Kalispel Resident Fish Project-

Kalispel Tribal Hatchery Operations and Maintenance

1997 Annual Report

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Abstract

In 1996, construction activities commenced on a largemouth bass hatchery located on the Kalispel Indian Reservation. The major construction activities were complete as of October 1997. Of the six objectives identified in the 1997 Anuual Operating Plan two objectives were fully achieved: the assembly of the life support system, and the preparation of the hatchery Operations and Maintenance Manual. The remaining four objectives were not fully achieved due to the hatchery not being completed before the spawning season (spring).

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Introdnction

In 1987, the Northwest Power Planning Council (NPPC) amended its Columbia River Basin Fish and Wildlife Program to include a resident fish substitution policy. This policy called for substitution of resident fish in areas where anadromous fish historically occurred, but were blocked with the construction of the Chief Joseph and Grand Coulee Dams. One of the first projects adopted by NPPC was the "Assessment of fishery improvement opportunities in the Pend Oreille river within the boundaries of the Kalispel Indian Reservation" (Ashe, et *al. 1992). The* purpose of this three-year study was to establish baseline information of existing fish populations and habitat; and identify possible methods of improving fisheries within the reservoir. Recommendations from this study are proposed as resident fish substitution under the Northwest Power Planning Council's 1987 Resident Fish Substitution Policy.

The assessment identified several factors within the reservoir that limited the fisheries opportunities within the Box Canyon reservoir. Some of these factors included water elevation fluctuations, lack of overwinter cover for age O+ bass, and inadequate recruitment of largemouth bass into the system The University of Idaho also perfonned a study during this time (Bennett, Liter, 1991) and concurred with the above factors and proposed similar recommendations of the assessment study published by Ashe.

Ashe, et al (1991) indicated that growth rates of largemouth bass during the first four years in the Box Canyon Reservoir were lower than bass from other locations of the northern United States, and conversely growth rates after the fourth year were comparable or even higher than other locations. The slower growth combined with a high rate of juvenile mortality associated with overwintering have reduced the potential for the bass population within the reservoir. Largemouth bass density estimates are approximately 6 pounds per surface acre in the Box Canyon Reservoir.

In 1991, Ashe and Bennett suggested the possibility of an off-site rearing facility to supplement the number of juvenile largemouth bass within the Box Canyon Reservoir. Supplemental stocking of yearling largemouth bass has been proven successful in other reservoirs. In chatfield Reservoir, Colorado, largemouth bass were hatchery-reared to one year of age using intensive and extensive culture from 1978 to 1981. Subsequent samples of age 2 bass in the reservoir composed I2%, 59%, and 59% of the population, during sample years 1980, 1981 and 1982, respectively (Kreiger and Puttman 1986). Increases in the age 2 class fish were directly attributed to hatchery supplementation.

Based on these findings, biological objectives for largemouth bass (Mcroptenrs salmoides) were identified and incorporated into the NPPC's program. The largemouth bass biological objectives are as follows.

- Increase the biomass of harvestable largemouth bass in the Box Canyon reservoir from the current 6 pounds/acre to an interim target of 8 pounds/acre by 2003 and a final target of 12 pounds/acre by the year 2008.

- Increase age 0+ largemouth bass overwinter survival from current levels of 0.4-3.9 percent to approximately 15-20 percent.

specific recommendations or strategies to attain these biological objectives were also formulated and presented to the NPPC for approval and funding. These recommendations are as follows.

- Opeate and maintain low-capital warm water hatchery constructed on the Kalispel Indian Reservation to produce 100,000 largemouth bass fry and *50,000* fingerlings for release into Box Canyon reservoir.

- Construct, operate, and maintain water control structures on the Pend Oreille wetlands wildlife project for the purpose of creating bass nursery sloughs.

- Construct, place, and maintain artificial cover structures to increase the amount of bass age 0+ fry winter cover in the Box Canyon reservoir. The purpose of the cover is to increase the overwinter survival of age 0+ largemouth bass.

- Monitor effectiveness of largemouth bass supplementation.

In 1996, construction activities commenced on the largemouth bass hatchery, located on the Kalispel Indian Reservation. The completion date of the hatchery was November, 1997. Upon completion of the hatchery, largemouth bass will be gathered, spawned, and reared in the facility. The initial outplanting ofjuvenile largemouth bass into the Box Canyon reach of the Pend Oreille river is scheduled for the spring of 1998.

The goals of this project are to facilitate the production and rearing of juvenile largemouth bass for supplementation and thereby increase the production of harvestable bass. The first year Annual Production Goal (APG) for the hatchery is to outplant 100,000 32mm fry and 50,000 14Omm fingerlings into the Box Canyon reservoir.

Description of Project Area

The Pend Oreille River begins at the outlet of Pend Oreille Lake, Idaho and flows in a westerly direction to approximately Dalkena, Washington. From Dalkena the river turns and flows north into British Columbia, where it eventually ties into the Columbia River. The approxlmate drainage area at the international border is 65,300 km* (Barber et *al. 1990). The* normal high flow month is June with a mean discharge of 61,858 cfs, the normal low flow month is August with a mean discharge of 11,897 cfs (Barber et *al.* 1990). The Box Canyon Reservoir has 47 tributaries and covers 90 river kilometers of the Pend Oreille River. The reservoir entails the portion of the river between the Albeni Falls and Box Canyon Dams,

The warm water fish hatchery is located on the 436 acre Pend Oreille Wetlands Wildlife Mitigation Project, located on the Kalispel Indian Reservation. The project is situated along the east side of the Pend Oreille River, approximately nine miles north of Usk, WA

Methods and Materials

Supplementation

All hatchery-reared largemouth bass will be marked with a fluorescent elastomer to distinguish them from the native largemouth bass population. Specific color and location of the elastomer will be used to specifically identify the location of the outplanting and the size of fish at release. Three different outplanting locations have been identified: Rednonrs slough, Dike slough, and Campbell slough (Figure 1). At this time, three separate sizes and two dates have been identified for release.

