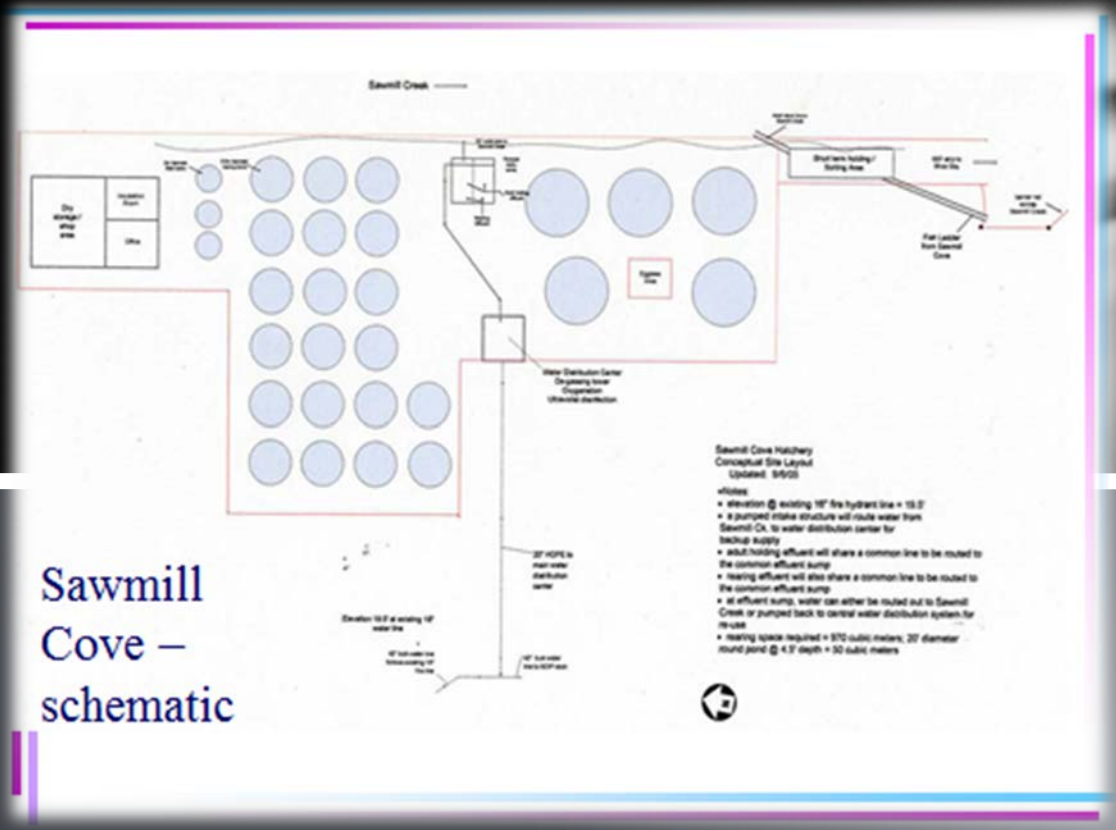
Building an Alaska salmon hatchery



Key elements in this session:

- The different types of water sources
- Name at least 5 key elements to consider when looking at a potential hatchery site
- What are “bio-criteria”?
- What is a “production plan”?

Think about it:

What are some primary considerations for LOCATION ?

1. Ocean access
2.
3.
4.
5.
6.
7.
8.
9.
10

Hatchery Site Selection Criteria

Quality and quantity of water

Consider the location and accessibility of the site.

- Ocean access if necessary
- Road access preferable
- Cost / means of remote access is necessary

Pathology of indigenous stocks

Are there wild stocks in the area that will be impacted by straying, are they using the water supply selected for the hatchery.

Who will benefit from the production?

Does the site have a good Terminal Harvest Area?

Political/social implications?

Types of water supplies

Barriered lake system

Barried lake/municipal hydro system

Non-barried lake/river system

Ground water system

Recirculation/reuse system

Barriered Lake

Pros?

1.

2.

3.

Cons?

1.

2.

3.

Barriered Lake System

- Likely the most typical in AK
- Water quality is usually good
- All have resident fish species but are not accessible by returning adults.
- Lake depth variable – affects temp
- May allow for hydro
- Costs associated with remote sites
- Probably need pressure reducing valve

Municipal water supply

Pros?

1.

2.

3.

Cons?

1.

2.

3.

Barriered Lake/Municipal Hydro

- Pipeline might be in place already
- Infrastructure nearby
- Might have cheap electricity
- Not much temp control
- Might have to pay for use of water
- Hatchery operations must be coordinated with utility operations.

Non-barriered lake/river system

Pros?

