



**Oregon Department of Fish and Wildlife
Fish Screening and Passage Program**

Fish Passage Priority List

February 1, 2013

Prepared By: Ken Loffink

Table of Contents

Acknowledgements	3
(1) Introduction	4
(1.1) Requirements of Rules and Statutes	4
(2) Past Prioritization Efforts	5
(2.1) 2007 Priority List	5
(2.2) Lessons Learned from 2007	6
(3) Development and Methodology of 2012 Priority List	7
(3.1) Data Inventory and Standardization	7
(3.2) Role of ODFW District Staff	8
(3.3) Role of Fish Passage Task Force	9
(3.4) Data Limitations	10
(4) The Prioritization Model	11
(4.1) The Equation	11
(4.2) Definitions and Data Sources	12
(4.3) Assumptions Made in the Model	17
(5) Results of the 2012 Prioritization	19
(6) Recommendations for Future Prioritization Efforts	19
(6.1) Data Source Refinements	20
(6.2) Model Refinements	20
(7) Conclusions/Discussion and Potential Use of the Priority List	21

Appendices

Appendix A: 2007 Priority List

Appendix B: 2007 Priority List Highlighting Removed or Fixed Project

Appendix C: 2013 Priority List

Acknowledgements

ODFW Staff: Todd Alsbury, Greg Apke, Tim Bailey, Pete Baki, David Banks, Jon Bowers, Robert Bradley, Jason Brandt, Bob Buckman, Jean Castillo, Chris Claire, Todd Confer, Charlie Corrarino, Nadine Craft, Jay Doino, Bill Duke, Mark English, Matt Falcy, Alex Farrand, Danette Faucera, Rod French, Chuck Fustish, Michael Gray, David Haight, Karen Hans, Rick Hargrave, Mike Harrington, Ray Hartlerode, Ron Hendrickson, Brett Hodgson, Tabatha Hoge, Holly Huchko, Shannon Hurn, Laura Jackson, Lisa Kingsley, Chris Knutsen, Michael Lambert, Steve Mamoyac, Steve Mazur, Ryan McCormick, Bruce McIntosh, Tom Murtagh, Jeff Neal, Ray Perkins, Dave Plawman, Tim Porter, Kelly Reis, Alan Ritchey, Pete Samarin, Ruth Schellbach, Jason Seals, Brent Smith, Marty Smith, Roger Smith, Lance Solis, John Spangler, Tom Stahl, Bill Tinniswood, Dan VanDyke, Gary Vonderohe, Joel Watts, Derek Wilson, Jeff Yanke, Jeff Ziller

Fish Passage Task Force: Doug Dehart, David Heller, Kim Kambak, Stuart Myers, Dawn Nilson, David Newton, Harry Rectenwald, Vera Simonton, Willie Tiffany,

1. Introduction: Purpose and Need

Fish passage is a key component to many facets of fisheries resource management. Connectivity between aquatic habitats is an important part of garnering successful and healthy fish populations. Without habitat connectivity, resident or fluvial fish species such as native trout, suckers, and whitefish become isolated, leading to reduced levels of genetic diversity and fitness. For anadromous populations, fish passage can allow access to new habitats or fertile spawning grounds that are pivotal for success of the species. In addition to providing access to vital spawning habitats for adults, fish passage also provides access to essential rearing habitats for juvenile species. Population isolation due to fish passage barriers also heightens migratory fish exposure to disturbances, thus increasing the potential magnitude of the disturbance at a population or individual level.

Fish passage barriers are prevalent throughout the Oregon landscape. Over time, despite fish passage rules and regulations, access to native fish habitats has been blocked or impaired by the construction of impassable culverts, dams, tide gates, dikes, bridges, and other anthropogenic infrastructure. Providing passage at these artificial obstructions is vital to recovering Oregon's native migratory fish populations. The Oregon Department of Fish and Wildlife's (ODFW) latest inventory shows over 27,800 artificial obstructions to fish passage in the State of Oregon. Of those, only 17% are documented as providing adequate fish passage for native migratory fish¹. With so many barriers spread across the landscape, and funding becoming scarce, it is paramount that we thoroughly prioritize fish passage, with inclusion of multiple parameters. This will allow for a focused effort to improving passage conditions and meeting a critical need of Oregon's native migratory fish.

1.1 Required by Statute and Rule

Fish passage prioritization and inventory is a requirement of the ODFW's Fish Passage Program (FPP) through Oregon Revised Statute (ORS) 509.585 (3). This statute states that ODFW shall "complete and maintain a statewide inventory in order to prioritize enforcement actions based on the needs of native migratory fish." Furthermore the statute states that the Department shall update the priority list every 5 years. The last fish passage priority list was approved by the Oregon Fish and Wildlife Commission in 2007.

As noted, the priority list shall be based on the needs of native migratory fish. More specifically, the base requirements of the priority list are identified in Oregon Administrative Rule (OAR) 635-412-0015 (2). This rule states the following:

The priority list shall be based on the needs of native migratory fish.

(a) The prioritization shall consider the following factors relative to each artificial obstruction for all native migratory fish currently or historically present at the artificial obstruction:

- (A) the quantity of native migratory fish habitat which is inaccessible,
- (B) the quality of native migratory fish habitat which is inaccessible,

¹ Note: During fish passage barrier data compilation efforts, emphasis was placed on the identification of features with known passage issues.

- (C) unique or limited native migratory fish habitat which is inaccessible, or should remain inaccessible for fish management purposes,
 - (D) the biological status of the native migratory fish,
 - (E) the level of fish passage currently provided at the artificial obstruction,
 - (F) the presence of other artificial obstructions upstream and downstream and the timeframe native migratory fish will be able to utilize restored passage, and
 - (G) existing agreements with the Department regarding fish passage.
- (b) The prioritization may utilize existing Department information or professional judgment in the absence of information specific to a given site.
- (c) The priority list shall contain one artificial obstruction per Oregon sub-basin, which shall be ranked across the state.