All outplanting locations will be sampled with a Smith-Root electro-shocking boat. Each outplanting location will be sampled using three, 10 minute transects. For a more detailed description of the supplementation monitoring and evaluation efforts, refer to the Kalispel Tribal Hatchery Supplementation Plan located in Appendix A

Hatchery Operation

Raceway spawning of largemouth bass will be employed at the Kalispel Tribal Hatchery. Raceway spawning of largemouth bass has been proven successful at the Jake Wolf Hatchery, San Marcos, TX and other largemouth bass hatcheries (Tom Hays pers. comm.). This technique allows the hatchery manager to easily observe the brood fish and determine the extent to which successful spawning is taking place. The use of artificial spawning nests will enable the hatchery staff to transport the fertilized eggs from the raceway to the hatchery troughs for intensive rearing. This reduces the number of broodstock required for achieving the APG's for the hatchery.

In the fall of 1997, 12-15 pairs of adult bass will be gathered and brought into the hatchery for acclimation. These brood&h will be held until the following spring when they will be crowded into the covered raceway for spawning. For a period of 2-3 weeks, the broodfish will be closely monitored while the water temperature is slowly increased. Once the water temperature in the raceway approaches 60" F and the broodfish appear ready to spawn, artificial spawning nests will be placed at eight foot intervals along each side of the raceway. A minimum of 12-14 nests will be placed in the 60 ft raceway. Broodstock requirements were determined based on a need of 150,000 32mm fry and assuming 67% survival During this time, the two sloughs will be filled and fertilized to enhance phytoplankton bloom The phytoplankton blooms provide a vegetative food source for zooplankton which the newly hatched fry will feed upon.

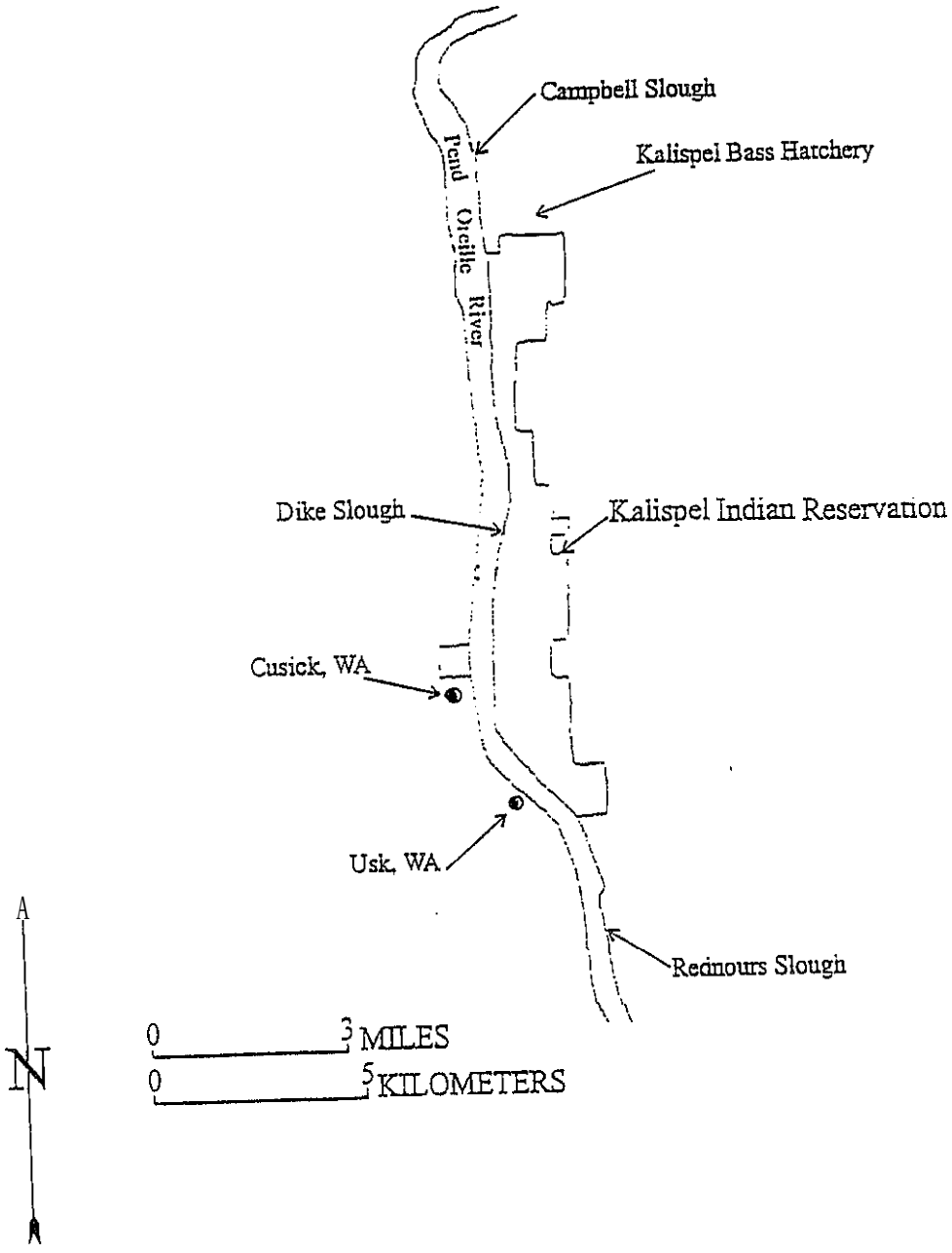

Figure 1. 1998 Largemouth bass release sires.

During each of the spawning periods, the artiticial nests with eggs are allowed to remain in the raceway for 1-2 days before being transferred to the incubation troughs. Each trough can be partitioned-off to hold fish that are more thau 2 days apart. This reduces the size disparity and any losses due to cannibalism. After 3-4 days in the troughs, the eggs hatch and the fry begin to appear. The fry are held in the troughs for an additional 4-5 days until they "swim up" in search of food. At this time, the fry will be transported from the incubation troughs to the rearing sloughs located adjacent to the pump station.

The largemouth bass fry will remain in the fertilized slough until most of the zooplankton is consumed (3-4 weeks). At this time, the largemouth bass fry will be marked and transported to the predetermined release site. Approximately 50,000 bass fry will be retained in the hatchery and trained on artificial feed. These fish will be raised in the hatchery at an initial density of 0.25 $lb./ft^3$, and trained to receive artificial feed until they achieve a density of up to 1.0 $lb./ft^3$. At this maximum density, the four indoor troughs (86 ft^3 each) can accommodate up to 45,000 65mm fingerlings (assuming 90% survival) and the raceway can accommodate up to 100,000 75mm fingerlings. These fingerling-sized fish will have then own distinctive mark relating to then size and location of release.

