5 You Grow Food Aquaponics
Opening its doors in 2011, You Grow Food Aquaponics is a small social venture located in Hope, British Columbia, that works toward issues of local food security and economic development through education, capacity building, and public engagement. Operating on half an acre, the operation is run out of a small-scale commercial greenhouse that was retrofitted to store the aquaponics system. Two tanks house approximately 40 tilapias, which produces
nutrient rich water for the more than 20 types of fresh herbs and greens they sell locally through a community supported agriculture (CSA) subscriptions. Additionally, owner/operator Stephanie Hooker is working with Kwantlen Polytechnic University in Vancouver, to turn the excess ammonia rich water into an organic fertilizer to be sold to local farmers and gardeners as a secondary market. Although the tilapia are not sold for consumption at this stage in the operation, expanding this market is definitely part of their expansion plan. You Grow Food Aquaponics was picked as a best practice because it highlights the potential of utilizing the waste output of an aquaculture enterprise to access secondary and tertiary markets.

2.2.6 First Ontario Shrimp Farm

Originally a hog farm operating outside of Campbellford, Ontario, the Cocchio family decided to leave the pork business when pork prices dropped in favour of the high returns on jumbo shrimp. Like finfish and shellfish, crustaceans do well in RAS systems; especially when compared to Asian counterparts grown in traditional net aquaculture. The ability to fully monitor the environment, feeding levels, and tank carrying capacity allow the shrimp to excel in terms of size and taste. Due to the excellence in product quality, First Ontario Shrimp Farm is currently selling almost half of their weekly output [approx. 50kg/week] directly to high-end restaurants across the Greater Toronto Area (GTA), before the product even leave the farm. First Ontario Shrimp Farm was picked as a best practice because it demonstrates the viability RAS products have on the market, as well as how to gain market penetration by developing relationships with buyers in lucrative markets, such a selling directly to high-end restaurants.
2.2.7 Komoka Trout Farm
This land-based aquaculture enterprise is currently transitioning from a traditional raceway style of aquaculture to a RAS facility. Owner/operator Kevin Keck explained that his rationale for the switch was due to RAS offering a superior product and a shortened grow out period to traditional raceway aquaculture. Keck also made the point that switching to RAS aquaculture would give him the opportunity to easily ramp up his business should he ever want to expand his operation. Although the primary focus of the farm is tourism – where people from the surrounding area can come and catch their own fish to take home - trout are also grown for stream and pond restocking. During the off-season, full-grown stock are taken to a local processing facility for sale in local markets. The Komoka Trout Farm was picked as a best practice because it demonstrates the potential versatility of land-based aquaculture enterprise and illustrates the merits of RAS aquaculture over more traditional forms of aquaculture. See Appendix A for descriptions of alternative types of land-based aquaculture.

2.2.8 Canada Banana Farm
Operating out of Blyth, Ontario, the Canadian Banana Farm is an interesting case study to be sure. Growing bananas, papaya, citrus (lemons/lime) & pineapple alongside with traditional crops, such as tomatoes, bell peppers, cucumber, squash, & potatoes; this greenhouse operation is anything but traditional. The Canadian Banana Farm was chosen as a best practice because it demonstrates the potential secondary market for fish-based fertilizers (output of RAS aquaculture), as well as the potential of what can
be grown in Canada. Using 100% fish fertilizer taken from a local aquaculture facility, the farm’s produce is not only larger and tastes better than anything found on the market, but the use of aquaculture fertilizer allows for an organic certification by the Canadian Food Inspection Agency (CFIA), which offers a higher ROI [sometimes more than double] than non-organic products. The combination of fertilizer, heat (greenhouse environment is controlled; stabilized at 28 degrees Celsius) and sunlight has allowed “traditional” Canadian veggies to grow at an increased rate. Terry Brake, and business partner Laurie Macpherson, state that this combo allows a 6-week turnaround time (planting to harvest) on their tomatoes. Additionally, Brake also noted that the aquaculture fertilizer was so beneficial to his operation, that they were now looking at adding an aquaponics facility. He estimates the farm will spend over $100 000 on fertilizer once they are running at full capacity.

2.2.9 Albion Fisheries, Processing Plant.
Opened in 2013, Albion Fisheries’ new GFSI certified processing plant is state-of-the-art, with top-to-bottom temperature control and is equipped with the latest processing technologies. During the site visit, Guy Dean, Albion’s Vice President, gave the interns a personal tour around the 65,300-square-foot facility. The site visit focused upon all aspects of the new facility, including the examination of their completely automated processing system (heading/gutting – cleaning – filleting – pin boning – skinning – portioning), all which augment their traditional skilled hand cutting process. After the tour, Albion’s VP generously sat down with the interns for almost two hours offering his wisdom and personal anecdotes of the seafood industry.

Albion was approached as a best practice because they have a foundational knowledge of the BC Seafood Market and the know-how to maximize market penetration and build brand loyalty. Additionally, Albion has worked with several RAS operators along the BC coast to help them get up and running. The team saw Albion as a potential ally to the
Nanwakolas, in terms of the development of a land-based aquaculture project and the sale of product.

In addition to the site visits, the research interns conducted a preliminary global best practice scan of the possibilities of LBA. The findings from this scan informed the following discussion sections. The results can be found in Appendix A.
3 - The Range of Possibilities for LBA

The interviews and site visits demonstrated that there is an enormous range possibilities for the development of a land based aquaculture operation. The following sections capture these ranges of possibilities in terms of the three research perspectives.

3.1 Regulation & Planning
Regulation and licensing procedures become more arduous with the complexity of the project. Small backyard facilities for educational or individual food production require little licensing and regulation, while large scale commercial aquaculture facilities require significant regulating procedures. There are many government regulations, acts and agencies involved in the management of wild and cultivated marine stocks including land based aquaculture. DFO is the federal lead for ensuring sustainable management of aquaculture activities under the Fisheries Act including where the provincial government oversees licensing. The regulating process becomes more complex with vertical integrations of business models, such as inclusion of a processing or hatchery facility.

3.2 Food Security
With several members, a discussion emerged on the spectrum between consumption and commodification; on one hand an LBA project could entirely produce food for the community, where on the other had any seafood produced could be entirely marketed for economic gain to generate funds for community development. Our research on food systems suggests that there can be alternatives outside of this simple spectrum however, related to the integration of aquaponics or the use of system wastes as fertilizer. There is also a diversity of species being cultivated with LBA/RAS systems around the world. Further discussions around species choice will need to include considerations of community taste/uptake if the intent is consumption, as well as markets and market prices if the intent is commodification.

