Bonneville Power Administration ***and*** ***US Bureau of Reclamation***

Research, Monitoring and Evaluation (RM&E)
Habitat Information Resources
for
Snake River Steelhead

Presented for

The FCRPS 2015 Tributary Habitat
Expert Panel Review Process

By

Bonneville Power Administration

&

United States Bureau of Reclamation

Table of Contents

List of Tables

List of Figures

Introduction

The Federal Columbia River Power System (FCRPS) Action Agencies (AAs) — US Army Corps of Engineers, Bonneville Power Administration, and Bureau of Reclamation — are implementing a tributary habitat program of work that is guided by the 2008 FCRPS Biological Opinion (BiOp) and 2010 and 2014 supplements. The 2010 supplement incorporates the 2008 FCRPS BiOp and an Adaptive Management Implementation Plan resultant of the court-ordered remand of the 2008 BiOp. The Reasonable and Prudent Alternatives (RPA) in the 2008 BiOp and 2010 and 2014 supplements direct achievement of improvements to tributary habitat by 2018.

The process used to estimate changes in habitat quality improvements (HQIs) involves local expert panels that evaluate tributary habitat improvement actions for improvements to factors limiting salmon and steelhead. The work of the expert panels is facilitated by the AAs, who convene a forum to review and evaluate habitat improvement actions specific for Chinook and steelhead populations included in Table 5 of the 2008 BiOp. The 2014 BiOp supplement included recommendations to the AAs to incorporate research, monitoring and evaluation (RM&E) information to the panel process.

This document serves as a framework to focus efforts to assemble and make available RM&E information to the expert panels. This document is intended to guide panel members and interested parties to available RM&E resources. This document also serve as a primer for the expert panel process and includes supporting information for those not directly involved in the process.

Individual documents covering four Evolutionary Significant Units/Distinct Population Segments (ESUs/DPSs) for Chinook and steelhead covered under the 2008 FCRPS BiOp are accessible by hyperlinks that cover:

1. Upper Columbia Spring Chinook ESU
2. Upper Columbia Steelhead DPS
3. Snake River Spring/Summer Chinook ESU
4. Snake River Steelhead DPS

Resources will be accessible in the form of referenced literature; hyperlinks to reports/documents/websites portals; and data/information available from entities/programs such as: Columbia Habitat and Aquatic Monitoring Program (CHaMP), PACFISH/INFISH Biological Opinion (PIBO) aquatic and riparian monitoring program, and the USDA Forest Service Air Water and Aquatic Environments Program (AWAE) NorWeST Stream temp. The hyperlinks provided above for each ESU/DPS serve as portals to the AAs expert panel website. Hyperlinks provided throughout this document guide readers to specific reports/documents that provide greater detail and guidance on topics important to the expert panel process.

Expert Panel Process

The expert panel process was an outcome of the Habitat Collaboration Workgroup (HCW) convened subsequent to issuance of the Record of Decision on the 2008 BiOp. The expert panel approach is described in Appendix C of the 2007 FCRPS Comprehensive Analysis.

The expert panel process was developed as a means to evaluate the effect of tributary habitat improvement actions on limiting factors/ecological concerns for salmon and steelhead for populations included in RPA 35 Table 5. RPA 35, Table 5 includes the HQIs the AAs are required to deliver by 2018 (2008-2018 is the period of the current BiOp). Habitat improvement actions that address key limiting factors/ecological concerns affecting survival and production of Chinook salmon and steelhead are the focus of the AAs work. The expert panels are convened to evaluate changes to limiting factors/ecological concerns consequent of implementing those actions.

The expert panels were convened formally for the first time in 2009, then again in 2012. The next expert panel workshop will be convened in 2016. The timing of the third expert panel workshops relates to agreements struck during the development of the 2014 BiOp supplement. During the workshops, panels evaluate and then estimate changes in tributary habitat limiting factor/ecological concerns function resulting from completed habitat improvement actions. The evaluation is called the "look back" because the panels look back to see what work was completed from the time the panels were last convened to the present. During the workshops the panels also evaluate anticipated changes in tributary habitat function resulting from planned habitat improvement actions. This evaluation is called the "look forward" and covers the period from the present time forward to when the next expert panel workshop will be convened (Figure 1). The AAs prepared a paper on the guidance for evaluating limiting factors/ecological concerns related to habitat improvement actions implemented pursuant to the FCRPS BiOp.

Different expert panels are assembled throughout the Columbia Basin, corresponding to the areas where the HCW determined expert input would be necessary to evaluate the current condition of habitat for salmonids and to evaluate the potential benefits of tributary habitat improvement actions on limiting factors/ecological concerns. The panels were designated for areas where it was determined that salmon and steelhead were the most imperiled.

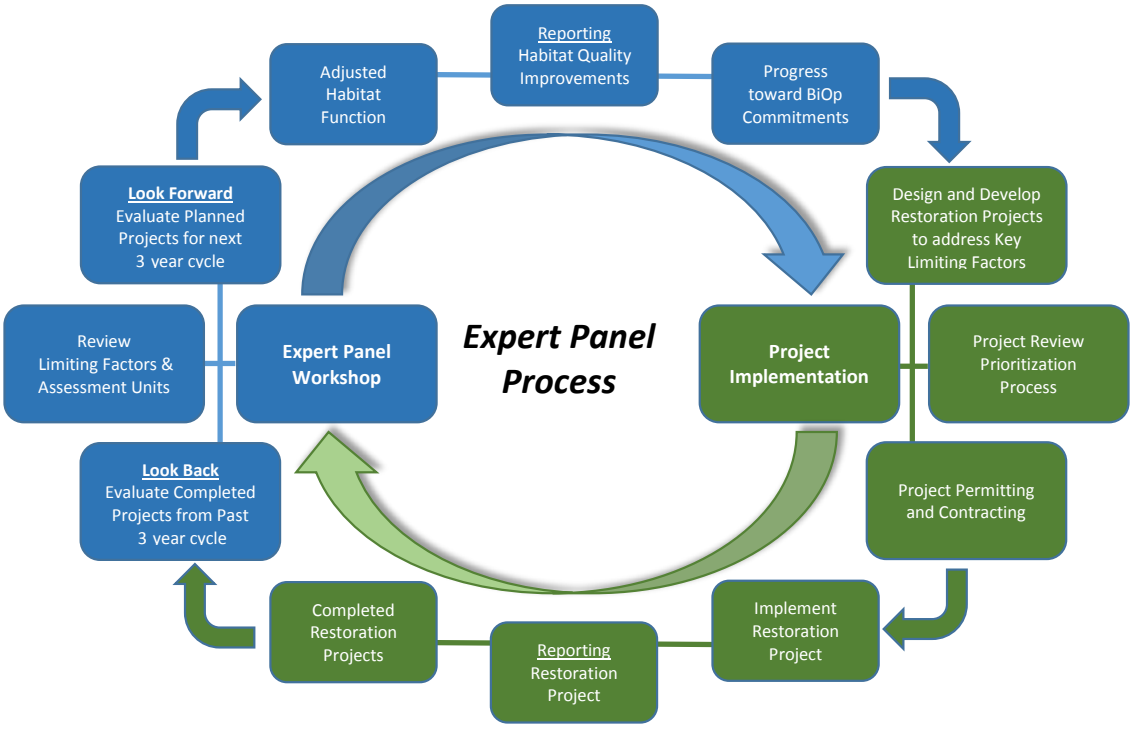

Figure 1. Diagram of the expert panel process used to implement and evaluate habitat improvement actions necessary to fulfill FCRPS BiOp Commitments.

Assessment Units

The spatial unit of evaluation used in the expert panel process is the assessment unit (AU). AUs are set based on geographic boundaries delimiting where Chinook or steelhead use a watershed or subwatershed for a specific purpose and where certain limiting factors/ecological concerns affect that use. For example, if a certain area of a watershed or subwatershed is limited by water quality and as well is an area used by fish for a specific purpose (e.g., spawning or rearing) the geographic boundary of that area establishes the AU boundary. Because AUs are unique in the habitat they provide fish and as well in the limiting factors/ecological concerns that affect production each AU within a population is weighted. For example, if one AU receives more use by one life stage of fish than another AU, that AU will be weighted higher relative to the weights of other AUs where fish use is lower. All of the weighting factors assigned AUs in a watershed or subwatershed total 100% when summed. Each AU within a population's watershed or subwatershed has different capacities and/or production potentials; and so are weighted accordingly. Again, AU weighting is based on the percentage use of the AU relative to other AUs used by the population.

