



Culvert Repair Programmatic Agreement 2018 Annual Report

Oregon Department of Fish and Wildlife | Oregon Department of Transportation
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Oregon Department of Fish and Wildlife

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Executive Summary

The Oregon Department of Transportation (ODOT) and the Oregon Department of Fish and Wildlife (ODFW) are implementing a five-year Culvert Repair Programmatic Agreement (CRPA) project that allows ODOT to make specific short-term repairs to culverts without having to meet full fish passage criteria at the repair location. ODOT now has the ability to make critical repairs to aging culverts in a cost-effective manner, while providing a benefit to Native Migratory Fish (NMF) over the status quo by improving fish passage at each site repaired. In addition, ODOT paid \$2 million into an ODFW-managed account that will fund the highest priority fish passage restoration projects off the state highway system.

ODOT's culvert inventory has revealed that approximately 10,500 culverts are in poor or critical condition and need to be repaired or replaced in the near term to maintain the safety and integrity of the state highway system. The cost to replace all of these culverts in kind would be well over \$1 billion. This cost would be substantially higher for the installation of larger culverts or bridges to meet state and federal fish passage criteria. Culvert repair work on fish-bearing streams has largely been deferred over the past 17 years due to the inability to meet fish passage design criteria with a repair and the lack of available funding for full fish passage criteria replacements. Culvert repairs typically can be completed for \$50,000 to \$250,000. Culvert replacement projects that meet fish passage criteria can cost from \$1.5 million to over \$12 million each.

In 2018, nine culverts were repaired under the CRPA. The total cost for these repairs was \$1,254,400. The estimate to replace these culverts was \$16.3 million. ODOT was able to avoid over \$15 million of cost to address these culverts by way of the CRPA. However, this cost avoidance should be evaluated relative to the design life provided by the approach. The repairs have added approximately 10-25 years of life to these culverts, whereas full replacements would have provided a new design life of 75 years. However, even given the difference in life span for the two approaches, life cycle costs are much lower for the repair option.

Fish passage improvements at the culvert repair projects used a combination of eliminating jump heights, increasing water depths, and decreasing water velocities. These projects improved access to over 19 miles of potential habitat. Additionally, part of the \$2 million allocated to passage restoration was used to fund nine of the highest priority fish passage projects off the state highway system in 2018. When completed, these projects will provide improved access to 313 miles of potential fish habitat.

The CRPA continues to showcase how interagency coordination and collaboration creates positive outcomes. This mutually beneficial agreement allows ODOT to make progress in maintaining the aging state highway system, while also providing on- and off-highway ecological benefits to NMF. Taxpayer dollars are used efficiently for culvert repair work, and hundreds of miles of potential habitat for NMF are made more accessible.

Definitions

- **Hydraulic conditions:** The conditions of the stream crossing in the context of water velocity, depth, complexity, vertical profiles, and capacity.
- **Culvert:** A pipe or conduit used to convey water, utilities, livestock, wildlife or equipment, from one side of the road to the other.
- **Poor and critical culvert condition:** A culvert that scores a poor or critical has structural deficiencies that pose a danger to the traveling public, the environment, and the community connections, which warrant repair or replacement before a possible failure occurs.
- **Soil arch:** The compacted soil that surrounds the culver. This compacted soil hold the load of the above material and roadway traffic, relieving the pressure from the culvert itself.
- **Fish passage:** The ability, by the weakest NMF and life history stages determined by ODFW to require passage at the site, to move volitionally, with minimal stress, and without physical or physiological injury upstream and downstream of an artificial obstruction.
- **Good and excellent habitat:** High quality habitat likely to provide a significant benefit to NMF. Any habitat recognized as a contributor to sustaining fish and wildlife populations over time.
- **Tributary:** A river or stream flowing into a larger river or lake.
- **High priority barriers:** Any barrier found on the [ODFW Fish Passage Priority List](#). Or determined by professional opinion to be a significant barrier to NMF migration.
- **Backwatered:** When the water surface through the outlet of the culvert and downstream are equal.
- **Perched condition:** When the outlet of the culvert is elevated above the downstream water surface creating a freefall condition.
- **Fish rocks or fish blocks:** Large rocks (or concrete blocks) placed in a stream or culvert to improve habitat, create scour holes, and areas of reduced velocity. Placing structures in the stream also creates eddies or vortices in their wake.
- **Weir:** A low dam built across the stream channel or culvert designed to raise the water level upstream.
- **NMF:** Native Migratory Fish species defined in OAR 635-007-0501 that includes 32 species of fish that migrate as for their lifecycle needs.
- **Baffles:** A structure used to restrain the flow of water in a culvert to provide migrating fish a place to rest and create water depth during low flows.
- **Roughened channel:** An artificially built channel downstream of a culvert designed to alleviate a perch and match conditions in the surrounding streambed.

- **In water work period:** [Guidelines for timing of in water work](#), developed by ODFW and established to avoid impacts to the vulnerable life stages of native migratory fish including migration, spawning and rearing.
- The rules, laws, and other references material regarding NMF passage regulations can be found below:
 - [Oregon Fish Passage Rules](#).
 - [Oregon Plan for Salmon and Watersheds](#).
 - [Oregon Fish Passage Statutes](#).

Background

ODOT and ODFW are implementing a five-year programmatic agreement for culvert repair in Oregon spanning 2018 to 2022. The Oregon Fish and Wildlife Commission approved the CRPA as a programmatic approval under Oregon fish passage rules (OAR 635-412-0020(3)b). This allows ODOT to make specific short-term critical repairs to aging culverts without meeting full fish passage criteria at the repair location, but still providing a benefit to NMF over the status quo by improving fish passage at each site repaired.

This agreement follows and expands on a previous three-year pilot project for western Oregon. Under the pilot CRPA, **ODOT was able to avoid over 70 million dollars of cost to repair instead of replacing these failing culverts** [ODOT 2019](#). This new five-year agreement expands the service area to a statewide scale and allows the CRPA to be used on high priority fish passage barriers. With both CRPAs, ODOT and ODFW continue to advance the Oregon Plan for Salmon and Watersheds habitat restoration goals, while allowing repairs to critical transportation infrastructure in locations that are lower priorities for fish passage in a cost-effective manner.

As a condition of the agreement, ODOT agreed to pay \$2 million into an ODFW-managed account to fund high priority fish passage projects off the state highway system to offset delays in meeting full fish passage criteria at culvert repair locations. This payment allows ODOT to use the agreement on 40 projects, with the opportunity for ODOT to pay an additional \$50,000 for each culvert repaired once the first 40 are complete. ODOT also committed to continue funding the ODOT Fish Passage Program to address the highest priority fish passage projects on the state highway system. In addition, ODOT funded two transportation liaison positions within ODFW, to coordinate the agreement's implementation and develop a database of ODOT culverts that includes fish presence, passage information, and a prioritization model.

The CRPA agreement is a crucial tool allowing ODOT to make meaningful progress by addressing culvert infrastructure problems, while demonstrating a benefit to NMF. ODOT and ODFW have measured success by documenting the number and cost of culverts repaired under this agreement, as well as the benefits of incremental fish passage improvements provided at

the repair sites. Additionally, NMF gain major benefits through off-highway high-priority fish passage compensation fund projects.

Programmatic Goals

The CRPA includes several key goals and sideboards for ODOT to conduct the culvert repair pilot program.

The goals of the CRPA include:

- a) Provide improved fish passage conditions at each culvert repair site.
- b) Address statewide fish passage priority barriers using the \$2 million fish passage fund in the most expeditious and efficient way practical.
- c) Improve state highway infrastructure conditions at each culvert repair site to address public safety.
- d) Generate information on the costs, impacts, efficiency, and effectiveness of the CRPA project approach.
- e) Develop a work plan to further identify resources and gather information on fish presence and barriers.

Programmatic Sideboards

The CRPA allows repairs to culverts that meet all of the following criteria:

- Culverts must be located on ODOT-owned or operated stream crossings and can be located anywhere in the state.
- Culvert repairs may provide (up to) an additional 25 years of culvert life.
- Repaired culverts must include fish passage improvements.
- Culverts can be rated as a high priority for fish passage, as determined by ODFW, provided all feasible passage improvements are conducted at the site.
- Culverts that provide access to Habitat Category 1 and tide gates are excluded. OAR 635-415-0025 (1) defines Category 1 Habitat and includes habitat that is irreplaceable, essential habitat for a fish or wildlife species, population, or unique assemblages of species.
- Sliplining is excluded from repair options.

Note: Culverts that are not within current or historic NMF habitat are not subject to fish passage laws and regulations and may be repaired outside of this agreement. In addition, ODOT may choose to implement full ODFW criteria fish passage or use the existing exemption or waiver process for fish passage for culvert repair or replacement outside the CRPA.

Purpose and Need

Figure 1: Repair and Replacement Costs vs Funding Summary

Description: Image summarizes typical culvert repair costs, typical replacement costs meeting fish passage criteria, and the resulting deferral.