3.3 Regional Development & the Social Economy
As the interview participants suggested, a viable business needs to be profitable. But what does that look like? Where traditional business would argue in favour for the one,
that profitability should be maximized no matter the cost; the social economy would contest that by working together, we can attain higher levels of economic development & social welfare for all those involved. As we look toward a better understanding of the potential and feasibility of land-based aquaculture, the lenses of regional economic development and the social economy offer a way to balancing the view of traditional economic development with the interests of local and regional communities. The benefits of enabling the development of more vibrant and inclusive local economies extend beyond the opportunities of employment and short-term influxes of capital investment, to an increase in social cooperation and collaboration, a greater retention and recirculation of currency in the local economy, and a stronger resiliency to the boom and bust cycle of the global economy.
4 - Working Group Meeting

The Mitacs research team met with the Working Group made up of representatives of Nanwakolas member nations on November 7, 2016 at the KDC Health Centre in Campbell River to discuss what the research team has learned about land based aquaculture as an industry and from members of the Nanwakolas Council. The goals of the Working Group were to:

- Present findings of industry wide land based aquaculture scan of available technologies
- Present stories from site visits of operating land based aquaculture facilities
- Present and discuss what was heard from interviews about aquaculture from member nation representatives
- Dialogue on the spectrum of possibilities within the research themes: regulation and planning, food, business development
- Dialogue on what a useful tool for aquaculture development provides

4.1 Meeting Participants

The following Nanwakolas member representatives, industry representatives and SFU research collaborators we present at the Working Group Meeting:

4.1.1 Nanwakolas Members

Dean Drake - Wei Wai Kum; Councilor, Fisheries Portfolio
Scott Harris – Nanwakolas Council; Marine Plan Coordinator (via phone)
Chris Roberts - Wei Wai Kum; Nanwakolas Council
Thomas Smith – Tlowitsis; Councilor, Manager of Chief’s Pride Aquaculture
James Speck - Da’naxda’xw Mamalilikulla Tribes (DMT); Fisheries - Manager
Richard Sumner - Mamalilikulla First Nation; Chief
Edna - Mamalilikulla First Nation;

4.1.2 Industry Participants

Daniel Rabu - Aboriginal Aquaculture Association; Aquaculture Business Technical Expert

4.1.3 Mitacs Cluster Internship Participants

Mark Roseland - SFU Faculty & Research Supervisor
4.2 Synopsis of the event

4.2.1 Welcome & Introductions

The group started the morning by welcoming the participants of the working group. An ice breaker activity was used during the introductions to help put the participants at ease. Using Google Maps/Google Earth, the activity is designed to give participants the opportunity to “zoom” in on a place that is important to the participant, allowing them to share the personal story to the rest of the group. Several members of the working group offered locations and stories of places they lived when they were children and/or traditional band territory.

4.2.2 Project Progress & Findings

The interns gave a presentation that discussed the steps their Phase One research took. During their discussion, they highlighted their major take-a-ways from their research to date, which included: a literature review, interviews, and site visits.

4.2.3 Dialogue on Research Themes

Three 30 minute dialogues were held to discuss and further discussion around each of the three research topics: Regulation & Planning, Food Security and Social Entrepreneurship & Economic Development. Several questions were explored through engaging dialogue throughout the day including: is it easier to get land-based aquaculture licenses from a regulatory point of view? If restrictions from DFO regulations could be removed, does interest lie in finfish or shellfish for LBA? How does the spectrum of consumption vs commodification resonate? Is food security a priority in your community? What might future collaboration look like for the Nanwakolas? What opportunities would an ideal or ‘viable’ business bring to your community?

The dialogue motivated by these questions helped to provide more insight and context to some of the challenges surrounding LBA on Northern Vancouver Island. There was
unease and indignation surrounding the fact that bureaucratic DFO processes and political agendas prevent the development of fisheries such as sea cucumber that are well suited to BC waters, economically favourable and hold cultural significance to First Nations. There was observed strong, common interest in taking steps to make pursuing shellfish aquaculture - either land-based or traditional - for food, social, and ceremonial purposes, as a hatchery to make more seed locally available and education programs to build capacity. There was also some interest in multi-phase business plan opportunities that may provide food now, and profitable returns further on in the future, however, there were still concerns about pursuing any venture that is not business-first. Finally, there was interest in nations working together to create strategic multi-stakeholder partnerships, as it almost impossible for the smaller nations to attempt any substantially sized project on their own. Discussions also surfaced around the significance of a First Nations owned and operated regional hatchery in BC that could help build local capacity (ie. skills and training), as well as promote knowledge sharing between Council nations.

4.2.3.1 Dialogue: Regulation & Planning
The dialogue on regulation and planning, with respect to LBA, included discussion on questions such as:

- Is it easier to get land based licenses from a regulatory point of view?
- If we had a magic wand to eliminate DFO regulations for land based shellfish, does interest in LBA lie in shellfish or finfish?

Dialogue Summary
Daniel Rabu helped to clarify DFO jurisdiction for the group. Anytime that someone feeds a fish that is held within a container, the process is open to regulation by DFO. There was unease and indignation from the group surrounding the fact that bureaucratic DFO processes and political agendas prevent the development of fisheries such as sea cucumber that are well suited to BC waters, economically favourable and hold cultural significance to First Nations. Daniel Rabu provided context and anecdotal stories of DFO licensing challenges around two species: sea cucumber and geoduck. Geoduck licenses are often denied by DFO not due to environmental concerns, but because the industry is an oligopoly, and therefore a limited number of companies hold significant
political influence. However, there are still some traditional geoduck beds that are owned by First Nations.

On the topic of shellfish LBA, there was discussion that the land based technologies for shellfish are too expensive. One of the main costs is producing plankton, the main food requirement for shellfish that is freely available in the ocean. There is also a deficit of human capital needed to start shellfish LBA facilities. A willing workforce with technical knowhow is required. One question that could be explored further in future discussions is: how does human capacity affect implementation and regulatory requirements?

There was a strong, common interest in taking steps to make pursuing shellfish aquaculture, either land based or traditional ocean based. Steps could include assertion of First Nation food, social and ceremonial rights to plant shellfish seed in traditional waters and food, social and ceremonial harvest of high value and culturally significant shellfish species such as geoduck and sea cucumber. As well, a hatchery could be established abiding by the DFO policy for no grow-out of bivalve species in land based operations and that, if DFO regulations shifted, as the industry thinks they might, member nations would be able to expand operations to full grow-out LBA. Additionally, Thomas Smith explained that Chief’s Pride oysters often struggle to find and buy available local oyster seed and are at times forced to buy seed from as far away as New Zealand. Education programs to train and build the human capacity needed to operate shellfish facilities (hatchery, traditional ocean or land based) are a common interest among the workshop participants so that First Nations are well positioned to take a share of the industry if and when DFO licenses for shellfish LBA are further developed.

Reflections
There is limited understanding of what the DFO regulations currently are surrounding shellfish aquaculture and especially land based aquaculture. A proof of concept facility may be important in developing understanding and interest from DFO to develop regulations to allow the grow-out of bivalve species. There was encouraging discussion about the power of a facility that could bring people together to provide education and
preparedness for First Nation members that are interested in gaining a stake in the shellfish LBA industry. However, technical advancements in energy requirements and capital cost may still limit the development of shellfish LBA facilities.

### 4.2.3.2 Dialogue: Food Security

In this section, participants and interns engaged in a discussion around the impacts that a food production technology might have on community food security. Discussion focused around the questions:

- How does this spectrum of consumption vs. commodification resonate?
- How might aquaponics come into play?
- Is Food security a priority in your communities?

**Dialogue Summary**

Throughout the discussion, we heard varying degrees of assertion that a project must be a business first. This set the tone for the discussion to follow, in that any kind of charity, community-consumption project might not stand on its own two feet. Integrating community food security was certainly not rejected, but discussion tended toward creative and multi-stage solutions. Comments were raised that often these projects are touted for all the community benefits, but then everyone just focuses on those benefits and not running the business itself. The comment was offered as support for the argument of making it primarily a business venture.

Regulation was repeated as a significant concern, building on the previous discussion. Dissatisfaction was expressed that the DFO can have so much influence as to inhibit the community from tackling food insecurity. The example one participant provided was that communities with beaches in their traditional territories are unable to seed the beaches and grow clams or mussels even if they were just for community consumption. Some interesting discussion emerged around the idea of a “food first, business later” strategy. The premise of this discussion was the notion that if community consumption of an aquaculture product is already occurring at a great enough scale, the DFO might be more easily persuaded to accommodate licensing the venture as a business. The strategy was a more radical discussion of possible strategies and not all participants
seemed interested as no suggestions were offered as to how such a project would get capital to start in the first place.