The approach to weighting AUs was based on the habitat intrinsic potential analysis conducted by NOAA Fisheries (Cooney and Holzer 2006). The analysis of intrinsic potential evaluated historic production potential across tributary habitats used by Interior Columbia Basin yearling type Chinook and steelhead populations. The qualification of "potential" was based on empirically derived relationships between

salmon spawner densities and channel characteristics (Montgomery et al., 1999). Thus, the weight of an AU within a population reflects the relative importance of that AU to other AUs within the population.

For each AU the expert panel also identifies limiting factors/ecological concerns. Like AUs, limiting factors/ecological concerns are weighted based on the factors most limiting Chinook and steelhead in a watershed or subwatershed. The higher weighted limiting factors/ecological concerns indicate their importance relative to other limiting factors/ecological concerns in the AU. The number of limiting factors/ecological concerns per AU and population can be extensive. So, in 2012 to facilitate the work of the expert panels the AAs rolled up the limiting factors/ecological concerns information into a series of pie maps to display AUs and their weights and the limiting factors/ecological concerns and their weights.

Ecological Concerns and Limiting Factors

In 2011, NOAA-Fisheries adopted standardized limiting factors/ecological concerns with definitions of Ecological Concerns and Ecological Sub-Concerns (Appendix 1). The standardized terminology and definitions were intended to improve understanding about what a specific limiting factor/ecological concern was referring to when the expert panels were in discussion. During the 2012 expert panel workshops the panels were asked to cross walk the original limiting factors/ecological concerns with the new standardized terms. To be assured that nothing would be lost in translation the AAs retained the reference to the original limiting factors/ecological concerns.

Habitat Improvement Actions

Reviewing and evaluating benefits of habitat improvement actions is fundamental to the expert panel process and establishes the change in limiting factors/ecological concerns associated with each AU. Pursuant to the BiOp, every three years the AAs complete a comprehensive evaluation of what has been accomplished insofar as benefits of tributary habitat program of work is considered. The document that is developed is referred to as the Comprehensive Evaluation (CE) and summarizes by population the improvements that have been achieved over the preceding three year interval. The last CE was completed in 2013 (FCRPS AAs 2013). Table 1 displays the percent HQIs resulting from tributary habitat improvement actions for Snake River steelhead (CE Section 2, Table 35, pg. 150).

Table 1. Percent HQIs from actions benefitting steelhead in the Snake River DPS. Projects completed through 2011 and projected through 2018 (Source: Comprehensive Evaluation, Sec 2 Table 35). Percent HQI is based on RPA action 35 Table 5 commitments by 2018.

ESU/DPS	MPG	Population	Percentage at or above 2018 Table 5 Habitat Quality Improvement (HQI)	
			Percentage of HQI through 2011	Projected Percentage of HQI through 2018
Snake River Steelhead	Grande Ronde River	Grande Ronde River lower mainstem tributaries	100%	100%
		Grande Ronde River upper mainstem tributaries	75%	100%
		Joseph Creek	100%	100%
		Wallowa River	200%	300%
	Imnaha River	Imnaha River	100%	300%
	Lower Snake	Asotin Creek	125%	125%
		Tucannon River	60%	940%
	Salmon River	Lower Middle Fork Salmon Mainstem (Big, Camas and Loon Creeks)	21%	150%
		East Fork Salmon River	100%	200%
		Lemhi River	767%	900%
		Pahsimeroi	300%	411%
		Salmon River upper mainstem	67%	133%
		Secesh River	83%	100%
		South Fork Salmon River	100%	500%
	Clearwater River	Lochsa River	38%	106%
		Lolo Creek	25%	150%
		Selway River	100%	100%
		South Fork Clearwater River	29%	121%

Information that supports the planning and assessment of benefits for tributary habitat improvement actions includes habitat status and trend monitoring and action effectiveness monitoring. Fish and habitat status and trend monitoring informs identification of limiting factors/ecological concerns and assessment of benefits from tributary habitat improvement actions, based on relationships between habitat condition and fish productivity and capacity. Action effectiveness monitoring supports identification of linkages between the effect of habitat actions on fish numbers and habitat condition at the project or site level and the watershed level. The tributary habitat discussion in the 2014 supplement drew attention to the utility and necessity of RM&E to inform the AAs program of work in delivering HQIs. With increasing efforts to expand RM&E to inform the tributary habitat program, the AAs recognized the need to focus data collection efforts and to organize the information that will come on line over the next several years. The background that is documented in the "Columbia Basin Tributary Habitat Improvement: A Framework for Research, Monitoring and Evaluation" is supplemented by this document that outlines the approach and thought process for organizing information.

In a recent literature review on the benefits of habitat improvement actions, initial results have identified fish passage improvements, in-stream wood and rock structures, livestock grazing controls, connection or construction of off-channel habitat and flow augmentation among the most proven forms

of habitat improvements benefitting fish (BPA and BOR 2013). According to the review these types of projects have the most rapid response time, while benefits of projects like riparian habitat restoration can take longer to be realized (see table "Response Time and Longevity"). The literature review also points to the life stages for spring-summer Chinook (e.g., parr-to-smolt) that benefit from these actions. The study demonstrated that survival was generally highest in the least disturbed watersheds but also revealed that survival was higher in treated watersheds (Paulsen and Fisher 2005). Examples of different types of habitat improvement actions implemented to address limiting factors/ecological concerns are presented in the AAs CE (CE Section 1, Pg. 56).

The combined efforts of the Integrated Status and Effectiveness Monitoring Program (ISEMP) and Columbia Habitat Monitoring Program (CHaMP) have started to illustrate fish and habitat responses to habitat improvement actions (ISEMP/CHaMP 2015). Information collected in Intensively Monitored Watersheds like Bridge Creek, Oregon; the Entiat River in Washington; and the Lemhi River in Idaho have begun to show benefits of these habitat improvement actions. For example, in Bridge Creek installation of structures to encourage dam building have significantly reduced channel incision and increased both the number and size of pools. The response has been rapid and encouraging, showing a degree of reconnection to the floodplain, increase in water table elevation and a reduction in maximum daily water temperatures. In the Entiat, adding rocks and wood to the stream as well as reconnecting the floodplain are increasing pool frequency and depth and the amount of large wood. In one particular study on the Entiat, fish density and affinity for treated microhabitat increased compared to untreated habitats (BPA and BOR 2013). In the Lemhi River, tributary reconnection among other habitat improvements has shown that juvenile Chinook are taking advantage of habitat that would not otherwise be accessible (ISEMP/CHaMP 2015). These habitat improvement actions and monitoring efforts are beginning to show increases in survival, abundance and productivity (ISEMP/CHaMP 2015).

RM&E Information & Organization

RM&E information organized for the expert panel process is available on a Bureau of Reclamation website that was developed specifically to support the expert panel process. The following flow diagram displays an overview of the organization of RM&E resources (Figure 3). Under the main heading of expert panel, there are five main topics; Workshops, Meetings, Quick References, Map Tools and Background that provide navigation to different information associated with the expert panel process. The quick references provide links for each ESU/DPS and facilitates access to information organized by (Figure 3; light blue boxes). In a general category named "Other RM&E Resources" information on topics such as climate change, habitat use, habitat improvement, and other categories of interest are available. In prior years, this information was made available through directories that were not necessarily organized by watershed or population. For the 2016 workshops, the AAs are preparing population by population directories to guide panel members to information relevant to their area. The AAs have also been coordinating with CHaMP project to develop current habitat information that corresponds to a specific set of limiting factors/ecological concerns (i.e., sediment, temperature, etc.). This RM&E resource is discussed in more depth in the following section.

