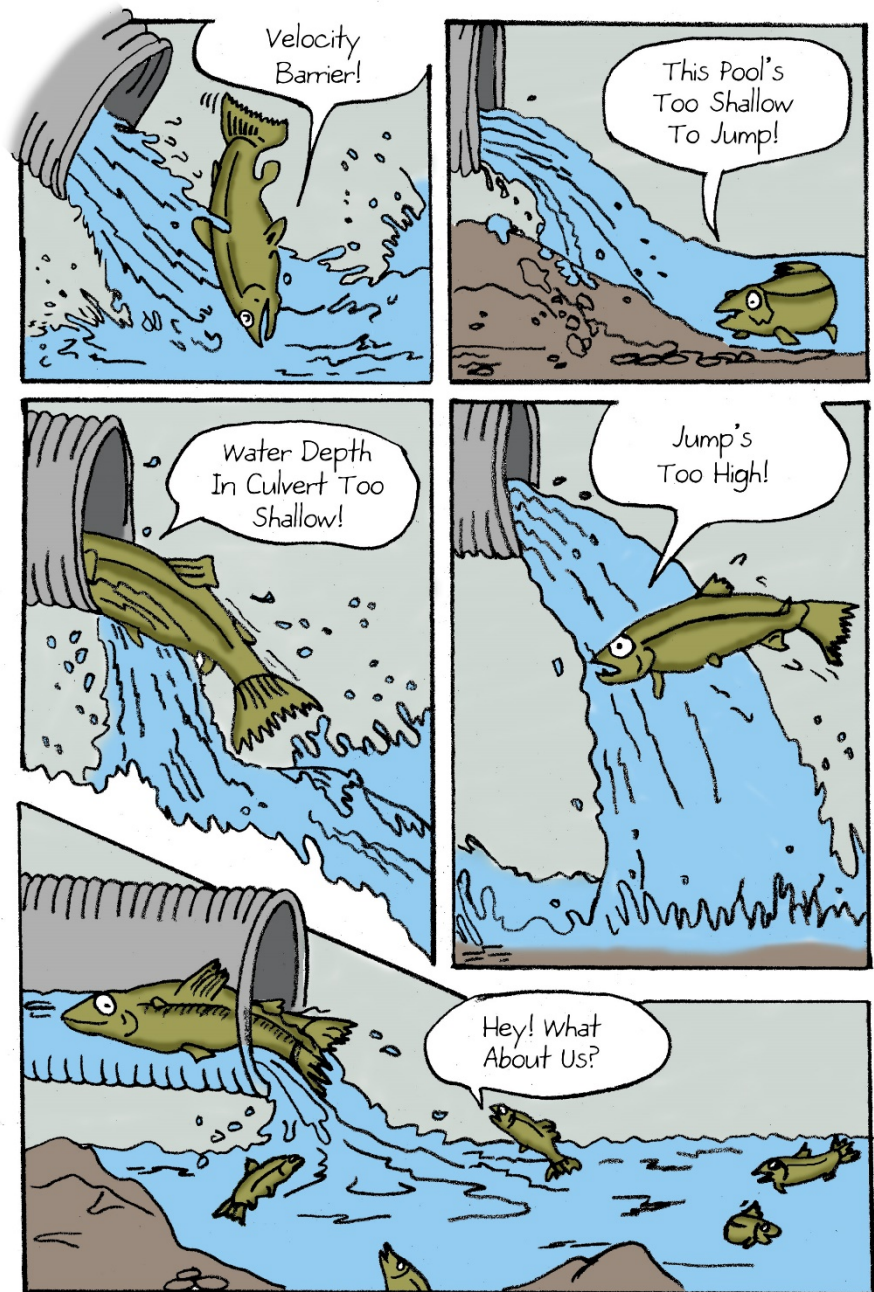


Fish Passage and Stream Restoration Training

Biological Considerations

Damon Romero
WSDOT Fish Passage Coordinator

- Culverts are on WSDOT's barrier list because they create conditions that exceed the swimming or leaping abilities of an adult (6") trout.
- Barrier corrections must be passable for all species of salmon at all life stages at all flows where the fish would naturally seek passage.





Level A Barrier Example: SR 112 Joe Cr.

