

FISH PASSAGE BANKING PILOT PROJECT



FINAL REPORT

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WILLAMETTE PARTNERSHIP

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EXECUTIVE SUMMARY

Between 2014-2020, Oregon Department of Fish and Wildlife (ODFW) and Oregon Department of Transportation (ODOT) partnered to develop the processes and tools necessary to pilot a fish passage mitigation banking program in Oregon's North Coast. Fish passage mitigation banking would allow ODFW to steer mitigation of impacts to passage from multiple, geographically dispersed waiver sites toward fish passage banks – locations where high priority barriers are removed and significant benefits for native migratory fish are created.

A Fish Passage Mitigation Banking Project Team comprised of ODFW Fish Passage staff, ODOT staff, as well as staff from The Nature Conservancy and Willamette Partnership (who were contracted by ODOT to provide technical expertise) lead the establishment of the Pilot. ODOT sponsored the development of a fish passage mitigation bank by removing the highest rated North Coast barrier identified on the 2013 Statewide Fish Passage Priority List located on the East Fork of the South Fork (EFSF) of the Trask River. Implementation of the Pilot took place between 2016-2018. Specific objectives of the Pilot were to 1) Rigorously test and refine the Net Benefit Analysis (NBA) Tool, 2) Conduct a limited number of fish passage mitigation banking transactions, and 3) Evaluate the potential for implementation of a fish passage mitigation banking program regionally or statewide.

Effective implementation of the Pilot required the development of a set of protocols and rules to guide use of the fish passage mitigation bank. These included defining a *service area*, creating a *mitigation banking instrument*, defining *conditions or limitations* on the use of the bank, and identifying *criteria of success* for evaluating the effectiveness of the Pilot in meeting overall project objectives as well as for demonstrating the suitability of fish passage banking for statewide application in Oregon.

Overall, the results and findings from the Pilot indicated that it was successful in meeting its objectives and demonstrating that fish passage mitigation banking is a viable and useful mechanism to ensure ODFW's fish passage net benefit requirements are addressed.

Performance of Net Benefit Analysis Tool The rigorous testing and evaluation of the performance criteria of accuracy, sensitivity, repeatability, and usability of a Net Benefit Analysis Tool resulted in a process that credibly and consistently quantifies the habitat *benefits* of improving passage at barriers (mitigation credits) as well as the *impacts* to passage from permitted activities (debits). A brief synopsis of those results is provided in the report and detailed information on the testing can be found in a companion report (Appendix 4).

Conducting Banking Transactions A fish passage mitigation bank was created in 2016 by deconstructing the EFSF dam and restoring upstream conditions. The NBA tool was used to calculate the credits generated at the site which included 26.8 steelhead salmon credits, 25 cutthroat trout credits, 21.2 coho salmon credits and 18.7 Chinook salmon credits. ODOT and ODFW worked together to identify eligible waiver sites to be used as debits against the bank. A total of 12 debits of cutthroat habitat were calculated; the remainder were retired from the bank.

Evaluating Pilot Success Even with the application of the very conservative conditions requiring a 3:1 ratio of credits to debits and requiring a minimum of 1 debit for each waiver, the benefits to native migratory fish by the removal of the EFSF dam clearly exceeded the cumulative impacts created by the 12 waivers. Although there were challenges in finding eligible waiver sites, the overall conclusion is that an established mitigation banking program, with sufficient staff capacity and with systems in place to manage information and manage banking transactions, would be a predictable process that would allow permittees with mitigation obligations to plan out their activities and estimate mitigation costs more efficiently and effectively than may happen under the current system.

There were some key lessons learned from Pilot implementation. One was that there were challenges with ODOT being the only user of the mitigation bank. ODOT had difficulties finding eligible waiver sites given the conditions of the Pilot. Opening the bank to additional users or using a batched waiver approach (i.e. siting a mitigation bank in an area with known or predicted demand for mitigation credits)

may help address some of this. Another is that ODFW would need increased staff capacity in order to effectively implement and operate a fish passage mitigation banking program. Operationally, there are specific needs for GIS expertise (i.e. using and adaptively managing the GIS component of the NBA Tool) as well as administrative responsibilities for managing the process of reviewing and approving waivers and managing data and information associated with banking transactions that are beyond the current capacity of Fish Passage staff.

Recommendations for Moving Forward While the geographic area of the Pilot was limited to the North Coast District, one of the key objectives of this project was to evaluate options for expanding a fish passage mitigation banking program regionally or statewide, assuming that there were clear benefits to be gained from establishing and operating such a program. The determination of an appropriate geographic scale at which to expand a banking program in the future would be based on several factors including the predicted future *demand* for waivers and potential use of a mitigation bank, the potential for entities/organizations to create a mitigation bank and a *supply* of mitigation credits, and the potential for ODFW staff to increase capacity to manage a mitigation banking program in the future.

Use of the NBA tool in new geographies would require modifications to specific indicators. The HabRate model used to score habitat quality would need to be updated to account for the native migratory fish species in the geography where the program is operating. Other indicators might have to be modified depending on the climatic and vegetative conditions. For example, application of the tool in areas of the state east of the Cascades would need to account for water temperature and water availability as key habitat quality variables for native migratory fish as well as riparian conditions other than forest plant communities.

The Pilot was limited to ODOT as the only user of the mitigation bank, however, most mitigation banks are open to multiple users. Expanding the scope of the program regionally or statewide would also mean expanding the user base of the banking systems both in terms of bank sponsors and entities eligible to purchase/use mitigation credits as a way to meet their net benefit requirement under fish passage rules. ODFW might also consider adapting the standard approach to mitigation banking to support a batched waiver approach as to ODOT or other entities with impacts to sponsor a bank site.

Finally, any formal implementation of a mitigation banking program would require the development and use of a credit registry to track the status of credits generated by banks and the transactions that take place within a specific bank. It would also be a useful tool to support ODFW in managing and tracking the activity of different banking users.

INTRODUCTION

Artificial barriers to fish passage, in the form of culverts, dams, tide gates, and other infrastructure, are common throughout Oregon. The ability to move through a stream system is essential for native migratory fish species, and restoring habitat availability by improving fish passage across barriers is an important tool for recovering populations of native migratory fish. Oregon's Fish Passage Statute (ORS 509.580 through 509.910) gives Oregon legal authority to ensure that for a given project, fish passage is addressed wherever fish are currently or were historically present. Under the Habitat Mitigation Policy (OAR 635, Division 415) and the Fish Passage Rules (OAR 635, Division 412), Oregon Department of Fish and Wildlife (ODFW) can require or recommend mitigation (i.e. alternatives to providing fish passage at an artificial obstruction) as a way to address passage requirements.