1.

2.

3.

Cons?

1.

2.

3.

Non-barriered Lake/River system

- Not a good source
- Low head pressure may require pumping.
- Resident anadromous fish may be present
- Rivers can get "interesting" during hvy rains
- Should disinfect incoming water

Groundwater system

Pros?

1.

2.

3.

Cons?

1.

2.

3.

Ground Water systems

- Well and Spring waters
- Clean and pathogen free
- Constant temperature
- Low in Oxygen?
- High in nitrogen?
- Pumping costs?

Recirculation systems

Pros?

1.

2.

3.

Cons?

1.

2.

3.

Recirculation / Reuse systems

- Can recirc close to 100% of water w/equipment
- High capital and maintenance costs
- Require maintenance/monitoring of water quality
- Dependence on equipment / increased risks

Hatchery Design – 3 golden rules

1. Don’t Shortcut the Process and make sure the engineers are on a tight leash!

2. It’s cheaper to get it right the first time!

3. Design for maximum production and then some!

Now that water supply is in place, what other stuff will we need (besides fish!)?

1.
2.
3.
4.
5.
6.
7.
8.
9.
10

Hatchery Design – items to consider at the outset

- Production Plan
- Bio Criteria
- Water Supply/Quality
- Supply Lines to Hatchery and Valve Control
- Feed Handling
- Stock Rotation – Transfers, sorting, disease treatments
- Predator Control
- Buildings – Incubation, Shop, Office, Housing
- Raceways, Circular tanks or other. Indoor/Outdoor
- Alarm Systems
- Saltwater Net Pens, Transfer system and facilities
- Fish Ladder

Production plan examples

ADFG Sportfish Hatchery Plan

TABLE 2-1: *ADF&G Bio-plan Release Schedule*

Species	Stock	Life Stage	Target Size (g)	Odd/ Even/ Every	First Release	Last Release	Production (# of fish)	Biomass (kg)
Arctic Char	Aleknagik Lake	Catchable	160	Odd	15-May	15-Jun	42,225	6,756
Sub Total							***42,225***	***6,756***
Arctic Grayling	Chena River	Catchable	120	Every	15-May	15-Jul	37,050	4,446
Sub Total							***37,050***	***4,446***
King Salmon	Any	Smolt	13	Every	15-May	1-Jul	1,050,000	13,650
	Crooked Creek	Smolt	13	Every	15-May	1-Jul	105,000	1,365
	Deception Creek	Smolt	13	Every	15-May	1-Jul	210,000	2,730
	Ninilchik River	Catchable	120	Every	23-Sep	7-Oct	-	-
		Smolt	13	Every	15-May	1-Jul	680,000	8,840
	Ship Creek	Catchable	120	Every	23-Sep	7-Oct	138,350	16,602
		Smolt	13	Every	15-May	1-Jul	525,000	6,825
Sub Total							***2,708,350***	***50,012***
Lake Trout	Summit Lake	Catchable	160	Even	15-May	15-Jun	42,225	6,756
Sub Total							***42,225***	***6,756***
Rainbow Trout	Swanson River	Fingerling	2	Every	15-Jun	1-Jul	809,500	1,619
		Catchable	120	Every	15-May	15-Aug	319,900	38,388
Sub Total							***1,129,400***	***40,007***

Medvejie Annual Production Plan

2.2	**Objective 1**
	Depending on broodstock availability, produce:
	a) 42 million @ 2.0 gram (average) chum fry for Deep Inlet - release Apr 06
	b) 10 million @ 3.5 gram (average) chum fry for Deep Inlet - release May 06
	c) 7 million @ 2.0 gram (average) chum fry for MCIF release - Apr 06
	d) 2.2 million @ .9 gram coho fry for coho lake rearing.
	Release to Deer Lake in late June, 2006.
	e) 10,000 Indian River coho smolts @ 20 grams - release May 06
	f) 10,000 Indian River coho fry for hatchery rearing - release May 07
	g) 130,000 Plotnikof Lake coho smolts @ 15g - release May 06
	h) 220,000 Plotnikof Lake coho fry - release May 07
	i) 2,000,000 @ 50 grams chinook smolts - release May 06
	j) 750,000 @ 20 grams 0 check chinook smolts - release July 05
	k) 250,000 @ 10 grams 0 check chinook smolts - release June 05
	l) 1.1 million chinook fry for hatchery rearing - release May 07
	m.) 1.0 million chinook fry for Green Lake rearing - release May 07
	n.) 1,500,000 chinook fry for zero check program - release July 06
	o.) 500,000 chinookfry for zero check program - release June 06
	p.) 100-300,000 Pink fry for Medvejie Creek mitigation - release Mar 06
	Task 1: chinook
	a) Harvest Chinook adults for cost recovery (July 05)
	b) Collect broodstock and conduct eggtakes (August 05)
	1. Individual family tracking for BKD on all eggs.
	2. utilize alternate eggtake sources if necessary to achieve 5.0 million goal
	c) Incubate eggs/fry (Aug 05 - Jan 06).
	d) Rear 1.1 million BY04 fry and smolts at MCIF (Dec 04 -- May 06)

Water supply and production plan in place……..what's next?