The participants were quite interested in the possibilities of aquaponics. This discussion was largely focused on the “You grow food” site visit, as this was our primary exposure to aquaponics. The participants greatly appreciated that the venture in hope was set up with the primary focus of addressing the issue of community food security in Hope. Furthermore, there was interest in the apparent simplicity of the system, although we may have inadequately communicated that simplicity - while the system wasn’t overburdened with technical complexity, there was a great amount of knowledge/managerial capacity. A participant mentioned a similar system in Northern Alberta (Thunderbird Lake) which could be a topic of further investigation. Furthermore, participants were interested in knowing whether the regulatory process is any different because of both the aquaponics product and the scale.

Reflections
The shared focus of most participants -that any venture had to be a viable business foremost was not unexpected, but did initially limit some of the creative potential of the dialogue. However, it emerged that the spectrum of consumption vs. commodification may not have adequately described the range of options available to the community. This spectrum reduces the issue to a dichotomy (You can’t sell your fish and eat it too), and wrongly suggests that the only path to food security is self-sufficiency. Hatching, growing, and selling fish in a way that you have greater control over brings greater control over community decision making. The idea of a regional hatchery (particularly share/cooperative options) would build capacity and allow the community to claim greater control of production first, and potentially consumption later. There was some suggestion that production could be used to empower communities to present alternatives to the stiff DFO regulations. The focus on food production and capacity building, as opposed to consumption suggests that a lens of food sovereignty might be applicable to this situation, in that a community defining a greater part of their food system can lead to sustainable development. Unfortunately, we were not able to focus directly on the questions of community taste and preference, and how particular
indigenous traditions should dictate food production choices. This could be a focus of further engagements in Phase II.

### 4.2.3.3 Dialogue: Social Entrepreneurship & Economic Development

The participants and interns engaged in a dialogue focusing around ideas of social entrepreneurship & economic development. The discussion focused around the following questions:

- ➢ What does your interest in a land-based aquaculture operation look like?
- ➢ What might future collaboration look like for the Nanwakolas?
- ➢ What would a viable business bring to your community (ie. employment, food, etc.)?

**Dialogue Summary**

Much of the initial dialogue revolved around improving the state of fish protein in Canada. Several participants commented on the importance of being prepared for the future of seafood by focusing on building an even stronger foundation now. In terms of RAS aquaculture, Thomas suggested that the future is finfish (unless operating on industrial scale, like Marine Harvest) because vertical integration and product diversification are imperative for making smaller scale operations economically viable. Otherwise, margins tend to be too low.

This discussion around vertical integration and diversification led into a dialogue regarding the potential of creating a strategic multi-stakeholder partnership among member nations for the purposes of developing a First Nations owned & operated regional hatchery in BC. As pointed out by Chris Roberts, strategic partnerships aid in knowledge sharing and building social license amongst stakeholders. A partnership among member nations would allow such a high capital investment projects like the implementation of a regional hatchery to be realized, as strategic partnerships split the associated costs of a project among stakeholders, thus minimizing risk for everyone involved. This idea was furthered by Chief Richard Sumner, as he explained that strategic partnerships are integral for the expansion of any smaller nation, as developing an extensive project would almost be impossible otherwise.
Additionally, great significance was placed on a First Nations owned & operated regional hatchery in BC. Workshop participants saw the hatchery as an opportunity for fostering cultural development, while also cultivating deeper connections of social & human capital amongst First Nations across Canada. With seed coming from the US and UK, there is certainly a strong interest in maximizing supply chain management on the BC coast. However, there are many questions that still need to be addressed, such as: 1) economies of scale - the operation needs to be large enough to be viable; 2) possible ownership structures - joint venture vs. cooperative; 3) management & business development - imperative to have the right people in place who understand how to operate & expand business; and 4) stakeholder obligations, code of conduct, & structure of agreement.

The final minutes of the dialogue turned to a discussion around the immediate challenges currently facing the Nanwakolas Tribal Council in terms of the land-based aquaculture. Emphasis was placed on two main factors: A) capacity building - in terms of skills & training among tribal members; and B) having the ability / knowledge to share with other band & council members. Both factors were understood to be important in building social license and the political willingness amongst council nations for any project moving forward.

Reflections
The idea that a business needs to be economically viable was pushed through the entire dialogue. Although this needs to be fundamentally true of any business, the dialogue focused on the traditional sense of economic development instead of being taken a little more outside of the box in terms of what ‘viability’ can possibly look like. Moreover, the theme of consumption vs commodification introduced in the second dialogue underpinned most of the discussion. It is evident that this topic will continue to surface as we move forward into Phase II and collectively begin imagining what a potential RAS enterprise could offer the community (beyond economic stimulus). Moving forward, greater attention needs to paid by the interns around the explanation of benefits that social innovation and the social economy can bring to a community. This was apparent during the latter half of the dialogue, particularly during the discussion
around what an ownership model might look like (ie: joint venture vs. cooperative). From anecdotes around the table, a cooperative business structure was previously employed by the Nanwakolas, however anecdotes suggest that by-laws and governance structures weren’t properly initiated/set up and the venture failed.

4.2.4 Dialogue on Project Future

The final stage of the working group was a dialogue around the question: “what should the next steps for the project and proposed tool development look like?” During the dialogue, the project interns discussed the creation of a decision support tool/toolbox with participant members, which would ideally help communities of the Nanwakolas who are interested in harnessing emerging Recirculating Aquaculture System (RAS) technology to fully consider their values when developing and implementing potential land-based aquaculture projects. Lastly, part of the dialogue revolved around the possible amalgamation of the Nanwakolas’ Community Well-Being Wheel with the Community Capital Framework developed by the Centre for Community Sustainable Development at SFU.

The team received positive feedback regarding the possible direction of the tool's development. From a report card to a type of analysis that could facilitate discussions with investors, the participants offered several suggestions that focused around some sort of values-measuring framework that would be employed to inform economic development projects focus them on community benefits. Despite several strong mentions of place and a willingness to see people, capacity and food return to their home communities, it should be noted that there was general agreement that for any project to be deemed a success, it must be treated as a business first and foremost. Additionally, further facilitation is needed before any final decisions can be made, as several participants expressed concern regarding the need to talk to their communities before committing to anything.
5 - Directions for Phase 2

5.1 Guiding Questions at the End of Phase 1
A disconnect we noticed throughout Phase 1 is that whenever we presented the project focus as land based aquaculture there was general interest; however, as discussion continued it tended towards traditional ocean-based aquaculture practices. We feel that there are probably several reasons for this disconnect, but the main ones might be that 1) member representatives are not specifically interested in LBA or 2) there is little understanding of LBA systems, how they work, or what they are capable of so conversation defaults to what people know. Based on the generally positive feedback of investigating LBA operations, we feel that there is an opportunity to provide more education on LBA. More widespread knowledge of how the systems work, who's running them, what they're capable of, and where the owner's see the industry going will be valuable in expanding the conversation around LBA. Additionally, we feel that this type of education has the most impact when it directly involves the owners operators and site visits to see, touch, and experience a LBA facility.

Over the course of the introductory meeting, member representative interviews and working group, we also noticed that discussion often shifted away from finfish and toward shellfish. Again, there are likely several reasons for this including cultural and moral opinions on farming finfish in high density operations, a greater knowledge of shellfish operations, more interest in shellfish operations, and hesitancy towards finish operations knowing that the Kuterra operation is facing some challenges. Based on these observations as well as lively discussion on the importance of shellfish for Food, Social, Ceremonial purposes, current business ventures of Nanwakolas member nations with intermittent challenges of accessing seed for several growers on Vancouver Island, we feel that concentrating on shellfish for the Phase 2 of the project is warranted. Additionally, there was support at the working groups to explore opportunities for First Nations joint LBA venture.
5.2 Phase 2 Scope & Outcome Proposal: Where do we go from here?

