



Culvert Repair Programmatic Agreement 2022 Annual Report

**Oregon Department of Fish and Wildlife | Oregon Department of Transportation
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This information can be made available in alternative format by contacting Allen Gillette, Fish Passage Program Lead (503) 871-7192.

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Oregon Department of Transportation

Statewide Project Delivery Branch – Engineering & Technical Services Branch

Environmental Section

4040 Fairview Industrial Drive SE

Salem, Oregon 97302

(503) 871 - 7192

[Website](#)

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If you believe you have been discriminated against, as described above in any program, activity or facility, or if you desire further information, please contact:

Deputy Director, Fish & Wildlife Programs, ODFW

4034 Fairview Industrial Dr. SE

Salem, OR 97302

(503) 947-6000

or write to the

Chief, Public Civil Rights Division Department of the Interior

1849 C Street NW

Washington, DC 20240.

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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. This enables ODOT to make critical repairs of 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 \$2.5 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 require repair or replacement in the near term to maintain the safety and integrity of the state highway system. Based on current estimates, it would require over \$18.5 billion to replace all the culverts under the state highway network. The typical design life of a culvert can range from 25 to 75 years. Based on current funding allocations, it would take over 1,500 years to replace all the culverts owned and managed by ODOT. Culvert repair work on fish-bearing streams has largely been deferred over the past 18 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 2022, three culverts were repaired under the CRPA. The total cost for these repairs was \$604,000. The estimate to replace these culverts was \$5.8 million. ODOT was able to defer over \$5 million of cost to address these culverts by using 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 6 miles of potential habitat for NMF. Additionally, part of the \$2.5 million allocated to passage restoration was used to fund fish passage projects off the state highway system. A solicitation process was conducted in 2021. When completed, these projects will provide improved access to over 130 miles of potential habitat for NMF. Two of these

projects were completed in 2022. Access to 92 miles of habitat was improved through these fish passage restoration projects.

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

- Backwatered: When the water surface through the outlet of the culvert and downstream are equal.
- 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.
- Culvert: A pipe or conduit used to convey water, utilities, livestock, wildlife, or equipment, from one side of the road to the other.
- Fish passage: The ability, by the weakest native migratory fish 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.
- Fish rocks or fish blocks: Are 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.
- High priority barriers: Any barrier found on the ODFW Fish Passage Priority List. Or determined by professional opinion to be a significant barrier to native migratory fish migration.
- Hydraulic conditions: The conditions of the stream crossing in the context of water velocity, depth, complexity, vertical profiles, and capacity.
- 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.
- Invert: The bottom portions of a culvert. Usually, the first area of wear due to interaction with water and sediment transport.
- NMF: Native Migratory Fish species defined in OAR 635-412-0005 that includes 32 species of fish that migrate as for their lifecycle needs.
- Perched condition: When the outlet of the culvert is elevated above the downstream water surface creating a freefall condition.

- 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.
- Roughened channel: An artificially built channel downstream of a culvert designed to alleviate a perch and match conditions in the surrounding streambed.
- Soil arch: The compacted soil that surrounds the culvert. This compacted soil holds the load of the above material and roadway traffic, relieving the pressure from the culvert itself.
- Tributary: A river or stream flowing into a larger river or lake.
- Weir: A low dam built across the stream channel or culvert designed to raise the water level upstream.

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 first 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 where fish passage can be improved 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. Based on the number of expected projects under the agreement, ODOT has provided an additional \$500,000. 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.

