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

Getting Started in Aquaculture Information Session

Aquaponics

CANADIAN AQUACULTURE SYSTEMS INC.
BIOENGINEERING TECHNOLOGIES & BUSINESS MANAGEMENT SOLUTIONS

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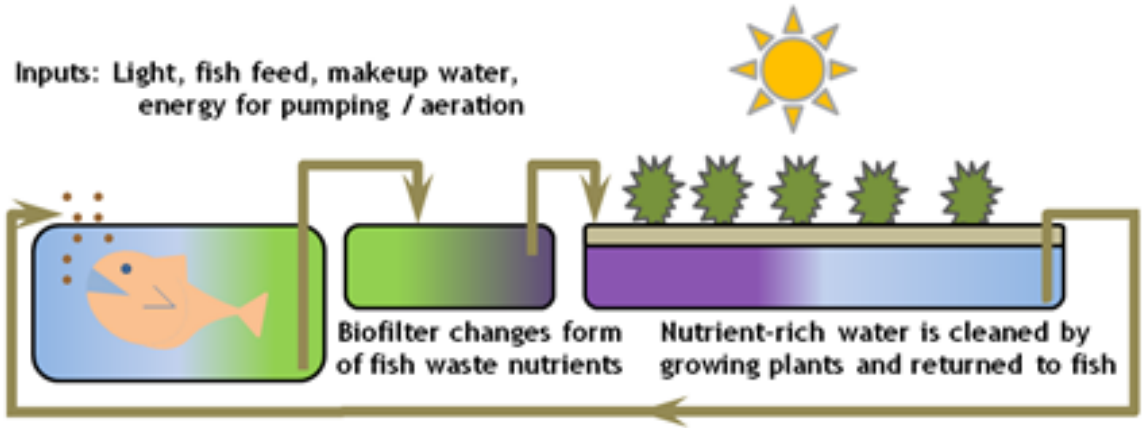
Why Aquaponics?

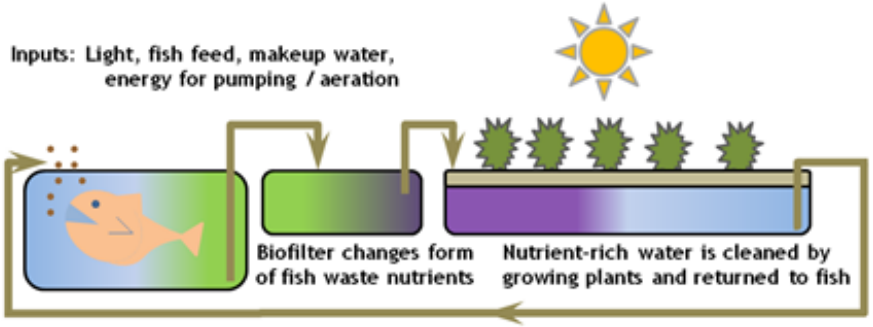
- Nitrate is a by-product in intensive aquaculture systems and must be removed
- Denitrification systems can be complex and add an additional cost
- Plants provide a denitrification function and provide an additional saleable crop



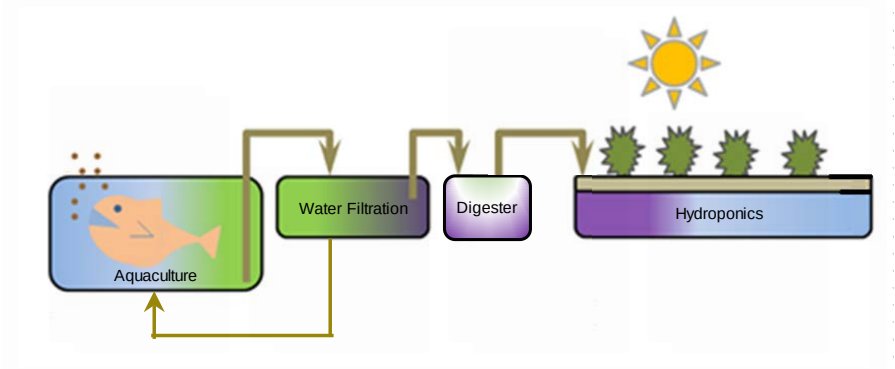
www.sfi.mtu.edu

Coupled v. De-Coupled Systems

- Coupled Systems
  - Common water for fish and plants



- De-coupled Systems
  - Independent recirculation systems for fish and plants
  - Nutrients are digested and then transferred to plants



Media Bed Technique

- Inert medium (clay balls, coco fibre) used to secure roots
- Beds flooded and drained or drip-irrigated
- Advantages:
  - High surface area for growth of beneficial bacteria in root zone
  - Excellent for vine crops
- Disadvantages:
  - In coupled aquaponics, media can trap solids and promote growth of deleterious bacteria