The question we propose to address in Phase 2 is: can a shellfish hatchery, based on a land-based RAS system serve the community development needs of the Nanwakolas member nations? We would approach this problem with a community education strategy and the development of a Community Site Assessment Tool as two principal outcomes.

We envision an education strategy that coordinates expert panel engagements and site visits with a group assembled by the Nanwakolas Council in a one or two-day event. We would invite the expert connections developed through Phase 1, which might include Steven Summerfelt (Freshwater Institute), Steve Atkinson (Little Cedar Falls), Stephanie (You Grow Food), Richard Hardy (K‘omoks) and others. The interns benefited from experiential site visits and recommend Vancouver Island University and Little Cedar Falls for the quality of the sites as well as their proximity to Campbell River. If it is agreed that there should be emphasis on a hatchery operation, including local shellfish hatchery operations such as Hollie Wood Oysters will be advantageous. We envision that the participants might be representatives from Nanwakolas member nations that are well positioned to pass knowledge on to other band members and may include a youth contingent and existing capacity-building programs (such as the Guardian Watchmen). Completing this education event as a conclusion to Phase 2 would directly address three findings of Phase I: a lack of understanding regarding LBA, a strong desire to strengthen community capacity, and a need for broader community buy-in.

In addition to an education strategy, we propose to carry out development of the Community Site Assessment Tool and test its applicability on a hatchery partnership venture. The analysis would identify the initial technical demands/limits of a shellfish hatchery and whether RAS technology can be used, challenges with implementation, how the project fits within the community well-being framework and a business plan that might have a phased approach that could include community food immediately, viable business seed sales in the near future and grow out operations for the long term. We feel that this tool could satisfy the desire expressed during the working group dialogue.
for broad community approval by serving as a dialogue-support tool. Our focus on a shellfish hatchery would serve as a trial run of the Community Site Assessment Tool to determine the strengths and weaknesses of the tool. Refinements to the tool would be made to leave the Nanwakolas with something that might be more broadly applicable to various aquaculture business ventures in the future.
Appendix F

Community Well-Being Framework
The Community Well-Being Scan:
Applying Nanwakolas Culture & Values to Sustainable Community Development

A Nanwakolas & SFU Research Partnership

Mitacs Accelerate
Community Well-Being Priority Areas

Assets

Assets refers to the physical or built resources found within the community. Built environment represents the built assets of the Nation. A high score means that community members have access to the required housing. Infrastructure represents the utilities needed to satisfy basic needs and achieve productivity. Land use represents the available land within a community available for development. A high score means the Nation has the land needed to expand and grow as a nation. Transportation represents the access community members have. A high score means the community has access to adequate transportation. Focusing investment, both financial and non-financial, can improve community assets such as public facilities (e.g., access to Band facilities); water and sanitation; efficient transportation; safe, quality housing; adequate infrastructure, and telecommunications.

Table 1.1. Community Wellbeing Priority Area – Assets

<table>
<thead>
<tr>
<th>Stock</th>
<th>Indicator</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Built Environment</td>
<td>Affordable Housing</td>
<td>• Percentage of affordable housing units built. • Affordable housing increases the stock of housing that low-income residents can access.</td>
</tr>
<tr>
<td></td>
<td>Band Facility Access</td>
<td>• Membership has access to Band facilities, including: Office, Recreation Hall, Health Centre, and other band-own infrastructure.</td>
</tr>
<tr>
<td></td>
<td>Building Stock Adequacy</td>
<td>• Proportion of occupied private dwellings whose life safety is deemed suitable or safe to live in.</td>
</tr>
<tr>
<td></td>
<td>Core Housing Need</td>
<td>• Proportion of neighbourhood population in core housing need. There should be adequate, suitable, and affordable housing available in a community.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Households are in core housing need if they live in housing that is inadequate, unsuitable, or unaffordable, and cannot access a suitable, adequate alternative in the local market without spending 30% or more of their before-tax household income.</td>
</tr>
<tr>
<td>Stock</td>
<td>Indicator</td>
<td>Description</td>
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</tr>
</tbody>
</table>
|       | Supportive Housing              | • The existence of designated supportive housing for citizens in need of care. Supportive housing provides a valuable resource to those in need of extra care and assistance on a regular basis.  
  • This indicator helps assess if the Nation’s housing stock is adaptable to support the current and future needs of the community. |
|       | Potable Water                   | • Proportion of occupied private dwellings with (at least 50 lpcd) potable water.  
  • Infrastructure should enable city-dwellers to meet their basic needs and that support their daily activities, including running water. |
|       | Reliable Communication          | • Proportion of occupied private dwellings that have access to reliable communications networks.  
  • Infrastructure should enable city-dwellers to meet their basic needs and that support their daily activities, including reliable communications networks. This also includes reliable internet access. |
|       | Sanitation                      | • Proportion of occupied private dwellings with reliable access to safe sanitation.  
  • Infrastructure should enable city-dwellers to meet their basic needs and that support their daily activities, including running water and safe sanitation practices. |
<p>|       | Recycling Services              | • Availability and participation in recycling services programs |
|       | Remote Territory Access         | • Band infrastructure that increases access to remote villages and traditional harvest areas (docks, lodging). |
| Land Use | Industrial Commercial Land     | • Amount of industrial/commercial land available (ha). The area of land available for industrial and commercial development provides an indication how well the community can meet its future industrial and commercial development needs |
|       | Residential Land                | • Number of residential lots available within the community. The area of land available for residential |</p>
<table>
<thead>
<tr>
<th>Stock</th>
<th>Indicator</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Traditional Land Use</td>
<td>• Amount of traditional land available (ha). The area of land available for traditional land use provides an indication how well the community can meet its traditional foods and resources and cultural needs.</td>
</tr>
</tbody>
</table>
| Transportation        | Access to Transit                | • Access to public transit is measured by Walk Score, a publicly available, third party public transportation index that assigns a numerical score to any address in the United States, Canada, and Australia. Transit Score provides a 0-100 rating indicating how well an address is served by public transportation.  
• Ratings range from "Rider’s Paradises" where multiple transit options are available within a 5-minute walk (400m) to areas with limited or no nearby public transportation. Good public transportation is mandatory for sustainable urban developments. |
|                       | Band Transportation              | • Specialized transportation (ie: vans, busses, boats) that is band-owned and operated, which are used specifically for transporting membership that lack the access or ability to transport themselves for their daily needs (such as helping elders get to and from their doctor appointments and grocery shopping). |
|                       | Pedestrian Infrastructure        | • Percentage of paved roads with infrastructure for pedestrian traffic, on one or either side of the road. Sidewalks & bike lanes are a large component of pedestrian oriented transportation.  
• Having a measurement of the amount of pedestrian infrastructure in the community provides an indication of how safe it is to walk/bike and how likely residents will use these methods as a means of transportation. |

**Community**

Community constitutes the “glue” that holds the Nation together. It has both an informal aspect related to social networks and a more formal aspect related to institutions and social
development programs. Furthermore, it characterizes many of the tangible and intangible aspects of that comprise a healthy and interconnected community: community cohesion, connectedness, reciprocity, fellowship, participation, discipline and ethics, and commonly shared rules, laws, and information. Citizenship represents the amount of democratic participation found within the Nation. A high score means that the community is actively engaged in democratic action. Cohesion represents community togetherness. A high score means that community members are connected with each other. Communication represents message transmission and information sharing across the Nation from band leadership. A high score means that there is continuity of message and information is being disseminated without issue. Community readiness represents the human component of the Nation’s ability to move forward on band-led development projects. A high score means the band has the human resources in place to actively pursue development projects. Governance represents the responsiveness of the current band leadership. A high score means leadership is transparent in their decision making and open to community input. Safety represents the Nation’s security and wellbeing. A high score means community members are safe on a day to day basis.