The rules, laws, and other reference material regarding NMF passage regulations can be found below:

- [Oregon Fish Passage Rules.](#)
- [Oregon Plan for Salmon and Watersheds.](#)
- [Oregon Fish Passage Statues.](#)

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 the following criteria:

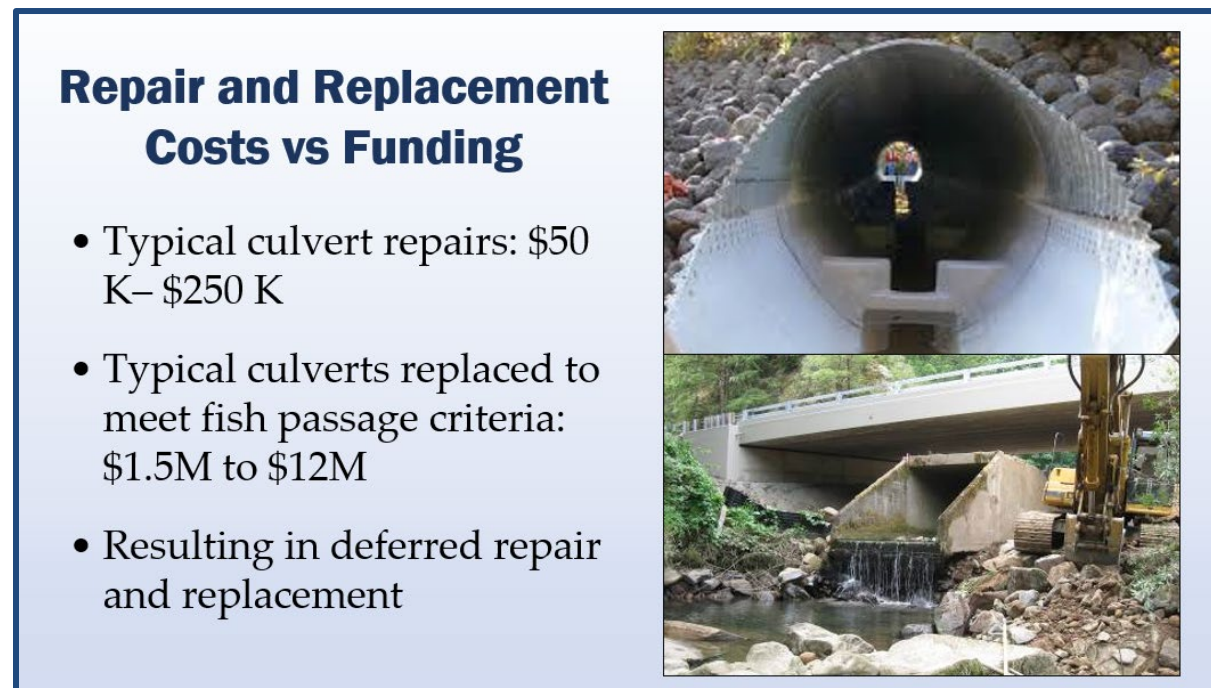
- Culverts must be located on ODOT-owned or operated stream crossings and can be located anywhere in the state.
- Culvert repairs may provide (up to) an additional 25 years of culvert life.
- Repaired culverts must include fish passage improvements.
- Culverts can be rated as a high priority for fish 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.
- Slip lining is excluded from repair options.
- Culverts with tide gates are excluded.

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.