- Almost all fish passage barriers are undersized
- Site 990214, pre-correction, was considered 67% passable (partial barrier) due to “WS Drop” or hydraulic drop of 0.85 feet
- If an adult fish made the jump into the culvert they would face 116 feet of very difficult conditions
- Outfall developed over time due to being undersized and creating excessive velocity

Level B Barrier Velocity Example: SR 112 UNT to Whiskey Creek



- Site 991693, located 17 miles east of Joe Creek.
- Twin 3' Concrete Pipes <math><0.4\%</math> slope
- Basin Area= 1.25 sq mi
- Precipitation= 75 inches
- Velocity>5 feet/second
- 67% passable



Level B Depth Barrier Example: SR 531 UNT to Edgecomb Creek

- Tiny Basin Area, 0.14 sq. mi.
- Annual Precipitation= 39.2"
- Level B results:
 - Velocity= 2.2 feet/second
 - Depth<2 inches at low-flow period
- 33% Passable

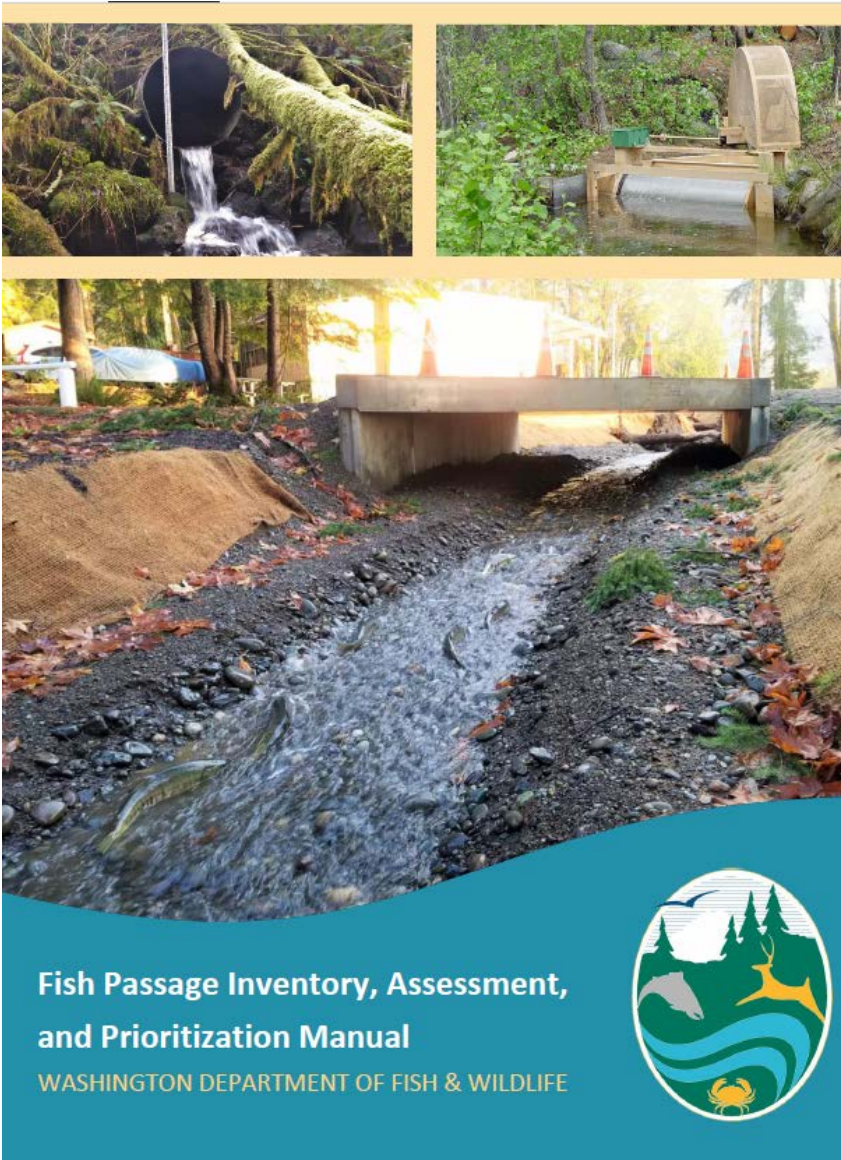


Tidal Velocity Barrier Example: SR 509 Wapato Creek

- Unknown barrier by Level A
- Level B not applicable due to tidal influence
- Requires WDFW Engineer Review

- Inadequate Depth observed
- Allowable velocity= 3 feet/second
- Tidal hydrology only= passable
- Tidal + Q_{fp} = 5.4 feet/second
- Predicted to be worse if downstream crossing were not limiting and attenuating tidal processes

WDFW Barrier Assessment Manual 2019



<https://wdfw.wa.gov/publications/02061>



Entrainment= Velocity



- Depth insufficient for adult salmon-
- Pre-spawn mortality of female Pink salmon
- Will not trigger a Level B barrier status due to presence of bed material and adequate span

“Other” Barrier Example:
SR 532 Church Creek





Barrier Effects on Habitat

SR 112 MP 33.21 Joe Creek - 990214

Photos taken on different dates and flow conditions but still...