Deep Water / Raft Technique

- Common in aquaponics
- Plants float on rafts
- Advantages:
  - Allows for well-mixed, aerated troughs
  - Relatively low risk
  - Water volume provides thermal mass for stable temperatures
- Disadvantages:
  - Structural requirement to support weight of water
  - Solids settling in tanks

Nutrient Film Technique

- Plants placed in shallow troughs with fast-flowing water
- Advantages:
  - Higher plant densities
  - Lower weight enables vertical stacking

Fresh City Farms, Canada

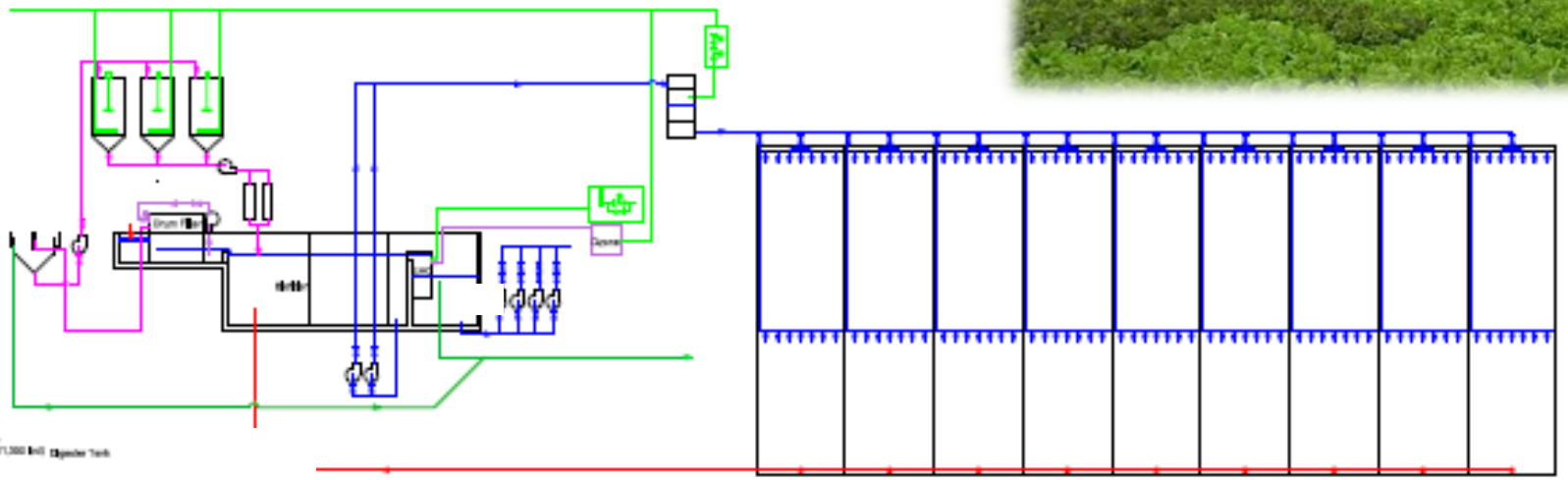
Aqua Greens, Mississauga, ON

Trend AquaFresh Organics, Niagara

- 50 tonnes annual fish production
- 400,000 – 600,000 heads of leafy vegetables
- Organic certification for fish and vegetables

GlobalTRUST an SAI GLOBAL company

Standards Council of Canada
Conseil canadien des normes



WMT

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AQUAPONICS Economics

Completed Builds	sq Ft	Total Cost	Cost per Sq ft
Hong Kong	25,833	$400,000	$15.48
Bahrain	4,306	$200,000	$46.45
Oman	4,306	$100,000	$23.23
Toronto*	2,000	$19,000	$9.50
Newmarket^*	1,000	$42,000	$42.00
India	3,200	$60,000	$18.75

**Volunteer Labour only* **Indoor Systems*

Capital Expense

- Cost to build systems varies by **300**%
  - High - $45 sq. / ft.
    - 25+ year lifespan, concrete or FRP
    - Artificial Lighting
  - Low - $10.00 / sq. ft.
    - Lumber + Liner
    - Volunteer Labour

Production

- Production Estimates Vary Wildly
- Forecast from LEARNED EXPERIENCE
- Importance of phased build-out
- Feasibility, Partners, Human Capital

Retail Prices

- Organic up to +40% higher prices,
- Can you get certified?
- CSA vs. Retail vs. Farmers Markets
- Institutional Opportunities

WATERFARMERS AQUAPONICS

AQUAPONICS Canadian Challenges

- Heating
- Artificial Lighting – bulb type, LED, waste heat output, Lumens, cost
- Risk is not well understood
- Supply chain is not well established
- Lack of human capital
- Steep learning curve
- Few commercially successful operations, no ‘models’

