Kalispel Tribe of Indians

Coldwater Hatchery Conversion

Hatchery Feasibility Study

Prepared For: Kalispel Tribe of Indians
Natural Resources Department

Prepared By: McMillen, LLC

MCMILLEN, LLC

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ABBREVIATIONS AND ACRONYMS

BAMP	Biological Assessment and Management Plan
BOR	U.S. Bureau of Reclamation
BPA	Bonneville Power Administration
cfs	cubic feet per second
COE	U.S. Army Corps of Engineers
CRITFC	Columbia River Inter-Tribal Fish Commission
cu ft	cubic feet
CWT	Coded wire-tag
DART	Data Access in Real Time
DI	Density Index
DPS	Distinct Population Segment
EA	Environmental Assessment
EDT	Ecological Diagnosis and Treatment
EIS	Environmental Impact Statement
EMAP	Environmental Monitoring and Assessment Program
EPA	Environmental Protection Agency
ESA	Endangered Species List
ESU	Ecologically Significant Unit
FCRPS	Federal Columbia River Power System
FI	Flow Index
fpp	fish per pound
fps	feet per second
ft	feet
FWP	Fish and Wildlife Program
gpm	gallons per minute
HGMP	Hatchery Genetics Management Plan
HOR	Hatchery origin
HSRG	Hatchery Scientific Review Group
ICTRT	Interior Columbia Technical Recovery Team
ISRP	Independent Scientific Review Panel
KTOI	Kalispel Tribe of Indians
LWD	large woody debris
M&E	Monitoring and evaluation
MOA	Memorandum of Agreement
MPG	Major Population Group
NMFS	National Marine Fisheries Service
NOAA Fisheries	National Oceanic and Atmospheric Administration – Fisheries
NPCC	Northwest Power and Conservation Council
NPDES	National Pollution Discharge Elimination System
NOR	Natural origin
PCD	Predation, competition, disease
pHOS	Number of hatchery fish present on the spawning grounds
PIT	Passive Integrated Transponder
PNI	Proportion of Natural Influence
PUD	Public Utility District

pNOB	Proportion of Natural Origin Broodstock
RAMP	Risk Assessment Modeling Project
RM	River mile
RRS	Relative reproductive success
RTT	Regional Technical Team
sq ft	square feet
SRFB	Salmon Recovery Funding Board
SS	Settleable Solids
TRBT	Triploid Rainbow Trout
TRMP	Tribal Resources Management Plan
TSS	Total Suspended Solid
UCR	Upper Columbia River
UCRTT	Upper Columbia Regional Technical Team
USACE	U.S. Army Corps of Engineers
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
WCT	Westslope Cutthroat Trout
WDOE	Washington Department of Ecology
WDFW	Washington Department of Fish and Wildlife

GLOSSARY

Abiotic	independent of life and living things, e.g. chemical and physical factors which affect the ability of organisms to live are "abiotic" factors
Acclimation	the processes by which hatchery fish are accustomed to the natural waters into which they will be released
Biotic	having to do with life and living things
Broodstock	adult fish used by hatcheries to propagate the next generation of fish
Outplants	hatchery fish released into natural streams or lakes
Loci	places or positions; in genetics, the positions of genes are called "loci"
Residualization	fish which remain in place and do not migrate
Restoration	returning habitat to conditions necessary to support healthy fish populations
Sub-watershed	the system of tributary streams within a watershed of a major river
Supplementation	using hatchery-bred fish to augment fish populations in rivers and streams

EXECUTIVE SUMMARY

The Kalispel Tribe of Indians (KTOI) have identified the need to study the feasibility of converting the existing largemouth bass warm water fish hatchery at Flying Goose Ranch to a coldwater fish hatchery. The hatchery is located ½ mile inland from the right bank of the Pend Oreille River, approximately 8 miles north of Usk Washington. Native trout and anadromous fish populations in the Pend Oreille River watershed have had a long history of decline beginning with the construction of Box Canyon Dam hydroelectric project in the 1950's. Bonneville Power Administration (BPA), funded the existing bass hatchery as mitigation for loss of anadromous fish in the 1990's. Illegally planted Northern Pike have recently out competed the largemouth bass in the Pend Oreille River resulting in declines in the bass populations. The conversion of the warm water facility to coldwater harvest and conservation programs is consistent with long term tribal goals to restore the health of indigenous Westslope Cutthroat Trout (WCT) populations basin wide, while also providing mitigation for lost harvest opportunities via a Triploid Rainbow Trout (TRBT) program. This study has determined that it is feasible to convert the existing hatchery to a coldwater hatchery that would support both of the proposed harvest and conservation aquaculture programs.

The harvest program intends to rear TRBT in batches of 200 to 400 fish with sequenced releases approximately 3 months apart, for a total of 4 releases per year. KTH proposes to experiment with fish release sizes from 8-inch length (5 fish per pound), up to 16-inch length (1 fish per pound). One release site has been identified at an existing spring fed pond located on tribal property at Indian Creek, near it's confluence with the Pend Oreille River.

The conservation aquaculture program would be based on restoring populations of genetically pure WCT in small streams located in local watersheds. This effort will require collection of native broodstock from these streams prior to treating them to remove hybridized and non-indigenous species. The broodstock will then be spawned in two successive years and then returned, along with progeny to the stream of origin.

Biological criteria were developed to define aquaculture parameters for fish production including, numbers of fish and eggs by life stage, timing of fish development, fish holding, incubation and rearing vessel requirements, growth rate targets, and related water quality and supply flow rates. This criteria is then incorporated into a preliminary hatchery operations schedule which in turn were used to develop detailed infrastructure requirements for the proposed aquaculture programs. Peak water supply flows of approximately 160 gpm (without reuse) of both surface water and groundwater were established in order to meet production goals. Water reuse technology enabling a 50% reduction in supply flows is planned. In order to reliably achieve these flow rates, the surface water pumpstation will need to be re-built so that motors and electrical gear are above flood levels, and one to two new groundwater wells constructed.

Based on site visit evaluations, biological criteria and alternatives analysis, the following modifications and improvements were identified for converting the existing hatchery to coldwater fish production:

- Increase groundwater supply by constructing 1 to 2 additional wells into the existing shallow aquifer. Consider installing a lower head higher capacity pump in the existing well and adding a small booster pump to provide potable water pressure at a lower flow rate.
- Provide a degassing and storage headbox for the groundwater supply.
- Re-build the surface water pumpstation in the existing footprint if possible.
- Construct a back-up surface water pumpstation that can be connected to emergency power.
- Provide the capability to blend surface water and groundwater using an automated set-point controller system in order to mimic natural stream temperatures for the WCT program.

- Re-configure existing indoor space for the incubation, broodstock holding, and juvenile fish rearing facilities.
- As a minimum, incorporate serial reuse to reduce peak water demands. If budgets allow, incorporate airlift pump water reuse methods.
- Add a duplex air blower system to replace the single existing unit, sized to run airlifts and/or air stones in all rearing vessels.
- Optimize the process water treatment systems, especially the surface water treatment equipment to ensure reliable supply of silt free, disinfected water to fish holding and rearing vessels.
- Provide for adjustable timer based photo-period lighting controls in the WCT areas in order to minimize the effects of domestication.
- Improve monitoring and alarm, and back-up power systems.

Two construction cost scenairos, were developed based on discussions with KTOI. One option is to use an existing lower hatchery building for both the TRBT production and for WCT broodstock holding, with the upper hatchery building dedicated to WCT incubation and rearing. This option is labeled the decentralized WCT option. A second option is to add a 900 square foot extension to the north end of the upper hatchery building to house the WCT broodstock program. This option would centralize the WCT program in the upper hatchery building. Tables ES-1 and ES-2 show conceptual construction cost estimates of these two options.

Table ES-1. Decentralized WCT Program – Conceptual Construction Cost Summary

Item	Cost
Division 01 - General Requirements	$79,350
Division 02 - Existing Conditions	$20,700
Division 03 - Concrete	$50,313
Division 05 - Metals	$17,250
Division 06 - Wood and Plastic	$31,602
Division 07 - Thermal and Moisture Protection	$3,450
Division 08 - Openings	$5,750
Division 09 - Finishes	$3,450
Division 10 - Specialties – Well Drilling	$57,500
Division 11 - Equipment	$235,428
Division 26 - Electrical	$187,450
Division 31 - Earthwork	$12,650
Division 33 - Utilities	$23,000
Division 40 - Instrumentation and Controls	$27,600
Division 42 - Process Water Systems	$92,863
Division 43 - Mechanical	$24,495
Construction Total - 2014 Dollars	$872,850
Contractor Overhead and Profit 16%	$139,656
2014 Project Cost	$1,012,506
Escalation to 2015 Mid-Point of Construction at 3%	**$1,042,881**
Accuracy Range +35%	$1,303,601
Accuracy Range -15%	$886,449

Table ES-2. Centralized WCT Program - Conceptual Construction Cost Summary

Item	Cost
Division 01 - General Requirements	$95,163
Division 02 - Existing Conditions	$20,700
Division 03 - Concrete	$64,113
Division 05 - Metals	$17,250
Division 06 - Wood and Plastic	$31,602
Division 07 - Thermal and Moisture Protection	$3,450
Division 08 - Openings	$11,500
Division 09 - Finishes	$3,450
Division 10 - Specialties – Well Drilling and PEMB	$119,600
Division 11 - Equipment	$279,128
Division 26 - Electrical	$212,175
Division 31 - Earthwork	$12,650
Division 33 - Utilities	$23,000
Division 40 - Instrumentation and Controls	$27,600
Division 42 - Process Water Systems	$100,913
Division 43 - Mechanical	$24,495
Construction Total - 2014 Dollars	$1,046,788
Contractor Overhead and Profit 16%	$167,486
2014 Project Cost	$1,214,274
Escalation to 2015 Mid-Point of Construction at 3%	**$1,250,702**
Accuracy Range +35%	$1,563,377
Accuracy Range -15%	$1,063,096

Conceptual program costs for planning and design, environmental compliance, and operations and maintenance were also developed as summarized in Tabel ES-3 for the higher cost option.

Table ES-3. Centralized WCT Program - Project Cost Summary

Program Area	Conceptual Costs
Planning and Design	$120,000
Construction	$1,250,700
Capital Equipment	$10,000
Environmental Compliance	$30,000
Operations and Maintenance	$260,000
Research, Monitoring & Evaluation	$100,000
Total – One Time (Excludes RME and O & M)	$1,410,700

SECTION 1
INTRODUCTION

1.0 Purpose of the Feasibility Study

The Kalispel Tribe of Indians (KTOI) have identified the need to study the feasibility of converting an existing largemouth bass warm water fish hatchery at Flying Goose Ranch to a coldwater fish hatchery. The hatchery is located ½ mile inland from the right bank of the Pend Oreille River, approximately 8 miles north of Usk Washington. The proposed coldwater hatchery would support both harvest and conservation aquaculture programs. This study analyzes the feasibility of the cold water conversion and develops fish production options and related hatchery improvement alternatives for potential implementation.

1.1 Authorization

McMillen LLC (McMillen) was retained by KTOI to provide technical services for the Hatchery Feasibility Study, per the agreement authorized on April 14, 2014.

1.2 Program Need and Justification

Native trout and anadromous fish populations in the Pend Oreille River watershed have had a long history of decline beginning with the construction of Box Canyon Dam hydroelectric project in the 1950's. Bonneville Power Administration (BPA), funded the existing bass hatchery as mitigation for loss of anadromous fish in the 1990's. Illegally planted Northern Pike have recently out competed the largemouth bass in the Pend Oreille River resulting in declines in the bass populations.

The conversion of the warm water facility to coldwater harvest and conservation programs is consistent with long term tribal goals to restore the health of indigenous WCT populations basin wide, while also providing mitigation for lost harvest opportunities via the TRBT program.

The proposed KTOI WCT program may also be able to support other native fish recovery programs that are underway in the watershed, including the Seattle City Light conservation aquaculture program and a variety of resident fish passage and habitat improvements being implemented by Pend Oreille PUD.

1.3 Document Overview and Organization

The feasibility study describes the existing infrastructure at the hatchery, provides several hatchery production alternatives for harvest and conservation aquaculture programs, and provides conceptual design and cost estimating of needed infrastructure improvements. The major study sections and intended purpose are presented in Table 1-1.

Table 1-1. Document Organization and Purpose

Section	Description	Purpose
1	Introduction	Summarizes the project authorization, background, purpose and scope.
2	Overview of Program Goals and Existing Conditions	Summarizes proposed programs, and program justification, goals and objectives.
3	Biological Criteria and Operations Schedules	Provides detailed biological requirements for aquaculture programs along with preliminary water budgets for hatchery operations over full rearing cycles.
4	Conceptual Design of Proposed Coldwater Aquaculture Facilities	Provides a conceptual description of aquaculture and related facilities necessary to support the proposed program.
5	Conceptual Cost of Proposed Program	Provides comparative analysis of program alternatives, including capital and operating costs along with biological considerations.
6	Conclusions	Presents the preferred alternative(s) for further study and implementation.
7	References	Provides list of referenced published documents used in the study preparation.
Appendices		
A	Original Design Drawings	From 1995 Design Report
B	Water Supply Data	Includes water quality and related supply information.
C	Cost Estimate Details	Presents cost estimating take-offs and unit price basis used in the analysis.

SECTION 2
OVERVIEW OF PROPOSED PROGRAMS AND EXISTING CONDITIONS

2.0 Goals and Objectives

If feasible, the Kalispel Tribe intends to convert the existing Kalipsel Tribal Hatchery (KTH), a warm-water largemouth bass hatchery at Flying Goose Ranch, into a coldwater hatchery to support tribal harvest and conservation aquaculture. This re-purposing will support tribal objectives to maintain harvest opportunities with fast-growing non-reproducing triploid rainbow trout (TRBT) and to begin restoration and recovery efforts for indigenous westslope cutthroat trout (WCT) populations. Largemouth bass will be phased out.

2.1 Harvest Program

The harvest program intends to rear TRBT in batches of 200 to 400 fish with sequenced releases approximately 3 months apart, for a total of 4 releases per year. KTH proposes to experiment with fish release sizes from 8-inch length (5 fish per pound), up to 16-inch length (1 fish per pound). One release site has been identified at an existing spring fed pond located on tribal property at Indiam Creek, near it's confluence with the Pend Oreille River.

2.2 Conservation Aquaculture Program

The conservation aquaculture program will be based on restoring populations of genetically pure WCT in small streams located in local watersheds. This effort will require collection of native broodstock from these streams prior to treating them to remove hybridized and non-indigenous species. The broodstock will then be spawned in two successive years and then returned, along with progeny to the stream of origin.

2.3 Existing Hatchery Infrastructure

The existing largemouth bass hatchery is located on the right bank of the Pend Oreille River, approximately 9 miles north, (downstream) of Usk, Washington. Major facility components are shown in Figure 2-1 and include:

- A surface water intake and pipeline located in the Pend Oreille River;
- A two stage surface water pumpstation located on the right bank of the river;
- A 2,500 foot long 6-inch diameter pumped surface water supply pipeline from the pumpstation to treatment facilities in the upper hatchery building;
- Surface water treatment facilities including a packed column aeration, rotating drum screen, UV disinfection, bead filtration, and water heating located on two levels in the upper hatchery building;
- A 32 x 60-foot, 1,920 square foot upper hatchery building configured for early rearing that houses four 2'-4" wide, 24 foot long fiberglass rearing troughs and the treatment equipment noted above;
- A 30 x 80-foot, 2,400 square foot lower hatchery building that houses two 9'-4" wide x 60' long concrete raceways for bass grow-out;
- Three trapezoidal shaped outdoor rearing ponds, 0.2 to 0.35 acres of surface area with outlet control/ harvest kettle structures;
- A wetlands effluent treatment system;

- An 80 gpm groundwater well that provides potable water and limited amounts of high quality groundwater at 48 to 51 degrees F, to hatchery incubation and rearing facilities;
- A low pressure air blower and piped distribution system to airstones located in rearing vessels for emergency oxygenation and water quality improvement;
- A 30 kw propane fired emergency power generator with a 500 gall propane fuel tank;
- Support buildings including a manager's residence, shop building, office (old garage),and pole barn.

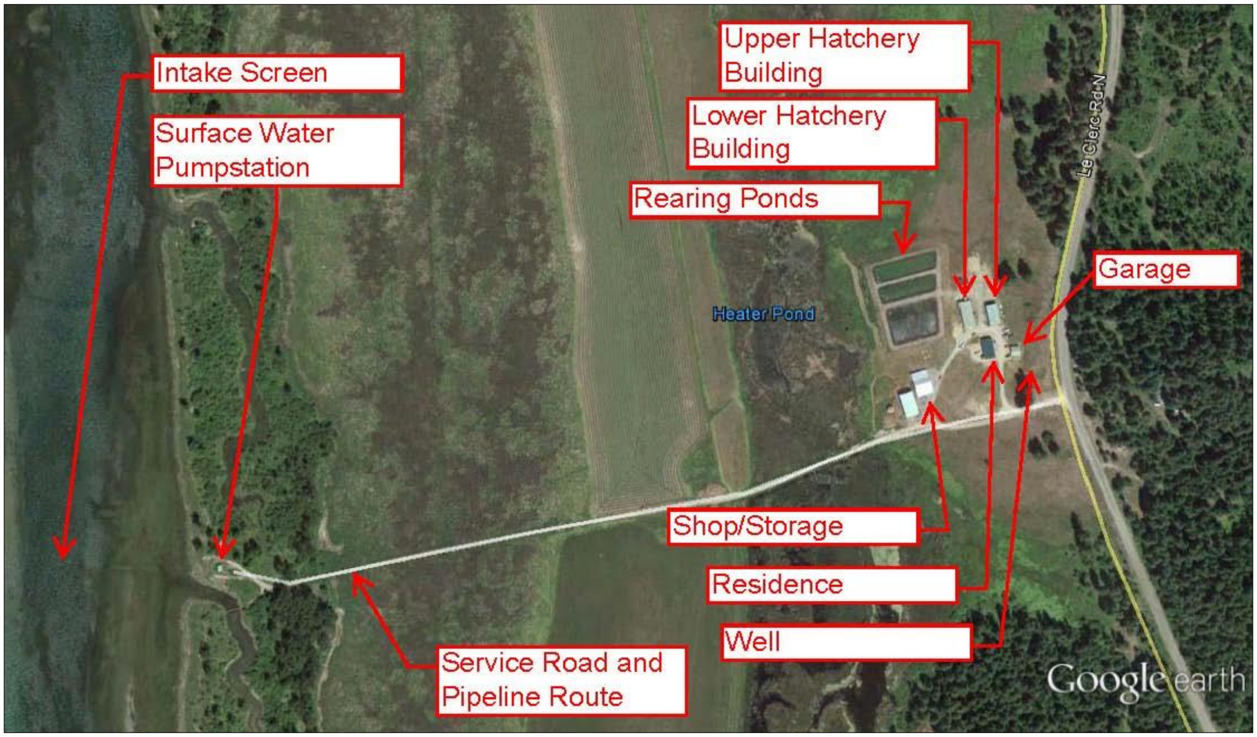

Figure 2-1. Existing Kalispel Tribal Hatchery

It is anticipated that much of the existing infrastructure will be incorporated into the proposed cold water hatchery with some high priority modifications and upgrades. There are significant reliability problems with the surface water intake and pumpstation that will need to be corrected, including raising the pump motors and electrical panels to be above flood elevations, and resolving siltation problems. The groundwater well discharge piping needs to be upsized to accommodate flow available. One to two more wells are recommended to provide a redundant supply to meet peak demands and provide back-up in case of mechanical failure.

2.4 Hydraulic Profile

The existing hydraulic profile of the surface water supply system begins with an intake screen approximately 300 feet offshore in the Pend Oreille River. The screen is a metal fabricated cylinder attached to a vertical 10-inch diameter pipe elbow and supported in place by a concrete anchoring system. The original design drawings indicate a normal river level of 2031, which varies seasonally and depends on hydropower operations as well. An 8-inch HDPE pipe connects from the intake structure to the pumpstation sump on the right bank of the river. A silt barrier develops every year inside the sump creating a variable amount of head loss. The floor elevation of the pumpstation is at elevation 2037.

During flood events the river level has been 5 to 6 feet above this floor elevation for periods as long as 1 to 2 months, which creates a significant electrical hazard and water supply reliability problems.

The pumpstation uses double pumping to boost water to the hatchery. Duplex 1.5 horsepower submersible low head pumps located in a deep concrete sump were designed to lift the water only enough to supply sloughs along the river channel and to supply the 6-inch suction manifold to higher head end suction centrifugal pumps. The higher head pumps supply water via a 6-inch transmission pipeline through a bead filter in the upper hatchery building then up to the degassing equipment on the mezzanine level of elevation of 2071.0 in the upper hatchery building. The high point in the piping system at the degasser is approximately elevation 2079.0. The surface water supply is gravity fed from the degassing headbox at elevation 2073 through a drum screen and UV disinfection process and then on to rearing facilities. The water surface elevations in the upper hatchery rearing troughs is 2063.5. The lower hatchery building raceways have a water surface elevation of approximately 2060.5

The outdoor rearing ponds have a water surface elevation of 2048 and bottom elevation of 2045. The hatchery outfall daylights into a large wetlands area at elevation 2043.

SECTION 3
BIOLOGICAL CRITERIA AND OPERATIONS SCHEDULES

3.0 Biological Criteria and Operations Schedules

Biological criteria has been developed to define aquaculture parameters for fish production including, numbers of fish and eggs by life stage, timing of fish development, fish holding, incubation and rearing vessel requirements, growth rate targets, and related water quality and supply flow rates. This criteria is then incorporated into a preliminary hatchery operations schedule which in turn will be used to develop detailed infrastructure requirements for the conservation aquaculture program. Understanding the operations schedule is critical because it drives the water requirements and determines space requirements for incubation, early rearing, and juvenile rearing improvements for each aquaculture program.

3.1 Aquaculture Programs

The feasibility analysis is based on TRBT and WCT production programs described in more detail in the following sub-sections.

3.1.1 Harvest Program – Triploid Rainbow Trout

The triploid rainbow trout (TRBT) program will support a tribal harvest program. These fish will be reared from eyed eggs, fry, or fingerlings purchased from commercial vendors, in small batches of approximately 400 fish at a time. A new batch of fish will be started every 3 months to produce approximately 4 release events per year. The purchased fish will be placed directly into rearing units and reared until reaching a release size of 8 to 16-inches. Total TRBT production will be approximately 1,500 pound per year.

