TETRA TECH

Memorandum

Date:	August 3, 2017
To:	Kathy Hansen (YRAA)
c:	
From:	Don Beard, Bridget LaPenter (Tetra Tech)
Project No./Name:	YRAA Hatchery
Subject:	Interim Hatchery Concepts

Background

Based on our discussions with you and others associated with YRAA, we understand that it is YRAA's desire to investigate possible hatchery locations that can make use of land and water supplies that are located on properties under the control of the City of Yakutat or others who may be accommodating to development of the project.

In order to assist YRAA with this evaluation, we have performed the following:

1. Don Beard visited Yakutat on June 7, 2017 and met with Herb Holcomb and Nate Endicott. He was shown possible water resources that could be developed for a hatchery facility, mostly in and around Puget Cove. A summary of these investigations is shown on Figure 1.
2. Don Beard and Bridget LaPenter of Tetra Tech, and Jay Chenault of Applied Earth Sciences, met with Kathy Hansen and Ed Neal on June 15, 2017 and discussed possible strategies for verifying water and land availability. In the course of this discussion, it was determined that YRAA would like to review the feasibility of developing a smaller, interim facility that may be more likely to succeed with the limited water and land resources currently available.
3. Jay Chennault provided the attached memo suggesting possible methods for field verification of ground water availability.
4. Tetra Tech prepared the following concepts for development of an interim hatchery.

Interim Hatchery Concepts

YRAA is proposing to produce summer chum salmon with the goal of developing a self-sustaining program that results in annual harvests for commercial, cost recovery and broodstock. We understand that preliminary permit discussions between YRAA and ADFG have indicated that initial production will be limited to about 10 million eggs until the hatchery program has been verified. YRAA requested that Tetra Tech investigate the facility and water needs for a 6 to 12 million egg facility.

The facility and water requirements to incubate, short-term rear and release 6 to 12 million chum salmon are summarized in Table 1 and the attached drawings. We've shown how these facilities could be housed in traditional building, or installed in standard size shipping containers. We've also shown how the incubation facility could be mounted on a barge and operated as floating hatchery.

In addition to the design criteria in Table 1, these concepts are based on the following assumptions:

1. Water for incubation will be supplied by gravity flow. Given the remoteness of the sites being considered and the extent of Yakutat's power system, a pumped water supply is not considered feasible. From egg take through fry outmigration, the flow of incubation water must be uninterrupted.

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2. If the flow discharged from the incubators is used for either non-volitional outmigration of fry or short-term holding and crowding of adults, it would probably need to be pumped given the low head possibly available. These operations are both staffed continuously so the pumps could be monitored continuously.
3. The hatchery will be staffed continuously from egg take through fry release. At remote sites, security and quick responses to emergencies are essential. Some type of living accommodation must be provided on-site. After the fry are released and before the subsequent year egg take, intermittent staffing is acceptable.

Adult Returns

The most uncertainty with these concepts may be related to establishing a system to manage adult returns and take eggs on continuing basis. We are not aware of a major chum salmon hatchery that has established an adult return and egg take with the limited water supplies being considered here.

It should be emphasized that the systems required to manage returns, collect broodstock and perform egg takes is not something that Tetra Tech can verify at this time. Adult handling and egg takes are stock-sensitive issues and the subject of more detailed fish culture and fisheries management evaluation than our office is prepared to perform. Specific stocks to be used should be identified and fish culture professionals familiar with those stocks should be consulted before embarking on the proposed program.

Any site that is limited to low water flows indicated in Table 1 would not provide adequate flow to drive a conventional fish ladder and adult holding system used in most chum hatcheries. Flows more in the range of 1000 gpm or more would be required throughout the adult return period for such a system.

Some of the issues that need to be determined include the following:

1. Release and return sites.
2. Return timing of selected stocks.
3. Ripeness, fecundity and male/female ratios of selected stocks.
4. Collection and freshwater holding requirements.

We understand that YRAA proposes to use eggs taken from other areas to start this program. Some typical criteria for holding adult chum salmon and taking eggs are shown in Table 1. These criteria can vary substantially and should only be used as a guide for conceptual planning until a more thorough evaluation can be performed of specific the stocks to be used.

We hope that this information, combined with the previous reports, is helpful to you. If you would like to discuss any elements of the project with us, please let us know. Thank you.

