



State of Washington  
**DEPARTMENT OF FISH AND WILDLIFE**

Mailing Address: 600 Capitol Way N, Olympia, WA 98501-1091 • (360) 902-2200 • TDD (360) 902-2207  
Main Office Location: Natural Resources Building, 1111 Washington Street SE, Olympia, WA

**To:** Carl Schroeder, Association of Washington Cities  
Bill Leonard, WSDOT Highways and Local Programs Environmental Manager

**From:** Justin Zweifel, WDFW Fish Passage Inventory and Assessment Unit Supervisor

**Date:** June 30, 2015

**Subject:** Final Report of City Fish Passage Inventory in Puget Sound, 2013 - 2015

We are pleased to provide the 2013 - 2015 Fish Passage City Inventory Final Report. This inventory and assessment effort began in June 2012 and continued through June 2015. We have provided progress reports during this period and this report provides the results for the inventory and assessment of road crossings in 47 Puget Sound cities between June 2012 and June 2015.

Detailed electronic reports were produced as a result of the inventory and assessment surveys. These will be provided to the Cities once our review for completeness and accuracy is completed in July.

We appreciate the opportunity to serve you and your partners and are available to continue to provide expert services in this field.

This page intentionally left blank

# **Puget Sound Cities Fish Passage Inventory Final Report for**

**July 1, 2013 through June 30, 2015**



In partnership with the Association of Washington Cities (AWC) and the Washington State Department of Transportation's Highways and Local Programs (HLP), the Washington Department of Fish and Wildlife (WDFW) inventoried, assessed, and prioritized fish passage barriers in anadromous waters associated with city streets in the Puget Sound region. The Puget Sound region is defined as watersheds that drain into the Puget Sound, Hood Canal, and Strait of Juan de Fuca. The project also included a reassessment and update of available city inventory data. The inventories and associated habitat surveys were conducted utilizing methods described in WDFW's Fish Passage Barrier and Surface Water Diversion Screening Assessment and Prioritization Manual (WDFW 2009). This final report summarizes the results of the Puget Sound Cities Fish Passage Inventory work completed between June 1, 2012 and June 30, 2015. Detailed Fish Passage and Diversion Screening Inventory (FPDSI) database reports and Priority Index (PI) values will be provided directly to each city in Table 1.

## **METHODS**

WDFW, HLP, and AWC selected cities within priority Puget Sound watersheds to conduct fish passage inventory and habitat assessment work. Inventory and assessment work was completed in four time phases, determined by the identification of high priority watersheds, coordination of other ongoing surveys, and available funding. Selected cities were contacted by phone and letter to inform them of the fish passage work that would occur in their city.

To prepare for inventory field work, maps were created that included city boundaries, stream crossings, road names, and existing FPDSI database records. WDFW field crews drove to all mapped anadromous stream crossings within the incorporated city boundaries to document, photograph, and take the necessary measurements to evaluate road crossings using the methodology described in the WDFW Fish Passage Barrier and Surface Water Diversion Screening Assessment and Prioritization Manual (WDFW 2009). WDFW crews also visited previously inventoried road crossings to verify and update existing data in FPDSI, when necessary. Any unmapped anadromous stream crossings that were encountered while working within the incorporated city boundaries were also documented and evaluated.

Using a strategic approach, WDFW conducted stream habitat assessments on high priority streams to calculate PI values that may be used to prioritize city road crossings for future fish

passage barrier correction. This inventory was focused on anadromous streams and therefore required field crews to verify anadromous access prior to conducting upstream habitat surveys. The field crews documented any natural barriers that preclude upstream migration, such as waterfalls and high-gradient stream sections. If anadromous access was verified, the field crews took measurements of the quality and quantity of potential fish habitat and documented additional barriers within the stream.

## DATA SUMMARY

Between June 1, 2012 and June 30, 2015, 722 newly inventoried crossings and 458 reassessed crossings were evaluated in 47 cities for a total of 1,180 fish passage barrier assessments on city roads. Five additional cities were determined to have no road crossings on anadromous streams. Of the 1,180 evaluated road crossings, 589 were determined to be fish passage barriers; 464 of the 589 fish passage barriers are barriers to anadromous salmon and steelhead. Stream habitat assessments for barrier prioritization were completed for 106 fish passage barriers. Table 1 summarizes the results of the road crossings inventoried for each city.