Table 1.2. Community Wellbeing Priority Area – Community

<table>
<thead>
<tr>
<th>Stock</th>
<th>Indicator</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Citizenship</td>
<td>Elder Involvement</td>
<td>• Utilizing Elder knowledge and skills in community activities and program development (ie: mentorship programs)</td>
</tr>
<tr>
<td></td>
<td>Membership Participation</td>
<td>• Percentage of members attending AGMs, Band meetings, committees &amp; working groups. This indicator measures whether citizens are willing to participate in community decision-making and process building.</td>
</tr>
<tr>
<td></td>
<td>Participatory Democracy</td>
<td>• Percentage of members voting in Band elections. Voter turnout in municipal elections is an indicator of citizen participation in the political aspects of society.</td>
</tr>
<tr>
<td></td>
<td>Youth Participation</td>
<td>• Percentage of youth members involved in band activates.</td>
</tr>
<tr>
<td>Cohesion</td>
<td>Inter-Family Relationships</td>
<td>• Mechanisms are in place that help cultivate positive relationship building, unity, and togetherness between families in the Nation.</td>
</tr>
<tr>
<td>Stock</td>
<td>Indicator</td>
<td>Description</td>
</tr>
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<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td></td>
<td>Off-Reserve Barriers</td>
<td>• Mechanisms are in place that work to overcome barriers to inclusion and access to services that on-reserve members have available to them.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Bands are only funded to serve the ‘on-reserve’ population and have limited resources to meet the ‘off-reserve’ memberships’ needs.</td>
</tr>
<tr>
<td></td>
<td>Community Cohesion</td>
<td>• Percentage of membership who participate in social activities. Activities can range from volunteering to bringing people together for community gatherings or to work on something that is mutually beneficial to the community.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Community cohesion affects social capital on the neighbourhood scale. An individual's involvement in their community, through volunteering, helps build perceptions of safety and trust in strangers and membership alike.</td>
</tr>
<tr>
<td></td>
<td>Social Programs</td>
<td>• Mechanisms are in place that support youth, elders, and ‘vulnerable’ members of the band.</td>
</tr>
<tr>
<td></td>
<td>Continuity</td>
<td>• Mechanisms are in place that ensure continuity &amp; consistency of messages disseminated from leadership (via communication plan)</td>
</tr>
<tr>
<td>Communication</td>
<td>Cross-Department</td>
<td>• Mechanisms are in place that allow for active cross pollination between silos (departments/bands/nations) through band member engagement, community member dialogue, and information sharing.</td>
</tr>
<tr>
<td></td>
<td>Engagement</td>
<td>• Mechanisms are in place that allow leadership to actively engage with band membership (via communication plan).</td>
</tr>
<tr>
<td></td>
<td>Off-Reserve</td>
<td>• Mechanisms are in place that ensure active communication with off-reserve membership (via communication plan).</td>
</tr>
<tr>
<td>Community Readiness</td>
<td>Capacity</td>
<td>• Mechanisms are in place that help determine whether the Nation has the capacity (i.e., the necessary people &amp; human resources) available to successfully develop and implement community projects.</td>
</tr>
<tr>
<td>Stock</td>
<td>Indicator</td>
<td>Description</td>
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</tr>
<tr>
<td>Mobilization</td>
<td>• Mechanisms are in place that aid band leadership in the analysis of potential risks facing the community (financial, environmental, and/or social; includes timing implications and urgencies).  &lt;br&gt;• Indicator can be used to address emergency preparedness, as well as from the perspective of mobilizing for direct action, protests and demonstrations.</td>
<td></td>
</tr>
<tr>
<td>Social Impact</td>
<td>• Mechanisms are in place to analyze impacts of community projects.</td>
<td></td>
</tr>
<tr>
<td>Utilization</td>
<td>• Mechanisms are in place that aid band leadership in accessing which opportunities (i.e., development or community projects) should be focused on. Successful projects should ideally focus on the Nation’s priority areas and look to capitalize upon the existing skills, education, and training of the band membership, instead of relying too heavily on external expertise.</td>
<td></td>
</tr>
<tr>
<td>Governance</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Community Dialogue</td>
<td>• Mechanisms are in place that allow for two-way communication between the band leadership and membership. Leadership is open to listening and receiving community input &amp; feedback from band membership</td>
<td></td>
</tr>
<tr>
<td>Confidence</td>
<td>• Band membership is confident in the abilities of the governing body.  &lt;br&gt;• Confidence in political institutions is crucial for the stability of societies and for the functioning of democracy. Confidence also shapes people’s willingness to cooperate in achieving collective goals and financing public goods.</td>
<td></td>
</tr>
<tr>
<td>Responsiveness</td>
<td>• Band leadership and administrative staff respond quickly to any recommendations, suggestions, or criticisms put forth by the band membership.</td>
<td></td>
</tr>
<tr>
<td>Transparency</td>
<td>• Band leadership is transparent in terms of policies created and actions taken by the Band to their membership.</td>
<td></td>
</tr>
</tbody>
</table>
### Stock | Indicator | Description
--- | --- | ---
Safety | Break & Enter | • Break & enter occurrences; 2016. Aggregate business and residential. Neighbourhood crime should be low. Crime against property can have a major impact on the well-being of victims and on the wider community. Breakdown in social capital can thus be measured directly by assessing levels of crime.

| Crime Rate | • Serious crime rate (offences per 1,000 population); includes violent and property crime. Crime rate considers the risk of citizen’s face to becoming victim to a crime. A high crime rate indicates that citizens are more susceptible to becoming a victim, leading to mistrust and loss of social capital.

| Perceived Safety | • The percentage of residents who feel unsafe in their neighborhoods. Perceived safety tells a different story than crime rates, showing how residents feel about safety in their communities.

| Suspicious Activity | • Number of houses (known/suspected) of criminal behaviour in the community.

| Traffic Incidents | • Motor vehicle crashes resulting in an injury or fatality. Streets should be safe to drive, and safe for pedestrians and cyclists.

### Culture

Culture is the product of shared experience through traditions, customs, values, heritage, identity, and history. This priority area focuses on the traditions and values, heritage and place, social history, and worldview of the Nation. Similar to Community, Culture also is made up of both tangible and intangible aspects: singing, dancing, stories, food, rituals, spirituality, ceremonies, celebrations, heritage buildings, and art. Culture defines Indigenous communities, influences decision-making, and shapes how people communicate with one another. Moreover, it is extremely important to Indigenous communities, as culture is shared intergenerationally and underpins Indigenous knowledge, which is used to guide community wellbeing. Heritage & Identity represent the cultural expression and history of the Nation. A high score means that the community is strongly linked to their past are able to practice their traditional beliefs and
worldviews. Intergenerational transfer represents how cultural knowledge is passed down from one generation to the next. A high score means that cultural traditions are being preserved and shared. Language and Protocol is similar to Intergenerational transfer, however, instead of passing down customs and traditions, traditional languages and cultural protocols are passed down. Territory connection represents the connection the Nation has with their ancestral lands. A high score mean that the community has access and protect their traditional territories.