3.1.2 Conservation Program – Westslope Cutthroat Trout

The westslope cutthroat trout (WCT) program will be based on recovery of this indigenous species in local streams. Once a stream is selected for recovery, a salvage operation will be conducted to collect genetically pure 3 to 5 year old adult fish for placement into a captive broodstock program. The selected stream will then be piscicide treated annually for three years to remove hybridized and non-native fish species. In the meantime, the captive broodstock will be spawned in two successive years to create two age classes of progeny. At the end of the second year, the brood fish and age 0 and age 1 progeny will be outplanted back to the stream of origin as shown in Table 3-1 (Courtesy of Kalispel Tribe).

Table 3-1. Proposed Westslope Cutthroat Recovery Schedule

Population	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Stream 1	Fall salvage/ 1st treatment	Spring spawn fall 2nd treat	Spring spawn fall 3rd treat	Spring release brood and age 1,2 offspring		
Stream 2		Fall salvage/ 1st treatment	Spring spawn fall 2nd treat	Spring spawn fall 3rd treat	Spring release brood and age 1,2 offspring	
Stream 3			Fall salvage/ 1st treatment	Spring spawn fall 2nd treat	Spring spawn fall 3rd treat	Spring release brood and age 1,2 offspring

The facility will be planned to support up to three WCT stream restoration projects at a time. The number of broodstock collected may vary significantly depending on the size, existing population and estimated carrying capacity of specific streams. For the purposes of this feasibility study, a collection goal of up to 300 adult fish per stream has been used, along with a production goal of 8,000 juvenile fish per age class.

Experimental rearing of wild cutthroat at other similar facilities indicates that wild fish have difficulty transitioning to hatchery food when they are brought into captivity, and that hatchery survival rates are initially low. Also, a percentage of the wild fish may need to be sacrificed for disease testing and other quality assurance measures. Survival can be improved by supplementing feedings with natural foods (e.g. mealworms, earth worms, grasshoppers) during this transition period. Individuals that learn to eat pelleted food early gain a growth advantage, and wild cutthroat grow at very different rates, so they must be separated into two or more size classes to reduce food competition. Natural food supplements should be terminated for a week to 10 days before fish are separated by size to clearly differentiate which fish have transitioned to hatchery pellets, so they can be weaned from natural foods. The smaller fish continue to receive natural food supplements until they adjust.

Tank shape and sizes for juvenile rearing have advantages and disadvantages. Circular tanks 4 to 6 ft. diameter are self-cleaning, so offer an advantage for maintenance, but the fish tend to be more aggressive and fin nipping occurs at a greater frequency. Rectangular tanks must be cleaned more often, but fish spread out, set up their own areas and become less aggressive. Cleaning rectangular tanks or troughs provides the fish culturists with information on the ratio of fish waste to uneaten food, which is valuable for fine-tuning feeding levels. Multiple small tanks will be needed to keep donor populations separated.

The broodstock salvage operation will begin in the fall each year, followed by the first spawning event in the spring of the next year. Incubation will occur in April through June in vertical stacks of incubator trays. In July, fry will be ponded into small fiberglass circular tanks or troughs. Adult fish and each cohort of juveniles will be housed in isolation units to preserve the genetic strain of donor/recipient populations. Each group of broodstock and juvenile cohort will have three dedicated rearing units to allow operators to segregate fish according to size and growth rates in order to improve the survival of slower growing fish.

Total WCT production will be 400 to 500 pounds per year.

3.2 Biological Variables

The primary biological variables used in the preparation of the operations schedule include the timing of spawning and fish development cycles, water temperatures, feed usage, fish growth rates, loading densities and flow indices are summarized in Table 3-2. The basis of the variable values used in the development of the operations schedules is explained below.

Table 3-2. Biological Criteria

	Program		Comments
Criteria	**Triploid Rainbow Trout**	**Westslope Cutthroat Trout**	
	Program	**Program**	
Adult Holding	None	Yes	Temporary Captive Brood Program
Timing	NA	Year-Round	
# of Fish	NA	300	Includes 3 Brood Years
Size of Fish	NA	6” to 15”	Average Size Range
Number & Size of Containers	NA	(9) – 6’ dia.	3 Vessels per Brood Year
Density	NA	0.10 lb/cf/in.	Variable
Fecundity	NA	200 to 500	
Production Goals			
Age 0	400 x 4	8,000	
Age 1	NA	8,000	
Incubation			
Timing	3 months apart	Jan-Mar	
# eggs	1,000 max	10,000 per cohort	
Water Source	River/Well	River/Well	
Eggs per Unit	1,000	5000	7 tray stack for WCT at 700 eggs/tray
Total Units	1	2	
Flow per Unit (gpm)	5	5	Vertical Incubators
Flow per Program (gpm)	5	10	
Water Temp.Target	50 - 55˚F	TBD	Stream Specific - Mimic natural for WCT
Juvenile Rearing per Age Class			
Timing	Varies	July-May +1	
# of fish per tank	200 to 400	1300	
Pond Size	Varies	40 ft^3	Existing 2’4” wide x 25’ long troughs for WCT early rearing
Water Source	Well	River - Well	Well water used exclusively July - October
Water Temp	50˚F	38-55˚F	
Total Units	1 to 2	8 to 10	
Flow per Unit (gpm)	9	11	
Flow per Age 1 (gpm)	29	63	
Max. Density Index	0.2 $lbs/ft^{3/in}$	0.2 $lbs/ft^{3/in}$	D.I.=(weight of fish)/(fish length x volume of rearing unit.
Size at Transfer	1 to 5/lb	40/lb	

gpm = gallons per minute

3.2.1 Water Quality

The hatchery water supply for all trout life stages will need to be gas-stabilized, oxygenated to saturation and be silt and pathogen free. Treatment will include aeration degassing treatment for both groundwater and surface water supplies, and silt settling or particle filtration, and UV disinfection for surface water supplies.

3.2.2 Water Temperature and Expected Growth Rates

Water temperature is a primary determining factor in the development and growth rate of fish. Groundwater and spring water temperatures in the region are typically fairly constant year round, in the range of 48 to 50 degrees F, (though may have a greater variation if it is surface water influenced). Surface water in the Pend Oreille River varies seasonally and annually between 38 degrees F in the winter to over 75 degrees F in July and August. The triploid rainbow trout program will utilize first or second pass ground water at 50 degrees F. The WCT program will utilize river water from roughly November through June at natural temperatures in order to reduce domestication effects. Well water will be used for the WCT program July through October when the river water temperatures exceed fish health standards. Surface water and groundwater supplies will be plumbed to each broodstock and rearing vessel to allow blending of different temperatures of water during transition periods and to provide some redundant supply capacity.

Growth efficiency varies with water temperature and food ration. WCT respond well to a nearly natural water temperature regime. Growth efficiency is greatest at slightly higher temperatures when food is unlimited, and slightly lower temperature when food is limited (or when fish are transitioning to hatchery pellets). The variable growth rates of wild WCT can be characterized as average growth rates within range bars. The rate of growth is used to calculate the total weight of fish per program at the end of each month in order to determine tank volume requirements. The target growth rate for juvenile TRBT rearing is 20% body weight per month. The target growth rate for WCT juvenile rearing is 0.015 mm per centigrade temperature unit per day based on data from growth studies on wild fish by Fraley (2002). The anticipated growth rate for WCT captive broodstock is 0.3 grams/day based on data from Seloloni Springs Hatchery.

For the WCT conservation program, mimicking natural stream temperatures has been identified as an important parameter for avoiding domestication effects in the hatchery (Marotz pers. comm.). It is recommended that tempered water supplies be available to broodstock holding and rearing units for this reason.

3.2.3 Aquaculture Loading Densities

In order to determine the water volume of rearing tanks needed to meet production goals, the KTOI have established a rearing density criteria of 0.2 pounds of fish per cubic foot per inch of fish length for juvenile rearing. This density value is used to determine the minimum rearing volume required for the juvenile rearing program as shown on Table 3-3. Broodstock holding densities vary depending on the size of the fish collected, and will average 0.1 lb/cf/in. based on beginning with and average 6-inch fish length.

3.2.4 Water Supply Rates

A flow index of 1.0 will be used for TRBT production. The WCT program is based on program experience at Sekokoni Springs Hatchery in Montana and is set at using a conservative flow index of 0.75. For incubation, a standard flow rate of 5 gpm per vertical stack will be used.

3.3 Biosecurity Concerns

Pathogens could be imported to the facility with fish or eggs collected from any wild source, so inspection of a representative sample from all donor sources, and annual inspections, are essential.

Best management practices include sampling donor populations before fish are collected from the wild, or holding wild fish in isolation (separate water source) until individuals are certified free of reportable pathogens and genetically pure WCT. If the donor population is sufficiently populous, approximately sixty individuals from each lot could be sacrificed for disease testing before the fish are moved from the isolation water source to the rearing tanks. Testing should be conducted using procedures established by the American Fisheries Society (AFS), Fish Health Section (FHS) in the AFS/FHS Bluebook, Suggested Procedures for the Detection and Identification of Certain Finfish and Shellfish Pathogens, 2003 Edition. A sample size of 60 fish, 4 inches or larger will result in a 95% confidence of being able to detect a fish pathogen, assuming as few as 5% of the fish in the population are infected with the pathogen (AFS/FHS Bluebook, attribute sampling table).

Fish health specialists screen fish for reportable fish pathogens [Include testing for all salmonid pathogens of concern in the study area]:

*Infectious Hematopoietic Necrosis Virus (IHNV)
*Infectious Pancreatic Necrosis Virus (IPNV)
*Viral Hemorrhagic Septicemia Virus (VHSV)
**Oncorhynchus masou* Virus (OMV)
**Renibacterium salmoninarum*
**Aeromonas salmonicida*
**Yersinia ruckeri*
**Myxobolus cerebralis*

If testing results are positive for a reportable fish pathogen, fish should be removed from the facility and all equipment sanitized. The source population will be removed from the list of possible donor populations.

3.4 Aquaculture Operations Schedules

Preliminary operations schedules are presented in Table 3-3 and 3-4. Each shows a two year operating cycle in order to capture any potential overlapping flows or rearing capacity needs from multiple programs or age classes on station at the same time. The proposed programs have multiple year class overlaps, since there will be up to 4 batches of TRBT, 3 populations of WCT broodstock, and 3 batches of juvenile WCT on station at a given time.

3.4.1 Triploid Rainbow Trout Program

KTOI is considering two release sizes 8 inches and 16 inches of length, for the TRBT program. The 8-inch release alternative (Table 3-3) would be based on 400 fish per batch. The 16-inch release alternative (Table 3-4) would be based on 200 fish per batch to keep the overall water and space requirements in the same range. Production will begin with the purchase of up to 1000 eyed eggs or 500 fingerlings from a commercial vendor. Each batch of eggs will use a single marisource tray with a water supply of 5 gpm. The swim-up fry or purchased fingerlings will be placed into a strat tank or screened section of an existing raceway in the lower hatchery building. As the fish develop they will be split out into larger portions of the existing raceways. Peak water supply flows of 11 gpm per tank are required for 8-inch fish and 23 gpm per tank for 16-inch fish.

The KTOI may also experiment with using the existing outdoor lined ponds for final rearing of TRBT in the fall and spring as weather condtions and water tempertures allow.

3.4.2 Westslope Cutthroat Trout Program

Salvaged broodstock will be brought in to the hatchery each fall and segregated by size into two to three holding tanks. Based on results at Sekokoni Springs, 6-foot diameter x 5' deep circular tanks with external standpipe drains have worked the best for transitioning fish from natural feed to pellet diets. Flow rates to these tanks will be 6 to 8 gpm depending on fish size. Over the course of the two and a half year holding period these fish will grow from an average size of 6-inches to 15-inches in length.

The WCT production begins in April with spawning of the salvaged broodstock and subsequent egg incubation in vertical stacks of marisource incubator trays. After hatch in June, fry will be placed into the existing early rearing troughs or 4-foot diameter circular tanks. Two to three holding units will be provided for each age class of each population to allow for segregation of various fish sizes. Each tank will be supplied with 5 to 6 gpm of water. The peak groundwater flow for WCT production will be 124 gpm in October. The peak flow of surface water will be 158 gpm in April just prior to outplanting. With fish from two age classes for one population and fish from one age class from a second population on station at once, a total of 9 separate tanks in three isolation units will be required.

3.4.3 Optional Remote Westslope Cutthroat Trout Broodstock Facility

The KTOI own a large ranch parcel on Indian Creek several miles upstream of the present hatchery site. This parcel has a 4 cubic foot per second (1800 gpm) senior water right S3-006319CC, dated 1912 for diversion of water from Indian Creek. The right is for irrigation of 284 acres and 2920 acre feet, and continuous use from March through October. The KTOI have proposed that a small portion of this water right be considered for holding WCT broodstock at the Indian Creek location. The intent would be to minimize domestication of the captive WCT broodstock during the two years they are held prior to release back to waters of origin.

In order to implement this optional facility, the existing diversion structure and transmission pipe would need to be evaluated for serviceability. The water right would need to be modified to allow for year round non- consumptive use of a smaller flow, (less than 0.5 cfs). A small pole barn with simple flow through water supply and drain piping would provide a cost effective facility for holding the wild broodstock on a natural water supply.

3.5 WCT Natural Rearing Strategies

Several methods are under consideration to reduce domestication of WCT broodstock and juvenile fish. Utilizing a combination of groundwater and surface to mimic natal small stream water temperatures will be a critical element. Other measures include using darker colored fiberglass tanks, provisions for sub-surface feed introduction into the tanks, photo-period lighting controls, low loading densities, and the potential retrofitting of an existing outdoor lined ponds to a naturalized rearing channel. Natural rearing strategies will be explored further during future planning and design phases.

gpm Ground Water

gpm Surface Water/Reuse GW

8-Oct-14

Table 3-3; KALISPEL TRIBE FLYING GOOSE RANCH HATCHERY - COLD WATER CONVERSION
PRELIMINARY BIOPROGRAM AND APPROXIMATE HATCHERY OPERATION SCHEDULE
Water Budget Summary - Flows in gpm (Single Pass - No Reuse) 8-Inch TRBT

			MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR
PRODUCTION SCHEDULES																												
Triploid Rainbow Trout				Year A												Year B												
Batch #1 - Triploid Rainbow Trout - In Heath Tray	*1,000*	*# Eyed Eggs*		5	5	5										5	5	5										
Batch #1 Grow Out	*400*	*Fingerling Rearing*					5	5	5	5	5	5	5	5	6	9	11		5	5	5	5	5	5	5	5	12	12
Batch #2 - Triploid Rainbow Trout - In Heath Tray	*1,000*	*# Eyed Eggs*					5	5	5										5	5	5							
Batch #2 Grow Out	*400*	*Fingerling Rearing*								5	5	5	5	5	5	5	5	6	9	11		5	5	5	5	5	5	5
Batch #3 - Triploid Rainbow Trout - In Heath Tray	*1,000*	*# Eyed Eggs*								5	5	5										5	5	5				
Batch #3 Grow Out	*400*	*Fingerling Rearing*											5	5	5	5	5	5	5	5	6	9	11		5	5	5	5
Batch #4 - Triploid Rainbow Trout - In Heath Tray	*1,000*	*# Eyed Eggs*											5	5	5										5	5	5	
Batch #4 Grow Out	*400*	*Fingerling Rearing*														5	5	5	5	5	5	5	5	6	9	11		5
West Slope Cutthroat - Program Years 3 and 4																												
Broodstock Holding - 3 Populations in three tanks each	*900*	*Fish Total*	22	23	23	24	25	25	37	39	42	44	46	48	50	51	39	40	42	43	49	51	53	55	56	58	59	42
Incubation	*1*	*Marisource Iso-Stacks*		5	5	5										5	5	5										5
Juvenile Rearing - Stream 1 First Spawning (3 cohorts)	*8,000*	*Fingerling Rearing*				4.5	6.4	11.3	10.8	13.0	13.3	17.2	16.7	18.4	19.8	21.7	25.5	29.3	34.6	37.9	40.1	46.7	50.8	54.4	55.4	57.6	59.3	63.2
Juvenile Rearing - Stream 1 Second Spawning (3 cohorts)	*8,000*	*Fingerling Rearing*																4.5	6.4	11.3	10.8	13.0	13.3	17.2	16.7	18.4	19.8	21.7
Juvenile Rearing - Stream 2 First Spawning (3 cohorts)	*8,000*	*Fingerling Rearing*																4.5	6.4	11.3	10.8	13.0	13.3	17.2	16.7	18.4	19.8	21.7
Groundwater Total (gpm)				10	10	10	41	47	58	67	15	15	20	20	21	39	41	31	118	134	132	153	31	21	29	31	27	32
Groundwater for TRBT (gpm)				5	5	5	10	10	10	15	15	15	20	20	21	34	36	26	29	31	21	29	31	21	29	31	27	27
Groundwater for WCT (gpm)				5	5	5	31	37	48	52						5	5	5	89	103	111	124						5
Surface Water/Serial ReuseTotals (gpm)			22	23	23	29					55	61	63	66	69	73	65	79					130	144	145	153	158	149
River Temps	*Deg. F*		41	45	51	55	68	75	66	58	46	42	38	38	41	45	51	55	68	75	66	58	46	42	38	38	41	45
River Temps	*Deg. C*		5	7	11	13	20	24	19	14	8	6	3	3	5	7	11	13	20	24	19	14	8	6	3	3	5	7
GW Temps	*Deg. F*		49.6	49.6	49.6	49.6	49.6	49.6	49.6	49.6	49.6	49.6	49.6	49.6	49.6	49.6	49.6	49.6	49.6	49.6	49.6	49.6	49.6	49.6	49.6	49.6	49.6	49.6
GW Temps	*Deg.C*		9.8	9.8	9.8	9.8	9.8	9.8	9.8	9.8	9.8	9.8	9.8	9.8	9.8	9.8	9.8	9.8	9.8	9.8	9.8	9.8	9.8	9.8	9.8	9.8	9.8	9.8
PRODUCTION CRITERIA AT KALISPEL TRIBAL HATCHERY																												
TRIPLOID RAINBOW TROUT - Typical Growout Cycle, 4 batches per year 3 months apart																												
Number of Triploid Rainbows	400	Sub-Yearlings to 8 -inches																										
Initial Ponding at	0.18	grams/fish					First ponding										Mid May Release											
Fish Weight - Grams,End of Month at	2	(%bw/day) Growth Rate on GW					0.33	0.61	1.11	2.06	3.72	6.88	12.47	21.70	40.10	72.63	97.75											
Fish Length - End of Month, C=4,000	7.2	inches					1.3	1.6	1.8	2.3	2.7	3.3	4.1	4.9	6.0	7.2	8.1											
Total Fish Weight- End of Month		lb					0.3	1	1	2	3	6	11	19	35	64	86											
Max Rearing Volume (ft3) Req'd at	0.2	lb/cf/in.					1	2	3	4	6	9	13	20	29	44	53											
Flow Req'd (gpm) at Flow Index of	1.0						0.2	0.3	0.5	0.8	1.2	1.8	2.7	3.9	5.9	8.9	10.6											
WEST SLOPE CUTTHROAT																												
Captive Broodstock - Held 2.5 years	3	Brood Years on Station																										
Salvaged Broodstock - Number of Fish per Brood Year	300	Fish																										
Stream 1 Total Fish Weight Beginning at	0.08	lb. (0 .3 gr/day ave growth)							24	30	36	42	48	54	60	66	72	78	83	89	95	101	107	113	119	125	131	137
Length at .25mm/day ave growth		inches							6	6	7	7	7	7	8	8	8	9	9	9	10	10	10	10	11	11	11	12
Max Rearing Volume (ft3) Req'd at DI=	0	lb/cf/in.							40	48	54	61	67	72	77	81	86	90	93	97	100	103	106	109	111	114	116	118
Flow Req'd (gpm) at Flow Index of	1	(lb/FI*in)							5	6	7	8	9	10	10	11	11	12	12	13	13	14	14	14	15	15	15	16
Stream 1 Total Fish Weight		lb.	131	137	143	149	155	160.8	167	173	179	185	191	196	202	208												
Length at .25mm/day ave growth		inches	11	12	12	12	12	12.8	13	13	14	14	14	15	15	15												
Max Rearing Volume (ft3) Req'd at DI=	0.10	lb/cf/in.	116	118	120	122	124	125.7	127	129	131	132	134	135	136	138												
Flow Req'd (gpm) at Flow Index of	1.00	(lb/FI*in)	12	12	12	12	12	12.6	13	13	13	13	13	13	14	14												
Stream 1 Total Broodstock Volume		cf	116	118	120	122	124	125.7	167	177	185	193	200	207	213	219												
Stream 1 Total Broodstock Flow		gpm	12	12	12	12	12	12.6	18	19	20	21	22	23	24	25												
Stream 2 Total Fish Weight Beginning at	0.08	lb. (0 .3 gr/day ave growth)																			24	30	36	42	48	54	60	66
Length at .25mm/day ave growth		inches																			6	6	7	7	7	7	8	8
Max Rearing Volume (ft3) Req'd at DI=	0.10	lb/cf/in.																			40	48	54	61	67	72	77	81
Flow Req'd (gpm) at Flow Index of	0.75	(lb/FI*in)																			5	6	7	8	9	10	10	11
Stream 2 Total Fish Weight		lb.	60	66	72	78	83	89.4	95.4	101.3	107.3	113.207	119.2	125.1013	131	137	149	155	161	166.7	173	179	185	191	196	202	208	
Length at .25mm/day ave growth		inches	8	8	8	9	9	9.2	10	10	10	10	11	11	11	12	12	12	13	13.1	13	14	14	14	15	15	15	
Max Rearing Volume (ft3) Req'd at DI=	0.10	lb/cf/in.	77	81	86	90	93	96.7	100	103	106	109	111	114	116	118	122	124	126	127.4	129	131	132	134	135	136	138	
Flow Req'd (gpm) at Flow Index of	0.75	(lb/FI*in)	10	11	11	12	12	12.9	13	14	14	14	15	15	15	16	16	17	17	17.0	17	17	18	18	18	18	18	
Stream 2 Total Broodstock Volume		cf																										
Stream 2 Total Broodstock Flow		gpm																										
Stream 3 Total Fish Weight Beginning at	0.08	lb. (0 .3 gr/day ave growth)							24	30	36	42	48	54	60	66	72	78	83	89	95	101	107	113	119	125	131	137
Length at .25mm/day ave growth		inches							6	6	7	7	7	7	8	8	8	9	9	9	10	10	10	10	11	11	11	12
Max Rearing Volume (ft3) Req'd at DI=	0.10	lb/cf/in.							40	48	54	61	67	72	77	81	86	90	93	97	100	103	106	109	111	114	116	118
Flow Req'd (gpm) at Flow Index of	0.75	(lb/FI*in)							5	6	7	8	9	10	10	11	11	12	12	13	13	14	14	14	15	15	15	16
Brood Tank Volume	110.00	cu.ft/tank																										
Flow Req'd at Flow index of	0.75		22	23	23	24	25	25	37	39	42	44	46	48	50	51	39	40	42	43	49	51	53	55	56	58	59	42
Juvenile Rearing Growth Rate (mm/month) at	0.015	mm/ctu/day	2.3	3.3	4.9	5.8	4.6	4.6	4.4	4.6	3.5	2.6	1.6	1.4	2.3	3.3	4.9	5.8	4.6	4.6	4.4	4.6	3.5	2.5	1.5	1.5	2.3	3.2
Steam 1 - First Spawn Group	8,000	fish				Age 0 - First Spawn Group												Age 1 First Spawn Group										
Fish Length (Inches)	4.1	inch target				1.1	1.3	1.5	1.6	1.8	1.9	2.1	2.1	2.2	2.3	2.4	2.6	2.8	3.0	3.2	3.3	3.5	3.7	3.8	3.8	3.9	4.0	4.1
Fish Weight Ea.- per Piper Taqble I-5		grams - End of Month				0.2	0.4	0.7	0.8	1.0	1.1	1.5	1.5	1.7	1.9	2	3	4	4	5.1	5.7	7.0	7.9	8.7	9.0	9.5	10	11
Total Weight of Fish	194	Total pounds				3.7	6.2	12.3	13.2	17.6	19.4	26.4	26.4	30.0	33.5	38.8	49.3	61.7	77.5	89.9	100.4	123.3	139.2	153.3	158.6	167.4	176.2	193.8
Cubic Feet Tanks Req'd at DI=	0.2	lb/cf/in.				17	24	42	40	49	50	64	63	69	74	81	96	110	130	142	150	175	190	204	208	216	222	237
2.3 x 25' Troughs Req'd at	100	cf ea				0.2	0.2	0.4	0.4	0.5	0.5	0.6	0.6	0.7	0.7	0.8	1.0											
4' Semi-Square Tanks Req'd at	70	cf ea																1.6	1.9	2.0	2.1	2.5	2.7	2.9	3.0	3.1	3.2	3.4
Tank Loading for Cohort Isolation		No. Tanks																2	2	2	4	4	4	4	4	4	4	4
Flow Req'd at Flow Index of	0.75					4.5	6.4	11.3	10.8	13.0	13.3	17.2	16.7	18.4	19.8	21.7	25.5	29.3	34.6	37.9	40.1	46.7	50.8	54.4	55.4	57.6	59.3	63.2
Steam 1 -Second Spawn Group	8,000	fish																Age 0 - Second Spawn Group										
Fish Length (Inches)	2.4	inch target																1.1	1.3	1.5	1.6	1.8	1.9	2.0	2.1	2.2	2.3	2.4
Fish Weight Ea.- per Piper Taqble I-5		grams - End of Month																0.2	0.4	0.7	0.8	1.0	1.1	1.5	1.5	1.7	1.9	2.2
Total Weight of Fish	39	Total pounds																3.7	6.2	12.3	13.2	17.6	19.4	26.4	26.4	30.0	33.5	38.8
Cubic Feet Tanks Req'd at DI=	0.2	lb/cf/in.																17	24	42	40	49	50	65	63	69	74	81
2.3 x 25' Troughs Req'd at	100	cf ea																0.2	0.2	0.4	0.4	0.5	0.5	0.6	0.6	0.7	0.7	0.8
Tank Loading for Cohort Isolation		No. Tanks																3	3	3	3	3	3	3	3	3	3	3
Flow Req'd at Flow Index of	0.75																	4.5	6.4	11.3	10.8	13.0	13.3	17.2	16.7	18.4	19.8	21.7
Steam 2 - First Spawn Group	8,000	fish																Age 0 - First Spawn Group										
Fish Length (Inches)	2.4	inch target																1.1	1.3	1.5	1.6	1.8	1.9	2.0	2.1	2.2	2.3	2.4
Fish Weight Ea.- per Piper Taqble I-5		grams - End of Month																0.2	0.4	0.7	0.8	1.0	1.1	1.5	1.5	1.7	1.9	2.2
Total Weight of Fish	39	Total pounds																3.7	6.2	12.3	13.2	17.6	19.4	26.4	26.4	30.0	33.5	38.8
Cubic Feet Tanks Req'd at DI=	0.2	lb/cf/in.																17	24	42	40	49	50	65	63	69	74	81
2.3 x 25' Troughs Req'd at	100	cf ea																0.2	0.2	0.4	0.4	0.5	0.5	0.6	0.6	0.7	0.7	0.8
Tank Loading for Cohort Isolation		No. Tanks																3	3	3	3	3	3	3	3	3	3	3
Flow Req'd at Flow Index of	0.75																	4.5	6.4	11.3	10.8	13.0	13.3	17.2	16.7	18.4	19.8	21.7
Tank Summary																												
Broodstock Tanks 6-foot Dia x 5' d	9	max	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9
Early Rearing Troughs	2	max				1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2