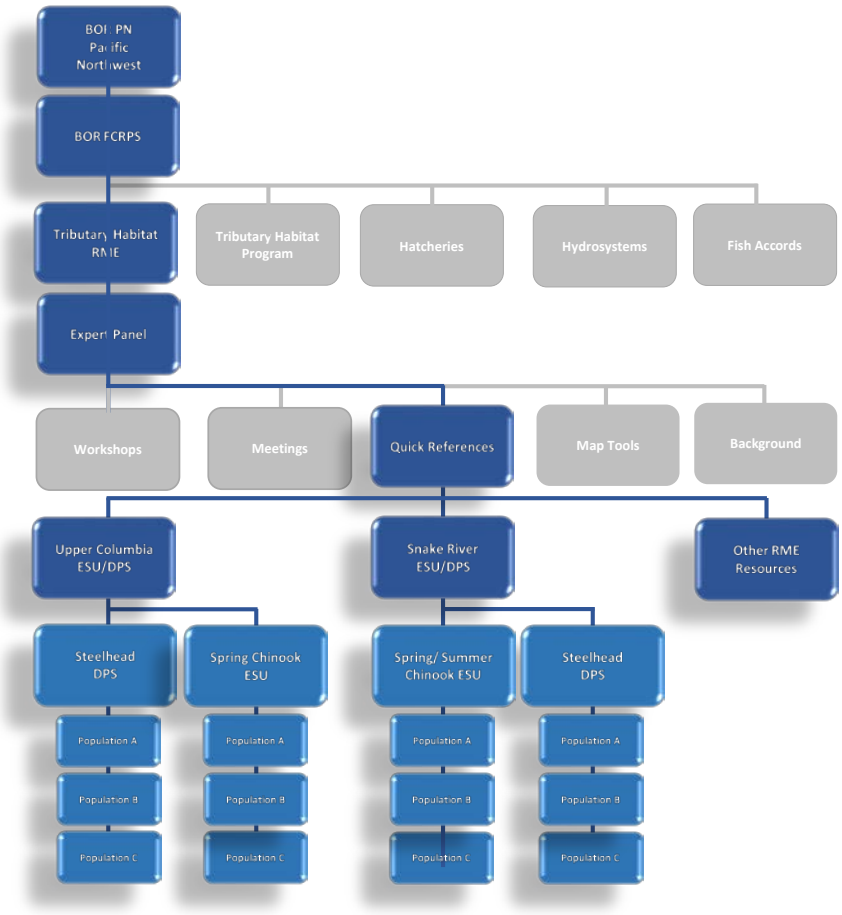

Figure 2. Flow diagram of Bureau of Reclamation website to RM&E information organized at the population level.

Request for RM&E

In an effort to provide a comprehensive RM&E resource to each expert panel, the AAs requested that watershed group members, agencies, tribes and participants to share available data and information. The objective is to build a resource that will inform panel members during panel meetings as well as a resource to inform others about current research on habitat. Appendix 2 provides a more detailed request from the AAs on RM&E information.

Snake River Steelhead

The Snake River Steelhead DPS contains six major population groups (MPGs) with 24 extant populations excluding functionally extirpated populations (above Hell Canyon Complex and North Fork Clearwater). There are 132 AUs that have been identified for this DPS by the expert panels (Figure 3). The Snake River basin steelhead DPS includes all naturally spawned populations of steelhead in streams in the Snake River basin of southeast Washington, northeast Oregon, and Idaho and includes six artificial propagation

programs as part of the DPS (e.g., Tucannon River, Dworshak National Fish Hatchery, Lolo Creek, North Fork Clearwater, East Fork Salmon River, and the Little Sheep Creek/Imnaha River Hatchery steelhead hatchery programs [NMFS 2011b]).

During the initial assembly of the expert panels for the Snake River Steelhead DPS, 21 limiting factors/ecological concerns (ecological concern subcategories) and their current habitat function were identified for steelhead. From this list, agencies, tribes, and organizations have developed, designed, and completed habitat improvement actions to address those 21 limiting factors/ecological concerns. Expert panels assembled for the Snake River steelhead DPS assess a new list of habitat improvement actions every three years (implementation cycle) and will be asked to do so again for the "look back" period (2013-2015) for completed projects, and "look forward" period (2016-2018) for proposed projects. Combined there are 1,054 habitat improvement actions that have been completed or planned in 89 of the 132 AUs. In the sections to follow, we briefly discuss the limiting factors/ecological concerns and planned habitat improvement actions in the Lower Snake, Grande Ronde River, Imnaha River, Clearwater and Salmon MPGs for Snake River steelhead. Assembling existing RM&E resources for the Snake River expert panels should follow the intersection of completed/planned habitat improvement actions with AUs where limiting factors/ecological concerns will be addressed.

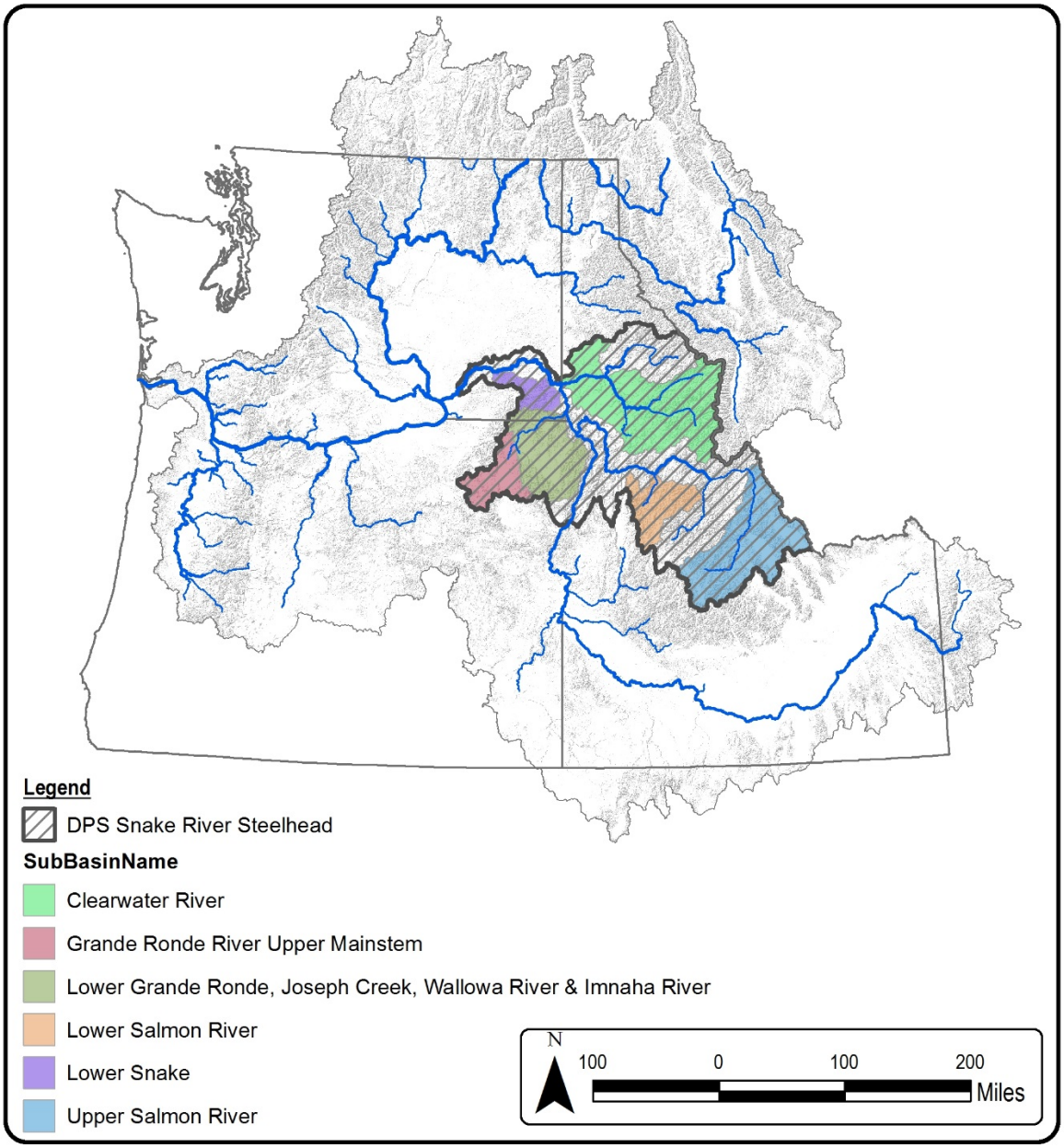

Figure 3. Snake River Steelhead DPS and populations involved in the expert panel process.

Lower Grande Ronde, Joseph Creek, Wallowa River & Imnaha River

These steelhead populations have been grouped together because they represent a single expert panel workshop apart from the upper Grande Ronde River steelhead. These populations contain 36 AUs with 39 planned habitat improvement actions within 16 AUs (Table 2; Figure 4). These habitat improvement actions have been or will be completed by end of 2018. Most of the habitat improvement actions occur within the Imnaha and Wallowa river watersheds. Limiting factors/ecological concerns identified for the Grande Ronde and Catherine Creek populations are presented in Table 3.

Table 2. Assessment unit names, codes and weight (in percent) along with the number of planned habitat improvement actions for the Lower Grande Ronde, Joseph Creek, Wallowa and Imnaha River populations of the Snake River steelhead DPS.