Between 2014-2020, ODFW and Oregon Department of Transportation (ODOT) partnered to develop the processes and tools necessary to pilot and test a fish passage mitigation banking program in Oregon's North Coast. Fish passage mitigation banking would allow ODFW to steer mitigation from multiple, geographically dispersed waiver sites toward fish passage banks – locations where high priority barriers are removed and significant benefits for native migratory fish are created. In addition, it would eliminate issues associated with temporal loss of habitat that occurs between the timing of a permitted impact and the completion of mitigating activities. Finally, mitigation banking would provide ODFW, waiver applicants, and other stakeholders with a standardized and transparent process to evaluate whether mitigation is appropriate, adequate, and sustainable in terms of meeting conservation goals for native migratory fish habitat in Oregon.

The Fish Passage Mitigation Banking project team (Project Team) was comprised of ODFW Fish Passage staff, ODOT staff, and staff from The Nature Conservancy and Willamette Partnership who were contracted by ODOT to provide technical expertise to the project. The work was divided into two main phases: 1) establishing the feasibility of a banking approach in the North Coast (see Appendix 1. Gap Analysis) and building a Net Benefit Analysis Tool that would allow the calculation of bank credits and debits (see Appendix 2. Net Benefit Analysis Tool), and 2) designing and implementing the Fish Passage Banking Pilot ("Pilot") to test the tools and protocols developed for potential future implementation of a banking program, either regionally or statewide.

This final report summarizes the work and findings from Phase 2, implementation of the Pilot, as well as overall lessons learned and considerations and recommendations for a future fish passage mitigation banking program in Oregon.

Information about the specific components of all aspects of the project, from the feasibility analysis to the development and testing of the Net Benefit Analysis Tool, can be found in detailed technical reports appended to this final report.

OVERVIEW OF THE FISH PASSAGE MITIGATION BANKING PILOT

The Fish Passage Mitigation Banking Pilot took place between 2016-2019 and was developed to provide a pragmatic and real-world demonstration and test of a fish passage banking approach to meeting Oregon's fish passage requirements implemented through ODFW's existing waiver process. The Pilot was conducted in Oregon's North Coast Basin (Figure 1).

The specific objectives of the Pilot were to:

1. Rigorously test and refine the Net Benefit Analysis (NBA) Tool
2. Conduct a limited number of fish passage mitigation banking transactions, and
3. Evaluate the potential for implementation of a fish passage mitigation banking program regionally or statewide.

Objective 1: Testing the Net Benefit Analysis Tool

In order to use the Net Benefit Analysis Tool in programmatic permitting decisions, it was important to establish that it could produce credible results. The NBA Tool¹ was developed in Phase 1 of the project and includes a Fish Passage Credit Calculator (“Calculator”) that quantifies the impact of permitted actions (debits) and the benefits of mitigation through improvement of fish passage (credits) to fish habitat in terms of quality weighted acres of native migratory habitat for specific species of fish. To evaluate its suitability for use in a regulatory program, the Calculator was tested in field conditions to determine its accuracy, repeatability, sensitivity, and usability.

Objective 2: Conduct a limited number of mitigation banking transactions

The Pilot was implemented in Oregon’s North Coast Basin with ODOT as the only sponsor of a fish passage mitigation project. ODFW and ODOT developed a mitigation bank site by removing a high priority barrier and used the Net Benefit Analysis Tool to quantify the number of fish passage credits generated at the site. Over the course of the Pilot, ODOT requested that a small number of waiver projects be used as debits against the bank. The NBA Tool was used to quantify the debits of each of the waiver sites.

Objective 3: Evaluate the potential for statewide implementation of a fish passage banking program

A final objective of the Pilot was to evaluate the potential for implementation of a fish passage banking program statewide. To do so would require that the administrative procedures, as outlined in the Mitigation Banking Instrument, were effective in achieving a net benefit for native migratory fish and in helping ODFW implement its fish passage program.

NORTH COAST PILOT DEVELOPMENT

Effective implementation of the Pilot required the Project Team establish a set of protocols and rules for guiding use of the fish passage mitigation bank. These included defining a *service area*, creating a *mitigation banking instrument*, defining *conditions* or *limitations* on the use of the bank, and identifying *criteria of success* for evaluating the effectiveness of the Pilot in meeting overall project objectives.

Service Area Definition

A service area is the geographic location within which a mitigation bank can sell credits to eligible projects with impacts. From an ecological perspective, service areas are often defined tightly—keeping mitigation as close to the location and kind of impact as possible. From an economic perspective, service areas need to be large enough to capture enough transactions to ensure there is adequate demand for credits from a specific bank that makes investment in the cost of establishing a bank worthwhile.

The Oregon Administrative Rules for Fish and Wildlife Habitat Mitigation Policy OAR 635-412-0040 states: “(9) Mitigation: (a) shall be conducted in-proximity to the artificial obstruction, with respect to geographic scope;(b) shall have habitat type and quality which is more beneficial than that affected by the artificial obstruction, if mitigation is passage into, restoration of, or enhancement of habitat; (c) shall at least benefit the same native migratory fish species affected at the artificial obstruction...”

¹ The Net Benefit Analysis Tool include a customized Geographic Information Systems (GIS) interface that collects and organizes all the data layers required for the desktop analysis. Currently the collected data layers cover only the North Coast region, but expansion of the tool to full statewide coverage in Oregon is possible. It provides a custom toolbar to expedite the spatially explicit data processing steps that are required in order to extract information about a site from the GIS source data. A habitat quality calculator in an Excel spreadsheet format, termed the Fish Passage Credit Calculator, uses the information extracted from the GIS data to calculate composite quality scores and credit values for a site.

OAR 635-412-0005 defines “in-proximity” as being within the same watershed or water basin, as defined by the Oregon Water Resources Department, and having the highest likelihood of benefiting the native migratory fish populations, as defined by the Oregon Department of Fish and Wildlife, directly affected by an artificial obstruction. They define “watershed” as “...a drainage basin encompassing a stream, its tributaries, and associated uplands at the USGS 4th Field Hydrologic Unit level.” As such, the 4th level HUC watershed was used as the geographic definition of a service area for the Fish Passage Mitigation Banking Pilot.

Mitigation Banking Instrument Development

The Mitigation Banking Instrument is a legally binding document that describes how the Fish Passage Mitigation Banking Pilot in the North Coast was to be operated. It defined the roles and responsibilities of both ODFW and ODOT including:

- ODOT as a permit applicant to ODFW requesting fish passage waivers;
- ODOT as a credit developer, generating mitigation credits by providing fish passage at a priority barrier; and
- ODFW staff operating the mitigation banking program.

It was developed using examples of wetland mitigation banking instruments common in Oregon.

The instrument was signed by ODFW and ODOT in 2014 and provided the authorization for the Fish Passage Mitigation Banking Pilot to generate credits to be used as mitigation for waivers in the designated service area. The document also provided detailed information on:

- Mitigation project site selection and eligibility
- Monitoring, reporting and other project management requirements
- Credit accounting rules
- Mitigation banking program management (including guidelines for Instrument Modification and Dispute Resolution)

The signed version of the instrument is included in Appendix 3.

