

Deep Creek - Starveout Diversion Project

State(s): Oregon

Managing Agency/Organization: Lake County Umbrella Watershed Council

Type of Organization: Nonprofit

Project Status: Ongoing

Project type: WNTI Project

Project action(s): Barrier Removal, Instream Habitat Restoration, Watershed Connectivity, Monitoring. Removal of 1 diversion barrier and reconnection of 3.0 miles of stream.

Trout species benefitted: Redband Trout

Population: Warner Lakes Basin Watershed

Project summary: This project is part of a much larger restoration effort taking place in the Warner Lakes Basin Watershed to provide fish passage, habitat improvement, and future species recovery for the Warner Lakes Redband trout (State Sensitive species and the Warner sucker (Federally Listed Species). The Lake County Umbrella Watershed Council and partners in the Warner Basin Aquatic Habitat Partnership will address ten fish passage barriers within the Honey, Deep, and Twentymile Creek systems in the next six years. The Western Native Trout Initiative as well as the Oregon Watershed Enhancement Board and others have contributed project success. This project is currently under construction, with a completion date set for November 30, 2020.

The Starveout Diversion Fish Passage project is part of a large habitat improvement and fish passage effort taking place in the Warner Basin Watershed of Lake County Oregon. In the last five years, the Warner Basin Aquatic Habitat Partnership, a local group of partners (Lake County Umbrella Watershed Council, Lakeview Soil and Water Conservation District, Bureau of Land Management, US Forest Service, US Fish and Wildlife, and Oregon Department of Fish and Wildlife) has collectively focused on targeting three primary tributaries that host the Warner Sucker, a Federally Threatened and Endangered species and the Warner Lakes Redband Trout, a State Listed Sensitive species. The goal of the Warner Basin Aquatic Habitat Partnership is to execute a restoration program that will lead to the recovery of Warner sucker and improvement of Warner Lakes Redband Trout populations in the Warner Lakes Basin. Objectives to achieve the Partnerships goal include implementing fish passage solutions at irrigation diversions, screening irrigation diversion intakes, enhancing stream corridor habitats in Deep Creek, Twentymile Creek, and Honey Creek- the three focal tributaries in the Warner Basin. WNTI previously funded the [Deep Creek Town Diversion](#) (2018) and is funding design work on three additional diversion projects in Deep Creek in 2019/2020.

Problem the Project Addresses: The Recovery Plan for the Threatened and Rare Native Fishes of the Warner Basin and Alkali Sub basin (USFWS 1998) and the Oregon Conservation Strategy (ODFW 2016) outline limiting factors for Warner sucker and Warner Lakes Redband Trout. USFWS (1998) identified three primary limiting factors affecting Warner sucker and Warner Lakes Redband Trout, including, irrigation diversion structures that create fish passage barriers and entrain fish, large populations of established non-native fish species that prey on juvenile native fish in the Warner Lakes, and stream habitat degradation due to land use practices. The Initiative is primarily focused on addressing irrigation infrastructure and stream corridor habitat.

In the last five years the Warner Basin Aquatic Habitat Partnership (WBAHP) has completed all the high priority projects outlined within the Partnerships Strategic Action Plan for Twentymile Creek, have completed five focal projects in Honey Creek and one focal project in Deep Creek. Ten irrigation barriers remain within the Honey and Deep Creek systems at this time. The Partnership was recently awarded a Focused Investment Partnership Grant through the Oregon Watershed Enhancement Board to address the remaining 10 barriers in the next 6 years. This grant proposal specifically focuses on the Starveout Diversion, one of the largest diversion dams in the Deep Creek system. Fish passage solutions are designed to address diversion-specific constraints, water user management practices, and fish species swimming capabilities.

The Starveout Diversion Fish Passage project was initiated two years ago with a landowner, irrigator and partner kickoff meeting including WBAHP members. At this meeting the WBAHP requested information from the landowner/irrigator and discussed concerns and suggestions. WBAHP retained a consultant (River Design Group, Inc.) to complete the site survey and other field data collection, hydrologic modeling, and a fish passage alternatives analysis. The consultant prepared 30% designs sufficient for hydraulic modeling and a preliminary construction cost estimates for each alternative. In 2020, WNTI is funding 90% design for this diversion using funds from a nonprofit Foundation. Project alternatives consisted of a concrete ladder, an Obermeyer weir with a bypass channel, and a rock ramp fishway/roughened channel. The preferred alternative was agreed to by WBAHP and the landowner/irrigators one year ago. The selected solution includes replacement of the existing diversion dam and installation of an engineered roughened channel on both the river right and river

left channel, due to the stream forking at the point of diversion. The roughened channel is expected to provide fish passage, restore watershed connectivity, and be a lower maintenance fish passage solution relative to other fish passage alternatives that were reviewed. The replacement dam and rock ramp will also improve the stability of the diversion structure. The existing dam is currently undermined and the concrete skin is no longer supported by underlying fill. Existing boulders will be repositioned and additional boulders will be imported to maximize rock ramp stability.