AU Code	Assessment Unit Names	Assessment Unit Weight (%)	2013-2018 Planned Restoration Actions
IRS1	Lower Imnaha R.	9.9%	0
IRS2	Lower Imnaha Tribs	1.9%	2
IRS3	Cow, Lightning, & Horse Creeks	23.0%	0
IRS4	Upper Imnaha River Mainstem	11.9%	0
IRS5	Upper Imnaha R. Tributaries	15.4%	4
IRS6	Lower Big Sheep Mainstem	13.4%	2
IRS7	Lower Big Sheep and Little Sheep Cr. Tributaries	15.2%	2
IRS8	Upper Big Sheep & Little Sheep Mainstem	4.1%	2
IRS9	Upper Big Sheep & Little Sheep tributaries	5.3%	2
	Total	**100.0**	**14**
JCS1	Joseph Cr. Mainstem	20.5%	1
JCS2	Cottonwood Creek	14.5%	1
JCS3	Joseph Creek Small Tributaries	4.5%	0
JCS4	Swamp & Davis Creeks	13.7%	0
JCS5	Elk & Crow Creeks	11.2%	0
JCS6	Lower Chesnimnus Creek and Prairie Tributaries	12.4%	0
JCS7	Upper Chesnimnus Creek and Forest Tributaries	23.2%	2
	Total	**100.0%**	**4**
LGS1	Lower Grande Ronde River Mainstem - mouth to Wenaha River	13.3%	0
LGS2	Lower tributaries to the Lower Grande Ronde River	9.6%	0
LGS3	Wenaha River Mainstem	6.4%	0
LGS4	Wenaha River Forks and Tributaries	20.1%	0
LGS5	Lower Grande Ronde River Mainstem - Wenaha River to Wallowa River	10.6%	0
LGS6	Courtney, Mud, Grossman, and Wildcat Creeks	35.3%	3
LGS7	Upper Tributaries of the Lower Grande Ronde River	4.6%	0
	Total	**100.0%**	**3**
WRS1	Lower Wallowa River	3.8%	0
WRS2	Lower Wallowa Tributaries - Howard, Wise, and Fisher Creeks	4.2%	0
WRS3	Wallowa River Canyon - Minam River to Dry Creek - and Tributaries	9.8%	1
WRS4	Lower Minam River and tributaries (downstream from Cougar Cr.)	4.7%	0
WRS5	Upper Minam River and tributaries (upstream from Cougar Cr.)	20.1%	0
WRS6	Mid-Wallowa River - Dry Creek to Lostine River	2.8%	0
WRS7	Dry Creek and Tributaries	8.2%	0
WRS8	Bear Creek and Tributaries	9.7%	1
WRS9	Whisky Creek	6.6%	2
WRS10	Lostine River	9.9%	4
WRS11	Hurricane Creek	2.9%	1
WRS12	Prairie Creek	5.3%	0

AU Code	Assessment Unit Names	Assessment Unit Weight (%)	2013-2018 Planned Restoration Actions
WRS13	Upper Wallowa River and small tributaries (upstream of Lostine R.)	12.3%	4
	Total	**100.0%**	**13**

The most widespread and numerous limiting factors/ecological concerns noted for these populations are channel structure and form, riparian condition, habitat quantity, sediment, water quantity and water quality (Table 3). Increased sediment quantity occurs in 32 (89%) of the AUs while increased stream temperature occurs in 29 AUs (81%). Instream structural complexity, low dissolved oxygen, decreased water quantity, barriers and poor riparian condition in more than half of the AUs. Less wide spread and numerous, limiting factors/ecological concerns like poor floodplain condition, bed and channel form and increased water quantity occurred 15-20% of the AUs. More localized concerns were noted for steelhead predation in the Lower Grande Ronde River mainstem AU and altered primary productivity in the Lostine River AU.

There are 39 habitat improvement actions planned for the 2013-2018 period covering four major limiting factors/ecological concerns for these steelhead populations (Table 4). The priority for assembling existing RM&E resources for the expert panel follows the intersection of currently planned habitat improvement actions with limiting factors/ecological concerns that will be addressed in those 16 AUs.

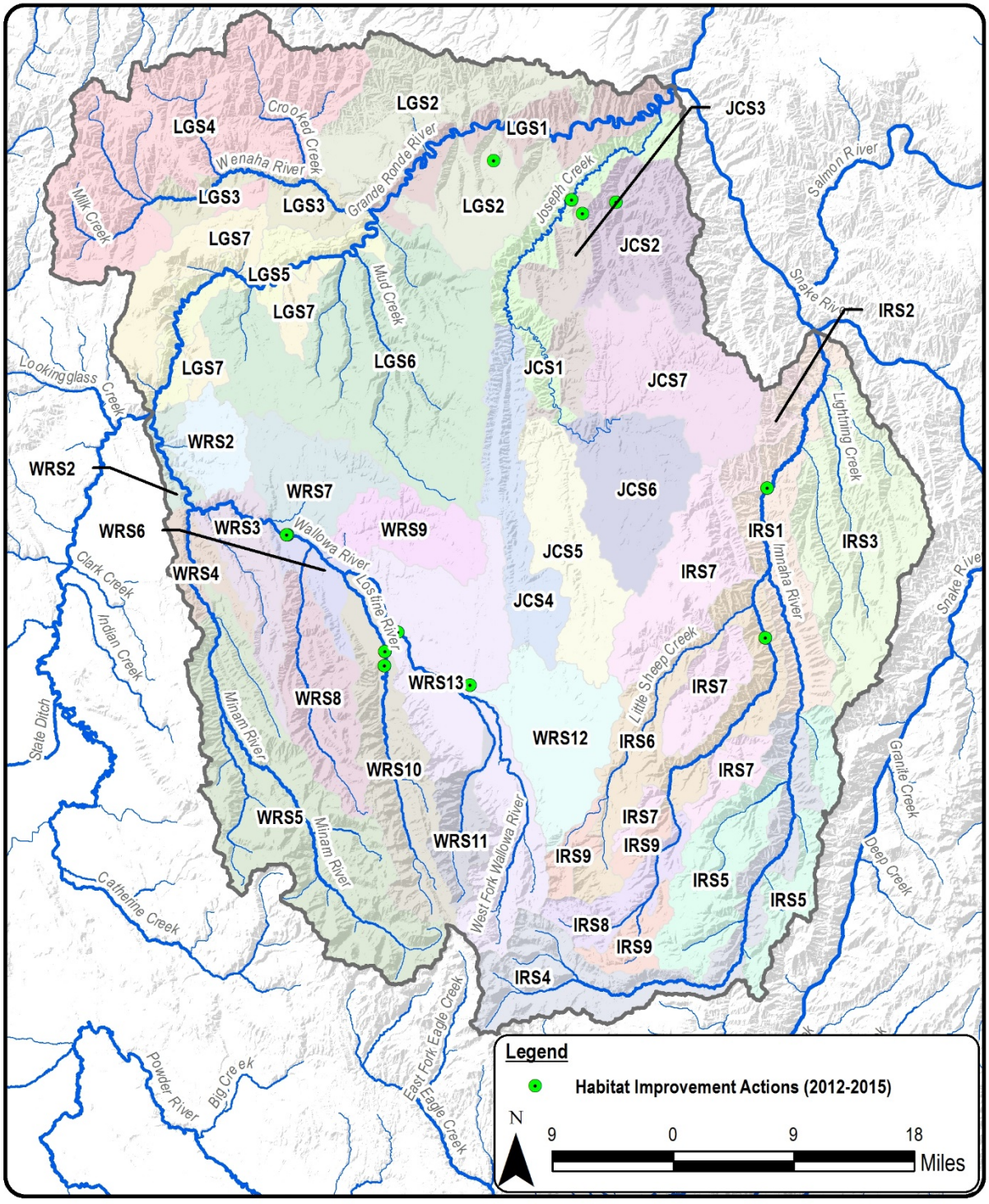

Figure 4. Lower Grande Ronde, Joseph, Wallowa and Imnaha steelhead populations, AU level boundaries and locations of habitat improvement actions.

Table 3. Limiting factors/ecological concerns identified by an "X" for ecological sub-categories in AUs of the lower Grande Ronde mainstem tributaries, Joseph Creek, Wallowa River and Imnaha River populations. Assessment units in gray have no planned habitat improvement actions for the 2013-2018 expert panel cycle.

