R & E Grant Application 13 Biennium

Project #: 13-089

Phillips Reservoir Fishery Monitoring Equipment

Project Information

R&E Project Request: $4,272.00
Match Funding: $0.00
Total Project: $4,272.00
Start Date: 12/15/2014
End Date: 3/15/2015
Project Email: timothy.d.bailey@state.or.us
Project Biennium: 13 Biennium
Organization: ODFW - Grande Ronde Watershed District Office

Applicant Information

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Past Recommended or Completed Projects

Number	Name	Status
11-036	Luger Pond Handicap Fishing Access Development	Completed
09-057	Phillips Reservoir Fishery Restoration	Completed
09-183	Phillips Reservoir Creel Survey	Completed
09-219	North Powder Pond Fishing Access Improvement	Completed
09-264	Grande Ronde Watershed District Fishery Monitoring	Completed
09-265	Phillips Reservoir Trap Nets	Completed
11-066	Phillips Reservoir Fishery Restoration - Phase II	Completed
11-074	Northeast Oregon Spring Chinook Creel Surveys	Completed
11-146	Phillips Reservoir Creel Survey 2013	Completed
11-158	Grande Ronde Watershed Monitoring Equipment	Completed
11-159	2013 Northeast Oregon Spring Chinook Creel Surveys	Completed
13-001	Phillips Reservoir Creel Survey 2013 - Phase 2	Approved
13-050	Phillips Reservoir Monitoring and Evaluation	Approved

Project Summary

This project is part of ODFW's 25 Year Angling Plan.

Activity Type: Monitoring

Summary: The purpose of this project is to purchase equipment needed to support monitoring and evaluation of fishery restoration activities at Phillips Reservoir. The primary activity under evaluation is the introduction of sterile tiger muskie intended to prey upon and reduced the abundance of yellow perch.

Funds are requested to purchase an 8' deep Merwin trap net and two holding pens. The la Grande District currently has two of these trap nets, one 12' deep and one 16' deep, however, results spring 2014 indicate a need to be able to effectively trap in shallower water. Thus, we are requesting to purchase an additional trap net.

Objectives: Fishery management objectives are shown in the attachment "Fishery Management Objectives"

Monitoring and evaluation objectives are described in the attached Phillips Reservoir Tiger Muskie Monitoring and Evaluation Plan (M & E Plan).

The specific objective of this funding request is to improve the effectiveness of monitoring activities. The first year of monitoring efforts proved ineffective in obtaining an accurate abundance estimate of yellow perch which is key to monitoring the effectiveness of the tiger muskie introduction. This was primarily due to insufficient overall catch of yellow perch and recapture of tagged perch. While Merwin trap nets were effective in capturing large numbers of perch as part of the perch removal project implemented 2009 - 2013, reservoir conditions were muck different in 2014, making the Merwin trap nets we have less effective. The volume of water in the reservoir during April 2014 sampling was much lower than in the previous five years. Thus water depths at key perch spawning locations, where large numbers of perch were caught in past years, were much shallower. The two Merwin trap nets we currently have effectively fish at depths of 12' and 16', while the preferred trapping locations in 2014 were 6 to 10 feet deep. We would like to purchase an additional trap net (8 foot depth) so that in future years we have the ability to effectively trap perch in shallower water depths. Current water storage in Phillips is very similar to 2013 at the same time, indicating that 2015 sampling conditions will likely be similar to 2014. We would like to purchase just the netting component of the trap, not the floats. We can use the floats and hardware we currently have to deploy a shallower trap net.

The additional holding pens are needed in order to hold marked trout prior to dispersal into the reservoir and yellow perch during the marking process. In 2014 we had insufficient net pen holding space and encountered moderate mortality of trout held in the two pens we currently have.

Fishery Benefits: Implementation of the M & E Plan will allow us to evaluate the efficacy of our current management approach at Phillips Reservoir to improve the rainbow trout fishery by controlling yellow perch abundance. We will use the m & e results to determine in 2018, whether or not to continue stocking of tiger muskie.
The intended outcome of the tiger muskie introduction, and supporting M & E Plan,

are to improve the recreational fishery at Phillips Reservoir.

Watershed Benefits:

Reduction of yellow perch abundance in Phillips Reservoir would improve rearing conditions for native redband trout that use the reservoir. The overabundant population of yellow perch, which are very efficient planktivores, remove the larger sized zooplankton from the reservoir, which are important prey items for redband trout using the reservoir. Thus rearing conditions for redband trout using the reservoir are not good. Reduced yellow perch abundance should lead to more availability of zooplankton species preferred by redband trout and other gamefish species.
Additionally, reduction of zooplankton abundance can result in greater volumes of algae, including deleterious blue-green algae, creating a concern for water quality and human health. Reduction of perch numbers could prevent such a situation from occurring.

Current Situation:

Phillips Reservoir once supported a very popular fishery for primarily rainbow trout(some of trophy size), but also bass and crappie. Introduction of yellow perch caused a severe decline in the trout fishery. Creel survey data show 35,000 anglerdays
before the perch introduction and 3,100 angler-days in 2010 after introduction, a decline of over 90%.

Thirty-two percent of the 2008 angler survey respondents indicated that they no longer fish at Phillips Reservoir due primarily to the decline in trout abundance and size. Anglers that target trout when they fish the reservoir showed the following level of satisfaction with the fishery: 4% very satisfied, 27% satisfied, 40% unsatisfied and 29% very unsatisfied.

The fishery was supported by the stocking of fingerling sized rainbow trout, which was highly cost effective. Fingerling trout survived and grew very poorly once yellow perch were introduced, eliminating this as a viable management option. The fishery is now supported by stocking of legal-sized rainbow trout (put and take fishery) and an experimental release of sub-legal sized trout. Before introduction of perch the weight of the trout per length was much greater.

Per the 2008 angler survey, approximately 21 percent of the respondents would like a perch fishery to exist, but would like the average size of the fish to increase. The average size of perch in gillnet samples has been 7-8 inches.

