



R & E Grant Application 21-23 Biennium

Project #: 21-003
Amendment #: 1

Diamond Lake Monitoring/Invasive Species Removal

Project Information

Requested Cycle: 21-1
R&E Project Request: \$81,946
Other Funding: \$44,790
Total Project: \$126,736
Spending Start Date: 7/1/2021
Spending End Date: 6/1/2023
Project Start Date: 7/1/2021
Project End Date: 6/1/2023
Organization: ODFW - Umpqua Watershed District Office

Technical Contact

Name: Francis Drake
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Applicant Information

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Past Recommended or Completed Projects

This applicant has no previous projects that match criteria.

Authorized Agent

Name: Francis Drake
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Roseburg, OR 97470-9413
Telephone: 541-464-2157

Email: francis.w.drake@odfw.oregon.gov

Location Information

Where is it?

The project will occur on public land owned or managed by another party

Landowner Information

Name: Umpqua National Forest
Affiliation: United States Forest Service, Department of Agriculture
Address: 2020 Toketee Ranger Station Rd
Idleyld, OR, 97447
Phone: 541-498-2531

Site Description

Street Address, nearest intersection, or other descriptive location.

Nearest major intersection: OR Highway 138 and NF-4795.

Diamond Lake Resort: 350 Resort Dr.

Diamond Lake, OR 97731

The resort is the main epicenter of activity on Diamond Lake. 1.4 miles South of the resort on NF-4795 (Diamond Lake Loop), is a USFS Visitor Information Center. The ODFW cabin and the weir are located 2.2 miles from the resort and marina on the North end of the lake.

Directions to the site from the nearest highway junction.

From Highway 138, exit and follow the signs for the Diamond Lake Resort. Continue for 0.9 miles to the entrance of the resort.

Following project completion, public anglers will be allowed the following level of access to the project site:

Full access

Please describe what leases, easements, agreements are in place to ensure angler access to the project site, and what is the length of each agreement.

N/A; US Forest Service public land and boat ramps allow angler access at multiple points.

Dominant Land Use Type:

Forest

Project Location

General Project Location.

County: DOUGLAS
ODFW Dist: Umpqua
Stream/Lake/Estuary Name: Diamond Lake
Sub-basin: 17100301
Tributary of: North Umpqua River

Specific Project Location.

Latitude

Longitude

Project Summary

Project Summary

Please provide a couple sentence summary of the proposal.

Tui chub presence was confirmed in Diamond Lake in 2015. As per the Diamond Lake Restoration Project FEIS (2004), Diamond Lake Management Plan (2009), and Diamond Lake OAR 635-500-0703, action continues to be taken by ODFW to manually remove tui chub and golden shiner, and stock piscivorous trout.

Overall Project Goals

Describe the primary goals or outcomes of the entire project, including elements not requesting funding from R&E.

Per the Diamond Lake Management Plan, FEIS and OAR 635-500-0703, maintain a premier, "blue-ribbon" trout fishery and promote healthy lake ecology which contributes to quality trout habitat.

Inhibit tui chub population growth in Diamond Lake by removing as many of the invasive cyprinids as possible via mechanical removal methods and stocking of piscivorous trout.

Evaluate the impact of mechanical removal and piscivorous trout on the tui chub population.

Continue to maintain a positive working relationship with the Diamond Lake Working Group and other partners. In addition, improve public outreach on invasive species awareness.

Primary objectives of R&E funding

Please describe the measurable objectives for the R&E portion of the funding request.

Hire two employees (seasonal BSAs) to be housed at Diamond Lake for at least three months(2021 and 2022)and purchase necessary equipment for the most efficient monitoring and removal of invasive cyprinids at Diamond Lake.

Maximize net set efforts on a daily/weekly basis to remove as many invasive cyprinids as possible. Propose trap net sets 100-150 per season and cast/seine net samples as time and conditions allow.

Collect a statistically valid number of tiger and triploid brown trout diet samples as determined by ODFW biometrician for diet evaluation and comparisons. Use results to inform future stocking numbers and species.

Run the Diamond Lake weir panel trap on a daily basis to monitor possible out-migration of tiger and triploid brown trout.

Conduct 2-3 creel surveys per month selected by the statistical creel protocol to evaluate rainbow trout fishery metrics.

Monitor trends in tui chub catch per unit effort to track changes in relative abundance and provide information to adjust techniques and locations of sampling.

Current Situation/Justification

Please describe the current situation and explain why this funding is needed.

On two separate occasions tui chub have completely decimated the ecosystem of Diamond

Lake, causing poor water quality, lack of a fishery, and closures due to toxic algae blooms. Successful efforts funded by R&E to curtail possible tui chub proliferation and therefore protect the health of the trout fishery, water quality, and dependent economy have been undertaken since the rediscovery of tui chub in October 2015. See attached 2018-2020 Project Update and Diamond Lake Economic Reports.