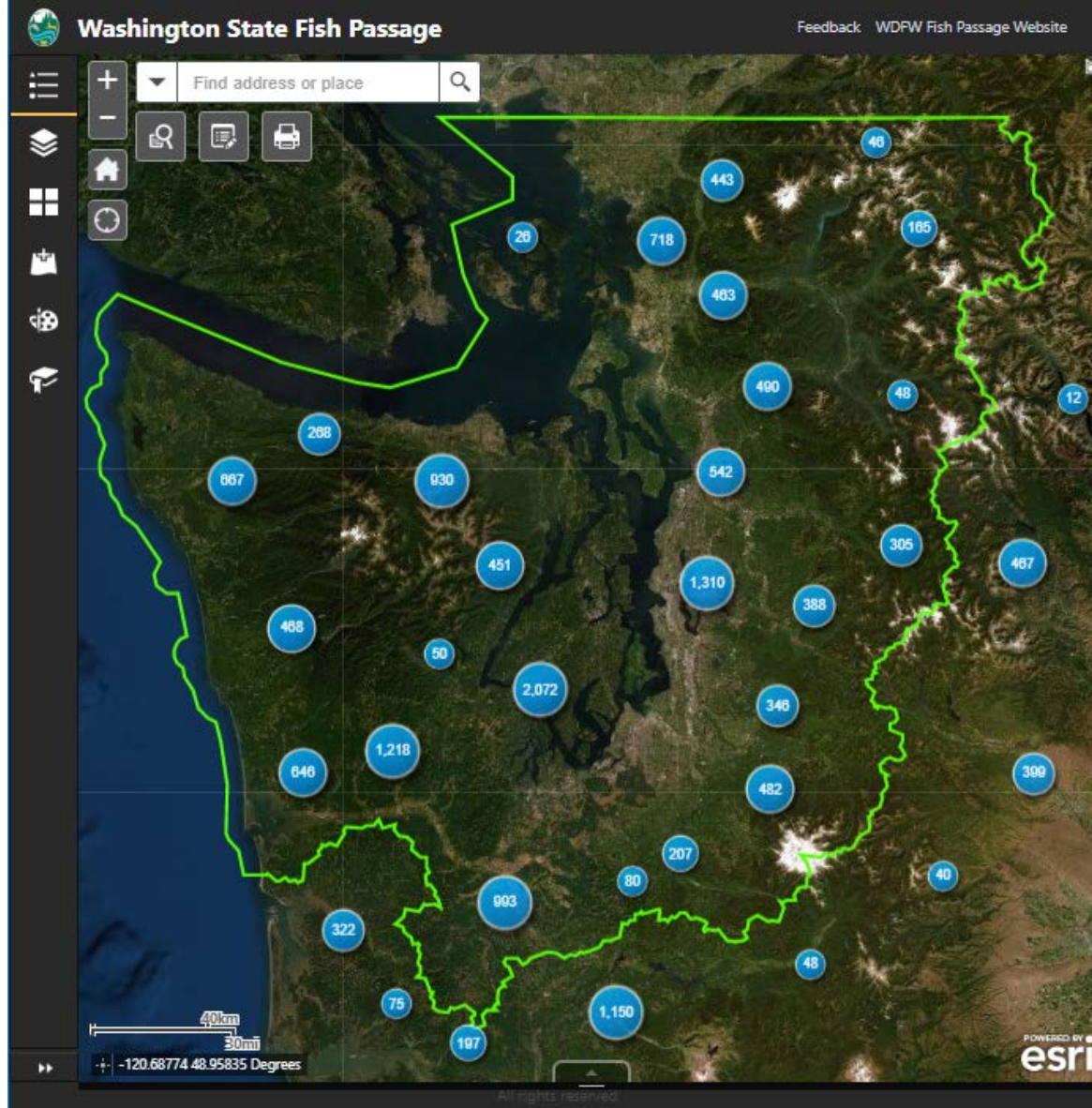
Upper photo is upstream of SR 112

- Natural recruitment of LWM
- Habitat is complex with pools and riffles
- Well graded substrate