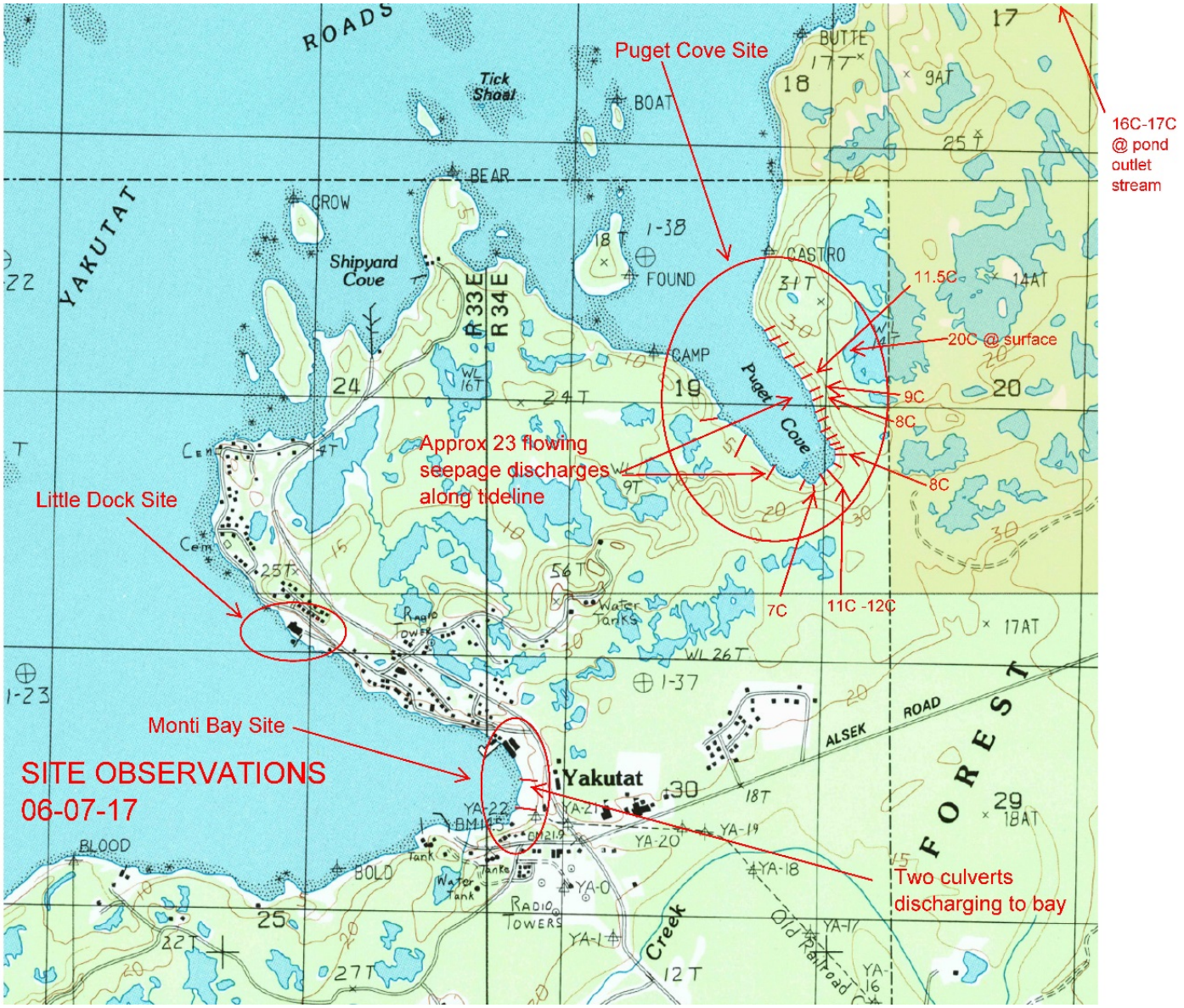


Figure 1.

Site Observations, 06-07-17

YRAA Hatchery Water Supply

Table 1
YRAA Interim Incubation Facility
Fish Culture Design Criteria

User Inputs

INCUBATION

Option	Species	Egg Capacity	Type	Eggs/Inc	No. Inc	Inc per stack	No. Stacks	Stack GPM	Total GPM	Actual Egg Capacity
	Chum	6,000,000	Nopad	180,000	34	4	8	15	135	6,480,000
	Chum	12,000,000	Nopad	180,000	67	4	17	15	255	12,240,000

FRY PONDING ***

Option	Unit ^	Number	Vol [M³]	Flow** [GPM]	Max GPM	Fry No.****	Fry Final Wt [g]	Biomass [Kg]	Density [Kg/M³]
1	Raceway	1	32	141	141	1,500,000	0.4	600	18.8
2	Raceway	1	32	141	141	1,500,000	0.4	600	18.8