From 2009 - 2013, the district implemented a project to mechanically remove yellow perch from the reservoir, partially funded by the R & E Program, intended to reduce their abundance. Even though this project removed approximately 1.4 million yellow perch from the reservoir, abundance estimates do not indicate a measureable decrease in the population. Neither has there been a trend of increasing size, growth or survival of stocked rainbow trout.

After Oregon Fish and Wildlife Commission approval to introduce tiger muskie into

Phillips reservoir to control the yellow perch population and restore the rainbow trout fishery, the first release of 25,000 five-inch juvenile tiger muskie occurred in June 2013.

Spring 2014 marks the first sampling, post release of tiger muskie in 2013. Through implementation of the yellow perch removal project, 2009 through 2013, we learned of the best locations to trap perch using trap nets during spawning. However, the water storage level in the reservoir was much lower during our spring 2014 trapping than in any of the past five years. Water depths were much shallower at the most productive trapping sites. The depths were too shallow to use the 12' and 16' traps we currently have. As a result, we were forced to trap at what we know have been less productive sites, and experienced a very poor capture of yellow perch.

The primary purpose of the spring trapping is develop estimates of abundance for yellow perch and trout, using mark-recapture. These data will help us determine the effect tiger muskie are having on the yellow perch population, and response of rainbow trout. The relatively lower capture of yellow perch in 2014, also led to lesser recapture of marked perch. This resulted in a perch abundance estimate with a very wide 95% confidence interval. Thus, the data will have little utility in our evaluation.

A trap net of shallower depth would allow us, per water depths experienced in spring 2014, to trap at the most productive locations under low pool conditions, and hopefully achieve better perch abundance estimates in low water years. The current water storage in Phillips Reservoir indicates that there will be low water conditions in spring 2015.

Alternatives: From the standpoint of M & E, we have chosen the measurement of the metrics we think are necessary to evaluate the tiger muskie introduction. While there are other techniques available for evaluating the chosen metrics, we have chosen what we believe are the most efficient in terms of cost and personnel.
With regard to management, a number of other atlernatives were considered for achieving fishery objectives at Phillips Reservoir. Documents describing these are available upon request.

Designer: The M & E Plan was developed by Terry Shrader, Eastside Recreational Fisheries Biologist, and Tim Bailey, La Grande District Fish Biologist.

Methods: See the attached M & E Plan.

Inspector: Tim Bailey

Funding Elements: Purchase of equipment

Partners: No

Existing Plan: No

Affected Contacted: No

Affected Supportive: No

Project Schedule/Participants/Funding

Activity	Date	Participants
Purchase Equipment	3/15/2015	Fish District

Affected Species:
Rainbow Trout
Tiger Muskie
Yellow Perch

Project Permits

This project has no permits.

Project Monitoring

This project has no monitoring.

Project Maintenance

This project has no maintenance plans.

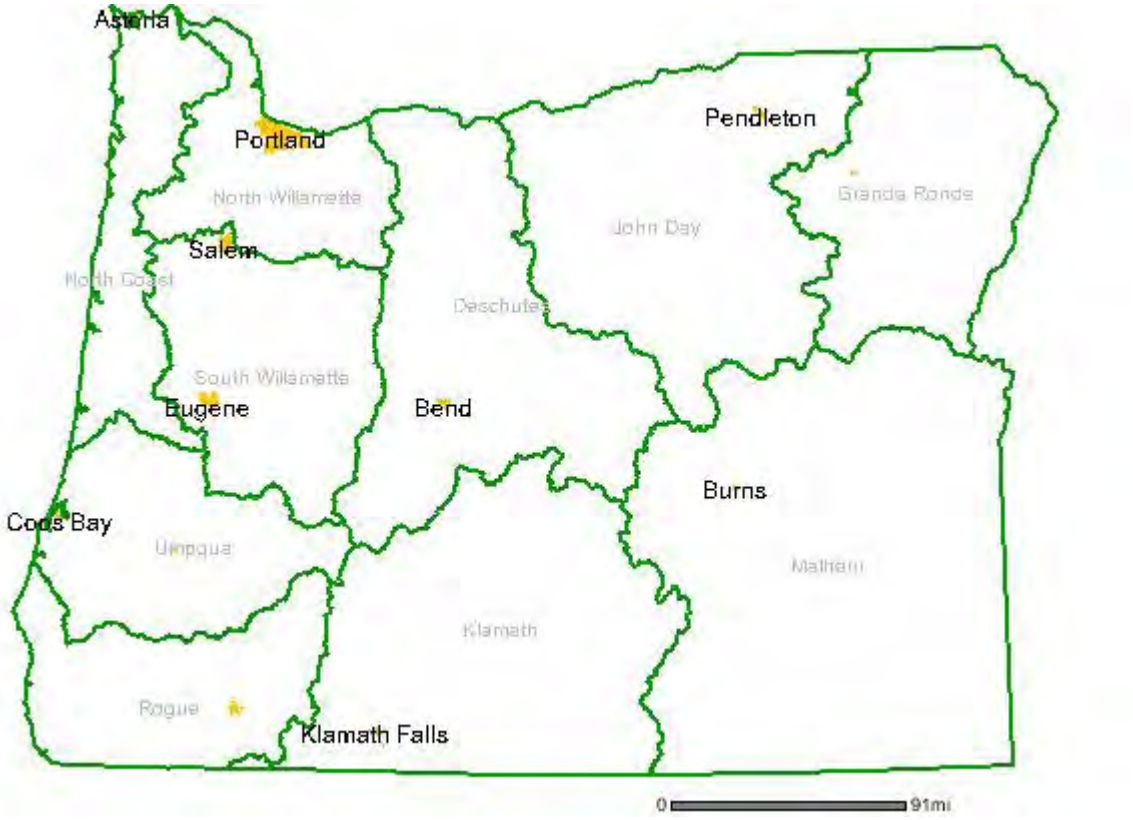
Project Match Funding

Funding Source	Cash	In-Kind	Other	Description	Total	Secured?	Conditions?	Comments
R&E Request	$4,272.00	$0.00	$0.00		$4,272.00	No	No	
				Total Match Funding:	$4,272.00			