The 2013 fish passage priority list was developed in accordance with these requirements and guidelines.

2. Past Prioritization Efforts

Artificial obstruction inventory and prioritization was identified as a key component of managing fish passage in Oregon during the formation of Oregon's fish passage laws. The Fish Passage Task Force (FPTF), a volunteer advisory group created when fish passage laws were accepted in 2001, further defined the need for inventory and prioritization. Criteria and guidelines for fish passage prioritization were defined in 2004, and even though some level of prioritization of projects has always occurred, the first formal fish passage priority list was approved in 2007.

2.1 2007 Priority List Methodology

In 2007 ODFW developed a priority list of artificial obstructions consistent with the guidelines listed in the rule and met the statutory needs presented in section 1.1. During the 2007 prioritization effort, ODFW FPP staff asked each of the 18 ODFW fish districts to provide the top 5 fish passage priorities in their district. District Biologists and staff were not expected to do extensive on-the-ground data gathering, as these top passage priority sites should have been readily evident based on their knowledge district. In addition, District Biologists were asked to exclude sites where fish passage restoration was imminent (i.e., a totally funded project is in place or clear trigger has or will happen) and sites where mitigation (per an agreement) was provided (e.g., waiver sites, Corps of Engineers' dams with hatcheries, hydropower dams with Settlement Agreements). The District Biologists were also asked to rank the priority barriers within their District, without limitations on number per sub-basin and based on professional judgment (i.e., taking into account factors that are not otherwise quantified). Finally, the District Biologists were asked to provide the following information for their priority barrier sites, which was used to rank them collectively across the state:

- number and listing status of native migratory fish species present currently and historically,
- distance of habitat blocked by the artificial obstruction,
- subjective quality of habitat blocked by the artificial obstruction,

- other complete (total blocking barriers) upstream and downstream artificial obstructions,
- the current level of passage at the artificial obstruction (i.e., is it a complete or partial barrier), and
- importance of upstream habitat for unique or isolated native migratory fish populations.

The information, provided by the District Biologists, was then used to rank sites across the State to come up with the statewide priority list. The primary factors used for the statewide ranking were: the number of state and federally-listed threatened and endangered migratory fish species; the distance which would be made accessible, upstream of the site, to the next complete barrier; the number of complete downstream barriers; the level of fish passage currently provided at the site; the presence of unique populations or habitat; and the relative ranking made by the District Biologist. The influence of each of these factors on a site's ranking are summarized below:

<u>Factor</u>	<u>Impact on Ranking</u>
T&E Species.....	higher number increases priority
Distance.....	higher distance increases priority
Downstream Barriers	higher number decreases priority
Passage Level.....	higher level of obstruction increases priority
Unique Site.....	higher degree of uniqueness increases priority
District Biologist Rank*	higher rank increases priority

* takes into account habitat quality

The final approved 2007 fish passage priority list is attached (Attachment A). The final 2007 list did not include a numeric ranking, rather the list categorized projects into low, medium, and high categories based on their priority scores. By grouping barriers into low, medium, and high priority categories, variability surrounding the data used for ranking as well as the variability in the ranking methodology (prioritization model) has less impact on the priority list.

2.2 Lessons Learned from the 2007 Priority List

The 2007 priority list provided the framework for the 2013 prioritization effort. During the 2007 effort, the expertise of District Biologists and their staff was vital to the development of the priority list. The institutional knowledge harbored within the districts was and continues to be invaluable to this prioritization effort and other fish management actions. However, the need for more data was clear. The final 2007 Priority List tabulated data and ranked a total of 67 barriers, each of which was located within a different Oregon sub-basin. This number fell a little short of the requirement for a barrier in each of the 90 sub-basins that are totally or partially within Oregon. Several sub-basins did not receive a priority barrier, because either no priority barriers were identified in those sub-basins, or barrier information was limited within those sub-basins.

The 2007 Priority List identified 67 priority fish passage barriers. However, hundreds of other priority barriers were not identified by this Priority List. As such, there was some public perception that if a barrier was not on the list, then it was not a high priority. Due to this perception, the 2013 prioritization effort focused on obtaining a more complete inventory and using a more comprehensive prioritization to establish a more robust list that better reflected the scope of the fish passage issue in Oregon.

Despite data limitations, the 2007 Priority List was a very useful tool for fishery managers. Of the 67 barriers on this list, 17 have been addressed either through removal of the artificial obstruction, or through construction of an approved fish passage facility (Appendix B). Addressing passage at 17 high priority fish passage locations in five years is a significant accomplishment.

3. Development of the 2013 Priority List

By reviewing the 2007 prioritization efforts and the lessons learned from that effort, the 2013 prioritization focused on two primary goals: 1) a more comprehensive inventory of fish passage artificial obstructions in Oregon; and 2) a more robust prioritization structure list and methodology. The 2013 prioritization effort utilized a comprehensive approach that was both data driven and based on professional knowledge. This new approach includes components that incorporated data standardization, barrier inventory, professional knowledge, and biological data.

3.1 Geographic Information Systems (GIS) Data Inventory, Standardization, and Prioritization Metrics

The need for a more comprehensive single artificial obstruction database in Oregon has been longstanding. Beginning in 2007, the ODFW Natural Resource Information Management Program (NRIMP) began the inventory data management process by creating the Oregon Fish Passage Barrier Data Standard (OFPBDS). This data standard established the type of information (data content), and the format of that data (data structure), needed at every artificial obstruction site to accurately inventory and prioritize fish passage obstructions.