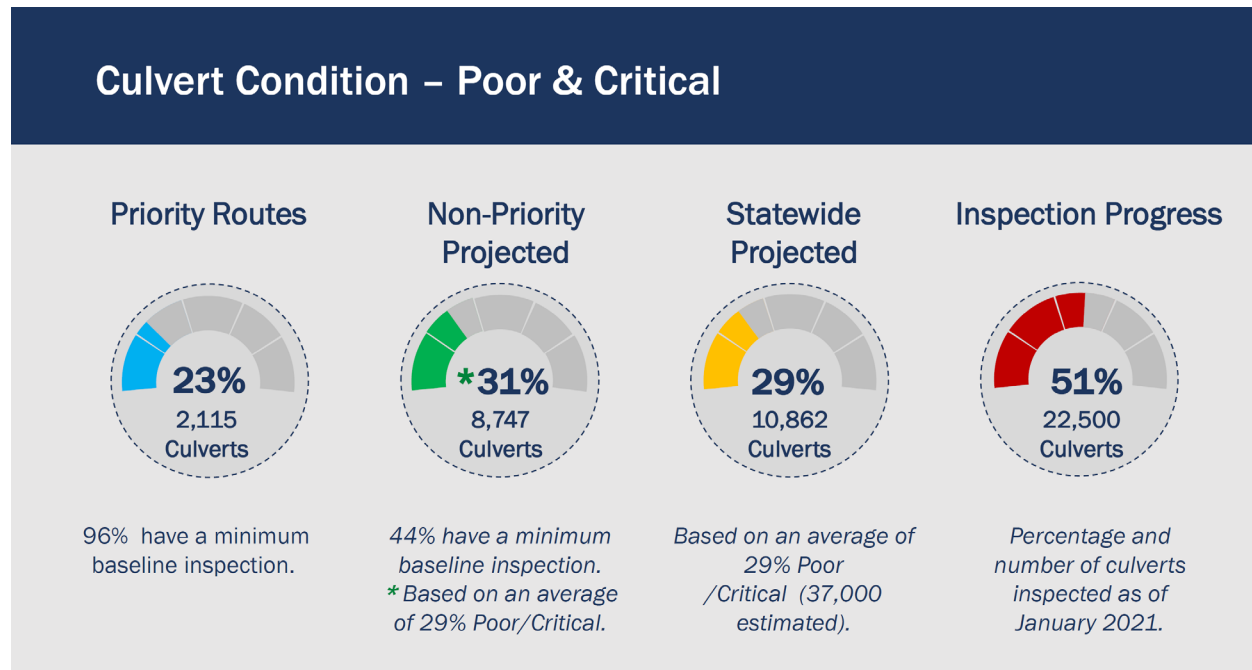
Culvert Inventory

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. ODOT has completed culvert inventory on 51 percent of the state highway system, including all 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 29 percent, or roughly 10,862, 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 (Figure 2). The cost to replace all 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.

Figure 2: Culvert Inventory and Condition Summary

Description: Image summarizes culvert Inspection Progress and gives metrics for percentage estimates for poor and critical condition.



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. The ODOT Large Culvert Program receives \$12 million annually for culvert replacements. Based on current costs, it would require over \$18.5 billion to replace all the culverts under the state highway network. The typical design life of a culvert can range from 25 to 75 years. Based on current funding allocations, it would take over 1,500 years to replace all the culverts owned and managed by ODOT. 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 1997-2022, ODOT completed 157 voluntary fish passage projects and improved access to over 535 miles of NMF habitat. This is a voluntary investment in fish passage, because these projects were not completed due to 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 OR 99W Coleman Creek Culvert Replacement Project, Figure 3, 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 4-foot by 6-foot concrete box culvert with a 46-foot-long bridge. The original culvert was undersized for the stream channel, causing channel scour and incision. The culvert also had a large perch at the outlet, which resulted in a significant passage barrier for both adult and juvenile NMF. The Coleman Creek fish passage project opened access to over 4 potential miles of high-quality spawning and rearing habitat for summer and winter steelhead, fall Chinook salmon, cutthroat trout, and lamprey species at a cost of \$5.3 million.

Figure 3: OR 99W Coleman Creek Culvert Replacement Project, Before and After

Description: The top panel of two photos shows Coleman Creek before the replacement. The photo shows the original culvert outlet with large perch, creating a fish passage barrier. The bottom photo is after the culvert replacement, showing a new 46-foot long bridge with the reconstructed stream channel under it.





CRPA Process and Timelines

As a condition of the CRPA agreement, the agencies developed a streamlined project timeline. Construction of culvert repair 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 timesaving and efficiency-increasing procedural processes. This led to the creation and implementation of new CRPA initiation forms for scoping, design