Some city road crossings were difficult to evaluate due to complex hydraulic conditions. Common examples include culverts that are several blocks long, culverts that are tied into stormwater or sewer systems, and culverts with an internal grade break. Other complex hydrologic field conditions included tidal influence, wetlands, or tributaries located immediately downstream of the road crossing that preclude Level B analysis. At these sites, barrier status is unknown and may require engineering review.

The following is a list of the descriptions of the contents in Table 1:

- **Newly Inventoried Crossings:** These crossings were newly inventoried by WDFW and were entered into FPDSI during the contract period (June 1, 2012 – June 30, 2015).
- **Reassessed Crossings:** These crossings were already included in FPDSI, due to an earlier assessment, and were updated in FPDSI during the contract period.
- **Fish Passage Barriers Assessed During Contract:** These crossings block passage to resident or anadromous salmonids and were assessed during the contract period.
- **Fish Passage Barriers Total:** These are all sites in FPDSI that block passage to resident or anadromous salmonids.
- **Salmon & Steelhead Barriers Assessed During Contract:** These are fish passage barriers assessed during the contract period that inhibit access to at least one of the following species with an anadromous life history: chum salmon (*Oncorhynchus keta*), pink salmon (*O.*

*gorbuscha*), coho salmon (*O. kisutch*), sockeye salmon (*O. nerka*), chinook salmon (*O. tshawytscha*), or steelhead trout (*O. mykiss*).

- **Salmon & Steelhead Barriers Total:** These are all sites in FPDSI that inhibit access to at least one of the following species with an anadromous life history: chum salmon (*Oncorhynchus keta*), pink salmon (*O. gorbuscha*), coho salmon (*O. kisutch*), sockeye salmon (*O. nerka*), chinook salmon (*O. tshawytscha*), or steelhead trout (*O. mykiss*).
- **Unknown Barrier Status Assessed During Contract:** These are sites assessed during the contract period where complex hydrological conditions exist and standard protocols could not determine passability. Examples of this include wetland to wetland culverts or tidally influenced culverts.
- **Unknown Barrier Status Total:** These are all sites in FPDSI where complex hydrological conditions exist and standard protocols could not determine passability. Examples of this include wetland to wetland culverts or tidally influenced culverts.
- **Salmon & Steelhead Barriers Prioritized During Contract:** These sites were prioritized during the contract period using the habitat assessment protocols outlined in the WDFW publication “*Fish Passage Barrier and Surface Water Diversion Screening Assessment and Prioritization Manual*” (WDFW 2009) and they inhibit access to at least one of the following species with an anadromous life history: chum salmon (*Oncorhynchus keta*), pink salmon (*O. gorbuscha*), coho salmon (*O. kisutch*), sockeye salmon (*O. nerka*), chinook salmon (*O. tshawytscha*), or steelhead trout (*O. mykiss*).
- **Salmon & Steelhead Barriers Prioritized Total:** Total sites in FPDSI that have been prioritized using the habitat assessment protocols outlined in the WDFW publication “*Fish Passage Barrier and Surface Water Diversion Screening Assessment and Prioritization Manual*” (WDFW 2009) and inhibit access to at least one of the following species with an anadromous life history: chum salmon (*Oncorhynchus keta*), pink salmon (*O. gorbuscha*), coho salmon (*O. kisutch*), sockeye salmon (*O. nerka*), chinook salmon (*O. tshawytscha*), or steelhead trout (*O. mykiss*).
- **Man-made Fish-Bearing Sites:** Total sites in FPDSI that are in fish bearing streams as determined by at least one of the following methods: average scour line width greater than 2 feet in Western Washington, streams identified as fish habitat (Type “F”) by Washington State Department of Natural Resources (DNR), documented salmonid use, or listed as fish bearing in *SalmonScape* (<http://wdfw.wa.gov/mapping/salmonscape/>).