NET PEN REARING

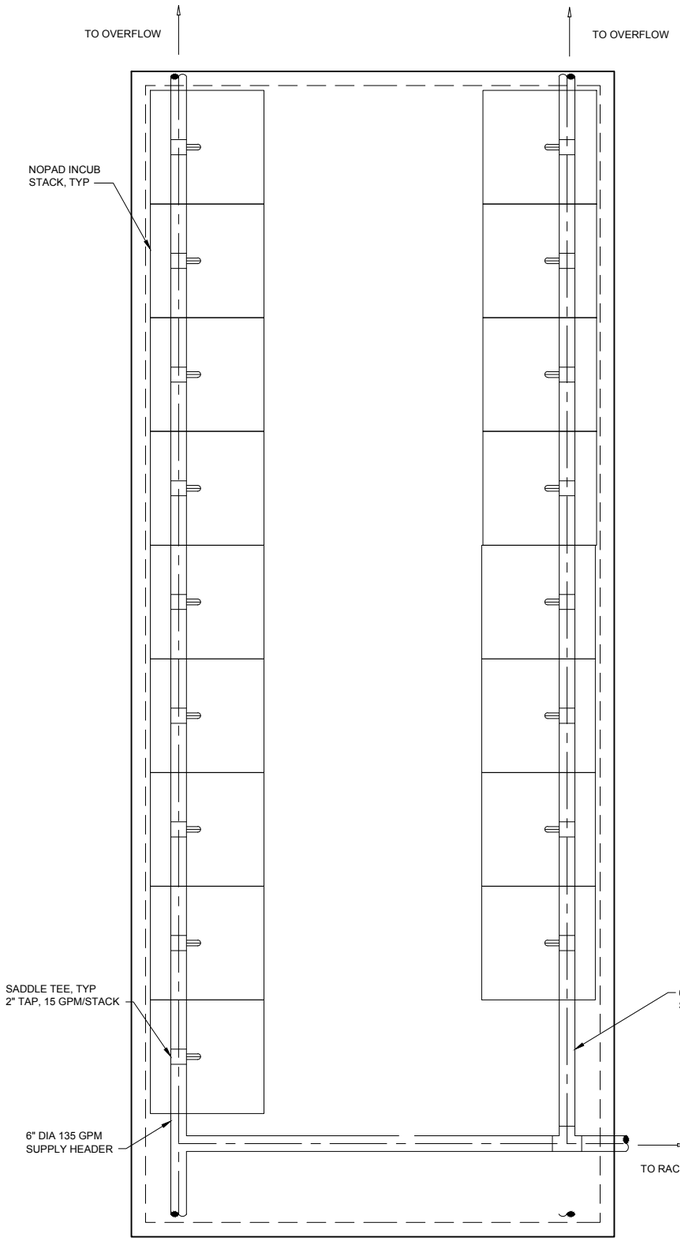
Option	Unit Size	Volume of Each [M³]	Number of Pens at 3M fry each	Total Volume [M³]	Total Fry at 95% Survival	Fry Final Wt [g]	Biomass [Kg]	Density [Kg/M³]
1	40x40x15	680	3	2,040	6,156,000	2.0	12,312	6.0
2	40x40x15	680	5	3,399	11,628,000	2.0	23,256	6.8

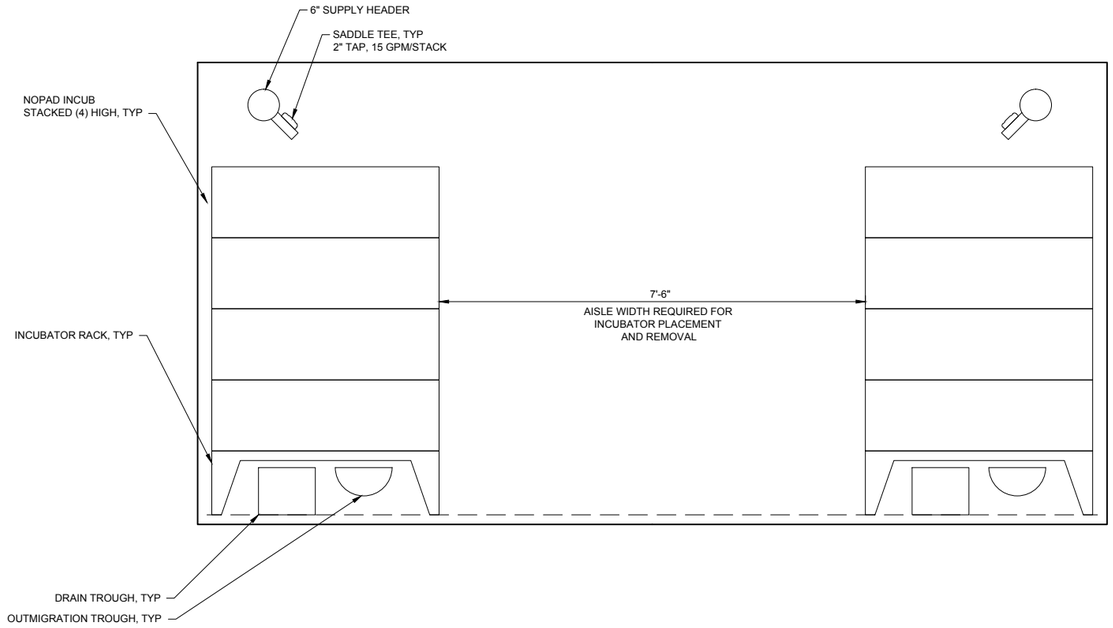
^ Assume (1) 40x8x3.5 raceway for outmigration
^^ Assume 1 change per hour max flow required.
*** Typically lasts 24 hrs with non-volitional outmigration
**** Assumes approx 8 incubators per day max outmigration
Chum typically pond at 0.3-0.4 g/fry

TYPICAL EGG TAKE ASSUMPTIONS (WILL VARY WITH STOCKS SELECTED)