After the creation of the OFPBDS, NRIMP began compiling barrier inventory data from multiple sources throughout the state. Data was obtained from local, state, and federal agencies, watershed councils, tribes, counties, and other entities that possessed fish passage barrier data. These data were compiled, standardized to match the requirements of the OFPBDS, and were loaded into a GIS database. This database represents the most thorough statewide inventory of artificial obstructions to date, and includes information on the number and type of artificial obstructions in the state, as well as the level of fish passage at each barrier, and the physical characteristics of each obstruction.

The database is dynamic, but the most up to date information shows that approximately 27,800 fish passage artificial obstructions (those structures, such as culverts, dams, tide gates, levees, etc., placed in fish bearing streams that hinder, or have the potential to hinder fish passage) exist in Oregon. This number continues to grow as our knowledge of structures across the state increases. Of this total, approximately 17% are documented as providing adequate fish passage, 21% are complete barriers to fish passage (block all life stages, species, etc.), 19% are partial barriers, and approximately 43% have a “status unknown passage condition.” Of the 27,800

artificial obstructions in the database, culverts make up the vast majority with over 23,000 (83%) inventoried, while dams are the next most common barrier type with over 2,500 inventoried (9%).

After standardizing the barrier data and compiling a statewide inventory, a series of maps and spreadsheets containing barrier data was distributed to ODFW fish District Biologists for review, refinement, and to support the fish passage prioritization effort. Maps were created at the 5th Hydrologic Unit Code (HUC) watershed level (approximately 1:24,000 scale), showing the location of each barrier in the database, the barrier's fish passage status, and its location relative to current fish distribution and other artificial obstructions. These maps were tools for district staff to review and make decisions regarding the highest priority barriers in each respective district. They also, provided staff an opportunity to comment and provide input on data gaps. During this process, ODFW District Biologists and staff were asked to identify the top 25 priority barriers in each of their respective watershed districts.

Once all "top 25" barriers and other data inputs or corrections were compiled, NRIMP analyzed each of the priority barriers and applied the applicable data needed for prioritization. Specifically, at each priority barrier, the quantity of available upstream habitat (by species), species presence, the biological status of species present, and the number of upstream artificial obstructions were tabulated. The priority barrier metrics were then provided to the FPP for input into the prioritization formula.

3.2 Role of ODFW District Staff

In December 2011, 18 ODFW Fish Districts were contacted to provide additional information and review of the fish passage prioritization process. The request contained instructions for each district to perform the following:

- Identify the district's 25 highest fish passage priority barriers
 - o Based on the biologist's knowledge of their district, fish use, habitat, etc.
- Review, edit, or confirm data listed on the maps and spreadsheets for each barrier included on the district's top 25 list, including level of passage, habitat quantity upstream (current and historical), native migratory fish presence, and biological status of those fish (listed as threatened or endangered under the Endangered Species Act (ESA)).
- Review, edit, or confirm information for other priority barriers not in the district's top 25.
- Provide additional barrier information where data gaps exist within the database

By the end of January 2012, each district had submitted the requested information on their "top 25" priority barriers. The focus of this initial step was to create a comprehensive list of priorities based primarily on the biological benefits that would occur, if passage were provided at the artificial obstruction.

As discussed in section 2.1, maps and spreadsheets were provided to district staff to assist in the prioritization process. Regardless this process was a cumbersome exercise for district staff to complete. Some districts have in excess of 1,000 barriers, with varying amounts of associated information and data. Selecting a "Top 25" from each district was a challenge. In doing so,

district staff was also able to provide valuable input NRIMP regarding fish species, habitat data, and distribution. Selecting only a “Top 25” was difficult for some districts due to the magnitude of known artificial obstructions. Many districts included more barriers than the minimum 25 that were initially requested. All artificial obstructions that district staff included as their top priority barriers, regardless if more than 25 were submitted, were included in the final fish passage priority list.

After the initial request for top priority barriers, and the subsequent addition of the applicable biological information by NRIMP, the FPP requested final input from District Biologists in August 2012. This final step involving district staff was used to gather qualitative information, based on best professional knowledge or judgment, or other data sources when applicable that would increase or decrease the priority ranking of a given barrier. During this process District Biologists also confirmed the native migratory fish species present at each priority barrier, and made final comments. All of the final comments and information was received by the FPP from September through November 2012.

3.3 Role of Fish Passage Task Force

The Fish Passage Task Force (FPTF) is comprised of nine volunteers, appointed by the ODFW Director, whom represent interests subject to the installation of fish passage facilities (also referred to “water users” as a generic term), Fishing Conservation, and Public-at-Large constituencies. The FPTF makes recommendations to the Oregon Fish and Wildlife Commission, reports to the Oregon Legislature, and advises ODFW on rulemaking, funding, waivers, exemptions, and prioritization. The FPTF has been vital in developing the 2013 fish passage priority list.

The FPTF has reviewed and made recommendations on various aspects of the prioritization steps throughout 2011 and 2012. In November of 2011, the FPTF was provided a copy of the 2007 priority list (Attachment A), and a copy of the 2007 priority list that highlighted priority barriers that had been removed or corrected (passage provided at) on the list (Attachment B). During this meeting, staff notified FPTF members that a new prioritization effort in 2012 was forthcoming. At this time FPTF members brainstormed potential goals and uses of the new Priority List and provided suggestions to FPP staff.