Two rearing sloughs will be used to hold and raise largemouth bass. Each slough has a water control structure (dam) at its mouth and a 4 inch water supply from the pump station. The dams have an overflow spillway with stop-log channels for water level control and a 6 inch gate valve for draining the slough during fish harvest and pond maintenance activities. The south slough has the potential for an air supply line at a furture date. This will enable the intensive rearing and overwintering of fish in the slough. Water will be supplied by two submersible pumps located in the pump station.

Monitoring and Evaluation

Supplementation

Monitoring and evaluation of supplementation efforts will be conducted by electroshockiug the outplanting locations following release to estimate the survivability of hatchery-stocked largemouth bass. All hatchery-raised largemouth bass will be marked with a fluorescent elastomer. The color and location of the elastomer mark will identify the size of the fish at the time of release and the location of release. Strategies on the most effective release size and most suitable release locations will be formulated to best accomplish our Annual Production Goals (APG).

Each outplanting location will be sampled using three, 10 minute transects. For a more detailed description of the supplementation monitoring and evaluation efforts, refer to Appendix A.

Hatchery Operation

Efficiency of the hatchery operation will be closely monitored by the hatchery staff. Listed below are factors that will be monitored at the hatchery (physical and biological) and are derived from Piper et al. (1992).

Physical aspects

- Volume of water (ft^3) used IN each trough during hatchery operations.
- Amount of water flow (gallons/minute) into each trough during hatchery operations.
- Water temperature

Biological aspects

- Mortality
  1. Percent survivability from egg to fry.
- Food and Diet
  1. Cost/pound for fish feed.
  2. Relationship (conversion) between the amount of feed to the amount of actual growth/fish.
- Fish
  1. Amount ofbroodstock and number of eggs produced/fish.
  2. Amount and weight of fry hatched during spawn (troughs).
  3. Amount and weight of fry planted into rearing sloughs.
  4. Amount of fry transported from rearing sloughs to outplanting location.
  5. Weight gain/loss of broodfish (pre-spawn and post-spawn).
  6. Date eggs fertilized, hatched, transferred to sloughs, and outplanted.
  7. First feeding of fiy.
- Disease
  1. Occurrence, kind, and possible contributing factors.

Rearing sloughs

Physical aspects

- Volume (acre feet), average depth of slough.
- Amount of inflow required to maintain water level in slough.
- Average water temperature.
- Fertilization date, type, amount, cost, and results.
- Amount of phytoplankton and zooplankton blooms (dates of bloom, types of plankton).

Biological aspects

- Mortality
  1. Percent survivability from fry to fingerling.
- Food and Diet
  1. Cost per pound of feed and cost per pound of fish gained.
  2. Amount of food fed as percentage of fish body weight.
  3. Pounds of food fed per pound of fish produced (conversion).

Fish

1. Gain in weight.
2. Average length and weight before release into sloughs.

- Disease
  1. Occurrence, hind, and possible contributing factors

Results and Discussion

Construction of the hatchery building, pump station, and raceway was completed in October of '97. The 1997 Annual Operating Plan listed six objectives for the year. Many of these objectives were contingent on the hatchery being completed at the scheduled time. No 1997 Annual Production Goals (APG) were achieved. Listed below are the 1997 objectives along with the amount ofprogress achieved for the year.

Objective 1. Assembling of the Life Support System for the hatchery.

This objective was met. These components were purchased and installed by the Kalispel Tribe. The internal components for the hatchery included a 30 micron Drum Screen, Ultraviolet Disinfectant Unit, 300,000 btn water heater, Biofilter, and a Degas&/Aeration Column. Specifications for the internal life support components are provided in the Operations and Maintenance manual (Appendix B). These particular items are all associated with water treatment for the hatchery. The remaining items such as supply lines, pumps, etc. were provided by the main contractor responsible for the project.

Objective 2. Use of Operating and Maintenance Manual (once completed).

The preparation of the Operating and Maintenance manuals are requirements of the construction contractor and the hatchery design consultant. Contractors Northwest Inc. provided the manufacturer literature on all items installed in the hatchery. JC Aquaculture Consultants provided an Operation Manual for the hatchery. The Kalispel Tribe is responsible for the manufacturer literature on the items they purchased The manufacture literature will be available for review at the Kalispel Tribal Hatchery. The Operations Manual can be found in Appendix B.

Objective 3. Egg collection, spawning, and incubation of largemouth bass eggs to meet 1997APG.

The broodfish spawning techniques and egg collection/incubation techniques have been developed. These activities are described in the Method and Materials section of this document. No 1997 APG's were achieved.

Objective 4. Develop fry and fingerling rearing methods to meet 1997 APG.

Fry rearing strategies include all the activities from fry "swim up" to transportation of fry to the outplanting location. These rearing activities are described in the Method and Materials section oftbis document. No 1997 APG's were achieved.

Objective 5. Identification of 1997 distribution dates and locations for outplanting largemouth bass fry and fingerlings.

Three outplanting locations were identified for 1997. They include the Rednours slough, Dike dough, and Campbell slough (figure 1). These sites will also be used for 1998 outplantings The dates for outplantings are June/July (fiy) and September/October (fingerlings).

Objective 6. Monitor effectiveness of hatchery supplementation. Complies with the Northwest Power Planning Council's (NPPC) Fish and wildlife Program under section 10.88.19.

A Kalispel Tribal Bass Hatchery Supplementation Plan has been prepared and is attached as Appendix A

Summary and Concluseions

The activities for this project began with the ordering and installation of the internal life support system for the hatchery. The construction contractor worked through some very harsh weather conditions to complete the hatchery building before winter set in The hatchery building needed to be completed in order for the hatchery staff to begin the installation of the life support system. Through the fisrst winter, the hatchery staff was able to perform 75% of the work

The construction activities commenced at the hatchery in August of 1997. Up to this point, the only evidence of new construction was the hatchery building and some excavation work The water intake line, pump station, raceway building, and sheet pile dams still needed to be completed These major items were finished by October, 1997. A preliminary walk-through was performed in mid-October witb the final walk-through taking place in November.