The continuation of this project has been deemed critical at both District and Statewide levels to help prevent the proliferation of tui chub as well as to meet requirements of the Diamond Lake Restoration Project FEIS (2004), Diamond Lake Management Plan (2009), and Diamond Lake OAR 635-500-0703. Additionally, in the internal 2018 ODFW Reservoir Dogs statewide project prioritization process this project ranked high in both the "Illegal Introduction" (#2 of 12 projects) and "RM&E" (#2 of 37 projects; #1 in the "Science" sub-category) groups. As such, this project was chosen by both groups to be recommended for R&E funding and was presented to the R&E Board in September with ODFW's endorsement as a statewide priority project. See attached Reservoir Dogs ranking documents.

Recreation and Commercial Benefit

This project will provide benefits to:

Recreational fisheries

Explain how this project will contribute to current (and/or potential) fishing opportunities, access, or fisheries management.

Diamond Lake is one of the premiere fishing destinations in Oregon. It attracted over 50,000 anglers and generated over \$2 million in local revenue in 2009 (see attached Diamond Lake Economic Report). History of tui chub at Diamond Lake indicates that these invasive minnows can proliferate to population levels that adversely affect both the health of the lake and the renowned trout fishery. Tui chub population expansion in Diamond Lake has previously led to complete ecosystem collapse which was devastating to both recreational fishing opportunities and the nearby economy. Addressing the possible tui chub issue before the population reaches levels seen in previous years should help to ensure that the premiere rainbow trout fishery remains productive and water quality continues to be good enough for other recreational activities on the lake.

Percent benefit split between Commercial and Recreational anglers:

0 % Commercial

100 % Recreational

Please explain, or justify, how the percentage split was determined:

No commercial fishing opportunities are available at Diamond Lake. It is stocked specifically for recreational sport anglers. Funding will be used to ensure the premiere Diamond Lake recreational rainbow trout fishery remains productive and to provide additional catch-and-release tiger and brown trout fisheries.

This project has been identified as an ODFW priority for:

Local/watershed

Basin/regional

Statewide

Does this project directly support implementation of the ODFW Strategic Plan and/or current Fish Division priorities?

Yes

Diamond Lake Restoration Project FEIS (2004); see "Additional Materials"

Diamond Lake Management Plan (2009); see "Additional Materials"
Diamond Lake OAR 635-500-0703; see "Additional Materials"

Please briefly explain when this was identified as a priority and what process or workgroup was used to identified this as an ODFW priority.

The Diamond Lake FEIS (2004 USFS, ODFW, ODEQ) and Diamond Lake Management Plan (2009 ODFW) identified tui chub as a primary factor influencing the decline of the lake's water quality, ecosystem, and subsequently the trout fishery. ODFW Reservoir Dogs also identified as priority in 2018.

Identify any plan or other document that identifies this priority.

Diamond Lake Restoration Project FEIS (2004): The large tui chub population has affected lake conditions such that toxic algae blooms have occurred during the summers of 2001-2003...triggering lake closures.

Diamond Lake Management Plan (2009): The first year post-treatment (2007), Diamond Lake attracted 72,085 angler trips and generated an estimated \$3.76 million dollars in sales and \$2.57 million in labor

Diamond Lake OAR 635-500-0703: Conduct ecologically based fishery monitoring and evaluations necessary to maintain ecology based fishery objectives and healthy lake ecology; and ...control illegally introduced fish species.

Diamond Lake Economic Report (2011): From 1994-2006 angler numbers dropped from 70,500 to 6,000. This resulted in a loss of \$4.9 million in annual sales and \$1.4 million in labor.

ODFW Reservoir Dogs RME-Group ranked 1st for Monitoring category.

Is this project part of an approved Salmon-Trout Enhancement Program (STEP) activity?
No

This project is intended to benefit the following species:

Other Species
Rainbow Trout, Tiger Trout, Triploid Brown Trout

This project will benefit anglers or fishery by providing:

Angling Opportunity
Monitoring/Research

Angling Opportunity

This project will:

Improve the opportunity for anglers to catch fish (better stocked fish, trapping)
Provide new opportunity for anglers to catch fish (new pond, more fish to stock more areas, new species)
Restore a degraded fishery

Monitoring/Research

This project will be used to evaluate:

Population composition (i.e age, species, survival, size, or genetics)
Angler satisfaction/harvest (Creel)
Distribution (i.e. presence, absence, abundance)

Has this project been reviewed or developed by an individual with appropriate qualifications (i.e

ODFW biometrician, research professor)?