Project Budget

Item	Item Type	Units	Unit Cost	R&E Funds	Match Funds	Total
8' Merwin Trap Net	Equipment	1	$3,880.00	$3,880.00	$0.00	$3,880.00
Net Holding Box	Equipment	2	$140.00	$280.00	$0.00	$280.00
4" PVC Pipe	Supplies/Materials /Services	80	$0.85	$68.00	$0.00	$68.00
PVC Elbow	Supplies/Materials /Services	8	$5.50	$44.00	$0.00	$44.00
					Total Budget:	$4,272.00

Project Map



Additional Files

Click a link to view that particular file.

Fishery Management Objectives

M & E Plan

Signature Page

Trap Net Quote

Phillips Reservoir Fishery
Monitoring and Evaluation Plan

Background Information

A very productive and popular recreational fishery developed at Phillips Reservoir immediately after construction was completed in 1968. Angler use of this reservoir was high (67,510 angler-days in 1970), considering it is in a relatively sparsely populated region of Oregon. An end came to the productivity of one of the region's most popular trout fisheries as the result of the illegal introduction of yellow perch, first documented in 1991. The perch quickly populated the reservoir and by the mid 1990's they were the dominant species. This expansion led to changes in the reservoir's zooplankton community that impacted the productivity of other gamefish populations in the reservoir, namely rainbow trout smallmouth bass, and black crappie. The trout fishery severely declined due to this introduction. Angler-days declined from 34,955 in 1981 to 3,103 in 2010.

Phillips Reservoir Fisheries Management Plan Implementation

The Phillips Reservoir Fisheries Management Plan provides a prescription of management actions intended to restore the rainbow trout fishery, per objectives provided in Appendix A. There is significant uncertainty on whether or not the management prescription can overcome existing challenges to accomplish these goals and objectives. Thus, an adaptive approach is warranted where monitoring and evaluation is implemented to assess effectiveness of the management prescription. This document - the Phillips Reservoir Monitoring and Evaluation Plan - outlines the monitoring activities necessary to objectively evaluate the progress toward our management goal of restoring the rainbow trout fishery.

As of January 2013, three management actions have been implemented in an attempt to restore the trout fishery. First, the trout stocking program was changed; the current trout stocking strategy consists of 33,600 legal sized rainbows (Oak Springs Stock) spread out over the months of April through July and 24,600 sub-legals (Oak Springs Stock) released in mid-September. Second, in 2004, 2005, 2009-2012 perch were netted and removed from the reservoir in an attempt to reduce their abundance. Finally, tiger trout were introduced into the reservoir in 2011 to replace the trophy aspect of the trout fishery that once existed with a unique, sterile hybrid. This strategy has maintained a trout fishery at the reservoir, although it does not meet the public's expectation. Creel data collected in 2007 and 2009 and a statistical creel survey in 2010 show that the catch rate is at or above the average, but the length of fish caught are smaller than those caught in the past.

In 2012, after researching various options available to control yellow perch, ODFW staff gained OFWC approval to reclassify tiger muskie from a prohibited species (OAR 635-056-0050) to a controlled species (OAR 635-056-0075) specifically for introduction into Phillips reservoir for fishery management purposes. This provided ODFW with legal authority to proceed with the proposed introduction of tiger muskie into Phillips Reservoir for the purpose of controlling yellow perch abundance to improve the trout fishery. Beginning in 2013, and continuing for an initial evaluation period of five years, tiger muskie will be released annually into Phillips Reservoir to achieve a target density of 1-2 adult tiger muskie adults per acre, which should be effective at controlling over abundant prey species without negatively impacting the

target management species (trout). Tiger muskie will be managed primarily as a catch-and-release fishery; high minimum length limits will allow these fish to grow to sizes that they can consume the greatest number of perch. Adjustment of stocking numbers and the determination of whether or not to continue the program after the five year evaluation period will be based on results from activities outlined in this monitoring and evaluation plan. It is anticipated a targeted sport fishery could develop for tiger muskie. Management decisions regarding tiger muskie will be made based on their intended purpose - to control yellow perch abundance for restoring the trout fishery - and not their value as a targeted sport fishery should one develop.

Biological Objectives Indicative of Fisheries Effects

In addition to the fishery goals and objectives outlined in Appendix A, it is important to set biological objectives to provide indicators that management actions are affecting the system in a way necessary to attain fishery objectives. Biological responses will likely occur before fishery improvements will be detected. The primary indicators used will be the effectiveness of management actions (rainbow trout stocking, tiger trout stocking, tiger muskie stocking and mechanical perch removal) to reduce perch biomass and achieve improved growth and survival of rainbow trout stocked in the reservoir as fingerlings or sub-legals.

The intended density of adult tiger muskie in the reservoir is 1-2 fish/acre, although at this density, adequate samples to characterize the population in terms of density, growth and survival will be difficult. Therefore, monitoring of tiger muskie effects will be focused primarily on their impacts on yellow perch and the success of the hatchery trout program. Although there are many examples of using tiger muskie to control undesirable prey species in conjunction with maintaining or improving a hatchery trout program, higher abundance of tiger muskie would likely lead to them overrunning the perch prey base and then negatively impacting abundance of stocked rainbow trout and native fish species. Thus, careful monitoring of prey abundance is required. In terms of response time, it is anticipated it will take a minimum of three years after the initial introduction for tiger muskie to begin have a measurable effect on the yellow perch population and a minimum of five years before any level of control is achieved.

Fisheries Monitoring and Evaluation Plan

Objective 1: Characterize recreational fishery.