The installation of the life support system and the preparation of the Operations and Maintenance Manual were the only objectives achieved for the year. The remaining objectives were all contingent on the hatchery being constructed prior to the spawn. These objectives will be fully achieved during the next operational season.

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APPENDICES

Appendix A

Kalispel Tribal Hatchery

Largemouth Bass Supplementation Study

KALISPEL TRIBE
LARGEMOUTH BASS HATCHERY
SUPPLEMENTATION STUDY

INTRODUCTION

In 1987, the Northwest Power Planning Council (NPPC) amended its Columbia River Basin Fish and Wildlife Program to include a resident fish substitution policy. This policy caped for substitution of resident fish in areas where auadromous fish historically occurred, but were blocked with the construction of the Chief Joseph and Grand Coulee Dams. One of the first projects adopted by NPPC was the "Assessment of fishery improvement opporhmities in the Pend Oreille river within the boundaries of the Kalispel Indian Reservation" (Ashe, et *al 1992). The* purpose of this three-year study was to establish baseline information of existing fish populations and habitat; and identity possible methods of improving fisheries within the reservoir. Recommendations from this study are proposed as resident fish substitution under the Northwest Power Planning Council's 1987 Resident Fish Substitution Policy.

The assessment identified several factors within the reservoir that limited the fisheries opporhmities within the Box Canyon reservoir. Some of these factors include water elevation fluctuations; lack of overwinter cover for age 0+ bass; and inadequate recruitment oflargemouth bass *into the system. The* University of Idaho also performed a study in within this tiemline (Bennett, Liter) and concurred with the above factors and proposed similar recommendations of the assessment study published by Ashe.

Based on these findings, biological objectives for largemouth bass (Micropterus *salonides),* bull trout *(Salvelinus* confluentus), and cutthroat trout *(Oncorhynchus clarki)* were identified and incorporated into the NPPC'S program The largemouth bass biological objectives were as follows.

- Increase the biomass of harvestable largemouth bass in the Box Canyon reservoir from the current 6 pounds/acre to an interim target of 8 pounds/acre by 2003 and a final target of 12 pounds/acre by the year 2008.

- Increase age 0+ largemouth bass overwinter survival from current levels of 0.4-3.9 percent to approximately 15-20 percent.

Specific recommendations or strategies to attain these biological objectives were also formulated and presented to the NPPC for approval and funding. These recommendations are as follows.

- Operate and maintain low-capital warm water hatchery constructed on the Kalispel Indian Reservation to produce 100,000 largemouth bass fry and 50,000 fingerlings for release into Box Canyon reservoir.

- Construct, operate, and maintain water control structures on the Pend Oreille wetlands wildlife project for the purpose of creating bass nursery sloughs.

- Construct, place, and maintain artiticial cover structures to increase the amount of bass age 0+ frt winter cover in the Box Canyon reservoir. The purpose of the cover is to increase the overwinter syrvuvak of age 0+ largemouth bass.

- Monitor effectiveness of largemouth bass supplementation.

The objective of this study is to test the survivalbility ofhatchery-raised bass through their first year following planting. Expected interpretations include strategies for release size and outplanting locations.

METHODS AND MATERIALS

All hatchery-raised largemouth bass released into the reservoir will be marked with a visible implant fluorescent elastomer. The color and the location of elastomer shall indicate the release location and the size of the fish at the time of release, respectively. All supplementation efforts shall be performed within a 20-30 miles stretch of the 57 mile long Box Canyon reservoir that currently provides suitable largemouth bass habitat. Specific outplanting locations will focus on areas which currently support a viable largemouth bass population. A list of the outplanting locations along with stocking sizes are listed in Table 1, below.

Table 1. Outplanting locations and release numbers

Outplanting Location	Fry	Fingerling	Fingerling 1+	Totals
Rednours slough	33,333	15,000	1,667	50,000
Dike slough	33,333	15,000	1,667	50,000
Campbell slough	33,334	15,000	1,666	50,000
Totals	100,000	45,000	5,000	150,000

Three different fish sizes will be released at each location. The first stocking will take place in early summer and will consist of approximately 100,000 fry (-55mm). The second stocking will take place in early fall and consist of approximately 45,000 fingerlings (-125mm), A third stocking will take place the following spring with approximately 5,000 fingerlongs age l+. Each group of fish will have its own distinctive mark that will indicate a specific release size and location (Figure 1).