In February of 2012, the FPTF identified “prioritization and inventory” as a top FPTF priority and a key component of the FPP. During discussions, the FPTF recommended that the FPP consider application of the best available science, biological effectiveness, and program efficiency during the fish passage prioritization process. At this time the FPTF recommended that staff document each step and the process for developing the list and ranking criteria, in order to provide context for the list, build a basis for continued refinement of the prioritization process, and create transparency for the list and process.

During June of 2012, the FPTF provided recommendations to FPP staff regarding the equation to be used to calculate the priority ranking of each barrier. The FPTF reminded staff to try and keep the prioritization process as simple as possible, especially given the large number of barriers and the variable nature of the data provided, but keep it biologically sound. The FPTF discussed the “weighting” of specific factors, and recommended that staff test different approaches and weighting of criteria in the model development. It also recommended sensitivity testing to

determine how different variables and weighting factors affected individual rankings. FPTF members also discussed the factors to be used in the prioritization list, and recommended that the list follow the requirements listed in OAR, that each specific factor used in the prioritization should be well defined, and have appropriate data sources cited.

The FPTF discussed several potential uses for the prioritization list including:

- Enforcement (as required by ORS)
- Solicitation of funding
- Allocation of limited funds for restoration actions.

Based on these recommendations from the FPTF, FPP staff continued the development of the priority list. Specifically, FPP staff ensured that the process was well defined and documented, and that the list would be robust and defensible. It was hoped that the list would be useful for not only enforcement purposes, but also serve as a tool for funding agencies (OWEB, Amercian Rivers, other grantors) and fish passage project implementers statewide (Watershed Councils, SWCD's, tribes, local ODFW offices, etc.).

In August of 2012, FPP staff presented a draft prioritization methodology for ranking passage barriers to the FPTF. The draft equation, used to generate rating scores, incorporated many factors, including level of passage, species present, habitat quantity, and habitat quality. The FPTF noted the complexity associated with creating a universal equation to calculate priority and discussed the difficulties associated with this process given the wide array of habitat types, fisheries needs, and varied information availability in each basin, eco-region, and demographic area. Due to these difficulties, the FPTF and FPP agreed that the equation and methodology for the priority list be developed with a flexible approach and narrower ranking system. The FPTF also stressed the need for the equation to be simple, and explainable, and recommended that more weight be given to fish species diversity, and to somehow include historically accessible habitat into the priority equation.

In November of 2012, the FPTF was presented a draft copy of the 2012 Fish Passage Priority list, as well as a draft copy of the equation used to calculate the scores for each site used to assign a priority ranking. Based on previous FPTF recommendations, the equation was modified from earlier drafts and each factor used was better defined. The FPTF recommended FPP staff to move forward in creating the final priority list and to be able to f present the list to the Oregon Fish and Wildlife Commission, for approval, in early 2013. At this time the FPTF also recommended that a process paper be developed. This document would clearly explain the prioritization process, define the factors used in the equation, cite the sources of the data used in the prioritization, disclose the limitations and assumptions made in the list, and explain the intended use of the priority list.

After review of the final priority list and the prioritization process paper in December 2012, the FPTF provided their final comments on the priority list, edits on the draft process paper, recommended approval of the priority list by the Oregon Fish and Wildlife Commission.

3.4 Data Limitations

There is variability in the completeness of the data used in the model. The data used in the 2013 fish passage priority list is the best available data, and the result of years of collaboration between department staff and other agencies. Despite this, additional data gaps and needs exist, including passage status, habitat distribution, and location of other artificial obstructions. The primary data used for quantifying the inaccessible habitat, upstream of the priority barriers, is “salmon centric.” Habitat data for anadromous species such as chinook, coho, and steelhead is fairly well documented, while habitat data for other salmonid species, such as redband trout are lacking but still relatively comprehensive. Other native migratory fish species, such as suckers and whitefish, have little or no published habitat or distribution data. Historical data for all species is also not as widely documented as current distribution. Therefore, as this prioritization process and other projects evolve, there remains a great need for more timely and complete data, and improved procedures for data storage and management.

4. The Prioritization Model

A total of 598 priority barriers were included on the updated 2013 statewide priority list. These barriers were evaluated with the requirements of OAR in mind, with each barrier containing information on species present, biological status of species, quality of habitat upstream, quantity of habitat upstream, level of passage currently provided at the obstruction, unique or limited habitat located upstream, presence of artificial obstructions in proximity to the priority barrier, and other information relative to the priority (socio-economic concerns, historic habitat, likelihood of passage, etc.).

4.1 The Equation

As required by rule, the equation takes into consideration the factors listed above, and is based primarily on the needs of native migratory fish. The priority equation used to develop the 2012 priority list, is as follows:

$$((Quantity \times Quality) \times (\frac{LevelofPassage}{5})) + 30(\# listedNMF) + 10(\# nonlistedNMF) + 15(\# autoup) - 15(autodown)$$

The equation can be broken down into two parts, habitat, and species status/dynamics. The first part is the habitat immediately upstream of the priority barrier that would be made accessible if passage were provided. The equation has been set up so that these factors (habitat quantity, habitat quality, and level of passage) make up roughly 50% of the total points possible. The second part of the equation, are the species present, their biological status, and any unique or limiting factors (included in the “auto up” or “auto down” portion of the equation). This section of the equation makes up approximately the remaining 50% of the total points possible. Based on the definitions given below in section 3.2, the total points possible in the priority equation is 500 (a score of 500 would be a perfect score).