Assessment Unit		Habitat Quantity			Injury and Mortality				Food			Riparian Condition		Peripheral and Transitional Habitats				Channel Structure and Form		Sediment Conditions		Water Quality							Water Quantity			Population Level Effects			
		Anthropogenic Barriers	Natural Barriers	HQ-Competition	Predation	Pathogens	Mechanical Injury	Contaminated Food	Altered Primary Productivity	Food-Competition	Altered Prey Sp. Comp. & Div.	Riparian Condition	LWD Recruitment	S. Channel and Wetland Cond.	Floodplain Condition	Estuary Conditions	Nearshore Conditions	Bed and Channel Form	Instream Structural Complexity	Decreased Sediment Quantity	Increased Sediment Quantity	Temperature	Oxygen	Gas Saturation	Turbidity	pH	Salinity	Toxic Contaminants	Increased Water Quantity	Decreased Water Quantity	Altered Flow Timing	Reduced Genetic Adaptiveness	Small Population Effects	Demographic Changes	Life History Changes
Code	Name	1.1	1.2	1.3	2.1	2.2	2.3	2.4	3.1	3.2	3.3	4.1	4.2	5.1	5.2	5.3	5.4	6.1	6.2	7.1	7.2	8.1	8.2	8.3	8.4	8.5	8.6	8.7	9.1	9.2	9.3	10.1	10.2	10.3	10.4
IRS1	Lower Imnaha River																				X	X	X							X					
IRS2	Lower Imnaha Tribs	X										X									X	X	X												
IRS3	Cow, Lightning, & Horse Creeks	X																X			X	X													
IRS4	Upper Imnaha River Mainstem	X																X			X	X	X												
IRS5	Upper Imnaha R. Tributaries	X										X						X			X	X	X						X	X					
IRS6	Lower Big Sheep Mainstem	X										X						X			X	X	X							X					
IRS7	Lower Big Sheep and Little Sheep Cr. Tribs	X										X									X	X	X						X	X					
IRS8	Upper Big Sheep & Little Sheep Mainstem	X																			X	X								X					
IRS9	Upper Big Sheep & Little Sheep tributaries	X										X									X	X	X						X	X					
LGS1	Lower GR River Mainstem (mouth to Wenaha River)				X														X		X	X								X					
LGS2	Lower tributaries to the Lower GR River	X										X							X		X	X							X	X					
LGS3	Wenaha River Mainstem																		X																
LGS4	Wenaha River Forks and Tributaries																																		

Assessment Unit		Habitat Quantity			Injury and Mortality				Food			Riparian Condition		Peripheral and Transitional Habitats				Channel Structure and Form		Sediment Conditions		Water Quality							Water Quantity			Population Level Effects			
		Anthropogenic Barriers	Natural Barriers	HQ-Competition	Predation	Pathogens	Mechanical Injury	Contaminated Food	Altered Primary Productivity	Food-Competition	Altered Prey Sp. Comp. & Div.	Riparian Condition	LWD Recruitment	S. Channel and Wetland Cond.	Floodplain Condition	Estuary Conditions	Nearshore Conditions	Bed and Channel Form	Instream Structural Complexity	Decreased Sediment Quantity	Increased Sediment Quantity	Temperature	Oxygen	Gas Saturation	Turbidity	pH	Salinity	Toxic Contaminants	Increased Water Quantity	Decreased Water Quantity	Altered Flow Timing	Reduced Genetic Adaptiveness	Small Population Effects	Demographic Changes	Life History Changes
Code	Name	1.1	1.2	1.3	2.1	2.2	2.3	2.4	3.1	3.2	3.3	4.1	4.2	5.1	5.2	5.3	5.4	6.1	6.2	7.1	7.2	8.1	8.2	8.3	8.4	8.5	8.6	8.7	9.1	9.2	9.3	10.1	10.2	10.3	10.4
LGS5	Lower GR River Mainstem (Wenaha R to Wallowa R)											X							X		X	X								X					
LGS6	Courtney, Mud, Grossman, & Wildcat Cr.	X										X							X		X	X							X	X					
LGS7	Upper tribs of the Lower Grande Ronde River																		X		X														
JCS1	Joseph Cr. Mainstem																	X			X	X	X												
JCS2	Cottonwood Creek														X						X	X	X							X					
JCS3	Joseph Creek Small Tributaries	X																	X		X	X	X							X					
JCS4	Swamp & Davis Creeks											X									X	X	X												
JCS5	Elk & Crow Creeks											X			X				X		X	X	X							X					
JCS6	Lower Chesnimnus Creek and Prairie Tributaries	X										X			X				X		X	X	X							X					
JCS7	Upper Chesnimnus Creek and Forest Tributaries	X																	X		X	X	X							X					
WRS1	Lower Wallowa River																				X	X													
WRS2	Lower Wallowa Tribs - Howard, Wise & Fisher Cr																		X		X	X													
WRS3	Wallowa R Canyon - Minam R to Dry Cr & tribs	X										X			X				X		X		X												
WRS4	Lower Minam R. & tribs (down from Cougar Cr.)																		X		X	X													
WRS5	Upper Minam R & Tribs (up from Cougar Cr.,)																		X																

Assessment Unit		Habitat Quantity			Injury and Mortality				Food			Riparian Condition		Peripheral and Transitional Habitats				Channel Structure and Form		Sediment Conditions		Water Quality							Water Quantity			Population Level Effects			
		Anthropogenic Barriers	Natural Barriers	HQ-Competition	Predation	Pathogens	Mechanical Injury	Contaminated Food	Altered Primary Productivity	Food-Competition	Altered Prey Sp. Comp. & Div.	Riparian Condition	LWD Recruitment	S. Channel and Wetland Cond.	Floodplain Condition	Estuary Conditions	Nearshore Conditions	Bed and Channel Form	Instream Structural Complexity	Decreased Sediment Quantity	Increased Sediment Quantity	Temperature	Oxygen	Gas Saturation	Turbidity	pH	Salinity	Toxic Contaminants	Increased Water Quantity	Decreased Water Quantity	Altered Flow Timing	Reduced Genetic Adaptiveness	Small Population Effects	Demographic Changes	Life History Changes
Code	**Name**	**1.1**	**1.2**	**1.3**	**2.1**	**2.2**	**2.3**	**2.4**	**3.1**	**3.2**	**3.3**	**4.1**	**4.2**	**5.1**	**5.2**	**5.3**	**5.4**	**6.1**	**6.2**	**7.1**	**7.2**	**8.1**	**8.2**	**8.3**	**8.4**	**8.5**	**8.6**	**8.7**	**9.1**	**9.2**	**9.3**	**10.1**	**10.2**	**10.3**	**10.4**
WRS6	Mid-Wallowa River (Dry Cr to Lostine River)											X						X	X			X													
WRS7	Dry Creek and Tributaries	X										X									X	X								X					
WRS8	Bear Creek and Tributaries	X										X							X		X	X	X							X					
WRS9	Whisky Creek	X										X			X			X	X		X	X	X							X					
WRS10	Lostine River	X							X						X				X		X	X	X							X					
WRS11	Hurricane Creek	X										X			X				X		X	X	X							X					
WRS12	Prairie Creek	X										X			X			X	X		X		X					X							
WRS13	Up. Wallowa R & small tribs (up from Lostine R.)	X										X			X				X		X		X							X					
	All AU Totals	**21**	**0**	**0**	**1**	**0**	**0**	**0**	**1**	**0**	**0**	**19**	**0**	**0**	**9**	**0**	**0**	**8**	**21**	**0**	**32**	**29**	**21**	**0**	**0**	**0**	**0**	**0**	**6**	**21**	**0**	**0**	**0**	**0**	**0**

Table 4. Number of planned habitat improvement actions in the lower Grande Ronde mainstem tributaries, Joseph Creek, Wallowa River and Imnaha River populations for the period of 2013-2018 organized by the and limiting factors/ecological concerns that are being addressed.