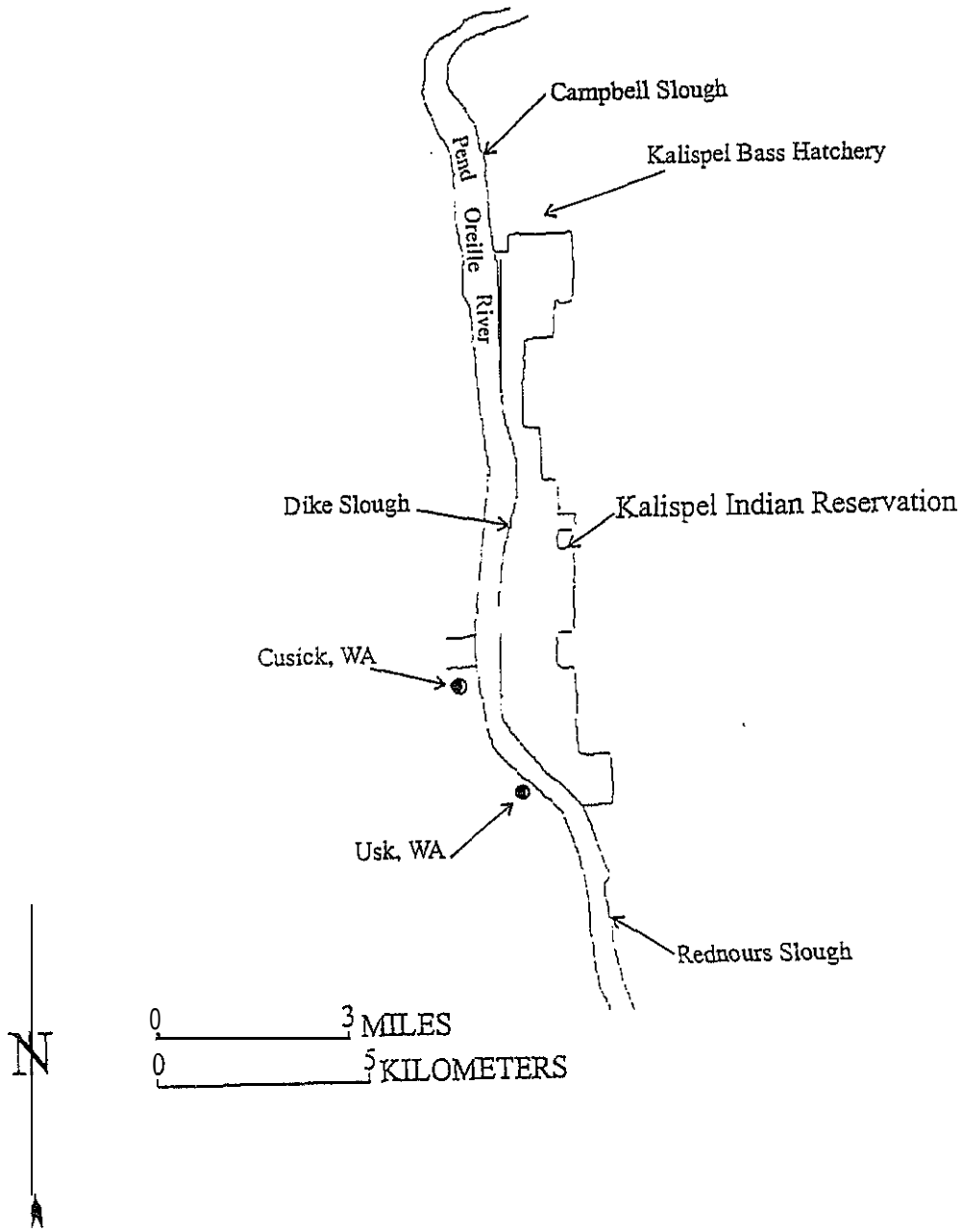

Figure 1. 1998 Largemouth bass release sites.

Recapture rates of the different release sizes will be tested for significance using the Chi^2 test of singnificance (distribution). AU hatchery released fish recaptured during the study will be remarked and released into the reservoir. The mark-recapture numbers will then be summed up for the entire sampling period (March-October).

$$Chi^2 = \sum \frac{[Observed - Expected)^2}{Expected}$$

Each outplanting location will be sampled monthly (March-October) following release. Three ten-minute transects will be performed at each release site. Two transects shall be located on opposite banks within the slough and another located immediately downstream of the slough in the main channel All areas will be sampled with a Smith-Root electro-shocking boat. Only largemouth bass will be sampled. A catch per unit effort (CPUE) will be calculated for each transect and reiease area.

$$CPUE = \sum \frac{Sample\ time}{Fish\ sampled}$$

A Jolly-Seber model will be used to generate survival estimates for the hatchery-raised fish. The data gathered during the study will be entered into a computer-based program entitled 'MARK". This program utilizes a Jolly-Seber model to generate survival estimates. The survival rates between hatchery-raised bass and the native population will be compared, along with different survival rates between release sizes.

The plot-level caps for each sampling area will be as follows:

1. Study name
2. Date
3. Time of day
4. Transect name and number
5. River elevations at Box Canyon, Albeni Falls, and Cusick
6. Water temperature
7. Crew initials

Only largemouth bass will be sampled within each transect. The specific measurements for each fish will be as follows:

1. Species
2. Total length (mm)
3. Total weight (grams)
4. Sex (if possible)
5. Other identifying marks

KALISPEL TRIBAL BASS HATCHERY
STJPPLEMENTATION STUDY

NULL HYPOTHESIS

H, : Survival release size 1 = Survival release size 2 = Survival release size 3

ALTERNATIVE HYPOTHESIS

H_1: Survival release size 1 > Survival release size 2

H_2: Survival release size 2 > Survival release size 1

H_3: Survival release size 1 > Survival release size 3

H_4: Survival release size 3 > Survival release size 1

H_5: Survival release size 2 > Survival release size 3

H_6: Survival release size 3 > Survival release size 2

Release size 1 = Fry age 0+ (approximately 100,000 released)

Release size 2 = Fingerling age 0+ (approximately 45,000 released)

Release size 3 = Fingerling age l+ (approximately 5,000 released)

Appendix B

Kalispel Tribal Hatchery

Operations and Maintenance Manual

KALISPEL WARM WATER FISH HATCHERY
KALISPEL TRIBE OF INDIANS
PEND OREILLE COUNTY, WASHINGTON

REVISED PRELIMINARY OPERATIONS MANUAL

NOVEMBER 25,1997

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- Water Heater
- Air Blower

EMERGENCY GENERATOR 14

RIVER PUMP STATION

There are 5 pumps:

- Two 1.5 HP submersible pumps (P-01 &P-02) each rated at 135 - 200 gpm.
- Two 3.0 HP centrifugal booster pumps (P-03 & P-04) each rated at 100 - 150 gpm.
- One smaller 1.0 HP centrifugal booster pump (P-05) rated at 35 gpm (for wintertime operation).

Normal Operation

Normal operation requires only one submersible pump,(either P-01 or P-02), plus one centrifugal booster pump (either P-03 or P-04).

Before turning on any booster pump, make sure that the 4" surface water (SW) butterfly valve at the raceway is fully open, otherwise the pump will overheat and bum-out. If surface water flow is also desired within the hatchery building, slowly open the 4" SW supply valve to the loft, then partly close the 4" SW butterfly valve at the raceway until sufficient pressure is available at the loft. You should verify this by both looking at the flow meter in the 4" line to the loft, as well as checking the water level in the splitter box at the loft - which should approach the top of the overflow weir.

One booster pump (P-03 or P-04) at the pump station should provide enough flow under most culture conditions for both the raceway (about 50 gpm) and the hatchery building (another 50 gpm ±). The pump station flow meter indicates what the total flow is to the raceway and the hatchery building — again, about 100 gpm for each booster pump. Alternate the use of the 3 HP booster pumps to even-out pump wear and to ascertain their condition.