Bio - Criteria

Bio-Criteria

Essentials for healthy production of fish

Much depends on water quality you have to work with

Indigenous pathogens

Somewhat species and stock dependent

What biological criteria do you think are important in a water system?

Some key terms you need to know:

Density = kilograms of fish per cubic meter of rearing space

- Discuss fish weight (in grams per fish)
- Discuss kilogram
- Discuss cubic meters

Flow = liters of water into a container per minute of time

- Discuss liters, milliliters

Dissolved oxygen is expressed in milligrams of oxygen per liter of water

TAN = Total Ammonia Nitrogen

Bio – criteria examples

- Recirculation facility
- Limited rearing space facility
- Limited water supply facility

Bio Criteria – ADFG Sportfish Hatchery
This is a recirculation facility

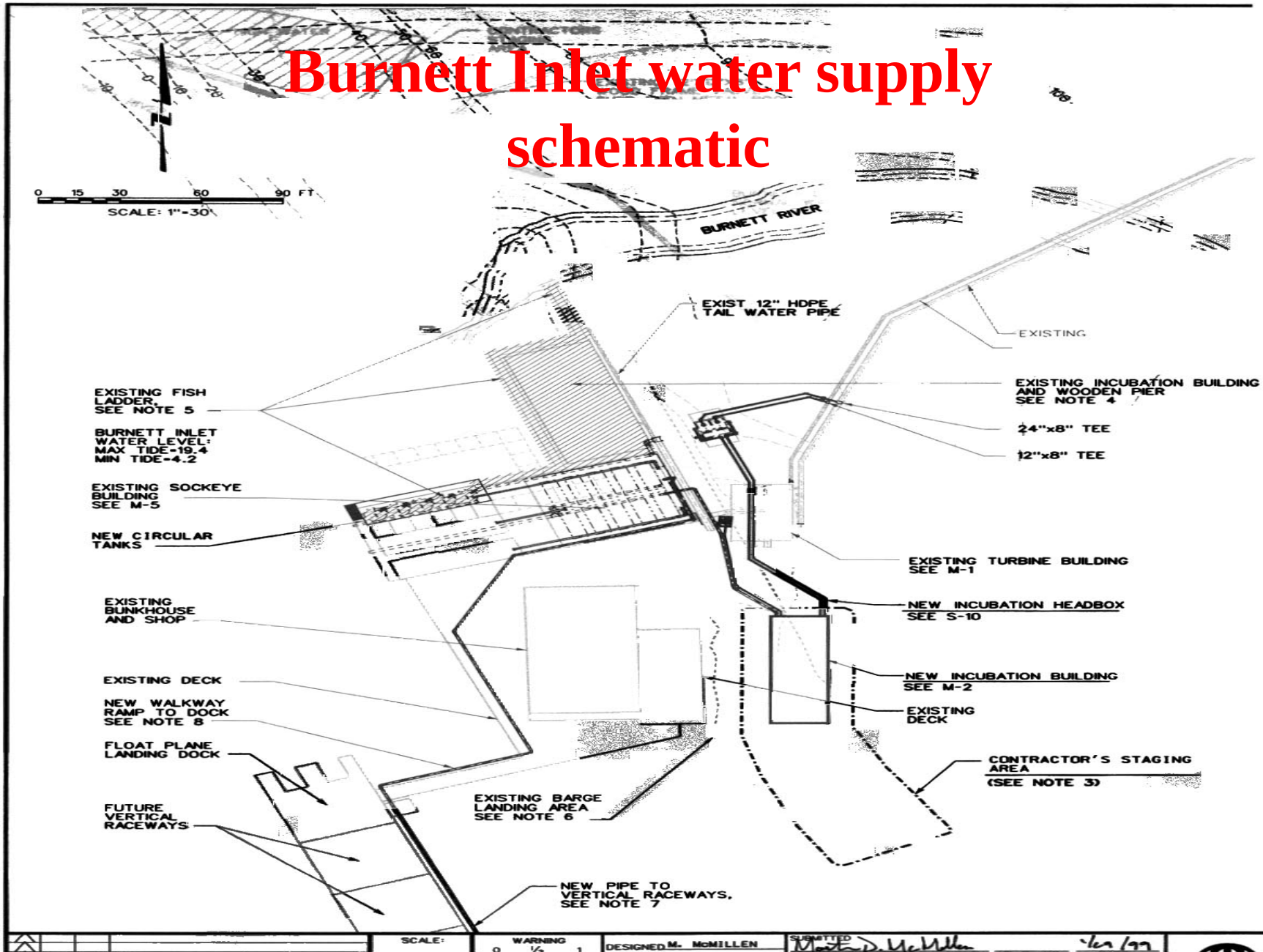
TABLE 4-1: *Summary of Feed Use Assumptions*