Yes

District Fish Biologist Greg Huchko and former Assistant District Fish Biologist Jason Brandt developed the initial project plans that have been utilized since 2016. Since then the project has been discussed with ODFW Fish Division staff, the Umpqua Watershed Manager, ODFW biometrician, Diamond Lake Working Group (Douglas County, USFS, and USFWS), and local conservation groups (Audubon Society, Steamboaters). Ongoing project components and further details related to the design of the proposed diet analysis aspect of this project were discussed and reviewed during the 2017 Reservoir Dogs statewide project evaluation process. This project ranked #2 of 37 projects in the "Research, Monitoring, and Evaluation" category and #2 of 12 projects in the "Illegal Introductions" group as determined by fellow ODFW staff throughout the state.

The ODFW biometrician in conjunction with Umpqua Fish District staff developed the creel design and protocol, and we will continue working with the biometrician as we refine the diet analysis component of the project.

Is this study critical to fishery management decisions?

Yes

Building upon the efforts that have taken place since 2016, which have shown positive results in terms of cyprinid removal and tui chub population growth reduction, we plan to continue evaluating the effectiveness of early targeted removal efforts in conjunction with the stocking of piscivorous trout species in limiting tui chub population expansion in Diamond Lake. Based on continued observations of tiger trout preying on invasive cyprinids in Diamond Lake, we plan to continue working closely with the ODFW biometrician and Oregon State genetic research personnel this winter to develop a more statistically rigorous diet comparison between tiger and brown trout which will help inform the Umpqua District if either of the species is more likely to prey on invasive cyprinids in Diamond Lake and in turn which species we should focus on stocking. We will also continue to evaluate how possible tui chub proliferation impacts the important rainbow trout fishery. By monitoring tui chub population dynamics and trying to remove as many tui chub as possible, ODFW will work to ensure there is a viable trout fishery and suitable water quality in the future.

Yes

Site-specific catch rates of introduced species help to inform trapping location, gear type, and duration in order to maximize efficiency. Tiger and brown trout gut content samples can help to inform annual stocking needs/rates necessary for invasive species control.

Is there a plan to repeat this monitoring or research in the future?

Yes

The Umpqua District will continue to work with Fish Division to determine long-term funding strategies. Efforts are likely to continue as long as tui chub are present in Diamond Lake. However, results from this project will inform the most efficient and effective future management actions.

Will the data be reported or published?

Yes

A report outlining results from the project will be made available to the public yearly or bi-yearly depending on information availability and completeness, and continued monitoring will hopefully result in a scientific manuscript comparing tiger and triploid brown trout diets.

Project Description

Schedule

Activity	Date	RE Funding
Set 3-6 trap nets 3-4 days per week	July-September, 2021; June-September 2022	Yes
Monitor panel trap at outlet weir daily	July-September, 2021; June-September 2022	Yes
Statistical creel survey 2-3 per month	July-September, 2021; June-September 2022	Yes
Shoreline oriented seine and cast net sampling as conditions and time allow	July-September, 2021; June-September 2022	Yes
Tiger and brown trout diet analysis as fish are collected	July-September, 2021; June-September 2022	Yes
Data entry and analysis weekly/monthly and summary report yearly/bi-yearly.	July-September, 2021; June-September 2022	Yes

Permits

Permit	Secured?	Date Expected
ODFW Scientific Take Permit	Yes	In-hand

Project Design and Description

Please describe in detail the methods or approach that will be used to achieve the project objectives.

In order to meet our objective of hiring two employees (seasonal BSAs) to be housed at Diamond Lake for at least three months (per year) and purchase necessary equipment for the most efficient monitoring and removal of invasive cyprinids at Diamond Lake we plan to: (1) Acquire appropriate levels of funding through this grant, work with ODFW HR staff to work through the hiring process, interview candidates and ultimately hire two seasonals by May 15th. (2) Prepare the ODFW cabin at Diamond Lake for residence prior to the start of the field season or arrange other accommodations if the cabin is not suitable. Preparations include fixing over-winter damage, maintaining running water and heat, and pest management. (3) Through experience gained from the 2016 through 2020 removal efforts, evaluation of literature, and discussions and recommendations from other ODFW staff we will determine what equipment is most appropriate to purchase. We will make these purchases via state Visa "SPOTS" cards or through a purchase order.

In order to meet our objective of maximizing net sets on a daily/weekly basis to remove as many invasive cyprinids as possible, we plan to: (1) Complete 150-200 trap net sets per season. Trap nets are comprised of 1/4" mesh netting, (1) 4'x5' framed "traps", (1) 4'x50' leads, and (2) 4'x 25' wings. Work done from 2016-2020 indicates that trap-netting is an efficient sampling method for the collection of cyprinids. Up to six trap nets at a time will be fished for 24-hour periods on average. (2) Cast/seine netting as many times as conditions and schedules allow. (3) All cyprinids will be enumerated and removed from the lake and tui chub will be examined further for size, sex, and ripeness. If juvenile cyprinids cannot be identified to species, a sub-sample will be preserved for future identification analyses.