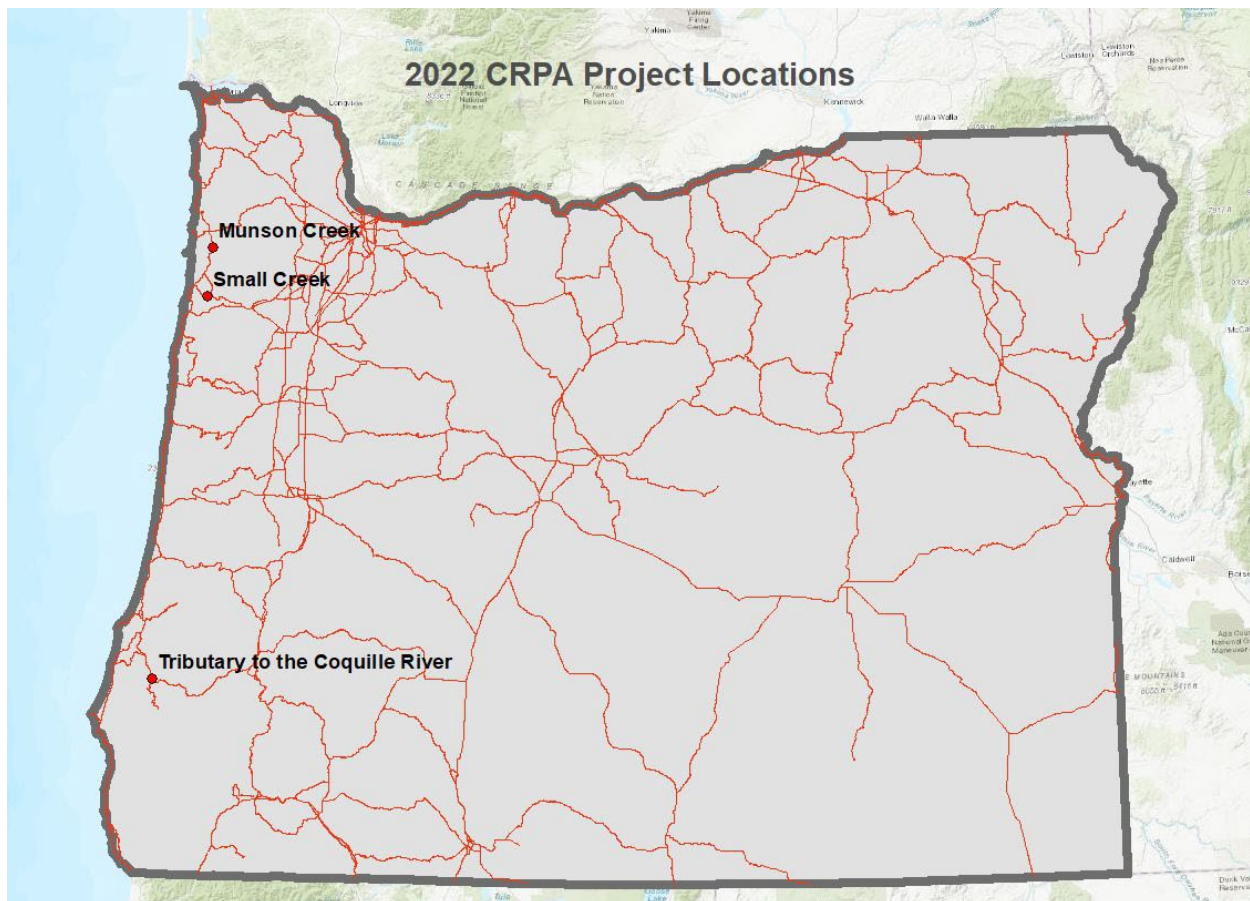
and submittals, and the creation of a quality assurance and review process for submittals. These forms and procedures were developed and tested in 2018 with full implementation in 2019.

2022 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 2022, ODFW approved and ODOT repaired three culverts under the CRPA (Figure 4).

Figure 4: Locations of CRPA Projects that Were Constructed in 2022

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



Culvert Cost Analysis and Repair Summary

The cost to repair three culverts in 2022 was \$604,000. The estimated cost to replace these culverts was \$5.8 million. Through the CRPA, ODOT deferred costs of **over \$5 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 2022 projects were repaired using two different techniques.

- Two 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.
- One of the projects used a cured-in-place liner (CIPP) that adds a new continuous layer around the circumference of the culvert, resulting in restored structural capacity.

The CIPP seals the entirety of the pipe, keeping water inside the barrel and the structurally compacted soil outside the culvert intact.

