

**Commercial Hydroponic High Value Specialty Crop Production
at Chena Hot Springs Resort.
ChenaFresh Greenhouses**

Submitted by Jeff Werner for ChenaFresh Greenhouse

Chena Hot Springs Resort (CHSR) is a year round greenhouse operation producing hydroponic lettuce production operation producing NFT (Nutrient film technique) lettuce, herbs, baby salad greens, and basil.

Recently, CHSR has upgraded the production systems to enhance lettuce production with ebb and flow seedling starting protocols to increase time to market, improve quality, and ensure adequate water and nutrient delivery. The ebb and flow benches is also used for hydroponic fresh herb production. The hydroponic baby greens system is constructed of wider troughs than being used before for the head type lettuce. The larger troughs enabled it easier to grow the micro greens on a mat type of a system. The nutrient solution for both the ebb and flow and micro-green system is being provided by a master make up tank that is also supporting the pre-existing lettuce production system.. The Ebb and flow benches are also used for herb production. In order to facilitate the increased production the installation of an additional controller was required. The production of the micro greens and ebb and flow system did increase the use of the recirculation water resulting in an increase potential of pathogens. An UV stabilizer was installed to control water pathogens.



To meet an increased demand for Alaska grown lettuce, greens, herbs, and other producible items for Alaska' markets, CHSR has installed and is utilizing the following equipment as result of this proposal,

Chenafresh hydroponic salad greens



Hydroponic Greens in system



**Hydroponic baby green,
baby herb production
system**



**Ebb and Flow benches for
lettuce seedling and herb
production.**



New ebb and flo tank for production system.



Spinach and baby greens in production system.



HID Lighting System for HBG production. –

Additional lights were installed along with existing lights to increase available light to plants.

HID lighting reflectors and sockets. Increasing the production space in the greenhouse required additional lighting for winter production.

Hydroponic and Climate Controller

In order to properly facilitate the additional production and equipment, an additional controller was necessary. The CHSR program currently has two IGROW 1400 controllers, both were need for the expansion of the lettuce project, Both controllers work together and be necessary to adequately to control and manage the ebb and flow, and the additional water treatment equipment used. This controller controlled the entire hydroponic system.



High Output UV Stabilizer



UV stabilization is used in hydroponic systems to sterilize the water to protect from water borne pathogens. The diversity of all of the hydroponic systems in production and recycling of the water increases the potential for destructive water borne pathogens that could effect plant health, productivity and product quality.

The increase of the production capabilities increased the production at Chena hot Springs by 65% for yield delivered from the greenhouse.

The equipment increased the variety of products in production allowing a variety of lettuce, greens, and herbs available to the customer. The equipment is in use 12 months, this extended production time does require very strict controls and management. The extended production time also requires the use of lights.

The different specialty crops produced by this equipment, system.

- Baby greens
- spinach
- mustard greens
- asian greens
- micro-lettuce
- basil
- green onions



Financial

Total project.....	\$10958
State of Alaska	\$5000
Chena Hot Springs	\$5958

Equipment without shipping costs

Controller for ebb and flow and nft system.....	4491.00
Lighting system (Sunlight Supply)	1514.50
Ebbflow and nft system (cropping)	2800.45
Ebbflow and nft system (cropping)	805.20
Ebbflow and nft system (Dripworks).....	859.75
Aquatic UV filter.....	298.00

Total project receipts	10768.90
Chena Hot Spring project cost w/shipping	12926.01

Balance due State of Alaska	5000.00
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Please note that all receipts show delivery to Jeff Werner at UAF. Due to the nature of this project UAF Controlled Environment Research Lab assist Chena Hot Springs to ensure that the project was feasible. UAF receives a significant discount towards equipment for projects such as this and other activities at Chena Hot Springs. Chena Hotsprings has reimbursed UAF for expenses as illustrated on invoice 09101001 attached.

All equipment is at Chena Hot Springs Resort in production and property of Chena Hot Springs.