gpm — *Ground Water*

gpm — *Surface Water/Reuse GW*

8-Oct-14

Table 3-4; KALISPEL TRIBE FLYING GOOSE RANCH HATCHERY - COLD WATER CONVERSION
PRELIMINARY BIOPROGRAM AND APPROXIMATE HATCHERY OPERATION SCHEDULE
Water Budget Summary - Flows in gpm (Single Pass - No Reuse) 16-inch TRBT

			MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR
PRODUCTION SCHEDULES																												
Triploid Rainbow Trout				Year A															Year B									
Batch #1 - Triploid Rainbow Trout - In Heath Tray	1,000	*# Eyed Eggs*		5	5	5													5	5	5							
Batch #1 Grow Out	200	*Fingerling Rearing*					5	5	5	5	5	5	5	5	5	5	7	10	15	23	5	5	5	5	5	5	5	5
Batch #2 - Triploid Rainbow Trout - In Heath Tray	1,000	*# Eyed Eggs*					5	5	5													5	5	5				
Batch #2 Grow Out	200	*Fingerling Rearing*								5	5	5	5	5	5	5	5	5	5	7	10	15	23	5	5	5	5	5
Batch #3 - Triploid Rainbow Trout - In Heath Tray	1,000	*# Eyed Eggs*								5	5	5													5	5	5	
Batch #3 Grow Out	200	*Fingerling Rearing*											5	5	5	5	5	5	5	5	5	5	7	10	15	23	5	5
Batch #4 - Triploid Rainbow Trout - In Heath Tray	1,000	*# Eyed Eggs*											5	5	5													5
Batch #4 Grow Out	200	*Fingerling Rearing*														5	5	5	5	5	5	5	5	5	5	7	10	15
West Slope Cutthroat - Program Years 3 and 4																												
Broodstock Holding - 3 Populations in three tanks each	900	*Fish Total*	22	23	23	24	25	25	37	39	42	44	46	48	50	51	39	40	42	43	49	51	53	55	56	58	59	42
Incubation	1	*Marisource Iso-Stacks*		5	5	5										5	5	5										5
Juvenile Rearing - Stream 1 First Spawning (2 cohorts)	8,000	*Fingerling Rearing*				4.5	6.4	11.3	10.8	13.0	13.3	17.2	16.7	18.4	19.8	21.7	25.5	29.3	34.6	37.9	40.1	46.7	50.8	54.4	55.4	57.6	59.3	63.2
Juvenile Rearing - Stream 1 Second Spawning (2 cohorts)	8,000	*Fingerling Rearing*																4.5	6.4	11.3	10.8	13.0	13.3	17.2	16.7	18.4	19.8	21.7
Juvenile Rearing - Stream 2 First Spawning (2 cohorts)	8,000	*Fingerling Rearing*																4.5	6.4	11.3	10.8	13.0	13.3	17.2	16.7	18.4	19.8	21.7
Groundwater Total (gpm)				10	10	10	41	47	58	67	15	15	20	20	20	30	32	35	124	148	141	159	45	30	35	45	30	40
Groundwater for TRBT (gpm)				5	5	5	10	10	10	15	15	15	20	20	20	25	27	30	35	45	30	35	45	30	35	45	30	35
Groundwater for WCT (gpm)				5	5	5	31	37	48	52						5	5	5	89	103	111	124						5
Surface Water/Serial ReuseTotals (gpm)			22	23	23	29					55	61	63	66	69	73	65	79					130	144	145	153	158	149
River Temps	*Deg. F*		41	45	51	55	68	75	66	58	46	42	38	38	41	45	51	55	68	75	66	58	46	42	38	38	41	45
River Temps	*Deg. C*		5	7	11	13	20	24	19	14	8	6	3	3	5	7	11	13	20	24	19	14	8	6	3	3	5	7
GW Temps	*Deg. F*		49.6	49.6	49.6	49.6	49.6	49.6	49.6	49.6	49.6	49.6	49.6	49.6	49.6	49.6	49.6	49.6	49.6	49.6	49.6	49.6	49.6	49.6	49.6	49.6	49.6	49.6
GW Temps	*Deg.C*		9.8	9.8	9.8	9.8	9.8	9.8	9.8	9.8	9.8	9.8	9.8	9.8	9.8	9.8	9.8	9.8	9.8	9.8	9.8	9.8	9.8	9.8	9.8	9.8	9.8	9.8
PRODUCTION CRITERIA AT KALISPEL TRIBAL HATCHERY																												
TRIPLOID RAINBOW TROUT - Typical Growout Cycle, 4 batches per year 3 months apart																												
Number of Triploid Rainbows	**200**	**Sub-Yearlings to 16-inches**																										
Initial Ponding at	**0.18**	**grams/fish**					First ponding Year A													End of Month Release								
Fish Weight - Grams,End of Month at	**2**	**(%bw/day) Growth Rate on GW**					0.33	0.61	1.11	2.06	3.72	6.88	12.71	22.14	40.90	74.08	136.88	247.93	458.08	846.34								
Fish Length - End of Month, C=4,000	**7.2**	**inches**					1.3	1.6	1.8	2.3	2.7	3.3	4.1	4.9	6.0	7.2	8.9	11.1	13.8	16.6								
Total Fish Weight- End of Month		**lb**					0.15	0.27	0.49	1	2	3	6	10	18	33	60	109	202	373								
Max Rearing Volume (ft3) Req'd at	**0.2**	**lb/cf/in.**					1	1	1	2	3	5	7	10	15	23	34	49	73	112								
Flow Req'd (gpm) at Flow Index of	**1.0**	**(lb/FI*in)**					0.1	0.2	0.3	0.4	0.6	0.9	1.4	2.0	3.0	4.5	6.8	9.8	14.7	22.5								
WEST SLOPE CUTTHROAT																												
Captive Broodstock - Held 2.5 years	**3**	**Brood Years on Station**																										
Salvaged Broodstock - Number of Fish per Brood Year	**300**	**Fish**																										
Stream 1 Total Fish Weight Beginning at	**0.08**	**lb. (0 .3 gr/day ave growth)**							24	30	36	42	48	54	60	66	72	78	83	89	95	101	107	113	119	125	131	137
Length at .25mm/day ave growth		**inches**							6.0	6.3	6.6	6.9	7.2	7.5	7.8	8.1	8.4	8.7	9.0	9.2	9.5	9.8	10.1	10.4	10.7	11.0	11.3	11.6
Max Rearing Volume (ft3) Req'd at DI=	**0.1**	**lb/cf/in.**							40	48	54	61	67	72	77	81	86	90	93	97	100	103	106	109	111	114	116	118
Flow Req'd (gpm) at Flow Index of	**0.75**	**(lb/FI*in)**							5	6	7	8	9	10	10	11	11	12	12	13	13	14	14	14	15	15	15	16
Stream 1 Total Fish Weight		**lb.**	131	137	143	149	155	161	167	173	179	185	191	196	202	208												
Length at .25mm/day ave growth		**inches**	11	12	12	12	12	13	13	13	14	14	14	15	15	15												
Max Rearing Volume (ft3) Req'd at DI=	**0.1**	**lb/cf/in.**	116	118	120	122	124	126	127	129	131	132	134	135	136	138												
Flow Req'd (gpm) at Flow Index of	**1.0**	**(lb/FI*in)**	12	12	12	12	12	13	13	13	13	13	13	13	14	14												
Stream 1 Total Broodstock Volume		**cf**	116	118	120	122	124	126	167	177	185	193	200	207	213	219												
Stream 1 Total Broodstock Flow		**gpm**	12	12	12	12	12	13	18	19	20	21	22	23	24	25												
Stream 2 Total Fish Weight Beginning at	**0.08**	**lb. (0 .3 gr/day ave growth)**																			24	30	36	42	48	54	60	66
Length at .25mm/day ave growth		**inches**																			6.0	6.3	6.6	6.9	7.2	7.5	7.8	8.1
Max Rearing Volume (ft3) Req'd at DI=	**0.1**	**lb/cf/in.**																			40	48	54	61	67	72	77	81
Flow Req'd (gpm) at Flow Index of	**0.75**	**(lb/FI*in)**																			5	6	7	8	9	10	10	11
Stream 2 Total Fish Weight		**lb.**	60	66	72	78	83	89	95	101	107	113	119	125	131	137	149	155	161	167	173	179	185	191	196	202	208	
Length at .25mm/day ave growth		**inches**	7.8	8.1	8.4	8.7	9.0	9.2	9.5	9.8	10.1	10.4	10.7	11.0	11.3	11.6	12.2	12.5	12.8	13.1	13.4	13.7	14.0	14.3	14.6	14.9	15.2	
Max Rearing Volume (ft3) Req'd at DI=	**0.1**	**lb/cf/in.**	77	81	86	90	93	97	100	103	106	109	111	114	116	118	122	124	126	127	129	131	132	134	135	136	138	
Flow Req'd (gpm) at Flow Index of	**0.75**	**(lb/FI*in)**	10	11	11	12	12	13	13	14	14	14	15	15	15	16	16	17	17	17	17	17	18	18	18	18	18	
Stream 3 Total Fish Weight Beginning at	**0.08**	**lb. (0 .3 gr/day ave growth)**							24	30	36	42	48	54	60	66	72	78	83	89	95	101	107	113	119	125	131	137
Length at .25mm/day ave growth		**inches**							6.0	6.3	6.6	6.9	7.2	7.5	7.8	8.1	8.4	8.7	9.0	9.2	9.5	9.8	10.1	10.4	10.7	11.0	11.3	11.6
Max Rearing Volume (ft3) Req'd at DI=	**0.1**	**lb/cf/in.**							40	48	54	61	67	72	77	81	86	90	93	97	100	103	106	109	111	114	116	118
Flow Req'd (gpm) at Flow Index of	**0.75**	**(lb/FI*in)**							5	6	7	8	9	10	10	11	11	12	12	13	13	14	14	14	15	15	15	16
Flow Req'd at Flow index of	**0.75**		22	23	23	24	25	25	37	39	42	44	46	48	50	51	39	40	42	43	49	51	53	55	56	58	59	42
Juvenile Rearing Growth Rate (mm/month) at	**0.015**	**mm/ctu/day**	2.3	3.3	4.9	5.8	4.6	4.6	4.4	4.6	3.5	2.6	1.6	1.4	2.3	3.3	4.9	5.8	4.6	4.6	4.4	4.6	3.5	2.5	1.5	1.5	2.3	3.2
Stream 1 - First Spawn Group	**8,000**	**fish**				Age 0 - First Spawn Group												Age 1 First Spawn Group										
Fish Length (Inches)	**4.1**	**inch target**				1.1	1.3	1.5	1.6	1.8	1.9	2.1	2.1	2.2	2.3	2.4	2.6	2.8	3.0	3.2	3.3	3.5	3.7	3.8	3.8	3.9	4.0	4.1
Fish Weight Ea.- per Piper Taqble I-5		**grams - End of Month**				0.2	0.4	0.7	0.8	1.0	1.1	1.5	1.5	1.7	1.9	2	3	4	4	5.1	5.7	7.0	7.9	8.7	9.0	9.5	10	11
Total Weight of Fish	**194**	**Total pounds**				3.7	6.2	12.3	13.2	17.6	19.4	26.4	26.4	30.0	33.5	38.8	49.3	61.7	77.5	89.9	100.4	123.3	139.2	153.3	158.6	167.4	176.2	193.8
Cubic Feet Tanks Req'd at DI=	**0.2**	**lb/cf/in.**				17	24	42	40	49	50	64	63	69	74	81	96	110	130	142	150	175	190	204	208	216	222	237
2.3 x 25' Troughs Req'd at	**100**	**cf ea**				0.2	0.2	0.4	0.4	0.5	0.5	0.6	0.6	0.7	0.7	0.8	1.0											
4' Semi Square Tanks Req'd at	**70**	**cf ea**																1.6	1.9	2.0	2.1	2.5	2.7	2.9	3.0	3.1	3.2	3.4
Tank Loading for Cohort Isolation		**No. Tanks**																2	2	2	4	4	4	4	4	4	4	4
Flow Req'd at Flow Index of	**0.75**					4.5	6.4	11.3	10.8	13.0	13.3	17.2	16.7	18.4	19.8	21.7	25.5	29.3	34.6	37.9	40.1	46.7	50.8	54.4	55.4	57.6	59.3	63.2
Stream 1 -Second Spawn Group	**8,000**	**fish**																Age 0 - Second Spawn Group										
Fish Length (Inches)	**2.4**	**inch target**																1.1	1.3	1.5	1.6	1.8	1.9	2.0	2.1	2.2	2.3	2.4
Fish Weight Ea.- per Piper Taqble I-5		**grams - End of Month**																0.2	0.4	0.7	0.8	1.0	1.1	1.5	1.5	1.7	1.9	2.2
Total Weight of Fish	**39**	**Total pounds**																3.7	6.2	12.3	13.2	17.6	19.4	26.4	26.4	30.0	33.5	38.8
Cubic Feet Tanks Req'd at DI=	**0.2**	**lb/cf/in.**																17	24	42	40	49	50	65	63	69	74	81
2.3 x 25' Troughs Req'd at	**100**	**cf ea**																0.2	0.2	0.4	0.4	0.5	0.5	0.6	0.6	0.7	0.7	0.8
Flow Req'd at Flow Index of	**0.75**																	4.5	6.4	11.3	10.8	13.0	13.3	17.2	16.7	18.4	19.8	21.7
Stream 2 - First Spawn Group	**8,000**	**fish**																Age 0 - First Spawn Group										
Fish Length (Inches)	**2.4**	**inch target**																1.1	1.3	1.5	1.6	1.8	1.9	2.0	2.1	2.2	2.3	2.4
Fish Weight Ea.- per Piper Taqble I-5		**grams - End of Month**																0.2	0.4	0.7	0.8	1.0	1.1	1.5	1.5	1.7	1.9	2.2
Total Weight of Fish	**39**	**Total pounds**																3.7	6.2	12.3	13.2	17.6	19.4	26.4	26.4	30.0	33.5	38.8
Cubic Feet Tanks Req'd at DI=	**0.2**	**lb/cf/in.**																17	24	42	40	49	50	65	63	69	74	81
2.3 x 25' Troughs Req'd at	**100**	**cf ea**																0.2	0.2	0.4	0.4	0.5	0.5	0.6	0.6	0.7	0.7	0.8
Flow Req'd at Flow Index of	**0.75**																	4.5	6.4	11.3	10.8	13.0	13.3	17.2	16.7	18.4	19.8	21.7
Tank Summary																												
Broodstock Tanks 6-foot Dia x 5' d	**9**	**max**	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9
Early Rearing Troughs	**2**	**max**				1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2
4 -foot Semi-Square Rearing Tanks	**8**	**max (4 x 2 for 3rd yr.)**				0	0	0	0	0	0	0	0	0	0	0	0	2	2	2	4	4	4	4	4	4	4	4

SECTION 4
CONCEPTUAL DESIGN OF COLDWATER AQUACULTURE FACILITIES

4.0 Conceptual Design of Coldwater Aquaculture Facilities

This section describes alternatives considered for infrastructure improvements to support the proposed coldwater aquaculture programs described above, followed by preliminary recommendations.

4.1 Cold Water Conversion Feasibility and Alternatives

There have been no fatal flaws identified that would prevent a successful conversion of the facility from a warm water to cold water aquaculture facility. Considering overall space and functional requirements, it appears that the proposed fish culture vessels would fit within the footprints of the existing upper and lower hatchery buildings. For planning purposes, KTOI requested that two designs be developed:

1. Locate all incubation and WCT early rearing in the upper building, with TRBT rearing and WCT broodstock holding in the lower building.
2. Centralize the WCT program in an expanded upper building, with the lower building dedicated to the TRBT program

Alternatives considered for improvements to the hatchery water supplies, treatment systems, and rearing vessels are discussed in the following subsection.

4.1.1 Groundwater Source Development and Alternatives

In general, the capacity of cold water production will be limited by the availability of cold water. For eight months each year the existing treated surface water supply from the Pend Oreille River is a suitable source for fish rearing. However, during the late summer – early fall months when temperatures in the existing Pend Oreille River supply reach lethal levels for salmonids, an alternative source will be needed. Mechanically chilling the available surface water would be expensive in terms of capital and operating costs. Utilizing the existing cold groundwater supply efficiently and developing additional groundwater capacity will provide more reliable and cost effective solutions for the coldwater hatchery conversion. The operating schedule shown on Table 3-3 indicates a need for a peak flow of 150 gpm of cold groundwater. Ideally two additional wells of similar capacity would be developed to meet peak flows and provide redundancy in case of mechanical failure. Based on the shallow pump setting depth of the existing well, 3 horsepower motors (complete with low level probes for pump shutdown and alarm), will likely be adequate to provide the design flow rate.

There is one six-inch existing well outfitted with a high head potable water pump that is capable of producing 80 gpm of high quality groundwater at a temperature of 48 to 51 degrees F. The well was constructed and tested in 2011(well log and subsequent water quality testing data are included in Appendix B). It is relatively shallow, with a drilled depth of 78 feet. The 2011 well log indicates a water bearing sand and gravel strata at a depth of 56 to 78 feet where drilling was terminated. The extent of the water bearing strata and aquifer transmissivity within the hatchery site has not been explored. A review of other well logs in the area indicate mostly lower producing 10 to 20 gpm domestic wells drilled into variable sub-surface conditions described as limestone, granite and shale. There is a 100 gpm well drilled to a depth of 330 feet approximately 1 mile to the north of the hatchery site.

