

RECOVERY PROGRAM

Recovery Program Project Number: C20

FY 2018-2022 SCOPE OF WORK for:

Operation, maintenance, and fish escapement evaluation of the Highline Lake spillway net (fish barrier); operation, maintenance, and fish escapement evaluation of the Elkhead Reservoir spillway net (fish barrier)

Reclamation Agreement number: R12AP40001

Reclamation Agreement term: July 11, 2013 – September 30, 2017

Lead agency: Colorado Parks and Wildlife

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Category:

- Ongoing project
- Ongoing-revised project
- Requested new project
- Unsolicited proposal

Expected Funding Source:

- Annual funds
- Capital funds
- Other *[explain]*

I. Title of Proposal:

Operation, maintenance, and fish escapement evaluation of the Highline Lake spillway net (fish barrier); operation, maintenance, and fish escapement evaluation of the Elkhead Reservoir spillway net (fish barrier)

II. Relationship to RIPRAP:

This project will involve the operation and maintenance of the Highline Lake spillway net, and evaluation of the net as a fish anti-escapement device. The project will also involve the operation and maintenance of the Elkhead Reservoir spillway net, and evaluation of the net as a fish anti-escapement device.

General Recovery Program Support Action Plan

- III. Reduce negative impacts of nonnative fishes and sportfish management activities (nonnative and sportfish management).
- III.A. Reduce negative interactions between nonnative and endangered fishes.
- III.A.2. Identify and implement viable active control measures.
- III.A.2.c. Evaluate the effectiveness (e.g., nonnative and native fish response) and develop and implement an integrated, viable active control program.
- III.B. Reduce negative impacts to endangered fishes from sportfish management activities

Colorado River Action Plan: Mainstem

- III.B. Reduce negative impacts to endangered fishes from sportfish management activities
- III.B.1. Evaluate control options and implement measures to control nonnative fish escapement from Highline Reservoir
- III.B.1.a. Operate and maintain Highline Reservoir net

Green River Action Plan: Yampa and Little Snake Rivers

- III.B.1. Prevent nonnative fish introduction; reduce invasion and recruitment
- III.B.1.a.(2) Implement control measures as needed to control escapement (during and after Elkhead expansion construction). Post-construction: monitor and maintain Elkhead screens (YS C-1)

III. Study Background/Rationale and Hypotheses:

The Stocking Procedures (USFWS 2009) require the use of screens/nets to control escapement of stocked, nonsalmonid fishes from ponds and reservoirs (NFAHC 2014). Specifically, the 1996 Stocking Procedures (USFWS 1996) state “public and private waters that have a direct connection to rivers in the Upper Colorado River Basin (UCRB) (e.g., Elkhead Reservoir, Highline Reservoir, and many ponds) will be equipped or managed with an anti-escapement device or practice acceptable to the Service and the State fish and wildlife agency. The Program will pursue funding for equipping public reservoirs with anti-escapement devices.” In addition and as noted by the Nonnative Fish *ad hoc* Committee (2014), “maintenance of screens and their infrastructure is an ongoing, necessary, and expensive commitment.” The committee recommended two high

priorities related to this topic, including 1) “that screens be used to manage sport fish populations based on Compatible list species that are considered to be compatible with endangered fish recovery and not for management of Non-compatible list or demonstrably invasive species in the UCRB, including northern pike and smallmouth bass,” and 2) that “monitoring of all screens on public waters and reporting on their function and maintenance on an annual basis be completed to help ensure their reliability in preventing/controlling fish escapement” (NFAHC 2014). Colorado Parks and Wildlife is addressing both of these priorities within this Scope of Work at both Highline Lake and Elkhead Reservoir.

Highline Lake

Funding from the Recovery Implementation Program for endangered fishes in the UCRB became available in 1998 (Martinez 1999) for installation of a fish screen at Highline Lake within the State Park (near Loma, Colorado). The first spillway net at Highline Lake was installed on August 18, 1999, with a projected service life of up to 5 years under local conditions (Martinez 2000). The Highline Lake spillway net is 363 feet wide, 19 feet deep, has a dry weight of 1,400 pounds and mesh openings of 0.25 inches (Martinez 2001). It is fabricated of the high tech fiber Dyneema, a material well suited for the net due to its resistance to abrasion, light degradation, and fatigue without special coverings or coatings (Martinez 2002). This increase in net durability has resulted in the spillway net being left in place year-round, even during winter when the lake is frozen (Martinez 2001).