Task 1.1: Conduct angler creel surveys during the 5-year evaluation period to monitor the efficacy of the tiger muskie and tiger trout introductions.

Rationale: Creel surveys will be critical in analyzing the efficacy of the tiger muskie and tiger trout introductions in improving conditions in the reservoir for a hatchery trout program. Meeting management objectives for the trout fishery is the ultimate goal of the muskie introduction, while tiger trout were introduced because it was thought that their piscivorous nature and the abundant perch in the reservoir offered a better chance of producing trophy trout for which Phillips was historically known. Creel census and gillnet sampling to monitor the trout fishery

were limited during the 1990's, and early 2000's, so there is little data to characterize the decline of the fishery, post perch introduction.

Approach: A statistical creel survey is planned for 2013. The results of this and other recent creel information will be used as baseline information to compare against once muskie are introduced. Although muskie will hopefully be introduced Spring 2013, they will not appreciably affect the system so any creel information collected that year can be included in the baseline.

In 2014 or 2015, the Warmwater Program could potentially provide seasonal time for May and June and the La Grande District could use interns from July on. It will be imperative to conduct a creel in 2017 because the decision as to whether to continue the tiger muskie program must be made prior to the 2018 field season.

The primary objectives for the creel survey would be to 1) determine catch rate and size distribution of rainbow trout, tiger trout, and yellow perch by anglers, 2) determine catch rate and size distribution of warmwater game species by anglers, and 3) estimate total and season angler pressure from April/May through October.

Task 1.2: Conduct angler opinion surveys during the 5-year evaluation period to monitor any potential changes in angler satisfaction resulting from management efforts.

Rationale: The 2008 angler opinion survey conducted by ODFW was used to develop management objectives for Phillips Reservoir. It documented angler dissatisfaction with the state of the trout fishery at that time. Management actions taken to improve the fishery will ultimately be measured by improvements in the quality of the trout fishery and the level of angler satisfaction with the fishery. Angler opinion surveys conducted concurrently with angler creel surveys will allow correlation of angler satisfaction to angler success with the most judicious use of staff time.

Approach: Incorporate an angler opinion survey similar to the 2008 angler opinion survey into the 2013 creel survey to reinforce baseline information on angler satisfaction. As with the creel survey, it will be imperative to conduct an angler opinion survey in 2017 because the decision as to whether to continue the tiger muskie program must be made prior to the 2018 field season. Ideally, an additional creel/angler opinion survey should be conducted midway through the initial 5-year evaluation period (2015).

Objective 2: Monitor performance of stocked trout.

Task 2.1: Develop quantitative survival estimates for hatchery sub-legal rainbow trout stocked in the fall.

Rationale: The survival and growth of rainbow trout stocks in the reservoir are important factors in assessing the effectiveness of stocking various strains of hatchery trout. It will be important to develop quantitative estimates of the survival of sub-legal trout stocked in the fall. There is no baseline data on the survival of rainbow trout fingerlings released into Phillips Reservoir in the past. As the abundance of yellow perch decreases, it is hoped that their negative impact on trout survival will also diminish. However, because of the high variability of fingerling survival based on size and timing of release and the particular reservoir environment, no objective is provided for this metric. Rather, an improving trend in survival will provide evidence that reservoir conditions are improving for trout. This information will be used to make decisions on future stock selection and hatchery releases.

Approach: In Spring 2012, 3,000 catchable trout were stocked throughout the reservoir to mix and be captured in Merwin traps along with surviving sub-legal trout stocked in Fall 2011. This resulted in a 95% confidence interval of less than 1% of the point estimate for survival. However, 2013 will be the last year of the large-scale Merwin trapping effort so either in 2013 or 2014, alternative methods, possibly reduced-scale Merwin trapping or South Dakota trapnets should be used to see what level of effort is needed to generate accurate population and survival estimates. This methodology should be determined before the 2016 field season so baseline and project-effect levels of survival can be compared prior to the 2018 decision point.

Task 2.2: Monitor the growth of sub-legal rainbow trout.

Rationale: Trout fingerlings released in the 1970's and 1980's achieved 5" of growth in length from their first to second fall in the reservoir. Annual growth of rainbow trout in other Baker County reservoirs range from 2.6 to 7.3 inches. The interim objective for growth of sub-legal rainbows stocked in the fall will be for them to increase in average length by 4" from their first to second spring in the reservoir.

Approach: Fall-stocked sub-legal rainbow trout will be adipose marked to distinguish them from wild trout naturally occurring in the reservoir and stocked legal-sized rainbow trout. Methods used to generate quantitative survival estimates for hatchery sub-legal rainbow trout stocked in the fall (Task 2.1), as well as efforts to monitor changes in reservoir fish biomass contribution (Task 3.3) should capture enough fish to provide data on growth of stocked sub-legal rainbow.

Task 2.3: Monitor the growth of legal-sized rainbow trout.

Rationale: As yellow perch density changes, the ability of hatchery trout fingerlings to grow and survive to produce the trophy component of the fishery changes.

Approach: 3,000 legal-sized trout stocked for the purpose of estimating sub-legal trout survival will be marked with a fluorescent spray dye. These legal-sized trout will be stocked every year about the same time and their fluorescent spray mark will differentiate them from other catchable trout stocked later in the season. If a subsample is measured when they are stocked, we will be able to follow the growth of each cohort as they are recovered throughout the project and determine if their growth responds to changes in yellow perch density. Methods used to generate quantitative survival estimates for hatchery sub-legal rainbow trout stocked in the fall (Task 2.1), as well as efforts to monitor changes in reservoir fish biomass contribution (Task 3.3) should capture enough fish to provide data on growth of dye-marked stocked legal-sized rainbow.

Task 2.4: Monitor the growth and survival of stocked tiger trout.