Table 1. Puget Sound Cities Fish Passage Inventory: June 1, 2012 – June 30, 2015

| City                             | Newly Invented Crossings <sup>1</sup> | Reassessed Crossings | Fish Passage Barriers Assessed During Contract | Fish Passage Barriers Total | Salmon & Steelhead Barriers Assessed During Contract | Salmon & Steelhead Barriers Total | Unknown Barrier Status Assessed During Contract <sup>2</sup> | Unknown Barrier Status Total <sup>2</sup> | Salmon & Steelhead Barriers Prioritized During Contract | Salmon & Steelhead Barriers Prioritized Total | Man-made Fish-bearing Sites |
|----------------------------------|---------------------------------------|----------------------|--|-----------------------------|--|-----------------------------------|--|---|---|---|-----------------------------|
| <b>Phase I</b>                   |                                       |                      |  |                             |  |                                   |  |   |   |   |                             |
| <b>WRIA 7 - Snohomish</b>        |                                       |                      |  |                             |  |                                   |  |   |   |   |                             |
| Duvall                           | 7                                     | 15                   | 15   | 15                          | 14   | 14                                | 1  | 1   | 5   | 14  | 22                          |
| Gold Bar*                        |                                       |                      |  | 1                           |  | 1                                 |  | 1   |   |   | 6                           |
| Issaquah                         | 28                                    | 16                   | 22   | 22                          | 18   | 18                                | 1  | 1   | 12  | 14  | 46                          |
| Sammamish                        | 42                                    |                      | 15   | 15                          | 9  | 9                                 | 9  | 9   | 9   | 9   | 35                          |
| Skykomish*                       |                                       |                      |  |                             |  |                                   |  |   |   |   |                             |
| Snohomish                        | 21                                    |                      | 14   | 14                          | 14   | 14                                | 2  | 2   | 14  | 14  | 20                          |
| <b>WRIA 12 - Chambers/Clover</b> |                                       |                      |  |                             |  |                                   |  |   |   |   |                             |
| DuPont                           | 5                                     |                      | 3  | 3                           | 3  | 3                                 | 1  | 1   | 2   | 2   | 5                           |
| Fircrest                         | 3                                     |                      | 2  | 2                           | 2  | 2                                 |  |   | 2   | 2   | 3                           |
| Lakewood                         | 9                                     | 2                    | 1  | 1                           | 1  | 1                                 | 1  | 1   |   |   | 10                          |
| Ruston                           | 1                                     |                      | 1  | 1                           | 1  | 1                                 |  |   |   |   | 1                           |
| Stellacoom                       | 10                                    |                      | 6  | 6                           | 6  | 6                                 | 1  | 1   | 6   | 6   | 8                           |
| University Place                 | 6                                     | 1                    | 3  | 3                           | 3  | 3                                 |  |   | 3   | 3   | 7                           |
| <b>Phase II</b>                  |                                       |                      |  |                             |  |                                   |  |   |   |   |                             |
| <b>WRIA 3 - Lower Skagit</b>     |                                       |                      |  |                             |  |                                   |  |   |   |   |                             |
| Burlington                       | 5                                     | 4                    | 3  | 3                           |  |                                   | 5  | 6   |   |   | 10                          |
| Hamilton                         | 1                                     | 2                    |  |                             |  |                                   | 2  | 2   |   |   | 3                           |
| La Conner*                       |                                       |                      |  |                             |  |                                   |  |   |   |   |                             |
| Mount Vernon                     | 35                                    | 33                   | 17   | 17                          | 16   | 16                                | 14   | 14  | 14  | 14  | 53                          |
| Sedro Woolley                    | 4                                     | 9                    | 2  | 2                           | 1  | 1                                 | 4  | 4   |   |   | 14                          |
| <b>WRIA 10 - Puyallup/White</b>  |                                       |                      |  |                             |  |                                   |  |   |   |   |                             |
| Bonney Lake                      | 1                                     |                      |  |                             |  |                                   | 1  | 1   |   |   | 1                           |
| Buckley                          |                                       | 3                    | 2  | 3                           | 2  | 3                                 |  |   |   |   | 4                           |
| Enumclaw                         | 24                                    |                      | 1  | 1                           |  |                                   | 11   | 11  |   |   | 22                          |