Lower photo is downstream of SR 112

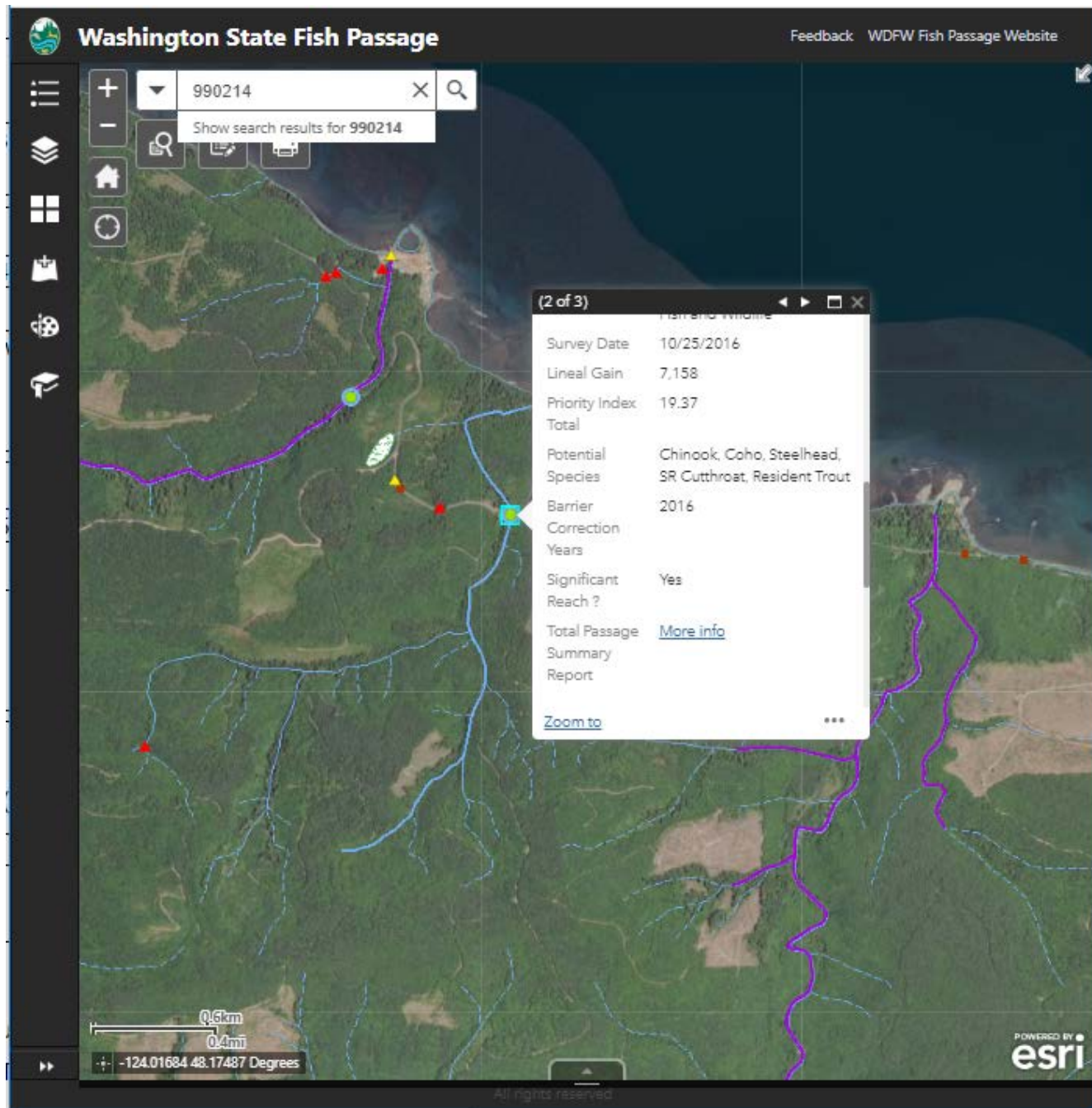
- Lacking LWM
- Uniform riffle
- Coarser substrate



WDFW Fish Passage Website

<https://geodataservices.wdfw.wa.gov/hp/fishpassage/index.html>

- Site Description
 - WRIA #
 - Species
- Culvert Assessment
 - Measurements
 - Avg. Stream Width
 - Barrier Assessment Method
 - Barrier Reason
- Habitat Survey Summary
 - File names
 - Comments
 - Potential Habitat Gain



WDFW Fish Passage and Diversion Screening Inventory Database

Site Description Report

Site ID

Project

Geographic Coordinates

Latitude (WGS 84):	<input type="text" value="48.1741028"/>
Longitude (WGS 84):	<input type="text" value="-124.0555573"/>
East (NAD 27):	<input type="text" value="772,854.5"/>
North (NAD 27):	<input type="text" value="1,055,667.3"/>

General Location

Road Name:	<input type="text" value="SR 112"/>
Mile Post:	<input type="text" value="33.21"/>
County:	<input type="text" value="Clallam"/>
WDFW Region:	<input type="text" value="6"/>

PI Species

<input type="checkbox"/> Sockeye	<input checked="" type="checkbox"/> Chinook	<input checked="" type="checkbox"/> Sea Run Cutthroat
<input type="checkbox"/> Pink	<input checked="" type="checkbox"/> Coho	<input checked="" type="checkbox"/> Resident Trout
<input type="checkbox"/> Chum	<input checked="" type="checkbox"/> Steelhead	<input type="checkbox"/> Bull Trout

Associated Features

<input checked="" type="checkbox"/> Culvert	<input type="checkbox"/> Dam	<input type="checkbox"/> Natural Barrier	<input type="checkbox"/> Diversion
<input type="checkbox"/> Non-Culvert Xing	<input type="checkbox"/> Other	<input type="checkbox"/> Fishway	

Location/Directions

Site Comments

Waterbody

Stream:	<input type="text" value="Joe Cr"/>
Tributary To:	<input type="text" value="Strait of Juan de Fuca"/>
WRIA:	<input type="text" value="19.0109"/>
River Mile:	<input type="text" value="0.60"/>
Fish Use Potential:	<input type="text" value="Yes"/>
FUP Criteria:	<input type="text" value="Biological"/>