Rationale: Tiger trout have been introduced to replace, at least on an interim basis, the trophy aspect of the trout fishery that once existed. While tiger trout have performed well under a wide range of environmental conditions and species assemblages, it is unknown to what extent they will achieve their intended purpose in Phillips Reservoir. Although there will likely be issues with differences in size, condition, or timing at stocking that may complicate or preclude comparison, tiger trout survival and/or growth through the evaluation period may be another metric that can be used to monitor the effects of tiger muskie.

Approach: Assuming equal catchability as rainbow trout, methodology developed for Tasks 2.1 and 3.3 will also allow us to estimate survival of stocked tiger trout. However, as the growth and survival of tiger trout is secondary to that of stocked rainbow trout, considerations should be given to methodology to generate accurate survival estimates for the latter.

Objective 3: Monitor changes in reservoir food web, with respect to yellow perch abundance.

Task 3.1: Monitor changes in yellow perch population density.

Rationale: The intended density of tiger muskie in the reservoir will be so low that it will be difficult to characterize the population through sampling. Therefore, monitoring yellow perch abundance is an indirect measure of the tiger muskie introduction effort. Although there are many examples of using tiger muskie to control undesirable prey species in conjunction with maintaining or improving a hatchery trout program, higher abundance of tiger muskie would likely lead to them overrunning the perch prey base and then negatively impacting abundance of stocked rainbow trout and native fish species. Thus, careful monitoring of prey abundance, in this case yellow perch is required. Fish

managers from other states have found that managing the prey species at approximately 30% of the biomass provides the needed level of control while protecting other species from undesirable levels of predation and competition. Thus, as an interim target, it is desired that perch biomass not exceed 30% of the fish community by weight, as determined by proportion of fish caught in annual gillnet or trap net samples collected in the spring.

Approach: Past perch population estimates were generated by releasing double-tagged perch essentially concurrent with the initiation of Merwin trapping. Given the number of fish tagged and the number of captured/examined, we were 95% sure that the perch population estimate was within ~18% of the true number. The same will hold true with the 2013 perch population estimate as the full Merwin trapping effort will be repeated for the final time. Future more-limited trapping efforts with trapnets and/or Merwin traps are predicted to catch in the range of 40% of the perch that "historic" trapping captured. If this is the case and we continue to tag 500 perch, we can be 95% sure that the perch population estimates are within ~22-24% of the actual number. With the decrease in number of perch handled and examined for marks, the number marked would need to be increased to tighten confidence limits on perch population estimate; 1,000 tagged perch, might approach the accuracy of past population estimates.

In addition, we will attempt to correlate population estimates generated through mark-recapture using trapping to boat electrofishing catch-per-unit-effort (CPUE). Although the effectiveness of this technique will likely be limited at higher perch densities due to the asymptotic nature of the relationship, if the tiger muskie introduction is effective in reducing perch abundance, identification of the electrofishing CPUE/perch abundance relationship will facilitate monitoring of perch abundance with respect to the 30% biomass goal.

Task 3.2: Monitor changes in yellow perch population growth rates.

Rationale: As yellow perch population density is driven below the carrying capacity of the reservoir, intra-specific competition should decrease and perch growth rates should hypothetically increase.

Approach: This analysis is not critical to the evaluation of the success of our management actions. Age/growth analysis of perch performed in 2013 should provide a baseline for comparison to the results of a similar analysis performed in the final year of the initial evaluation period (2017). Standard protocol for complete age analysis – scales collected from 10 fish in every 10-mm length increment above 150 mm – will provide the information necessary for comparison.

Task 3.3: Monitor changes in reservoir fish biomass contribution.

Rationale: As was explained in the rationale for Task 3.1, fishery managers from other states suggest that as an interim target that perch biomass not exceed 30% of

the fish community by weight. Methodology utilized to achieve Task 3.1 will generate one index of fish community species biomass distribution, while the methodology outlined below will generate another index. The advantage of this methodology is that it is much more comparable to a long-term dataset available in district records.

Approach: District personnel may set two experimental gillnets in May at pre-established locations used in previous annual inventory trend netting. This information will then be comparable to historic gillnet sets. Although gillnet capture efficiency tends to be biased against warmwater species, this bias existed in past netting efforts. If we acknowledge and accept those biases, this netting methodology will generate another index of whether perch abundance is moving toward the 30% biomass target.

Objective 4: Monitor tiger muskellunge diet.

Task 4.1: Determine tiger muskie diet.

Rationale: Although the literature shows muskie will utilize perch, it also suggests that they will select against them as they are spiney-rayed fish. Diet analysis will illustrate the degree to which perch are being utilized as forage.

Approach: Stomachs will be collected from any dead muskie encountered, while stomach contents of live muskie encountered during sampling will be collected using gastric lavage and through a sieve (1-mm opening) and preserved in 70% ethanol for examination in the lab. Food items will be examined using a variable power (7-30X) binocular dissecting microscope and identified to the lowest practical taxonomic level (most often to order, but in some cases, sub-order or family), and counted. Identification of partially digested fish remains to family will be accomplished using a variety of keys available for diagnostic bones.

Percentage contribution to the diet (by volume) of each category of food item will calculated on the basis of the entire volume of food. Volume of other specific food items consumed will be calculated by multiplying the number of individuals by the average volume per individual. Average displacement (volume) per individual will be measured by placing representative individuals in a graduated centrifuge tube partially filled with water. This allowed volume estimation even if only partial remains of a prey item were found in a stomach.

Objective 5: Monitor for upstream movement of tiger trout.

Task 5.1: Monitor for presence/absence of tiger trout in Powder River upstream of Phillips Reservoir.

Rationale: Bull trout reside in tributaries of the Powder River upstream of Phillips Reservoir. While tiger trout are primarily sterile, there is the small possibility that they could either interbreed with bull trout and/or compete for habitat, should they leave the reservoir and migrate to reaches occupied by bull trout.