The project was publically presented at the 2009 SARE conference in Fairbanks, the 2009 Chena Renewable Energy Conference and available to anyone every day as part of the Chena Hot Springs “Free” renewable energy conference.



Hydroponic system stacked to maximize production space and to demonstrate a different technique for small space utilization.

AUG-29-2008 FRI 11:57 AM UAF ACCOUNTS PAYABLE

FAX NO. 907 4747048

P. 02

AUG-29-2008 12:59 FROM: LINK4 CORPORATION 7148547244

TO: 9P19874747046

P: 2/2

Link4 CORPORATION
Intelligent Controls

187 K Gateway Drive, Suite 101, Roseville, CA 95720 www.Link4corp.com
T: (916) 834 7241 F: (916) 834 7244

Invoice

Due Date	Invoice #
9/26/2008	1903

Bill To
University of Alaska Fairbanks Jeff Werner P.O. Box 757200 Fairbanks, AK 99775

Ship To
University of Alaska Fairbanks 901 Kayukuk RM 106 Fairbanks, Alaska 99775

P.O. Number	Date	Rep	Term	Shp Date	Via	F.O.B.	Project
50801A	8/28/2008	DT	CC	8/29/2008	UPS-GROUND	Placeonta	

PARTNUMBER	DESCRIPTION	QTY	UNIT PRICE	EXT PRICE
990-1601-02	1 Grow 1600 EXPANSION CONTROLLER (12 outputs + 2 alarms) DISTRIBUTIONAL GRADE, PREDRILLED NEMA 4 ENCLOSURE	2	2,495.00	4,990.00
FD-PD-05Q3	SPECIAL DISCOUNT		-499.00	-499.00
Shipping	Shipping tracking #1ZY049E00390763152	1	75.00	75.00

Subtotal	\$4,566.00
Sales Tax (0.0%)	\$0.00
Total (USD)	\$4,566.00
Payments/Credits	\$0.00
Balance Due (USD)	\$4,566.00



Invoice

Crop King
230 Quadral Dr.
Wadsworth, OH 44281

Invoice	1117646
Date	8/14/2008
Page	1

Bill To:

University of Alaska-Fairbanks
PO Box 757200
Fairbanks AK 99775

Ship To:

University of Alaska-Fairbanks
901 Koyukuk Dr. Rm 115
Fairbanks AK 99775

Purchase Order No.	Customer ID	Salesperson ID	Shipping Method	Payment Terms	Req Ship Date	Master No.	
	UNIVERSITYOF028	04	LTL	Cash	6/20/2008	38,847	
Ordered	Shipped	B/O	Item Number	Description	Discount	Unit Price	Ext. Price
30	30	0	CHA9612	80 X 255 MM End Cap	\$0.0000	\$4.5000	\$135.00
30	30	0	CHA9613	80 X 255 MM End cap with spout.	\$0.0000	\$3.5500	\$106.50
390	390	0	CHA9604	80 X 255 MM Channel Ln. Ft.	\$0.0000	\$3.8700	\$1,509.30
60	60	0	CHA9414	1" 45 Degree Elbow	\$0.0000	\$1.8800	\$112.80
400	400	0	MGBURLAP	9" x 52" Burlap	\$0.0000	\$0.3800	\$152.00
5	5	0	CHA9102	40x100mm Channel Splice	\$0.0000	\$2.1200	\$10.60
10	10	0	CHA9000	40x100 MM 4' Blank Cover	\$0.0000	\$4.4000	\$44.00
25	25	0	CHA9100	40x100 mm End Cap	\$0.0000	\$1.3300	\$33.25
25	25	0	CHA9101	40x100 mm End Cap w/ Spout	\$0.0000	\$1.4800	\$37.00
20	20	0	LEA1000	Leach Tray	\$0.00	\$14.01	\$280.20
2	2	0	ROC1006	Cube AX25x40 1" 10x10	\$0.0000	\$189.9000	\$379.80