Assessment Unit		Habitat Quantity			Injury and Mortality				Food			Riparian Condition		Peripheral and Transitional Habitats				Channel Structure and Form		Sediment Conditions		Water Quality							Water Quantity			Population Level Effects			
		Anthropogenic Barriers	Natural Barriers	HQ-Competition	Predation	Pathogens	Mechanical Injury	Contaminated Food	Altered Primary Productivity	Food-Competition	Altered Prey Sp. Comp. & Div.	Riparian Condition	LWD Recruitment	S. Channel and Wetland Cond.	Floodplain Condition	Estuary Conditions	Nearshore Conditions	Bed and Channel Form	Instream Structural Complexity	Decreased Sediment Quantity	Increased Sediment Quantity	Temperature	Oxygen	Gas Saturation	Turbidity	pH	Salinity	Toxic Contaminants	Increased Water Quantity	Decreased Water Quantity	Altered Flow Timing	Reduced Genetic Adaptiveness	Small Population Effects	Demographic Changes	Life History Changes
Code	Name	1.1	1.2	1.3	2.1	2.2	2.3	2.4	3.1	3.2	3.3	4.1	4.2	5.1	5.2	5.3	5.4	6.1	6.2	7.1	7.2	8.1	8.2	8.3	8.4	8.5	8.6	8.7	9.1	9.2	9.3	10.1	10.2	10.3	10.4
IRS1	Lower Imnaha River																																		
IRS2	Lower Imnaha Tribs	2																																	
IRS3	Cow, Lightning, & Horse Creeks																																		
IRS4	Upper Imnaha River Mainstem																																		
IRS5	Upper Imnaha R. Tributaries	3																			1														
IRS6	Lower Big Sheep Mainstem	2																																	
IRS7	Lower Big Sheep and Little Sheep Cr. Tribs	1																												1					
IRS8	Upper Big Sheep & Little Sheep Mainstem	1																			1														
IRS9	Upper Big Sheep & Little Sheep tributaries	2																			4									1					
LGS1	Lower GR River Mainstem (mouth to Wenaha River)																																		
LGS2	Lower tributaries to the Lower GR River																																		
LGS3	Wenaha River Mainstem																																		
LGS4	Wenaha River Forks and Tributaries																																		

Assessment Unit		Habitat Quantity			Injury and Mortality				Food			Riparian Condition		Peripheral and Transitional Habitats				Channel Structure and Form		Sediment Conditions		Water Quality							Water Quantity			Population Level Effects			
		Anthropogenic Barriers	Natural Barriers	HQ-Competition	Predation	Pathogens	Mechanical Injury	Contaminated Food	Altered Primary Productivity	Food-Competition	Altered Prey Sp. Comp. & Div.	Riparian Condition	LWD Recruitment	S. Channel and Wetland Cond.	Floodplain Condition	Estuary Conditions	Nearshore Conditions	Bed and Channel Form	Instream Structural Complexity	Decreased Sediment Quantity	Increased Sediment Quantity	Temperature	Oxygen	Gas Saturation	Turbidity	pH	Salinity	Toxic Contaminants	Increased Water Quantity	Decreased Water Quantity	Altered Flow Timing	Reduced Genetic Adaptiveness	Small Population Effects	Demographic Changes	Life History Changes
Code	Name	1.1	1.2	1.3	2.1	2.2	2.3	2.4	3.1	3.2	3.3	4.1	4.2	5.1	5.2	5.3	5.4	6.1	6.2	7.1	7.2	8.1	8.2	8.3	8.4	8.5	8.6	8.7	9.1	9.2	9.3	10.1	10.2	10.3	10.4
LGS5	Lower GR River Mainstem (Wenaha R to Wallowa R)																																		
LGS6	Courtney, Mud, Grossman, & Wildcat Cr.	1																			2														
LGS7	Upper tribs of the Lower Grande Ronde River																																		
JCS1	Joseph Cr. Mainstem																					1													
JCS2	Cottonwood Creek																				1														
JCS3	Joseph Creek Small Tributaries																																		
JCS4	Swamp & Davis Creeks																																		
JCS5	Elk & Crow Creeks																																		
JCS6	Lower Chesnimnus Creek and Prairie Tributaries																																		
JCS7	Upper Chesnimnus Creek and Forest Tributaries																				2														
WRS1	Lower Wallowa River																																		
WRS2	Lower Wallowa Tribs - Howard, Wise & Fisher Cr																																		
WRS3	Wallowa R Canyon - Minam R to Dry Cr & tribs	1																																	
WRS4	Lower Minam R. & tribs (down from Cougar Cr.)																																		
WRS5	Upper Minam R & Tribs (up from Cougar Cr.,)																																		

Assessment Unit		Habitat Quantity			Injury and Mortality				Food			Riparian Condition		Peripheral and Transitional Habitats				Channel Structure and Form		Sediment Conditions		Water Quality							Water Quantity			Population Level Effects			
		Anthropogenic Barriers	Natural Barriers	HQ-Competition	Predation	Pathogens	Mechanical Injury	Contaminated Food	Altered Primary Productivity	Food-Competition	Altered Prey Sp. Comp. & Div.	Riparian Condition	LWD Recruitment	S. Channel and Wetland Cond.	Floodplain Condition	Estuary Conditions	Nearshore Conditions	Bed and Channel Form	Instream Structural Complexity	Decreased Sediment Quantity	Increased Sediment Quantity	Temperature	Oxygen	Gas Saturation	Turbidity	pH	Salinity	Toxic Contaminants	Increased Water Quantity	Decreased Water Quantity	Altered Flow Timing	Reduced Genetic Adaptiveness	Small Population Effects	Demographic Changes	Life History Changes
Code	**Name**	**1.1**	**1.2**	**1.3**	**2.1**	**2.2**	**2.3**	**2.4**	**3.1**	**3.2**	**3.3**	**4.1**	**4.2**	**5.1**	**5.2**	**5.3**	**5.4**	**6.1**	**6.2**	**7.1**	**7.2**	**8.1**	**8.2**	**8.3**	**8.4**	**8.5**	**8.6**	**8.7**	**9.1**	**9.2**	**9.3**	**10.1**	**10.2**	**10.3**	**10.4**
WRS6	Mid-Wallowa River (Dry Cr to Lostine River)																																		
WRS7	Dry Creek and Tributaries																																		
WRS8	Bear Creek and Tributaries	1																																	
WRS9	Whisky Creek	2																																	
WRS10	Lostine River	1																	1											2					
WRS11	Hurricane Creek																		1																
WRS12	Prairie Creek																																		
WRS13	Up. Wallowa R & small tribs (up from Lostine R.)	2																	1											1					
All AU Totals		**19**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**3**	**0**	**11**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**5**	**0**	**0**	**0**	**0**	**0**

Grande Ronde River Upper Mainstem

The Grande Ronde River Upper Mainstem steelhead population represents a single expert panel apart from the Lower Grande Ronde River, Joseph Creek, Wallowa River and Imnaha River steelhead populations. This population contains 26 AUs with 309 planned habitat improvement actions within 19 AUs (Table 5; Figure 5). These habitat improvement actions have been or will be completed by end of 2018. Most of the habitat improvement actions occur within the Upper and Middle Grande Ronde River, Lower Catherine Creek, Sheep Creek and Clear Creek AUs. Limiting factors/ecological concerns identified for the Grande Ronde River Upper Mainstem steelhead population are presented in Table 6.

Table 5. Assessment unit names, codes and weight (in percent) along with the number of planned habitat improvement actions for the Grande Ronde River Upper Mainstem population of the Snake River steelhead DPS.

AU Code	Assessment Unit Names	Assessment Unit Weight (%)	2013-2018 Planned Restoration Actions
UGS1	Middle Grande Ronde River Mainstem, Wallowa River to Lookingglass Creek	0.5%	0
UGS2	Middle Grande Ronde River Mainstem - Lookingglass Creek to Catherine Creek	0.9%	43
UGS3	Middle Grande Ronde River Mainstem - Grande Ronde Valley	2.2%	31
UGS4	Upper Grande Ronde River Mainstem - Upstream End of Grande Ronde Valley to Meadow Creek	1.8%	5
UGS5	Lookingglass Creek and Tributaries	1.8%	2
UGS6	Phillips, Clark, Cabin and Gordon Creeks, Duncan and Rysdam Canyons, and tributaries	6.6%	0
UGS7	Indian Creek and Tributaries	0.7%	4
UGS8	Willow Creek and Tributaries	8.8%	9
UGS9A	Lower Catherine Creek and Tributaries (mainstem migration corridor only)	5.3%	2
UGS9B	Lower Catherine Creek and Tributaries (contributing area and tributaries only)	11.3%	28
UGS10A	Middle Catherine Creek and Tributaries - Pyles Creek to Swackhammer	3.6%	9
UGS10B	Middle Catherine Creek and Tributaries - Swackhammer to North and South Forks	0.3%	0
UGS11	South Fork Catherine Creek	1.0%	0
UGS12	North Fork Catherine Creek	2.8%	9
UGS13A	Five Points Creek and Tributaries	1.8%	5
UGS13B	Conway/Owsley Creeks	3.5%	6
UGS14	Meadow Creek and Tributaries (Except Dark Canyon and McCoy Creeks)	3.5%	6
UGS15	McCoy Creek, Dark Canyon, and Tributaries	1.8%	3
UGS16	Rock, Whiskey, Spring, Jordan, Bear, and Beaver Creeks and Tributaries	1.9%	19
UGS17	Upper Grande Ronde River Mainstem, Meadow Creek to Limber Jim Creek	3.5%	29
UGS18	Upper Grande Ronde River Mainstem, Limber Jim Creek to Clear Creek	7.1%	0
UGS19	Upper Grande Ronde River Mainstem and Tributaries, Clear Creek to Headwaters	10.4%	3
UGS20	Limber Jim Creek and Tributaries	4.7%	5
UGS21	Fly Creek and Tributaries	6.7%	13
UGS22	Sheep Creek and Tributaries	1.9%	56
UGS23	Clear Creek and Tributaries	5.7%	22
	Total	**100.0%**	**309**