WATERFARMERS AQUAPONICS

Aquaponics v. Hydroponics

- Purdue University study (Flores et al. 2018)
  - Two experimental systems for production of basil, lettuce and cherry tomato
  - One aquaponics (tilapia) and one hydroponics (commercial fertilizers)
  - Capital cost was 8% higher for aquaponics
  - Operating cost was 12% higher for aquaponics

Table 1 – Financial results for aquaponics and hydroponics

Results	Hydroponics	Aquaponics			
		Non-organic prices	10% veg. price increase	20% veg. price increase	30% veg. prices increase
IRR (%)	48.7	18.27	32.61	45.83	58.51
NPV ($)	73,872	20,144	47,447	74,750	102,052
Payback (yrs)	3.13	6.83	4.04	3.25	2.79
Benefit/Cost	1.36	1.11	1.22	1.32	1.43

Moose Cree First Nation Aquaponics
An Opportunity for Remote Communities

- Local production of nutritious fish and vegetables on a year-round basis leading to healthier diets
- More reasonable prices for fresh fish and vegetables
- Enhanced food security and self-sufficiency
- An opportunity to provide diversified experiences for youth and other community members
- Integrated with the science and culinary arts programs in the school system
- Employment opportunities within the community
- Potential spin-off opportunities utilizing by-products from the operation (e.g. processing by-products)

Moose Cree First Nation

Products

Fresh, farmed-raised fish and vegetables

Moose Cree First Nation

- Fresh rainbow trout
  - ~1,000 kilograms of fish / month
  - 250 kg per week
- Leafy vegetables
  - ~65,000 heads per year
  - Lettuces, basil, spinach, herbs, etc.
- Specialty Crops (in future)
  - Strawberries

Dutch Buckets

Nutrient Film Technique

Deep Water Raft Culture

Business Model

All-female triploid eggs purchased from Troutlodge

Juvenile fish raised in local high school

Fish Production

Competitive tender: Fish feed supply

Fish Harvest

Nutrient separation & digestion

Vegetable Production

Seed Propagation

$

Moose Cree Aquaponics

$

Direct sales to local communities

Aquaculture Works!

Project Planning
System Design
Tendering
Project Mgmt
Technical Support
Training
QC/QA

Moose Cree First Nation

Community Model

- Developing a related curriculum for implementation in the local school is a key part of the initiative

Aquaculture

- Students will produce juvenile trout for on-growing in the venture
- Key curriculum components:
  - Biology
  - Environment
  - Mathematics
  - Chemistry

Hydroponics

- Students will propagate seedlings for on-growing in the venture
- Key curriculum components:
  - Biology
  - Environment
  - Mathematics
  - Chemistry