PAID

\$2031.80 to go on V 7524 9/10 Balance of \$
784.85 + Frt To go on card M 3381 11/09

Subtotal	\$2,800.45
Misc	\$0.00
Tax	\$0.00
Freight	\$1,481.00
Trade Discount	\$0.00
Payments	\$0.00
Total	\$4,281.45

Dripworks Invoice

DripWorks / Everlner
 190 Sanhedrin Circle
 Willits, CA 95490
 (800) 522-3747

Invoice #	47813
Date	06/08/2008 23:51:56
Account Number	13340

Bill To:

Univeersity of Alaska Fairbank
 Jeff Werner
 FNJWW@UAF.EDU

PO Box 757200
 Fairbanks, AK 99775
 United States
 907 474-6932

Ship To:

University of Alaska Fairbanks
 Jeff Werner

901 Koyukuk Dr Rm 115
 Fairbanks, AK 99775
 United States
 907 474-6932

WHOLESALE - Special shipping for Alaska

LINE	QUANTITY	DESCRIPTION	UNIT PRICE	TOTAL
1	10	PRSLHH12-Sen Lo Flo Hose, 12# (FHxMH) pg 42	6.8000	68.00
2	5	PRSG10-10 PSI Sen Hose Reg (FHxMH) pg 42	5.1000	25.50
3	12	ELRT-3/4in x 3/4in x 1/2in EasyLoc ftTft pg 33	2.9200	35.04
4	10	620ELFH-RDrip Easy Loc x Fem Hose pg 31	0.6900	6.90
5	10	620ELMH-RDrip Easy Loc x Male Hose pg 31	0.3700	3.70
6	10	620ELC-RDrip Easy Loc Coupler pg 31	0.4100	4.10
7	10	620ELT-RDrip Easy Loc Tee pg 31	1.0500	10.50
8	10	620ELL-RDrip Easy Loc Elbow pg 31	0.8400	8.40
9	10	620ELMC-RDrip Easy Loc End w/Cap pg 31	0.5500	5.50
10	10	620ELV-RDrip Easy Loc Valve pg 31	1.4000	14.00
11	10	620ELT-RDrip Easy Loc Tee pg 31	1.0500	10.50
12	10	620ELL-RDrip Easy Loc Elbow	0.8400	8.40

pg 31				
13	5	ELCA-1/2in x 620 Easy Loc Coupler	1.2000	6.00
14	10	ELL-1/2in Easy Loc Elbow pg 30	0.8800	8.80
15	5	ELRT12-3/4in x 1/2in x 1/2in Ez Loc ftTft pg 33	1.4000	7.00
16	10	CC34-3/4in Compression Coupler pg 33	0.5200	5.20
17	10	CRCC-Reducing Coupler 3/4inx 1/2in pg 33	0.8000	8.00
18	50	CA34-3/4in Compr x 3/4in PVC Slip(spgt) pg 33	0.2600	13.00
19	2	14500-1/4in x 500ft Poly Tube pg 28	22.0000	44.00
20	3	TDB5_500-5 Strand DB Wire, 500ft pg 50	118.6000	355.80
21	1	THMOD8-Hunter 8 Sta Module, ICC pg 49	75.0000	75.00
22	100	14GP2-Two Way Goof Plug pg 28 in 10s	0.0300	3.00
23	100	1490-1/4in Barbed Elbow pg 28 in 10s	0.0850	8.50
24	100	14C-1/4in Barbed Cross pg 28 in 10s	0.1550	15.50
25	100	14T-1/4in Barbed Tee pg 28 in 10s	0.0750	7.50
26	50	14DTB-1/4in x 1/8in Barbed Conn in 10s	0.1200	6.00
27	100	14TBC-1/4in Thead x Barb Connector pg 28 in 10s	0.1000	10.00
28	50	14LTB-1/4in Long Barbed Connector pg 28 in 10s	0.0900	4.50
29	10	14QCCP-1/4in Quick connect Coupler	1.6000	16.00
30	10	14QCL-1/4in Quick connect Elbow	1.7000	17.00
31	10	14QCT-1/4in Quick connect Tee	2.0000	20.00
32	10	14VfV-1/4in Barbed Valve pg 29	0.4600	4.60
33	1	PU400-Punch for 400 Barb pg 25	23.8000	23.80
Sub-Total			\$859.74	
Actual shipping cost will be applied				