Since the original installation in 1999, the Highline Lake spillway net has been replaced on two occasions, March 21, 2006 and most recently, March 14, 2014. The 2014 replacement occurred after Highline Lake was drawn down 20 feet during a dredging operation in the fall of 2013. The removal of the 2006 spillway net and installation of the 2014 spillway net occurred on dry land. All of the remnants of the original net were removed, and all of the existing thimbles and manta ray bolts were inspected. The 2014 replacement net was connected and tightened in a manner ensuring no openings that fish would be able to escape through.

Routine monitoring of the Highline Lake spillway net is performed under the supervision of Alan Martinez, Park Manager at Highline Lake State Park. A dive team inspected and cleaned the net on three occasions across the 2014 boating season. Since that time, the dive team has increased their inspections and cleanings to four occasions per year due to increased algal/debris buildup on the spillway net. Colorado Parks and Wildlife will continue to provide up to \$10,000 per year to cover operations and maintenance costs associated with the spillway net.

The bottom release (outlet) on Highline Lake, if not operated appropriately, is another potential source of nonnative fishes downstream to Mack Wash and Salt Creek, tributaries to critical habitat for endangered fishes of the Colorado River. A mandatory annual maintenance/opening of the Highline Lake outlet is to be performed during the summer period when hypolimnetic oxygen depletion occurs, precluding and/or minimizing escapement of warmwater fish species (NFAHC 2014). Multiple studies (Piper et al. 1982; USEPA 1986) indicate that various fish species may be tolerant of dissolved oxygen concentrations less than 5 mg/L. Martinez (2002, 2003) reported that dissolved oxygen concentrations in Highline Lake generally decreased to less than 2 mg/L below a depth of 19-26 feet from mid-July until late August, and recommended this 2 mg/L threshold for unscreened outlet releases at Highline Lake. Monitoring dissolved oxygen

levels near the Highline Lake outlet to detect this threshold should provide the possibility for a maximum six week window between July 1 and September 1 during which the mandatory opening of the outlet could be performed (NFAHC 2014).

The Highline Lake outlet structure was operated over a two week period in October 2013 in order to draw the reservoir down 20 feet for the dredging operation. A “sock” net attachment was installed over the culvert directly south of the outlet structure during this time, since the outlet structure was operated outside of the period when dissolved oxygen concentrations would be greater than 2 mg/L. The net aperture was similar to that of the spillway net, and was effective in catching fish that were flushed out of the outlet structure. This attachment will be used in the same capacity in the future, when mandatory outlet tests are required outside of the six week window and dissolved oxygen concentrations are sufficient for fish survival.

In addition to the annual monitoring and maintenance of the Highline Lake spillway net by Highline State Park personnel, the Colorado Division of Wildlife (CDOW) performed an evaluation of fish escapement following the installation of the 1999 spillway net. Evaluation of the net’s performance in controlling escapement of resident and stocked nonnative fishes from the reservoir was favorable (Martinez 2002). As a result of the findings of this evaluation, the Upper Colorado River Endangered Fish Recovery Program (Program) recommended maintaining a spillway net at this site to continue controlling the escapement of nonnative fish (PDO 2002). Further, CPW will continue to complete annual sampling to monitor fish escapement in the spring before spilling (within the reservoir, between the spillway net and spillway), and in the fall after spilling (outside of the reservoir, at several established sites within Mack Wash and/or Salt Creek). These fish monitoring costs are covered by CPW up to \$5,000.