With the above described "normal" operation, the surplus (up to 100 gpm) flow from the submersible pump is either automatically returned to the sump via the 4" overflow pipe. or directed to the sloughs by slowly cracking open (about 45 degrees) the 6" butterfly valve located outside the N.E. comer of the pump station. The 1" ball valve located beiow the air release valve in the 6" line to the sloughs should be opened first, however. Be sure to also open the 4" valve(s) to the slough(s). If both sloughs are to be supplied with water concurrently, these 4" valves should be opened one at a time.

and then closed-off after all me air is purged from the first line prior to opening the second 4" valve. Once all the air is purged from the second line, you may open-up the first valve again.

CAUTION: If the 6" butterfly valve supplying water to the sloughs is suddenly opened fully (90 degrees), the booster pump will probably be starved for water, and will not adequately supply the hatchery/raceway, causing an alarm to sound off at the hatchery building.

To prevent setting off me alarm, and if maximum flow to the slouch area is desired, then first turn on the second submersible pump (P-01 or P-02) prior to slowly opening the 6" butterfly valve to the sloughs (see note below). If this 6" valve *is* fully opened, double check the flow meter inside the pump station to ascertain that the booster pump is still pumping the full 100 ± gpm as was showing prior to opening the slough supply.

NOTE: One excellent way of adjusting the 6" valve to the sloughs under any pumping condition is to only open the valve until the overflow to the sump slows to a trickle. but does not stop. Wait several minutes to readjust the 6" valve prior to leaving the pump station, because trapped air in the slough Lines will be purged and could increase flow to the sloughs while possibly starving the booster pump(s). Once all the air is purged, close the 1" ball valve that is located below the air release valve in me 6" line to the sloughs. This will reduce the chance of further air entrainment.

High Water Demand (at Hatchery)

If some operations require in excess of 100 gpm at the hatchery/raceway area, men me second booster pump (P-03 or P-04) must also be turned on.

NOTE: With two booster pumps on, one submersible pump should still suffice as long as no water is being diverted to the sloughs, and river level is within 1 foot below dam spillway elevation 2035. At lower river levels turn cm the second submersible pump after checking the flow meter for pumping adequacy, or lack thereof.

Wintertime Operation

For wintertime operation use one submersible pump (P-01 or P-02) and the smallest booster pump (P-05). This combination will provide about 35 gpm to the hatchery building area, and if needed, about 150 gpm to the sloughs.

During wintertime operations, the river water used at the hatchery will be heated to maintain a desired temperature range, and the water reuse mode (100 gpm) will also be implemented to save on heating costs. For this reason, pump P-05 will be primarily used in the wintertime to provide make-up water only. As little as 10 - 15 gpm may be needed for several months.

As always, alternate use of the submersible pumps at least twice a month. This will not only even-out pump wear, but may also uncover a failed pump before it is needed.

Turning Pumps On

Consult the electrical controls and pump literature for proper sequence to be followed during start-up of any electrical motor.

NOTE: If power to the pump station has been shut off for any reason (see River Flooding section which follows), it is absolutely necessary that all pump controls be individually turned off prior to power being re-connected.

If everything appears in good operable shape after checking conditions of all equipment, motors and controls, then re-connect power and begin energizing one pump at a time commencing with P-01 & P-02. The pumps are turned on and off by pushing the appropriate black and red buttons on the motor control panel after turning the dial to the "HAND" position.

River Flooding

A. When river flooding above pump station floor elevation (El. 2040) is imminent, but is expected to crest at or below elevation 2043, take the following steps to protect the equipment:

1) Turn on both centrifugal booster pumps (P-03 & P-04) after turning on the 4" SW butterfly valve at the raceway.
2) Verify that both submersible pumps are on (P-01 & P-02).
3) Verify that 6" valve for supply to the sloughs is fully closed.
4) Turn the handle on the pump sump slide gate operator until the water level in the sump stabilizes about 4 feet below pump station floor level.
5) Install a small sump pump (1,500 gph ±) with integral float switch at floor level. Plug the pump into a wall receptacle. Aim (and secure) the pump discharge hose into the pump station sump.
6) Check flow meter for 200 + gpm. and general pump station security (turn-off lights, heater, etc.).
7) Exit the pump station and lock the door. Place a 4' x 6' plastic tarp in front of the door louver and pile sand bags in front of the door to hold the plastic tightly in place.
8) Call the power utility and alert them to the possibility that power to the pump station may have to be disconnected if the river stage continues to rise.

B. When river flooding approaches elevation 2042 and is not expected to crest soon, or before elevation 2043, take the following steps to protect the pump station equipment and pad-mounted transformer.

1) Commence water re-use mode of operation for the hatchery building area.
2) Once this mode of operation is fully established, call the power utility (Telephone Number:) and request that they disconnect power to the pump station immediately.

NOTE: Do not turn power on to the pump station before inspecting the pump station and assuring that all switches to each individual pump, heater and lights are turned off first. REFER TO PREVIOUS SECTION ENTITLED TURNING PUMPS ON.

RACEWAY

Two 4-inch butterfly valves control water supply to the enclosed raceway:

- The valve to the West provides untreated surface water (SW) directly from the pump station.
- The valve to the East provides treated water (TW) from the hatchery building, and is the normal mode of urovidine water to the raceway.

Water level within the raceway can be adjusted via stop logs or boards placed in the concrete grooves on the North end of the raceway. An alarm float switch is also located here, and must be adjusted whenever boards are added or removed. Screens can also be placed in the aluminum channels - if required (for sorting, crowding, etc.).

Water overflowing the two stop log channels is directed to the re-use sump, where it is either pumped back to the hatchery building for treatment and re-use, or overflows into the effluent ponds via a 6-inch pipe and knife gate valve.

The two 4-inch standpipes near the stop log channels are used for cleaning waste from the raceway. The normal procedure for raceway cleaning while fiih are being held, is as follows:

1) Disconnect or adjust the level. alarm in the downstream end of the raceway.
2) Crowd the fish to the South end of the raceway and provide plenty of water supply, and/or aeration via the air blower.
3) Remove stop log boards to lower the level slowly to the lowest safe level considering the fish being held.
4) Using a long-handled squeege and/or stainless steel push broom, brush the sides of the raceway first, and then push the solids along the bottom until they are mostly concentrated near the remaining stop logs.
5) Pull first one standpipe, and then the other, - being careful to limit this operation so that an adequate water level is maintained for the fish.
6) Replace the second standpipe and reset boards and alarms.
7) Re-adjust flow to the raceway.