In order to meet our objective of collecting a statistically valid number of tiger and triploid brown

trout for diet evaluation and comparisons, we plan to: (1) Continue consultation with the ODFW biometrician to finalize an appropriate sampling strategy. (2) Opportunistically collect samples from piscivorous trout stomachs via gastric lavage during trap-netting efforts, beach seining, cast-netting, weir trapping, and from permitted angler efforts. If possible, fish prey items will be identified to species. Results will be used to inform future stocking numbers and species.

In order to meet our objective of running the Diamond Lake weir panel trap on a daily basis to monitor possible out-migration of tiger and triploid brown trout we plan to: (1) Check the trap once in the morning and once the evening daily. (2) Clean the screening/paneling and trap to maintain adequate flow which will be done as needed (likely multiple times a day). (3) Record all pertinent data relative to fish presence in the trap. Any trout that are collected in the trap will be relocated away from the lake outlet.

In order to meet our objective of conducting 2-3 creel surveys per month we plan to: (1) Consult the creel protocol that has already been developed by our ODFW biometrician and subsequently select days, times, and locations of creel as the protocol suggests. Surveys will be conducted at a single, randomly chosen boat ramp per sampling event and will collect information such as number of anglers, number of hours fished, number of fish kept/released, two-rod validation, and size of trout harvested.

In order to meet our objective of monitoring trends in tui chub catch per unit effort to track changes in relative abundance and provide information to adjust techniques and locations of sampling we plan to: (1) Continue discussions between District staff and the ODFW biometrician to statistically test changes in catch per unit effort over time. (2) Continue discussions with the ODFW biometrician to further refine all of our sampling efforts.

In addition to the objectives detailed above that are specific to this R&E proposal we also plan the following actions through use of Umpqua Fisheries Enhancement Derby funds, ODFW Propagation resources, and California Fish and Wildlife resources: (1) In 2021/2022 we plan to continue acquiring and stocking approximately 15,000 3" tiger trout. (2) In 2021/2022 we plan to continue acquiring and stocking approximately 15,000 3" triploid brown trout. (3) Beyond 2022 we plan to continue the stocking of 15,000 3" tiger trout and 15,000 3" triploid brown trout annually as funding allows and our analysis of tiger and brown trout diets informs. We have worked with Fish Division, including Propagation staff, Klamath Hatchery, and other ODFW staff to make these stocking decisions. For more comprehensive information regarding this objective, please see attached documents and studies that were reviewed extensively and used to help guide us prior to making the decision to use tiger and triploid brown trout for cyprinid control.

See also attached 2018-2020 Project Update and 2018 R&E Review Team Questions and Answers documents for further information.

Engineering

Does the project involve capital improvement, engineering, site grading or other construction?

No

Project Management and Maintenance

What is the life expectancy of R&E funded construction, structures, equipment, supplies, data or fishery?

This project will continue as long as tui chub are present. Data will always remain valid.

Equipment will continue to be used for fish removal and monitoring at Diamond Lake and others around the Umpqua District as long as equipment is in working condition.

Who is responsible for long term management, maintenance, and oversight of the project beyond what is funded by R&E.

Umpqua District ODFW staff will oversee the project indefinitely. Equipment maintenance will also be undertaken by the Umpqua District for the life of the equipment. We have asked for \$2000 in this grant for cabin maintenance that may be needed over the next couple of years. Since the initiation of this project, we have had to address multiple cabin maintenance needs (e.g. new roof, plumbing and electrical fixes), but even though it is likely that additional maintenance will be needed, use of the cabin will still be much more economical than paying for alternative housing at Diamond Lake.

Will the project require ongoing maintenance?

Unknown

Is there a plan to collect baseline data and to conduct monitoring efforts to measure the effectiveness of the project?

Yes

Results from the 2018 through 2020 monitoring and removal efforts will be used as baseline data for this project (see attached 2018-2020 Project Update). Information and data collected in 2021/22 will be analyzed in an effort to determine the effectiveness of the following components of the project:

1. CPUE (fish/net) comparisons of tui chub and golden shiner removal efforts to track relative abundance and population trends as well as removal effectiveness.
2. Diet analysis of tiger and brown trout to determine the effectiveness of our stocking strategies of these two species as it relates to the predation upon, and reduction of, invasive cyprinids. These effectiveness monitoring efforts will help us formulate future stocking strategies of piscivorous trout. With the recent discovery of tiger trout predation on cyprinids at Diamond Lake, we are working to finalize a sampling strategy and statistically rigorous diet composition comparison between tiger and brown trout which will also inform the Umpqua District on the feasibility of continuing to stock piscivorous trout.
3. Creel analysis will continue in an effort to monitor the productivity of the fishery. This information will be analyzed and compared to the invasive species abundance data in order to determine the effectiveness of the project, i.e. if removal efforts are positively impacting the fishery.