The most widespread and numerous limiting factors/ecological concerns noted for steelhead in this population are channel structure and form, riparian condition, habitat quantity, sediment, water quantity and water quality (Table 6). Poor riparian condition and lack of instream structural complexity limiting factors/ecological concerns occur in all AUs while increased sediment conditions occur in all but

one AU. Decreased water quantity, barriers, increased stream temperature, poor bed and channel form and lack of LWD recruitment limiting factors/ecological concerns occur in 50%-89% of the AUs. Less wide spread and numerous, limiting factors/ecological concerns were noted for low dissolved oxygen and turbidity as well as poor floodplain, wetland and side channel conditions. Predation and altered prey species composition and diversity were limiting factors/ecological concerns unique to the lower Catherine Creek AUs.

Restoration efforts planned for the 2013-2018 period are diverse covering six major limiting factors/ecological concerns encompassing 19 AUs (73%) of the 26 steelhead AUs in the Grande Ronde Upper Mainstem steelhead population (Table 7). The priority for assembling existing RM&E resources for the expert panel follows the intersection of currently planned habitat improvement actions with limiting factors/ecological concerns that will be addressed in those 16 AUs.

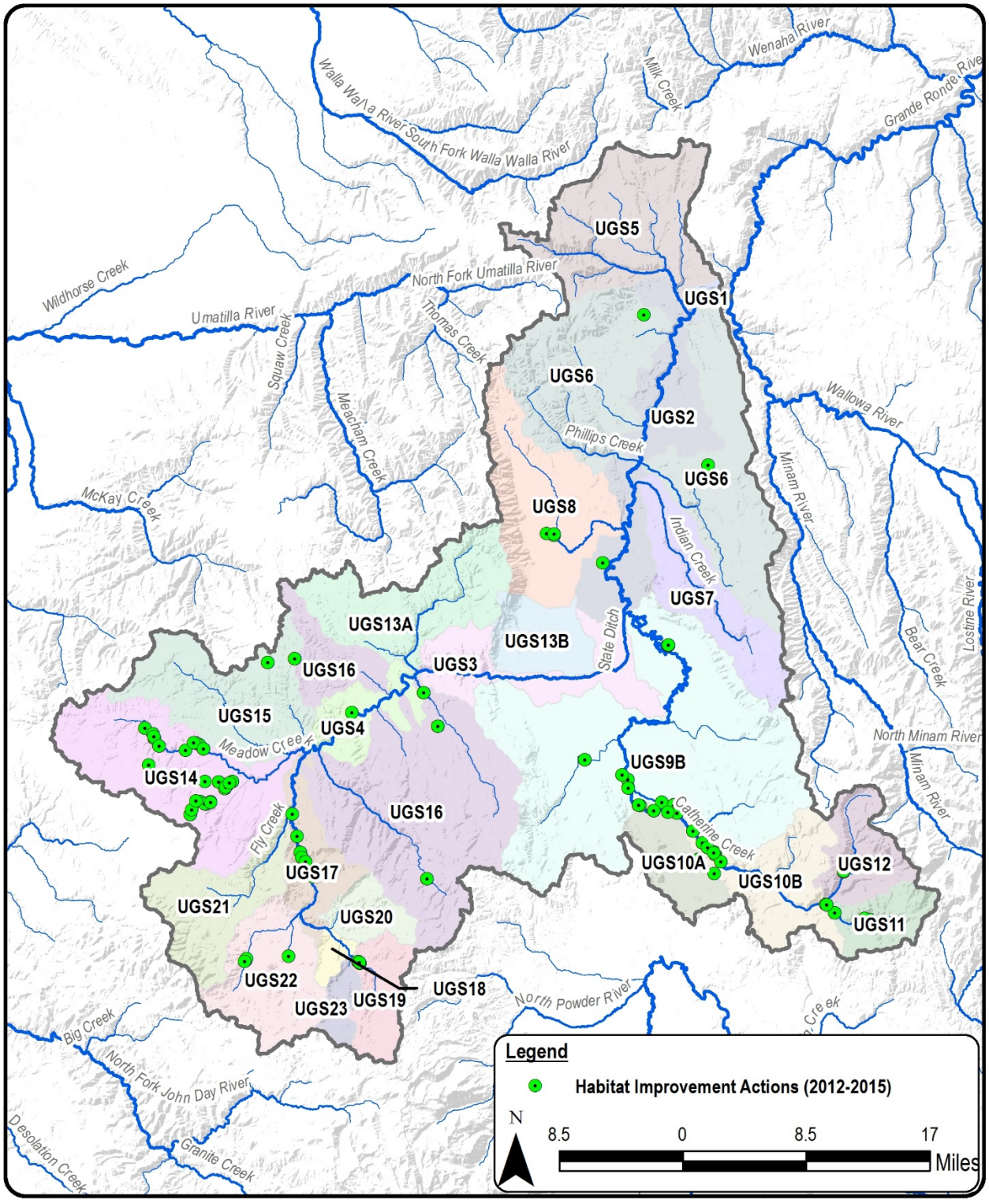

Figure 5. Upper Grande Ronde River Mainstem steelhead population, AU level boundaries and locations of habitat improvement actions.

Table 6. Limiting factors/ecological concerns identified by an "X" for ecological sub-categories in AUs of the lower Grande Ronde mainstem tributaries, Joseph Creek, Wallowa River and Imnaha River populations. Assessment units in gray have no planned habitat improvement actions for the 2013-2018 expert panel cycle.

Assessment Unit		Habitat Quantity			Injury and Mortality				Food			Riparian Condition		Peripheral and Transitional Habitats				Channel Structure and Form		Sediment Conditions		Water Quality							Water Quantity			Population Level Effects			
		Anthropogenic Barriers	Natural Barriers	HQ-Competition	Predation	Pathogens	Mechanical Injury	Contaminated Food	Altered Primary Productivity	Food-Competition	Altered Prey Sp. Comp. & Div.	Riparian Condition	LWD Recruitment	S. Channel and Wetland Cond.	Floodplain Condition	Estuary Conditions	Nearshore Conditions	Bed and Channel Form	Instream Structural Complexity	Decreased Sediment Quantity	Increased Sediment Quantity	Temperature	Oxygen	Gas Saturation	Turbidity	pH	Salinity	Toxic Contaminants	Increased Water Quantity	Decreased Water Quantity	Altered Flow Timing	Reduced Genetic Adaptiveness	Small Population Effects	Demographic Changes	Life History Changes
Code	Name	1.1	1.2	1.3	2.1	2.2	2.3	2.4	3.1	3.2	3.3	4.1	4.2	5.1	5.2	5.3	5.4	6.1	6.2	7.1	7.2	8.1	8.2	8.3	8.4	8.5	8.6	8.7	9.1	9.2	9.3	10.1	10.2	10.3	10.4
UGS1	Middle Grande Ronde River Mainstem, Wallowa River to Lookingglass Creek											X							X		X	X	X							X					
UGS2	Middle Grande Ronde River Mainstem - Lookingglass Creek to Catherine Creek											X							X		X	X	X							X					
UGS3	Middle Grande Ronde River Mainstem - Grande Ronde Valley	X										X	X					X	X		X	X	X							X					
UGS4	Upper Grande Ronde River Mainstem - Upstream End of Grande Ronde Valley to Meadow Creek											X	X					X	X		X	X								X					
UGS5	Lookingglass Creek and Tributaries	X										X	X						X																
UGS6	Phillips, Clark, Cabin and Gordon Creeks, Duncan and Rysdam Canyons, and tributaries	X										X	X					X	X		X	X								X					
UGS7	Indian Creek and Tributaries	X										X							X		X	X								X					
UGS8	Willow Creek and	X										X	X					X	X		X	X								X					