Table 1.3. Community Wellbeing Priority Area – Culture

<table>
<thead>
<tr>
<th>Stock</th>
<th>Indicator</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heritage &amp; Identity</td>
<td>Art &amp; Literature</td>
<td>• The number of publications and art pieces celebrating First Nations culture made by members of the community</td>
</tr>
<tr>
<td></td>
<td>Cultural Heritage</td>
<td>• The number of cultural celebrations &amp; regular events (ie. feasts &amp; Potlatches) annually held within the Nation. This indicator assesses the strength of the Nation’s cultural heritage.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• This measurement provides an indication of whether a community embraces and preserves its cultural heritage, while encouraging it to be enhanced. It can be presumed that a community with little to no events has likely little connection with its heritage.</td>
</tr>
<tr>
<td></td>
<td>Cultural Organizations</td>
<td>• The number of First Nation arts and culture organizations found within the Nation. These organizations serve as an indicator for the level of interest in and support of the arts and local culture that exist among the population.</td>
</tr>
<tr>
<td></td>
<td>Public Program Participation</td>
<td>• Participation rate in parks, recreation &amp; cultural programming. Measured in percentage of the population.</td>
</tr>
<tr>
<td></td>
<td>Familial Connections</td>
<td>• Mechanisms are in place that offer membership an opportunity to strengthen family relationships within the community</td>
</tr>
<tr>
<td></td>
<td>Preservation</td>
<td>• Mechanisms are in place that preserve cultural knowledge for future generations (ie: interviews and other culturally significant recordings, historical spatial components, traditional use databases)</td>
</tr>
<tr>
<td>Stock</td>
<td>Indicator</td>
<td>Description</td>
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</tr>
<tr>
<td></td>
<td>Traditional Knowledge</td>
<td>• Mechanisms are in place that offer cultural/traditional knowledge transfer opportunities.</td>
</tr>
<tr>
<td>Language &amp; Protocol</td>
<td>Language Speakers</td>
<td>• Number of community members able to speak traditional language(s)</td>
</tr>
<tr>
<td></td>
<td>Protocols</td>
<td>• Mechanisms are in place that support traditional protocols.</td>
</tr>
<tr>
<td></td>
<td>Language Programs</td>
<td>• Programs are available to band members that provide &quot;practical&quot; opportunities learning and practice traditional language.</td>
</tr>
<tr>
<td>Territory Connection</td>
<td>Cultural Protection</td>
<td>• The percentage of historic or culturally significant locations found within the Nation’s territory that are registered and protected by National, provincial, or local historic preservation programs.</td>
</tr>
<tr>
<td></td>
<td>Cultural &amp; Heritage Sites</td>
<td>• Number of recorded and designated heritage / cultural sites identified in local First Nation’s territory</td>
</tr>
<tr>
<td></td>
<td>Teachings &amp; Values</td>
<td>• Programs that teach band members the link between cultural values and resource stewardship are in place. Proof of the incorporation of these teachings can be found in land and resource policies, as well as the general practices of the Nation.</td>
</tr>
<tr>
<td></td>
<td>Territorial Knowledge</td>
<td>• Modern knowledge systems of territories have been built, maintained, expanded (ex: cultural cedar inventory project)</td>
</tr>
<tr>
<td></td>
<td>Territorial Visitation</td>
<td>• Mechanisms are in place that offer opportunities for band membership to spend time in traditional territories.</td>
</tr>
</tbody>
</table>

**Economic Prosperity**

Economic Prosperity refers to the ways in which the Nation allocates resources and makes decisions about their material lives. Business resources, such as locally owned and operated companies, are the suppliers and consumers within a community that generate employment and income. They transform community resources into products and services that encourage the
circulation of money within the community. Business Development represents the Nation’s readiness and capacity to develop and advance community-run businesses. Scoring high means that the Nation has the foundation needed to plan, develop, and support Indigenous business ideas. Economic Structure represents how the Nation’s businesses are organized. A high score means that there are a high number of Nation-owned businesses, which are diversely spread out over multiple industries. Financial Resources represents the funds and assets coming into the Nation from secondary or passive sources of income. Labour represents the Nation’s workforce and the amount of income coming into the band. A high score means that the community members are employed and earning a proper salary.

Table 1.4. Community Wellbeing Priority Area – Economic Prosperity

<table>
<thead>
<tr>
<th>Stock</th>
<th>Indicator</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Business</td>
<td>Development</td>
<td>Acceleration • Business enterprises owned by band members are supported by Nation through mentorship, investment, and other support services.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Business accelerators typically work with start-ups that have moved beyond the earliest stages of establishment, to help them expand and scale up.</td>
</tr>
<tr>
<td></td>
<td>Incubation</td>
<td>• Entrepreneurial support programs are available to work with band membership interested in developing new business ideas.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Business incubators work with entrepreneurs to help shape and develop their ideas into a viable business plan. Incubators typically offer services such as: shared work space, mentorship, network cultivation, and business development workshops.</td>
</tr>
<tr>
<td></td>
<td>Financial</td>
<td>Readiness • Capital financing is available for investment in enterprises and projects that owned by band members.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Financial readiness does not require excessive reliance on inequitable external investment. Inequitable external investment is defined as: funding that originates outside the band, which is asking for unfair returns on investment (ROI).</td>
</tr>
<tr>
<td>Stock</td>
<td>Indicator</td>
<td>Description</td>
</tr>
<tr>
<td>---------------</td>
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</tr>
<tr>
<td>Economic Structure</td>
<td>Diversification</td>
<td>• An index that reflects the extent to which the loss in legacy sector employment and has been replaced by job growth of new sectors, including higher education, heavy construction and engineering, film, and legal services.</td>
</tr>
<tr>
<td></td>
<td>Nation Owned Businesses</td>
<td>• Change in the number of Nation-owned businesses over the last full fiscal year. Businesses operating in the community should both be profitable and contribute back into the local economy, minimizing economic leakage.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Economic leakage occurs when money is diverted from circulating within the one economy into another. Using the annual change in the number of local businesses operating in the community provides indication of whether the local economy is strong enough to support new local business development.</td>
</tr>
<tr>
<td></td>
<td>Sustainable Resource Industries</td>
<td>• Sustainable resource-based jobs (in sustainable agriculture, natural resource conservation, or coastal restoration).</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• The amount of jobs in sectors which exploit natural resources in a sustainable way is an indicator of the region's sustainable use of natural capital.</td>
</tr>
<tr>
<td>Financial Resources</td>
<td>External Band Funding</td>
<td>• Total annual amount of external funding from Province &amp; Federal sources for band operations. (i.e.: INAC grants &amp; funding)</td>
</tr>
<tr>
<td></td>
<td>Independent Band Revenue</td>
<td>• The average change in band revenue over the last full fiscal year. Band revenue provides the community with the means to improve infrastructure, provide social services, and fulfill operational duties. A budget deficit leaves a community with little opportunity to improve local conditions. A considerable increase in revenue provides resources to pursue projects and initiatives to further progress towards achieving community goals.</td>
</tr>
<tr>
<td></td>
<td>Tourism</td>
<td>• Change in the number of tourists visiting band territories annually. This indicates the health of the local tourism industry. An increase in tourism offers opportunities to diversify and strengthen the economic capital of the community.</td>
</tr>
</tbody>
</table>
### Health & Wellbeing

Health & Wellbeing refers to the attributes embodied in individuals that facilitate the creation of personal, social and economic well-being”. This priority area needs continual maintenance by investments throughout one's lifetime and becomes eroded through the inability of a person to meet basic needs, such as access to food, clothing shelter, and education. It is broken into three stocks, each examining a different aspect of community health and wellbeing. Education reflects the community’s varying levels of education and training. This stock contributes directly to the labour productivity of a community and is sometimes described as the “livelihood asset”,