4.2 Definition and Data Source For Each Parameter

Quantity of Native Migratory Fish Habitat (Up to 130 points possible or approximately 26% of the total possible score): This factor is the amount of habitat immediately accessible to fish if passage were provided at the priority barrier. It is averaged across the species that would most likely utilize that habitat. This factor is based on the linear distance (miles) of fish habitat that would become accessible to the species present below the barrier, if passage were provided. This value would be the amount of miles between the priority barrier and the next complete barrier upstream, or the amount of habitat available up to an upstream barrier, natural barrier, or the end of fish use. The quantity is calculated by using a ranking system that assigns a point value according to the mileage class of the amount of miles available. If differing amounts of habitat exist for different species, the amount of habitat available will be averaged for all species, with each species being weighted equally. For example, if at a given barrier 10-miles of fall Chinook habitat, 20-miles of steelhead habitat, and 30-miles of cutthroat habitat exists upstream, the average habitat for all species would be 20-miles. The mileage ranking classes are as follows:

- >300 miles = 130 points
- 200-299 miles = 115 points
- 100-199 miles = 100 points
- 50-99 miles = 85 points
- 25-49 miles = 70 points
- 10-25 miles = 55 points
- 3-9 miles = 40 points
- 1-2 miles = 25 points
- < 1 mile = 10 points

By grouping mileage classes and their scoring, this took into consideration variability within distribution data available, yet also allowed for barriers with lots of habitat to receive lots of points (potential points available in this category are higher than any other). The peak score of 130 for greater than 300 miles of habitat was selected, because the highest value of averaged habitat available upstream did not exceed 400 miles. Therefore, this value was chosen as the top of the sliding scale for “Qabitat Quantity.”

Data Source: Source of Habitat Quantity is from “Oregon Fish Habitat Distribution Data Standard (OFHDDS)” GIS layers. Some habitats were quantified based on the professional opinion of the District Biologist if there was not concurrence on habitat distribution data from GIS, or if data was lacking in the OFHDDS database for a particular barrier.

Habitat Quality (up to 26% of the total priority ranking): this factor represents the quality of habitat upstream of the priority barrier that fish would gain access to. Habitat is categorized as low, medium, or high and given a point value according to the associated quality ranking. This value is multiplied by the Habitat Quantity factor. Habitat quality is quantified based on District

Biologists' professional knowledge of the habitat upstream of the priority barrier. In the absence of professional knowledge for a given site, habitat quality is based on any available habitat data, such as surveys, literature, or other data. By categorizing habitat quality into low, medium, and high categories, this allowed District Biologists to base the ranking off the fisheries needs and habitat characteristics specific to their geographic region. Scoring for Habitat Quality is based on the characteristics listed below.

High (2 points): Habitat upstream can be fully utilized by downstream fish populations with little or no restoration activities needed. Cover, substrate, stream features (pools, riffles, glides), stream temperature, and water quality are all optimal for production of native fish that would use them. Access to this habitat is expected to lead to noticeably higher fish productivity in the basin, and would significantly benefit the native migratory fish accessing the habitat. In order to be ranked as "good" the accessed upstream habitat, with these characteristics, must represent greater than 50% of the total available habitat.

Medium (1 point): Habitat upstream will likely be utilized by native migratory fish found below the obstruction. However, some restoration actions are likely needed to improve the quality/quantity of habitat, or the habitat naturally lacks some of the primary requirements for production of native migratory fish. Cover, pools, and substrate are generally suitable for fisheries production; however, quantity/quality of these habitats may be limited or unusable during certain periods of the year. Water quality and temperature may be limiting factors at times, or in certain locations. Overall, fish populations would likely see a benefit from access to this habitat.

Low (.5 points): Habitat upstream may be utilized by native migratory fish in need of passage; however, restoration activities are needed to restore native habitats, or the habitat inherently has limited value to native migratory fish. Conditions are characterized by very limited cover and pools available for rearing, and channel substrate is either silty or bedrock. Spawning habitat is limited or non-existent. Water quality and temperature are less than optimal for fish that are present presence for much of the year. Habitat in this class are often found in areas that are highly urbanized, affected by agriculture or grazing, have a degraded or limited riparian habitat, and/or have other conditions that are not beneficial for fish. Improved access to this habitat would likely have only marginal benefits to native fish or would require extensive restoration activities.

Scoring Habitat Quality based on this ranking system allows for a linear increase or decrease in the overall habitat value. By scoring high quality habitat as 2 points, low quality habitat as .5 points, and by multiplying those factors by Habitat Quantity in the priority equation, the assumption is made that high quality habitat is twice as valuable as medium habitat, while low quality habitat is half as valuable.

Data Source: All habitat quality data was obtained from District Biologists and their staff. Data was primarily based on professional opinion/knowledge of the habitats located upstream of the priority barriers. In some cases, where habitats were less well known by district staff, quality was determined from reports, habitat surveys, historical documents, maps, other data sources, or any combination thereof. District staff provided the data source they obtained the habitat quality determination from during the data collection process.

Level of Passage Currently Provided: This factor addresses the level of fish passage that is currently provided at a given obstruction. The scale, values, and descriptions are provided below:

- 5 - barrier to all native migratory fish,
- 4 - barrier to some native migratory fish adults and/or species,
- 3 - barrier to some native migratory fish adults and/or species for only part of migration period,
- 2 - barrier to all native migratory fish juveniles,
- 1 - barrier to some native migratory fish juveniles and/or for only part of migration period.
- 0 - Full volitional passage for all native migratory fish species, adults and juveniles.