Owner

Type:	<input type="text" value="State"/>
Name:	<input type="text" value="Washington State Department of Transportation"/>

The screenshot shows a web browser window displaying the Washington State Fish Passage website. The browser's address bar shows the URL: geodataservices.wdfw.wa.gov/hp/fishpassage/inde.... The website header includes the title "Washington State Fish Passage" and a "Feedback" link. A search bar at the top of the map area contains the site ID "990214". Below the search bar, a text prompt says "Show search results for 990214". The map displays a satellite view of a river reach with a blue line indicating the reach boundary. A data popup window is open over a specific location on the map, showing the following information:

(2 of 3)	
Survey Date	10/25/2016
Lineal Gain	7,158
Priority Index: Total	19.37
Potential Species	Chinook, Coho, Steelhead, SR Cutthroat, Resident Trout
Barrier	2016
Correction Years	
Significant Reach?	Yes
Total Passage Summary Report	More info
Zoom to	***

The popup window also includes navigation controls (back, forward, close) and a "Zoom to" button. The map interface includes standard GIS controls like zoom in/out, home, and layers. The bottom of the map shows a scale bar (0 to 200m) and coordinates: -124.06615 48.17046 Degrees. The ESRI logo is visible in the bottom right corner.

WDFW Fish Passage and Diversion Screening Inventory Database

Site Description Report

Site ID

Project

Geographic Coordinates

Latitude (WGS 84):	<input type="text" value="48.1741028"/>
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Waterbody

Stream:	<input type="text" value="Joe Cr"/>
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County:	<input type="text" value="Clallam"/>
WDFW Region:	<input type="text" value="6"/>

Owner

Type:	<input type="text" value="State"/>
Name:	<input type="text" value="Washington State Department of Transportation"/>

PI Species

<input type="checkbox"/> Sockeye	<input checked="" type="checkbox"/> Chinook	<input checked="" type="checkbox"/> Sea Run Cutthroat
<input type="checkbox"/> Pink	<input checked="" type="checkbox"/> Coho	<input checked="" type="checkbox"/> Resident Trout
<input type="checkbox"/> Chum	<input checked="" type="checkbox"/> Steelhead	<input type="checkbox"/> Bull Trout

- Stream Name
- Tributary to
- WRIA #

WDFW Fish Passage and Diversion Screening Inventory Database

Site Description Report

Site ID

Project

Geographic Coordinates

Latitude (WGS 84):	<input type="text" value="48.1741028"/>
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Waterbody

Stream:	<input type="text" value="Joe Cr"/>
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<input type="checkbox"/> Pink	<input checked="" type="checkbox"/> Coho	<input checked="" type="checkbox"/> Resident Trout
<input type="checkbox"/> Chum	<input checked="" type="checkbox"/> Steelhead	<input type="checkbox"/> Bull Trout

- Stream Name
- Tributary to
- WRIA #
- Water Resource Inventory Area
- Species
 - (Salmonid only)

Basic information of existing barrier:

- Shape
- Material
- Span
- Rise
- Length
- Water Depth in Culvert
- WS Drop
- Countersunk (streambed material throughout)
- Backwater (throughout)
- Slope
- Channel width (use with care!)
- Road fill depth

WDFW Fish Passage and Diversion Screening Inventory Database

Level A Culvert Assessment Report

Site ID: 990214	Stream: Joe Cr	WRIA: 19.0109
Latitude: 48.1741028	Tributary To: Strait of Juan de Fuca	Fish Use Potential: Yes
Longitude: -124.0555573		

Data Source	Washington Department of Fish and Wildlife	
Field Crew:	Nettnin;Staller	Review Date: 3/30/2004

Culvert Details							Level A Parameters					
ID	Shape	Material	Span	Rise	Length	WDIC	Apron	WSDrop	Location	Countersunk	Backwater	Slope (%)
1.2	RND	SPS	1.52	1.52	35.40	0.12	NO	0.26		No		1.00
2.2	RND	SPS	1.52	1.52	35.40	-99.99	NO	0.26		No		1.00

All dimensions in meters

Channel Description	
Toe Width (m):	3.2
Average Width (m):	-99.99
Culvert/Stream Width Ratio:	0.95
Plunge Pool	
Length (m):	5.50
Max Depth (m):	0.82
OHW Width (m):	9.45
Road	
Fill Depth (m):	3.00



- Barrier Reason
- % Passable
- Assessment Method
- Comments

Assessment Results			
Barrier:	<input type="text" value="Yes"/>	Passability (%):	<input type="text" value="67"/>
Reason:	<input type="text" value="WS Drop"/>	Fishway Present:	<input type="text" value="No"/>
		Method:	<input type="text" value="Level A"/>
		Recheck:	<input type="text"/>

Comments
1.2 = Log controls may work here (velocity isn't bad). May be steep downstream. Pipe is perched enough to block juveniles. On 10/20/04, RB culvert had a hole in the bottom near the upstream end. Probably more perforations throughout. 2.2 = Log controls (velocity isn't bad). May be steep downstream. Streambed is much wider than pipe upstream. Pipe is perched enough to block juveniles.