NOTE: Raceway cleaning could also be performed mechanically, by using a portable self-priming pump, a long flexible hose and a swimming pool vacuuming tool. This method of cleaning the raceway can be carried out without crowding the fish or adjusting water levels - if one is very careful. The cleaning waste effluent from the pump can be piped either into one of the two 4-inch standpipes, or directly to the West end of the re-use sump.

WATER REUSE

Water reuse mode can be used during emergencies, such as when the main supply pipeline is out of commission, or there is a power outage, or when power to the pump station is disconnected. Water *reuse* is also the normal mode *of* operation during the cold months, when heating of the water is desirable. The procedures outlined below assume that all systems are already in operation and are fully charged with water. A more elaborate and slower procedure is required when first placing the systems in operation. This is because all troughs, equipment and pipes must be fully filled with water and all air must be purged from the systems.

All systems within the hatchery building, plus pump P-06 and the air blower AB-2 are used during the reuse mode and must be connected to the emergency generator automatic transfer switch panel.

Emergency Water Reuse Mode is initiated by:

1) Turn on air blower AB-2 and all appropriate valves to supply air to the 4 troughs and the raceway (use air sparges, or air stones to diffuse the air). You may wish to shut-off the alarm at this time, but it must be re-connected when re-use mode is established.
2) Inside the hatchery building, first be sure to close the 4" butterfly valve that supplies water to the loft, then close the 1.5 inch ball valve that removes sludge from the bead filter. Finally, climb-up to the loft area and verify that the 6-inch knife valve downstream of the aeration column is fully open.
3) Verify that the 4-inch supply valve to the raceway is open, but do not close the adjoining 4-inch SW supply valve.
4) Lower a weir board into place in the re-use sump near the North end of the raceway.

5) Turn on power to pump P-06 and set the pump control on Auto. The pump should start automatically when the water level just starts to overflow the top of the weir board.

6) Adjust all supply valves and water levels at the troughs and the raceway if necessary.

7) When re-use mode is fully established. you may turn off pump station pumps and then close the 4-inch SW supply valve at the raceway.

8) Turn on the alarm system.

Winter Mode

1) Verify the 1.5 inch bead filter sludge valve is closed and that the bead filter is full of water.

2) Fully open the aeration column 6-inch knife valve.

3) Fully open 4-inch treated water supply valve to raceway but do not close the 4-inch SW supply valve at this time (see step No. 10).

4) Lower a weir board into place in the re-use sump (place in concrete grooves).

5) Turn on power to pump P-06 and set the pump control to Auto. The pump should start automatically.

6) Now, in the hatchery buildiig, shut off the 4-inch supply valve to the loft.

7) Climb-up to the loft and fully open the winter make-up water gate valve.

8) At pump station, energize and start up the small booster pump (P-05) after making sure that it's suction and discharge valves are fully open.

9) Shut down and de-energize the huger booster pump (P-03/04), but leave on one submersible pump (P-01 or P-02).

10) Now it is safe to shut-off the 4-inch SW supply valve at the raceway.

11) If water heating is required, see directions for Water Heater in the next section of this manual.

12) Adjust winter make-up water gate valve at loft as required to minimize heat/energy loss.

13) Adjust water supply valves at troughs and at raceway as required.

14) The alarm system should not sound-off if the above procedures are carried out in the sequence shown.

15) Do not forget to alternate the use of the submersible pumps (P-01102) on a regular schedule during these months, and throughout the year.

16) If booster pump P-05 fails during winter mode while fish are being held in the hatchery, turn winter make-up valve in the loft fully open, then turn on either booster pump P-02 or P-03 at the pump station for 10-15 minutes, and concurrently also fully open the l-inch dewatering valve at the pump station. This brass valve is located just below the flow meter.

17) You may wish to repeat step No. 16 above several times a day by turning one booster pump on or off, but be sure to close the l-inch dewatering valve after shutting down the pump; and open the l-inch valve before re-starting the booster pump. The winter make-up water valve in the loft can be left fully open all the time during this emergency mode of operation.

18) Replace booster pump P-05 at the earliest, and m-adjust make-up water to loft.

Bead Filter

Refer to the manufacturer's brochure which should be appended to this manual proper bead filter operation and back-washing procedures. For the Kalispel Hatchery, these procedures consists of:

1) Close sludge valve, open 6-inch knife valve at loft, place weir board *into re-*use sump and turn on the re-use pump P-06 to initiate operation (note: it *will* take several days for bacteria to establish on the beads and for the bead filter to remove ammonia effectively).

2) Initiate bead filter backwash mode when the pressure gauge approaches 15 psi. or as recommended by the manufacturer's literature, but NEVER EXCEED 15 psi PRESSURE. Bead filter backwash mode is initiated by performing the following sequence.

- turn 2" make-up valve fully on at loft
- rum off the alarm system
- turn off pump P-06 at m-use sump
- open bead filter sludge valve until filter is fully drained
- immediately close the sludge valve and start-up pump P-06
- *wash* out sludge line by opening hose bibb from adjacent 2" water supply line for a few seconds - then shut off
- re-adjust 2" make-up water valve at loft
- turn alarm system back on

NOTE: Bead filter performance is very much temperature - dependent. Cooler water temperatures, as can be expected during cold months at the hatchery - even with the water being heated, will mean that the fish loading at hatchery troughs and at the raceway may be limited. Consult the bead filter manufacturer if in doubt.

Aeration Column

The aeration column becomes operational whenever the bead filter and/or the water heater are used. The only control on the aeration column is the 6-inch knife valve which must be opened fully when the column is in operation. This 6-inch valve should be fully closed when the aeration column is not in operation.

The 6-inch knife valve can also be used to control the amount of re-use water that is treated by the drum screen and the *W* unit whenever the water heater is not used. By partiallv closing this 6-inch valve, a portion of the aerated re-use flow can be wasted down the 4-inch overflow pipe. The above procedure could be used during a disease outbreak, in order to lengthen the *W* contact time as an extra factor of safety during re-use mode.

The aeration column is packed full of plastic media that are placed inside of plastic netting bags. The media and the bag openings will eventually plug-up with algae growth and will need to be periodically removed and washed (by placing the full bags inside of a commercial, or heavy-duty dish washer). The column can be left in operation without the media if absolutely necessary, but the aeration performance of the column will be severely reduced.