Conditions/Limitations on Bank Use

In order to account for any uncertainty associated with the calculation of credits and debits, and to ensure a significant net benefit for native migratory fish as a result of these transactions, ODFW and ODOT agreed to a set of conditions or limiting terms for the use of the mitigation bank:

- 1) Each waiver site would use a 3:1 ratio of credits to debits; in other words, every debit would require 3 credits to meet mitigation obligations under the fish passage banking pilot,
- 2) Waiver sites would be debited a minimum of 1 credit (e.g. a debit of 0.3 (quality weighted acres of native migratory fish habitat) would require 0.9 credits given the 3:1 ratio; 0.9 credits would then be rounded up to 1 credit).
- 3) ODOT would limit the total number of waivers debited from the bank to 12, and
- 4) Each waiver site would have no more than 0.5 miles of native migratory fish habitat.

Success Criteria for the Pilot Project

In addition, a suite of criteria was established in order to evaluate the success of the Pilot and to demonstrate the suitability of fish passage banking for statewide application in Oregon.

1) *Net Benefit Analysis Tool Performance*

Central to the development and implementation of a fish passage mitigation banking program is the ability to produce comparable, quantitative assessments of fish passage impacts and benefits to native migratory fish habitat so that determination of a net benefit can be made. The Net Benefit Analysis Tool was built to serve as a standard procedure to quantify how many fish passage credits a waiver site will need from a passage mitigation bank in order to achieve a net benefit (and conversely, how many credits a mitigation site could provide).

The Net Benefit Analysis Tool is comprised of a habitat quality calculator in an Excel spreadsheet format (Fish Passage Credit Calculator), and a customized Geographic Information System (GIS) interface. The tool combines information about key characteristics of a site to produce scores of habitat quality and measures of habitat quantity which are then combined to estimate mitigation credits or debits – the ‘currency’ of a mitigation banking program.

The principles for tool development and performance were identified at the beginning of the project. It was determined that the Net Benefit Analysis Tool should be scientifically credible, transparent, standardized, make use of available data, be consistent with ODFW policies and, to the extent feasible, compatible with any state, regional or nationwide stream and fish habitat conservation banking approaches. The Net Benefit Analysis Tool was built to meet these principles.

Four main criteria are commonly applied to the performance of ecosystem service or ecosystem function quantification tools; they should be accurate, sensitive, repeatable and usable. Testing and evaluation of the Net Benefit Analysis Tool was conducted as part of Pilot implementation to evaluate its performance according to those criteria.

The performance criteria and general approach to their assessment are described very briefly here (see Table 1.); a detailed description of the testing procedures and results are documented in a testing report (see Appendix 4).

Table 1. Assessment of Performance Criteria for the NBA Tool

PERFORMANCE CRITERIA	DEFINITION	ASSESSMENT
Accuracy	Is the Calculator credible in rating a site in terms of native migratory fish habitat quality?	To evaluate accuracy, the Calculator scores for each study site were compared with an independent rating of habitat quality (e.g. ODFW data) and/or assessments of habitat quality as determined by the best professional judgment of ODFW District biologists. Those ratings and/or assessments were correlated with Calculator scores to evaluate how well outputs from the Calculator match independent assessments of a site’s habitat quality.
Sensitivity	Is the Calculator able to reflect changes in numeric values for indicators in the habitat quality scores?	The data collected from all test sites were used in a Monte Carlo simulation in order to determine if the scores generated for various metrics were sensitive enough to distinguish differences among a series of sites believed to differ in habitat quality.
Repeatability	Does the Calculator produce similar results when used by different users?	Data was collected specifically to determine if three independent but similarly trained testers applying the Calculator to the same five sites produced similar scoring of those sites. To meet the standard of repeatability for the Calculator, the variation among testers needed to be less than the variation detected among sites. ²
Usability	Is the NBA Tool user friendly with clear instructions for use?	All field testers, and any ODFW and ODOT staff that were trained to use the NBA Tool, responded to a series of questions evaluating the

² Elkum, N. and M.M. Shoukri. 2008. Signal-to-noise ratio (SNR) as a measure of reproducibility: design, estimation, and application. Health Serv. Outcomes Res. Protocol 8:119–133.

		usability of the calculator, the GIS application and the associated User's Guide.
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2) Effectiveness of a Mitigation Banking Approach

In order to demonstrate the effectiveness of a mitigation banking approach to meeting ODFW's Fish Passage Program goals, the Pilot needed to demonstrate that it:

- a. **Provided a net benefit for native migratory fish:** ODFW Fish Passage Rules (ORS 509.580(7)) define net benefit as "an increase in the overall, in-proximity habitat quality or quantity that is biologically likely to lead to an increased number of native migratory fish after a development action and any subsequent mitigation measures have been completed". Under the Pilot, a net benefit would be demonstrated by the total number of credits generated by the mitigation bank exceeding the total number of mitigation debits used by the permitted waivers.
- b. **Streamlined the waiver process for fish passage banking and made approval transparent and defensible:** A mitigation approach to meeting fish passage requirements should standardize the process for ensuring fish passage requirements are met for both ODFW and ODOT. This should ideally result in an increased efficiency in the use of ODFW staff time and resources to make fish passage waiver decisions. A consistently applied, science-based method for quantifying impacts and benefits to native migratory fish would provide documentation and increased transparency of those decisions.
- c. **Used ODOT resources more efficiently to provide greater benefit to native migratory fish over the traditional approach:** A banking approach shifts resources from waivers from multiple projects on streams with limited habitat quality and quantity to the removal of high priority barriers that open up significant habitat quality and quantity for native migratory fish. Mitigation banking would provide ODOT with an incentive to invest in high value restoration and conservation of native migratory fish habitat in Oregon. It would also allow ODOT to improve efficiency of their planning process by knowing in advance how and with what costs they could meet their fish passage mitigation obligations.

PILOT IMPLEMENTATION

Prior to implementation, the Pilot went through three phases of review and approval:

Task Force Recommendation: Over the course of the entire project, the Fish Passage Task Force was kept up to date, mostly through updates and presentations at regular Task Force meetings by agency staff and Willamette Partnership and TNC staff. The Project Team sought a recommendation from the Task Force to ODFW and the ODFW Commission to move forward with the development and implementation of the Pilot in February 2015.

Public Comment: ODFW sought public comment on the proposed pilot between April and May 2015. A summary document describing the Pilot (see Appendix 5) was posted online at ODFW and the public were invited to comment and provide feedback.

Commission Approval: In order to proceed with the pilot, ODFW Fish Passage staff sought formal approval from the ODFW Commission. In August 2015, the Project Team made a short presentation and had Task Force members provide testimony in support of the pilot. The Commission approved pilot implementation for 2016-2018.

Implementation of the Pilot consisted of three components to meet the three different objectives: 1) *testing* the Net Benefit Analysis Tool, 2) identifying eligible waivers and *conducting bank transactions*, and 3) *evaluating a mitigation banking approach* for statewide implementation.