The rock ramp fishway is designed to be 120ft. long on river left channel and 160ft on river right. Fish passage solutions will meet the criteria stated in Oregon Administrative Record 635-412-0035. A 1-dimensional hydraulic model (e.g., HEC-RAS) was used to iteratively design and model the roughened channels. To ensure the project designs meet passage criteria for Warner sucker and Lakes Redband Trout. This type of design is a cost-effective fish passage solution that will have minimal maintenance over time and meets all the criteria outlined for the two focal fish species. The roughened channels will be constructed with a gradation of angular rock designed to resist erosion and provide hydraulic conditions that will meet fish passage criteria. Debris and sediment loading in addition to periodic high magnitude floods are common in the Deep Creek Watershed due to the influence of summer time thunderstorms and spring snowmelt runoff.

Currently, the design consulting team is completing final analysis, design drawing updates, and materials specifications and quantities for the 90% design deliverable and project permitting.

Objectives: The overall goal of the proposed Starveout Diversion - Fish Passage project is to provide volitional passage for federally threatened Warner sucker, Oregon-species of concern Warner Lakes Redband Trout, and other native fish species inhabiting lower Deep Creek. Passage at the Starveout Diversion will expand the amount of spawning, rearing, and holding habitat available to the Deep Creek fish community; increase population connectivity; and provide access to deep cold water pools that provide summer refuge.

There are two primary project objectives that are intended to achieve the Deep Creek - Starveout Diversion Project goal. The three objectives include: 1) volitional fish passage, 2) minimizing fish passage solution maintenance and intervention; and 3) improvement of the existing surface water diversion.

Objective 1: Volitional Fish Passage - The proposed project will address upstream-downstream passage at the Starveout Diversion. The rock ramp will allow for fish movement upstream past the diversion, and safer downstream passage as fish will no longer pass over the vertical drop at the existing diversion.

Objective 2: Minimize Fish Passage Solution Maintenance and Intervention - A fish passage solutions alternatives analysis was completed for the Starveout Diversion. The selected rock ramp alternative was selected as the best combination of cost, fish passage potential, and maintenance requirements. The rock ramp should require minimal maintenance by the Adel Water Improvement District over time to ensure both fish passage and diversion operation. The rock ramp is expected to require less maintenance effort and better fish passage potential relative to the other reviewed alternatives.

Objective 3: The existing diversion will be stabilized to accommodate the rock ramp fishways and provide operational safety to the Adel Water Improvement District. The existing weir is being undermined and fill material has been scoured from underneath the weir's surface. Strengthening the diversion dam will ensure long-term operation of the diversion.

Project Activities: The Deep Creek - Starveout Diversion project solution includes two roughened channel, 120ft long roughened channel on river left, and 160 ft. long roughened channel on river right. Fish passage solutions will meet the criteria state in Oregon Administrative Record 635-412-0035. A 1-dimensional hydraulic model (HEC-RAS) was used to iteratively design and model the roughened channel. To ensure the project designs meet passage criteria for Warner Lakes Redband Trout and Warner sucker. This type of design is a cost-effective fish passage solution that will have minimal maintenance over time.

The roughened channel design was selected as an effective fish passage solution for native fish. This design will also require minimal maintenance for the Adel Water Improvement District. The roughened channel will be constructed with a gradation of angular rock designed to resist erosion and provide hydraulic conditions that will meet fish passage criteria.

Partners: The Warner Basin Aquatic Habitat Partnership:

- Bureau of Land Management
- US Fish and Wildlife Service

- Oregon Department of Fish and Wildlife
- US Forest Service
- Lakeview Soil and Water Conservation District
- Lake County Umbrella Watershed Council
- Oregon Watershed Enhancement Board
- Desert Fish Habitat Partnership
- Open Rivers Initiative through Western Native Trout Initiative
- Western Native Trout Initiative

Project Monitoring: Prior to on-the ground work, baseline data on physical habitat, sediment, flows and fish populations will have been established through monitoring efforts by Oregon Department of Fish and Wildlife and River Design Group, Inc. Post-restoration monitoring of fish passage will be conducted by Oregon Department of Fish and Wildlife. This will be assessed using fixed PIT-tag antennas installed near the downstream and upstream ends of the project. Cross sections will also be established to measure long term stability of the roughened channel. Photo monitoring at permanent points will be conducted annually for three years, and periodically after. Monitoring of riparian vegetation along the roughened channel will also take place through a series of photo-points to visually assess success of plant growth and vigor. Following restoration activities, partners will review monitoring results and assess success of the project.

Specific monitoring methodology is listed below:

- Fish (Warner Suckers and Redband Trout) will be captured in deep pools within the study area using panel hoop nets. This will be completed biweekly (downstream to upstream) mid-April through mid-June.
- Captured fish will be anesthetized using methyl sulfonate buffered with sodium bicarbonate and placed in an aerated bucket until processing.
- Fixed plate PIT antennas will be installed at the upstream and downstream ends of the fishway to evaluate the timing and number of trout and suckers moving upstream and passing through the new fishway.
- Water velocities will be measured at various locations in the roughened channel at various flows to assess whether passage success may be limited by water velocities.
- Stream temperatures will be collected continuously during the study period with a thermograph installed at the fishway. Associations between fish movement and temperatures will be described.

Long Term Maintenance: The Lake County Umbrella Watershed Council is currently working with the Adel Water District to establish maintenance guidelines. The Water District will maintain fish passage and the irrigation diversion structure for the lifetime of the project. The WBAHP will assist as needed and provide guidance.

Funding Source(s): National Fish Habitat Action Plan

Project cost: \$50,000

Start Date: 08/04/2020 **Completion Date:** 11/30/2020

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