Species	Stock	Life Stage	Feed Rate (% of biomass per day)	Daily Feed Use (kg feed/ day)	Protein Content of Feed (%)	TAN Production Rate (g TAN/hr)
Arctic Char	Aleknagik Lake	Fingerling	2.1%	3.8	52%	7.6
		Catchable	0.6%	42.7	47%	77.0
		Brood 1.5-2	0.4%	0.9	48%	1.6
		Brood 2-3	0.2%	1.3	48%	2.5
		Brood 3-4	0.2%	1.4	48%	2.6
Arctic Grayling	Chena River	Fingerling	3.1%	4.8	52%	9.6
		Catchable	1.0%	44.6	50%	85.4
King Salmon	Crooked Creek	Fingerling	2.7%	51.9	52%	103.4
		Smolt	1.3%	105.9	47%	190.8
	Deception Ck	Fingerling	2.7%	48.6	52%	96.9
		Smolt	1.3%	99.3	47%	178.9
	Ninilchik River	Fingerling	2.7%	55.1	52%	109.8
		Smolt	1.3%	112.5	47%	202.7
	Ship Creek	Fingerling	2.7%	52.7	52%	105.0
		Smolt	1.3%	107.6	47%	193.8
	Ship Ck CAT	Fingerling	3.6%	15.7	52%	31.3
		Smolt	2.2%	40.6	47%	73.2
		Sub-catchable	1.3%	129.0	47%	232.5
		Catchable	1.3%	186.1	47%	335.3

Bio – Criteria Summer Coho – limited rearing space at Burnett

Neck Lake Coho PreSmolts/Yearlings @ Burnett Inlet									
			Summer Coho						
Date	Maximum Ambient Temp.	# Fish	Wt.	Length	Rearing Area/m3	Density Kg m3	Turnover R	Loading Kg/lpm	
June	5.5	1,850,000	0.45	3.4	140	5.9	3	0.12	
July	9.5	250,000	0.75	4.3	200	0.9	3	0.02	
August	11	250,000	2.1	5.7	50	10.5	3	0.21	
August	11	250,000	2.29	5.87	100	5.7	3	0.11	
Sept.	11	250,000	5	7.7	100	12.5	3	0.25	
Sept.	11	250,000	7.2	8.6	150	12.0	3	0.24	
October	10.2	250,000	9.1	9.4	150	15.2	3	0.30	
October	8.6	250,000	10	9.7	150	16.7	3	0.33	
November	6	250,000	11	9.9	150	18.3	3	0.37	
December	3	250,000	11	9.9	200	13.8	3	0.28	
Jan - March	3	250,000	12	10.3	200	15.0	3	0.30	
April - May	5	250,000	14	10.8	240	14.6	3	0.29	