Egg Take Goal [1]	FecundityEggs/Fem [2]	Total Female Reqd	Spawn Ratio [3] Female	Spawn Ratio [3] Male	Total Fish Reqd	Run Duration (days)[4]	Duration of Peak Egg Take (days)[4]	Maximum Egg Take Day (eggs/day)[5]	Max Fish Handling Day (fish/day)[5]	Holding Volume Reqd (cf) [6]	Flow Reqd (gpm) [6]
6,821,053	2,000	3,411	22	8	4,651	42	18	473,684	323	484	258
12,884,211	2,000	6,442	22	8	8,785	42	18	894,737	610	915	488

[1] Assumes 95% survival green to hatch
[2] SF chums typically vary from 2,000 to 2,200
[3] Typical bucket of 40k to 50k fertilized eggs
[4] Six-week summer chum run, 75% of fish over 2 to 3 weeks
[5] Maximum day based on 1.25 X average over egg take duration
[6] Based on average adult fish held 1 day in freshwater at 1.5 cf/fish and 0.8 gpm/fish





HATCHERY LAYOUT

HALF BUILDING YIELDS 6.5 MIL CHUM EGGS IN (9) 4-HIGH INCUBATOR STACKS
FULL BUILDING YIELDS 12.2 MIL CHUM EGGS IN (17) 4-HIGH INCUBATOR STACKS