Potential Habitat Gain			
Survey Type:	<input type="text" value="FS"/>	Spawning (sq m):	<input type="text" value="5,262"/>
Significant Reach:	<input type="text" value="Yes"/>	Rearing (sq m):	<input type="text" value="9,506"/>
		Length (m):	<input type="text" value="7,158"/>
		PI Total	<input type="text" value="19.37"/>

- Barrier Reason
- % Passable
- Assessment Method
- Comments

Assessment Results			
Barrier:	<input type="text" value="Yes"/>	Passability (%):	<input type="text" value="67"/>
Reason:	<input type="text" value="WS Drop"/>	Fishway Present:	<input type="text" value="No"/>
		Method:	<input type="text" value="Level A"/>
		Recheck:	<input type="text"/>

Comments
1.2 = Log controls may work here (velocity isn't bad). May be steep downstream. Pipe is perched enough to block juveniles. On 10/20/04, RB culvert had a hole in the bottom near the upstream end. Probably more perforations throughout. 2.2 = Log controls (velocity isn't bad). May be steep downstream. Streambed is much wider than pipe upstream. Pipe is perched enough to block juveniles.

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		Length (m):	<input type="text" value="7,158"/>
		PI Total	<input type="text" value="19.37"/>

- Habitat Survey Type
- Length (Lineal Gain)
- Spawning area
- Rearing area

WDFW Fish Passage and Diversion Screening Inventory Database

Habitat Survey Summary Report

Site ID: 990214	Latitude: 48.1741028	Longitude: -124.0555573	WRIA: 19.0109
Stream: Joe Cr	Tributary To: Strait of Juan de Fuc	PI Total: 19.37	

Survey Type

Spreadsheet File(s):

990214.xls, 990214A.xls, 990214b.xls, 990214B1.xls, 990214b2.xls, 990214b3.xls, 990214b4.xls, 990214C.xls, 990214C1.xls

Downstream Survey

Date: Crew: Length (m):

Downstream Comments:

Excellent spawning and rearing available for resident fish. Habitat is complex with lots of LWD. Plunge Pool is more scour than plunge.

Upstream Survey

Date: Crew: Length (m):

Upstream Comments:

Barrier culvert 996972.

Potential Habitat Gain

Lineal (m):
 Spawning Area (sq m):
 Rearing Area (sq m):

Distribution
 Anadromous
 Resident Only
 Unknown

Gain Direction (Resident Only)

Potential Species Benefit

- | | | |
|--|---|--|
| <input type="checkbox"/> Sockeye / Kokanee | <input checked="" type="checkbox"/> Chinook | <input checked="" type="checkbox"/> Searun Cutthroat |
| <input type="checkbox"/> Pink | <input checked="" type="checkbox"/> Coho | <input checked="" type="checkbox"/> Resident Trout |
| <input type="checkbox"/> Chum | <input checked="" type="checkbox"/> Steelhead | <input type="checkbox"/> Bull Trout |

- Spreadsheet Files
- Comments

- Lineal Gain
- Spawning Area
- Rearing Area

- Salmonid Species

SR 112 Joe Creek

Table 1: Native fish species potentially present within the project area.

Species	Presence (Presumed, Modeled, or Documented)	Data Source	ESA Listing
Chinook (<i>Oncorhynchus tshawytscha</i>)	Presumed	WDFW Biological Scoping Report	Federally Threatened
Coho (<i>Oncorhynchus kisutch</i>)	Presumed	WDFW Biological Scoping Report	Not Warranted
Steelhead (<i>Oncorhynchus mykiss</i>)	Presumed	WDFW Biological Scoping Report	Federally Threatened
Coastal Cutthroat (<i>Oncorhynchus clarkii clarkii</i>)	Presumed	WDFW Biological Scoping Report	Not Warranted

WSDOT
Fish Passage Barrier
Scoping Summary Report

Site ID: 990214

WDFW Scoping Biologist: King Date: 2/28/07

Site Information

Stream Name: Joe Ck. WRIA: 19.0109

Tributary to: Strait of Juan de Fuca

State Route: 112 Mile post: 33.21

Barrier problem: Two round 1.52m diameter CMP culverts 35m long. Water velocity exceeds the WAC criteria.

Percent Passability: 67

Survey Data (from file)

Survey type: RSFS Survey Date: 12/21/04

Species claimed: CK,CO,SH,SCT,RT Survey crew: Busby/Hird

Habitat quality: (Spawn) 1.00 (Rear) 1.00 Upstream survey length: 7,158m

Additional upstream barriers: 1

Downstream survey length: 1,140m # Additional downstream barriers: 0

Comments on adequacy of file data (include changes/corrections made):

Removed Bull Trout from the PI since the only documented existing stocks are in the Dungeness and Elwha rivers. Also, the passability was changed from 67% to 33% based on the engineers scoping report.