Testing the Net Benefit Analysis Tool

Any tool developed for use as part of a regulatory program should produce accurate and verifiable results. Testing of the NBA Tool took place between 2015-2016 and involved both field work and

statistical analysis. Field application of the Calculator was conducted in the North Coast on sites considered to be representative of the District's geographic and hydrologic diversity. Field data, collected by trained users, was analyzed to determine the accuracy, sensitivity and repeatability of the Calculator. Testing was specific to the Fish Passage Credit Calculator and not to the GIS interface that captures much of the data that is used by the Calculator (although the repeatability and usability analysis did evaluate the process steps associated with deriving data from GIS).

The specific objectives for testing the Fish Passage Credit Calculator were to:

1. Evaluate the Calculator for its accuracy, sensitivity, and repeatability so that regulators and other stakeholders, including the public, have assurance that the information being used to make decisions meets those specific criteria;
2. Help regulators evaluate the level of risk and uncertainty that they bring to decisions made using the Calculator for meeting Fish Passage program requirements;
3. Create a transparent understanding about how the Calculator works; and
4. Support development of policy to support mitigation banking including development of quality assurance/verification protocols, mitigation ratios, and other rules or protocols that guide how to use the Calculator.

The approach, methods and findings for accuracy, sensitivity, and repeatability testing of the Calculator are summarized in the final testing report (see Appendix 4. Fish Passage Credit Calculator Testing Results. Task 2 Final Report). Initial review of the accuracy and sensitivity testing results identified a few issues related to the scoring processes associated with the Calculator. Those were addressed to produce the current, revised version of the Calculator (version 1.1i) Additionally, formatting of the Calculator interface and the associated User's Guide were substantially revised in response to results from the repeatability testing.

Mitigation Banking Transactions

The Fish Passage Mitigation Bank Pilot Project maintained in-proximity basin requirements as described in rule and used on every fish passage waiver processed since the current rules were adopted. ODOT identified the North Coast as an area where they expected a high level of demand during the implementation time period. The 2013 Statewide Fish Passage Priority list was the current barrier prioritization in place at the time. The East Fork South Fork (EFSF) Trask Dam was the highest rated North Coast barrier identified on the 2013 Statewide Fish Passage Priority List and was selected due to the ability to completely remove the highest-ranking barrier in-proximity to the Fish Passage Mitigation Bank impact sites.

Work on deconstructing the dam and restoring upstream conditions took place between June and September 2016.

Bank Site Credit Calculation

Credit values for the East Fork South Fork Trask bank site were calculated in June 2019 using version 1.1i of the Fish Passage Credit Calculator. The total credit values estimated for the bank site were

- o Chinook salmon = **18.7 credits**
- o Steelhead = **26.8 credits**
- o Coho salmon = **21.1 credits**
- o Cutthroat trout = **25.0 credits**

Details for the calculations are provided in the Calculator spreadsheet (see Appendix 6. Fish Passage Credit Calculator v1.1.i_Bank_EFSFTrask_20180816.xlsx) and in the credit calculation summary spreadsheet (see Appendix 7. ODOTPilot_CreditCalculation_Summary_201906.xlsx).

Multi-species Credit Accounting

The Fish Passage Credit Calculator can assess habitat quality for specific species and life stages of native migratory fish. Credits are calculated for each species separately, however, they are connected in the

accounting system. Although newly opened miles of stream may provide habitat for multiple species, the credits generated with those miles of stream may only be used once to offset the impacts for one specific species.

For example, if 15 of the 18.7 available chinook salmon credits were debited from the EFSF Trask Mitigation Bank, it would reduce the availability of the other species-specific credits by 15 credits. So, the new credit availability would look as follows:

Credit Type	Original Credit Amount	New Credit Amount (after 15 Chinook credits have been used)
Chinook salmon	18.7	3.7
Steelhead	26.8	11.8
Coho salmon	21.1	6.1
Cutthroat trout	25.0	10.0

Under this accounting system, newly available habitat is counted only once. It is, however, in a bank sponsors' best interest to generate as many species credits as possible. By generating more than one species-specific credit type, a bank can offer different options for meeting mitigation obligations.

Process for Waiver Site Identification

To identify candidate waiver sites that met the sideboards of the Pilot, ODOT compiled information about the following:

- Culvert sites that included "poor" or "critical" structural condition as found through culvert inventory surveys
- Sites that were designated a priority from ODOT maintenance crews as needing repair / replacement
- Sites that were focused on ODOT / Oregon Transportation Commission "Fix It Priority Routes" for hardening corridors
- Sites that were not designated as a priority for passage by ODFW.

ODOT and ODFW then completed a desk scoping exercise (sometimes accompanied by field work) to determine which of these candidate sites met the conditions of the Pilot. Many did not; either there more than 0.5 miles of fish habitat or, in one case, species present at the proposed waiver site that were not accounted for at the bank site.

From the revised suite of candidate sites, ODOT proposed waiver sites that were thought to meet all of the conditions of the Pilot and presented them to ODFW. ODFW Fish Passage staff visited each proposed site, usually with ODOT staff, to make a "fish/no fish" call. (Note: ODOT received a lot of "no-fish" calls as well as a list of culverts that could be repaired without triggering fish passage which proved to be a significant benefit for ODOT).

ODFW District Biologists verified the fish/no fish calls and provided a list of species found at each site. Although all approved waiver sites ended up having only cutthroat trout habitat, this was not a criterion or condition of the Pilot. One proposed waiver was rejected by the Task Force because of the presence of chum salmon not found at the mitigation site. The administrative rule governing fish passage mitigation states that the mitigation has to benefit the species affected.

Finally, ODFW surveyed sites to determine the amount of habitat upstream from the culvert. Due to access issues, ODFW was not able to survey a few of the sites. In those cases, they used a default approach: they assumed the "worst-case scenario" for habitat distance using GIS to measure the entire stream length (if it was less than 0.5 miles).

Once waiver sites were approved by ODFW, information about the site was provided to Willamette Partnership staff to conduct a debit calculation using the NBA Tool.

Waiver Sites Debit Calculations

Calculations for twelve waiver sites were made in June 2019 using version 1.1i of the Fish Passage Credit Calculator. They are listed individually in Table 2. Note that there was an additional waiver site listed in the 2017 waiver application (Hwy 53, MP 11.30), but no habitat survey data or other information was ever provided for this site.