<table>
<thead>
<tr>
<th>Stock</th>
<th>Indicator</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Labour</td>
<td>Average Wage</td>
<td>The average yearly income of band members. Average wages demonstrate the basic standard of living afforded by workers in the region. Ideally, wages should be above the national average wage; As of Sept. 2016, the average wage for Canadian employees was under $50,000 ($952 a week).</td>
</tr>
<tr>
<td>Labour Force</td>
<td>Labour Force</td>
<td>The proportion of band members working for the Band – this includes both administration and Band-owned enterprises. Labour force values provide an indication of how many people in the community are contributing to goods and service production.</td>
</tr>
<tr>
<td>Unemployment Rate</td>
<td>Unemployment Rate</td>
<td>The rate of unemployment for the band. The unemployment rate indicator shows the number of unemployed persons expressed as a percentage of the labour force. Unemployment is a difficult experience for many Canadians. In addition to the loss of work and income, unemployment can bring varying hardships for individuals and their families.</td>
</tr>
<tr>
<td>Wage Growth</td>
<td>Wage Growth</td>
<td>The annual growth in wage averages of employees over the last full fiscal year. Growth in wages is a sign of a functioning economy and indicates that workers are protected from inflation and increased cost of living.</td>
</tr>
<tr>
<td>Working Hours</td>
<td>Working Hours</td>
<td>The average number of hours worked per employee per week. In order to have a balanced quality of life and high-quality working conditions, employees should not exceed a reasonable number of weekly working hours (40hr/wk)</td>
</tr>
</tbody>
</table>
representing a person’s ability to pursue and achieve individual livelihood objectives. Healing and Prevention looks at the Band’s mental health programming. Physical wellbeing examines the physical health of the nation.

Table 1.5. Community Wellbeing Priority Area – Health & Wellbeing

<table>
<thead>
<tr>
<th>Stock</th>
<th>Indicator</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dropout Rate</td>
<td>Education</td>
<td>• The high school dropout rate. Dropping out of high school indicates the tendency for students to find no self-empowerment in education and the inability of educators to engage every student to flourish.</td>
</tr>
<tr>
<td>Early Childhood Education</td>
<td></td>
<td>• Percentage of children enrolled in early childhood education programs.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• This indicator helps to understand how well educational programs are serving young children in the Nation. Early Childhood Education Programs are an important first step in education and important part of the learning process. Programs such as the Aboriginal Headstart Early Childhood Education Program, are based within the community and incorporate the language and culture of the local First Nations in the curriculum.</td>
</tr>
<tr>
<td>High School Completion</td>
<td></td>
<td>• Proportion of band members who have completed high school. High-school completion is the prerequisite steppingstone to post-secondary education, now deemed essential to success in the labour market. High-school completion contributes to an individual’s self-worth and is thus a measurement of human capital.</td>
</tr>
<tr>
<td>Literacy Rate</td>
<td></td>
<td>• Literacy rate of adult band membership over the age of 15. Illiteracy is a major problem affecting residents for whom the public education system has not provided an adequate instruction in literacy and language.</td>
</tr>
<tr>
<td>Stock</td>
<td>Indicator</td>
<td>Description</td>
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<tr>
<td></td>
<td></td>
<td>opportunities that can improve one's standard of living, while helping to develop employable skills.</td>
</tr>
<tr>
<td></td>
<td>Agency Partnerships</td>
<td>• Strong Partnerships with regional health and social agencies have been cultivated.</td>
</tr>
<tr>
<td></td>
<td>Cultural Connectedness</td>
<td>• Mechanisms are in place that celebrate and edify the cultural roots (who we are) of the members. Cultural connectedness helps find healing through individual identity (wellbeing) and pride in place-based cultural connections. This indicator assesses the strength of the Nation’s cultural heritage. This measurement provides an indication of whether a community embraces and preserves its cultural heritage, while encouraging it to be enhanced. It can be presumed that a community with little to no events has likely little connection with its heritage.</td>
</tr>
<tr>
<td></td>
<td>Mental Wellness Programs</td>
<td>• Healing and prevention programs are available to deal with mental wellness, cultural healing, and lateral kindness.</td>
</tr>
<tr>
<td></td>
<td>Food Literacy Programs</td>
<td>• Programs are available that educate and support membership (on- &amp; off-reserve) to make more educated and informed decisions surrounding food (traditional &amp; Western). Food literacy is defined as having the knowledge, skills, and attitudes necessary to choose, grow, prepare and enjoy food to support one's health, community, and the environment. Food literacy programs work to give a better understanding of the importance of traditional foods, the long-term health effects caused by an unhealthy diet, and the promotion of healthy eating.</td>
</tr>
<tr>
<td></td>
<td>Life Satisfaction</td>
<td>• Percentage of people in the band who state they are satisfied or very satisfied with their life</td>
</tr>
<tr>
<td></td>
<td>Traditional Healing Practices</td>
<td>• Knowledge and use of traditional plants and medicines in healing practices.</td>
</tr>
<tr>
<td></td>
<td>Active Transportation</td>
<td>• The participation rate of residents in active transportation provides a measurement of physical activity. Physical activity is an important measurement of the requirement of being a healthy community. Participation in active transportation is influenced by physical capital to make it safe and accessible for residents.</td>
</tr>
</tbody>
</table>
### Stock Indicator Description

<table>
<thead>
<tr>
<th>Food Bank Use Rates</th>
<th>• Percentage of membership using the food bank. High food bank use rates indicate that band membership is increasingly having a difficult time obtaining food to meet their basic needs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Food Security</td>
<td>• The percentage of community who are food secure. Food security is defined as a condition in which all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life.</td>
</tr>
<tr>
<td>Healthcare Access</td>
<td>• Proportion of the membership w/ a regular medical doctor.</td>
</tr>
<tr>
<td>Obesity</td>
<td>• The percentage of population with obesity</td>
</tr>
<tr>
<td>Traditional Food Access</td>
<td>• Percentage of membership (on- &amp; off-reserve) with access to traditional foods.</td>
</tr>
</tbody>
</table>

### Resource Stewardship

Resource Stewardship refers to the conservation of any stock of natural assets that yields a flow of valuable goods and services into the future. This includes the conservation of non-renewable resources such as fossil fuels and minerals, renewable resources that can provide goods and services in perpetuity if managed sustainably, and the capacity of natural systems to continue providing critical goods and services while absorbing our pollutants and emissions. This priority area takes into account many of the different aspects of stewardship to guarantee that resources will be secured for future generations. Biodiversity and Landscape gauge the natural environment within the Nation’s traditional territory. Governance refers to the management of resource regimes. A high score reflects that management decision are shared and collaborative. Monitoring and Protection represent the Nation’s ability to monitor and react to resource issues. A high score means the community has the capacity and competencies needed to monitor and protect local resources. Resource health reflects the health/deterioration of local resources. A high score means resources are healthy.
### Table 1.6. Community Wellbeing Priority Area – Resource Stewardship