Repair and Replacement Costs vs Funding

- Typical culvert repairs: \$50 K– \$250 K
- Typical culverts replaced to meet fish passage criteria: \$1.5M to \$12M
- Resulting in deferred repair and replacement



Culvert Inventory

There are approximately 35,000 culverts under the state highway system; most were installed prior to 1970 and are nearing the end of their design life. ODOT began developing systematic information on culvert infrastructure and condition in 2013. By the end of the 2018 field season, ODOT completed culvert inventory on 51 percent of the state highway system, including all of the Highway Management Team's priority routes. Priority routes are the most important highways for freight movement, connectivity with major population centers, and emergency response.

The culvert inventory estimated approximately 30 percent, or roughly 10,500, of ODOT's culverts are in poor or critical condition and need to be repaired or replaced in the near term to maintain the safety and integrity of the state highway system. The cost to replace all of these culverts in kind would be well over \$1 billion. This cost would be substantially higher for the installation of larger culverts or bridges to meet fish passage criteria.

Declining Transportation Funds

As the increased need for culvert repair and replacement is coming to light, federal funds for highway projects have been drastically reduced (from \$740 million in 2011 to approximately \$300 million in 2015). State gas tax revenues, the principal funding source for the ODOT Maintenance Program, also decreased relative to construction and inflation costs. Even with a new infusion of transportation funds from Oregon House Bill 2017, the need to be efficient with funding requires creative approaches for managing Oregon's culvert infrastructure.

Fish Passage Rules and ODOT's Fish Passage Program

Oregon's fish passage law was updated in 2001. This law and the implementing regulations (OAR 635-412-0005(9) a-d) require ODOT to address fish passage whenever there is new construction, replacement, or major repair of a culvert in habitat currently or historically occupied by NMF. To meet fish passage design criteria, most existing culverts need to be replaced with much larger culverts or bridges.

ODOT has a proven record of enhancing fish passage and contributing to the Oregon Plan for Salmon and Watersheds. ODOT's Fish Passage Program will continue to reopen access to salmon habitat by installing large culverts and bridges in locations ODFW identifies as high priorities for fish passage. From 1997-2016, ODOT completed 145 voluntary fish passage projects and restored access to 482 miles of NMF habitat. This is a voluntary investment in fish passage, because these projects were not completed as a result of a trigger event, an action such as construction which requires that fish passage be provided, or other regulatory requirements. ODOT continues to be committed to addressing high priority fish passage barriers on the state highway system, and as part of the CRPA agreement, has dedicated at least \$4.2 million annually towards these projects.

The Joe Creek culvert replacement project, Figure 2, completed by the ODOT Fish Passage Program, is one example of ODOT's commitment to improving fish passage and supporting the Oregon Plan for Salmon and Watersheds. The project replaced an undersized 8-foot diameter corrugated metal culvert with a 20-foot wide arch culvert. The Joe Creek fish passage project opened two miles of high-quality spawning and rearing habitat for coho and Chinook salmon and steelhead at the cost of \$1.6 million. The original culvert, installed in 1950, was undersized for the stream channel. This construction blocked anadromous fish from accessing the upstream habitat for more than half a century.

Figure 2: Joe Creek Culvert Replacement Project, Before and After

Description: The first photo shows Joe Creek before the replacement, a perched culvert with water cascading from it causing a barrier for fish passage. The second photo is after the culvert replacement, showing a 20-foot arch culvert with the stream flowing through it.



CRPA Process and Timelines

As a condition of the CRPA agreement, the agencies developed a streamlined project timeline. Construction of culvert repairs needs to coincide with regulated in-water work periods (IWWP), which usually occur during low flow summer months. The timelines developed allow for full opportunity to scope potential projects, conduct site visits, develop plans and allow for contracting processes.

- February 28, the year before construction (> 16 months from target IWWP): ODOT provides a list of potential CRPA projects to ODFW for review. ODFW conducts desk scoping for species and life history designations.
- June 1, the year before construction (12-13 months to IWWP): ODFW reviews and approves the draft list based on criteria of agreement, including;
 - a. NMF species historically and currently present.
 - b. Migratory timeframes of concern.
 - c. Existing fish passage impediments.
 - d. Recommendations to improve fish passage conditions.
 - e. Recommended in-water work window.
- October 1, the year before construction (10 months to IWWP): ODFW and ODOT staffs conduct site visits to all potential projects. During these site visits, ODOT and ODFW collaboratively develop culvert repair and fish passage improvements for each site. Team members base the design plan on site conditions and constraints, hydraulic conditions, and the needs of NMF. Site visit summary forms are filled out and signed by both agencies, helping to guide design.

- February 28, the year of construction: (5 months to IWWP): ODOT provides culvert repair and fish passage design concepts to ODFW for review and comment. If Endangered Species Act (ESA) species are present, designs are also sent to the National Marine Fisheries Service (NMFS) for review and approval.
- March 31, year of construction (3-4 months to IWWP): ODFW (and or NMFS) reviews each incremental passage design and documents concurrence with the design approach.
- [Construction during IWWP](#): Projects constructed with oversight by ODOT and ODFW staff.
- Post-construction: Projects are continually monitored at 1, 3, and 5-year increments, usually following high flow events, by ODOT and ODFW staff to ensure that fish passage improvements are functioning as designed. If fish passage improvements do not function as intended, then ODOT and ODFW collaborate on an approach to fix fish passage elements during the next available IWWP or as approved by regulatory agencies.

A discussion on these timelines is provided under the lessons learned section of this report.

ODOT Major Culvert Maintenance Engineer

In 2018, the Geo-Environmental section of ODOT designated the Major Culvert Maintenance (MCM) Program to oversee culvert repairs across the state. A senior culvert maintenance hydraulic engineer manages the MCM program, which helps identify potential projects, recommends appropriate repair actions, and funds culvert retrofit projects. The program also guides engineers and designers specific to the CRPA agreement and works closely with the ODOT Fish Passage and Large Culvert programs. Due to the addition of this position, ODOT was able to identify and address time-saving and efficiency-increasing procedural processes. This led to the creation and implementation of new CRPA initiation forms for scoping, design and submittals, and the creation of a quality assurance and review process for submittals. These forms and procedures were developed and tested in 2018 with the intent to fully implement them in 2019.

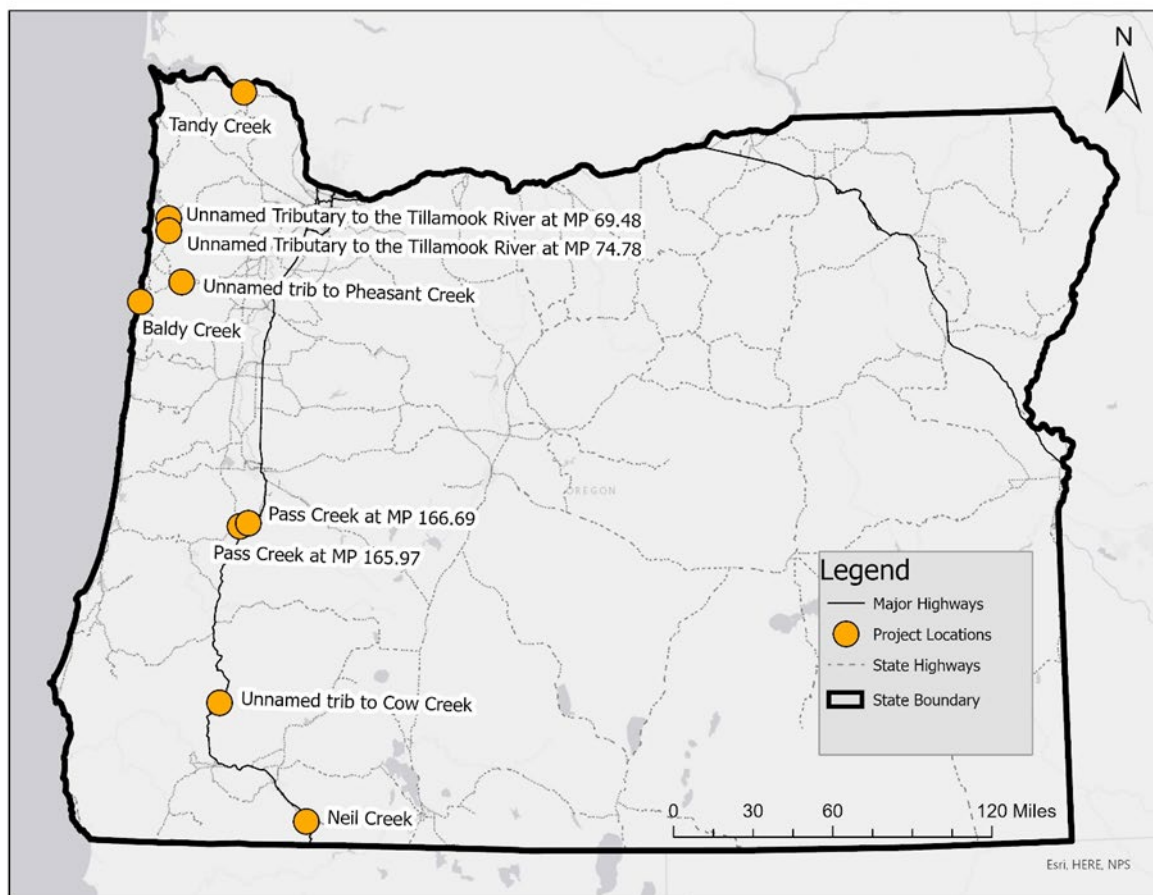
2018 Culvert Repair Projects

The CRPA report includes projects the year construction starts; however, projects are not always finished in one year. Likewise, construction is not necessarily initiated the year projects are approved and these projects are included in subsequent reports.