Table 1: 2022 Culvert Repair Cost Analysis

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

Stream Name	Hwy and MP	Diameter (ft)	Length (ft)	Repair	Full Fix Cost (approximate)	Repair Cost
Small Creek	OR 130, 7.4	4	54	Invert Pave	\$1.2 M	\$145,000
Munson Creek	US 101, 72.42	12 x 6	57	Invert Pave	\$2.8 M	\$175,000
Unnamed Tributary of the South Fork Coquille River	OR 42, 22.35	4	152	CIPP Liner	\$1.8 M	\$284,000

Fish Passage Improvements Summary

The 2022 CRPA projects used multiple fish passage improvement techniques during construction. Table 2 summarizes the fish passage improvements at each culvert location. All 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. In locations where the culvert outlets were perched, channel work was completed downstream to alleviate jump heights into the culvert.

The total miles of potential NMF habitat upstream made available was 6.22 miles. 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	Other NMF Species
Small Creek	OR 130, 7.4	0.93	Baffles and channel work	Present	Present and ESA Listed	Present	Potential for Pacific lamprey
Munson Creek	US 101, 72.42	4.73	Baffles and channel work	Present	Present and ESA Listed	Present	Fall Chinook salmon, Pacific lamprey
Unnamed Tributary of the South Fork Coquille River	OR 42, 22.35	0.56	Fish blocks	Present	No documented presence	No documented presence	No documented presence

Project Descriptions

OR130 MP 7.4 Small Creek Culvert Repair

Completed August 2022, Figure 5.

Pre-treatment Fish Passage Condition

This culvert conveys Small Creek, a tributary of the Little Nestucca River in Tillamook County, Oregon. Small Creek has an estimated active channel of 10' and the current culvert is 54' long and 4' in diameter. The culvert had an 18" drop on the outlet near the confluence with the Little Nestucca River, causing significant fish passage issues, and was a complete barrier for Pacific lamprey. The culvert showed signs of invert and barrel damage, and was in need of repair.

Post-treatment Fish Passage Condition

The culvert was repaired by paving the invert to cover the scour and seal the barrel. Fish passage improvements include a roughened riffle to the culvert outlet to eliminate the jump, and rounded cement corner baffles were installed to reduce velocities, and increase the depth in the culvert barrel.

These improvements will provide easier passage for coastal cutthroat, winter steelhead, Pacific lamprey and coho salmon to 0.93 miles of NMF habitat.

Figure 5: Small Creek Before and After

Description: Two images, the first displays the culvert pre-repair from the outlet end with a perch creating a fish passage barrier. The second shows the culvert post-repair from the outlet end with a roughened riffle backwatering the outlet.



OR101 MP 72.42 Munson Creek Culvert Repair

Completed September 2022, Figure 6.

Pre-treatment Fish Passage Condition

Munson Creek is a tributary of the Tillamook River south of Tillamook, Oregon in Tillamook County. The 12'X6' concrete box culvert is 57' long and was perched over 1' above the outlet pool, creating a partial barrier too many NMF, and a significant barrier for Pacific lamprey. At low flows, shallow sheet flow further posed passage issues.

The box culvert had exposed rebar and concrete wear from scour on the invert and was in need of repair. Some small sections of the walls had some erosion as well. The active channel width is estimated to be 17'.

Post-treatment Fish Passage Condition

The repair included repaving of the invert of the culvert and covering erosion scour and exposed rebar. To address the perch on the apron, a 70' roughened channel was built up to the culvert outlet, eliminating the jump. Weirs were placed in the culvert to reduce the velocities and increase the depth. The weirs are rounded to allow for lamprey migration. In addition, a low flow channel was created in the barrel to further increase passage depth during low flows. Improved passage here will provide easier access to 4.73 miles of habitat for coast cutthroat trout, Pacific lamprey, winter steelhead, coho and fall Chinook. Prior to construction, the fish salvage captured 18 adult Pacific lamprey from below the culvert apron. These individuals were released upstream, and extended the known distribution of Pacific lamprey in the Tillamook River Watershed.