The existing groundwater well was test pumped for 24 hours in August of 2014 as part of this study effort. The results indicated that the well was capable of pumping 80 to 85 gallons per minute with a two foot drawdown in the aquifer from static level. The maximum pump rate was limited by the size of the existing pump and to some degree by the friction losses in the discharge piping.

In our experience, a detailed groundwater study conducted by a hydrogeologist would be relatively expensive, involving geological studies, the construction of test wells, long term test pumping/monitoring, and a report with recommendations for next steps. These efforts have cost $50,000 to $100,000 on other projects. According to KTOI, the original 2011 well cost less than $20,000 to complete. As a first step, it appears most cost effective to work with a local driller to construct and test pump another shallow production well into the sand and gravel lens near the hatchery location vs. drilling test wells and/or conducting formal hydrogeological studies. If a construction of second production well is not successful, other options can then be considered.

4.1.2 Surface Water Development and Alternatives

Tables 3-3 and 3-4 indicate a peak surface water flow demand of 158 gpm at the end of a typical population rearing cycle. The two existing 5 horsepower surface water booster pumps are sized to deliver 160 to 200 gpm. A third 3 horsepower pump is used to meet smaller demands. It appears there is adequate flow capacity and redundancy at the existing pumpstation to meet the proposed service condition for the coldwater hatchery for the eight months a year that the water temperatures are cold enough to support trout aquaculture.

The existing pumpstation (Fig 4-1), needs to be modified or rebuilt to relocate electrical panels utility meter and pump motors approximately 6 feet higher to be above flood elevation. Resolution of the siltation problems noted above should also be included. Alternatives considered include constructing an entirely new pumpstation vs. retaining much of the existing structure and raising the floor, walls and roof within the same footprint.

Figure 4-1. Surface Water Pumpstation – Note High Water Mark on Wall Above Meter

The area around the existing pumpstation is constrained by the river, sloughs, and wetlands, resulting in very little space available for constructing a new one without impacting sensitive areas. The cost of an all new facility would be significantly higher compared to modification to the existing structure.

Based on limited investigations, it appears feasible to retain and add at least four feet of height to the existing structure. The existing sump consists of 48-inch diameter pre-cast manhole sections which could be added to with new riser sections. The building walls are also pre-cast concrete and could be extended vertically with lighter weight materials such as wood framing or masonry block. The roof could be detached and re-installed after the walls are raised. The electrical panels could be salvaged and relocated higher on the walls. A new access stairway and landing would be needed at the doorway, along with minor re-grading around the structure.

In either case, it is recommended that the obsolete double pumping configuration be demolished and replaced with two 7.5 horsepower single stage, duty/standby, vertical turbine pumps to increase power use efficiency and simplify operations and maintenance. Configuring the pump intakes inside the wet well to eliminate dead spots would alleviate the siltation problem. This could be accomplished by using a canned style pump casing and creating channels in the wetwell using concrete fill.

The pump station receives power from the Pend Oreille PUD. Power is routed overhead from Le Clerc Road to a pole on the west side of the ponds. From that pole, the PUD primary cable is routed underground to a pad mount transformer located east of the pumpstation. The PUD transformer is currently located in the floodplain and must be relocated or replaced in order to avoid a power shutdown during flood conditions. (The PUD will disconnect power from the transformer during high water level conditions.) A telephone conversation with a representative of the power utility indicates that there might be a couple of options to raise the transformer out of the floodplain. One option is to build an earthen berm and locate the padmount transformer at a higher elevation. Another option is to remove the pad mount transformer and replace it with some pole mounted transformers. Both options require extensive rework of the existing installation in order to accomplish the modification. The PUD cautioned that any modification to the power service in wetland areas would trigger an environmental review and require approval of the local public works department.

This station does not have any standby power capability. If there is a utility outage, the station is inoperable. It was stated during the site visit that power outages during the summer months are common. Provisions for standby power is necessary during mild temperatures as well as during inclement weather. Providing emergency power supply to this pumpstation is problematic due to the 2,000 foot wide floodplain that would isolate the facilty during high water. An elevated emergency generator would be required, however re-fueling the generator during extended flood events would need to be done by boat. Since the floodplain extends to with a couple hundred feet of the hatchery, it would be feasible to construct a new back-up surface water pumpstsation at the toe of the slope in the marsh area below the hatchery to provide surface water flow during flood events. The cost of this back-up pumpstation has been included in the construction cost estimates.

Figure 4-2. Surface Water Pumps – Note Silt from Flooding on Pipes

The intake screen area is reportedly silting in and may require maintenance or relocation depending in the results of more detailed site investigations. A detailed investigation of the intake and pumpstation structures while the river is in a low water condition is recommended.

The existing surface water treatment system located in the upper hatchery building consists of bead filtration followed by degassing/aeration, drum screen filtration, and UV disinfection. This system prevents larger suspended particulate from entering rearing vessels and does not remove fine silt and colloidal turbidity which typically occurs for 10 to 12 weeks in the spring. Removing these finer particles would be costly, requiring a large silt settling basin and/or a higher level of pressure filtration. Since turbidity events are relatively short lived, silt removal is not included in the project planning at this time.

4.1.3 Water Reuse Alternatives

Ideally the water supply to fish rearing vessels would be single pass to reduce fish stress, disease and biosecurity risks and with a fully redundant flow capacity. With the results of additional groundwater supply development unknown at this time, this planning effort includes provisions for incorporating water reuse technology. Appropriate, cost effective reuse alternatives include serial reuse and partial water reuse as described below.

Serial Reuse – This method would use gravity flow cold water from upper tanks to lower tanks with a minimal reconditioning such as oxygenation. This alternative could effectively double the amount of groundwater available at little additional cost, though it does increase the risk of pathogen transmission or genetic contamination. With the upper hatchery building approximately 4 feet higher elevation than the lower hatchery building, it would be feasible to supply rearing vessels in the lower building with re-oxygenated second pass gravity overflow water from the upper building. During peak demand periods the target flow to the lower building would be 24 gpm to TRBT rearing, and 48 gpm to WCT broodstock, for a total of 72 gpm. With a concurrent peak flow of 83 gpm required to the upper building, the flows balance out quite well for serial reuse.

Partial Water Reuse – Recirculating 50% to 75% of culture vessel flow can be accomplished using air lift pumps or partial recirculating aquaculture system (PRAS) technology. Either of these technologies could double or triple the amount of usable groundwater, at a higher cost than serial reuse.

Airlift pump reuse systems utilize low pressure air to circulate water flow, add oxygen, strip carbon dioxide, and reduce make-up water requirements. These systems were developed and optimized by the Freshwater Fisheries Society (FFS) of British Columbia and have been successfully implemented at three of their six sport fish hatcheries. Make up water flow rates and associated pumping costs have been reduced by 75% in raceways and 82% in circular tanks.

The units consist of a vertical double wall baffle assembly with a fine bubble diffuser located between the walls near the bottom of the unit (Figure 4-3). Low pressure air is fed into the diffuser. As the bubbles rise, they draw water in through holes the downstream face of the baffle and direct it out the top of the unit at the water surface, creating an upstream counter current at the water surface. The air bubbles re-oxygenate the water such that dissolved oxygen levels are maintained above 7 mg/l at all times. Make up water flow rates, though reduced by 50% to 75%, are still high enough to prevent the accumulation of ammonia and other metabolic by products.

Figure 4-3. Airlift pumps in Raceways (Courtesy of Ray Billings, FFS)

The PRAS technology is a more intensive treatment, using particle filtration (drum screens), recirculation pumps, gas stabilization towers, and optional UV disinfection and oxygen supplementation (Figure 4-4). These systems require a significant amount of piping, mechanical equipment, and operator expertise. Similar to the simpler airlift technology, water make up rates are reduced by 50% to 75%, and also have enough first pass make-up flow to eliminate the need for biofiltration to treat metabolites.

Based on recent quotes, airlift technology adds roughly $30 per cubic foot of rearing capacity. PRAS technology adds approximately $80 to $100 per cubic foot of rearing capacity. The operational (energy) costs of airlifts is roughly half that of PRAS equipment, and maintenance costs are also lower due to less mechanical equipment. In addition to the cost benefits of airlift reuse, it also provides a major biosecurity benefit in that no intermingling of reuse flow between tanks takes place.

Figure 4-4. PRAS at Eastbank Hatchery (Courtesy of PRAqua)

Incorporating 50% water reuse will reduce make-up water demands for both groundwater and surface water from approximately 150 gpm to less than 80 gpm. Simple serial reuse is the most cost effective method of meeting production goals if the biosecurity risks are deemed acceptable.

Recommend include provisions for 50% partial water reuse since it will allow use of first pass water for all functions and will reduce water supply pump energy costs as well. Considering the lower capital and operating costs, and greater bio-security, it is recommend to carry forward the airlift pump alternative. Since this technology consists primarily of low pressure air piping and drop-in airlift units, it would be feasible to install blowers and air piping as part of the initial retro-fit and add airlift units to individual vessels as funding allows.

4.1.4 Water Supply Tempering and Storage

The need for tempered water has been identified as an important facility component in order to hold WCT on near natural water temperature regimes. The operations schedule (Table 3-3) shows average water temperature variations by month in the river water supply that range from 38 to 75 degrees F. Groundwater temperatures are a relatively consistent 48 to 50 degrees F by comparison. The greatest flexibility would be provided by routing both groundwater and surface water supplies with isolation and blending valves at each rearing vessel. Providing individual automated blending valves and controllers at each rearing vessel would cost in the range of $5,000 per vessel and result in a costly and complex water supply system.

For greater operational simplicity and cost reduction, provisions for a centralized automated water temperature blending capability has been proposed by KTOI. This would logically occur at the proposed groundwater degassing and storage headbox with a connection from the surface water supply via a motorized blending valve with temperature sensor and an adjustable set-point controller. Since blending warmer and colder water will increase total dissolved gas (TDG) pressure in the water, small individual degas columns will be incorporated at the inlet to each rearing vessel.

A reasonable size for a groundwater storage vessel would provide for 1 to 2 hours of storage capacity at peak flow rates. At a peak flow of 80 gpm (with reuse), a 10,000 gallon storage tank would provide approximately 2 hours of reserve flow. A variety of storage vessels could be used, including insulated above ground fiberglass or polyethylene tanks, or partially buried concrete tanks. A partially buried concrete tank is recommended since it offers better insulation values during both hot and cold weather conditions and would be less exposed to potential vandalism or other damage compare to above grade tanks.

4.1.5 Rearing Vessels Alternatives

The existing facility utilizes rectangular fiberglass rearing troughs in the upper hatchery building and rectangular concrete raceways in the lower hatchery building. Recent studies (Summerfelt 1998), (Good 2009), have indicated advantages in using circular tanks for fish culture including better self-cleaning flow patterns for waste management, controllable higher radial water velocities that result in stronger swimming fish, and improved distribution of feed and dissolved oxygen within the vessel.

As noted in Section 3 above, operators of an existing WCT conservation hatchery at Sekokoni Springs in Montana have noted that WCT in particular have behaved more aggressively in circular tanks, manifested in fin nipping and gradual deterioration of fish condition. They have found that using segregated troughs or small semi-square tanks with rounded corners has decreased aggression and resulted in production of better quality fish.

For the purposes of this planning study, it is recommended that at least two of the four existing 2’-4” x 25’ long rectangular troughs (Fig. 4-5), be retained for initial WCT ponding and early rearing through year Zero. Six 4-foot semi-square tanks are proposed for WCT Age 1 fish. Nine 6-foot circular tanks are proposed for WCT broodstock.

For TRBT rearing, one of the existing concrete raceways in the lower hatchery building would provide more than enough rearing capacity for all 4 batches of fish. Alternatively, several smaller fiberglass tanks could be used within the footprint of the existing raceway. For planning purposes, it is assumed that the existing raceway is used.

Figure 4-5. Upper Hatchery Building Fiberglass Troughs, Water and Air Supply Piping

4.2 Proposed Facility Needs

Based on site visit evaluations, biological criteria and alternatives analysis, the following modifications and improvements have been identified for converting the existing hatchery to coldwater fish production:

- Increase groundwater supply by constructing 2 additional wells into a shallow aquifer.
- Provide a degassing and storage headbox for the groundwater supply.
- Re-build the surface water pumpstation in the existing footprint if possible.
- Construct a back-up surface water pumpstation that can be connected to emergency power.
- Provide the capability to blend surface water and groundwater using an automated set-point controller system in order to mimic natural stream temperatures for the WCT program.
- Re-configure existing indoor space for the incubation, broodstock holding, and juvenile fish rearing facilities.
- As a minimum, incorporate serial reuse to reduce peak water demands. If budgets allow, incorporate airlift pump water reuse methods.
- Add a duplex air blower system to replace the single existing unit, sized to run airlifts and/or air stones in all rearing vessels.
- Optimize the process water treatment systems, especially the surface water treatment equipment to ensure reliable supply of silt free, disinfected water to fish holding and rearing vessels.
- Provide for adjustable timer based photo-period lighting controls in the WCT areas in order to minimize the effects of domestication.
- Improve monitoring and alarm, and back-up power systems.

Due to the low fish production and feed amounts used at this facility it does not require and NPDES permit and there are no upgrades needed to the hatchery discharge or existing effluent wetlands treatment. A brief description of these major facility components is presented in the following paragraphs. The concept design drawings illustrate the overall facility layout.

4.2.1 Groundwater Supply, Storage and Tempering Systems

The proposed ground water budget is 150 gpm for single pass or 75 gpm for a 50% reuse. The existing well will provide at least 80 gpm based on the results of a 24 hour pump test in September of 2014. A second well with at least 80 gpm of production capacity is required in order to provide a fully redundant supply (in conjunction with 50% reuse), for maintaining critical flows to fish during the warm summer months. A third well is recommended in order to provide redundancy if budgets allow. In addition to one or two new wells, the groundwater supply system will include a storage tank with central degassing and water tempering capabilities, and a gravity flow piped distribution system to various points of use. The tempering system will consist of a motorized valve on a tee branch that connects the surface water supply to the groundwater supply. The valve will be modulated by a set-point controller based on a 4 to 20 mA signal from a thermal sensor located downstream of the mixing point. Groundwater piping will general consist of 4-inch main lines, with smaller branches to individual tanks and incubators.

There is plenty of area on higher ground to the east of the existing hatchery buildings to construct a partially buried, insulated storage tank for tempered groundwater. There appears to be approximately 20 feet of elevation difference between the upper hatchery building floor elevation and the paved road to the east. For planning purposes the tank will be sized to at 10,000 gallons to provide at least two hours of supply storage at the peak ground water flow rate of 80 gpm. Tank dimensions of 8-feet wide x 24 feet long and 7 feet of water depth will be used for cost estimating.

The size of the discharge piping on the existing well could not be verified during the site visit since it is buried. Where it enters the upper hatchery building, it is only a 1.5-inch steel pipe. It may be necessary to upsize to at least a 2-inch pipe from the well to the proposed degassing headbox in order to maximize yield from this well.

4.2.2 Surface Water Intake, Pumpstation and Treatment

The capacity of the existing surface water intake pipeline, pump station piping and supply pipeline from the pump station to the hatchery is adequate to provide the 155 gpm peak flow rate indicated in Section 3 above. The pump station will need to be modified to raise electrical panels and pump motors above flood elevation as shown in Figure 4-6. The pump wet well configuration will also be modified to eliminate siltation problems.

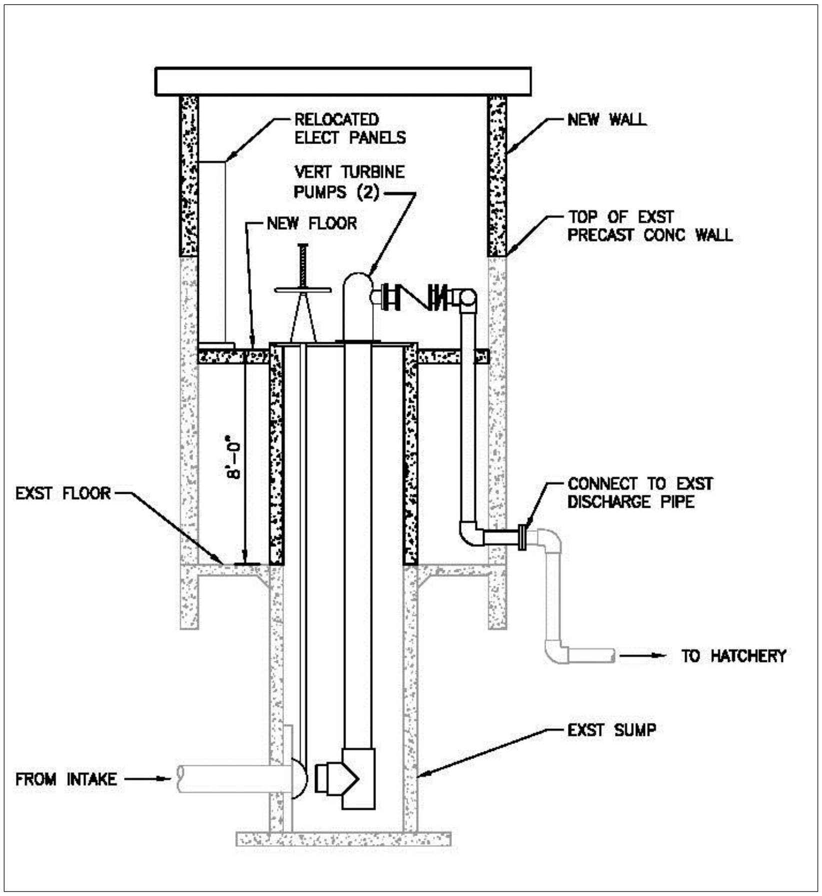

Figure 4-6. Surface Water Pump Station - Conceptual Modifications

The surface water supply system inside the hatchery building will be modified as needed to provide valved supply branches to the proposed rearing vessels. Water reuse technology will reduce surface peak water demand by 50%, to approximately 80 gpm. The existing treatment equipment is more than adequate to treat this reduced supply flow. Portions of existing surface water piping systems will be incorporated in the new design.

4.2.3 Water Reuse

Serial reuse piping will be incorporated to allow rearing vessel overflow water from the upper hatchery building to be used as second pass water in the lower hatchery building. Piping will also be provided for first pass water to be delivered to each vessel in the lower building as well.

Provisions for airlift pump reuse or low head oxygenation are also recommended. The airlift system would include installing a duplex 3 horsepower air blower system and extending air supply manifolds to all rearing vessel locations.

4.2.4 Hatchery Building Improvements

Two options have been developed for hatchery building improvements. A lower cost option where WCT broodstock is combined with TRBT indoor rearing in the lower hatchery building and a higher cost option where WCT broodstock holding is located in an expaned upper hatchery building, with the lower building dedicated to TRBT production.

Under the low cost option the upper hatchery building will require minor modifications to bring the new 4-inch groundwater supply piping into the building, and serial reuse piping out of the building. Eight to ten new 4-foot semi-square tanks will be added adjacent the floor trench in the space in between the existing rectangular troughs.

The option of locating the WCT broodstock holding tanks in the lower building would require the demolition of one of the two concrete raceways (Fig. 4-7). The TRBT rearing could be accomplished in the other concrete raceway, or it could be demolished as well and replaced with smaller fiberglass tanks or troughs. As with the upper building, minor modifications will be needed to bring new groundwater and serial reuse supply pipes into the building.

The centralized WCT option would require adding a 1,080 square foot extension at he north end of the upper hatchery building to accommodate the WCT broodstock holding and spawning area adjacent to the WCT incubation and early rearing. An overhead door and man door would be provided in the north wall of the addition with a concrete apron in front of the doors. A disinfection vestibule in between the new broodstock area and the WCT incubation and early rearing space is included for biosecurity purposes in this option.

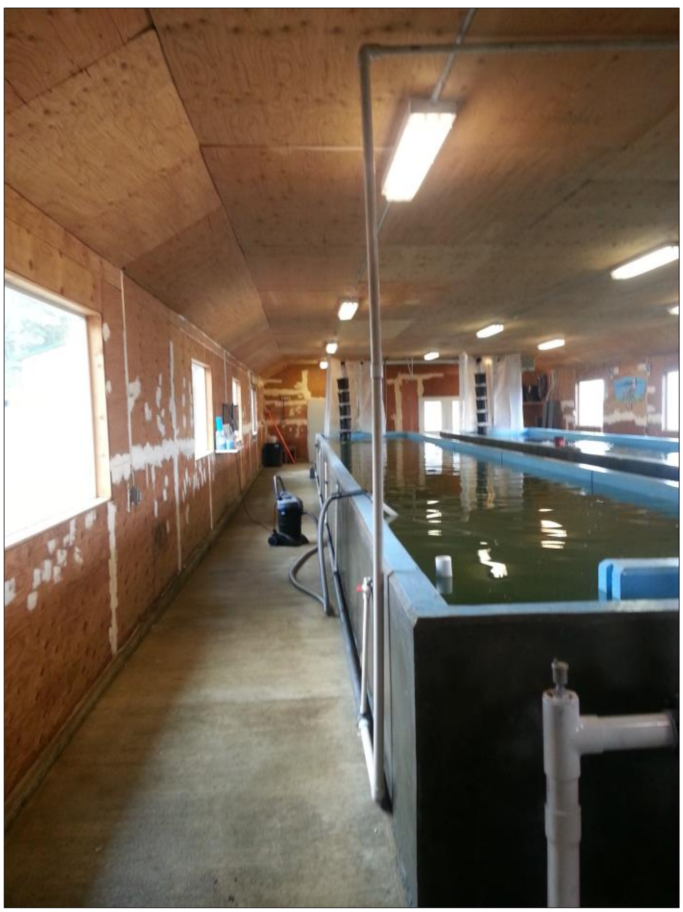

Figure 4-7. Lower Hatchery Building Raceways

4.2.5 Photoperiod Lighting Control

The lower hatchery building has four large windows in the long exterior east and west walls along each raceway, with additional windows in access doors to provide a high level of natural light and photoperiod exposure. The upper hatchery building has only a single window into the north wall of the production area along with small ports in the overhead door. Adjustable timers can be added to the lighting circuits in this building in order to provide photo period control at higher lighting levels.

4.2.6 Monitoring, Controls, Alarms and Power Systems

Monitoring and controls improvements will include flow and pressure sensors on both water supplies, temperatures on both water supplies, tank levels for each incubation, holding and rearing vessel, and equipment run status/fail monitoring. Local and auto-dialer alarms will be provided for any out of range and fail status indications.