- In 2018, ODFW approved ODOT to repair nine culverts under the CRPA.
 - ODOT began construction at seven locations during the year, while two were delayed until 2019.
- Two additional projects constructed in 2018 were approved in previous years.
- In total, nine CRPA projects started construction in 2018, and are included in this report (Figure 3).

Figure 3: Locations of CRPA Projects that Began Construction in 2018

Description: Map of Oregon showing the locations of the nine CRPA projects discussed in the report.



Culvert Cost Analysis and Repair Summary

The cost to repair the nine culverts was \$1,254,400. The estimated cost to replace these culverts \$16.3 million. Through the CRPA, ODOT mitigated costs of **over \$15 million** to address these culverts, see Table 1. However, this cost avoidance should be evaluated relative to the design life provided by the approach. The repairs have added approximately 10-25 years of life to these culverts, whereas full replacements would have provided a new design life of 75+ years. However, even given the difference in life span for the two approaches, life cycle costs are much lower for the repair option. The total approximate cost for full replacement of the nine projects would have been \$16,305,000, the cost for total repairs was \$1,254,400, equaling a total cost deferral of \$15,050,600.

The 2018 projects were repaired with several different techniques.

- Five of the projects used an invert pave to add a layer of reinforced concrete in the bottom of the culvert to seal the invert, keep water in the culvert barrel, and provide a connection to complete the culvert circumference, thereby repairing the structural capacity of the pipe.
- Two projects used centrifugally cast concrete. In this technique, a thin layer of strong concrete is cast by a spinning head to line the full diameter of the culvert.
- Additionally, two other repairs used a cured-in-place liner that adds a new continuous layer around the circumference of the culvert, resulting in restored structural capacity.

The latter two techniques seal the entirety of the pipe, keeping water inside of the barrel and the structurally compacted soil outside the culvert intact.

Table 1: 2018 Culvert Repair Cost Analysis

Description: Table depicts the stream and location, the culvert dimensions, type of repair, cost of repair, and the approximate cost of a full replacement.

Stream Name	Hwy and MP	Diameter (ft)	Length (ft)	Repair	Full Fix Cost (approximate)	Repair Cost
Trib. to Pheasant Creek	OR-18, 16.03	3	80	Cured-in-Place Pipe Liner	\$1,100,000	\$40,000
Neil Creek	I-5, 10.42	8	435	Invert Pave	\$4,700,000	\$256,000
Pass Creek	I-5, 165.79	12	284	Invert Pave	\$3,300,000	\$217,000
Pass Creek	I-5, 166.69	8	234	Invert Pave	\$2,500,000	\$163,000
Trib. to Cow Creek	I-5, 84.91	4.5	244	Cured-in-Place Pipe Liner	\$1,800,000	\$223,000
Trib. to Tillamook River	US 101, 69.48	5	98	Invert Pave	\$750,000	\$63,500
Trib. to Tillamook River	US 101, 74.78	6.5	140	Invert Pave	\$850,000	\$90,700
Tandy Creek	US 30, 65.46	4	90	Centrifuge Cast Concrete	\$805,000	\$134,100
Baldy Creek	US 101, 116.35	4	45	Centrifuge Cast Concrete	\$500,000	\$67,100

Fish Passage Improvements Summary

2018 CRPA projects used several fish passage improvement techniques during construction. Table 2 summarizes the fish passage improvements at each culvert location. Most of these techniques were used to buffer high water velocities, provide resting and variable flow conditions in the culvert, and provide more water depth during low flow to facilitate passage. One of these projects included installing a rock weir downstream of the culvert outlet to backwater the culvert and reduce jump heights.

The total miles of potential NMF habitat upstream made available is 19.52 miles (the potential miles at Pass Creek at mile point 166.69 were not included in the total due to being included in the Pass Creek project at mile point 165.79.) The project descriptions for each culvert repair are provided below.

Table 2: Fish Passage Improvement Analysis

Description: Table depicts the stream and location, the potential miles of habitat to end of fish use or next full barrier upstream, passage improvement, and the potential NMF species above the repaired passage (columns five–eight).

Stream Name	Hwy and MP	Maximum Potential NMF Habitat Miles	Passage Improvement	Cutthroat Trout	Coho Salmon	Steelhead/Rainbow Trout	Pacific Lamprey
Trib. to Pheasant Creek	OR-18, 16.03	8.90	Offset Side Weirs	Present		Present	
Neil Creek	I-5, 10.42	4.89	Fish Rocks	Present	Present and ESA Listed	Present	
Pass Creek	I-5, 165.79	3.67	Fish Blocks and Downstream Weir	Present	Present and ESA Listed	Present	
Pass Creek	I-5, 166.69	0.20	Plastic Baffles	Present			
Trib. to Cow Creek	I-5, 84.91	0.20	Baffles	Present			Present
Trib. to Tillamook River	US 101, 69.48	1.79	Fish Rocks	Present	Present and ESA Listed	Present	

Stream Name	Hwy and MP	Maximum Potential NMF Habitat Miles	Passage Improvement	Cutthroat Trout	Coho Salmon	Steelhead/Rainbow Trout	Pacific Lamprey
Trib. to Tillamook River	US 101, 74.78	0.27	Fish Rocks	Present			
Tandy Creek	US 30, 65.46	0.65	Fish Rocks	Present	Present		Present
Baldy Creek	US 101, 116.35	2.62	Downstream Boulder Weir	Present	Present and ESA Listed		Present

Project Descriptions

OR 18 MP 16.03 Unnamed Tributary to Pheasant Creek Culvert Repair

Completed September 2018, Figure 3.

Pre-treatment Fish Passage Condition

This culvert drains an unnamed tributary to Pheasant Creek, a tributary to the Little Nestucca River. The tributary passes under OR 18, approximately 5.5 miles west of the city of Grand Ronde in Polk County, Oregon.

This 80-foot long culvert is a 36" diameter corrugated metal pipe (CMP), passing a stream with an estimated active channel width of 14 feet. The culvert's structural condition was considered poor, due to severe settlement and open joint issues. If left untreated, these issues could allow water to escape the culvert and erode the soil arch under the roadway, ultimately leaving the highway unsupported and unsafe. Hydraulic calculations show flow conditions at the culvert had velocities of 2.44 fps and flow depths as low as 1.5 inches (flows ranging between 5 percent and 95 percent of the daily exceedance stream discharge). This flow exceeded the ODFW fish passage criteria of 2 fps. Species using the habitat upstream of the culvert include cutthroat trout and possibly pacific lamprey. The culvert was a partial velocity barrier to these species, potentially blocking or delaying access to approximately 0.2 miles of habitat.

Post-treatment Fish Passage Condition

The degraded culvert was repaired with a cast-in-place pipe liner that sealed the joints and alleviated the settlement issues, keeping the water flowing inside the culvert. Fish passage was

improved with the addition of staggered one-piece polymer baffles with rounded edges. These baffles were placed to decrease the velocities within the culvert and offer ample hydraulic variation for NMF. The rounded edges of the baffles were an important fish passage detail due to the possibility of adult Pacific lamprey in the system. Post-treatment conditions were estimated to have velocities of 1.03 fps and flow depths of 6.7 inches, thus improving access to the approximate 0.2 miles of upstream habitat.

Figure 4: Unnamed Tributary to Pheasant Creek Culvert Repair Before and After

Description: Two images, the first displays water running through the culvert pre-repair. The second shows water running through the culvert post-repair.



I-5 MP 10.36 Neil Creek Culvert Repair

Completed September 2018, Figure 4.

Pre-treatment Fish Passage Condition

Neil Creek is a tributary to Bear Creek in the Rogue River Watershed and is located approximately 2.7 miles south of Ashland in Jackson County. The Neil Creek culvert crosses under Interstate 5 at mile point 10.36. Neil Creek is a perennial stream with an upstream drainage basin of 10.4 square miles. The basin has approximately 8.9 miles of habitat upstream of I-5 for cutthroat trout, steelhead, and rainbow trout.

This concrete box culvert is 435 feet long, eight feet wide, and eight feet tall. The culvert's condition prior to repair was poor due to invert degradation. Invert degradation allows water to saturate the soil surrounding the culvert. It also erodes away the soil beneath the culvert and can lead to settling. If left untreated, these issues can lead to the roadway becoming unsupported and unsafe. The hydraulic conditions within the culvert presented numerous issues, including passage barriers of increased jump heights over the old concrete weirs and high velocities during high flow.

Post-treatment Fish Passage Condition

The culvert invert and concrete weirs were repaired, amending the invert degradation issue. The repair of the concrete weirs improved fish passage. These lowered the velocity in the culvert and allowed for variation of hydraulic conditions through the culvert to improve NMF passage conditions to the potential 8.9 miles of habitat upstream.

Figure 5: Neil Creek Culvert Repair Before and After

Description: Two images, the first is the pre-repair view inside the concrete box culvert with old weirs on the invert. The second image is inside of the concrete box culvert post-repair with water running through it.