Approach: Releases of tiger trout in 2011 and 2012 have not met either the target number or size, as a direct result no tiger trout were captured in sampling activities in 2011. Thus at this time, it is unlikely that significant numbers of tiger trout exist in the reservoir. Once in-reservoir sampling has documented significant survival of tiger trout, then sampling should occur in the Powder River, to determine movement upstream. Presence/absence of tiger trout in electrofishing samples will be used to documented upstream movement into the 8 Km reach above Phillips. One randomly selected 100 m site will be sampled in each 1 km reach of river. One pass will be completed with block nets.

Limnological Monitoring and Evaluation Plan

Objective 1: Monitor Basic limnological characterization of the reservoir

Rationale: The rule language changing the status of tiger muskie from prohibited to controlled states "Department will develop an environmental monitoring plan for Phillips Reservoir which should include:
a) Basic limnological characterization of the reservoir (nutrient concentrations, light penetration, vertical profiles of physical and chemical characteristics of reservoir water, zooplankton, and phytoplankton composition and densities)."

Approach: As the goal of this aspect of the M&E program is to monitor changes in water quality over the initial 5-year period following introduction of tiger muskie, complete limnological characterization of the reservoir is not necessary. This fact and the general homogeneity of the water mass in the lake reduces the number of sampling sites needed to monitor changes in basic limnological characteristics of the lake. Sampling will occur from May through October during years when a fisheries creel clerk is employed to take advantage of the additional manpower.

Task 1.1: Monitor changes in reservoir nutrient concentration.

Approach: Replicate integrated epilimnotic water samples for nutrient analysis will be collected at monthly intervals at a deep water station using a 15-m long, 2.54-cm diameter acrylic tube suspended vertically in the water column. Additionally, replicate water samples will be collected using a non-metallic Van Dorn bottle from the surface to depth at 5-m intervals at three times during the growing season - prior to spring stratification, late in the summer stratification and after the autumn overturn. Ideally, water samples will be analyzed for concentrations of total phosphorus, soluble reactive phosphorus, orthophosphate,

nitrate-nitrogen, nitrate-nitrogen, total Kjeldahl-nitrogen, ammonia-nitrogen, but budget constraints might limit the number of parameters tested.

Task 1.2: Monitor changes in reservoir light penetration.

Approach: At weekly intervals, a standard 20 cm (7.9 in) Secchi disk will be lowered into the water on the shaded side of the boat until it just disappears from sight. This depth is recorded to the nearest 0.1 meter. The disk is then lowered an additional meter and raised until it reappears. These two values are then recorded separately. The depth of disappearance and reappearance of the disk is averaged, and the depth is measured to the nearest 0.1 meter.

Task 1.3: Monitor changes in physical and chemical characteristics of reservoir water.

Approach: Temperature and dissolved oxygen profiles will be measured at 1 m increments weekly at the deepest point in the lake using a YSI temperature/dissolved oxygen meter. Total alkalinity and specific conductance of water samples collected monthly from depths corresponding to the epilimnion, metalimnion, and hypolimnion will be measured using electronic meters. Seasonal and spatial variability in pH requires more careful monitoring; measurements from water collected every other week from depths corresponding to the epilimnion, metalimnion, and hypolimnion should adequately track changes.

Task 1.4: Monitor changes in zooplankton community composition and density.

Approach: Zooplankton will be sampled bi-weekly at a deep water station by making replicate vertical tows at twice the Secchi depth or the entire water column above the thermocline (whichever is greater) at a rate of 0.5 m/s with a Wisconsin-type plankton net with 153 μm mesh and a 0.12 m diameter opening. In areas shallower than the above depth, tows will be started from just above the bottom. Zooplankton will be preserved with 70% ethanol and stained with rose Bengal. A one milliliter aliquot of each well-mixed sample will be used for analysis where zooplankters will be identified to the lowest practical taxonomic level, counted, and a subsample of the dominant taxa measured. To provide a statistically valid count at least 100 organisms will be counted from each sample. Size frequency distributions for cladocerans will be determined by measuring from the anterior margin of the head to the base of the tail spine. Copepods will be measured from the anterior margin of the head to the base of the caudal rami.

Task 1.5: Monitor changes in reservoir chlorophyll concentration.

Approach: Water samples for chlorophyll analysis will be collected at two week intervals (Table 2) at a deep water station. Replicate integrated water samples for chlorophyll analysis will be collected using a 15-m long, 2.54-cm diameter acrylic

tube suspended vertically in the water column, buffered with MgCO3, filtered through 0.45µm filter paper, and stored in the freezer until processed. Spectrophotometric determination of concentrations of chlorophyll-*a*, *b*, and *c*, as well as pheophytin-*a*, will be performed using standard methods for acetone extraction on two distinct sub-samples from each composite sample (APHA 1976).

Task 1.6: Monitor changes in reservoir phytoplankton composition and density.

Approach: Phytoplankton will be collected at a deep water station three times during the growing season using the same integrated hose sampler methodology used to collect samples for chlorophyll-a. One composite sample, consisting of three combined replicate water samples, will be collected for each sample site/time. All samples will be preserved with Lugol's iodine and held in the dark on ice until delivery to the laboratory where they will be concentrated by allowing to settle at least 24 hours and siphoning off most of the water. Enumeration will be accomplished in a Sedgwick-Rafter counting cell using a one milliliter aliquot taken from the well mixed concentrate. Phytoplankters will be reported by taxonomic group. The groups include:

- Chrysophyta
  - Diatoms
    - centric
    - pennate
- Chlorophyta
  - Green algae
    - coccoids
    - filamentous
- Cyanophyta
  - Blue-green algae
    - colonial
    - filamentous
- Others

Only algae that are alive at the time of preservation, based on cell contents, will be enumerated. Algae will be identified to the lowest practical taxonomic level and enumerated in sequentially viewed fields along transects of the counting chamber. Counting will continue until at least 100 units are counted and until no new taxa are observed. A unit is defined as a discrete algal particle (cell, filament or colony); when filamentous fragments are encountered they will be counted as whole organisms.