Project Funding

Funding

Have you applied for OWEB funding for this project?

No

Has this proposal, or similar proposal for this project location, previously been denied by OWEB or other funding source?

No

Other Funding Source	Type	Secured	Dollar Value	Comments
Umpqua Fish District / HQ staff-ODFW	In-Kind	Secured	28032	This funding is for District staff, equipment/gas and the ODFW biometrician's estimated time on the project.
Propagation-ODFW/California Fish and Wildlife	In-Kind	Secured	4200	Donation of 30K triploid brown trout eggs and rearing of brown and tiger trout
Umpqua Fisheries Enhancement Derby	Cash	Secured	12558	This funding is for the purchase of any additional tiger and brown trout beyond what may be available through other identified sources. These funds could also be used towards equipment.
		Total	44790	

Budget

Item	Unit Number	Unit Cost	In-kind or non-cash contributions	Funding from other sources	R&E Funds	Total Costs
PROJECT MANAGEMENT						
Umpqua District Fish Biologist (Hours+OPE)	80	52.11	4169	0	0	4169
		SUBTOTAL	4169	0	0	4169
IN-HOUSE PERSONNEL						
2 BSA's for 2 seasons + OPE (80%)	2240	31.23	0	0	69956	69956
Umpqua District Staff, Hours+OPE (Tech)	240	37.30	8952	0	0	8952
Umpqua District Staff, Hours+OPE (NRS-2)	180	47.85	8613	0	0	8613
Umpqua District Fish Biologist, Hours+OPE (NRS-3)	40	52.11	2084	0	0	2084
ODFW Biometrician (estimated hours)	20	42.54	851	0	0	851
ODFW Watershed Manager, Hours+OPE	20	69.17	1383	0	0	1383
		SUBTOTAL	21883	0	69956	91839
CONTRACTED SERVICES						
Tiger trout fingerlings (2021-22)	60000	0.07	4200	0	0	4200
Triploid brown trout eggs	30000	0.07	0	0	0	0
Supplemental tiger/brown trout eggs if needed	91000	0.07	0	6158	0	6158
		SUBTOTAL	4200	6158	0	10358
TRAVEL						
ODFW cabin maintenance	1	2000.00	0	0	2000	2000
		SUBTOTAL	0	0	2000	2000
SUPPLIES/MATERIALS						
Vehicle mileage and gas	3000	0.50	1500	0	0	1500
Boat gas (gallons)	120	4.00	480	0	0	480
Boat Maintenance	1	9990.00	0	0	9990	9990
		SUBTOTAL	1980	0	9990	11970
EDUCATION/OUTREACH						
			0	0	0	0
		SUBTOTAL	0	0	0	0
EQUIPMENT						
Trap-nets	2	0.00	0	4000	0	4000
Miscellaneous (formalin, jars, gastrolavage equipment)	1	0.00	0	400	0	400
Diet analysis	0	0.00	0	2000	0	2000
		SUBTOTAL	0	6400	0	6400
FISCAL ADMINISTRATION						
			0	0	0	0
		SUBTOTAL	0	0	0	0
		BUDGET TOTAL	32232	12558	81946	126736

Internal Review Results

Review Score: 1.8 out of 3

(0 = Do Not Fund, 1 = Strengthen Proposal, 2 = Recommend, 3 = Strongly Recommend)

Summary of Review Team Comments

The review team is supportive of this project for this biennium, but support for future R&E funding is diminishing. The team understands the value of Diamond Lake but it is time for the District to work with ODFW leadership to identify alternate long-term funding and plan for this. R&E is not intended to fund this long term and those funds could be used to improve other fisheries. A long-term sustainable approach or change in management needs to be developed based on findings from the past few years of monitoring. Scores included one 3, five 2s, and four 1s.

Specific Review Team Comments

Why is R&E being asked for money to do maintenance at the cabin? This seems like this is part of normal operations and should be done with district funds. Make sure engineering is included when appropriate.

While this is an important fishery, other fisheries are being neglected as so much focus is placed on this one waterbody.

A long-term plan should include consideration of a different approach to the management of the lake to reduce annual operating costs. For example, using trophy trout as a put and take option in the lake coupled with a modest sub legal release. This could create a destination fishery by releasing larger fish (Cranebows) that could help control the tui chub by utilizing them a prey base and reduce the need for continued dependence on significant removal.

Specific Review Team Questions

Diamond lake is an important fishery for the State of Oregon and is a priority for ODFW, legislature, anglers, and the public. That being said, continued management needs dedicated long-term funding from a non-R&E source. Applicant needs to work with management to pursue a long-term funding solution including requesting funding from the legislature through a POP. Please explain what the plan is for long-term funding and how R&E would fit into that without being the sole source of funding. What steps have been taken to find other funding sources? What sort of contribution has the resort provided given the benefit they receive from this management? What is the plan to have these other funds in place before asking R&E for any funding in 23-25?