Table 2. Waiver Sites Used as Debits in the Fish Passage Banking Pilot

WAIVER #	SITE	MP	HABITAT SURVEY YEAR	BASIN	SPECIES	DEBITS (QUALITY-WTD ACRES)	3:1 RATIO OF DEBITS TO CREDITS	MINIMUM DEBIT AMOUNT
1	Hwy 53	3.11	2017	Nehalem	Cutthroat	0.022	0.066	1
2	Hwy 53	3.55	2017	Nehalem	Cutthroat	0.076	0.228	1
3	Hwy 53	3.83	2017	Nehalem	Cutthroat	0.081	0.243	1
4	Hwy 53	12.34	2017	Nehalem	Cutthroat	0.096	0.288	1
5	Hwy 202	13.26	2017	Klaskanine	Cutthroat	0.116	0.348	1
6	Hwy 202	15.15	2017	Klaskanine	Cutthroat	0.079	0.237	1
7	Hwy 6	13.95	2018	Wilson	Cutthroat	0.022	0.066	1
8	Hwy 30	79.2	2018	L. Columbia	Cutthroat	0.022	0.066	1
9	Hwy 101	74.39	none	Tillamook	Cutthroat	0.045	0.135	1
10	Hwy 101	78.43	none	Nestucca	Cutthroat	0.072	0.216	1
11	Hwy 101	78.84	none	Nestucca	Cutthroat	0.12	0.36	1
12	Hwy 101	98.46	none	Ocean	Cutthroat	0.319	0.957	1
				TOTAL				12

Scores and calculations for all the waiver sites can be compared on the summary spreadsheet (see Appendix 7. ODOTPilot_CreditCalculation_Summary_201906.xlsx), "waivers" tab. The individual Calculator spreadsheet for each waiver site as well as the geodatabase containing the spatial data layers used to calculate scores for each site are available from Willamette Partnership upon request.

A summary of the transactions (total mitigation bank credits generated and total mitigation bank debits used against the bank) is provided in Table 3.

Two conditions of the Pilot were that:

- 1) Debits will require a 3:1 ratio (meaning every debit will require 3 credits as mitigation); and
- 2) Waiver sites will be debited a minimum of 1 credit (so even a debit of 0.3 quality-weighted acres will be rounded up to 1).

As such, although each of the 12 waivers sites cumulatively incurred less than 1 debit total, the rules required that 12 debits be deducted from the bank.

Table 3. Summary of Bank Credits and Debits as Calculated by the NBA Tool

CREDITS (Habitat quality x quantity)			
Chinook Salmon	Steelhead	Coho Salmon	Cutthroat
18.7	26.8	21.1	25.0

DEBITS (Habitat quality x quantity)			
Chinook Salmon	Steelhead	Coho Salmon	Cutthroat
0.0	0.0	0.0	12.0

Once the 12 cutthroat trout credits were used to meet the mitigation requirements of the 12 waivers, the remaining credits were permanently retired from the bank (i.e. they are no longer available to be used to offset future impacts).

EVALUATING THE SUCCESS OF THE PILOT

Overall, the results and findings from the Pilot indicate that it has been successful in meeting its objectives and demonstrating that fish passage mitigation banking is a viable and useful mechanism to ensure that ODFW's fish passage net benefit requirements are addressed.

Performance of Net Benefit Analysis Tool

The rigorous testing and evaluation of the Net Benefit Analysis Tool has resulted in a process to credibly and consistently quantify the habitat benefits of improving passage at barriers and the impacts to passage from permitted activities. A brief synopsis of the evaluation of the performance criteria of accuracy, sensitivity, repeatability, and usability for the NBA Tool is found below in Table 4. The detailed results of the testing work can be found in the report summarizing the testing results (Appendix 4).

Table 4. Performance Criteria for the Net Benefit Analysis Tool

PERFORMANCE CRITERIA	DEFINITION	ASSESSMENT
Accuracy	Is the Calculator credible in rating a site in terms of native migratory fish habitat quality?	To evaluate accuracy, the Calculator habitat quality scores for each study site were compared with an independent rating of habitat quality (e.g. ODFW data) and/or assessments of habitat quality as determined by the best professional judgment of ODFW District biologists. Those ratings and/or assessments were correlated with Calculator scores to evaluate how well outputs from the Calculator matched independent assessments of a site's habitat quality.
Sensitivity	Is the Calculator able to reflect changes in numeric values for indicators in the habitat quality scores?	The data collected from all test sites were used in a Monte Carlo simulation in order to determine if the scores generated for various metrics were sensitive enough to distinguish differences among a series of sites believed to differ in habitat quality.
Repeatability	Does the Calculator produce similar results when used by different users?	Data was collected specifically to determine if three independent but similarly trained testers applying the Calculator to the same five sites produced similar scoring of those sites. To

		meet the standard of repeatability for the Calculator, the variation among testers needed to be less than the variation detected among sites. ³
Usability	Is the NBA Tool user friendly with clear instructions for use?	All field testers, and any ODFW and ODOT staff that were trained to use the NBA Tool, responded to a series of questions evaluating the usability of the calculator, the GIS application and the associated User's Guide.

Overall, the testing demonstrated that the Fish Passage Credit Calculator performs within reason for a tool relying on digital data and indices for habitat quality. Results from the accuracy testing show a fairly consistent relationship between Calculator scores and best professional judgment (BPJ) rating of habitat quality for native migratory fish with the Calculator scoring sites higher than BPJ. The consistency reflects that the combination of key ecosystem components or elements into an integrated rating or score of habitat quality using the current algorithms and weighting is occurring as expected; the results are not random. In addition, the application of the Calculator to three real-world previously granted waiver requests (and their associated mitigation sites) resulted in similar outcomes as the original ODFW Net Benefit determination process. This provides further evidence of the tool's consistent and expected behavior.

The sensitivity analysis demonstrated that the metrics were sensitive enough to distinguish differences among a series of sites believed to differ in habitat quality and also provides some insight into how significant each of the indicators is in contributing to the overall score(s) of habitat quality. There is an opportunity for experts and specifically with ODFW biologists to ensure that the tool accurately reflects the influence or contribution of these factors to habitat quality for native migratory fish. For example, understanding the highly influential effect of Passage Status on the credit or debit amounts for specific sites may lead us to possibly change its weighting or to develop a program level policy that accounts for its significance (e.g. by changing the ratio of debit to credit amounts).

Finally, the repeatability testing shows that the method for deriving GIS data for calculating Nearstream and Landscape scale scores of habitat quality is highly repeatable. This means that the instructions for using the Net Benefit Analysis Tool to calculate these scores are clear and understandable and the processes for transforming data into scoring elements has limited room for user error. By contrast, the current method used by biologists for determining habitat quantity is more subjective and therefore less repeatable. We observed a few cases where decisions about the upstream extent of a site were made differently between users, indicating that additional checks or recommendations be established to ensure that site definitions are correct. There is therefore an opportunity to potentially clarify the instructions for users; several illustrated examples may help provide guidance to users who are unsure or unclear about how to delineate the relevant stream network.

The findings from the testing, and the changes made to the NBA Tool as a result, mean that the Project Team is confident that the Tool will contribute to a more streamlined, repeatable, transparent and predictable process for determining net benefit to native migratory fish that will be an essential component of a Fish Passage Mitigation Banking Program for Oregon.

Effectiveness of a Mitigation Banking Approach

The evaluation of the effectiveness of a mitigation banking approach to meeting ODFW's Fish Passage Program goals was more qualitative and may need to consider the longer-term benefits of the approach. The evaluation criteria established at the beginning of the Pilot were that mitigation banking:

1. Provide a net benefit for native migratory fish

³ Elkum, N. and M.M. Shoukri. 2008. Signal-to-noise ratio (SNR) as a measure of reproducibility: design, estimation, and application. Health Serv. Outcomes Res. Protocol 8:119–133.