Monitor and alarm points could be added at the pump station but quite a bit of buried wire or a radio-based telemetry system would have to be added in order to get the signals to the hatchery. An alternative is to monitor the pump station flow as it enters the hatchery to determine basic pump station status/data.

Utility power to the site is provided through a Pend Oreille PUD pad mount transformer at the hatchery building. It is rated at 208Y/120 volts, 400 amps , 3-phase. The existing service size appears adequate for the anticipated new loads. This may have to be confirmed with the use of a temporary 30-day power meter.

The existing standby generator is rated at 30 KW. It currently supplies back-up power to site critical loads. Currently, those loads include the blowers, well pump, pumps P7 and P8, the UV system, miscellaneous hatchery building receptacles /lights, the office building and similar miscellaneous loads in the raceway building. It appears to be loaded to approximately 70-95% of it's rating. During the site visit, it was mentioned that the generator greatly 'lugs down' as it assumes the building connected load. This indicates that it is probably loaded close to it's capacity.

New loads that should be added to the standby power system include the upsized and added blowers, two additional well pumps, an emergency surface water pump, plus some miscellaneous lights/outlets in the building addition. This will add close to 27 KW to the back-up power source. The existing generator is not large enough for the additional loads. A unit rated at 50-60 KW should replace the existing generator. In addition, the ATS (automatic transfer switch) and panel E would have to be replaced with higher rated gear. The replacement generator will be propane fueled and be served from the existing 500 gallon propane tank.

4.3 Conceptual Layouts and Alternatives

Layout concepts and alternatives are provided for the upper hatchery building, lower hatchery building, and a site layout showing the proposed groundwater storage facility. A lower cost alternative uses the upper hatchery for WCT rearing and the lower hatchery building for TRBT rearing and WCT broodstock holding.

A higher cost alternative which provides improved biosecurity and isolation between the two stocks of fish would dedicate the upper hatchery building to the WCT program and the lower hatchery building to the TRBT program. This would require a 900 square foot addition to the north end of the upper hatchery building to house the WCT broodstock. These layouts provide the basis for conceptual level costs presented in Section 5 and are discussed in more detail below.

4.3.1 Upper Hatchery Building

The existing production area in the upper hatchery building is approximately 30 feet wide and 32 feet long. The conceptual layout for this area (Fig 4-8), shows retaining the existing fiberglass troughs for WCT early rearing. The biological criteria indicate that only two of the four existing troughs are needed to meet program goals, so one pair of troughs could be removed to provide more space for incubation or other rearing vessels. A total of (10) proposed 4-foot semi square tanks are shown in between the troughs. Two vertical stack incubators are shown in the upper left corner of the room. The spacing is relatively compact, so again – it may be desirable to shift or remove one or two of the surplus troughs.

An alternative layout (Fig 4-9), was developed to provide space at the upper hatchery building for the WCT broodstock tanks including a large spawning area and a disinfection room in between the broodstock holding and incubation/rearing rooms.

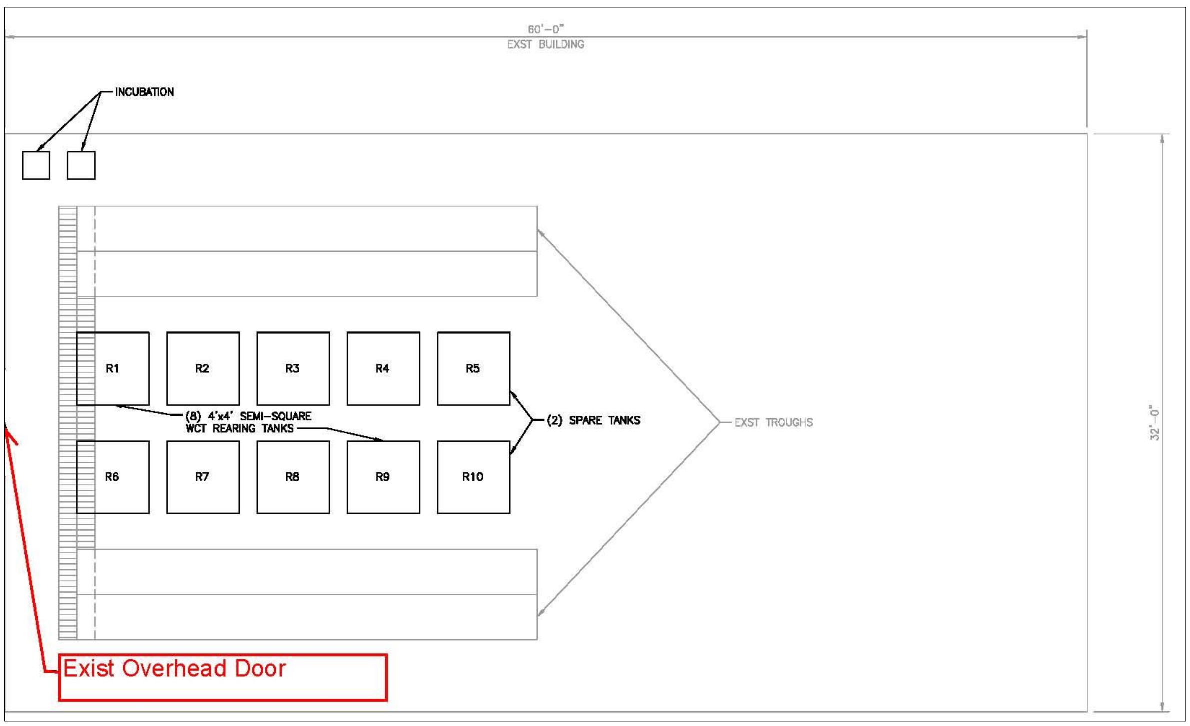

Figure 4-8. Upper Hatchery Building Layout – Decentralized WCT Option

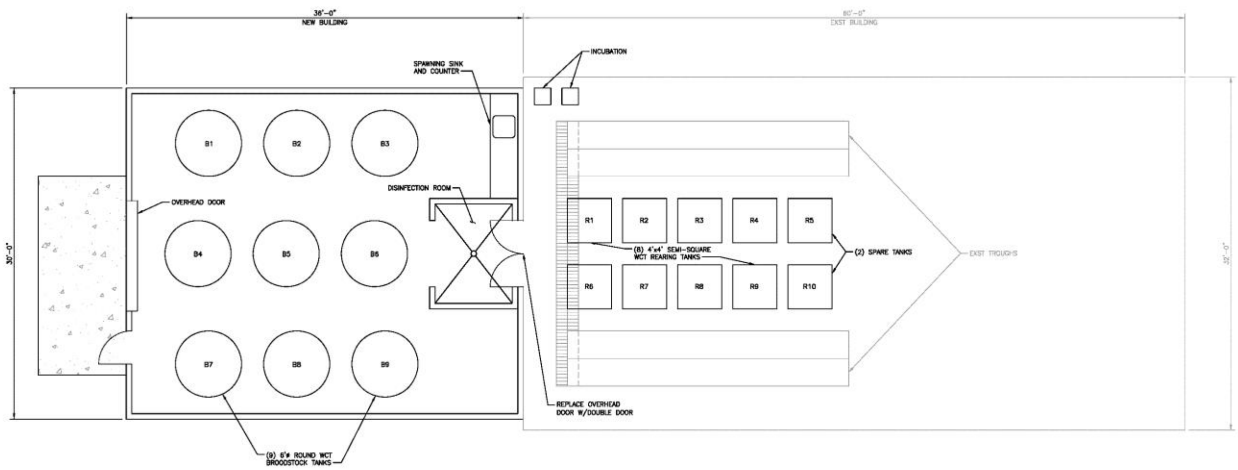

Figure 4-9 Upper Hatchery Building Centralized WCT Option

4.3.2 Lower Hatchery Building

The lower hatchery building is 30 feet wide by 80 feet long, with an open interior space dedicated solely to housing the two 8-foot wide by 62-foot long concrete production raceways. Under the decentralized WCT alternative the proposed layout for this area will provide rearing space for the TRBT grow-out and WCT broodstock holding. One of the existing raceways is demolished (Fig 4-10)and replaced by 9 of the 4-foot semi square tanks (or 6 foot diameter circulars), for the WCT broodstock. The other raceway is retained for the TRBT program. It has screen slots at 11 feet on center which will provide 5 compartments for holding the four different batches of TRBT. Each compartment will have approximately 260 cubic feet of water volume which exceeds the required volume shown in the operating schedule.

The centralized WCT alternative would leave both of the existing concrete raceways intact and dedicated to TRBT production. TRBT production would be limited by the amount of flow available since the rearing volume in the two raceways would accommodate significantly more fish than the present production goals indicate.

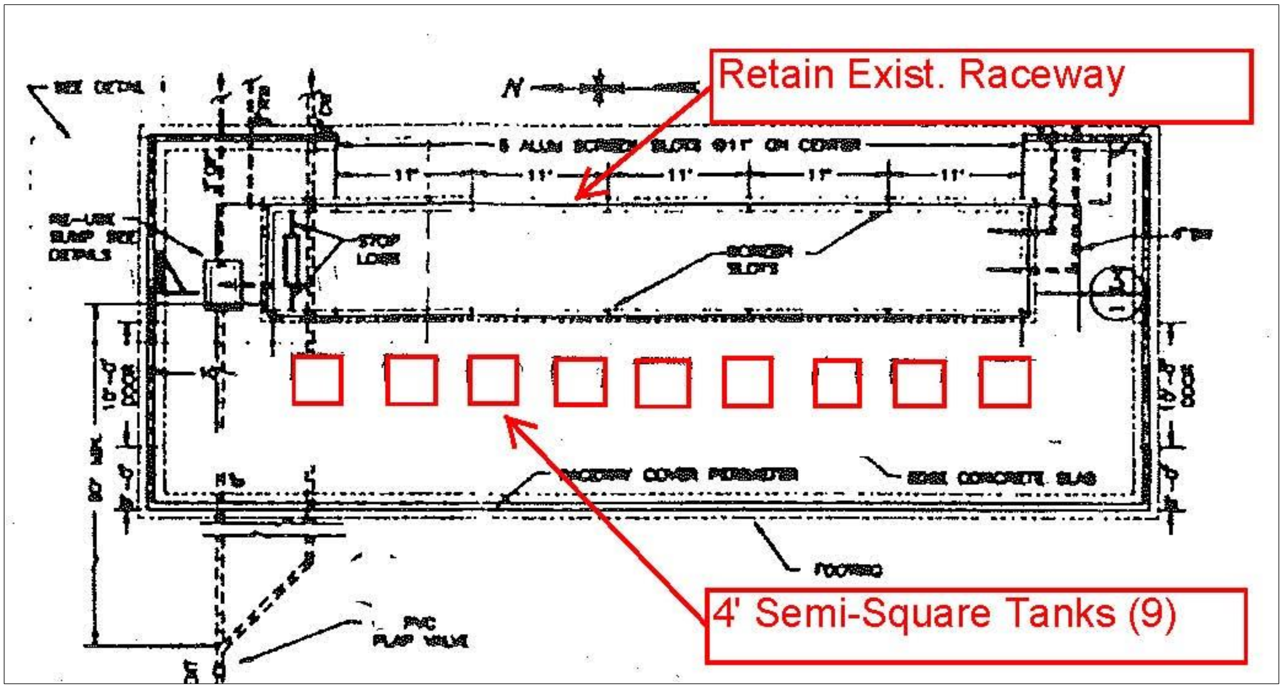

Figure 4-10. Lower Hatchery Building Layout – Decentralized WCT Option

4.3.3 Site Layout

New site features are limited to one or two new wells for the groundwater supply, the groundwater storage tank, and a larger blower shed to accommodate the duplex blower system. Figure 4-11 shows a preliminary layout of the new features. The well locations are not yet determined. The surface water pumpstation improvements and any necessary emergency generator upgrades will occur within the footprint of the existing facilities.

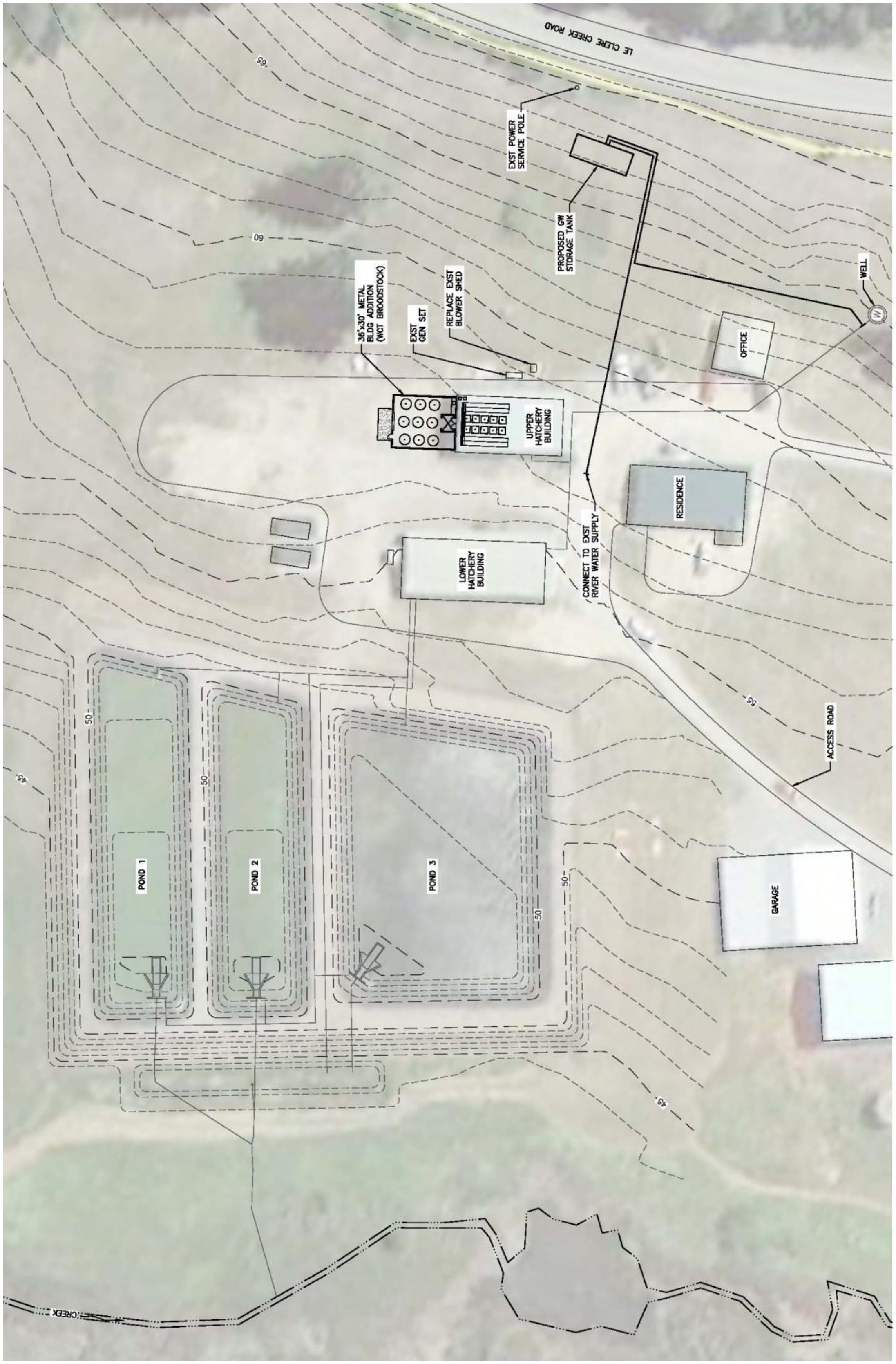

Figure 4-11. Site Layout

SECTION 5
CONCEPTUAL COSTS OF PROPOSED PROGRAM

5.0 Specifics of Conceptual Costs

A primary purpose of the conceptual design effort is to demonstrate feasibility and establish range of magnitude costs for project implementation. These costs include expenditures for planning and design, construction, capital equipment, and environmental compliance. Annual operating costs are also provided. A detailed estimate for construction costs is provided as Appendix C.

5.1 Planning and Design Costs

Planning and design costs are typically 10 to 12% of construction costs depending on project complexity. This project is considered complex due to the poorly documented existing conditions (no as-builts), and relatively complex small diameter piping required. If NPCC 3-Step scientific approval is required an additional 2 to 4% is typically required. For the purposes of this feasibility study a budget of $120,000 is shown for planning and design (Table 5-3), not including the potential additional costs of the NPCC 3-Step process.

5.2 Construction Costs

Capital construction costs are concept estimates based on a conceptual design. Due to the level of uncertainty, a contingency of 15% is applied to each line item in the cost estimate detail (See Appendix C). Such a contingency is largely dependent on the number of uncertainties associated with the project and the amount of pre-investigation work completed. Estimated construction costs represent a maximum range and likely cost reductions would be identified in future planning stages through analysis of alternatives. Tables 5-1 and 5-2 summarize the low and high option estimated construction costs organized by CSI specification division. Costs are broken down into major infrastructure and facility components and are based on the scope and conceptual descriptions presented in Chapter 4.

The estimated construction budget for the coldwater conversion project ranges from $1,074,000 to $1,288,000 in 2016 dollars. These costs are based on constructing all components as a single project.

Table 5-1. Decentralized WCT Option - Construction Cost Summary

Item	Cost
Division 01 - General Requirements	$79,350
Division 02 - Existing Conditions	$20,700
Division 03 - Concrete	$50,313
Division 05 - Metals	$17,250
Division 06 - Wood and Plastic	$31,602
Division 07 - Thermal and Moisture Protection	$3,450
Division 08 - Openings	$5,750
Division 09 - Finishes	$3,450
Division 10 - Specialties – Well Drilling	$57,500
Division 11 - Equipment	$235,428
Division 26 - Electrical	$187,450
Division 31 - Earthwork	$12,650
Division 33 - Utilities	$23,000
Division 40 - Instrumentation and Controls	$27,600
Division 42 - Process Water Systems	$92,863
Division 43 - Mechanical	$24,495
Construction Total - 2014 Dollars	$872,850
Contractor Overhead and Profit 16%	$139,656
2014 Project Cost	$1,012,506
Escalation to 2015 Mid-Point of Construction at 3%	**$1,042,881**
Accuracy Range +35%	$1,303,601
Accuracy Range -15%	$886,449

Table 5-2. Centralized WCT Option - Construction Cost Summary

Item	Cost
Division 01 - General Requirements	$95,163
Division 02 - Existing Conditions	$20,700
Division 03 - Concrete	$64,113
Division 05 - Metals	$17,250
Division 06 - Wood and Plastic	$31,602
Division 07 - Thermal and Moisture Protection	$3,450
Division 08 - Openings	$11,500
Division 09 - Finishes	$3,450
Division 10 - Specialties – Well Drilling and PEMB	$119,600
Division 11 - Equipment	$279,128
Division 26 - Electrical	$212,175
Division 31 - Earthwork	$12,650
Division 33 - Utilities	$23,000
Division 40 - Instrumentation and Controls	$27,600
Division 42 - Process Water Systems	$100,913
Division 43 - Mechanical	$24,495
Construction Total - 2014 Dollars	$1,046,788
Contractor Overhead and Profit 16%	$167,486
2014 Project Cost	$1,214,274
Escalation to 2015 Mid-Point of Construction at 3%	**$1,250,702**
Accuracy Range +35%	$1,563,377
Accuracy Range -15%	$1,063,096

5.3 Capital Equipment Costs

Capital equipment costs include office, lab and shop equipment and supplies, fish trucks, tagging materials, M & E supplies, etc., that are not part of construction costs and may need to be accounted for in overall project budgeting. Since the existing hatchery has much of this equipment already, the costs in this category may be significantly less than normal. An allowance of $10,000 is included and will be verified during future planning phases.

5.4 Environmental Compliance Costs

Environmental compliance costs are concept and show a contingency of (+/-35%). Development of the proposed facilities will incur environmental compliance costs subsequent to early planning stages (site feasibility and a Step 1 Master Plan). Environmental compliance steps for the proposed program could include the National Environmental Policy Act (NEPA) and other laws and regulations. However the present scope of the proposed improvements is mostly limited to previously disturbed areas at the surface water pumpstation and the existing hatchery buildings. Permitting for new wells and the groundwater storage facility should be relatively simple. An allowance of $30,000 been included in the present budget for environmental compliance and permitting.

5.5 Operations and Maintenance Costs

According to KTOI the present BPA operational funding does not cover the costs of operations for the warm water hatchery. More manpower will be required to manage and operate the proposed coldwater hatchery. In particular, more effort will be needed to conduct and monitor the WCT program. Operations costs at the hatchery will be expected to increase compared to present levels.

Table 5-3. Operations and Maintenance Costs

Category	Present Annual Cost
Salaries	$140,000
Utilities	$18,300
Feed	$17,000
Vehicle Expenses	$5,600
Vehicle Lease	$6,400
Travel	$4,900
Supplies and Materials	$15,500
Contracts	$10,000
Indirect Costs	$39,700
Total	**$257,400**

Replacing the double pumping configuration at surface water pumpstation with a more efficient single pumping step will result in energy savings of approximately 25%. During the summer months, the facility will switch over to all groundwater pumping. The aquifer appears to be slightly higher than the river water level, and the overall pump head will be lower due to shorter piping runs no filtration losses. Therefore, summertime pumping will be less costly as well. Table 5-4 provides an analysis of these pumping costs based on full flow through of pumped river water and groundwater supplies. The predicted power cost is approximately $2,000 per year which is slightly less than present pumping costs. Incorporating 50% water reuse system will cut the pumping cost in half for both sources to around $1,000 per year, similar to what it is now. If serial reuse is used, there will be additional energy costs associated with reuse. If airlift reuse is implemented, a 2 to 3 hp blower will be able to run the airlift pumps for both buildings at a nominal additional energy cost of $500 per year.