There has been continued support of this project from Fish Division, including support to pursue R&E funding. Fish Division agrees that the future of the Diamond Lake fishery and ecology which is a high priority and that our objectives, techniques, and methodologies are appropriate.

We plan to pursue a Policy Option Package (POP) in the 23-25 biennium for long-term funding of the project and will work closely with Fish Division and Region management on that process. At this time, we do not have sufficient district funds for the project nor have we been encouraged by Fish Division to pursue a POP for this project.

R&E is not the sole funding source. The proposed budget in this application includes \$32,232 in-kind/non cash contributions and \$12,558 in other funding sources, 35% of the total proposed budget. Other funding sources we have secured outside of ODFW staff time include the Umpqua Fisheries Enhancement Derby and California Dept. of Fish and Wildlife, We have

pursued grant funding through the USFS but these have been unsuccessful.

The resort is not a fishery management agency, however they do provide some services to ODFW. They routinely remove and install the dock at the ODFW cabin, where the work boat is parked. They have also assisted with some minor plumbing repairs in the past.

We will continue to seek additional outside funding sources prior to the 23-25 biennium but our primary goal will be to fund this project through a POP for that and future biennia.

Please describe the results and conclusions from the previous work and how those findings support the current proposal and the long-term plan. Has any monitoring actually demonstrated that angler use and success has improved over past few years or effort? Are we seeing any benefit from the tiger trout and brown trout releases?

Given that Fish Division has stated that chemical removal is not an option in the future, mechanical removal is the most reliable method available at this time.

Since the beginning of R&E funding in 2016 for this project, angler success has increased from .29 fish-per-angler-hour to an average of 0.54 (2015-2020). Since 2016 angler use has increased from 142,902 angler-hours to 267,665 with an average of 195,661 (2016-2020). We have found cyprinids in gastric lavage samples from both brown and tiger trout, as reported in the 2018-2020 Project Update (Supporting Documents Section). No R&E funds are requested for stocking in the proposed budget.

The Umpqua Fish District conducts other sampling (not part of this grant) to assess lake health, fish forage production, and fish health. Benthic macroinvertebrate sampling from 2019 showed the highest values (over 600 lbs/acre) since this monitoring began in 1947. Benthic macroinvertebrate values estimated immediately prior to previous rotenone treatments in 1954 and 2006 were both less than 20 lbs/acre. This is evidence that mechanical removal of invasive tui chub and golden shiners, as well as predation of these fish by stocked tiger trout and triploid brown trout, are preventing catastrophic collapse of the lake's ecology. Additionally condition factor (Fulton's K) of rainbow trout is consistently between 1.2 and 1.4 indicating healthy body conformation.

There is a lot of use of the terms "continuing discussion" and "continue to evaluate" in the application, more information on what that means would be appreciated. Please explain how this proposal is different from previous requests. Explain how this proposal fits into the long-term plan or assists in understanding the path to some sort of long-term plan or end game?

The first few years of this effort provided us insight on where to best target tui chub and golden shiner. During 2019 and 2020 efforts were more focused on these sites and depleting tui chub before moving net set location. With the purchase of 2 additional nets (from non-R&E funding) in December 2020, we will be able to dedicate 2 nets as index sites to assess long-term trends in catch, while still having 4 nets to actively seek out areas of tui chub abundance.

At some point we may see that predation of tui chub and golden shiner by stocked tiger trout and triploid brown trout becomes the primary mechanism to prevent catastrophic collapse of the lake's ecology. However, netting data shows relatively few tiger and brown trout encountered between July and September, primarily due to water temperatures along the shoreline frequently in excess of 20 degrees Celsius. Other non-R&E funded District monitoring shows regular use of shoreline habitats in the spring and fall. Tiger and brown trout typically inhabit the deeper, cooler

portions in the middle of the lake during summer months, leaving shoreline habitats open for uninhibited invasive species feeding and reproduction. Shoreline netting efforts in the summer fill the gap portion of the year that piscivorous stocked trout are not able to.

We are exploring the use of a YY tui chub program to breed out females, as this technique has become more widely used on a number of introduced species with successful outcomes. We will be working with Fish Division to discuss the feasibility of this management approach.

District and Division staff have looked into other alternatives in the past, but quickly ruled out options that include but are not

limited to: 1) Tiger muskellunge, spring Chinook, Williamson strain rainbow trout, Blackwater strain rainbow trout, etc. stocking. These were discussed, (with some even attempted in the past) but due to ecological, legal, lack of past effectiveness, or public perception concerns were not considered. 2) Primacord detonation: This was discussed primarily after the most recent discovery of golden shiners. It was not considered due to public and staff safety concerns, the fact it is non-discriminate and will affect non-target species, and predicted limited effectiveness. 3) No action, this was considered but is not an option due to legal obligations to remove tui chub and stock piscivorous trout as described in the FEIS, Diamond Lake Management Plan, and OAR 635-500-0703.