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MARK	DATE	DESCRIPTION	BY

YAKUTAT REGIONAL AQUACULTURAL ASSOCIATION
YAKUTAT, ALASKA

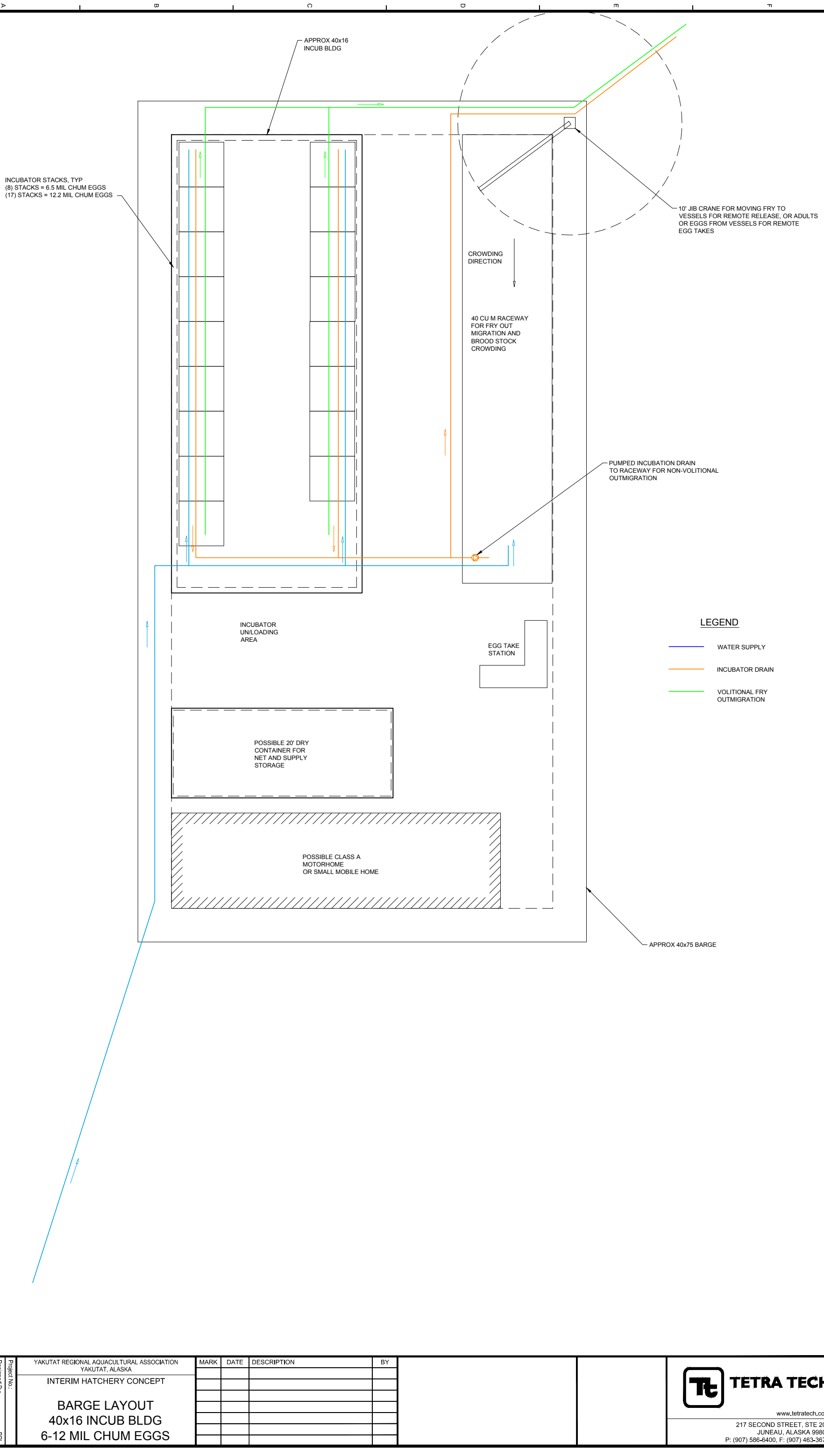
INTERIM HATCHERY CONCEPT

40x16 INCUB BLDG
6-12 MIL CHUM EGGS

Project No.:	
Designed By:	BPL
Drawn By:	BPL
Checked By:	DRB

SK1701

Bar Measures 1 inch



SK1702

Project No.:
Designed By: BPL
Drawn By: BPL
Checked By: DRB

YAKUTAT REGIONAL AQUACULTURAL ASSOCIATION
YAKUTAT, ALASKA

INTERIM HATCHERY CONCEPT

BARGE LAYOUT
40x16 INCUB BLDG
6-12 MIL CHUM EGGS

MARK	DATE	DESCRIPTION	BY

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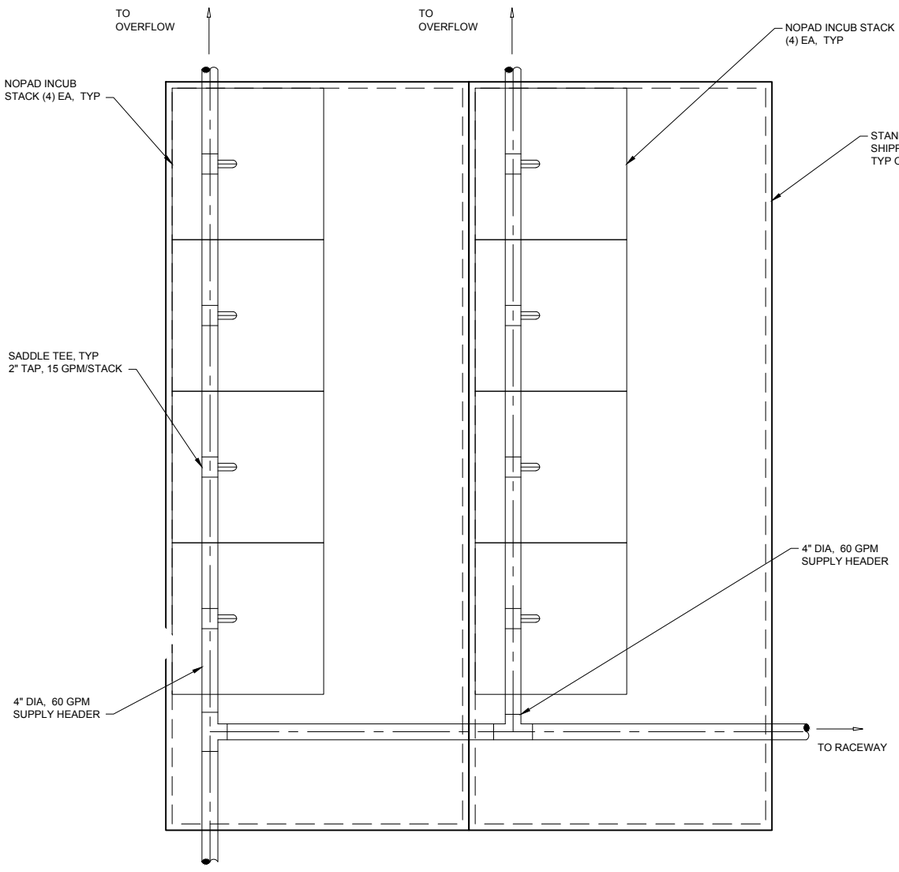
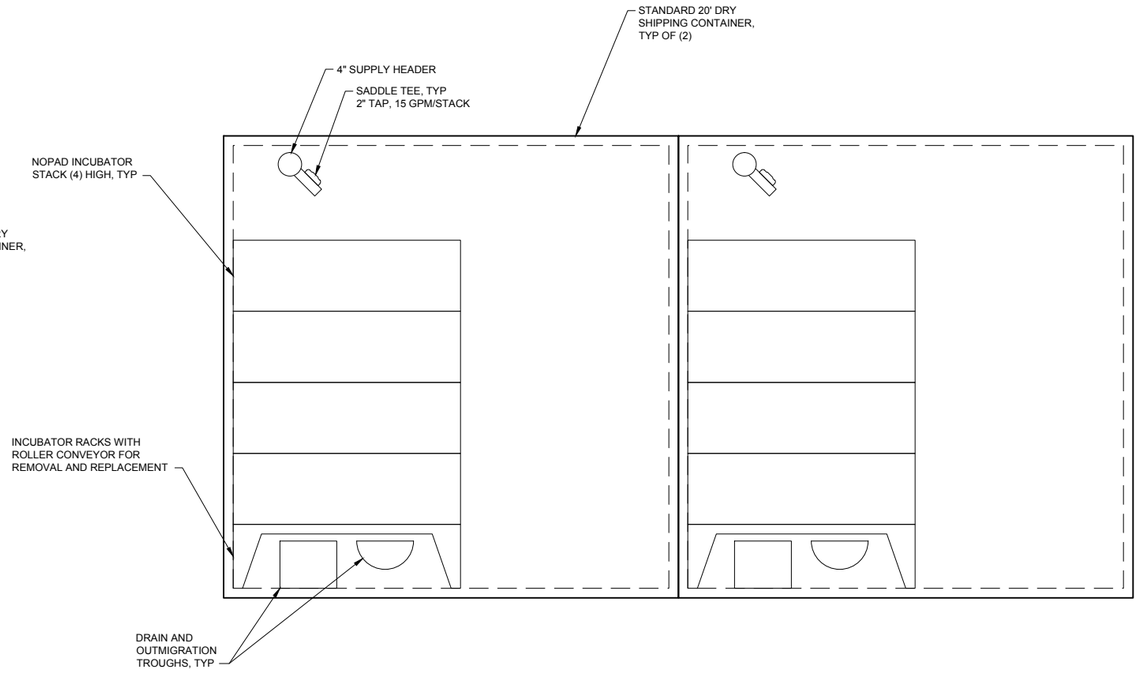
Bar Measures 1 inch