| City                             | Newly Invented Crossings <sup>1</sup> | Reassessed Crossings | Fish Passage Barriers Assessed During Contract | Fish Passage Barriers Total | Steelhead & Salmon Barriers Assessed During Contract | Steelhead & Salmon Barriers Total | Unknown Barrier Status Assessed During Contract <sup>2</sup> | Unknown Barrier Status Total <sup>2</sup> | Steelhead & Salmon Barriers Prioritized During Contract | Steelhead & Salmon Barriers Prioritized Total | Man-made Fish-Bearing Sites |
|----------------------------------|---------------------------------------|----------------------|--|-----------------------------|--|-----------------------------------|--|---|---|---|-----------------------------|
| <b>WRRIA 10 - Puyallup/White</b> |                                       |                      |  |                             |  |                                   |  |   |   |   |                             |
| Orting*                          |                                       |                      |  |                             |  |                                   |  |   |   |   |                             |
| Puyallup                         | 26                                    | 41                   | 37   | 39                          | 32   | 33                                | 8  | 8   | 28  | 28  | 63                          |
| Wilkeson                         | 1                                     | 5                    | 4  | 4                           | 4  | 4                                 |  |   |   | 3   | 6                           |
| <b>Phase III</b>                 |                                       |                      |  |                             |  |                                   |  |   |   |   |                             |
| <b>WRRIA 1 - Nooksack</b>        |                                       |                      |  |                             |  |                                   |  |   |   |   |                             |
| Bellingham                       | 42                                    | 89                   | 79   | 80                          | 56   | 56                                | 17   | 17  | 3   | 18  | 133                         |
| Everson                          | 1                                     |                      |  |                             |  |                                   |  |   |   |   | 1                           |
| Ferndale                         | 8                                     | 7                    | 6  | 6                           | 3  | 3                                 | 4  | 4   |   | 1   | 14                          |
| Sumas                            |                                       | 1                    |  |                             |  |                                   |  |   |   |   | 5                           |
| <b>WRRIA 3 - Lower Skagit</b>    |                                       |                      |  |                             |  |                                   |  |   |   |   |                             |
| Arlington                        | 26                                    | 4                    | 7  | 7                           | 6  | 6                                 | 6  | 6   |   |   | 30                          |
| Marysville                       | 14                                    | 51                   | 32   | 33                          | 32   | 33                                | 12   | 14  |   | 4   | 62                          |
| Stanwood                         | 5                                     | 1                    | 4  | 4                           | 4  | 4                                 | 1  | 1   |   |   | 6                           |
| <b>WRRIA 7 - Snohomish</b>       |                                       |                      |  |                             |  |                                   |  |   |   |   |                             |
| Everett                          | 28                                    | 7                    | 20   | 26                          | 6  | 10                                | 11   | 11  |   | 8   | 50                          |
| Granite Falls                    | 4                                     |                      | 4  | 4                           | 2  | 2                                 | 1  | 1   |   |   | 5                           |
| Lake Stevens                     | 23                                    | 1                    | 11   | 11                          | 9  | 9                                 | 6  | 6   |   |   | 28                          |
| <b>WRRIA 15 - Kitsap</b>         |                                       |                      |  |                             |  |                                   |  |   |   |   |                             |
| Bremerton                        | 7                                     | 8                    | 13   | 18                          | 12   | 17                                |  |   | 3   | 9   | 22                          |
| Gig Harbor                       | 20                                    | 4                    | 14   | 14                          | 4  | 4                                 | 7  | 8   |   |   | 24                          |
| Port Orchard                     | 5                                     | 18                   | 22   | 22                          | 18   | 18                                | 1  | 1   |   | 18  | 23                          |
| <b>Phase IV</b>                  |                                       |                      |  |                             |  |                                   |  |   |   |   |                             |
| <b>WRRIA 1 - Nooksack</b>        |                                       |                      |  |                             |  |                                   |  |   |   |   |                             |
| Lynden                           |                                       | 5                    | 3  | 7                           | 3  | 6                                 |  | 2   | 2   | 2   | 13                          |
| <b>WRRIA 3 - Lower Skagit</b>    |                                       |                      |  |                             |  |                                   |  |   |   |   |                             |
| Anacortes                        | 15                                    | 3                    | 10   | 10                          | 9  | 9                                 | 4  | 4   |   | 1   | 18                          |