Lastly, to address a comment from the review team regarding legal and trophy trout stock, please see below:

Rainbow trout stocking changes were considered, but the option was eliminated for the following reasons: 1) According to the 2009 Diamond Lake Management Plan and the Diamond Lake OAR 635-500-0703 we are obligated to maintain Diamond Lake's fishery primarily through the stocking of fingerling rainbow trout. 2) District staff agrees, based on historic creel and stocking data, that the stocking of 300,000 fingerling annually is the most cost efficient means to support our benchmarks of angler CPUE of at least 1.5 fish/angler. In order to maintain similar catch rates we estimate it would be necessary to stock a minimum of 100,000 legal sized trout, this would cost approximately \$40,000 annually as opposed an estimated \$6,250 for fingerlings 3) By just stocking larger "put and take" rainbow trout and not addressing the tui chub presence, ODFW would not be addressing all of the components of the Diamond Lake fishery. Specifically, we would not be considering the potential impacts to the Diamond Lake ecology and deleterious water quality impacts in the lake and downstream, habitats for recreational fish, habitats for wildlife, and human safety issues for recreational users.

The application states that two BSA's will be hired for "at least three months" each year. Will it be 3 months, or is it longer? Please clarify.

Two BSA's will be employed for at three months each year. If there is funding remaining at the end of the grant cycle, we plan to keep them on as funding allows to extend removal efforts.

This seems like could be too much work for two BSA's and may result in poor data collection resulting in a difficult/poor data analysis. Does the district have concerns about this? Has the district considered using interns or volunteers to assist with this?

This is not a concern at the District Level. Previous year's crews were able to conduct over 150 trap net sets per season and do data entry with QAQC. The increased effort provided by purchasing two more nets will be offset by data entry shared or done by District staff. The

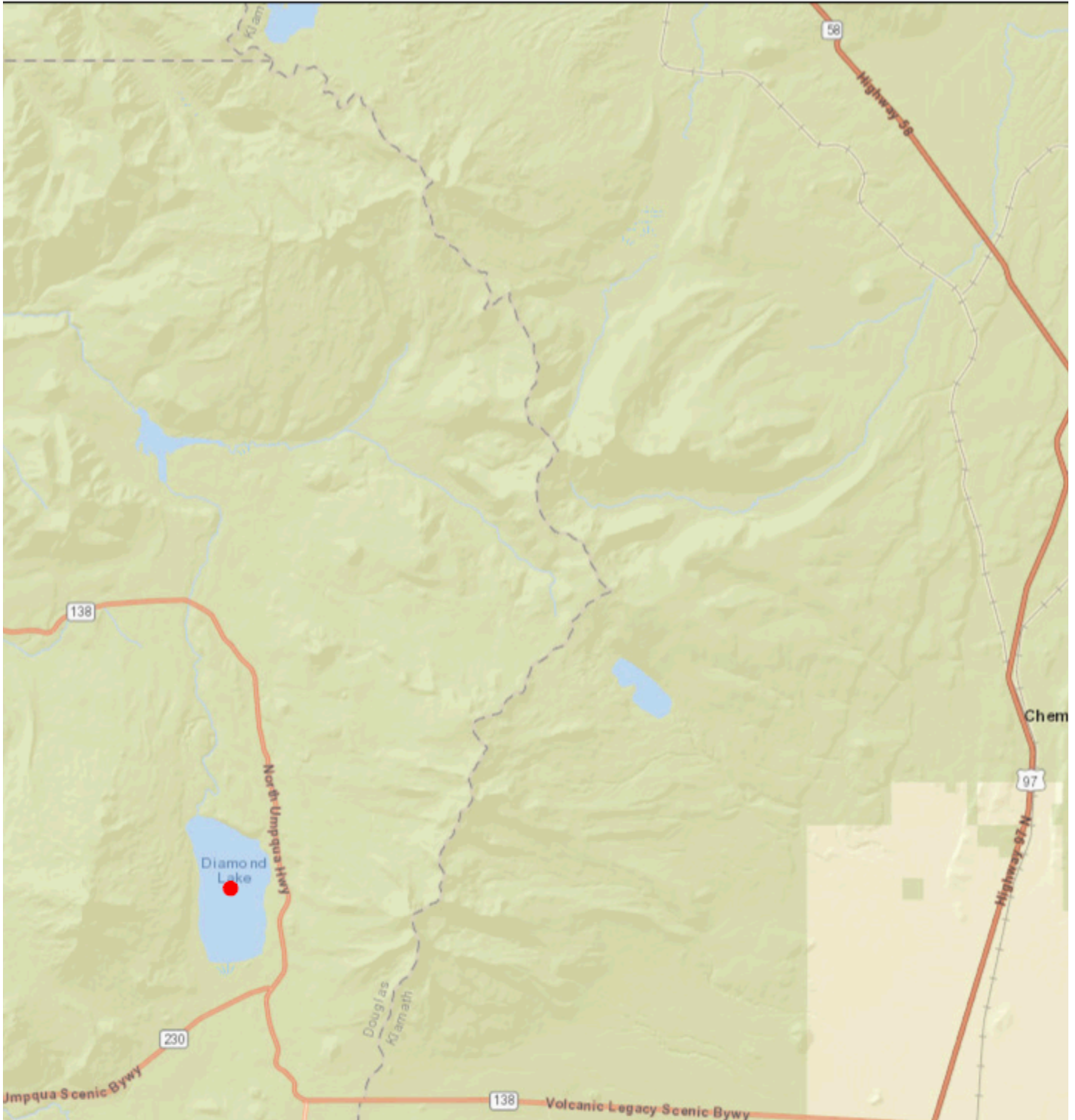
District has utilized both volunteers and interns to assist with field work in the past. However, this was not an option in 2020 due to lack of funding for an intern and COVID restrictions and is questionable for 2021 for the same reasons.