Task 1.7: Monitor changes in reservoir benthic macroinverebrate community composition and density.

Approach: The benthic macroinvertebrate fauna in Phillips Reservoir will be collected with duplicate Ekman dredge samples at 5 m depth intervals to 20 m at

the deepest part of the lake with no compositing of individual samples. Bottom materials will be washed through a U.S. Standard No. 30 sieve (pore size 0.59 mm), preserved in 70% ethanol and returned to the laboratory. Samples will be placed in a saturated salt solution to float organisms free from the sediment and debris. The organisms will be transferred back into 70% ethanol containing rose bengal, a stain selective for tissues. Macroinvertebrates will be counted and identified to the lowest taxonomic level practical.

APPENDIX A: Fishery management goals and objectives as outlined in the Phillips Reservoir Fisheries Management Plan.

Fishery Management Goal: Restore the recreational trout fishery to characteristics (catch rates, size of fish, etc.) approaching those experienced in the 1970's and 1980's. Provide opportunities for other species as described in species specific goals and objectives when they can be achieved without significantly impacting attainment of trout fishery goals and objectives.

Overall Management Objective: Average annual angler use of 38,000 angler-days

Trout Management Goal**:** Manage for a productive trout fishery that provides both stock and trophy-sized fish.

Objective: Catch Rate 0.50 fish/hour

Objective: Size distribution of catch representative of the fishery prior to perch introduction.

Warmwater Species Management Goal**:** Manage to provide fishery for trophy-sized bass. No management emphasis on black crappie.

Objective: Bass abundance and size optimized to achieve trophy size to the extent that they do not negatively impact stocked rainbow trout and the effective introduction of tiger muskie.

Perch Management Goal: Provide harvest opportunity as long as objectives of the trout fishery can be met.

Objective: Catch rate 1 fish/hr

Objective: Average length of catch is 10 inches.

APPENDIX B. Schedule for fisheries sampling at Phillips Reservoir. "XX" denotes that activity should be carried out in order to evaluate program, "CC" indicates that activity is not critical but would be beneficial to evaluation of program if carried out.

Task Activity	Year	Is activity planned?	Apr	May	Jun	Jul	Aug	Sep	Oct
1.1 Creel survey	2013	XX	XX	XX		XX	X	XX	X
	2014								
	2015	XX	XX	X	X	XX	X	XX	X
	2016	CC	CC	C	C	CC	C	CC	C
	2017	XX	XX	X	X	XX	X	XX	X
1.2 Angler opinion survey	2013	XX	XX	X	X	XX	X	XX	X
	2014								
	2015	CC	CC	C	C	CC	C	CC	C
	2016								
	2017	XX	XX	X	X	XX	X	XX	X
2.1 Survival of subcatchable trout	2013	XX	XX	XX					
	2014	XX	XX	XX					
	2015	XX	XX	XX					
	2016	XX	XX	XX					
	2017	XX	XX	XX					
2.2 Growth of subcatchable trout	2013	XX	XX	XX					
	2014	XX	XX	XX					
	2015	XX	XX	XX					
	2016	XX	XX	XX					
	2017	XX	XX	XX					
2.3 Growth of catchable RBT	2013	XX	XX	XX					
	2014	XX	XX	XX					
	2015	XX	XX	XX					
	2016	XX	XX	XX					
	2017	XX	XX	XX					
2.4 Growth and survival of tiger trout	2013	CC	CC	CC					
	2014	CC	CC	CC					
	2015	CC	CC	CC					
	2016	CC	CC	CC					
	2017	CC	CC	CC					
3.1 Perch density	2013[a]	XX	XX						
	2014[b]	CC	CC						
	2015[b]	CC	CC						
	2016[b]	XX	XX						
	2017[c]	XX	XX						
3.2 Perch growth	2013	CC	CC						
	2014								
	2015								
	2016								
	2017	CC	CC						
3.3 Perch % of community biomass	2013	XX	X	X					
	2014	XX	X	X					
	2015	XX	X	X					
	2016	XX	X	X					
	2017	XX	X	X					

APPENDIX B. (continued)

4.1	**Tiger muskie diet**	**2013**								
		2014	**CC**	**CC C**	**C C**	**C**	**CC C**	**C**	**CC C**	**C**
		2015	**CC**	**CC C**	**C C**	**C**	**CC C**	**C**	**CC C**	**C**
		2016	**CC**	**CC C**	**C C**	**C**	**CC C**	**C**	**CC C**	**C**
		2017	**CC**	**CC C**	**C C**	**C**	**CC C**	**C**	**CC C**	**C**
5.1	**Tiger trout emigration**[d]	**2013**								
		2014								
		2015								
		2016								
		2017								

[a] population estimate using full Merwin trapping effort

[b] Population estimate or density estimate using modified trapping effort and/or electrofishing.

[c] Ideally perch density estimate would be generated using full Merwin trapping effort.

[d] Surveys in Powder River will be performed annually if and when a population of tiger trout becomes established in the reservoir.

APPENDIX C. Schedule for limnological sampling for Phillips Reservoir. Nutrients to be sampled include total phosphorus, soluble reactive phosphorus, orthophosphate, nitrate-nitrogen, total Kjeldahl-nitrogen, ammonia-nitrogen.