Elkhead Reservoir

On September 23, 2016 a spillway net similar to the one at Highline Lake was installed just upstream of the spillway in Elkhead Reservoir at Elkhead Reservoir State Park (near Craig, Colorado). The Elkhead Reservoir net is made of the same high tech fiber Dyneema as the Highline net, but is more than 200 feet longer and almost twice as deep, 575 feet long and 30 feet deep, as the Highline net. An 800 feet long, foam-filled debris boom that is 2 feet in diameter with a 4 feet skirt that extends beneath the water surface is situated upstream of the spillway net to reduce wave action and protect the net from large logs and other debris.

Routine monitoring of the Elkhead Reservoir spillway net is performed under the supervision of Jacob Brey, Park Manager at Elkhead Reservoir State Park. A dive team from the contractor that built and installed the spillway net will complete an inspection sometime in mid-summer, 2017. At this point in time, CPW is predicting that the spillway net will need to be cleaned and inspected by a dive team on at least two occasions annually. The number of cleanings/inspections will be dependent on hydrological conditions across the season, and normal wear from year to year. Colorado Parks and Wildlife will provide up to \$10,000 per year to cover operations and maintenance costs associated with the spillway net.

There is also an outlet tower at Elkhead Reservoir, but the outlet structures are also screened to preclude fish escapement out of Elkhead Reservoir downstream into Elkhead Creek, a tributary to critical habitat for endangered fishes of the Yampa River. Maintenance and operation of the

outlet works are shared between the Colorado River Water Conservation District, Recovery Program, and the City of Craig.

In addition to the annual monitoring and maintenance of the Elkhead Reservoir spillway net by Elkhead Reservoir State Park personnel, CPW will also be completing annual sampling to monitor fish escapement in the spring before spilling, and in the fall after spilling (within the reservoir, between the spillway net and spillway). The stilling basin will also be sampled within the same time frame in the spring and fall, when there is no connection between Elkhead Reservoir and Elkhead Creek (i.e., either the reservoir has yet to spill or the reservoir has completed spilling for the year). These fish monitoring costs are covered by CPW up to \$10,000.

IV. Study Goals, Objectives, End Product(s):

Study Goals

Highline Lake

1) To operate and maintain a spillway net (fish barrier) at Highline Lake to control escapement of resident and stocked nonnative fishes that may reach critical habitat for endangered fishes in the Colorado River.

Elkhead Reservoir

1) To operate and maintain a spillway net (fish barrier) at Elkhead Reservoir to control escapement of resident and stocked nonnative fishes that may reach critical habitat for endangered fishes in the Yampa River.

Study Objectives

Highline Lake

1) To monitor and maintain the spillway net so that the net's function is retained in controlling the escapement of nonnative fishes, while providing for public safety and maximizing the life of the net.

2) To provide public awareness of the spillway net's purpose both in facilitating the recovery of endangered fishes, and in allowing for the stocking and management of approved nonnative warmwater sportfish species compatible with endangered fish recovery efforts.

Elkhead Reservoir

1) To monitor and maintain the spillway net so that the net's function is retained in controlling the escapement of nonnative fishes, while providing for public safety and maximizing the life of the net.

2) To provide public awareness of the spillway net's purpose both in facilitating the recovery of endangered fishes, and in allowing for the stocking and management of approved nonnative warmwater sportfish species compatible with endangered fish recovery efforts.

End Products

Highline Lake

- 1) Further documentation of the feasibility and costs to operate and maintain a large-scale spillway net in a high public use setting.
- 2) Reduced infusion and interaction of nonnative sportfish into critical habitat that might otherwise escape the reservoir and contribute to negative impacts on endangered fishes.
- 3) Positive public response to enhanced sportfish management in Highline Lake.

Elkhead Reservoir

- 1) Further documentation of the feasibility and costs to operate and maintain a large-scale spillway net in a high public use setting.
- 2) Reduced infusion and interaction of nonnative sportfish into critical habitat that might otherwise escape the reservoir and contribute to negative impacts on endangered fishes.
- 3) Positive public response to enhanced sportfish management in Elkhead Reservoir.