HATCHERY LAYOUT

1 CONTAINER YIELDS 2.8 MIL CHUM EGGS IN (4) 4-HIGH INCUBATOR STACKS

2 CONTAINERS YIELD 5.7 MIL CHUM EGGS IN (8) 4-HIGH INCUBATOR STACKS

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MARK	DATE	DESCRIPTION	BY

YAKUTAT REGIONAL AQUACULTURAL ASSOCIATION
YAKUTAT, ALASKA

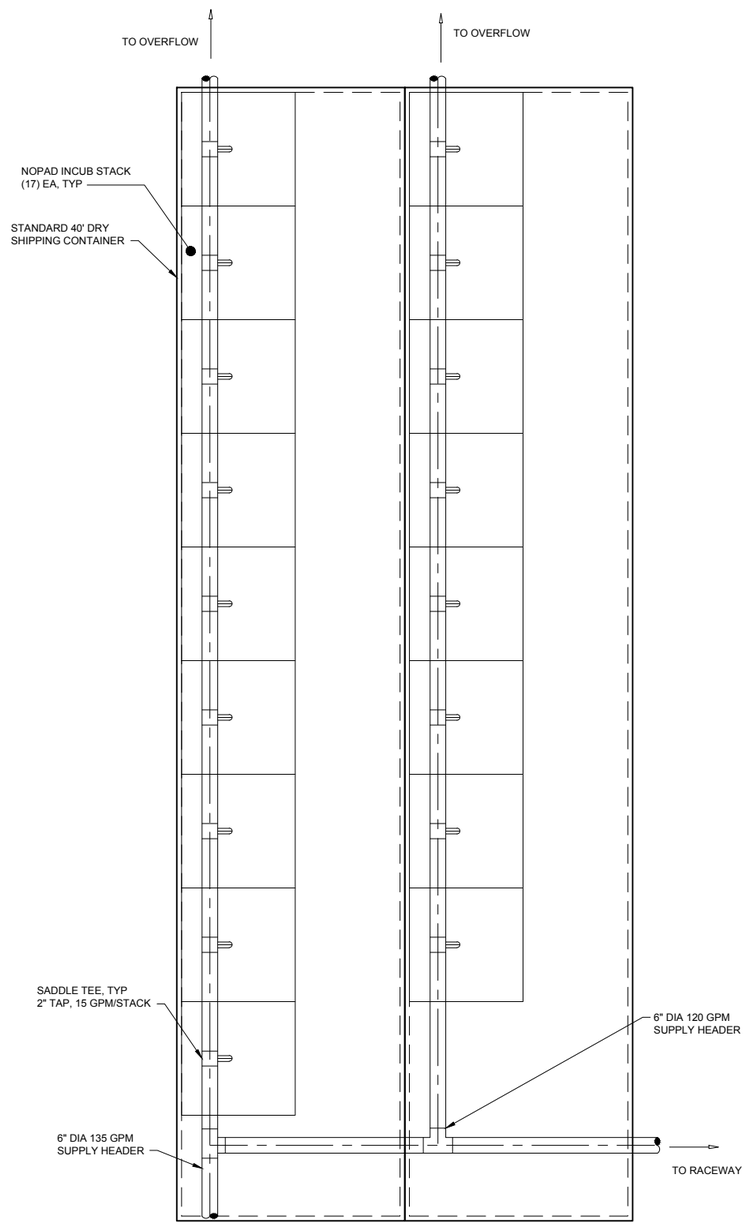
INTERIM HATCHERY CONCEPT

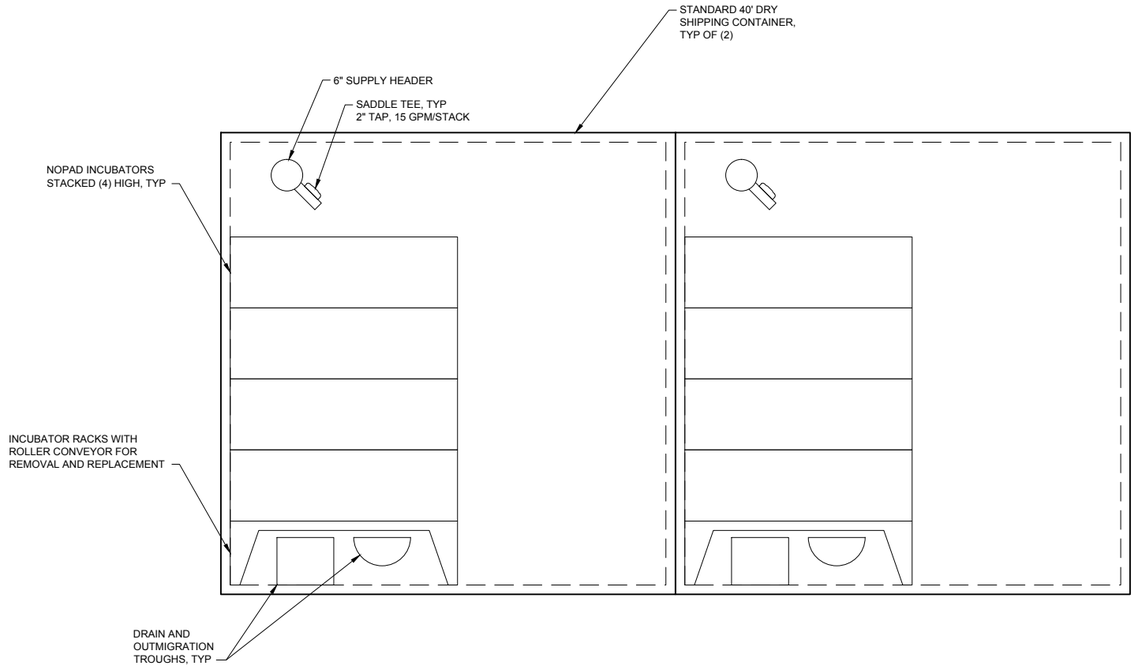
CONTAINER INCUBATION 3-6 MIL CHUM EGGS

Project No.:	
Designed By:	BPL
Drawn By:	BPL
Checked By:	DRB

SK1703

Bar Measures 1 inch





HATCHERY LAYOUT

1 CONTAINER YIELDS 6.5 MIL CHUM EGGS IN (9) 4-HIGH INCUBATOR STACKS

2 CONTAINERS YIELD 12.2 MIL CHUM EGGS IN (17) 4-HIGH INCUBATOR STACKS

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YAKUTAT REGIONAL AQUACULTURAL ASSOCIATION
YAKUTAT, ALASKA

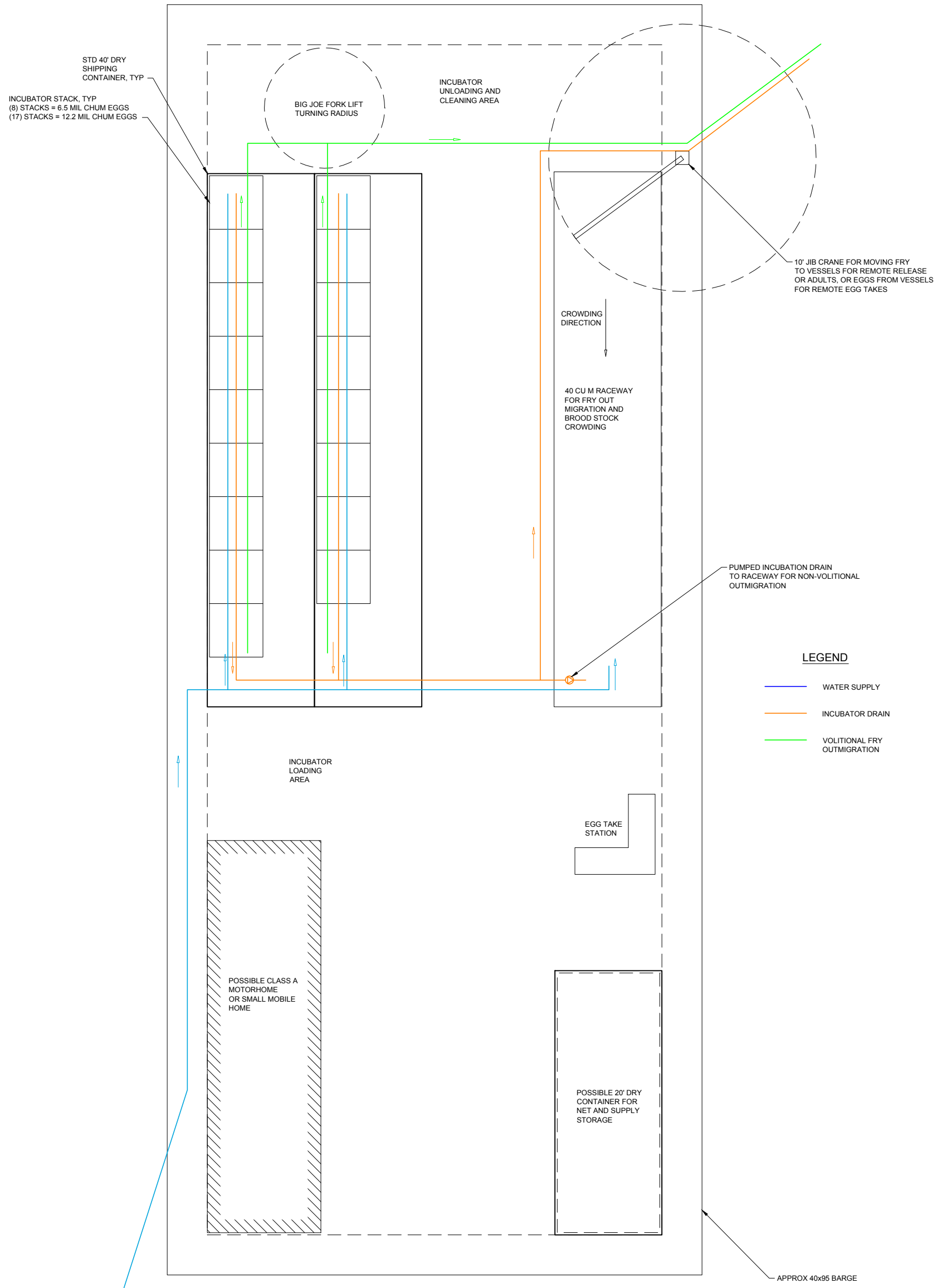
INTERIM HATCHERY CONCEPT

CONTAINER INCUBATION
6-12 MIL CHUM EGGS

Project No.:	
Designed By:	BPL
Drawn By:	BPL
Checked By:	DRB

SK1704

Bar Measures 1 inch



SK1705

Project No.:	
Designed By:	BPL
Drawn By:	BPL
Checked By:	DRB

YAKUTAT REGIONAL AQUACULTURAL ASSOCIATION
YAKUTAT, ALASKA

INTERIM HATCHERY CONCEPT

BARGE LAYOUT CONTAINER INCUBATION 6-12 MIL CHUM EGGS

MARK	DATE	DESCRIPTION	BY

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Bar Measures 1 inch

associated earth sciences incorporated

Memorandum

Date:	June 20, 2017	**Project Manager:**	Jay Chennault JWC
To:	Don Beard Tetra Tech, Inc.	**Principal in Charge:**	Charles Lindsay CSL
		Project Name:	Yakutat Regional Aquaculture Association
Address:	230 South Franklin, Suite 212 Juneau, Alaska 99801	**Project No:**	130623H002
Subject:	Puget Cove Springs Assessment – Field Data Collection		

Background

It is our understanding that the Yakutat Regional Aquaculture Association (YRAA) in Yakutat, Alaska is considering developing a new hatchery location that would support the incubation of 10- to 40-million chum and/or pink salmon eggs. To achieve these goals a consistent water source capable of approximately 200 to 800 gallons per minute (gpm) is necessary from the time period of approximately August 1st – March 15th each year. We also understand that a consistent power supply is unlikely in and around the town of Yakutat so a gravity fed water source is important.