2. Streamline the waiver process for fish passage banking and made approval transparent and defensible
3. Use ODOT resources more efficiently to provide greater benefit to native migratory fish over the traditional approach.

The intention was to develop indicators or metrics for each of these criteria that would allow the Project Team to objectively evaluate the Pilot. The first criterion (*provide a net benefit*) was straightforward to evaluate. Even with the application of the very conservative conditions requiring a 3:1 ratio of credits to debits and requiring a minimum of 1 debit for each waiver, the benefits to native migratory fish by the removal of the EFSF dam clearly exceeded the cumulative impacts created by the 12 waivers.

The second criterion of *streamlining the waiver process* was challenging to demonstrate during the actual Pilot primarily due to challenges associated with finding eligible waiver sites. The original intention was to track i) ODFW staff time for processing both pilot and non-pilot waivers, as well as ii) processing time from waiver application submittal to issuance in order to estimate time savings and efficiencies gained. This was not practical over the course of the Pilot and because of the challenges finding eligible sites, would not have provided an accurate picture of the *potential* for mitigation banking to streamline this process. However, an established mitigation banking program with sufficient staff and with systems in place to manage information and manage banking transactions, would be a predictable process, and one that would allow permittees with mitigation obligations to plan out their activities and estimate costs more efficiently and effectively than may happen under the current system.

The third criterion of *using ODOT resources more efficiently* was to be evaluated by tracking dollars expended per quality-weighted area of fish habitat opened in the North Coast and other parts of the state to estimate the value of investment in fish passage using mitigation banking over the traditional approach. Again, the effort required to find eligible waiver sites was an unforeseen challenge and made evaluation of this criterion during the Pilot impractical. But again, a fully functioning fish passage mitigation banking program would allow ODOT to estimate the costs and timelines of meeting their mitigation obligations.

ISSUES AND CONSIDERATIONS

Use of aquatic inventory habitat data to define habitat area and quality

One of the issues that arose during the Pilot was the use of aquatic inventory data (AQI) to define habitat area and quality. The current version of the NBA Tool uses the AQI habitat data previously collected during the Oregon Plan and basin-wide surveys and provided to the Project Team by the AQI laboratory. Only the reach-level data for the AQI Oregon Plan surveys, which are more widely distributed than the basin-wide surveys but are of shorter survey length, have been routed to stream data and can be displayed spatially in GIS. Both the reach-level and the unit-level data from the basin-wide surveys have been routed to the stream data; however, the majority of those habitat surveys were done prior to 2010 and may not represent current-enough stream conditions, so are of limited usefulness for the NBA process.

This led the project team to two conclusions. One, given the limited availability of recent habitat surveys, it is most likely that a waiver request for a specific barrier will require that the upstream reaches above the barrier be surveyed for habitat condition. Consequently, any method(s) developed to restrict habitat data by species distribution, and estimate habitat quality and quantity, must work on newly collected habitat survey data. Two, there is no immediate GIS-based method available to subset the available habitat unit data for each species above a barrier. And the data processing tools and knowledge for aggregating habitat units to the reach level are currently only available to the AQI laboratory staff who developed survey methods, databases, and data analyses processes. Further work is needed to refine an improved strategy for (more) consistent determination of habitat quantity of a specific site and to develop written guidelines describing the appropriate use of AQI habitat data.

Data Availability

In general, it is understood that older habitat data may not represent current stream conditions, therefore are of limited usefulness for the NBA Tool, and in many cases, there is insufficient habitat data available above a barrier meaning that data would have to be field collected.

As such, data collection could be a costly component of calculating debits associated with waivers, and could be an additional cost burden for some applicants. One approach to address this could be to provide the option for applicants to assume all high/maximum values in the NBA Tool as a “default”. This would maximize the debit obligation but would negate the need to expend resources on data collection.

It should also be noted that access to waiver sites to collect field data can be a challenge, especially on private landownership where it can take time to have access granted, or where access may be denied.

Calculator Outputs and District Biologist BPJ

During the testing phase, the Project Team received feedback that ODFW District Biologists would be more comfortable if the results from the Calculator were better aligned with best professional judgment (BPJ) in terms of accuracy testing. Given the variability of BPJ itself (see comparison between BPJ and HabRate in the Testing Report), it turns out that it may not be an effective reference point. But since ODFW District Biologists will be the final authority on how a site is rated, it is important they are not in a position to be in constant disagreement with Calculator outputs.

We recommend adopting Willamette Partnership’s verification standard⁴ in future program implementation: if a waiver applicant and a District Biologist agree within +/- 15% of the Net Benefit Analysis Tool outputs, then the waiver applicant’s results are accepted. If, however, there is greater than +/- 15% difference, then the District Biologist finding holds (i.e. either the District Biologist’s estimate of debits is accepted by the waiver applicant or there is an opportunity to redo some/any of the data analysis using the NBA Tool so that the estimate falls with the +/- 15% window).

LESSONS LEARNED FROM PILOT IMPLEMENTATION

Implications of Pilot Conditions/Limitations of Use

ODOT found the conditions of Pilot somewhat limiting; specifically, it was challenging to identify waiver sites that met the <0.5-mile limit/criterion. The geomorphological conditions of the North Coast likely mean that there are not many fish bearing streams in that region that are less than 0.5 miles, at least in proximity to the ODOT highway system, which is primarily located lower in stream basins. A lot of time and resources were expended by both ODOT and ODFW staff looking for eligible sites. This is relevant to the service area discussion below, though it is worth considering that other potential bank users such as the Oregon Department of Forestry or the US Forest Service may have more opportunities to meet this criterion.

Bank Siting and Service Area

Defining service areas for a statewide fish passage mitigation banking programs usually requires consideration of both ecology and economics (i.e. balancing the ecological needs for native migratory fish habitat with the economic sustainability of a bank as determined by the potential supply and demand of fish passage mitigation credits). The most important aspect of a fish passage banking program is ensuring net benefit for native migratory fish for any waiver provided or fish passage bank approved. Yet, the economics of a fish passage banking program also need to work; there needs to be enough demand for credits and enough sales of credits to make any investment in a mitigation bank economically viable.

⁴ <https://willamettepartnership.org/wp-content/uploads/2014/09/Verification-Protocol-V-1.pdf>

The service area for the Pilot, the North Coast District, was determined using the Fish Passage Statute definition of “in proximity” defined as an OWRD basin (or 4th field HUC). The North Coast District service area presented a challenge for ODOT during the Pilot; it was reportedly difficult to find waivers that met all the conditions of the Pilot in that area primarily due to the 0.5 mile habitat limitation. There was general consensus from ODOT staff that if the 0.5 mile habitat limitation were increased to 1.0 miles, there would have been more candidate waiver sites. ~~constitutes an effective service area for a fish passage mitigation bank moving forward.~~ The timelines of the Pilot were also a consideration; there was general consensus among participants that needing to find candidate waiver sites within the three year period of the Pilot acted as an additional constraint.