Figure 6: Munson Creek Culvert Repair Before and After

Description: Three images, the first is pre-repair looking at the culvert outlet and Apron. A 12" drop off of the apron can be seen. The second is post-repair looking inside the culvert from the outlet end with a roughened riffle backwatering the outlet, and rounded baffles on each side of a low flow channel. The third image shows Wade Holaday, Senior Major Culvert Maintenance Engineer, with an adult Pacific lamprey collected during fish salvage.



OR42 MP 22.35 Unnamed Tributary of the South Fork Coquille River Culvert Repair

Completed September 2022, Figure 7.

Pre-treatment Fish Passage Condition

This 152' long 4' diameter corrugated metal culvert conveys an unnamed tributary of the South Fork Coquille River under OR 42 near Myrtle Point, Oregon.

The culvert is deteriorating and has vertical and horizontal alignment breaks. The active channel width is estimated at 7' and is a seasonal stream, but provides coastal cutthroat trout habitat when it is flowing. The undersized culvert had velocity issues for fish passage at higher flows.

Post-treatment Fish Passage Condition

The structural condition of the culvert was addressed by installing a CIPP liner. Fish blocks were installed in the culvert to increase depth, increase hydraulic complexity and reduce velocities. The passage improvements will improve passage for coastal cutthroat trout to 0.56 miles of additional habitat upstream of Highway 42.

Figure 7: Unnamed Tributary of the South Fork Coquille River Culvert Repair Before and After

Description: Two images, the first shows inside the culvert from the outlet end pre-repair with water running through it. The second displays inside the culvert from the outlet end post-repair with fish blocks installed.



Monitoring Strategy and Adaptive Management

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), 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 post-construction in years 1, 3, and 5 after winter and spring channel-forming high flow events.

ODOT is 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. In 2022 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. 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 2022 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

Two projects completed in 2022 included out of barrel treatments to improve fish passage. In previous years, out of barrel treatments using rock weirs or a roughened channel were difficult to install due to right of way needs, and some of these projects were not installed as designed or directed.

To address challenges with working off of the ODOT right of way, projects with out of barrel treatments developed for 2022 delivery started the right of way process much earlier in project development. This allowed for negotiations with landowners and acquisition of easements well in advance of construction windows. This also allowed for more flexibility by the contractor for installation and maintenance of temporary water management facilities, which commonly are located off of the highway right of way. Overall, starting the right of way access process much earlier in project development was a valuable lesson learned, and will continue to be incorporated into future projects.

To address previous issues with construction of rock weirs and roughened riffles, the Major Culvert Maintenance Program and Region Technical Delivery Centers dedicated engineering staff to help oversee construction. This resulted in projects getting installed as per specification

and approved design. Questions from contractors regarding steps in placing bed material, sizing, and other sequencing could be answered real time, and both projects that proposed using roughened riffles were a success. In the future, resourcing an engineer for construction oversight of out of barrel work is essential for project success.

In-Barrel Treatments

All culvert CRPA projects implemented in 2022 included in-barrel treatments for fish passage improvements. Treatments included corner baffles and fish blocks. All in-barrel treatments were effective at improving fish passage. Lessons learned about in-barrel treatments include:

- Fish blocks need to be inspected before installed to ensure they are sized to match the approved design specifications.
- Early engineering phases need to consider hydraulic capacity when proposing in barrel treatments as fish passage improvements. Some projects initially scoped for 2022 construction did not have capacity for in barrel treatments, and were discouraged from using the agreement as no other fish passage improvements could be made at the site.

Pre-project Meeting with the Contractor

Early and often coordination between agency staff and contractors has shown to help the project delivery process. This can include a pre-construction meeting between the agencies and selected contractor to discuss plans for:

- 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

As part of engineering design for culvert improvements, culvert capacity and channel scour are evaluated for the proposed repair to ensure the site is suitable for in and out of barrel treatments. CRPA projects can benefit from advanced hydraulic modeling including fish passage conditions. Due to advanced hydraulic modeling not being available for all projects,

documentation of water velocities was not available for some locations. In turn, these projects lacked numeric evidence that velocity was a fish passage issue, and that it was improved after repair. When advanced hydraulic modeling is completed for both pre and post repair conditions, ODOT and ODFW can ensure that there is capacity for in-barrel treatments, along with documenting what flow conditions are an issue for fish passage and will be improved with proposed 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, right of way, engineering, and planning.