Table 5-4. Projected Pumping Costs

	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	Annual Total
Flow Requirements (cfs, ave)													
Surface Water	0.16	0.19					0.28	0.31	0.31	0.32	0.33	0.35	
River Water Pumping Schedule													
No. of Pumps	1	1	1	1	1	1	1	1	1	1	1	1	
Total Pumping (cfs)	0.16	0.19	0.00	0.00	0.00	0.00	0.28	0.31	0.31	0.32	0.33	0.35	
Total Head(ft)	102.0	102.0					102.0	102.0	102.0	102.0	102.0	102.0	
Horsepower per Pump	2.4	2.8	0.0	0.0	0.0	0.0	4.0	4.4	4.4	4.6	4.7	5.0	
Supply Pump Horsepower	2.4	2.8	0.0	0.0	0.0	0.0	4.0	4.4	4.4	4.6	4.7	5.0	
Energy Recovery Pump Horse Power	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Demand (kw)	2	2	0	0	0	0	3	3	3	3	4	4	
Service Charge	$42	$42	$42	$42	$42	$42	$42	$42	$42	$42	$42	$42	$504
Total Consumption (kwh)	1,262	1,487	0	0	0	0	2,162	2,369	2,369	2,473	2,542	2,681	
Consumption Charge	$50	$59	$0	$0	$0	$0	$86	$95	$95	$99	$102	$107	$694
Monthly Power Cost	$92	$101	$42	$42	$42	$42	$128	$137	$137	$141	$144	$149	$1,198

Assume: Typical Peak Flow per Pump =	0.4 cfs	Pump to H-box Elev	2080
		River Average Water Elev	2030
Pump Horsepower =	(gpm x ft head)/(3960 x eff) (80%	Estimated Sump Level	2028
at 102' TDH =	5.8 hp	Static Head	52
		Est. Dynamic Losses	50
		TDH During Peak Pumping	102
Power Cost- All kwh	$0.0400 per kwh		

	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	Annual Total
Flow Requirements													
Ground Water (gpm. ave)	30	31	124	128	131	150	20	21	29	20	27	32	
Ground Water (cfs, ave)	0.07	0.07	0.28	0.29	0.29	0.33	0.04	0.05	0.06	0.04	0.06	0.07	
Groundwater Pumping Schedule													
No. of Pumps	1	1	1	1	1	1	1	1	1	1	1	1	
Total Pumping (cfs)	0.07	0.07	0.28	0.29	0.29	0.33	0.04	0.05	0.06	0.04	0.06	0.07	
Total Head(ft)	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0	
Horsepower per Pump	0.7	0.7	2.8	2.8	2.9	3.3	0.4	0.5	0.6	0.4	0.6	0.7	
Supply Pump Horsepower	0.7	0.7	2.8	2.8	2.9	3.3	0.4	0.5	0.6	0.4	0.6	0.7	
Energy Recovery Pump Horse Power	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Demand (kw)	0	1	2	2	2	2	0	0	0	0	0	1	
Service Charge	$42	$42	$42	$42	$42	$42	$42	$42	$42	$42	$42	$42	$504
Total Consumption (kwh)	356	368	1,477	1,524	1,551	1,776	237	249	344	237	320	380	
Consumption Charge	$14	$15	$59	$61	$62	$71	$9	$10	$14	$9	$13	$15	$353
Monthly Power Cost	$56	$57	$101	$103	$104	$113	$51	$52	$56	$51	$55	$57	$857

		Pump to H-box Elev	2090
Assume: Typical Peak Flow per Pump =	0.33 cfs		
Pump Horsepower =	(gpm x ft head)/(3960 x eff) (80%	Estimated Aquifer Level	2035
at 70' TDH =	3.0 hp	Static Head	55
		Est. Dynamic Losses	10
		TDH During Peak Pumping	65
Power Cost- All kwh	$0.0400 per kwh		

5.6 Cost Summary

Table 5-5 provides a summary of conceptual level estimates of total project costs for key areas. Construction costs have been escalated to 2016 dollars. All other line item estimates are shown in 2014 dollars and will need to be escalated to the year they would occur once the project moves to future planning stages and a specific timeline is developed for future planning and implementation. For planning purposes, the centralized WCT option construction cost is used.

Table 5-5. Centralized WCT Program - Conceptual Cost Summary

Program Area	Conceptual Costs
Planning and Design	$120,000
Construction	$1,250 700
Capital Equipment	$10,000
Environmental Compliance	$20,000
Operations and Maintenance	$260,000
Research, Monitoring & Evaluation	$100,000
Total – One Time (Excludes O & M)	$1,400,700

SECTION 6
CONCLUSIONS

6.0 Summary

In summary, the conversion of the warm water bass hatchery to a cold water trout hatchery is feasible, primarily due to the availability of cold high quality groundwater. Redeveloping the existing hatchery would cost much less than developing a hatchery at a new un-improved site. Much of the existing hatchery infrastructure would be retained and used to support the proposed trout programs. One time project costs are in the $1.4 M range which compares favorably to other proposed conservation aquaculture programs in the region.

Next steps towards project implementation include securing funding for planning, design, environmental compliance, and construction, potentially conducting well drilling and pump testing to prove the ground water supply, and additional research and programming work utilizing WCT fish culture specialists. BPA funding involvement may required the preparation of a Step 1 master plan for the project under the NPCC 3-Step project implementation process.

SECTION 7
REFERENCES

Billings, R. (2013). Save Energy and Dollars with Airlift Technology. *Hatchery International,* May/June 2013, 32-33.

APPENDIX A

WCT GROWTH RATE AND BROODSTOCK DATA

Wild Westslope Cutthroat Trout Rearing Strategies

The biggest problem with bringing in wild trout into a hatchery environment is getting them to convert to feeding on pellets. Over 60% of the fish will starve to death if forced onto pellet feed without some form of live feed to help them adjust. Unfortunately, live feed (mealworms, crickets, etc.) are much more expensive than formulated pellet feed as well as detrimental to the long-term health of the fish. By using both feeds and periodically evaluating fish growth, over 90% of the fish can be switched to feeding entirely on pellets within about nine months.

Initial Feeding

When the fish are brought into the hatchery they should be sorted by size and placed into tanks at density indices <0.1. The density index is calculated by dividing the weight of the fish in pounds by the volume of the tank in cubic feet multiplied by the mean length of the fish in inches: $D=W/(V*L)$. The fish are fed both live feed and pellet feed at the rates of 2% and 1% total weight daily. Very little feeding will occur for the first 7-10 days. The fish will spend most of their time trying to find a way out. The tops of the tanks must be securely screened to prevent this from happening. After a 7-8 week adjustment period the fish are ready to be evaluated.

Feeding Behavior Evaluation/inventory

Once the fish been feeding for a month or more, they should be evaluated to determine which ones are feeding on pellets. Discontinue feeding live feed for 7-10 days and double the amount of pellets during the final 4 days of the evaluation. Sort and inventory the fish from each tank by size and fullness. Those that have switched will be the larger fish in each tank as well as having noticeably fuller bellies. These fish now can be kept separate and fed only pellets. The smaller, skinnier fish will need to be put back on the 2% live, 1% pellet diet. Repeat the evaluation/inventory again every 10 weeks or until all the fish are on pellets.

Feed Projections

I don’t recommend feeding to projections unless you have a target size that needs to be reached. I feed the fish a constant amount based on the last inventory (1% total weight) and update it the next inventory. The intervals between inventories is somewhat dependent on water temperature. Water temperatures above 55 degrees F necessitate a 7-8 week interval, while water temperatures below 45 degrees F can stretch the interval to 20 weeks.

Tank Selection

Recently, I’ve found that the fish switch to pellet feed much more readily in a large round tank than they do in rectangular ones. A 6 foot diameter, 5 foot deep tank with an external standpipe works very well. The fish are more aggressive and have nearly 100% conversion within the first three months of captivity.

Growth Rates

During the first weeks in the hatchery growth rates are around 0.1 mm/day due to the lack of initial feeding by the fish.

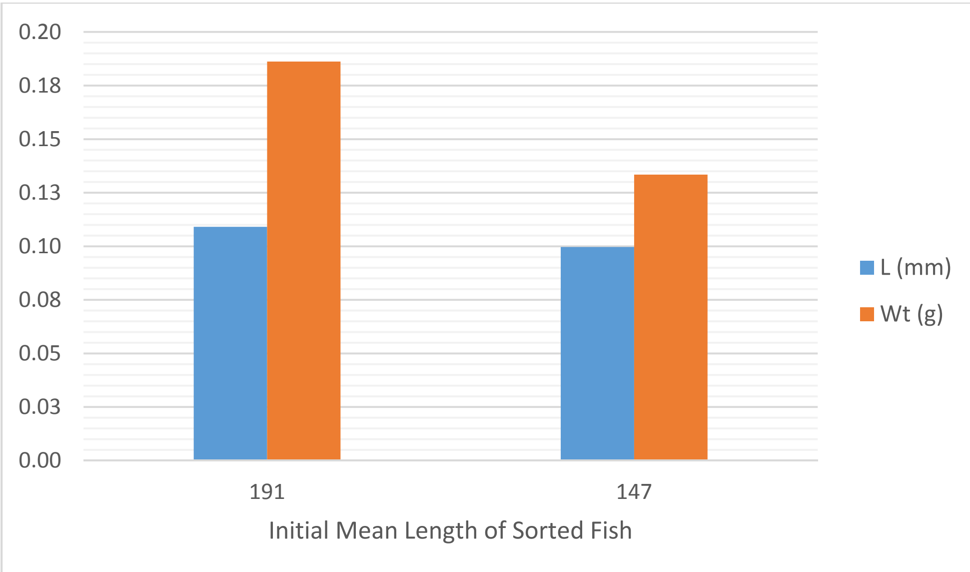

Figure 1. Mean daily growth rates of WCT during first evaluation interval, July 19-Aug 11. Note, mean water temperature was 57 degrees F.

Once the fish begin to acclimate to the hatchery, growth rates can be as high as 0.3 mm per day in the larger fish.

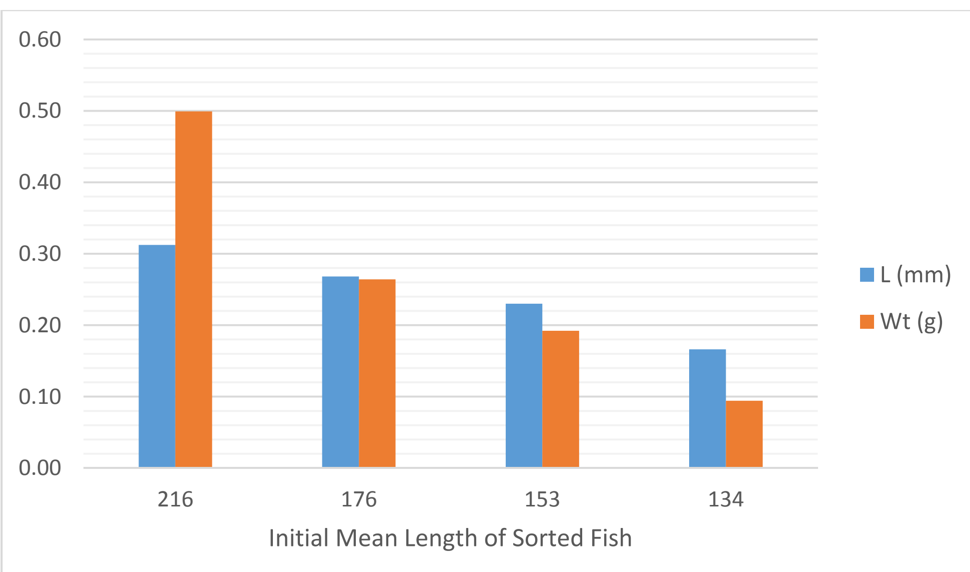

Figure 2. Mean daily growth rates of WCT during second evaluation interval, Aug11-Sep 9. Note, mean water temperature was 60 degrees F.

During the third evaluation interval, both size classes of pellet feeding fish grew at rates over 50% higher than the fish that hadn't converted yet. Lower water temperatures increased growth rates over those of the previous interval.

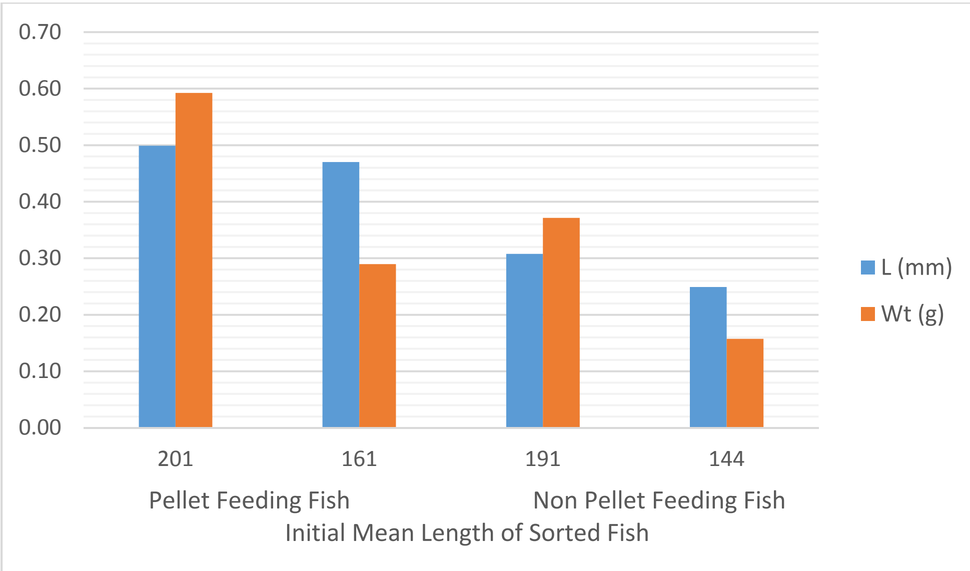

Figure 3. Mean daily growth rates of WCT during third evaluation interval, Sep 9-Oct 23. Note, mean water temperature was 55 degrees F.

During the fourth evaluation interval, growth rates among all fish declined due to a much longer interval between feeding rate updates.

Figure 4. Mean daily growth rates of WCT during fourth evaluation interval, Oct 23-Jan 5. Note, mean water temperature was 50 degrees F.

During the fifth evaluation period, growth rates were suppressed by the colder water temperatures and the very long interval between feeding rate updates (22 weeks).

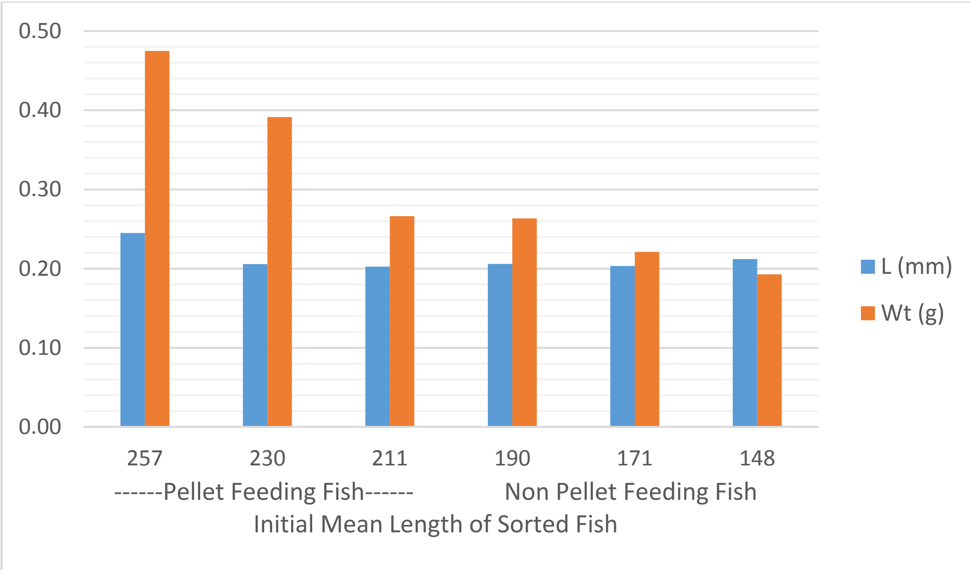

Figure 5. Mean daily growth rates of WCT during fifth evaluation interval, Jan 5-Jun 13. Note, mean water temperature was 45 degrees F.

Overall growth rates for the WCT kept in captivity from July 19th to June 13th were 0.25 mm and 0.34 grams per day. Mortality rates were 6.4% during this period. Growth rates could be reduced, if desired, by skipping 1-2 days of feed occasionally. If water temperatures can be controlled, I recommend 50-54 degrees F most of the time with a 3 month winter period at 40 degrees F. This will improve egg quality.

It's important to get all the fish onto pellet feed within 9 months. Any longer and the fish may develop fatty liver disease as a result of the high carbohydrate and unbalanced fatty acid content of the mealworm diet.

APPENDIX B

WATER SUPPLY INFORMATION

Anatek Labs, Inc.

1282 Alturas Drive • Moscow, ID 83843 • (208) 883-2839 • Fax (208) 882-9246 • email moscow@anateklabs.com
504 E Sprague Ste. D • Spokane WA 99202 • (509) 838-3999 • Fax (509) 838-4433 • email spokane@anateklabs.com

Client: KALISPEL TRIBE
Address: P O BOX 39
USK, WA 99180
Attn: DAN McMEEKAN

Batch #: 111117058
Project Name: FISH HATCHERY

Analytical Results Report

Sample Number 111117058-001
Client Sample ID GROUND WATER HATCHERY WELL
Matrix Drinking Water
Comments

Sampling Date 11/17/2011
Sampling Time 12:45 PM
Sample Location

Date/Time Received 11/17/2011 4:20 PM
Extraction Date

Parameter	Result	Units	PQL	Analysis Date	Analyst	Method	Qualifier
Alkalinity	231	mg/L	5	11/21/2011	APM	SM2320B	
NH3-N	ND	mg/L	0.02	11/18/2011	JLU	SM4500NH3G	
Chloride	2.64	mg/L	0.1	11/18/2011	WOZ	EPA 300.0	
Cyanide	ND	mg/L	0.01	11/22/2011	CRW	SM4500CNE	
Fluoride	ND	mg/L	0.1	11/18/2011	WOZ	EPA 300.0	
Calcium	63.8	mg/L	0.1	11/29/2011	KEA	EPA 200.8	
Hardness	216	mg/L	1	11/29/2011	KEA	EPA 200.8	
Magnesium	13.7	mg/L	0.1	11/29/2011	KEA	EPA 200.8	
NO3/N	0.420	mg/L	0.1	11/18/2011	WOZ	EPA 300.0	
NO2/N	ND	mg/L	0.1	11/18/2011	WOZ	EPA 300.0	
pH	7.30			11/18/2011	APM	SM 4500pH-B	
Sulfate	6.87	mg/L	0.1	11/18/2011	WOZ	EPA 300.0	
TOC	1.55	mg/L	0.5	11/21/2011	WOZ	SM5310C	

Certifications held by Anatek Labs ID: EPA:ID00013; AZ:0701; CO:ID00013; FL(NELAP):E87893; ID:ID00013; IN:C-ID-01; KY:90142; MT:CERT0028; NM: ID00013; OR:ID200001-002; WA:C595
Certifications held by Anatek Labs WA: EPA:WA00169; CA:Cert2632; ID:WA00169; WA:C585; MT:Cert0095

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504 E Sprague Ste. D • Spokane WA 99202 • (509) 838-3999 • Fax (509) 838-4433 • email spokane@anateklabs.com

Client:	KALISPEL TRIBE	**Batch #:**	111117058
Address:	P O BOX 39	**Project Name:**	FISH HATCHERY
	USK, WA 99180		
Attn:	DAN McMEEKAN		

Analytical Results Report

Authorized Signature Kathleen A. Sattler

Kathy Sattler, Lab Manager

MCL EPA's Maximum Contaminant Level
ND Not Detected
PQL Practical Quantitation Limit

This report shall not be reproduced except in full, without the written approval of the laboratory.
The results reported relate only to the samples indicated.
Soil/solid results are reported on a dry-weight basis unless otherwise noted.

Certifications held by Anatek Labs ID: EPA:ID00013; AZ:0701; CO:ID00013; FL(NELAP):E87893; ID:ID00013; IN:C-ID-01; KY:90142; MT:CERT0028; NM: ID00013; OR:ID200001-002; WA:C595
Certifications held by Anatek Labs WA: EPA:WA00169; CA:Cert2632; ID:WA00169; WA:C585; MT:Cert0095

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Login Report

Customer Name: KALISPEL TRIBE
P O BOX 39
USK WA 99180

Order ID: 111117058
Order Date: 11/17/2011

Contact Name: DAN McMEEKAN
Project Name: FISH HATCHERY

Comment:

Sample #: 111117058-001 **Customer Sample #:** GROUND WATER HATCHERY WELL

Recv'd: ☑ **Collector:** DAN McMEEKAN **Date Collected:** 11/17/2011
Quantity: 1 **Matrix:** Drinking Water **Date Received:** 11/17/2011 4:20:00 P
Comment:

Test	Lab	Method	Due Date	Priority
ALKALINITY	S	SM2320B	11/19/2011	***Normal (6-10 Days)***
AMMONIA-NITROGEN	S	SM4500NH3G	11/29/2011	***Normal (6-10 Days)***
CHLORIDE	S	EPA 300.0	11/29/2011	***Normal (6-10 Days)***
CYANIDE IN DW MOSCOW SM	M	SM4500CNE	11/29/2011	***Normal (6-10 Days)***
FLUORIDE	S	EPA 300.0	11/29/2011	***Normal (6-10 Days)***
GROSS ALPHA	S	EPA 900.0	11/29/2011	***Normal (6-10 Days)***
GROSS BETA	S	EPA 900.0	11/29/2011	***Normal (6-10 Days)***
HARDNESS by EPA 200.8	S	EPA 200.8	11/29/2011	***Normal (6-10 Days)***
NITRATE/N	S	EPA 300.0	11/19/2011	***Normal (6-10 Days)***
NITRITE/N	S	EPA 300.0	11/19/2011	***Normal (6-10 Days)***
pH	S	SM 4500pH-B	11/19/2011	***Normal (6-10 Days)***
RADIUM 226	S	EPA 903.0	11/29/2011	***Normal (6-10 Days)***
RADIUM 228	S	EPA 904.0	11/29/2011	***Normal (6-10 Days)***
SULFATE	S	EPA 300.0	11/29/2011	***Normal (6-10 Days)***
TOC	S	SM5310C	11/29/2011	***Normal (6-10 Days)***

Customer Name:	KALISPEL TRIBE			**Order ID:**	111117058
	P O BOX 39			**Order Date:**	11/17/2011
	USK	WA	99180		
Contact Name:	DAN McMEEKAN			**Project Name:**	FISH HATCHERY
Comment:					

SAMPLE CONDITION RECORD

Samples received in a cooler?	Yes
Samples received intact?	Yes
What is the temperature inside the cooler?	7.8
Samples received with a COC?	Yes
Samples received within holding time?	Yes
Are all sample bottles properly preserved?	Yes
Are VOC samples free of headspace?	N/A
Is there a trip blank to accompany VOC samples?	N/A
Labels and chain agree?	Yes

111115 003 EWUN Last Due 11/25/2011
1st SAMP 11/13/201 1st RCVD 11/15/2011
LEAD & COPPER

Washington Chain of Custody - Lead Copper Analysis

WATER SYSTEM NAME	EASTERN WASHINGTON UNIVERSITY	WATER SYSTEM #	219009
SEND REPORT TO:	JAMES BUTLER	PHONE NUMBER	509 359-6561
ADDRESS:	101 ROZELL	FAX NUMBER	509 359-6751
		COUNTY	SPOKANE
CITY STATE ZIP	CHENEY, WA 99004		

Anatek Labs, Inc.