One way to evaluate the potential effectiveness of a particular OWRD basin as the service area for a mitigation banking program is to conduct a demand analysis that estimates how many projects in a given service area are likely to need debits request waivers in say, the next five years. The analysis could also include estimates of how much would it cost to provide passage at one of ODFW’s identified priorities (as a mitigation bank), and determine if the potential demand would make the investment viable. This would be important given the differences in size and habitat distribution among different drainages throughout Oregon. And it would be essential if is ODOT (or another entity) is the sole user of a future banking program.

Opening the bank to additional users could help to increase demand for waivers and improve the potential return on investment in creating a bank.

There may also be options to define specific criteria by which a fish passage bank may use a smaller service area than the 4th field HUC. For example, a smaller service area might be used if the waiver is for a stream with important fish populations (putting the impact and mitigation in closer proximity). The determination of appropriate size of a mitigation bank service area will be easier with information on the location and timing of demand (potential waiver sites) and supply (the costs of creating a fish passage bank at a sample of priority fish passage barriers) for a given geography.

Cost/Benefit of a Mitigation Banking Program

The economics of a service area size ties into the issue of the costs associated with a mitigation banking program, specifically how much resources are potentially required to find eligible waiver sites and to collect any field data needed to calculate debits using the NBA Tool.

The cost of quantifying credits and debits cannot/should not be a disincentive to users of a mitigation bank; banking needs to be affordable to potential bank users/applicants (e.g. counties and Oregon Department of Forestry as examples).

One approach to limit costs for bank users/credit purchasers could be to provide the option for applicants to assume all high/maximum values in the NBA Tool as a default. This would maximize the debit obligation but would negate the need to expend resources on data collection. A future option could be to incorporate the use of less expensive remote data (e.g. LIDAR where available) into the NBA Tool.

Finally, the Project Team developed a rapid/simple approach to the net benefit analysis to be used for scenario planning (see Appendix 8). Applying the Net Benefit Analysis Tool for basic site evaluation and screening provides several types of information about a potential passage improvement project site: delineation of the site, estimation of the extent of potential habitat above a barrier for each native migratory fish species, and a relatively coarse-scale assessment of the quality of the habitat above the barrier. It would allow waiver applicants and ODFW staff to quickly run a desktop analysis and get a ballpark estimate of the potential costs and benefits of pursuing a full credit or debit calculation for a specific site.

ODFW Staff Capacity

ODFW has consistently identified lack of capacity as a concern/limiting factor in implementing and operating a fish passage mitigation banking program. Operationally, there are specific needs for GIS expertise (using and adaptively managing the GIS component of the NBA Tool) as well as administrative responsibilities for managing the process of reviewing and approving waivers/debits and managing data and information associated with banking transactions that are currently beyond the capacity of Fish Passage staff.

Ideally, there are efficiencies to be gained through agency-wide use of mitigation banking. The additional effort would be offset by no longer needing to manage individual waiver applications so that in the long run, this approach would represent a time savings over the current net benefit analysis. There are also opportunities to develop agency-wide systems for managing the needs associated with mitigation programs; both a fish passage and a sage grouse habitat banking program managed/operated by ODFW would have similar needs in terms of credit registries and GIS capacity.

Finally, the methodology and process should improve with use and refinement (adaptive management) and, over time, there would be an expectation that staff capacity would be more efficiently aligned with the needs of operating the banking program that did not exist during the pilot phase.

RECOMMENDATIONS FOR MOVING FORWARD: CONSIDERATIONS FOR STATEWIDE/FUTURE USE

Scope of Program

Geographic Area

While the geographic area of the Pilot was limited to the North Coast District, one of the key objectives of this project was to evaluate options for expanding a fish passage mitigation banking program regionally or statewide, assuming that there were clear benefits to be gained from establishing and operating such a program. The determination of an appropriate geographic scale at which to expand a banking program in the future will be based on several factors:

- *Demand*: what is the predicted future demand for waivers and potential use of a mitigation bank?
- *Supply/Bank Sponsors*: what is the potential for entities/organizations to create a mitigation bank and a supply of mitigation credits?
- *ODFW staff capacity*: what is the potential for ODFW staff to increase capacity to manage a mitigation banking program in the future?

Multi-User Banks

The Pilot was limited to ODOT as the only user of the mitigation bank, however, most mitigation banks are open to multiple users. In the case of fish passage, there are a number of entities that could find mitigation an attractive option to meeting the net benefit requirement when trigger events require fish passage be addressed. Opening the Fish Passage Mitigation Banking Program to multiple users should not add significant complexity to the overall management of the program. The development and use of a credit registry (see below) would be a straightforward way for ODFW to manage and track the activity of different users.

Bank Sponsors

In the world of mitigation banking, the development of mitigation banks or sponsoring a mitigation bank is often undertaken a financial opportunity. Fish passage mitigation bank sponsors could include entities such as ODOT with enough future impacts to make the sponsorship of a fish passage bank worthwhile. It could also include a private entity that views the sponsorship of a bank as a lucrative financial investment. For example, in 2017, there was express interest from an outside third party to invest in a second fish passage mitigation bank in Oregon. Soliciting what kind of interest there might be from different bank sponsors would be an important element of determining the potential for expanding the banking program.

Batched Waiver Approach

Because of the uncertainty associated with demand for waivers for a given bank and the limited ability to develop a clear demand analysis for future waivers/debits, it may be challenging for a bank sponsor to calculate the potential return on investment of removing a high priority barrier. One option could be to pursue a “batched waiver” approach to siting future banks. Ideally, ODOT and others entities with likely waivers, could plan out proposed projects in a 5 to 10-year window in a specific service area and determine if there is enough demand to attract a bank sponsor. The bank sponsor would then site the bank in that service area and have some certainty about a specific level of demand for credits making the investment more attractive.

NBA Tool Changes for a Statewide or Regional Program

The Fish Passage Net Benefit Analysis Tool was developed specifically for the North Coast pilot area. If fish passage mitigation banking is ultimately approved for regional or state-wide use, a number of modifications will need to be made to ensure applicability of the tool in other areas of the state.

There are a number of places in the Calculator spreadsheet where specific fish species are listed. The species checklist on the cover page and the list of species with HabRate scores are currently specific to the pilot area. If the Calculator is used in other areas of the state, these would need to be modified to include local species and remove inapplicable ones. The suite of species for which input criteria have been developed for use in the HabRate model is limited. If there are additional native migratory fish

species of special concern in other areas of the state, ODFW staff could request the Corvallis Research Lab customize inputs for those species and add them to the HabRate model.