Burnett Inlet water supply schematic

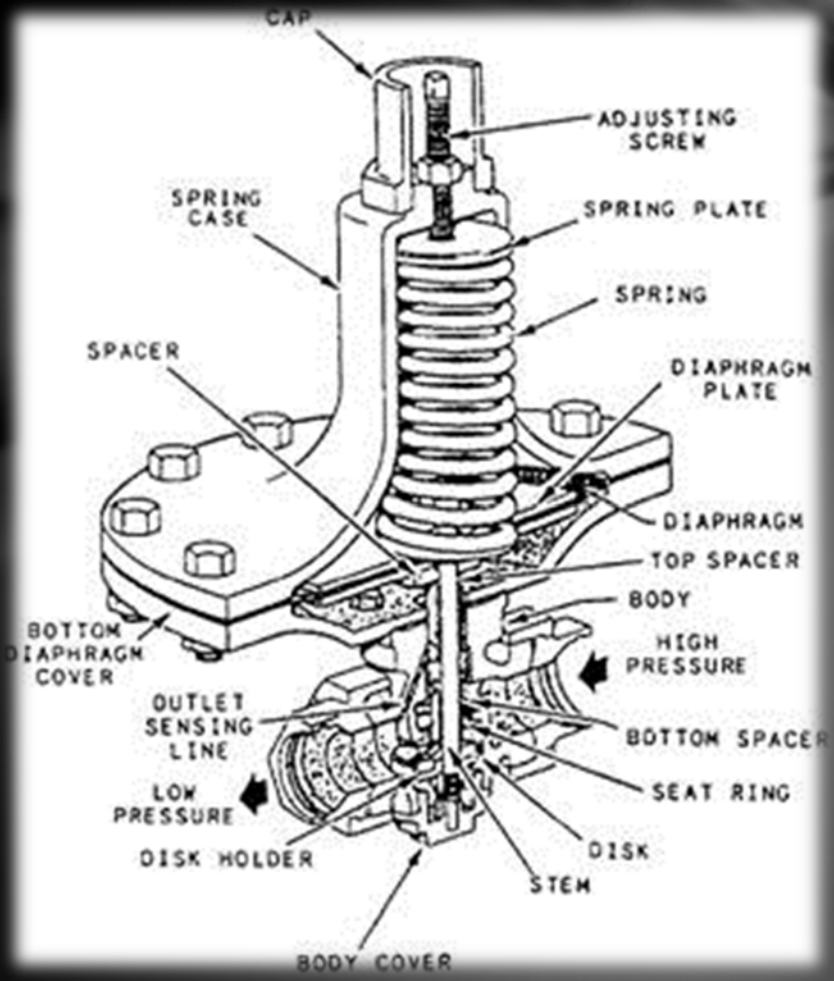


Burnett Inlet water supply

Control valves for penstock

Valve control at hatchery

- Pressure Reduction – why is this necessary?
- Hydro Power
- Distribution valves to route water



Burnett Inlet

Barriered Lake

Penstock 1 or 2, Intake structure

Burnett Saltwater Rearing - Net Pens

Burnett - Future Seas Sea Bags

Burnett - Fish Ladder

Bio – Criteria: Sawmill Cove Limited water supply

Updated:	6/6/2005								
Sawmill Cove Hatchery - Annual Water Usage									
			Rearing			Long Term AH			Monthly
Month	Incubation	# units	gpm/unit	total	# units	gpm/unit	total	Short Term AH	Total GPM
January	100	12	340	4080					4532
February	100	12	340	4080					4532
March	100	12	340	4080					4532
April	100	12	340	4080					4532
May		4	340	1360					1704
June		4	340	1360					1704
July		4	340	1360	3	680	2040	1000	5427
August		8	340	2720	3	680	2040	2000	7791
September		8	340	2720	6	680	4080	2000	9834
October		8	340	2720	6	680	4080		7834
November	100	8	340	2720	4	680	2720		6572
December	100	12	340	4080					4532
Parameters									
Incubation =	14 Heath trays @ 7gpm								
Rearing =	4 - 30'x4' round ponds, 2#/cu.ft. max, R=1 for fish from ponding to 4g								
	8 - 30'x4' round ponds, 2#/cu.ft. max, R=1 for fish from 4g to 8g								
	12 - 30'x4' round ponds, 2#/cu.ft. max, R=1 for fish from 8g to 12g								
Long Term Holding =									
	Total of 6 round ponds, 2#/cu.ft. max, R=2, phased in as adults return								
Short Term Holding =									
	1 - 50'x12'x4' raceway to receive/sort new fish, max 1500 fish, R=2								
	2 - 50'x12'x4' raceways to hold fish for processing, max 3,000 fish, R=2								