Thank you for your order



Crop King
230 Quadral Dr.
Wadsworth, OH 44281

Invoice

Invoice #	1117647
Date	8/14/2008
Page	1

Bill To:

University of Alaska-Fairbanks
PO Box 757200
Fairbanks AK 99775

Ship To:

University of Alaska-Fairbanks
901 Koyukuk Dr. Rm 115
Fairbanks AK 99775

Purchase Order No.		Customer ID	Salesperson ID	Shipping Method	Payment Terms	Req Ship Date	Master No.
		UNIVERSITYOF028	04	MOTOR FREIGHT	Cash	8/5/2008	39,660
Ordered	Shipped	B/O	Item Number	Description	Discount	Unit Price	Ext. Price
20	20	0	CHA9612	80 X 255 MM End Cap	\$0.0000	\$4.8800	\$97.60
20	20	0	CHA9613	80 X 255 MM End cap with spout.	\$0.0000	\$5.3800	\$107.60
40	40	0	CHA9414	1" 45 Degree Elbow	\$0.0000	\$2.5000	\$100.00
20	20	0	WRITE-IN	Used 12'6" 80x255mm Channel	\$0.0000	\$25.0000	\$500.00

PAID

Please ship this with his 1st order with
Crate. 3381 Charge to same card.

Subtotal	\$805.20
Misc	\$0.00
Tax	\$0.00
Freight	\$0.00
Trade Discount	\$0.00
Payments	\$0.00
Total	\$805.20

From: "Toya Johnson" <toyaj@aquaticceco.com>
 Subject: **Backorder E-Mail**
 Date: June 27, 2008 10:09:53 AM GMT-08:00
 To: <nhjww@uaf.edu>

To: **CHENA HOT SPRINGS RESORT**
 Order No.: **776377**

Thank you for your order from Aquatic Eco-Systems. One item or more in your order is backordered or has a lead time:


Part No.	Description	Price	Quantity on Backorder	Backorder/Lead Time
16790	UV3 TETRAPOND UV STERILIZER	\$298.00 EA	1	1-2 WEEKS

We have the following products in stock if you wish to substitute them for your original order:


Orig. Part No.	Sub. Part No.	Description	Orig. Price	Sub. Price

For technical questions about your order, please call Tech Support at 407-886-3939. Technicians are available from 8 a.m to 7 p.m. M-Th, 8 a.m. to 5 p.m. F and 10 a.m. to 2 p.m. Sat.

Thanks
 Toya



**AQUATIC
ECO-SYSTEMS, INC.**
 Since 1978
 2395 Apopka Blv. Apopka, FL 32703
 Ph: (407) 886-3939
 Fax: (407) 886-6787
 Email: aes@aquaticceco.com
 Web: aquaticceco.com
 Fed ID #: 59-1907012

PACKSLIP


Document #	00776110
PAGE	Page 1 of 1
DATE	6/25/2008

Cust #: **203286**
 Ship to: **1**
AK UNIVERSITY OF FAIRBANKS
ATTN : JEFF WERNER
JEFF 907-474-6932
FAIRBANKS, AK, 99775-

33

Customer PO number	Ship date	Sales person	Terms	
WEB #8921	6/25/2008	UNV	CC	
Document	Warehouse	Freight	Ship via	
100776110 010010	01	Prepaid	RPS	
Item number	Description	Quantity ordered	Quantity shipped	Quantity Backord
16790	UV3 TetraPond UV Sterilizer	1	1	0
16793	Replacement Bulb for UV3	1	1	0
35100	BULKHEAD FITTING" FIPT X FIPT	2	2	0
MD9	MAG-DRIVE 9.5 950 GPH PUMP	1	1	0