The significantly different climatic conditions in areas of the state east of the Cascades would require some additional considerations if the Calculator is to be used there. In degraded systems, water temperatures may be more likely to reach lethal levels and some stream reaches may be de-watered to the point of going dry at certain times of the year. The HabRate model does have the ability to factor these conditions into the model and override habitat scores in reaches where these conditions would prevent fish use. Extra attention would need to be paid to making sure the temperature and flow data required for that feature are provided as part of the request to the Corvallis Research Lab for HabRate results in places where this is applicable.

Another consideration for eastside streams is the Functional Riparian indicator. This indicator is currently most suitable for use in stream systems where forested plant communities would naturally be dominant. Other vegetation cover classes and associated riparian functionality modifiers may need to be identified for parts of the state not normally dominated by forests such as sagebrush steppe and native bunchgrass prairie found in Eastern Oregon.

When the Project Team embarked on this effort, there was interest in designing a calculator to determine debits and credits not only for culvert projects but also for other types of barriers such as dams, dikes/levees and tidegates. For the most part, the overall process and a number of the indicators probably can be used in these situations but some adjustments will be necessary. An additional consideration in the case of new proposed dams might include an assessment of potential downstream effect from the dam. In the case of dikes/levees and tidegates, a supplemental estuarine habitat quality module will need to be developed to replace the HabRate habitat quality rankings since the attributes used in HabRate are specific to stream systems. In some cases, where a project affects both estuarine and stream habitats, quality adjusted acres using both rankings could be used.

Finally, the weighting factors applied throughout different parts of the Calculator could also be tailored to different regions of the state.

Need for Credit Registry

Any formal implementation of a mitigation banking program would require the development and use of a credit and debit management system to track the status of credits generated by banks and the transactions that take place within a specific bank (i.e. debits used against the bank)⁵. In mitigation banking programs, this system is often referred to as a “registry” or “credit registry”.

Many registries assign unique serial numbers to credits and track movement of credits and debits. At a minimum, a credit registry needs to account for the following activities:

- **Bank development:** generation of credits by an organization or entity that wishes to develop a project or projects that creates benefits for native migratory fish
- **Waiver/impact project:** generation of debits by an organization or entity that triggers a fish passage mitigation requirement (and wishes to purchase credits as a means of meeting their net benefit requirement)
- **Verification:** the process by which ODFW reviews and then formally approves a credit or debit estimate
- **Transaction:** the deduction of credits from a bank
- **Credit retirement:** the removal of available credits from a bank
- **Bank retirement:** the closure of a bank when all available credits have been sold.

⁵ For example, the U.S. Army Corps of Engineers uses the [Regulatory and In-lieu fee Bank Information Tracking System](#) (RIBITS).

A credit registry for a fish passage mitigation banking program operated by ODFW would ideally have the following core functions:

FUNCTION	CHARACTERISTICS/DATA RECORDED
Track status of individual projects (impacts and barrier improvement/removal projects)	• Geographic location – basin/stream/highway milepost • Organization – who is responsible • Status – proposed/planned, under construction, complete
Track status of individual credits	• Provenance – which project a credit was created from; year created • Signature - what habitat and species/life stage it represents • Status - what has been done with it (used to offset impacts, used to account for uncertainty, permanently retired)
Mitigation Bank or All Credits Ledger	• Integrate information from individual credits to provide a basic accounting of credits and debits at present and over time (i.e. trades that have already happened) • Show the balance (credit availability, credits retired) of a bank
Reporting	• Some level of internal and external reporting • 'Effectiveness' reporting to demonstrate success of banking approach in meeting agency fish passage goals

Other Function and Usability Issues for Consideration

Criteria for developing a credit registry would include the following usability criteria:

- Usable by ODFW staff with training
- Inexpensive to set up and maintain
- Flexible enough to start simply and then add complexity/increased functionality (e.g. more credit types such as Sage Grouse Habitat mitigation credits) as needed.

Some considerations for the credit registry include:

- Should there be a public-facing aspect to the registry?
- Should it be shareable with/accessible to other state or federal Agencies?

A brief memo outlining the needs and characteristics of a credit registry for ODFW is available in Appendix 9.

CONCLUSION

The Fish Passage Mitigation Banking Pilot has been a rigorous and thorough evaluation of the potential of mitigation banking to meet the objectives of Oregon's Fish Passage Statute which ensures that impacts to fish passage are addressed using a net benefit standard.

Mitigation banking is generally seen as an efficient and effective way to address permitted impacts to natural resources. An ODFW fish passage mitigation banking program has the potential to create incentives to remove high priority stream barriers, would be effective in shifting mitigation from multiple, geographically dispersed waiver sites towards fish passage banks, and would eliminate the temporal loss of habitat that usually occurs between when a permitted impact takes place and when mitigation work is completed. The result would be significant benefits for native migratory fish and a substantial ecological return on investments made in improving passage in order to increase accessible habitat for fish. Use of the Net Benefit Analysis Tool to calculate how many credits and debits are created by restoration and construction projects respectively can also help identify where removal or improvement of artificial barriers and reestablishing passage can have the greatest benefit for native migratory fish species within a watershed.

Finally, mitigation banking creates a standardized and transparent process for ODFW, waiver applicants, and other stakeholders to evaluate whether mitigation is appropriate, adequate, and sustainable in terms of meeting conservation goals for native migratory fish habitat in Oregon.

ODFW and ODOT have made a considerable investment in the development, testing and demonstration of what is required to implement an effective fish passage mitigation banking program, providing one of the first examples nationwide of such an approach. Over the course of the Pilot, there was considerable interest from outside groups (e.g. from groups interested in developing a similar program in Savannah, GA and from South Korea) and the Pilot was featured in several write ups including a national Nature Conservancy [report](#) on environmental markets and stream barrier removal as well as Oregon Water Resources Department 2017 [Integrated Water Resources Strategy](#).

The tools and systems developed under the Pilot provide a repeatable, transparent, and data-driven process for making decisions about when and where to mitigate the effects of development on fish habitat and will serve as a useful foundation for ODFW should they decide to move forward with a regional or statewide Fish Passage Mitigation Banking Program.

APPENDICES

Appendix 1. Purpose, Gaps, and Path Forward to a Pilot Fish Passage Banking Program. Task 1 Final Report. April 2013

Appendix 2. Net Benefit Analysis Tool (Calculator, GIS Interface instructions)

Appendix 3. Signed Fish Passage Mitigation Banking Instrument. September 2014

Appendix 4. Results from Testing the Net Benefit Analysis Tool. Task 2 Final Report. April 2017

Appendix 5. Fish Passage Banking Pilot Overview. Public Comment document. April 2015

Appendix 6. Credit Calculations for EFSF Trask Dam (Fish Passage Credit Calculator v1.1.i_Bank_EFSFTrask_20180816.xlsx)

Appendix 7. Debit Calculations for Waiver Sites
(ODOTPilot_CreditCalculation_Summary_201906.xlsx)

Appendix 8. Rapid Net Benefit Analysis for Scenario Planning. April 2017

Appendix 9. Needs and Characteristics of a Credit Registry for ODFW