Anything ranked less than a 5 (complete barrier) will reduce the overall priority (cannot receive full credit for habitat being blocked if not a complete barrier). The “level of passage” rating will reduce the priority score based on the relative degree (percentage) of complete blockage at the barrier. The level of passage is applied to the upstream habitat value (Quantity and Quality), because anything less than a complete barrier indicates that fish are already accessing the habitat upstream at varying degrees depending on the severity of the blockage. Therefore, any score less than 5 for the “Level of Passage” ranking will **reduce** the overall score for habitat upstream by the following percentages:

- Level of passage rating: 4 = 20%
- Level of passage rating: 3 = 40%
- Level of passage rating: 2 = 60%
- Level of passage rating: 1 = 80%
- Level of passage rating: 0 = 100%

Data source: Level of passage data was obtained from the barrier data gathered on GIS. This barrier data is from a variety of sources, but was translated and collaborated into one data source to be consistent with the OFPBDS (as described in section 2.1 of this document). In many cases, ODFW district staff provided their recommended fish passage status based on knowledge of the barrier and history of fish passage at the site. Most of this data is professional judgment and is not based on comprehensive field sampling during various seasons and flow conditions.

Listed Native Migratory Fish (Can add up to 120 points or approximately 24% of the total possible priority score): This factor addresses fish in need of passage at the barrier that are listed as “threatened” or “endangered” under the federal Endangered Species Act (ESA). The presence of federally listed fish increases the priority ranking of a barrier. For each “listed” fish species present at the barrier, 30 points will be added to the priority ranking. There is no

maximum score possible for this factor; however, the highest number of ESA listed fish at any given site was four. Therefore, the highest score received for this factor is 120 points.

Data Source: Biological status data was obtained by a combination of GIS habitat distribution data and professional knowledge of District Biologists.

Species Diversity – (Can add up to 60 additional points or approximately 12% of the total possible priority score) This factor addresses the number of **non ESA listed** native migratory fish species or stocks in need of passage at the priority barrier (# of species or stocks that would utilize the habitat upstream of the barrier). For each, non-listed, native migratory fish species or stock present, 10 points will be given. There is a maximum of 60 total points available for this category. Native migratory fish species, according to OAR 635-412-0005 are as follows:

Acipenser medirostris Green Sturgeon
Acipenser transmontanus White Sturgeon
Amphistichus rhodoterus Redtail surfperch
Catostomus columbianus Bridgelip sucker
Catostomus luxatus/Deltistes luxatus Lost River sucker
Catostomus macrocheilus Largescale sucker
Catostomus microps Modoc sucker
Catostomus occidentalis Goose Lake sucker
Catostomus platyrhynchus Mountain sucker
Catostomus rimiculus Klamath smallscale sucker
Catostomus snyderi Klamath largescale sucker
Catostomus tahoensis Tahoe sucker
Catostomus warnerensis Warner sucker
Chasmistes brevirostris Shortnose sucker
Hypomesus pretiosus Surf smelt
Lampetra ayresi River lamprey
Lampetra lethophaga Pit-Klamath lamprey
Lampetra minima Miller Lake lamprey
Lampetra similes Klamath River lamprey
Lampetra tridentate Pacific lamprey
Oncorhynchus clarki Coastal, Lahontan and West Slope cutthroat trout
Oncorhynchus keta Chum salmon
Oncorhynchus kisutch Coho salmon
Oncorhynchus mykiss Steelhead, Rainbow and Redband trout
Oncorhynchus nerka Sockeye/Kokanee salmon
Oncorhynchus tshawytscha Chinook salmon
Prosopium williamsoni Mountain whitefish
Ptychocheilus oregonensis Northern pikeminnow
Ptychocheilus umpqua Umpqua pikeminnow
Salvelinus confluentus Bull trout
Spirinchus thaleichthys Longfin smelt
Thaleichthys pacificus Eulachon

Points are awarded per native migratory fish species or stock as follows:

- 1 NMF Species/Stock = 10 points
- 2 NMF Species/Stocks = 20 points
- 3 NMF Species/Stocks = 30 points
- 4 NMF Species/Stocks = 40 points
- 5 NMF Species/Stocks = 50 points
- >5 NMF Species/Stocks = 60 points

Data Source: Species presence data was obtained by a combination of GIS habitat distribution data and district staff professional knowledge.

Auto Up Factors (Can add up to 60 additional points or approximately 12% of the total possible priority score): These factors were not included in the original data collected for each barrier, but have been identified by ODFW staff as considerations that increase the overall priority of a barrier. For each “auto up” factor identified, 15 points will be added to the prioritization scoring. A maximum of 60 points (4 auto-ups) can be garnered for each site. For each one of the items listed below, 15 points will be added to the priority value:

- Over 5 miles of additional historical habitat
- Over 50 miles of additional potential habitat = 2 “auto ups” (30 points)
- Over 100 miles of additional potential habitat = 3 “auto ups” (45 points)
- Unique or limited habitat
- Unique or limited species
- Other factors identified by ODFW Staff that increase the priority, such as but not limited to):
 - Specific impacts to fisheries
 - Downstream migrant (juvenile) passage concerns
 - Importance to local communities
 - Barrier affects large population of fish

“Auto up factors” were given these point values so that District Biologists could identify sites that were of a potentially higher ranking due to difficult or un-quantifiable factors. This ranking makes the value of one “auto up” greater than the presence of one “non listed native migratory fish species,” but half the value of the presence of one ESA listed species. This allows for some un-quantifiable factors to influence the priority ranking, but has less effect on the ranking than other quantifiable factors such as “Habitat Quantity” or “listed species.”

Data Source: Auto up factor data was determined by district staff for unique factors that should increase a barrier’s priority ranking but were not captured in the original data query. FPP staff also identified

“auto up factors” by analyzing the data available on the priority list spreadsheet (such as additional potential habitat).