Supplemental site/stream/watershed information affecting value of correction:

Biologist's preliminary recommendation based upon site visit and file review:

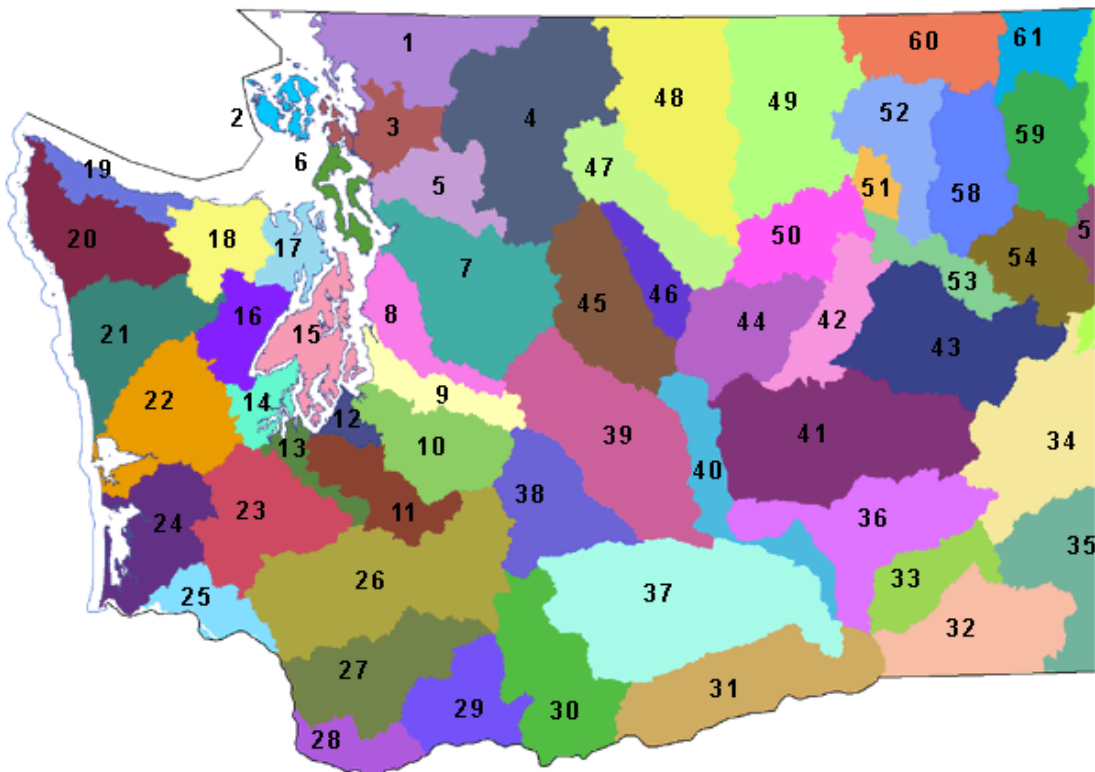
- "Defer" further scoping because the PI dropped below the current threshold due to changes made to the database (sign this form and provide an explanation)
- "Hold" until there are plans to address non-WSDOT barriers or habitat deficiencies. (sign this form and provide a **detailed explanation** of why this decision was made)
- "Continue" scoping process and request a scoping engineer be assigned (notify ERTA West Section Manager)

- Find by Interactive Map**
- By Salmon Recovery Region
 - By County
 - By Lead Entities
 - By WRIA

For more information on salmon recovery and conservation, please contact the WDFW Fish Program.
360-902-2700
fishpgm@dfw.wa.gov

For problems accessing this website or data found on this website, please contact WDFW SCoRE Help.
scorehelp@dfw.wa.gov