I-5 MP 165.97 Pass Creek Culvert Repair

Completed September 2018, Figure 5.

Pre-treatment Fish Passage Condition

This culvert conveys Pass Creek under I-5 approximately 7.7 miles south-west of Cottage Grove in Douglas County, Oregon. Pass Creek is a tributary to Elk Creek in the Umpqua River basin.

The 12-foot diameter CMP is 284 feet long and drains an area of 5.27 square miles. The culvert's surveyed condition was considered poor due to corrosion and a missing section of the invert. If left untreated, this could become a potential hazard to the traveling public due to water saturating and destabilizing the surrounding soil arch and roadbed, leading to settlement of the culvert that could leave the roadway unsupported.

The stream has an estimated active channel width of 15 feet. Water velocities during high flow conditions and shallow water depths during low flow conditions created a partial barrier for the upstream movement of fish through the culvert. Cutthroat trout, steelhead, rainbow trout, and ESA listed coho salmon were potentially blocked or delayed from accessing the approximately 4.89 miles of upstream habitat due to these conditions.

Post-treatment Fish Passage Condition

The culvert was repaired with a 6-inch paved invert treatment. This allowed for the degraded invert condition to be restored, keeping the water inside the barrel. Installing an 18-inch pre-cast concrete fish blocks at 10-foot intervals through the pipe improved fish passage. These blocks slow water velocities during high flow events, increase flow depth during low flow conditions, and create flow complexity within the culvert. The resulting conditions improve fish passage and increase access to the 4.89 miles of upstream habitat.

Figure 6: Pass Creek Culvert Repair Before and After

Description: Two images, the first shows the outlet end of the culvert pre-repair with water running through it. The second image shows the outlet of the culvert post-repair with water running through it.



I-5 MP 166.69 Pass Creek Culvert Repair

Completed August 2018, Figure 6.

Pre-treatment Fish Passage Condition

This culvert conveys Pass Creek under I-5 approximately 6.0 miles south-west of Cottage Grove in Douglas County, Oregon. Pass Creek is a tributary to Elk Creek in the Umpqua River basin. This culvert is an 8-foot circular CMP and is 234 feet long. In this location, Pass creek has an estimated active channel width of 15 feet. The culvert was considered to be in critical condition, mainly due to invert damage, water piping (water flowing on and around the outside or damaged sections of the pipe), and some end treatment issues that, if left untreated, could allow water to saturate the soil surrounding the culvert. This could cause the culvert to settle and the soil to erode, ultimately leaving the roadway unsupported.

Fish passage issues included high velocities during high water events, shallow depths during low flow events, and a small perch at the culvert outlet. These passage issues potentially prevented or delayed access for cutthroat trout, coho salmon, steelhead, and rainbow trout to the 3.67 miles of available upstream habitat.

Post-treatment Fish Passage Condition

The culvert was repaired with a 6-inch paved invert. This restored the invert integrity, resolved the water piping issues, and improved the end treatment to help keep the water flowing through the culvert and not around it and in the surrounding soil. Installing 10- inch pre-cast concrete fish blocks at 5-foot intervals throughout the culvert improved fish passage. The fish blocks increase flow depths during low flow, create eddies and flow complexities within the culvert, and reduce velocities during high flow. A weir was constructed downstream of the culvert outlet to increase the outlet pool elevation and reduce the 6-inch perch, allowing for improved access to the 3.67 miles of habitat upstream.

Amendment (Summer 2019)

Post-construction monitoring of the project documented that the specified rocks in the downstream weir were undersized, was not embedded into the channel, and not fully sealed, allowing water to flow through the rocks rather than maintaining surface flow. The following winter, a high water event displaced the rocks of the weir. Although subsequent high flow events recruited natural streambed material in the proximity of the original weir location, the ultimate backwater condition at the culvert outlet does not improve fish passage to the extent designed. Monitoring of the project continues to see how the natural recruitment of sediment will ultimately backwater the site. If the site does not backwater to the extent designed, a modification will be made during the applicable IWWP.

Figure 7: Pass Creek Culvert Repair Before and After

Description: Two images, the first shows the outlet end of the culvert pre-repair with water running through it. The second image shows the inside of the outlet of the culvert post-repair with water running through it.



Note on Pass Creek Culverts

These two projects on Pass Creek are part of a series of culvert improvements done along a two-mile stretch of I-5. A culvert at mile point 165.9 was repaired under the CRPA in 2017. The two culverts repaired in 2018 were at mile points 165.97 and 166.69. Additionally, two culverts are planned for 2019 and 2020 at mile points 167.04 and 167.17, respectively. Pass Creek flows south along I-5. Therefore, the increasing mile points correspond to movement upstream in the Pass Creek watershed. The amount of habitat above each culvert is reported in each CRPA report.

I-5 MP 84.91 Unnamed Tributary to Cow Creek Culvert Repair

Completed August 2018, Figure 7.

Pre-treatment Fish Passage Condition

This culvert passes an unnamed tributary at approximately 14 miles south of Canyonville, Oregon, leading into Cow Creek within the Umpqua River basin.

The culvert is an arch culvert 244 feet long and 36 tall and 54 inches wide with an estimated active channel width of six feet. The culvert was in critical condition due to severe distortion creating a structural blockage of the pipe and open joints. These issues, if left untreated, could compromise the safety of the roadway due to the surrounding soil arch eroding away through the open joints caused by the distortion, ultimately leaving the above roadway unsupported.

The intermittent tributary goes dry during the summer low flow period but provides refuge for cutthroat trout during winter higher flows. ODFW predicts the velocity through the culvert to be over 2 fps during much of the high flow season and would prevent or impede passage upstream. There are 0.2 miles of upstream habitat for cutthroat trout that was possibly inaccessible due to these conditions.

Post-treatment Fish Passage Condition

This critical condition culvert was repaired with a cured in place pipe liner, which realigned the distortion, closed the joints, and allowed for removal of the structural blockage. Through this repair, the surrounding soil arch is no longer exposed to the flowing water and, in turn, at risk of erosion. Installation of plastic baffles to provide hydraulic complexity and flow variations through the culvert improved fish passage. This aims to slow the water velocity during higher flow periods and improves access to the upstream 0.2 miles of high water refuge habitat.

Figure 8: Unnamed Tributary to Cow Creek Culvert Repair Before and After

Description: Two images, the first looks at the end of an arch culvert pre-construction, grass growing along the top, and thin layer of sediment in the bottom. The second image is post-repair, looks at the end of the arch culvert, it is surrounded by rock with baffles installed inside.



OR 101 MP 69.48 Unnamed Tributary to the Tillamook River Culvert Repair

Completed September 2018, Figure 8.

Pre-treatment Fish Passage Condition

The culvert passes an unnamed tributary that leads to the Tillamook River in Tillamook County, approximately 3.5 miles south of Tillamook, Oregon.

This tributary drains an area of 0.67 square miles and flows into the Tillamook River just downstream from the culvert. Water through the culvert is backwatered from the Tillamook River during high flows. Although flow in the tributary is low during the summer months, it provides refuge habitat during moderate and high flows.

The corrugated metal culvert is five feet wide and 98 feet long, with an estimated 11-foot wide active channel width. It was considered to be in critical condition due to a rusted invert condition. If left untreated, the soil below the culvert could erode allowing the culvert to settle into that open space. Ultimately then allowing water to flow around the culvert, saturating and eroding the above soil and roadbed to leave the roadway unsupported.

The velocity within the culvert at high flow was modeled to be 4.44 fps with a flow depth of 3.9 inches. This flow exceeds the ODFW fish passage criteria of 2 fps. Species using the tributary include cutthroat trout, ESA listed coho salmon, steelhead, and rainbow trout, with a potential 1.74 miles of habitat upstream.

Post-treatment Fish Passage Condition

An invert pave was used to repair the culvert, allowing the bottom of the culvert to be resurfaced and hold the water inside the culvert. Adding 20-inch fish rocks to create flow variations and to slow water velocities improved fish passage. The modeled water velocity after construction was 1.77 fps at a depth of 7.3 inches. This lowered velocity and increased hydraulic variation within the culvert, improving access to the 1.74 miles of habitat upstream for juvenile rearing of salmon and steelhead and spawning and rearing for coastal cutthroat trout.

Figure 9: Unnamed Tributary to the Tillamook River Culvert Repair

Description: Two images, the first is the inside of the culvert pre-repair. The second is inside the culvert post-repair. Here we can clearly see concrete on the invert and fish rocks installed.



OR 101 MP 74.78 Unnamed Tributary to the Tillamook River Culvert Repair

Completed September 2018, Figure 9.

Pre-treatment Fish Passage Condition

This culvert carries an unnamed tributary of the Tillamook River in the Tillamook basin, located approximately nine miles south of the city of Tillamook within Tillamook County.

The culvert is an elliptical corrugated metal pipe six and a half feet in height, five feet in width, and 140 feet in length. Its condition was critical due to a severely corroded invert that could potentially, if left untreated, allow water to saturate the surrounding soil arch and roadbed. If allowed to worsen, this could then lead to settlement of the pipe and erosion of the soil, ultimately leaving the roadway unsupported. The estimated active channel width is 10 feet.