CITY AND BOROUGH OF SITKA
DECEMBER 2, 1971

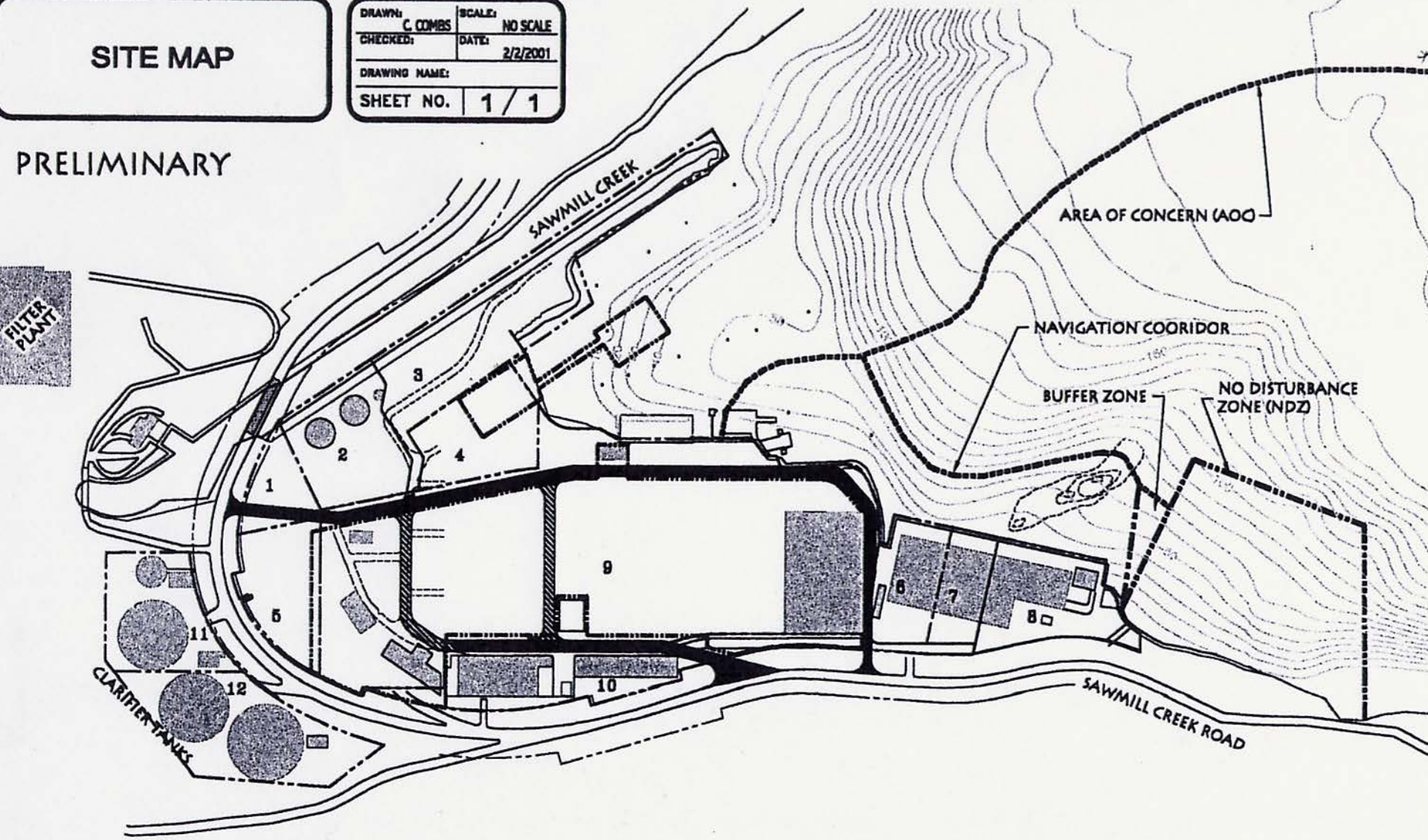
Sawmill Cove
INDUSTRIAL PARK

4600 SAWMILL CREEK ROAD SITKA, ALASKA 99835
TEL (907) 747-2219 FAX (907) 747-2268

SITE MAP

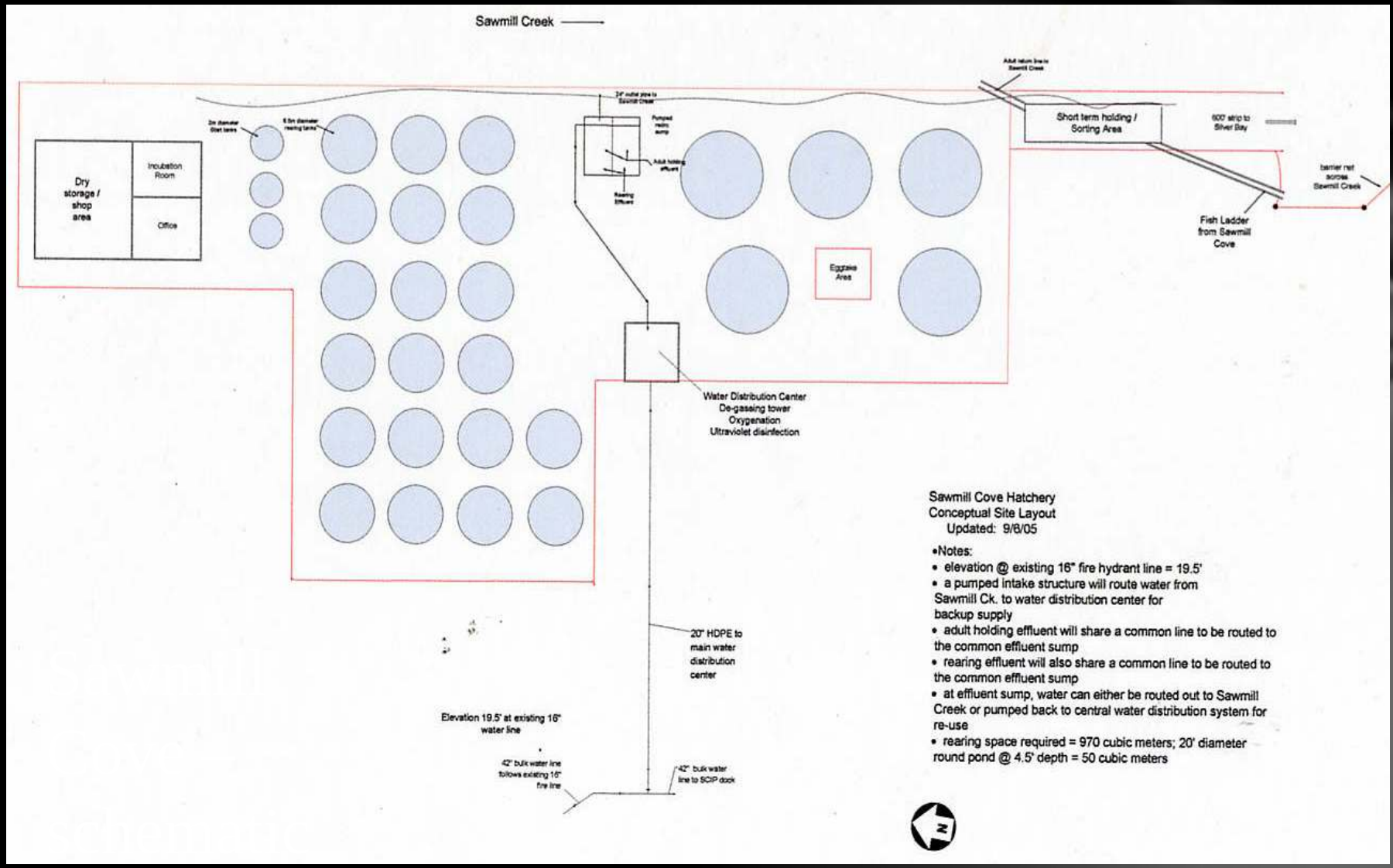
DRAWN: C. COMBS	SCALE: NO SCALE
CHECKED:	DATE: 2/2/2001
DRAWING NAME:	
SHEET NO.	1 / 1

PRELIMINARY



Sawmill Cove Hatchery Design

- Soil suitability for building – had to be assessed
- Road and utilities access are good
- Adjacent system an issue
- Shared water system with City of Sitka
- Effluent discharge location an issue
- Coho stock was an issue – impact on wildstocks



Sawmill Cove Hatchery
Conceptual Site Layout
Updated: 9/6/05

•Notes:

- elevation @ existing 16" fire hydrant line = 19.5'
- a pumped intake structure will route water from Sawmill Ck. to water distribution center for backup supply
- adult holding effluent will share a common line to be routed to the common effluent sump
- rearing effluent will also share a common line to be routed to the common effluent sump
- at effluent sump, water can either be routed out to Sawmill Creek or pumped back to central water distribution system for re-use
- rearing space required = 970 cubic meters; 20' diameter round pond @ 4.5' depth = 50 cubic meters

Other sites:

Layout

Water supply

Bio-criteria

Crystal Lake Hatchery

Production

- 1.1 million chinook
- 100,000 coho

Water Supply

- Low head after power generation from hydro plant for Petersburg.
- Cold water – hard to meet production goals

Physical Plant

- O2 generation
- Excellent layout for stock separation, many small rearing containers.