Water Resource Inventory Area (WRIA) Map

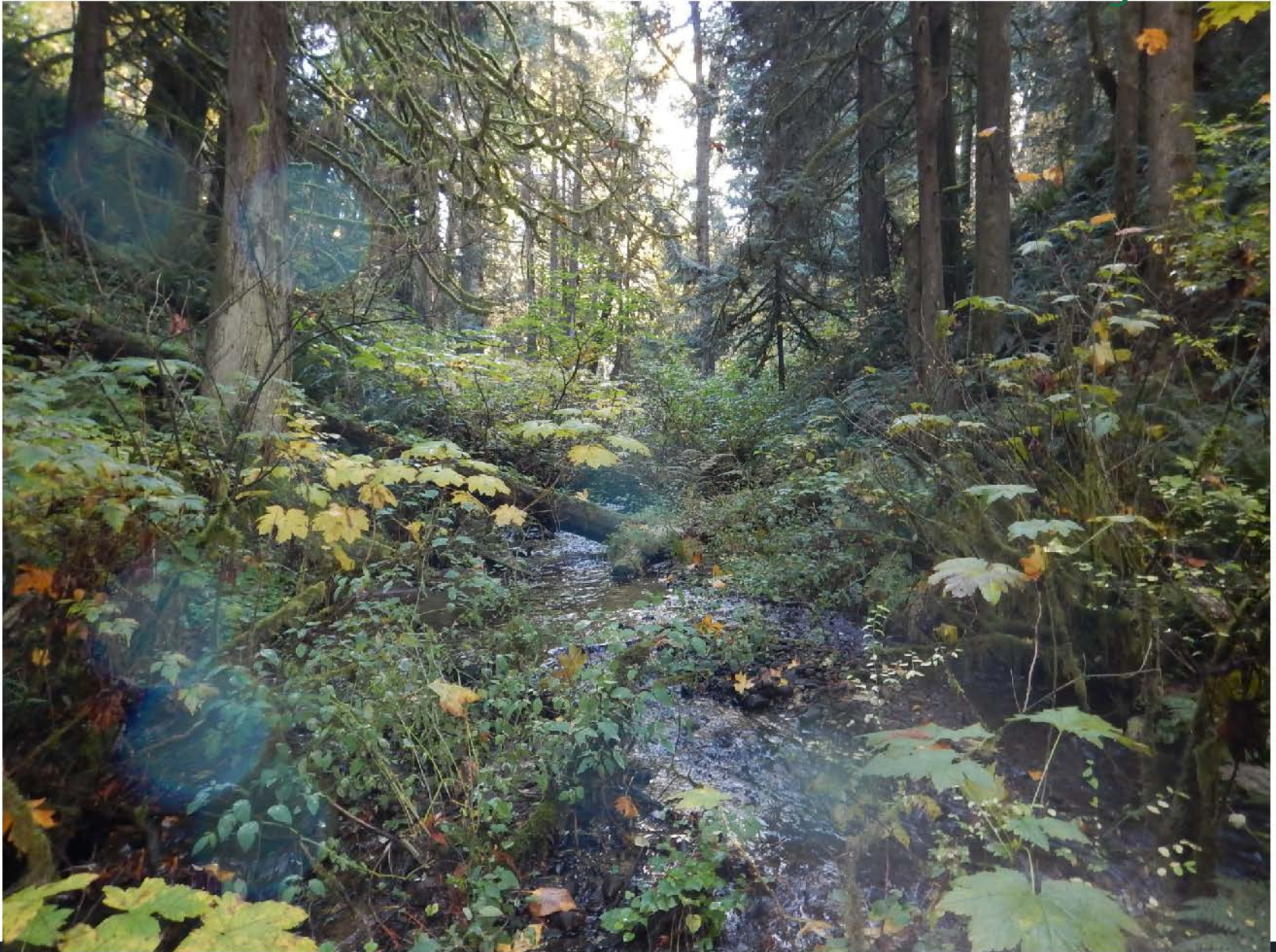


1-16 17-30 31-45 46-62

- WRIAs 1 - 16**
- WRIA 1 - Nooksack
 - WRIA 2 - San Juan
 - WRIA 3 - Lower Skagit-Samish
 - WRIA 4 - Upper Skagit
 - WRIA 5 - Stillaguamish
 - WRIA 6 - Island
 - WRIA 7 - Snohomish
 - WRIA 8 - Cedar/Samish
 - WRIA 9 - Duwamish/Green
 - WRIA 10 - Puyallup/White
 - WRIA 11 - Nisqually
 - WRIA 12 - Chambers-Clover
 - WRIA 13 - Deschutes
 - WRIA 14 - Kennedy-Goldsborough
 - WRIA 15 - Kitsap
 - WRIA 16 - Skokomish-Dosewallip

<https://fortress.wa.gov/dfw/score/score/>

Fish Habitat Character & Quality



Fish Habitat Character & Quality



Interdisciplinary Team Site Visit: Bankfull Width Concurrency



Interdisciplinary Team Site Visit: Reference Reach Selection



Fish Habitat Character & Quality



Salmon Habitat Limiting Factors in Washington State
By
Carol J. Smith, Ph.D.
Washington State Conservation Commission
Olympia, Washington



1

Limiting Factors to Salmon Productivity Include:

- Fish Passage Barriers
- Floodplain Impacts
- Poor Riparian Conditions
- Flashy Flows
- Low Flows
- Excessive sedimentation
- Warm water temperatures
- Lacking LWM

Riparian Conditions and Fish Habitat





Riparian Conditions and Fish Habitat





Riparian Conditions and Fish Habitat



Owen Caddy Interpretive Services for The Nature Conservancy

Riparian Conditions and Fish Habitat





Biological Considerations

Questions?

Damon Romero
WSDOT Fish Passage
Coordinator