The tributary contains cutthroat trout, with a potential 0.27 miles of habitat located upstream of the culvert. One of the most pressing fish passage was velocity and depth, measured at 3.78 fps with flow depths of four inches.

Post-treatment Fish Passage Condition

The culvert was repaired with an invert pave. This resurfaced the culvert's invert, lowering the previous concern of saturation, erosion, and the lack of support for the roadway. Installation of 24-inch fish rocks improved fish passage at this culvert. These provided hydraulic breaks and lowered water velocity to 1.5 fps at a flow depth of 7.5 inches. By reducing the velocity and increasing depths through the culvert and creating hydraulic variation within the culvert, there is improved passage to the 0.27 miles of upstream habitat.

Figure 10: Unnamed Tributary to the Tillamook River Culvert Repair

Description: Two images, the first is looking down at the mitered slope end treatment pre-repair. The second is looking down at the mitered slope end treatment post repair.



U.S. 30 MP 65.46 Tandy Creek Culvert Repair

Completed September 2018 Figure 10.

Pre-treatment Fish Passage Condition

Tandy Creek is a tributary of Westport Slough, which connects to the Columbia River. The culvert is located at mile point 65.46, approximately four miles west of Clatskanie, in Columbia County, Oregon. The Tandy Creek culvert is one of two culverts that drain a 1.62 square miles

drainage area. The creek splits around an agricultural field and rejoins into one watershed just downstream of this culvert.

The active channel width of this section of Tandy Creek is approximately nine feet. The four foot wide, 90-foot long culvert is tidally influenced. Before the repair, the culvert was backwatered during high tide, but became perched at low tide with a 3.5-foot jump. The creek is home to cutthroat trout, coho salmon, and Pacific lamprey, additionally, all these species would benefit to improved access to the potential 2.62 miles of habitat upstream of the culvert. The culvert itself was in poor condition due to general barrel issues such as heavy corrosion, but also due to the presence of a bulge in the crown under the roadbed. This was concerning because if left untreated, the bulge could weaken and give way. The soil and roadbed compacted above the culvert could then erode away, leaving the above roadway unsupported.

Post-treatment Fish Passage Condition

Centrifugal cast concrete was used to line the entire pipe. This reinforced the whole structure of the culvert, including the crown bulge. A boulder weir was installed downstream to backwater the culvert outlet, addressing the fish passage barrier. This increased the depth by six inches during low tide, overall minimizing outlet's perch and decreasing the jump height. These repairs improve access to the 2.62 miles of upstream habitat, including over one mile of juvenile coho rearing habitat.

Amendment (Summer 2019)

The downstream weir did not seal enough to adequately backwater the culvert when it was installed initially. Adjustments were made in the following months with the installation of additional rocks and fine sediments into the weir. The result of the adaptive management work continues to be monitored to ensure the weir is functioning as designed.

Figure 11: Tandy Creek Culvert Repair

Description: Two photos, the first shows the outlet end of the culvert recently dug out of the mud pre-repair, with water running through it. The second photo shows standing water at the post repaired outlet of the culvert.



U.S. 101 MP 116.35 Baldy Creek Culvert Repair

Completed September 2018 Figure 11.

Pre-treatment Fish Passage Condition

Baldy Creek is a direct tributary to the Pacific Ocean. The stream flows through the small town of Nelscott, north of Lincoln City, in Lincoln County, Oregon. Baldy Creek has a basin area of 0.69 square miles and a six-foot active channel width at the highway crossing. The 45-foot long, three and a half foot wide corrugated metal culvert is undersized for average flows. It presents a velocity barrier to cutthroat trout, with an average velocity of 5.01 fps. The culvert was in critical condition due to open joints, severe corrosion of the invert, and cracks in the metal. With time, these conditions could lead to the further collapse of the culvert, water outside the barrel, and the erosion through the open joints of the surrounding soil arch and roadbed, eventually leaving the roadway unsupported and unsafe. The culvert is partially blocking access to 0.65 miles of potential habitat.

Post-treatment Fish Passage Condition

The culvert was replaced with a centrifuge cast concrete pipe liner, which sealed the joints and the cracks and covered the degrading invert. Through these repairs, water is now staying within the culvert and lessened the pre-repair structural concerns. Along with the liner, 15-inch fish rocks were installed to provide hydraulic complexity in the culvert and slow water velocities. The estimated velocity in the culvert after treatment is 1.92 fps, which meets ODFW's requirements for fish passage for adults and juvenile NMF. By decreasing velocity and increasing depth there is now improved access for NMF to the 0.65 miles of upstream habitat.

Figure 12: Baldy Creek Culvert Repair

Description: Two images, the first shows water running through the inside of the culvert pre-repair. The second image shows water running through the culvert with fish rocks post-repair.



Monitoring Strategy

ODFW and ODOT developed a monitoring strategy that evaluates fish passage performance at each of the repaired culverts. Monitoring documents pre-project conditions (see Project Initiation Forms – Appendix 2), and post-project conditions (photographs shown in Project Descriptions), and initial evaluation of fish passage improvements (see Project Descriptions). ODOT monitors the fish passage improvements at each project to verify that they function as intended. As part of the CRPA agreement, monitoring is completed after winter and spring channel-forming high flow events in years 1, 3, and 5 post-construction.

ODOT remains responsible for ongoing maintenance to ensure the improved passage continues to function at all CRPA sites. However, once monitoring deems the fish passage improvement at a culvert is successful, assessments are less frequent. For monitoring in 2018 and previous years, monitoring has involved an ODFW liaison and the ODOT aquatic resources lead visiting each CRPA at least twice a year during different flows to determine if the CRPA project is successful or in need of modifications. When monitoring reveals a site where fish passage improvements do not meet the designed standard, additional work is planned to bring the sites into compliance. Alternatively, like the Pass Creek culverts, sites continue to be monitored to determine the extent of fish passage improvements and to ensure that those improvements are maintained over time. ODOT is currently developing a standardized monitoring form to aid in tracking and reporting the results of each repair.

Lessons Learned

Several opportunities to improve the implementation of the agreement were apparent in 2018, and are discussed below.

Information Management

Scoping and identifying projects for the CRPA each year is challenging and takes extensive amounts of time. ODOT's culvert inventory is unfortunately incomplete and does not contain substantial information on fish presence or habitat availability for all culverts on the highway system. Due to this information gap, field visits with ODFW and ODOT biologists are required to make final determinations regarding fish presence at each proposed repair location. With a more complete data set, identification and selection of repair projects could be accomplished more efficiently.

Out of Barrel Treatments

Tandy Creek and Pass Creek from the 2018 projects included out of barrel treatments to improve fish passage. Some out of barrel treatments include rock weirs or a roughened channel at culvert outlets to address jump heights into the culvert. The installation and performance of the channel spanning weirs installed provided several lessons learned and will help inform future implementation of similar structures. These lessons include:

- A project manager should be on-site to ensure the project is implemented as designed and ensure the contractor uses the correct materials as described in the specifications.
- Have an engineer, hydrologist, and or biologist on-site during weir construction to help field fit structures to provide the desired hydraulic relief while also allowing for low flow passage channels for fish migration. Weirs can themselves become additional passage barriers if not installed correctly.
- Continuously monitor the weir at low and high flow events. Many of these structures require several high water events to seal fully and settle. They may require adaptive management work to ensure the weirs continue to function in years following installation.
- Utilize appropriate size and type of streambed substrate materials to prevent subsurface flow, localized scouring, and loss of weir materials during high flow events.
- Designing and constructing the weirs to backwater the culvert outlet at elevations that include the repair work in the culvert, such as the new concrete layer, fish rocks, and other infrastructure added as part of the culvert repair. Install weirs at a higher backwater elevation above the insert than designed to account for settling, especially in tidal or fine substrate heavy work areas.
- Projects implemented for the CRPA from 2016 through the current projects, appear to be more reliably successful when out of barrel treatments are roughened channels rather than rock weirs.

In-Barrel Treatments

Eight of the nine culvert CRPA projects implemented in 2018 included in-barrel treatments for fish passage improvements. Most treatments consisted of baffles or fish rocks. All in-barrel treatments were effective at improving fish passage. However, one site, Neil Creek, included weirs in the culvert. These weirs create harmonic flow patterns during specific water velocities. The harmonic flow patterns are thought to reduce the ability of fish to pass during these conditions. Lessons learned about in-barrel treatments include:

- When installing vertical cement weirs within a culvert, a hydraulic engineer needs to space these appropriately to account for the energy in the system to avoid harmonic flow patterns.
- Fish rocks need to be inspected before installed to ensure they are sized to match the approved design specifications.

Pre-project Meeting with the Contractor

Hold a pre-project meeting with the contractor prior to project implementation to discuss the following:

- Temporary water management.
- Fish salvage timing.
- Equipment staging.
- Site-specific constraints.
- Project area access.
- Materials needed, as described in the specifications.

This meeting allows the contractor to ask site-specific questions and develop a detailed plan with ODOT construction personnel prior to work beginning.

Hydraulic Modeling

CRPA projects can benefit from hydraulic modeling. Due to the lack of hydraulic modeling done before repair, there was little to no documentation of the exact water velocities. In turn, projects lacked numeric evidence that velocity was a fish passage issue and that it was improved after repair. When hydraulic modeling is done before treatment ODOT and ODFW can ensure that there is capacity for in-barrel treatments, along with documenting that velocities are an issue for fish passage and will be improved with treatment.