Auto Down Factors (subtract up to 60 points or approximately 12% of the total possible score): These are factors not included in the original data collected for each barrier, but have been identified by ODFW staff as factors that should be considered to decrease the overall priority of a barrier. For each “auto down” factor identified, 15 points will be subtracted from the prioritization ranking. A maximum of 60 points (4 auto-downs) can be garnered for each site. For each one of the items listed below, 15 points will be subtracted from the priority value:

- Complete barriers downstream
- 3 or more complete barriers upstream
- 10 or more complete barriers upstream = 2 auto downs (-30 points)
- Imminent Trigger (high likelihood of passage in the near future)
- Existing ODFW Agreements (waivers)
- Fish Management Concerns (Non-native fish, or other concerns)
- Other factors identified by ODFW staff that decrease the priority

“Auto down factors” were given these point values so that District Biologists could identify sites that were of a potentially lower ranking due to difficult or un-quantifiable factors. This ranking makes the value of one “auto down” greater than the reduction of one “non listed native migratory fish species” at a given site, but half the value of the reduction of one ESA listed species. This allows for some un-quantifiable factors to influence the priority ranking, but have less effect on the ranking than other quantifiable factors such as “Habitat Quantity” or “listed species.”

Data Source: Auto down factor data was determined by district staff for unique factors that were not captured in the original data query that should be considered to decrease barrier’s priority scoring. FPP staff also identified “auto down factors” by analyzing the data available on the priority list spreadsheet (data such as complete barriers upstream).

Other Definitions:

Complete Artificial Obstruction (up or downstream): An artificial obstruction up or downstream of the priority artificial obstruction that completely blocks all native migratory fish migration. For complete artificial obstructions upstream, fish habitat available ends at these obstructions.

Additional Potential Habitat: Habitats that exist above other complete artificial obstructions located upstream of a priority barrier. These habitats would be potentially available in the future, if passage were provided at the blocking barrier(s).

4.3 Assumptions Made in the Model

A number of assumptions were made in the development of this priority model and the priority list. First, are assumptions made related to habitat distribution data. As noted in the data limitations section (section 2.4), the majority of the available data were “salmon centric.” It is common knowledge that individual salmon species and life stages have different habitat requirements/preferences. The same holds true for other species such as suckers, bull trout, and whitefish. Since the majority of habitat distribution data characterized salmon habitat, the decision was made to quantify available habitat, upstream of the priority barrier, by averaging the habitat quantities of the species with documented data. By averaging habitat, a balance is created between those fish species that may travel far upstream, and those species that typically do not. This assumption keeps the data from skewing towards quantities that are unrealistic for individual species. An example would be having Chinook, steelhead, and suckers listed as species present, habitat data shows 10 miles of habitat available for steelhead, 5 miles available for Chinook, and habitat is not mapped for suckers. The habitat quantity value for this example would be 7.5 miles (the average between Chinook and steelhead habitat), as this number more closely represents the stream miles that all species present could potentially occupy.

The habitat distribution data used for the Habitat Quantity factor is from the best and most up to date data available; however, within the data there is some variability. ODFW recognizes that the science and information regarding fish distribution (both current and historical) is ever evolving. Knowing that some variability exists in the data was a key in developing the model for two reasons. First, the habitat quantity factor was given points based on classes that described a range of miles available instead of giving points per mile of habitat. By using these classes, which are defined by a range of miles, to assign scores, a given amount of points (50-99 miles = 85 points) we acknowledge that some variability exists in the data. Second, the model and the priority list were created in a way that make them easy to access and update as new information becomes available. The priority list is a tool that can be updated and changed as passage is provided at barriers or new data is obtained.

Historical habitat for fish species is another piece of the data set with substantial variability. ODFW feels that it is important to include this information in the prioritization process, but also realizes that some geographic regions have better historic, habitat distribution data than others. For example, historical fish habitat for Chinook and steelhead is not well mapped in the drainages above the Snake River dams (Hells Canyon, Oxbow, Brownlee), but it is well documented in the Klamath basin. Due to these variations, historic habitat was not included as a “stand alone” factor. Rather, if well-documented, or professionally agreed upon historical habitat existed, it is quantified in the “auto up” factor. Likewise, complete barriers, located upstream of the priority barriers, were quantified in the “auto down” factor.

Habitat quality is a term used to determine the relative suitability of habitats for fish and other species. In this model, habitat quality was determined by the district biologists and their staff who are knowledgeable about local fish habitats. It is assumed that habitats, upstream of these high priority barriers, are well known by district staff. In cases where professional knowledge

was lacking, district staff consulted habitat surveys, reports, map data, literature, or any other means available to help ascertain or support their habitat quality determination.

The overall priority ranking and the prioritization model is primarily based on biology. This assumption is supported by OAR, which states that “the priority list shall be based on the needs of the native migratory fish.” ODFW also recognizes that other factors also come into play when prioritizing sites for fish passage restoration. Whether they are socio-economic in nature, or common sense driven, they help to provide a more complete picture of important considerations for a given site. The “auto up” and “auto down” factors are a way for district staff, or FPP staff to consider a number of other factors that may increase or decrease the priority of barriers. These factors included, but were not limited to, likelihood of passage, ODFW agreements, management decisions, historic habitat, presence of artificial obstructions, and others.

It is felt that the methodology selected for development of the priority list utilizes the best available information and the best professional judgment. There is a range of other ways that one could use to calculate priority. These could include many different factors, but ODFW believes this method best characterizes priorities based on biology and the guidelines set forth in OAR. Based on this, the variability within the data, and the variability within the prioritization model, ODFW categorized the priority barriers into distinct groups based on their raw scores. In doing this, it is assumed that all barriers within each succinct group have roughly the same overall priority within the state, and will provide close to an equal amount of benefit to native fish when improved passage is provided at these artificial obstructions. Despite this categorization system, it is assumed that all barriers on the priority list are high priorities in the state.