1282 Alturas Drive
Moscow, ID 83843
(208) 883-2839
FAX 882-9246
moscow@anateklabs.com
EPA # ID00013

504 E. Sprague Ste. D
Spokane, WA 99202
(509) 838-3999
FAX 838-4433
spokane@anateklabs.com
EPA # WA00169

www.anateklabs.com

Sample Purpose [X] Compliance (C) [ ] Investigative (I) [ ] Other Purpose (B)

DOH Source # Standing Distribution (93) (Lead/Copper Distribution)

Location Sample Taken	Date/Time	Location Sample Taken	Date/Time
1 #6 CES	11/13/11 5:20pm	11 #3 ART	11/13/11 6:15pm
2 #12 DRY	11/13/11 5:25pm	12 #5 CAD	11/13/11 6:20pm
3 #11 DRE	11/13/11 5:30pm	13 #33 PEC	11/13/11 6:25pm
4 #42 SCI	11/13/11 5:35pm	14 #62 WWF Conc.	11/13/11 6:30pm
5 #31 PUB	11/13/11 5:40pm	15 #52 SUR	11/13/11 6:40pm
6 #15 HAR	11/13/11 5:45pm	16	
7 #44 SHW	11/13/11 5:50pm	17	
8 #24 MAR	11/13/11 5:55pm	18	
9 #39 RRL	11/13/11 6:00pm	19 SWBS all sp	
10 #9 CMC	11/13/11 6:10pm	20	

17.9°C/LPU

SEND BILL OR RECEIPT TO

Payment due with samples unless credit has been established

Amount $

Received by

Payment Options
- [ ] Cash
- [ ] Bill
- [ ] Check#
- [ ] PO #
- [ ] Other

Shipper/Deliverer Signature	Jim Butler
Shipping/Delivery Date	11/15/11
Received By	[signature]
Date Received	11/15/11

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Radionuclide Analysis Report

System ID#:	105300036	System Name:	KALISPEL TRIBE		
Lab/Sample Number:	112 65307	Collect Date:	11/17/2011	DOH Source #:	
Multiple Source Nos:		Sample Type:		Sample Purpose:	
Date Received:	11/17/2011	Date Reported:	12/22/2011	Supervisor:	KAS
Date Analyzed:	12/6/2011				
County:		Sample Location:	GROUND WATER HATCHERY WELL		
Report To:	Address:	P O BOX 39		Sub Lab Sample #:	166-43383
	City, State, ZIP	USK, WA 99180			
	Phone Number:	509 445-1147			

DOH #	Analytes	LAB MDA	Results	Units	Date Analyzed	MCL	Analyst's Initials	Method	Qualifier
	EPA/State Regulated (These analysis should be performed in order as listed)								
165	Gross Alpha	1.0	1.05	pCi/L	12/6/2011	15	SUB	EPA 900.0	
166	Radium 228	0.5	1.07	pCi/L	12/6/2011	5	SUB	EPA 904.0	
	Determine Radium 226 activity only if Gross Alpha is greater than 5.0 pCi/L*								
39	Radium 226*	0.2	0.16	pCi/L	12/9/2011	5	SUB	EPA 903.0	
	Do the following only if specifically requested by the client or the state								
42	Gross Beta ****	1.0	2.10	pCi/L	12/6/2011	50	SUB	EPA 900.0	

Comments:

Certifications held by Anatek Labs ID: EPA:ID00013; AZ:0701; CO:ID00013; FL(NELAP):E87893; ID:ID00013; IN:C-ID-01; KY:90142; MT:CERT0028; NM: ID00013; OR:ID200001-002; WA:C595
Certifications held by Anatek Labs WA: EPA:WA00169; CA:Cert2632; ID:WA00169; WA:C585; MT:Cert0095

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Note:

MCL (Maximum contaminant Level): If the contaminant amount exceeds the MCL, immediately contact your regional DOH office.

MDA: Minimum Detectable Amount.

NA (Not Analyzed): use in the results column for compounds not included in the current analysis.

ND (Not Detected): use in the results column for compounds analyzed and not detected at a level greater than or equal to the MDA.

* If Gross Alpha is less than 5 pCi/L, it may be assumed that the Alpha activity is entirely due to Radium 226 (i.e., Radium 226 would not need to be run). The Alpha activity is then added to the Radium 228 activity (i.e., Beta activity) for MCL determinations. If the sum of the Alpha activity plus the Radium 228 activity is greater than 5 pCi/L, the Radium 226 activity must then be determined for water system compliance purposes (i.e., Radium 226 + Radium 228 activity).

** Uranium's MCL is given in mass terms (ug/L). When Uranium is determined by mass methods, it must be converted to activity levels (pCi/L) for calculation of the MCL (Gross Alpha less Uranium). A conversion factor of 0.67 pCi/L per ug/L should be used. Uranium needs to be determined only when the Gross Alpha exceeds 15 pCi/L.

*** Use Gross Alpha in lieu of Radium 226 when the Gross Alpha is less than, or equal to, 5.0 pCi/L.

**** The MCL for beta particle and photon radioactivity from man-made radionuclides is the average annual concentration which shall not produce an annual dose equivalent to the total body or any internal organ greater than four millirem/yr.

The results reported relate only to the samples indicated.
Soil/solid results are reported on a dry-weight basis unless otherwise noted.

Lab Supervisor: Kathleen A. Sattler **Date:** 12/22/2011

Comments:

Certifications held by Anatek Labs ID: EPA:ID00013; AZ:0701; CO:ID00013; FL(NELAP):E87893; ID:ID00013; IN:C-ID-01; KY:90142; MT:CERT0028; NM: ID00013; OR:ID200001-002; WA:C595
Certifications held by Anatek Labs WA: EPA:WA00169; CA:Cert2632; ID:WA00169; WA:C585; MT:Cert0095

WATER WELL REPORT

Original – Ecology, 1st copy – owner, 2nd copy – driller

Construction/Decommission *("x" in circle)*

☒ Construction

☐ Decommission *ORIGINAL INSTALLATION*

Notice of Intent Number _____

PROPOSED USE: ☒ Domestic ☐ Industrial ☐ Municipal ☐ DeWater ☐ Irrigation ☐ Test Well ☐ Other _____

TYPE OF WORK: Owner's number of well (if more than one) _____

☒ New well ☐ Reconditioned *Method:* ☐ Dug ☐ Bored ☐ Driven
☐ Deepened ☐ Cable ☒ Rotary ☐ Jetted

DIMENSIONS: Diameter of well 6 inches, drilled 78 ft.
Depth of completed well 78 ft.

CONSTRUCTION DETAILS

Casing Installed: ☒ Welded 6" Diam. from +2 ft. to 73 ft.
☐ Liner installed ____" Diam. from ____ ft. to ____ ft.
☐ Threaded ____" Diam. From ____ ft. to ____ ft.

Perforations: ☐ Yes ☒ No

Type of perforator used _____

SIZE of perfs _____ in. by _____ in. and no. of perfs _____ from _____ ft. to _____ ft.

Screens: ☒ Yes ☐ No ☒ K-Pac Location 71'

Manufacturer's Name _____

Type Stainless Steel Model No. _____

Diam. 5 Slot size .030 from 73 ft. to 78 ft.

Diam. _____ Slot size _____ from _____ ft. to _____ ft.

Gravel/Filter packed: ☐ Yes ☒ No Size of gravel/sand _____

Materials placed from _____ ft. to _____ ft.

Surface Seal: ☒ Yes ☐ No To what depth? 18 ft.

Material used in seal Bentonite

Did any strata contain unusable water? ☐ Yes ☒ No

Type of water? _____ Depth of strata _____

Method of sealing strata off _____

PUMP: Manufacturer's Name _____

Type: _____ H.P. _____

WATER LEVELS: Land-surface elevation above mean sea level _____ ft.

Static level 27 ft. below top of well Date 8/30/11

Artesian pressure _____ lbs. per square inch Date _____

Artesian water is controlled by _____ cap, valve, etc.)

WELL TESTS: Drawdown is amount water level is lowered below static level

Was a pump test made? ☐ Yes ☒ No If yes, by whom? _____

Yield: _____ gal./min. with _____ ft. drawdown after _____ hrs.
Yield: _____ gal./min. with _____ ft. drawdown after _____ hrs.
Yield: _____ gal./min. with _____ ft. drawdown after _____ hrs.

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level

Date of test Bailer test _____ gal./min. with _____ ft. drawdown after ___ hrs.

Airtest 80 gal./min. with stem set at 71 ft. for 2 hrs.

Artesian flow _____ g.p.m. Date _____

Temperature of water _____ *Was a chemical analysis made?* ☐ Yes ☒ No

CURRENT

Notice of Intent No. WE13487

Unique Ecology Well ID Tag No. BCE 676

Water Right Permit No. _____

Property Owner Name **Kalispel Tribe Fish Hatchery**

Well Street Address 9171 Leclerc Road

City Cusik County Pend Oreille

Location NW1/4-1/4 NW1/4 Sec 20 Twn 34 R 44 EWM ☒ Or WWM ☐

Lat/Long (s, t, r Still REQUIRED) Lat Deg _____ Min _____ Sec _____
Long Deg _____ Min _____ Sec _____

Tax Parcel No. Kalispel Tribal Land

CONSTRUCTION OR DECOMMISSION PROCEDURE

Formation: Describe by color, character, size of material and structure, and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of information. (USE ADDITIONAL SHEETS IF NECESSARY.)

MATERIAL	FROM	TO
Topsoil	0	1
Sand, gravel clay	1	12
Clay & silt, soft brown	12	22
Clay & silt, soft blue	22	56
Sand & gravel	56	78

Start Date 8/29/11 Completed Date 8/30/11

WELL CONSTRUCTION CERTIFICATION: I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

☒ Driller ☐ Engineer ☐ Trainee Driller or trainee License No. 1719

Name (Print Last, First) Morgan Joy

Driller/Engineer/Trainee Signature [signature]

IF TRAINEE: Driller's License No:

Driller's Signature:

Drilling Company **JOYCO DRILLING INC**

Phone **509-292-2000 or 877-292-WELL (9355)**

Address **1813 Willms Road**

City, State, Zip **Elk, WA 99009**

Contractor's Registration No. JOYCODI923M3 Date 9/7/11

❖ GII

GENERAL INDUSTRIES, INC

UPS Address - 814 S. DISHMAN ROAD - SPOKANE VALLEY, WA 99206
Mail Address - P.O BOX 13454 - SPOKANE VALLEY, WA 99213
PHONE 509-928-4268 FAX 509-928-4338
CONTRACTOR LICENSE # GENERII 147 MT

September 12, 2014

Mr. Derek Nelson, PE
McMillen, LLC
1401 Shoreline Drive
Boise, ID 83702

Dear Mr. Nelson

JOB: Kalispel Tribe Hatchery Well

Enclosed please find

1. **Copy of our well report**
2. **Pictures of the Pump Control panel – 1 phase to 3 phase converter**

The Pump is a F & W ? pump model 4F55S30
Power: 3 phase 230 Volt 3 HP

Well depth – 80 feet
Pump set at 63'

The inlet pipe is 1 ½" HDPE reduced to 1 ¼" galvanize
We used a 4" Master Meter it is only used once before on another test.

The Tribal dudes were very kind and helpful.
Thanks for the work.

Douglas O Bacheller

Douglas O. Bacheller

INVOICE

General Industries, Inc.
PO Box 13454
SPOKANE WA 99213
509-928-4268

Invoice No: 14-24-1
Invoice Date: 09/11/2014

Application No: 14-24-1
Completed Thru:
Owner Job No: 14-24

To: Mr Derek Nelson, PE
McMillen, LLC
1401 Shoreline Drive
BOISE ID 83702

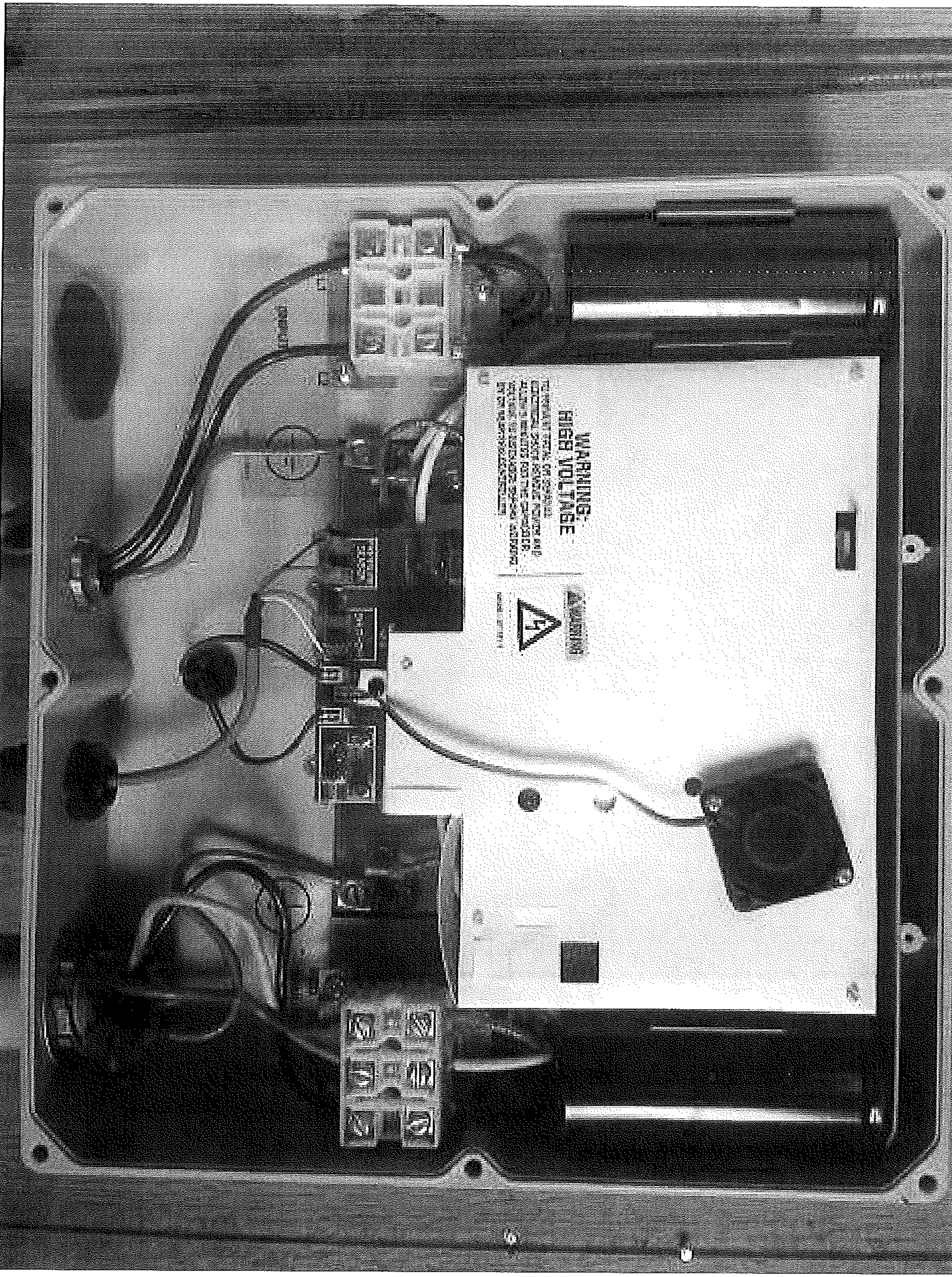
Contract: 14-24 Kalispel Tribe Well Pump Test

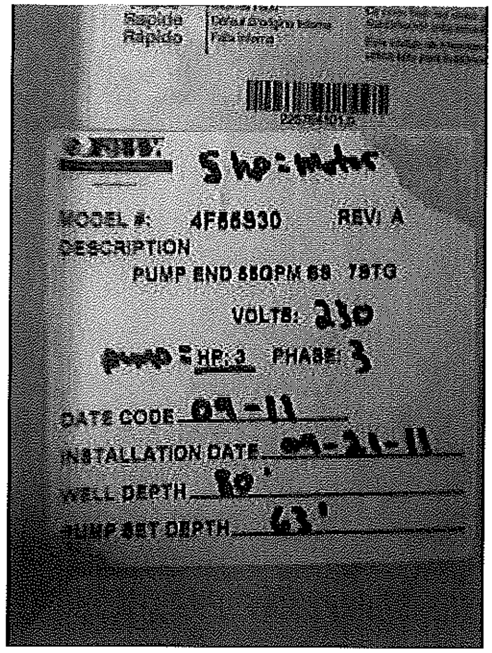
PHASE	COST CODE	CHG ORD	DESCRIPTION OF WORK	SCHEDULED VALUE	PREVIOUSLY COMPLETED	THIS PERIOD	% COMPL	TOTAL COMPLETED	BALANCE TO FINISH	RETENTION
01			Mob	572.00	0.00	572.00	100	572.00	0.00	0.00
02			Material	588.61	0.00	588.61	100	588.61	0.00	0.00
03			Labor	1612.00	0.00	1612.00	100	1612.00	0.00	0.00
04			Equipment Rental	260.00	0.00	260.00	100	260.00	0.00	0.00
			Totals To-Date:	3032.61	0.00	3032.61	100	3032.61	0.00	0.00

Scheduled Value:	3,032.61
Plus Change Orders:	0.00
To-Date Scheduled Value:	3,032.61
Total Completed To-Date:	3,032.61
Less Retention:	0.00
	3,032.61
Less Previous Billing:	0.00
Current Payment Due:	**3,032.61**

Kalispel Tribe Well Pump Test

Date	Time HRS	Feet To Water	GPM	Total GAL. X 1000	AMPS R	AMPS Y	AMPS B
9/10/2014	11:30	27'-2"	80	1707	16.9	17.8	19.0
	11:45	29'-0"	85	1708	17.5	17.6	18.5
	12:00	29'-2"	80	1709	17.7	18.9	18.1
	12:15	29'-2"	75	1710	17.4	17.7	18.2
	12:30	29'-2"	80	1712	18.0	18.1	19.0
	1:00	29'-2"	80	1714	18.1	17.6	18.2
	1:30	29'-2"	80	1716	17.6	18.1	19.0
	2:00	29'-2"	80	1719	17.5	18.2	19.0
	2:30	29'-2"	80	1721	17.7	18.1	18.9
	3:00	29'-2"	80	1723	17.5	18.2	18.3
	3:30	29'-3"	85	1726	17.5	17.9	18.0
	4:30	29'-3"	80	1731	18.1	18.0	18.2
	5:30	29'-2"	80	1735	19.7	18.0	18.5
	11:30	29'-3"	80	1765	17.9	18.1	18.3
9/11/2014	3:30	29'-4"	80	1784	17.7	18.3	18.7
	7:30	29'-5"	80	1803	17.4	18.4	19.2
	10:30	29'-3"	80	1818	17.5	18.1	18.5


WARNING:
HIGH VOLTAGE



— Attachments:

2014091195100324.jpg	45.3 KB
2014091095122028.jpg	11.6 KB

APPENDIX C

COST ESTIMATE DETAILS

Line Item	Item	Quantity	Unit	Unit Cost	Subtotal	Contingency	Cost	Total
	Division 01 - General Requirements							**$ 95,162.50**
1.1	Mobilization/Demobilization	1	%	$ 0.10	$ 95,162.50	0.0%	$ 95,162.50	
	Division 02 - Existing Conditions							**$ 20,700.00**
2.1	Selective Demolition - Raceway Removal	1	LS	$ 10,000.00	$ 10,000.00	15.0%	$ 11,500.00	
2.2	Clearing and Grubbing	1	LS	$ 3,000.00	$ 3,000.00	15.0%	$ 3,450.00	
2.3	Pumpstation Selective Demolition	1	LS	$ 5,000.00	$ 5,000.00	15.0%	$ 5,750.00	
	Division 03 - Concrete							**$ 64,112.50**
3.1	GW Storage - Concrete Slab	15	CY	$ 650.00	$ 9,750.00	15.0%	$ 11,212.50	
3.2	GW Storage - Concrete Walls	20	CY	$ 1,100.00	$ 22,000.00	15.0%	$ 25,300.00	
3.3	SW Pumpstation - Sump Mods & Floor	1	LS	$ 12,000.00	$ 12,000.00	15.0%	$ 13,800.00	
3.4	Broodstock Building Addition Slab	20	CY	$ 600.00	$ 12,000.00	15.0%	$ 13,800.00	
	Division 05 - Metals							**$ 17,250.00**
5.1	Pumpstation Stairs	1	LS	$ 15,000.00	$ 15,000.00	15.0%	$ 17,250.00	
	Division 06 - Wood and Plastic							**$ 31,602.00**
6.1	Storage Tank Cover	192	SF	$ 75.00	$ 14,400.00	15.0%	$ 16,560.00	
6.2	Pumpstation Walls	336	SF	$ 30.00	$ 10,080.00	15.0%	$ 11,592.00	
6.3	Remove and Replace PS Roof	1	LS	$ 3,000.00	$ 3,000.00	15.0%	$ 3,450.00	
	Division 07 - Thermal and Moisture Protection							**$ 3,450.00**
7.1	Allowance	1	LS	$ 5,000.00	$ 5,000.00	15.0%	$ 3,450.00	
	Division 08 - Openings							**$ 11,500.00**
8.1	Pipe Penetrations	1	LS	$ 5,000.00	$ 5,000.00	15.0%	$ 5,750.00	
8.2	Windows and Doors	1	LS	$ 8,000.00	$ 8,000.00	15.0%	$ 5,750.00	
	Division 09 - Finishes							**$ 3,450.00**
9.1	Misc Painting	1	LS	$ 3,000.00	$ 3,000.00	15.0%	$ 3,450.00	
	Division 10 - Specialties							**$ 119,600.00**
10.1	Well Drilling and Test Pumping	2	EA	$ 25,000.00	$ 50,000.00	15.0%	$ 57,500.00	
10.2	PEMB addition to Upper Hatchery Building	1,080	SF	$ 50.00	$ 54,000.00	15.0%	$ 62,100.00	
	Division 11 - Equipment							**$ 279,128.00**
11.1	Surface Water Pumps - 7.5 hp	2	EA	$ 6,600.00	$ 13,200.00	15.0%	$ 15,180.00	
11.2	Well Pumps - 3 hp w/Pitless units	2	EA	$ 8,000.00	$ 16,000.00	15.0%	$ 18,400.00	
11.3	Air Blowers	2	EA	$ 135.00	$ 270.00	15.0%	$ 310.50	
11.4	Airlift Pumps	1	LS	$ 60,000.00	$ 60,000.00	15.0%	$ 69,000.00	
11.5	WCT Rearing Tanks (4 Ft. Semi Sq. X 3 Ft deep)	10	EA	$ 1,500.00	$ 15,000.00	15.0%	$ 17,250.00	
11.6	WCT Broodstock Tanks(6 Ft. Dia. X 5 Ft deep)	9	EA	$ 2,000.00	$ 18,000.00	15.0%	$ 20,700.00	
11.7	Incubation Stacks	2	EA	$ 1,000.00	$ 2,000.00	15.0%	$ 2,300.00	
11.8	Spawning Table	1	EA	$ 750.00	$ 750.00	15.0%	$ 862.50	
11.9	GW Central Degassing	2	EA	$ 1,500.00	$ 3,000.00	15.0%	$ 3,450.00	
11.10	Rearing Tank Degassing	19	EA	$ 500.00	$ 9,500.00	15.0%	$ 10,925.00	
11.11	Back-Up RW Pumpstation	1	LS	$ 100,000.00	$ 100,000.00	15.0%	$ 115,000.00	
11.12	Set Point Controller Assembly	1	LS	$ 5,000.00	$ 5,000.00	15.0%	$ 5,750.00	
	Division 26 - Electrical							**$ 212,175.00**
26.1	RW Pumpstation Power and Controls	1	LS	$ 52,000.00	$ 52,000.00	15.0%	$ 59,800.00	
26.2	Well Power and Controls	2	EA	$ 7,500.00	$ 15,000.00	15.0%	$ 17,250.00	
26.3	Tempering System Power and Controls	1	LS	$ 16,000.00	$ 16,000.00	15.0%	$ 18,400.00	
26.4	Back-Up RW Pumpstation Power and Controls	1	LS	$ 20,000.00	$ 20,000.00	15.0%	$ 23,000.00	
26.5	Emergency Power Upgrade Allowance	1	LS	$ 60,000.00	$ 60,000.00	15.0%	$ 69,000.00	
26.6	Power and Lighting for Upper Hatchery Addition	1	LS	$ 21,500.00	$ 21,500.00	15.0%	$ 24,725.00	