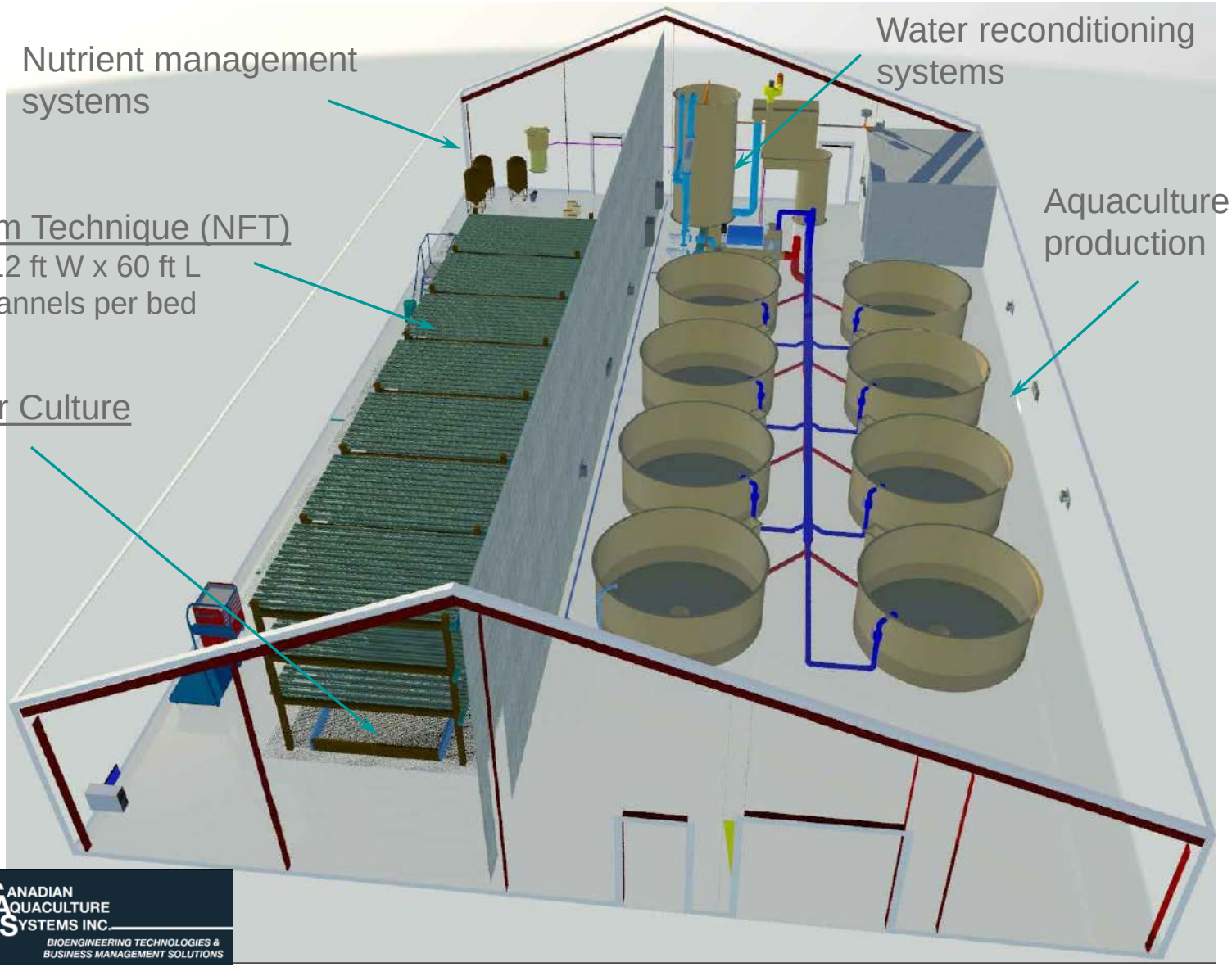
Culinary Arts

- Students will prepare meals using fish and vegetables from the venture
- Key curriculum components:
  - Food Preparation
  - Health & Nutrition
  - Food Safety

Moose Cree First Nation

Aquaponics Venture

Moose Cree First Nation



Nutrient Film Technique (NFT)

- 3 beds at 12 ft W x 60 ft L
- 90 NFT channels per bed

Deep Water Culture

- 8 ft x 60 ft

WMT

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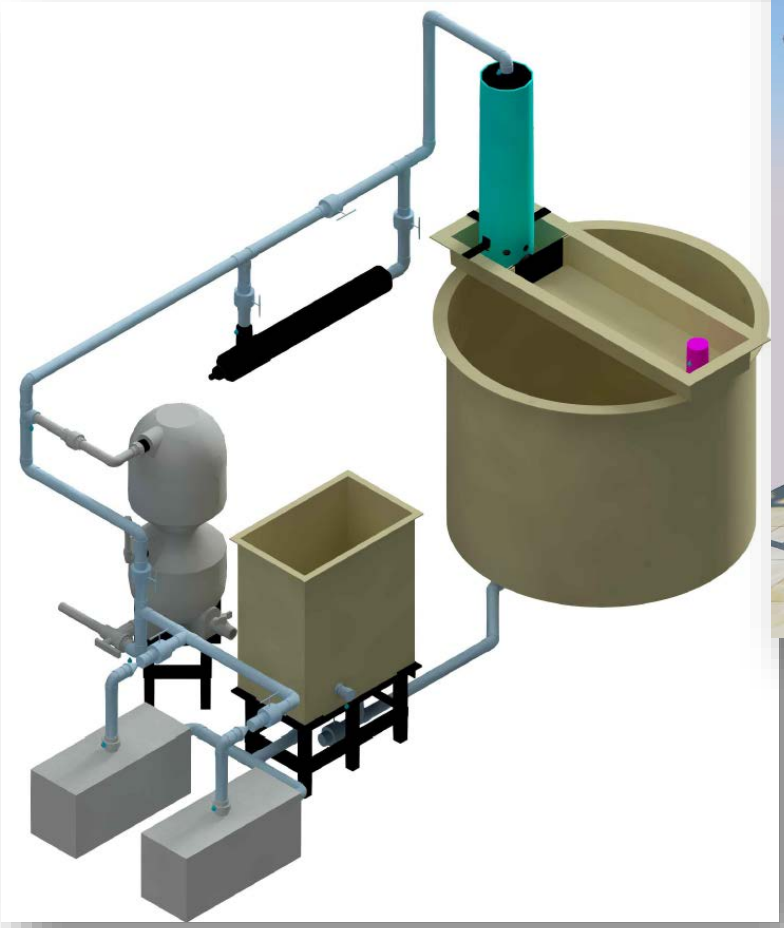
Moose Cree Aquaponics Demonstration System

Aquaculture System



Hydroponic System

Creating Prosperity – One Client at a Time

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

www.canadianaquaculturesystems.com

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