V. Study Area:

Highline Lake State Park, Loma, Colorado; Elkhead Reservoir State Park, Craig, Colorado

VI. Study Methods/Approach:

Operations and Maintenance

Highline Lake

Formerly, the operations and maintenance of the original spillway net were funded via a cooperative agreement between Colorado State Parks and the CDOW to cover up to \$10,000 in annual costs incurred by Highline Lake State Park. Colorado State Parks and the CDOW merged to form Colorado Parks and Wildlife (CPW) in 2011. As of July 1, 2011, CPW will be responsible for covering the operations and maintenance costs of the spillway net up to \$10,000 annually, contingent on availability of funds. If annual costs exceed \$10,000, then CPW will request the Program cover the additional costs. This scenario has not occurred to date.

Elkhead Reservoir

Per a May 20, 2015 CPW letter to the U.S. Bureau of Reclamation outlining CPW's obligations related to the "Elkhead Reservoir Fish Escapement Net," CPW will be responsible for covering the operations and maintenance costs of the spillway net up to \$10,000 annually, contingent on availability of funds. Operation and maintenance costs exceeding the \$10,000 per year limit will be cost shared equally (50:50) between CPW and the Program, subject to the mutual agreement of CPW and the Program. If mutual agreement on the expenditure of funds exceeding the first \$10,000 in any calendar year cannot be obtained, the issue will be referred to the Program's Implementation Committee for resolution. Resolution will occur in a timely manner, to avoid

impacting the safe and prudent operation of Elkhead Reservoir. Colorado Parks and Wildlife anticipates that this scenario may be likely, based on the large-scale size of the net and additional intricacies that are not applicable to the Highline Lake spillway net.

At the end of the useful life cycle of the net, the Program, CPW, District and Reclamation will consult on the need to replace the net, and if needed, who will assume responsibility for installation, operation and maintenance.

Fish Monitoring

Highline Lake

Colorado Parks and Wildlife will continue to complete annual sampling to monitor fish escapement in the spring before spilling (within the reservoir, between the spillway net and spillway), and in the fall after spilling (outside of the reservoir, at several established sites within Mack Wash and/or Salt Creek). Colorado Parks and Wildlife will complete this annual sampling at the agency's expense, which is contingent on availability of funds.

Elkhead Reservoir

Colorado Parks and Wildlife will complete annual sampling to monitor fish escapement in the spring before spilling, and in the fall after spilling (within the reservoir, between the spillway net and spillway). The stilling basin will also be sampled within the same time frame in the spring and fall, when there is no connection between Elkhead Reservoir and Elkhead Creek (i.e., either the reservoir has yet to spill or the reservoir has completed spilling for the year). Colorado Parks and Wildlife will complete this annual sampling at the agency's expense, which is contingent on availability of funds.

VII. Task Description and Schedule:

Operations and Maintenance

Highline Lake

Task 1. Maintain protective buoy line

Schedule: March/April-October

Task 2. Net cleaning and repair operations (in water)

Schedule: March/April-October

Task 3. Weekly visual survey

Schedule: March/April-October

Task 4. Underwater survey

Schedule: March/April-October

Task 5. Preparation of final report documenting operations and maintenance, and related costs

Schedule: November/December

Elkhead Reservoir

Task 1. Maintain protective debris boom
Schedule: March/April-September

Task 2. Net cleaning and repair operations (in water)
Schedule: March/April-September

Task 3. Weekly visual survey
Schedule: March/April-September

Task 4. Underwater survey
Schedule: March/April-September

Task 5. Preparation of final report documenting operations and maintenance, and related costs
Schedule: November/December

Fish Monitoring

Highline Lake

Task 1. Fish sampling to monitor fish escapement downstream of the spillway net (within the reservoir, between the spillway net and spillway)
Schedule: February/March (pre-spill conditions)

Task 2. Fish sampling to monitor fish escapement downstream of the spillway net (outside of the reservoir, within Mack Wash and/or Salt Creek)
Schedule: November (post-spill conditions)

Task 3. Equipment maintenance, data entry, data analysis, and preparation of fisheries final report
Schedule: February/March-November/December

Elkhead Reservoir

Task 1. Fish sampling to monitor fish escapement downstream of the spillway net (within the reservoir, between the spillway net and spillway)
Schedule: March (pre-spill conditions) and September/October (post-spill conditions)