5. Results of the 2012 Fish Passage Prioritization List

The final priority list contains 534 high priority fish passage barriers (Attachment C), with an additional 55 barriers characterized as “other significant barriers in need of more data.” Out of the 27,800 artificial obstructions documented in Oregon, the 534 priority obstructions comprise less than 2% of the total. Of the 534 priority obstructions 289 (59%) are dams, 207 (39%) are culverts, and the remaining 38 (7%) are include tide gates, fords, bridges, and other artificial obstructions. Dams make up the majority of the “top” priorities. This is largely, due to the fact that they generally block large segments of habitat on larger river systems. The priorities have been organized into classes, with each class representing barriers of similar priority ranking. It is important to note, that all barriers on the list are high priorities for ODFW.

6. Recommendations For Future Improvements

As is the case for all large-scale projects, there is always room for improvement. In this case, discrepancies, shortfalls, and potential data gaps were noted along the way to help identify process improvements that could be made for future priority lists. That being said, this list was developed to be dynamic that will be adaptively managed when new information is identified. It

is ODFW's goal to ensure that this priority list of artificial obstructions represents the best available science and reflects data that is accurate and up to date.

6.1 Data Source Refinements

The data utilized in this priority list is the result of years of hard work by many individuals. It represents the best data available science; however, it is clear that there are still data gaps. Several priority barriers, listed by district biologists, could not be ranked on the list, because not enough data existed to support a prioritization ranking. These barriers were highlighted as "other significant barriers," ODFW hopes to fill in the data gaps as new information becomes available, and to update the priority list as this occurs.

It is also clear that more emphasis needs to be invested into developing distribution data for non-salmonids, particularly those listed species native to Oregon, such as Lost River suckers, small-scale suckers, and Warner suckers of the Klamath and Warner basins. These species are important native migratory fish, with habitat requirements that differ significantly from salmonids, and limited data exists regarding their status and distribution.

6.2 Model Refinements

The prioritization model serves to answer the question "Where will the greatest biological benefits be realized if passage is provided?" The model does a good job of utilizing biological factors and professional judgment to answer this question. However, models are currently being developed that look at habitat factors such as watershed area, wetted channel width, miles of habitat, gradient, and other important habitat features to provide a more comprehensive estimate of potential fish use. Most notably, this has been completed for coho on the coast. Broader application of this approach, for other species, would be a great tool in improving the statewide priority list.

Similarly, in future fish passage prioritization efforts, another look at habitat quality could warrant less subjective results. Habitat types and their individual extent and quality, rather than habitat quality of entire stream reaches, could be applied to the habitat metric. Values would be given to certain types of habitat for different species, such as miles of rearing habitat for Chinook, or miles of spawning habitat for suckers. Each habitat type, for each species, could be weighted to help determine a more accurate estimate of the habitat upstream for native migratory fish in need of passage. Currently, the data simply does not exist to be able to quantify all habitats, by species, across the state. Extensive surveys have been done over the years, by ODFW and others, but additional data collection is warranted, including a standardization of how data is collected and universal stratification of habitat quality levels. As new habitat data and surveys are completed, this system of quantifying the quantity and quality of habitat

upstream of an artificial obstruction, by individual fish species, could be a valuable and more accurate way to calculate priority.

7 Conclusions and Use of the Document

The priority list represents the highest priority barriers for fish passage in the state. These sites will provide the large benefits to native migratory fish, by providing access to high quantity and quality habitats, if passage is provided. Fish passage restoration efforts should be focused on these priority barriers, specifically the highest priorities on the list.

This list is a viable tool for several uses. These include:

- 1. Enforcement by the Oregon Fish and Wildlife Commission (OFWC).** As directed by OAR 635-412-0015 and by ORS 509.585, the OFWC may enforce that fish passage be provided if the barrier is one of ODFW's top ten priority barriers, **and** ODFW secures 60% of non owner/operator funding for fish passage at the barrier. As passage is enforced at top barriers, provided after a "trigger event," or provided voluntarily, the list will be updated so that a current "top ten" exists for the state.
- 2. Prioritization for funding by ODFW and other Funding Agencies.** Funding agencies and grantors take many aspects of a project into consideration prior to either funding or denying funding to a project. This list can serve as a primary filter for these agencies. The list can be used to get a sense of a given site's relative priority as compared to another priority barrier. This list should not solely be used as the basis of funding decisions, but can serve as a foundation for these types of decisions.
- 3. Mitigation Opportunities for Fish Passage Waivers.** This list is a prime source for obtaining mitigation locations for fish passage waivers or to offset other impacts that may qualify. A barrier's presence on the priority list does not automatically mean that it qualifies as a valid mitigation site to offset impacts; however, the list should be a starting point for locating potential fish passage mitigation sites.
- 4. A database of high priority projects.** The list is comprised of barriers in each of the 18 fish districts across the state. The list will not only categorize fish passage priorities at the statewide level, but will also categorize fish passage priorities at the district level. Local entities, such as ODFW Fish Districts, Watershed Councils, Soil and Water Conservation Districts, and other interested parties can use the list of priorities in their respective geographic locations to help make decisions on restoration of fish passage. This list will give those agencies and groups a better idea of where high priority locations are, and the conditions present at each.

The priority list can be utilized in many ways; however, one way it should not be utilized is as a sole source of data. As noted in this document, a number of assumptions were made in the development of this list. Because of those assumptions, habitats were averaged based on the available data at each barrier, and actual habitat located above a barrier may vary for each species as compared to the average amount of habitat that is listed on the priority list. Also, as noted previously, determination and understanding of historic fish distribution, and current fish distribution for some species, continues to be a work in progress.