<table>
<thead>
<tr>
<th>Stock</th>
<th>Indicator</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biodiversity &amp; Landscape</td>
<td>Coastal Restoration</td>
<td>• Area (ha.) of coastal wetlands that have been restored to date</td>
</tr>
<tr>
<td></td>
<td>Community Growing Spaces</td>
<td>• The total number of urban growing sites found within the community; includes community gardens, urban farms, school gardens, and other kinds of growing patches.</td>
</tr>
<tr>
<td></td>
<td>Habitat Preservation</td>
<td>• Percentage of developed area which has been preserved, and/or restored, and/or enhanced, and/or created</td>
</tr>
<tr>
<td></td>
<td>Native Plant Preservation</td>
<td>• Percentage of native plants preserved and/or used in landscaping</td>
</tr>
<tr>
<td></td>
<td>Site Contamination</td>
<td>• Number of contaminated sites in territory, as per the BC contaminated sites registry.</td>
</tr>
</tbody>
</table>
| | Water Potability | • Water potability is the measurement of physical, chemical, and biological contaminants in the water source that could potential cause harm if consumed.  
  • Possible sources of contamination include urban runoff, industrial pollution, agricultural runoff, and human and animal waste |
| | Wetland Loss | • The percentage of coastal wetland area (ha.) lost over the past year |
| Governance | Information Flows | • Chief, Councillors and senior administrative staff have access to all available information to make high-level resource decisions.  
  • Strong internal flows of information strengthen capacity and allow for accurate and informed decision-making by band leaders. |
<p>| | Integrated Management | • Resource management is integrated into governance decisions. |
| | Self Determination | • Self-determination is practiced through shared decision making, co-management, and ecosystem-based management agreements |</p>
<table>
<thead>
<tr>
<th>Stock</th>
<th>Indicator</th>
<th>Description</th>
</tr>
</thead>
</table>
|            | Co-management                      | • Working collaboratively with other regional Nations to develop resource management agreements that articulate how land and resources should be managed to ensure resilience of local ecosystems.  
• Partnerships between Nations are strengthened through shared agency and decision-making on both governmental and Nation level. |
|            | Capacity                           | • Nation has the necessary equipment and infrastructure (boats, vehicles, safety gear, recording instruments, etc.) needed to monitor, protect, and remediate their lands and resources. |
|            | Competency                         | • Membership have the competencies (skills, certifications, etc.) needed to monitor, protect, and remediate their lands and resources. (e.g., Guardian Watchmen program) |
|            | Structure                          | • Band administration is structured to manage and expedite monitoring, protection, and remediation work (i.e.: program manager, reporting structures, insurances, payroll, etc.) |
|            | Intergenerational                  | • Resources, such as traditional food sources have been secured for future generations                                                                                                                                 |
|            | Remediation Planning               | • Mechanisms for remediation planning have been developed and are currently active                                                                                                                                 |
|            | Species Protection                 | • Mechanisms for species protection have been developed and are currently active                                                                                                                                 |
|            | Sustainable Resource Use           | • Mechanisms for sustainable resource use have been developed and are currently active                                                                                                                                 |
|            | Traditional Foods                  | • Traditional food sources are available the Nation’s territory to be harvested, hunted, and/or fished.                                                                                                                                 |
Appendix G

Community Capital Scan Toolkit Tutorial
Step 1 – Web address

Go to Community Capital Toolkit Website - https://cct.susdev.sfu.ca/. First, sign up then talk to the site administrator to give you access to the site. In this case, please speak to Chris Roberts and he will set up your account.

Step 2 – Sign in

Once your account is set up, sign in to the website with the email you and password you signed up with.

Step 3 – Creating a new project

Either click on “Create Project” or choose one that has already been established.
If choosing to create a new project, input the name of the project and remember to choose your organization. Doing so will help keep your project organized on the website. When you are ready to begin, click “Create Balance Sheet”.

**Step 4**

When starting a new project, you’ll notice the ‘Capitals’ on the left side of the window. Each capital can be individually clicked on, which will allow you to view and add to their corresponding stocks and indicators. Don’t forget to add the description of the scan/project on the right side of the window.
Step 5

Once you choose a capital, you’ll be brought to the next page where you’ll be able to start adding the different parameters to the community capital. When starting a project, you’ll notice that the capital is empty except for the two stocks that can be seen in the circle graph. To the right of the circle graph, you’ll see the list of stocks (parameters) that are currently being used. The ‘Add Stock’ button at the bottom of the ‘Stock’ is where you have to go to start adding your own stocks and indicators that your community is interested in measuring.

Step 6 - Adding a stock

Upon clicking the ‘Add Stock’ button, you will be given two options: 1) select a stock template and 2) create a new stock template.
If you choose “Select stock template”, a drop-down menu will appear with any stocks that are currently stored in the database. As you see here, ‘Language & Protocol’ and ‘Territory Connection’ are two stocks that can be added.

If you choose “Create new stock template”, the new stock template window will pop up. Within the window you can add whatever stock you’d like to begin measuring. Once you name and define your stock, click on the “Create stock template” button.

Once you have created your stock, go back to the original “stock” menu and choose “Select stock template”. Your stock will be added to the drop-down menu.
Once your pick selected your stock, you’ll notice that it will be added to both the list of stocks and circle graph.

**Step 7 – Adding an Indicator**

Once the stock has been added, clicking on its name (on the right-hand list) will take you to the ‘Indicator’ screen for that stock. It is here where you can add any needed indicator. Adding an Indicator is done in a similar way as adding a stock. Click on “Create new indicator template” to start the process.
This is the layout for the ‘New Indicator Template’ screen. There are multiple aspects to building out an indicator. While most of these elements are self-explanatory, the Indicator Unit and Range are a little trickier.

**New indicator template**

- **Indicator Path** – Highlights where the indicator can be found.

- **Indicator Name**.

- **Indicator Description**.

- **Indicator Unit** – What the indicator will be measuring.

- **Indicator Range** – Range of indicator measurement.

- **Indicator Data Source** – Source of the information regarding the indicator. Also, where you found the information.

- **Indicator Notes** – Any useful information regarding the indicator.
When picking out your indicator unit, choose the one that makes the most sense. For example, where one indicator might be ‘Native Plant Preservation’, which would examine the percentage of native plants preserved and/or used in landscaping; another might be ‘Coastal Restoration’, which would use the hectare (ha.) unit to examine the area of coastal wetlands that have been restored to date. Ultimately, you have to pick the best unit for the job.
Next is range. Range is used to set the parameters of the unit being measured. To set up the range, you must have a maximum and a minimum, with a set of gradients in between. In the example below, the range is set between 0 and 100, with gradients of 50, 65 and 80. In this example, if this indicator is scored by the user as 58, it will fall within the range of amber. If this indicator is scored by the user as 85, however, it will fall within the range of green (most optimal).

To save the indicator once you are finished building it, click “Create Indicator Template” at the bottom of the window. Once clicked, you will be taken to the “Tutorial Stock Template” screen, where you can add multiple indicators to the stock. Clicking the “Create Indicator” button will bring you back to the “New Indicator Template” screen, for you to repeat the process.
Now that you have created all the needed Indicators, it’s time to add them to the stock. You’ll notice that the “Create new indicator template” has changed to “Add Indicator”, now that you’ve some indicators to the stock’s database.

Upon clicking “Add Indicator”, a choice of two options will appear: 1) “Select Indicator Template”, and b) “Create New Indicator”. Choosing “Select Indicator Template” will open up a dropdown menu; choosing “Create new indicator template” will take you back to the “Tutorial Stock Template” screen. The dropdown menu will allow you to pick from the Indicators that you’ve just created. Pick all that apply.
Similar to the stocks, you’ll notice that each chosen Indicator will be added to both the list of Indicators on the right-hand side of the screen, as well as the circle graph on the left.

Continue process until you have a) created each stock needed for your scan, and b) populated each stock with indicators.

**Step 8 – Add Values**

Once you are ready, add your values to each Indicator. Make sure the value entered falls within the range set for the Indicator.
The final result should look like this. Once the values are added to each indicator, they will illustrate the health or value of what the indicator is measuring. Similar to the colours found within the range: Green [best] → Yellow → Amber → Red [worst].

The total condition of the stock is derived by the average of each indicator found within. The more indicators, the clearer the picture of the stock’s condition. The three ‘tutorial indicators’ are green, yellow, and red respectively. When averaged out, the condition of the stock is amber. It is up to the user to define what ‘amber’ means.