Timelines

Overall, the timelines identified in the CRPA agreement streamlines project development and delivery compared to full culvert replacement projects. On some projects, the timelines have been more difficult to meet, and are usually associated with sites requiring extended time for scoping, engineering, and planning.

Desk and field scoping of potential projects continues to become more efficient as ODOT region and statewide staff have become more familiar with the sideboards of the agreement.

Engineering guidance has been developed specific to these types of culvert retrofits, and overall design timelines have improved. For projects that do not require right of way easements or purchase, utility relocation, or other work outside of the culvert barrel, this timeline has been found to be effective in streamlining coordination and project delivery.

A few projects have been delayed outside of the timeline specified in the agreement. Federally-funded corridor projects, some with over 100 culverts, take much longer to scope and design compared to single culvert projects. Projects requiring right of way for channel work or access can be delayed up to a year or more. Federal permitting processes can also delay design and approval due to increased review and turnaround times. The construction of some culvert retrofit approaches, such as centrifugal cast concrete, require special equipment and knowledge to install, leading to limited or no bids during project the public bidding process. Culvert emergency repairs typically do not allow for full scoping and or design based on need to implement the project for public safety reasons.

As more projects are completed under the CRPA, ODOT and ODFW staffs are finding more ways to cross walk the timelines of the agreement to federally-funded corridor projects. Projects potentially requiring right of way, utility, or federal permitting coordination are identified early in the desk and field scoping process, allowing for extended timelines and planning. More contractors are bidding on culvert repair projects as technologies and construction approaches become more prevalent in the contracting field. This timeline should be revisited in future agreements; however, overall it has been found to be effective in streamlined project development and delivery.

Culvert Paving and Outlet Perch

Four of the culverts repaired in 2018 used an invert pave. In other words, lining the bottom of the culvert with concrete; this is shown in Figure 12. This method restores the culvert's structural integrity, seals any perforations, and covers rusting corrugated metal pipe. When hydraulic capacity exists, up to 6" of concrete with supportive rebar is installed on the invert and up the sides of the culvert throughout its length. One of the lessons learned in this repair approach is that extending the new concrete to the culvert's outlet can create a perched condition in relation to the receiving pool, particularly during low flow periods, which means that the jump height for fish to access the culvert and any upstream habitat has increased by potentially 6" plus. This was a particular issue for repairs done on Pass Creek, where the combination of increased perch height and downstream weir adjustments resulted in less than expected backwater conditions.

If this treatment is proposed to repair a culvert in the future, it is advised that the potential perch be considered during scoping and design. This issue can be alleviated through the additional use of an out of the barrel treatment. A rock weir downstream to backwater the

outlet or tapering the concrete repair as the concrete is placed in the outlet section are two suggestions.

Figure 13: Invert Pave Example



Outreach

In 2018, all of the CRPA projects came from ODOT Regions 2 and 3. The CRPA is a beneficial tool designed to be used statewide. With further outreach in Regions 1, 4, and 5, more project planners will understand the applications of the agreement. With this additional outreach project, planners can more readily select appropriate projects when they are available.

Additional outreach efforts from both ODOT and ODFW can help highlight the unique and successful approaches of this partnership. Future repair agreements will need support from both agencies, and outreach targeting the cost efficiency and benefits to NMF can help inform future funding and staffing needs. Likewise, outreach efforts showcasing the agreement to the general public can help provide transparency into the effort to maintain the state highway system in an ecologically and fiscally responsible manner.

Compensation Projects

The CRPA included a provision that ODOT provides ODFW with \$2 million to address the highest priority fish passage projects in the state off of the ODOT system. This funding is to offset the delay in achieving full fish passage criteria at the culvert repair locations. In addition to the passage improvements at each repair location, the compensation package demonstrates a clear benefit to NMF over providing full passage at each of the repair locations at this time.

In 2018 ODFW requested grant applications for projects to fund with the compensation funding. ODFW evaluated these proposed projects for benefits to NMF, based on:

- Habitat quantity and quality.
- Species composition.
- Funding need.
- Cost/benefit ratio.
- Contribution to fish conservation and recovery.

Projects identified in the 2013 ODFW Fish Passage Priority List and/or a Conservation and Recovery Plan were given preference. Nine projects were selected for funding (Figure 13, Table 3). When all nine projects are complete, they will provide access to 313 miles of good and excellent quality habitat for many species of NMF (Table 4). The compensation projects will be described in detail in the CRPA completion report at the end of the pilot project.

Figure 14: Locations of the ODFW Compensation Fund Projects Selected in 2018.

Description: Map of Oregon showing the locations of the ODFW compensation fund projects selected in 2018.

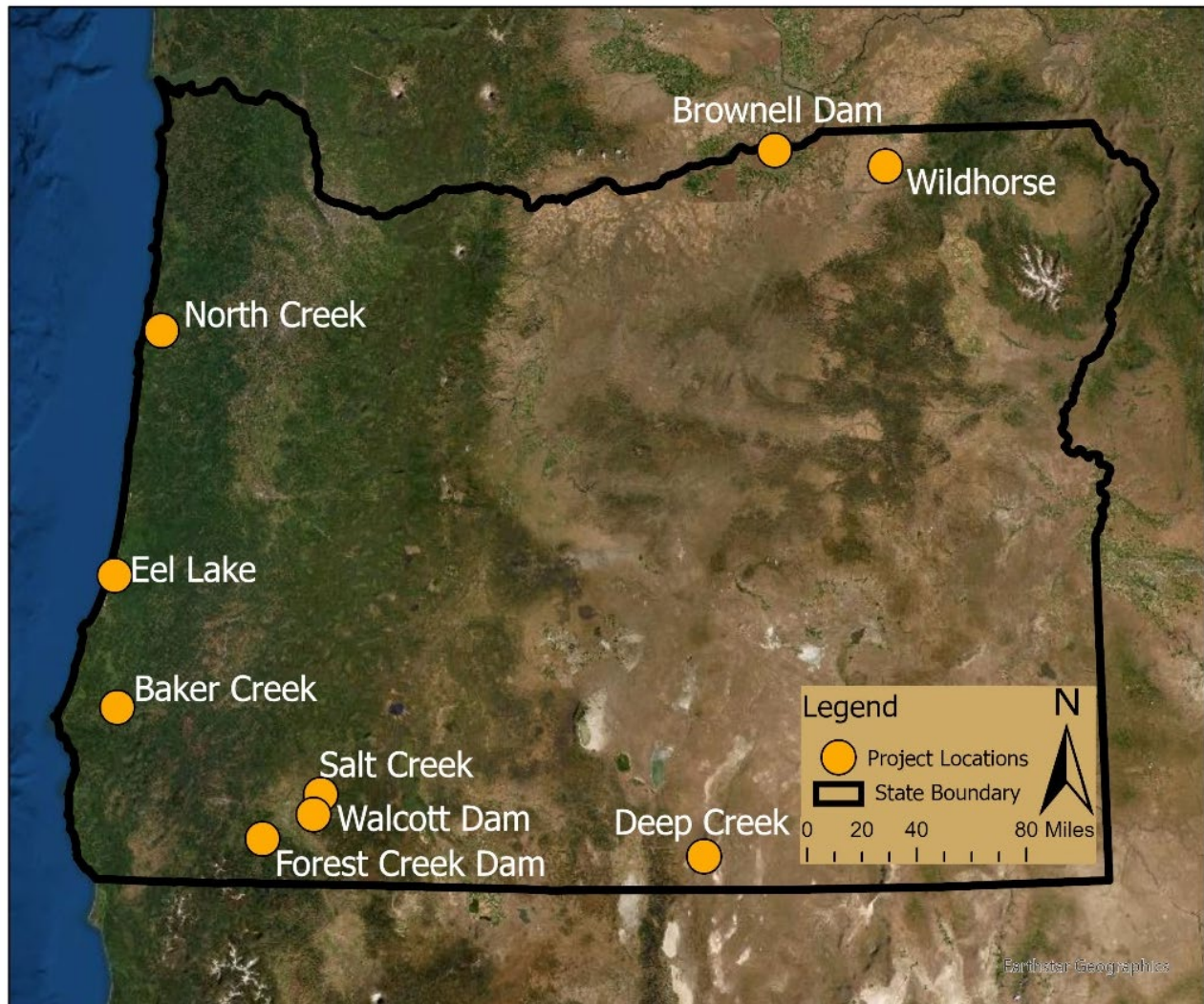


Table 3: ODFW Compensation Projects Synopsis for the CRPA

Table includes each project, the completion date, the benefit to NMF, the project and the project location.

Project Name	<u>Actual</u> or Projected Completion Date	Habitat Access Provided to NMF (miles)	Project Cost	Funds Contributed by ODOT	County
Deep Creek	12/11/2019	3	\$504,120	\$50,000	Lake County
Baker Creek	11/1/2019	2	\$678,764	\$200,000	Coos County
North Creek	10/17/2019	13	\$966,664	\$145,000	Lincoln County
Brownell Dam	8/2/2018	237	\$138,785	\$50,000	Umatilla County
Eel Lake	8/30/2019	4	\$47,314	\$10,000	Coos County
Forest Creek Dam	9/24/2019	6.4	\$177,043	\$113,375	Jackson County
Salt Creek	8/1/2018	7.5	\$85,121	\$17,000	Jackson County
Walcott Diversion	7/30/2019	25	\$268,043	\$100,000	Jackson County
Wildhorse Creek	11/4/2019	15.4	\$667,964	\$140,000	Umatilla County

Table 4: Fish Species Summary for ODFW Compensation Projects

Table includes the project site and the NMF species present, a check mark indicates presence.