| City                                  | Newly Inven-toried Crossings <sup>1</sup> | Reassessed Crossings | Fish Passage Barriers Assessed During Contract | Fish Passage Barriers Total | Salmon & Steelhead Barriers Assessed During Contract | Salmon & Steelhead Barriers Total | Unknown Barrier Status Assessed During Contract <sup>2</sup> | Unknown Barrier Status Total <sup>2</sup> | Salmon & Steelhead Barriers Prioritized During Contract | Salmon & Steelhead Barriers Prioritized Total | Man-made Fish-Bearing Sites |
|---------------------------------------|---|----------------------|--|-----------------------------|--|-----------------------------------|--|---|---|---|-----------------------------|
| <b>WRIA 8 - Cedar/Sammamish</b>       |   |                      |  |                             |  |                                   |  |   |   |   |                             |
| Mercer Island                         | 37  |                      | 29   | 29                          | 24   | 24                                | 6  | 6   |   |   | 37                          |
| <b>WRIA 11 - Nisqually</b>            |   |                      |  |                             |  |                                   |  |   |   |   |                             |
| Eatonville                            | 8   |                      | 4  | 4                           | 2  | 2                                 | 1  | 1   |   |   | 8                           |
| Roy                                   | 2   |                      |  |                             |  |                                   |  |   |   |   | 2                           |
| Yelm                                  | 4   |                      | 3  | 3                           | 2  | 2                                 |  |   |   |   | 7                           |
| <b>WRIA 12 - Chambers/Clover</b>      |   |                      |  |                             |  |                                   |  |   |   |   |                             |
| Tacoma**                              | 56  | 2                    | 27   | 29                          | 27   | 28                                | 23   | 23  | 3   |   | 62                          |
| <b>WRIA 13 - Deschutes</b>            |   |                      |  |                             |  |                                   |  |   |   |   |                             |
| Lacey                                 |   | 6                    | 1  | 1                           | 1  | 1                                 | 4  | 5   |   |   | 7                           |
| Olympia                               | 20  | 39                   | 26   | 29                          | 23   | 26                                | 20   | 20  |   |   | 66                          |
| Rainier*                              |   |                      |  |                             |  |                                   |  |   |   |   |                             |
| Turnwater                             | 25  | 15                   | 20   | 21                          | 20   | 20                                | 10   | 10  |   |   | 41                          |
| <b>WRIA 14 - Kennedy/Goldsborough</b> |   |                      |  |                             |  |                                   |  |   |   |   |                             |
| Shelton                               | 6   | 11                   | 2  | 2                           | 1  | 1                                 | 12   | 12  |   |   | 16                          |
| <b>WRIA 15 - Kitsap</b>               |   |                      |  |                             |  |                                   |  |   |   |   |                             |
| Bainbridge Island                     | 47  | 36                   | 57   | 63                          | 28   | 31                                | 12   | 13  |   |   | 86                          |
| Poulsbo                               | 10  | 1                    | 4  | 5                           | 3  | 4                                 | 1  | 2   |   |   | 14                          |
| <b>WRIA 17 - Quilcene/Snow</b>        |   |                      |  |                             |  |                                   |  |   |   |   |                             |
| Sequim                                | 56  | 5                    | 23   | 23                          | 23   | 23                                | 13   | 13  |   |   | 61                          |
| <b>WRIA 18 - Elwha/Dungeness</b>      |   |                      |  |                             |  |                                   |  |   |   |   |                             |
| Port Angeles                          | 24  | 10                   | 20   | 20                          | 20   | 20                                | 5  | 5   |   |   | 34                          |
| <b>Totals</b>                         | <b>722</b>                                | <b>458</b>           | <b>589</b>                                     | <b>623</b>                  | <b>464</b>   | <b>488</b>                        | <b>238</b>   | <b>248</b>                                | <b>106</b>  | <b>210</b>                                    | <b>1214</b>                 |

<sup>1</sup> Some of the newly inventoried crossings were determined to be non fish-bearing.

<sup>2</sup> Barriers with unknown status represent complex hydrological conditions where Level A analysis cannot determine fish passage. Level B assessment can frequently model conditions at these sites and determine passability. These sites with unknown status represent a portion of the population that are either waiting for data analysis or are too complex for Level B analysis (wetland to wetland culverts, tidal culverts).

\* Inventories in the cities of Goldbar, Skykomish, La Conner, Orting, and Rainier were conducted however no culverts were identified in anadromous streams within their incorporated urban growth area (UGA).

\*\* Inventory field efforts have been completed for the City of Tacoma, however data entry was not completed by June 30, 2015.

*Detailed FPDSI database reports and PI values will be provided directly to each city in Table 1.*

## REFERENCE

Washington Department of Fish and Wildlife. 2009. Fish Passage and Surface Water Diversion Screening Assessment and Prioritization Manual. Washington Department of Fish and Wildlife. Olympia, Washington.