Task 2. Fish sampling to monitor fish escapement downstream of the spillway net (outside of the reservoir, within the stilling basin and prior to and post-connection with Elkhead Creek)
Schedule: March (pre-spill conditions) and September/October (post-spill conditions)

Task 3. Equipment maintenance, data entry, data analysis, and preparation of fisheries final report
Schedule: March-November

VIII. Deliverables, Due Dates, and Budget by Fiscal Year:

Highline Lake

FY 2018-2022

Operations and Maintenance

Deliverables: Completion of Tasks 1-5

The spillway net will be inspected and cleaned on at least four occasions per year by a contracted dive team for a total cost of \$4,000 (\$1,000 per inspection/cleaning). This routine maintenance of the net should decrease algal/debris buildup, and prolong the life of the net. If a fifth inspection/cleaning is required, the total cost for cleaning will be \$5,000.

Budget: \$10,000 (at CPW expense; not to exceed \$10,000 of CPW funds, and contingent on availability of funds)

Fish Monitoring

Deliverables: Completion of Tasks 1-3

Budget: At CPW expense, and contingent on availability of funds

Elkhead Reservoir

FY 2018-2022

Operations and Maintenance

Deliverables: Completion of Tasks 1-5

The spillway net will be inspected and cleaned on at least two occasions per year by a contracted dive team for a total cost of \$6,000 (\$3,000 per inspection/cleaning). This routine maintenance of the net should decrease algal/debris buildup, and prolong the life of the net. If a third inspection/cleaning is required, the total cost for cleaning will be \$9,000.

Budget: \$10,000 (at CPW expense; not to exceed \$10,000 of CPW funds, and contingent on availability of funds)

Fish Monitoring

Deliverables: Completion of Tasks 1-3

Budget: At CPW expense, and contingent on availability of funds

IX. Budget Summary:

Highline Lake

Colorado Parks and Wildlife will be responsible for covering the operations and maintenance costs of the spillway net up to \$10,000 annually, contingent on availability of funds. If annual costs exceed \$10,000, then CPW will request the Program cover the additional costs. This scenario has not occurred to date. Colorado Parks and Wildlife will also cover the costs associated with monitoring fish escapement, which is contingent on availability of funds.

Elkhead Reservoir

Colorado Parks and Wildlife will be responsible for covering the operations and maintenance costs of the spillway net up to \$10,000 annually, contingent on availability of funds. If annual costs exceed \$10,000, then CPW and the Program will share the additional costs at 50:50 ratio. Colorado Parks and Wildlife anticipates that this scenario may be likely, based on the large-scale size of the net and additional intricacies that are not applicable to the Highline Lake spillway net. Colorado Parks and Wildlife will also cover the costs associated with monitoring fish escapement, which is contingent on availability of funds.

FY 2018: Colorado Parks and Wildlife: Operations and maintenance up to \$10,000; CPW and Program: 50:50 ratio of shared costs, if costs >\$10,000

FY 2019: Colorado Parks and Wildlife: Operations and maintenance up to \$10,000; CPW and Program: 50:50 ratio of shared costs, if costs >\$10,000

FY 2020: Colorado Parks and Wildlife: Operations and maintenance up to \$10,000; CPW and Program: 50:50 ratio of shared costs, if costs >\$10,000

FY 2021: Colorado Parks and Wildlife: Operations and maintenance up to \$10,000; CPW and Program: 50:50 ratio of shared costs, if costs >\$10,000

FY 2022: Colorado Parks and Wildlife: Operations and maintenance up to \$10,000; CPW and Program: 50:50 ratio of shared costs, if costs >\$10,000

X. Reviewers:

Harry Crockett, Benjamin Felt, Tory Eyre, Jenn Logan, Alan Martinez, and Jacob Brey;
Recovery Program Director's Office, Biology Committee

XI. References:

Martinez, P.J. 1999. Westslope warmwater fisheries. Federal Aid in Fish and Wildlife Restoration Project-F-325-R4 Progress Report. Colorado Division of Wildlife, Fort Collins, Colorado.

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