Desk and field scoping of potential projects continues to become more efficient as ODOT region and statewide staff 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 for temporary water management 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. And some repair approaches, such as centrifugal cast concrete, require special equipment and knowledge to install, leading to limited or no bids during the public bidding process. Culvert emergency repairs typically do not allow for full scoping and or design based on the 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.

Outreach

All of CRPA projects completed in 2022 came from ODOT Regions 2 and 3, and the only region yet to have a CRPA project was Region 4. Scoping of several potential projects was conducted in Region 4 during 2022, and it is anticipated that at least two of these culverts can use the agreement in future design cycles.

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

In 2022, ODFW oversaw completion of two Compensation Restoration Projects. These projects were part of the \$2.5 million-dollar ODOT funded compensation as part of the CRPA Agreement. These statewide high priority projects are located off the ODOT network and were solicited through an ODFW managed funding processes. Balm Grove Dam and Annie Creek Irrigation improvement projects are discussed in more detail below.

Balm Grove Dam

This project removed the Balm Grove Dam on Gales Creek, a tributary of the Tualatin River. This channel spanning dam was in Group 4 of the ODFW 2019 Statewide Fish Passage Barrier List and providing full fish passage here improved access to 87 miles of NMF habitat. The dam had been in place for almost 100 years. Instream habitat improvements were completed along with the dam removal.

Figure 8: Balm Grove Dam Removal Project Before and After Photos

Description: Two images, the first shows an aerial view of the dam and spill way with water running throughout. The second displays the restored channel with a riffle running next to a channel bank.



Annie Creek

This project provided volitional fish passage at two irrigation diversion pushup dams on Annie Creek, a tributary to the Wood River in the Upper Klamath Basin. Both barriers were removed and a roughened riffle was constructed to provide volitional fish passage. Both diversions were combined and a new criteria fish screen was installed to prevent the entrainment of juvenile fish. Removing these barriers allows upstream and downstream volitional passage in the lower five miles of Annie Creek.

Figure 9: Annie Creek Irrigation Diversion Project Before and After Photos

Description: Two images, the first shows an upstream view of the push up dam with water running through it. The second displays a side profile view of the restored channel.



The implementation of these projects, along with others selected through 2019 and 2021 solicitation processes, improved NMF access to a total of 572.6 miles and 3000 acres of habitat since the first ODFW solicitation in 2015. The Compensation Projects will be described in greater detail in the ODFW CRPA completion report.

Conclusion

In 2022, the CRPA project continued to be a valuable method of extending the working life of failing and degraded culverts on ODOTs highway infrastructure, while providing enhanced passage for NMF.

Annual cost deferment of over \$5 million dollars was realized through the ability to fix culverts under a streamlined programmatic process. Access to over 6 miles of habitat were enhanced for NMF at culvert enhancement locations, and access to over 92 miles of habitat was improved off the highway network.

Continued monitoring and reporting on 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 habitat for NMF.

Appendix 1: Culvert Repair Programmatic Agreement

Can be made available by contacting the ODOT Statewide Project Delivery Branch –
Engineering & Technical Services Branch at:
ODOT Environmental Section
4040 Fairview Industrial Drive SE
Salem, Oregon 97302
(503) 871 - 7192

Appendix 2: Project Initiation Forms for 2022 Culvert Repairs

Can be made available by contacting the ODOT Statewide Project Delivery Branch –
Engineering & Technical Services Branch at:
ODOT Environmental Section
4040 Fairview Industrial Drive SE
Salem, Oregon 97302
(503) 871 - 7192

Appendix 3: As-built Plans for 2022 Culvert Repairs

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Engineering & Technical Services Branch at:
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Salem, Oregon 97302
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