A sure sign that the aeration column is in need of clean media is a higher-than normal water level at the top of the column. If this high water level goes unnoticed, the water will eventually overflow the top of the column and make a mess below. It is recommended, that the media be washed whenever the water level at the top of the column is within 5 inches of the lip. Check this level daily.

WATER TREATMENT

The water to be used in the hatchery complex is treated in order to promote *tish* health and growth. Proper operation and maintenance of the water treatment equipment is essential in order to achieve the above benefits.

Drum Screen

P.R.A. Manufacturing Ltd. Model RFM 3024
Rotofilter with 37 micron screen and automated level control (backwash pump and spray nozzles).

The motor controller for the drum screen should be left on "Auto" mode in order to conserve energy and wear on the backwash pump. The backwash pump will be energized by the high level float (near the entry to the drum screen) switch, and its running time is also adjustable.

During periods of high river water turbidity, it would be advantageous to set the drum screen controller in the "On" mode-and leave it there. In this mode there will be minimal difference in water levels inside and outside the screen, thus assuring less intrusion of small particles.

The maximum capacity of the drum screen is 340 gpm, which could be utilized during future expansion of the hatchery. A finer screen (about 20 micron) could be used to provide even better water quality, but capacity would drop to below 200 gpm.

Solid square "plugs" have been provided to be used in case the screen becomes tom in a few locations. In case of more substantial screen failure, it will be necessary to replace a complete screen panel. Contact first the Manufacturer at (250) 754-4844 for advice on any problem. If they cannot be reached, call T.R. Gregg, the supplier, at (541) 929-3225.

NOTE: FOR WINTER MODE OF OPERATION, IT MAY BE NECESSARY TO USE A MODIFIED PIPE PLUG AT THE 8-INCH FILTER OUTLET lN ORDER TO PREVENT WATER LEVEL FROM GOING BELOW THE OUTLET PIPE LIP ELEVATION. FAILURE TO DO THIS COULD DAMAGE THE FILTER DRUM WATER SEAL.

U.V. unit

Ideal Horizons, I c . Model 1H - 1OL
with marrow band ultraviolet meter (0 - 100% readout).

Consult first the supplier in case of any questions:
T.R. *Gregg* (541) 929-3225

The quartz jackets will have to be periodically cleaned, as indicated by the U.V. meter readout.

This cleaning will necessitate shutting off POWER and bypassing water around the U.V. unit. Bypassing can be accomplished by closing two 6-inch butterfly valves and opening the third one. After draining the UV vessel using the round drain plug on the bottom (N. end), the light bulbs must be carefully removed and properly stored while the quartz sleeves are washed clean with a wet cloth. Re-assemble the unit in the reverse order of the above.

Water Heater

The part number for the propane water heater provided by Aquatic Eco-Systems, Inc. (800) 422-3939 is VG 405 (399,000 BTU).

Contact either Mark Benson or John Koeniger during the one-year warranty period (believed to expire in July, 1998). After the warranty expires, call a local swimming pool heater repair shop.

CAUTION: TOO RAPID A RATE OF WATER HEATING COULD RESULT IN THERMAL SHOCK FOR THE FISH EXPOSED TO THIS WATER.

ALWAYS RAISE WATER TEMPERATURE IN SMALL INCREMENTS (ABOUT 2° F). ALSO, BE SURE THAT RE-USE MODE IS FULLY ESTABLISHED AND ALL AIR IS PURGED FROM HEATER LINES PRIOR TO TURNING ON THE WATER HEATER. THIS LAST ITEM IS ACCOMPLISHED BY OPENING BOTH INLET AND DISCHARGE BALL VALVES AT HEATER BOOSTER PUMPS SEVERAL MINUTES PRIO TO ENERGIZING THE PUMP(S).

The water heater is made operational by turning on the propane supply and the electrical power, and then assuring that the pilot light or electronic ignition is working properly.

Normally, only one booster pump (P-07 or P-OS) is used to activate the water heater. However, during start-up. it is safer for the fish if both pumps are turned on sumultaneously. This will result in a lower temperature difference across the heater's heat exchangers:

1) With both pumps operating, slowly rotate the temperature control dial on the heater in a counter-clockwise rotation, but only barely until the heater cycles on.
2) Read the temperature probe at the indicator when the temperature stabilizes and the heater automatically shuts-off.
3) Leaving both pumps (P-07 and P-08) on, repeat the above two steps every hour - or - so, until the desired temperature level is achieved and stabilized.
4) Turn off either pump P-07 or P-08 and the respective inlet and discharge ball valves at the pump that has been turned off.
5) Set the temperature alarm to come on for both high and low temperatures.

Air Blower

The Roots rotary-lobe air blower is part number RB-22A with 3 HP motor, and the complete package was assembled and supplied by Aquatic Eco-Systems, Inc. (800) 422-3939.

Contact either Mark Benson or John Koeniger at the above number, even after the warranty period expires (July, 1998?)

The only precaution to follow prior to turning on the air blower, is to have some air relief valve open - preferably at the far end of the air line, such as at the raceway risers. This will prevent rapid heat rise at the blower, by allowing air to circulate through the unit.

With the relief valve open. adjust the weights on top of the pressure relief valve until the desired air pressure is indicated at the gauge (about 4 to 5 psi).

Close the air relief valve at the raceway riser and monitor the pressure gauge to see if the reading has changed (it should not). Then open the air lines to the respective air stones or air sparges.

Clean out the air intake filters periodically, by blowing compressed air ~~from inside of the filter-out.~~

Lubricate all fittings as per manufacturer's instructions and check tightness of screw clamps securing the flex hose.

EMERGENCY GENERATOR (this section to be completed by J=U=B.)

The propane powered emergency generator is Model No _____, supplied by _____ tel. no. _____ - _____

The generator unit needs to be periodically started to verify *its* operating condition. It is recommended that this check be performed at least every months, utilizing the following procedures:

1) _____
2) _____

erc. etc.

The emergency generator can be utilized to power the following equipment during a power outage:

- water heater
- air blower AB - 2
- booster pumps P-07 and P-08
- re-use pump P-06
- U.V. Unit
- drum filter
- various 115 V outlets
- various lights
- monitor and alarm system

J-U-B to verifv the above.