Associated Earth Sciences, Inc. (AESI) previously assisted the YRAA in evaluating the potential water availability in sites at Redfield Cove, the West Addition Hydrant, and Broken Oar/Sawmill Cove in 2013. The YRAA is now considering a potential site at Puget Cove. Mr. Don Beard of Tetra Tech, Inc. recently visited Puget Cove and noted approximately 23 flowing seeps and springs along the shoreline into Puget Cove, and has asked AESI to help develop a field data collection program to further characterize the springs, and the potential to develop the springs as a water source to support a hatchery.

Puget Cove

Puget Cove is located approximately 1.75 miles west of Broken Oar/Sawmill Cove. In our previous evaluation of Broken Oar/Sawmill Cove we estimated the cumulative discharge from three concentrated springs was in excess of 700 gpm. Although smaller in size, Puget Cove has similar characteristics to Broken Oar/Sawmill Cove, including topography, orientation and surficial geology. In that sense, it is not surprising that abundant springs were observed along Puget Cove. However, uncertainties in the location, elevation, discharge, and seasonal fluctuation of the springs need to be evaluated to understand if the location is suitable for the YRAA's needs.

Field Data Collection Program

To evaluate these uncertainties, AESI recommends a field data collection program that includes the following elements:

1. Locate the headwaters of 2-3 of the largest spring discharges entering Puget Cove. Mark with a survey flag or stake with the date observed.

2. Establish a discharge monitoring point near the headwaters of each spring. Attempt to modify the channel to concentrate the discharge to a point where the cross section (width and depth) and velocity can be estimated to estimate discharge. Measure temperature of spring discharge.

3. Install a drive point piezometer approximately 10 feet upslope from each spring discharge. Use an inertial pump (foot valve) to develop the piezometer screen and remove fine grained material from the drive point. Measure depth down to ground water inside the piezometer.

4. Install a data logging pressure transducer in each piezometer to record the daily water level.

5. Use a rod and level to measure the elevations of each spring monitoring point, spring headwaters and top of piezometer standpipe to a common point (e.g. potential location of hatchery facility).

6. Revisit the monitoring points monthly to download the dataloggers, measure depth to ground water in the piezometers, estimate spring discharges, and mark the spring headwater location with a survey flag or stake with the date observed. Note changes in the spring headwater elevation from the previous visits.

If you have any questions, please contact Jay Chennault at (425) 250-0347.

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