Task	Parameter measured	Frequency[a]	Location[b]	May	Jun	Jul	Aug	Sep	Oct
1.1	Nutrient concentration	Monthly	Epilimnion composite	XX	XX	XX	XX	XX	XX
	Before strat	strat	5-m interval	XX		XX		XX	
	Strat			late		late		late	
	After strat								
1.2	Secchi	Weekly		XX	XX	XX	XX	XX	XX
1.3	pH	Bi-weekly	Zonal	XX	XX	XX	XX	XX	XX
1.3	Total alkalinity, specific conductance	Monthly	Zonal	XX	XX	XX	XX	XX	XX
1.3	D.O. and Temperature	Weekly	Surface to depth, 1 m intervals	XX	XX	XX	XX	XX	XX
1.4	Zooplankton	Bi-weekly	Epi&mesolimnion[c]	XX	XX	XX	XX	XX	XX
1.5	Chlorophyll	Bi-weekly	Epilimnion composite	XX	XX	XX	XX	XX	XX
1.6	Phytoplankton	Mid-month	Epilimnion composite	XX		XX		XX	
1.7	Benthic inverts	Mid-month	5m, 10m, 15m, 20m	XX		XX		XX	

[a] Bi-weekly means every other week. Strat refers to three sampling occasions: prior to spring stratification (late May), late in the summer stratification (late July), and after the autumn overturn (late September).

[b] Zonal denotes 3 samples: epilimnion, metalimnion, and hypolimnion.

[c] Sample at twice the secchi depth or the entire water column above the thermocline, whichever is deeper.

Fishery Management Goals and Objectives

Management actions need to be driven by a vision for what the fishery at Phillips Reservoir is desired to look like in the future. Goals and objectives have been developed for this purpose. The goals and objectives listed below were developed based on the intent of achieving the outcome anglers would like to see as communicated in the 2008 angler survey (ODFW 2009).

Fishery Management Goal: Restore the recreational trout fishery to characteristics (catch rates, size of fish, etc.) approaching those experienced in the 1970's and 1980's. Provide opportunities for other species as described in species specific goals and objectives when they can be achieved without significantly impacting attainment of trout fishery goals and objectives.

Overall Management Objective: Average annual angler use of 38,000 angler-days

Trout Management Goal**:** Manage for a productive trout fishery that provides both stock and trophy-sized fish.

> Objective: Catch Rate 0.50 fish/hour
> Objective: Size distribution of catch representative of the fishery prior to perch introduction (Figure 5).

Warmwater Species Management Goal**:** Manage to provide fishery for trophy-sized bass. No management emphasis on black crappie.

> Objective: Bass abundance and size optimized to achieve trophy size to the extent that they do not negatively impact stocked rainbow trout and the effective introduction of tiger muskie.

Perch Management Goal: Provide harvest opportunity as long as objectives of the trout fishery can be met.

> Objective: Catch rate 1 fish/hr
> Objective: Average length of catch is 10 inches.

Timothy Bailey

From: H. Christiansen Co <hchris5509@aol.com>
Sent: Thursday, June 26, 2014 8:27 AM
To: timothy.d.bailey@state.or.us
Cc: bruce@hchrisnets.com
Subject: Re: Merwin Trap Net Quote

Tim,

We can make this Merwin Trap as you have it specified for $3,600.00.

Shipping, via FedEx freight to LaGrande will add $280.00.

We can ship 5-6 weeks after receiving your order.

Please note new e-mail address.

Sincerely,

Bruce Sederberg
President
H. Christiansen Co.
4976 Arnold Rd.
Duluth, MN 55803
218.724.5509
800.372.1142
218.724.5609 fax
bruce@hchrisnets.com
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-----Original Message-----
From: Timothy Bailey <timothy.d.bailey@state.or.us>
To: HChris5509 <HChris5509@aol.com>
Sent: Wed, Jun 25, 2014 1:03 pm
Subject: Merwin Trap Net Quote

Bruce,

I purchased a couple of Merwin trap nets from you back in 2011. I am in need of another and would like to get a quote for an 8 foot deep trap per the attached specs. The traps I purchased in 2011 were 12 and 16 feet deep.

Tim Bailey
Oregon Department of Fish & Wildlife
107 20th Street
La Grande, OR 97850
541-962-1829

Applicant Signature Page
Fish Restoration and Enhancement Program
(Oregon Department of Fish and Wildlife Applicants)

I hereby make an application for financial assistance under the terms and conditions of the Fish Restoration and Enhancement Program as described in my project application. I acknowledge that:

- This proposal is an identified priority at the X district, X region, and/or X state level and has been identified as such in the application (**check box** for appropriate level).
- This proposal is consistent with any applicable goals, policies, rules, species or basin management plans adopted by the F&W Commission and this has been explained in the application.
- This proposal will not be used to cover, back fill, or fund shift elements that have been cut or defunded as part of agency budget reductions. Approved deferred maintenance or projects with division approval are exceptions.

I understand that if my project proposal is approved for Restoration and Enhancement (R&E) Program funding, the following will apply:

- Applicants must sign an agreement containing the terms and conditions for the project implementation, release of funds, and documentation of completion. Non-compliance may impact future funding opportunities.
- The R&E Program will not pay for expenses which occur before the approved start date or after the end date.
- Funding is available one biennium only without prior authorization by the R&E Board.
- Applicant agrees to notify the R&E Program of all funds not needed for the project upon determination.
- Any inappropriate expenses using R&E funds will be corrected by the applicant immediately. By the close of the biennium any expenses exceeding, or not identified in, the grant approval will be reverted to a local cost code.
- Copies of all landowner, monitoring and maintenance agreements must be submitted to the R&E Program.
- Educational products resulting from projects are public domain.
- Information collected is subject to Oregon Public Records Law.
- As applicable, the project will be consistent with all federal, state, and local regulations, including the State Land Use Planning Goals & Local Land Use Plans, prior to any on the ground work.

By signing this application, I certify to the best of my knowledge that the information contained in the application are true, complete and accurate. If awarded funding the applicant agrees to follow all terms and conditions outlined in the agreement.

Project Title: Phillips Reservoir Fishery Monitoring Equipment

Applicant Name: Tim Bailey Title: _____

Applicant Signature: [redacted] Date: 6-25-14

Manager Certification
To be completed by Watershed Manger, Hatchery Coordinator, Program Manager, or higher level manager.

- I concur with the statements above and the applicant has permission to request these funds.

Manger Name: Nick Myatt Title: Watershed District Manager

Manager Signature: [redacted] Date: 7/1/14