	Division 31 - Earthwork							**$ 12,650.00**
31.1	Excavation - Storage Tank	100	CY	$ 20.00	$ 2,000.00	15.0%	$ 2,300.00	
31.2	Type GF Backfill and Compaction	150	CY	$ 40.00	$ 6,000.00	15.0%	$ 6,900.00	
31.3	Erosion Control	1	LS	$ 3,000.00	$ 3,000.00	15.0%	$ 3,450.00	
	Division 33 - Utilities							**$ 23,000.00**
33.1	Electrical Service Upgrades	1	LS	$ 20,000.00	$ 20,000.00	15.0%	$ 23,000.00	
	Division 40 - Instrumentation and Controls							**$ 27,600.00**
40.1	Monitoring and Alarm System	1	LS	$ 40,000.00	$ 40,000.00	15.0%	$ 46,000.00	
40.2	Flow Meters	6	EA	$ 4,000.00	$ 24,000.00	15.0%	$ 27,600.00	
	Division 42 - Process Water Systems							**$ 100,912.50**
42.1	SW Pumpstation Re-Piping	1	LS	$ 8,000.00	$ 8,000.00	15.0%	$ 9,200.00	
42.2	SW Pumpstation Valves	1	LS	$ 3,000.00	$ 3,000.00	15.0%	$ 3,450.00	
42.3	SW 3-inch Piping to Headbox	200	LF	$ 30.00	$ 6,000.00	15.0%	$ 6,900.00	
42.4	GW 3-inch Piping to Headbox	1000	LF	$ 30.00	$ 30,000.00	15.0%	$ 34,500.00	
42.5	GW 4-inch Distribution Piping	500	LF	$ 40.00	$ 20,000.00	15.0%	$ 23,000.00	
42.6	Supply Drops	38	EA	$ 250.00	$ 9,500.00	15.0%	$ 10,925.00	
42.7	External Standpipe Assemblies	15	EA	$ 750.00	$ 11,250.00	15.0%	$ 12,937.50	
	Division 43 - Mechanical							**$ 24,495.00**
43.1	4-inch Btfy Valves	6	EA	$ 500.00	$ 3,000.00	15.0%	$ 3,450.00	
43.2	3-inch Btfy Valves	3	EA	$ 300.00	$ 900.00	15.0%	$ 1,035.00	
43.3	2-inch Ball Valves	8	EA	$ 200.00	$ 1,600.00	15.0%	$ 1,840.00	
43.4	1.5 inch Tank Supply Valves	38	EA	$ 200.00	$ 7,600.00	15.0%	$ 8,740.00	
43.5	1-inch Incubation Supply Drops	2	EA	$ 100.00	$ 200.00	15.0%	$ 230.00	
43.6	Air Supply Piping/Valves	1	LS	$ 8,000.00	$ 8,000.00	15.0%	$ 9,200.00	
	Project Subtotal (without Division 01)							**$ 951,625.00**
	Project Total - 2014 Dollars							**$ 1,046,787.50**

Line Item	Item	Quantity	Unit	Unit Cost	Subtotal	Contingency	Cost	Total
	Division 01 - General Requirements							**$ 79,350.00**
1.1	Mobilization/Demobilization	1	%	$ 0.10	$ 79,350.00	0.0%	$ 79,350.00	
	Division 02 - Existing Conditions							**$ 20,700.00**
2.1	Selective Demolition - Raceway Removal	1	LS	$ 10,000.00	$ 10,000.00	15.0%	$ 11,500.00	
2.2	Clearing and Grubbing	1	LS	$ 3,000.00	$ 3,000.00	15.0%	$ 3,450.00	
2.3	Pumpstation Selective Demolition	1	LS	$ 5,000.00	$ 5,000.00	15.0%	$ 5,750.00	
	Division 03 - Concrete							**$ 50,312.50**
3.1	GW Storage - Concrete Slab	15	CY	$ 650.00	$ 9,750.00	15.0%	$ 11,212.50	
3.2	GW Storage - Concrete Walls	20	CY	$ 1,100.00	$ 22,000.00	15.0%	$ 25,300.00	
3.3	SW Pumpstation - Sump Mods & Floor	1	LS	$ 12,000.00	$ 12,000.00	15.0%	$ 13,800.00	
	Division 05 - Metals							**$ 17,250.00**
5.1	Pumpstation Stairs	1	LS	$ 15,000.00	$ 15,000.00	15.0%	$ 17,250.00	
	Division 06 - Wood and Plastic							**$ 31,602.00**
6.1	Storage Tank Cover	192	SF	$ 75.00	$ 14,400.00	15.0%	$ 16,560.00	
6.2	Pumpstation Walls	336	SF	$ 30.00	$ 10,080.00	15.0%	$ 11,592.00	
6.3	Remove and Replace Roof	1	LS	$ 3,000.00	$ 3,000.00	15.0%	$ 3,450.00	
	Division 07 - Thermal and Moisture Protection							**$ 3,450.00**
7.1	Allowance	1	LS	$ 5,000.00	$ 3,000.00	15.0%	$ 3,450.00	
	Division 08 - Openings							**$ 5,750.00**
8.1	Pipe Penetrations	1	LS	$ 5,000.00	$ 5,000.00	15.0%	$ 5,750.00	
	Division 09 - Finishes							**$ 3,450.00**
9.1	Misc Painting	1	LS	$ 3,000.00	$ 3,000.00	15.0%	$ 3,450.00	
	Division 10 - Specialties							**$ 57,500.00**
10.1	Well Drilling and Test Pumping	2	EA	$ 25,000.00	$ 50,000.00	15.0%	$ 57,500.00	
	Division 11 - Equipment							**$ 235,428.00**
11.1	Surface Water Pumps - 7.5 hp	2	EA	$ 6,600.00	$ 13,200.00	15.0%	$ 15,180.00	
11.2	Well Pumps - 3 hp w/Pitless units	2	EA	$ 8,000.00	$ 16,000.00	15.0%	$ 18,400.00	
11.3	Air Blowers	2	EA	$ 135.00	$ 270.00	15.0%	$ 310.50	
11.4	Airlift Pumps	1	LS	$ 30,000.00	$ 30,000.00	15.0%	$ 34,500.00	
11.5	WCT Rearing Tanks (4 Ft. Semi Sq. X 3 Ft deep)	6	EA	$ 1,500.00	$ 9,000.00	15.0%	$ 10,350.00	
11.6	WCT Broodstock Tanks(6 Ft. Dia. X 5 Ft deep)	9	EA	$ 2,000.00	$ 18,000.00	15.0%	$ 20,700.00	
11.7	Incubation Stacks	2	EA	$ 1,000.00	$ 2,000.00	15.0%	$ 2,300.00	
11.8	Spawning Table	1	EA	$ 750.00	$ 750.00	15.0%	$ 862.50	
11.9	GW Central Degassing	2	EA	$ 1,500.00	$ 3,000.00	15.0%	$ 3,450.00	
11.10	Rearing Tank Degassing	15	EA	$ 500.00	$ 7,500.00	15.0%	$ 8,625.00	
11.11	Back-Up RW Pumpstation	1	LS	$ 100,000.00	$ 100,000.00	15.0%	$ 115,000.00	
11.12	Set Point Controller Assembly	1	LS	$ 5,000.00	$ 5,000.00	15.0%	$ 5,750.00	
	Division 26 - Electrical							**$ 187,450.00**
26.1	RW Pumpstation Power and Controls	1	LS	$ 52,000.00	$ 52,000.00	15.0%	$ 59,800.00	
26.2	Well Power and Controls	2	EA	$ 7,500.00	$ 15,000.00	15.0%	$ 17,250.00	
26.3	Tempering System Power and Controls	1	LS	$ 16,000.00	$ 16,000.00	15.0%	$ 18,400.00	
26.4	Back-Up RW Pumpstation Power and Controls	1	LS	$ 20,000.00	$ 20,000.00	15.0%	$ 23,000.00	
26.5	Emergency Power Upgrade Allowance	1	LS	$ 60,000.00	$ 60,000.00	15.0%	$ 69,000.00	

	Division 31 - Earthwork							**$ 12,650.00**
31.1	Excavation - Storage Tank	100	CY	$ 20.00	$ 2,000.00	15.0%	$ 2,300.00	
31.2	Type GF Backfill and Compaction	150	CY	$ 40.00	$ 6,000.00	15.0%	$ 6,900.00	
31.3	Erosion Control	1	LS	$ 3,000.00	$ 3,000.00	15.0%	$ 3,450.00	
	Division 33 - Utilities							**$ 23,000.00**
33.1	Electrical Service Upgrades	1	LS	$ 20,000.00	$ 20,000.00	15.0%	$ 23,000.00	
	Division 40 - Instrumentation and Controls							**$ 27,600.00**
40.1	Monitoring and Alarm System	1	LS	$ 40,000.00	$ 40,000.00	15.0%	$ 46,000.00	
40.2	Flow Meters	6	EA	$ 4,000.00	$ 24,000.00	15.0%	$ 27,600.00	
	Division 42 - Process Water Systems							**$ 92,862.50**
42.1	SW Pumpstation Re-Piping	1	LS	$ 8,000.00	$ 8,000.00	15.0%	$ 9,200.00	
42.2	SW Pumpstation Valves	1	LS	$ 3,000.00	$ 3,000.00	15.0%	$ 3,450.00	
42.3	GW 3-inch Piping to Headbox	1000	LF	$ 30.00	$ 30,000.00	15.0%	$ 34,500.00	
42.4	GW 4-inch Distribution Piping	400	LF	$ 40.00	$ 16,000.00	15.0%	$ 18,400.00	
42.5	Supply Drops	38	EA	$ 250.00	$ 9,500.00	15.0%	$ 10,925.00	
42.6	External Standpipe Assemblies	19	EA	$ 750.00	$ 14,250.00	15.0%	$ 16,387.50	
	Division 43 - Mechanical							**$ 24,495.00**
43.1	4-inch Btfy Valves	6	EA	$ 500.00	$ 3,000.00	15.0%	$ 3,450.00	
43.2	3-inch Btfy Valves	3	EA	$ 300.00	$ 900.00	15.0%	$ 1,035.00	
43.3	2-inch Ball Valves	8	EA	$ 200.00	$ 1,600.00	15.0%	$ 1,840.00	
43.4	1.5 inch Tank Supply Valves	38	EA	$ 200.00	$ 7,600.00	15.0%	$ 8,740.00	
43.5	1-inch Incubation Supply Drops	2	EA	$ 100.00	$ 200.00	15.0%	$ 230.00	
43.6	Air Supply Piping/Valves	1	LS	$ 8,000.00	$ 8,000.00	15.0%	$ 9,200.00	
	Project Subtotal (without Division 01)							**$ 793,500.00**
	Project Total - 2014 Dollars							**$ 872,850.00**

Group: 2100302 0000210034

Pend Oreille County Public Utility District
P.O. Box 190
Newport, WA 99156-0190

Telephone:
(509) 447-3137 Mid-county
(509) 446-3137 North county
(509) 242-3137 South county

KALISPEL TRIBE
PO BOX 39
USK WA 99180-0039

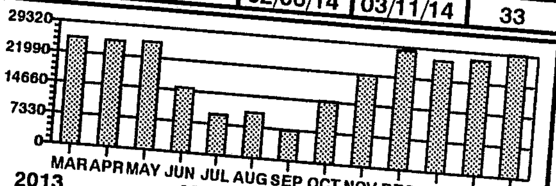
Account Number 18518		Page 1 of 1
Statement Date 03/17/2014		Due Date 04/07/2014

Billing Summary

Previous Balance	1,119.11
Payment 03/07/14	1,119.11 CR
Balance Forward	0.00
Current Charges	1,194.57
Amount Due	**1,194.57**

Service Address: 9171 LECLERC RD N Service Desc: CT METER/FISH HATCHERY Loc: 6036950

Meter	Type	From	To	Days	Prev Rdg	Current Rdg	Multiplier	Usage	Type of Bill
84405873	KWH	02/06/14	03/11/14	33	53631	54364	40	29320	MONTHLY
	KW	02/06/14	03/11/14	33		1.160	40	46.400	



Monthly Usage

Period	Days	Usage	KWH/Day
This Year	33	29320	888
Last Year	26	25360	975

Detail of Electric Charges

KWH CHARGE	29320 KWh @	$0.03930	$1,152.28
BASIC CHARGE	1 service @	$42.29	$42.29
	Total This Service		$1,194.57

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Account Number 18518	Page 1 of 1
Statement Date 04/17/2014	Due Date 05/07/2014

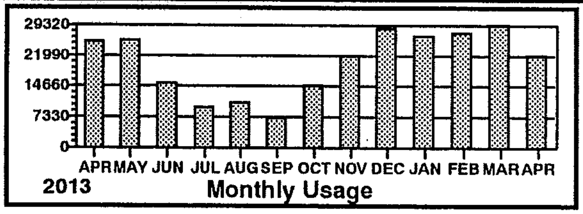
Billing Summary

Previous Balance	1,194.57
Payment 03/28/14	1,194.57 CR
Balance Forward	0.00
Current Charges	908.46
Amount Due	**908.46**

KALISPEL TRIBE
PO BOX 39
USK WA 99180-0039

Service Address: 9171 LECLERC RD N   Service Desc: CT METER/FISH HATCHERY   Loc: 6036950

Meter	Type	From	To	Days	Prev Rdg	Current Rdg	Multiplier	Usage	Type of Bill
84405873	KWH	03/11/14	04/08/14	28	54364	54915	40	22040	MONTHLY
	KW	03/11/14	04/08/14	28		1.050	40	42.000	



Detail of Electric Charges

KWH CHARGE	22040 KWh @	$0.03930	$866.17
BASIC CHARGE	1 service @	$42.29	$42.29
Total This Service			$908.46

Period	Days	Usage	KWH/Day
This Year	28	22040	787
Last Year	29	25240	870

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Pend Oreille County Public Utility District
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Account Number 18518	Page 1 of 1
Statement Date 05/19/2014	Due Date 06/09/2014

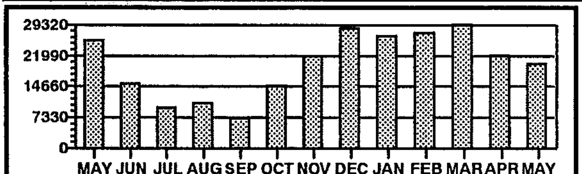
Billing Summary

Previous Balance	908.46
Payment 05/09/14	908.46 CR
Balance Forward	0.00
Current Charges	829.86
Amount Due	**829.86**

KALISPEL TRIBE
PO BOX 39
USK WA 99180-0039

Service Address: 9171 LECLERC RD N Service Desc: CT METER/FISH HATCHERY Loc: 6036950

Meter	Type	From	To	Days	Prev Rdg	Current Rdg	Multiplier	Usage	Type of Bill
84405873	KWH	04/08/14	05/12/14	34	54915	55416	40	20040	MONTHLY
	KW	04/08/14	05/12/14	34		0.940	40	37.600	



Monthly Usage

Detail of Electric Charges

KWH CHARGE	20040 KWh @	$0.03930	$787.57
BASIC CHARGE	1 service @	$42.29	$42.29
Total This Service			$829.86

Period	Days	Usage	KWH/Day
This Year	34	20040	589
Last Year	33	25480	772

KALISPEL TRIBE
JUN 11 2014
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Pend Oreille County Public Utility District
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(509) 446-3137 North county
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LISPEL TRIBE
BOX 39
K WA 99180-0039

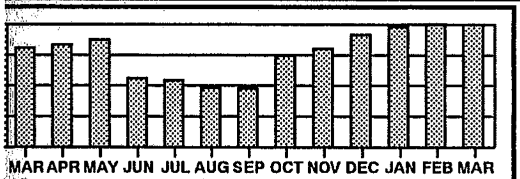
Account Number 18677	Page 1 of 1
Statement Date 03/17/2014	Due Date 04/07/2014

Billing Summary

Previous Balance	239.93
Payment 03/07/14	239.93 CR
Balance Forward	0.00
Current Charges	239.34
Amount Due	**239.34**

ice Address: LECLERC RD N Service Desc: HATCHERY PUMPS Loc: 6036940

eter	Type	From	To	Days	Prev Rdg	Current Rdg	Multiplier	Usage	Type of Bill
59162	KWH	02/06/14	03/11/14	33	77441	82455	1	5014	MONTHLY
	KW	02/06/14	03/11/14	33		7.580	1	7.580	



13 Monthly Usage

od	Days	Usage	KWH/Day
Year	33	5014	152
Year	26	4036	155

Detail of Electric Charges

KWH CHARGE	5014 KWh @	$0.03930	$197.05
BASIC CHARGE	1 service @	$42.29	$42.29
Total This Service			$239.34

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Account Number 18677	Page 1 of 1
Statement Date 04/17/2014	Due Date 05/07/2014

Pend Oreille County Public Utility District
P.O. Box 190
Newport, WA 99156-0190

Telephone:
(509) 447-3137 Mid-county
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(509) 242-3137 South county

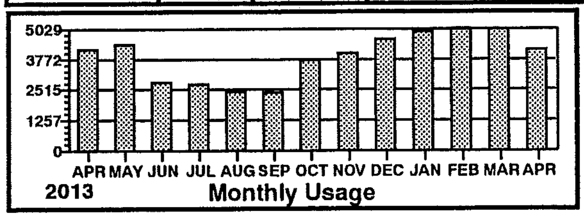
Billing Summary

Previous Balance	239.34
Payment 03/28/14	239.34 CR
Balance Forward	0.00
Current Charges	204.83
Amount Due	**204.83**

KALISPEL TRIBE
PO BOX 39
USK WA 99180-0039

Service Address: LECLERC RD N Service Desc: HATCHERY PUMPS Loc: 6036940

Meter	Type	From	To	Days	Prev Rdg	Current Rdg	Multiplier	Usage	Type of Bill
01259162	KWH	03/11/14	04/08/14	28	82455	86591	1	4136	MONTHLY
	KW	03/11/14	04/08/14	28		7.300	1	7.300	



Detail of Electric Charges

KWH CHARGE	4136 KWh @	$0.03930	$162.54
BASIC CHARGE	1 service @	$42.29	$42.29
Total This Service			$204.83

Period	Days	Usage	KWH/Day
This Year	28	4136	148
Last Year	29	4176	144

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Newport, WA 99156-0190

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(509) 446-3137 North county
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KALISPEL TRIBE
PO BOX 39
USK WA 99180-0039

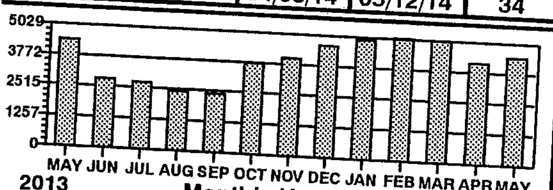
Account Number 18677	Page 1 of 1
Statement Date 05/19/2014	Due Date 06/09/2014

Billing Summary

Previous Balance	204.83
Payment 05/09/14	204.83 CR
Balance Forward	0.00
Current Charges	216.82
Amount Due	**216.82**

Service Address: LECLERC RD N Service Desc: HATCHERY PUMPS Loc: 6036940

Meter	Type	From	To	Days	Prev Rdg	Current Rdg	Multiplier	Usage	Type of Bill
01259162	KWH	04/08/14	05/12/14	34	86591	91032	1	4441	MONTHLY
	KW	04/08/14	05/12/14	34		7.180	1	7.180	



Monthly Usage

Period	Days	Usage	KWH/Day
This Year	34	4441	131
Last Year	33	4384	133

Detail of Electric Charges

KWH CHARGE	4441 KWh @	$0.03930	$174.53
BASIC CHARGE	1 service @	$42.29	$42.29
	Total This Service		$216.82

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