Crystal Lake back-up water supply

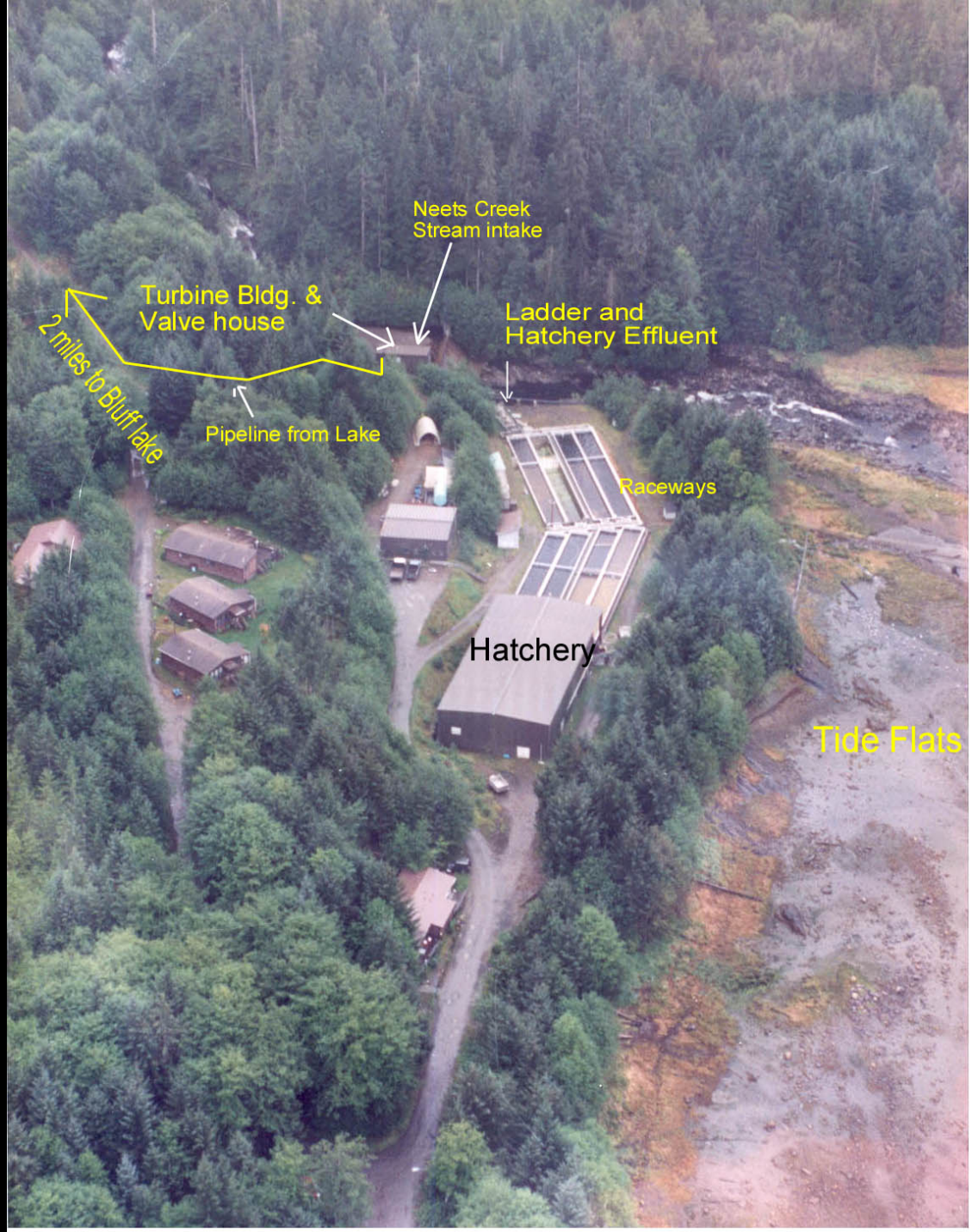

Crystal Lake uses raceways and circulars
Why might you use one over the other?


Crystal Lake circulars – note
the automatic feeders

Crystal Lake – dealing with winter weather, supersaturation and oxygen


Crystal Lake – reuse pumps

Neets Bay


Neets Creek
Stream intake
Turbine Bldg. &
Valve house
2 miles to Bluff lake
Pipeline from Lake
Ladder and
Hatchery Effluent
Raceways
Hatchery
Tide Flats

Neets – turbine generator


You've seen this photo a few times. Now look at the Big Picture – what items are incorporated to meet production goals?
1B
1A


How does this equipment help meet production goals?

Fish ladders – various styles, sizes, lengths. Why?


New ladder in place

Medvejie Hatchery and watershed – a perfect example of the need for planning

- Good example of planning for growth
- Production goals are dynamic
- Groundwate r supply!
- City power
- Road access
- No indigenous pathogens
- Stretching water supply

Review – Elements of Successful Program

Production does not adversely impact wild stocks.

- Genetics Policy

Does not complicate management of existing fisheries.

- Salmon Escapement Goal Policy
- Policy for Management of Mixed Stock Salmon Fisheries

Water source is clean and abundant, meets minimum water quality standards developed by ADFG.

Evaluate site for construction costs.

Site and water supply allow for future expansion.

Location provides suitable terminal harvest area for hatchery operator.

Assignment 9 – site selection

- What is the Production Goal for your facility? You can very likely find this on their website or just ask…….What are they trying to accomplish?
- Where is the site located? Near a town, remote, what community? Accessible by vehicle or do they have to barge everything in?
- What is the water source (use one of the examples listed in this session)