We did not include an intern or volunteers in the budget, as their availability is not guaranteed. If we are fortunate enough to get volunteer or intern assistance, we will certainly use their help at Diamond Lake.

Please explain why a creel is the appropriate method and why utilizing a tag reward program to reduce the cost was not utilized.

Creel allows District staff to obtain statistically valid estimates of Catch per Unit Effort (CPUE), overall catch, harvest, and angler hours (effort) throughout the ice-free portion of the year, not just a 3 month snapshot. There is a difference in CPUE between spring, summer, and fall. A tag reward program would not provide that level of detail. Volunteers and District staff conducted approximately 9 out of 21 creel samples (43%) in 2020.

Project Map



Additional Files

Budget Information

Maps

[Project Map](#)

Map image of project location

Photos

Design Information

Management Plans and Supporting Documents

[2018-19 R&E Team Q&A](#)

[2018-2020 Project Update](#)

[British Columbia Stocking Analysis \(2004\)](#)

[Diamond Lake Economic Report](#)

[Diamond Lake FEIS \(2004\)](#)

[Diamond Lake Management Plan \(2009\)](#)

[Diamond Lake OAR 635-500-0703](#)

[Diamond Lake Stomach Analysis \(2002-2004\)](#)

[Historic Angler Trip Data](#)

[Piscivorous Rainbow Analysis Study](#)

[Piscivorous Trout Behavior Study](#)

[Reservoir Dogs Ranking Illegal Species \(2018\)](#)

[Reservoir Dogs Ranking RM&E \(2018\)](#)

[Tiger Trout Life History Study](#)

[Tiger Trout Performance Study](#)

[Tiger Trout Review Study](#)

Permits and Reviews

Partnerships

Public Comment

Administrative Documents

[Signature Authorization Page](#)

Completion Report

Objectives and Accomplishments

Hire two employees (seasonal BSAs) to be housed at Diamond Lake for at least three months(2021 and 2022)and purchase necessary equipment for the most efficient monitoring and removal of invasive cyprinids at Diamond Lake.

Did you meet the objective? Yes

We successfully hired two BSA for two summers worth of work

Maximize net set efforts on a daily/weekly basis to remove as many invasive cyprinids as possible. Propose trap net sets 100-150 per season and cast/seine net samples as time and conditions allow.

Did you meet the objective? Yes

Between 2021 and 2022 the crew completed 474 individual nets sets.

Collect a statistically valid number of tiger and triploid brown trout diet samples as determined by ODFW biometrician for diet evaluation and comparisons. Use results to inform future stocking numbers and species.

Did you meet the objective? No

Due to environmental conditions we were limited in the number of diet sampled collected. Water temperatures continually exceeded 70 degrees F leading to increased stress on captured trout. Collecting diet samples during this time would lead to higher mortality. We will continue to collect diet samples when possible and evaluate when possible.

Run the Diamond Lake weir panel trap on a daily basis to monitor possible out-migration of tiger and triploid brown trout.

Did you meet the objective? Yes

Very few trout were observed leaving the lake in 2021/22 likely due to reduced flows.

Conduct 2-3 creel surveys per month selected by the statistical creel protocol to evaluate rainbow trout fishery metrics.

Did you meet the objective? Yes

We have completed scheduled surveys and this information is assisting management decisions at Diamond Lake.

Monitor trends in tui chub catch per unit effort to track changes in relative abundance and provide information to adjust techniques and locations of sampling.

Did you meet the objective? Yes

Most of the minnows are captured near the Northwest corner of the lake and efforts have been increased in these areas.

Comments

Grantee agreed to forfeit all remaining funds.