Your Order Picked with Pride by: DJP

UAF Controlled Environment Agriculture Lab

Agricultural and Forestry Experiment Station

PO 757200
Fairbanks, AK 99775
Phone: 907-474-6932 Fax: 907-474-1538
jeff.werner@alaska.edu

Invoice

Bill To:
Chena Hot Springs Resort
C/O KK Recycle
MP 9.5 Richardson Hwy
North Pole, AK 99705

Ship to:
Chena Hot Springs Resort
MP 65 Chena Hot Springs Road
Fairbanks, AK 99705

Invoice No.: 09101001

Customer ID: CHSR01

Date	Order No.	Sales Rep.	Via	Term
09/30/2009	1	Bernie Karl		30 net

Quantity	Item	Description	Total
1	001	Invoice - Sunlight Supply	1744.27
1	002	Link 4 Controller Invoice 1903	4566.00
1	003	Dripworks Invoice 47813	859.74
1	004	Cropking Ebb and flow materials Invoice 117646	4281.45
1	005	Irrigation equipment: 300 feet driptape, corners, mainlinetube	200.00
1	006	Cropking Invoice 117647	805.20
1	007	Aquatic Eco Systems	298.00
1	008		
45	009		207.35
1			

Total:	12962.01
Paid:	12962.01
:	
Balance Due:	0
:	



Sunlight Supply, Inc.
National Garden Wholesale.

5408 N.E. 88th Street - #A-101 - Vancouver, WA 98665
Toll Free 888-478-6544 - Local 360-883-8846 - Fax 360-883-5395

INVOICE

IN1093212

Page: 1

CUSTOMER NO. **UNIALA**

BILL TO:

University Of Alaska Fairbanks
3295 College Road
Suite 103
Fairbanks, AK 99775-7940
USA

SHIP TO:

UNIVERSITY OF ALASKA FAIRBANKS
905 KOYUKUK ROOM 303
ATTN: JEFF WERNER
FAIRBANKS, AK 99775-7940
USA

Contact: Jeff Werner

DATE	SHIP VIA	PO B	TERMS			
7/24/2008	FEDEX LTL	DESTINATION	Net 30 days			
PURCHASE ORDER NUMBER	ORDER DATE	SALESPERSON	YOUR ORDER NUMBER			
EMAIL 07/24/08	7/24/2008	0070 - Patrick Vivian - New	S214114			
REQUIRED	QUANTITY	SHIPPED	ITEM NUMBER	DESCRIPTION	UNIT PRICE	AMOUNT
10	10	0	904310	LUMEN MAX REFLECTOR	\$71.95	\$719.50
10	10	0	903055	5KV SOCKET ASSEMBLY WITH 15 F	\$17.50	\$175.00
10	10	0	901802	M1000.U37.CDX (6/CASE)	\$62.00	\$620.00
SUB TOTAL						\$1,514.50
FREIGHT CHARGES						\$229.77
TOTAL AMOUNT						\$1,744.27
Paid - Credit Card						
<div style="border: 1px solid black; padding: 5px; display: inline-block;"> <p>--- New from Sunlight Supply / NGW ---</p> <ol style="list-style-type: none"> 1) Green T5 4' lamps 2) Vermicrop Extractor and Cartridges 3) Liquid Kool Bloom 2.5 & 6 gal 4) Scalpel 5) Optimum Growth CO2 Regulators 6) Grodan - Rose/Maxi/Giants Pots </div>						
Date	Fax	<p>FAIRBANKS</p> <p>Date <u>7-29</u> Fax <u>7439</u></p> <p>Please provide receiving.</p> <p>Juanita x6115</p>				
Juanita x6115	receiving.					

THANK YOU

Ref. No: G 006603039