Species	Deep Creek	Baker Creek	North Creek	Brownell Dam	Eel Lake*	Forest Creek Dam	Salt Creek	Walcott Diversion	Wildhorse Creek
Cutthroat Trout		✓	✓			✓	✓		✓
Coho Salmon		✓		✓		✓	✓	✓	✓
Redband Trout	✓			✓					
Steelhead/Rainbow Trout		✓	✓	✓		✓	✓	✓	✓
Chinook Salmon		✓	✓	✓		✓	✓	✓	
Pacific Lamprey		✓	✓	✓	✓			✓	✓

Species	Deep Creek	Baker Creek	North Creek	Brownell Dam	Eel Lake*	Forest Creek Dam	Salt Creek	Walcott Diversion	Wildhorse Creek
Brook Lamprey					✓				
Klamath Smallscale Sucker								✓	
Warner Sucker	✓								

* Additional species of NMF are present in Eel Lake; however, the fish passage project was specifically designed to benefit lamprey.

Conclusion

In 2018, the CRPA project continued to be a valuable method of extending the working life of failing and degraded culverts on ODOT's highway infrastructure, while providing enhanced passage for NMF.

Annual cost avoidance of over \$15 million dollars was realized through the ability to fix culverts under a streamlined programmatic process. Access to over 19 miles of habitat were enhanced for NMF at culvert enhancement locations. Also, nine projects were selected through the ODFW-managed compensation fund that, when completed, will provide improved habitat access for NMF to over 313 miles of stream habitat.

Continued monitoring and reporting of the success of the CRPA program will inform future adaptations and program development. The agreement demonstrates successful interagency cooperation in maintaining the highway system for the traveling public, saving taxpayer dollars, and improving access to critical aquatic habitat for ESA listed species.

Appendix 1: Culvert Repair Programmatic Agreement

**ODOT CULVERT REPAIR
PROGRAMMATIC AGREEMENT PILOT PROJECT
Final 12-8-2017**

The parties to this Programmatic Agreement, (hereafter "Agreement") are the Oregon Department of Fish and Wildlife (ODFW), and the Oregon Department of Transportation (ODOT), both agencies of the State of Oregon.

I. PURPOSE

1. It is the policy of the State of Oregon to provide for upstream and downstream passage for native migratory fish in all waters of this state in which they are currently or have historically been present, as described in Oregon Revised Statute (ORS) 509.585, Oregon Administrative Rule (OAR) 635-412-0020, and envisioned by the Oregon Plan for Salmon and Watersheds (Executive Order 99-01).
2. It is the Mission of ODOT to provide a safe, efficient transportation system that supports economic opportunity and livable communities for Oregonians.
3. Pursuant to ORS 509.585 and OAR 635-412-0020, certain actions, or "trigger events,"¹ at "artificial obstructions"² where native migratory fish (as defined in OAR 635-412-0005(32)) are currently or were historically present require the review and approval of fish passage by ODFW or the Oregon Fish and Wildlife Commission (OFWC) prior to those trigger events occurring. OAR 635-412-0020(3)(b) allows ODFW to grant "programmatic approval" of a fish passage plan for multiple artificial obstructions of the same type.
4. ODOT owns and operates a number of culverts as part of its transportation system. ODOT desires the opportunity to conduct repair activities on their culverts to meet the original life expectancy of the culvert structure. These activities (Appendix A) may constitute a fish passage trigger event as defined by OAR 635-412-0005(9).
5. This Agreement is intended to serve as the ODFW fish passage approval for the short-term repairs of ODOT culverts associated with this pilot project that meet the requirements and conditions of this Agreement (including Appendix A).
6. The goals of this Agreement include:
 - a) Provide improved fish passage conditions at each culvert repair site
 - b) Address statewide fish passage priority barriers using the fish passage fund (defined in Section III(3) of this agreement) in the most expeditious and efficient way practical
 - c) Improve State highway infrastructure conditions at each culvert repair site to address public safety
 - d) Generate information on the costs, impacts, efficiency, and effectiveness of the culvert repair pilot project approach
 - e) ODOT and ODFW will develop a work plan and identify resources to develop information on fish presence and barrier status on the State highway system and include this information in the ODOT State Highway Drainage Facility Management System (DFMS)

¹ "Trigger events" for the purposes of this Agreement shall mean, with respect to an "artificial obstruction" (defined in OAR 635-412-0005(3)) located where native migratory fish are currently or were historically present: "construction" activities (defined in OAR 635-412-0005(9)), "fundamental changes in permit status" (defined in OAR 635-412-0005(25)), or "abandonment".

² "Artificial obstruction" means any dam, diversion, dike, berm, levee, tide or flood gate, road, culvert or other human-made device placed in the waters of this state that precludes or prevents the migration of native migratory fish.

II. APPLICABILITY

1. This Agreement applies to ODOT, including its independent contractors, when repairing ODOT owned culverts. It does not apply to other State or local agencies, or private persons.
2. This Agreement applies when ODOT culvert repair actions covered by this pilot project constitute a "trigger event" to Oregon's Fish Passage Policy. The Agreement identifies and determines how ODOT shall proceed as per the terms of this Agreement. ODOT remains responsible to address and comply with fish passage laws for activities and situations not covered by this Agreement.
3. Under this Agreement only ODFW may determine that native migratory fish are not currently and were not historically present at a site; however ODOT may assume presence of native migratory fish.
4. This Agreement applies to culverts that meet all of the following criteria:
 - a) Culverts located within the State of Oregon;
 - b) Culverts not identified on the ODOT ten year passage implementation plan.³
 - c) Culverts located in or which would prevent access to Habitat Category 1⁴ habitat are excluded.
 - d) Culverts with tide gates are excluded.
 - e) Full traditional culvert slip-line repair treatments are excluded.

III. PROVISIONS OF THE AGREEMENT

1. ODOT will be permitted to conduct the culvert repair activities described in appendix A through the 5-year term of this Agreement. Culvert replacements are not authorized by this Agreement.
2. ODOT will ensure that fish passage improvements⁵ occur at each culvert repaired under this Agreement, with the goal of maximizing native migratory fish passage to the extent feasible at each site. Culverts identified as a high fish passage priority on the current ODFW-ODOT Culvert Fish Passage Priority list are eligible for repair under this programmatic provided that fish passage is significantly⁶ improved as part of the repair project.

³ ODFW and ODOT will jointly develop a 10 year passage implementation plan for ODOT to address fish passage at High Priority sites utilizing the ODOT Fish Passage Program funds. Projects not identified on this implementation plan are eligible for the Culvert Repair Programmatic Agreement.

⁴ Habitat Category I is defined in OAR 635-415-0025(1) and include habitats that are irreplaceable, essential habitat for a fish or wildlife species, population, or a unique assemblage of species and is limited on either a physiographic province or site specific basis, depending on the individual species, population or unique assemblage.

⁵ Fish passage improvements may include but are not limited to the following treatments: weirs, baffles, fish rocks, roughened channels, rock weirs, or other treatments within or outside the culvert that decrease water velocities, increase water depths, or reduce jump heights. ODFW-ODOT Liaison will work with ODOT to ensure site specific fish passage improvements are appropriate for the fish species and site conditions. If fish passage exists and cannot be further improved at ODOT's culvert repair site, fish passage improvements may occur at the next passage barrier up or downstream of ODOT's culvert as negotiated on a case by case basis. The goal of addressing passage up or down stream of ODOT's culvert is to ensure that a cumulative net benefit is realized by the fish population at the trigger site.

⁶ For High Priority Fish Passage Barriers ODOT will address everything possible and necessary at the project site to improve fish passage without replacing the structure itself. This includes improving outlet conditions (where applicable) to address jump height into the culvert and/or provide a backwater condition at the culvert outlet.

3. ODOT will provide ODFW fish passage restoration funds to offset the delay in full fish passage at the repair culverts as a result of this Agreement. This passage restoration fund account will be funded with \$2 million dollars at the beginning of the agreement to offset the delay in passage for the first 40 culverts repaired under the agreement. For each culvert repaired after the first 40, ODOT will contribute an additional \$50,000 dollars to the fund. ODOT anticipates repairing approximately 20 culverts each year under the five year agreement for a projected total of 100 culverts repaired and \$5 million dollars of restoration funding.
4. ODFW will manage and administer these funds to specifically address high priority fish passage projects statewide regardless of ODOT ownership and independent of geographic location. ODFW will use generally accepted accounting practices to manage these funds and shall ensure these funds are allocated in the most expeditious and cost effective means while maximizing benefit to native migratory fish.
5. ODOT will continue to fund at least \$4.2 million annually into the ODOT Fish Passage Program for the term of this agreement. This funding is separate and in addition to the ODFW fish passage restoration funds described in section III (3) and funding for the liaisons described in section III (8) of this agreement. The ODOT Fish Passage Program funding will be used to address the ten year passage implementation plan administered by ODOT.
6. During the year prior to the target year for proposed culvert repairs: By February 28th (typically 16 months in advance of the target in-water work window), ODOT will provide ODFW a list of potential culverts to be repaired during the following year's in-water work period under the terms of this Agreement for each year of the Agreement. ODFW will review and approve the list based on criteria in Section II.4.a-e above, by June 1st, or within 90 days of receiving the list. By October 1st ODFW will provide ODOT with the following information for each potential repair project at the repair site:
 - a) Native Migratory Fish Species historically and currently present
 - b) Migratory timeframes of concern
 - c) Existing fish passage impediments
 - d) Recommendations to improve fish passage conditions
 - e) Recommended in-water work window
7. ODOT and ODFW will collaboratively develop fish passage improvements for each repair site, based on site conditions and constraints, hydraulic conditions, and the needs of Native Migratory Fish. ODOT will provide fish passage design concepts to ODFW for review and comment by February 28th of the year of proposed culvert repairs. ODFW will review each incremental passage design and document concurrence with the design approach by March 31st, or within a month of receiving the fish passage design concepts.
8. ODOT will fund two ODFW/ODOT Liaison positions to help implement this Agreement.
9. Culvert repair actions not authorized by this Agreement require specific approval by ODFW if the repair actions meet the trigger definition. This Agreement does not preclude ODOT from pursuing other options to address or comply with fish passage laws at ODOT structures.
10. ODOT is responsible for obtaining all other state and federal permits and permissions necessary for completion of activities approved by the Agreement.

11. All in-water work associated with this Agreement will occur during the appropriate ODFW in-water work window, or as negotiated.
12. This Agreement in no way purports or authorizes take of a federally listed species.
13. Pursuant to OAR 635-412-0035 (1 and 10) ODOT is responsible for following all best management practices during construction/maintenance activities to protect fish, wildlife, and their habitats. These BMP's include but are not limited to, adequately dewatering and isolating worksites, performing fish salvages, and providing adequate downstream passage, bypass, and screening if necessary.

IV. POST-PROJECT OBLIGATIONS

1. **Maintenance.** ODOT is responsible for all maintenance required such that culverts repaired under this Agreement continue to provide the improved level of fish passage that was achieved under this Agreement.
2. **Inspection and Record-Keeping.** ODFW may inspect any road-stream crossing for which ODOT is responsible (ORS 509.625 and OAR 635-412-0020(3)(b)(D)). If inspection of a culvert repair site installed under this Agreement indicates that fish passage improvements are not functioning as intended, ODFW shall notify ODOT. ODOT shall work with ODFW to determine the cause and, during a work period approved by ODFW, expeditiously rectify problems as necessary (OAR 635-412-0020(3)(b)(E)).
3. **Monitoring and Reporting.** ODOT and ODFW will implement a monitoring plan prior to project construction that will include pre and post repair project site analyses of fish passage conditions. ODOT, or its designee, shall monitor and report all repair projects implemented under this agreement to verify that fish passage improvement(s) function as intended. Monitoring shall be completed after winter and spring channel forming high flow events in years 1, 3, and 5 after completion of each culvert repair and fish passage improvement. Monitoring shall identify native migratory fish species and life stages affected at each culvert repair site and the quantity and quality of habitat above each barrier. Monitoring shall consist of a best professional judgment assessment by a qualified fisheries biologist of fish passage conditions. This includes noting any water surface jumps, channel adjustments, streamflow velocity characteristics, channel bed stability, scour occurrence, and other relevant data to ensure the project is functioning as designed for fish passage. Pre- and post-treatment photographs of each site shall be included in the monitoring reports. If monitoring indicates that fish passage is not being provided consistent with project intent, ODOT shall consult with ODFW, determine the cause, and during a work period approved by ODFW, expeditiously rectify problems as necessary (OAR 635-412-0020(3)(b)(E)). If in the final year, post-project assessment reveals a successful project and that fish passage has not deteriorated, then the project will be removed from the post-project monitoring obligations. ODOT remains responsible for the ongoing maintenance necessary to ensure the improved level of fish passage continues to function until the next trigger event.
4. **Annual Report.** By February 1st of each year of the Agreement, ODOT shall provide an Annual Electronic Report on all culverts repaired under this Agreement. The Annual Electronic Report shall consist of:
 - a) Narrative discussion of program activities,
 - b) Map of culverts repaired under program,
 - c) Description and date of repair action(s) performed at each culvert under the Agreement,
 - d) Description of how fish passage was improved at each culvert repaired under the Agreement,

- e) Project specific monitoring results from monitoring efforts identified in # 3 above,
 - f) Estimate of fish habitat upstream of each culvert, and
 - g) List of species present at each culvert.
 - h) Analysis of estimated annual cost savings of culvert repairs made vs. the cost of culvert replacements.
5. Final Report. At the conclusion of the pilot project each agency shall provide a final report.
- a) ODFW shall provide a final pilot project analysis and report on the effect(s) of the pilot project on fish passage. The report will include: site locations, native migratory fish species, quantity and quality of habitat upstream of barriers for both the:
 - I. effects of the culvert repairs and the fish passage improvements made at each repair site, and
 - II. fish passage improvements implemented with the fish passage funds (defined in Section III(3) of this agreement), administered by ODFW.
 - b) ODOT shall provide a final project report on the effect(s) of the pilot project on maintaining the highway infrastructure. The report will include: number of culverts repaired, improvements to infrastructure condition, the cost effectiveness of repairs relative to infrastructure benefits, and an analysis of the cost savings of culvert repairs made vs. the cost of culvert replacements.
 - c) These reports will be used to develop a strategy to address the culvert infrastructure issue(s) on the State highway system and the needs of native migratory fish. Final reports shall be complete by June 30, 2023.
6. Coordination Meetings. Staff from ODOT and ODFW affected by this Agreement, will meet annually, or as otherwise deemed appropriate, to collaboratively review projects implemented under this Agreement and evaluate adaptive management measures, as appropriate.

V. GENERAL PROVISIONS

1. Notice. The parties' contact persons for all notices provided for under this Agreement, except as specifically provided otherwise, are as follows:

Agency	ODFW	ODFW Technical	ODOT	ODOT Technical
Name	Greg Apke	Pete Baki	William Warncke	Wade Holaday, P.E.
Title	ODFW Fish Passage Coordinator	ODFW/ODOT Liaison	ODOT Fish Passage Program Team Leader	ODOT Culvert Maintenance Engineer
Address	4034 Fairview Industrial Dr. SE Salem, OR 97302	4034 Fairview Industrial Dr. SE Salem, OR 97302	4040 Fairview Industrial Dr. SE Salem, OR 97302	4040 Fairview Industrial Dr. SE MS #6 Salem, OR 97302-1142
Phone	503-947-6228	503-947-6234	503-986-3459	(503) 986-4046
E-Mail	greg.d.apke@state.or.us	Pete.Baki@state.or.us	William.M.Warncke@odot.state.or.us	Wade.HOLADAY@odot.state.or.us

Either party may change a designated contact person at any time by providing written notice to the other party.

- 2. Amendments. Amendments to this Agreement may be made within applicable laws at the mutual agreement and signature of the ODFW Fish Screens and Passage Program Manager and the ODOT Environmental Resources Unit Manager.
- 3. Term. This Agreement is entered into on the date of last signature by and between ODFW and ODOT, both representing the State of Oregon. This Agreement expires Dec 31, 2022.
- 4. Termination. This Agreement may be terminated at any time through mutual agreement by the parties or by either party after a 30-day written notice. If terminated, culverts previously

repaired consistent with this Agreement will not be subject to additional fish passage requirements beyond maintenance as described in IV(1), until an additional trigger event may occur.

RUP
1/19/18



1/18/18

Date

Highway Division Administrator
Oregon Department of Transportation



Date

Chair, Oregon Fish and Wildlife Commission

Appendix A

Examples of ODOT culvert repair actions* allowed under the Culvert Repair Programmatic Agreement that currently trigger fish passage laws

- Strip line
- Spot and localized repairs
- Spray on coating
- Cured in place technology
- Spiral wound
- Pave invert
- Add or extend end treatments
- Replace interior sections of culvert**
- Replace road pavement and sub base above culverts

*The intent of the culvert repairs allowed under the programmatic agreement is to provide (up to) an additional 10 to 25 years of culvert life. The actual life of the culvert and repair will depend on site specific conditions. These repairs are considered short-term fixes, not in effect a culvert replacement that provides a new design life.

** This technique is intended to replace 1 to 3 segments of a pipe that have broken or failed prematurely. It is not intended to replace the majority of the pipe.

Culvert repair techniques not listed above are allowed provided they fully meet all requirements of this agreement. Culvert repair techniques not listed above will be discussed by the ODFW and ODOT contacts identified in section V prior to implementation.

Full traditional Slip-line culvert repairs are specifically excluded from this Programmatic Agreement.

Appendix 2: Project Initiation Forms for 2018 Culvert Repairs (Available Upon Request)

Appendix 3: As-built Plans for 2018 Culvert Repairs (Available Upon Request)