Assessment Unit		Habitat Quantity			Injury and Mortality				Food			Riparian Condition		Peripheral and Transitional Habitats				Channel Structure and Form		Sediment Conditions		Water Quality							Water Quantity			Population Level Effects			
		Anthropogenic Barriers	Natural Barriers	HQ-Competition	Predation	Pathogens	Mechanical Injury	Contaminated Food	Altered Primary Productivity	Food-Competition	Altered Prey Sp. Comp. & Div.	Riparian Condition	LWD Recruitment	S. Channel and Wetland Cond.	Floodplain Condition	Estuary Conditions	Nearshore Conditions	Bed and Channel Form	Instream Structural Complexity	Decreased Sediment Quantity	Increased Sediment Quantity	Temperature	Oxygen	Gas Saturation	Turbidity	pH	Salinity	Toxic Contaminants	Increased Water Quantity	Decreased Water Quantity	Altered Flow Timing	Reduced Genetic Adaptiveness	Small Population Effects	Demographic Changes	Life History Changes
Code	Name	1.1	1.2	1.3	2.1	2.2	2.3	2.4	3.1	3.2	3.3	4.1	4.2	5.1	5.2	5.3	5.4	6.1	6.2	7.1	7.2	8.1	8.2	8.3	8.4	8.5	8.6	8.7	9.1	9.2	9.3	10.1	10.2	10.3	10.4
	Tributaries																																		
UGS9A	Lower Catherine Creek and Tributaries (mainstem migration corridor only)	X			X						X	X	X	X	X			X	X		X	X	X						X					
UGS9B	Lower Catherine Creek and Tributaries (contributing area and tributaries only)	X			X						X	X	X	X	X			X	X		X	X	X						X					
UGS10A	Middle Catherine Creek and Tributaries - Pyles Creek to Swackhammer	X										X	X	X	X			X	X		X	X	X		X					X				
UGS10B	Middle Catherine Creek and Tributaries - Swackhammer to North and South Forks	X										X	X	X	X			X	X		X	X								X				
UGS11	South Fork Catherine Creek											X	X						X		X	X								X				
UGS12	North Fork Catherine Creek	X										X	X						X		X	X								X				
UGS13A	Five Points Creek and Tributaries	X										X	X					X	X		X	X								X				
UGS13B	Conway/Owsley Creeks	X										X	X					X	X		X	X	X							X				
UGS14	Meadow Creek and Tributaries (Except Dark Canyon and McCoy Creeks)											X	X					X	X		X	X								X				
UGS15	McCoy Creek, Dark Canyon, and Tributaries	X										X	X					X	X		X	X								X				

Assessment Unit		Habitat Quantity			Injury and Mortality				Food			Riparian Condition		Peripheral and Transitional Habitats				Channel Structure and Form		Sediment Conditions		Water Quality							Water Quantity			Population Level Effects			
		Anthropogenic Barriers	Natural Barriers	HQ-Competition	Predation	Pathogens	Mechanical Injury	Contaminated Food	Altered Primary Productivity	Food-Competition	Altered Prey Sp. Comp. & Div.	Riparian Condition	LWD Recruitment	S. Channel and Wetland Cond.	Floodplain Condition	Estuary Conditions	Nearshore Conditions	Bed and Channel Form	Instream Structural Complexity	Decreased Sediment Quantity	Increased Sediment Quantity	Temperature	Oxygen	Gas Saturation	Turbidity	pH	Salinity	Toxic Contaminants	Increased Water Quantity	Decreased Water Quantity	Altered Flow Timing	Reduced Genetic Adaptiveness	Small Population Effects	Demographic Changes	Life History Changes
Code	**Name**	**1.1**	**1.2**	**1.3**	**2.1**	**2.2**	**2.3**	**2.4**	**3.1**	**3.2**	**3.3**	**4.1**	**4.2**	**5.1**	**5.2**	**5.3**	**5.4**	**6.1**	**6.2**	**7.1**	**7.2**	**8.1**	**8.2**	**8.3**	**8.4**	**8.5**	**8.6**	**8.7**	**9.1**	**9.2**	**9.3**	**10.1**	**10.2**	**10.3**	**10.4**
UGS16	Rock, Whiskey, Spring, Jordan, Bear, and Beaver Creeks and Tributaries	X										X	X					X	X		X	X								X					
UGS17	Upper Grande Ronde River Mainstem, Meadow Creek to Limber Jim Creek	X										X	X						X		X	X								X					
UGS18	Upper Grande Ronde River Mainstem, Limber Jim Creek to Clear Creek											X	X						X		X	X													
UGS19	Upper Grande Ronde River Mainstem and Tributaries, Clear Creek to Headwaters											X	X						X		X														
UGS20	Limber Jim Creek and Tributaries											X	X						X		X									X					
UGS21	Fly Creek and Tributaries	X										X	X						X		X	X													
UGS22	Sheep Creek and Tributaries											X	X						X		X	X													
UGS23	Clear Creek and Tributaries	X										X	X						X		X														
All AU Totals		**17**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**2**	**26**	**23**	**4**	**4**	**0**	**0**	**13**	**26**	**0**	**25**	**22**	**7**	**0**	**1**	**0**	**0**	**0**	**0**	**20**	**0**	**0**	**0**	**0**	**0**

Table 7. Number of planned habitat improvement actions in the lower Grande Ronde mainstem tributaries, Joseph Creek, Wallowa River and Imnaha River populations for the period of 2013-2018 organized by the limiting factors/ecological concerns that are being addressed.

Assessment Unit		Habitat Quantity			Injury and Mortality				Food			Riparian Condition		Peripheral and Transitional Habitats				Channel Structure and Form		Sediment Conditions		Water Quality							Water Quantity			Population Level Effects			
		Anthropogenic Barriers	Natural Barriers	HQ-Competition	Predation	Pathogens	Mechanical Injury	Contaminated Food	Altered Primary Productivity	Food-Competition	Altered Prey Sp. Comp. & Div.	Riparian Condition	LWD Recruitment	S. Channel and Wetland Cond.	Floodplain Condition	Estuary Conditions	Nearshore Conditions	Bed and Channel Form	Instream Structural Complexity	Decreased Sediment Quantity	Increased Sediment Quantity	Temperature	Oxygen	Gas Saturation	Turbidity	pH	Salinity	Toxic Contaminants	Increased Water Quantity	Decreased Water Quantity	Altered Flow Timing	Reduced Genetic Adaptiveness	Small Population Effects	Demographic Changes	Life History Changes
Code	Name	1.1	1.2	1.3	2.1	2.2	2.3	2.4	3.1	3.2	3.3	4.1	4.2	5.1	5.2	5.3	5.4	6.1	6.2	7.1	7.2	8.1	8.2	8.3	8.4	8.5	8.6	8.7	9.1	9.2	9.3	10.1	10.2	10.3	10.4
IRS1	Lower Imnaha River																																		
IRS2	Lower Imnaha Tribs	2																																	
IRS3	Cow, Lightning, & Horse Creeks																																		
IRS4	Upper Imnaha River Mainstem																																		
IRS5	Upper Imnaha R. Tributaries	3																			1														
IRS6	Lower Big Sheep Mainstem	2																																	
IRS7	Lower Big Sheep and Little Sheep Cr. Tribs	1																												1					
IRS8	Upper Big Sheep & Little Sheep Mainstem	1																			1														
IRS9	Upper Big Sheep & Little Sheep tributaries	2																			4									1					
LGS1	Lower GR River Mainstem (mouth to Wenaha River)																																		
LGS2	Lower tributaries to the Lower GR River																																		
LGS3	Wenaha River Mainstem																																		
LGS4	Wenaha River Forks and Tributaries																																		

Assessment Unit		Habitat Quantity			Injury and Mortality				Food			Riparian Condition		Peripheral and Transitional Habitats				Channel Structure and Form		Sediment Conditions		Water Quality							Water Quantity			Population Level Effects			
		Anthropogenic Barriers	Natural Barriers	HQ-Competition	Predation	Pathogens	Mechanical Injury	Contaminated Food	Altered Primary Productivity	Food-Competition	Altered Prey Sp. Comp. & Div.	Riparian Condition	LWD Recruitment	S. Channel and Wetland Cond.	Floodplain Condition	Estuary Conditions	Nearshore Conditions	Bed and Channel Form	Instream Structural Complexity	Decreased Sediment Quantity	Increased Sediment Quantity	Temperature	Oxygen	Gas Saturation	Turbidity	pH	Salinity	Toxic Contaminants	Increased Water Quantity	Decreased Water Quantity	Altered Flow Timing	Reduced Genetic Adaptiveness	Small Population Effects	Demographic Changes	Life History Changes
Code	Name	1.1	1.2	1.3	2.1	2.2	2.3	2.4	3.1	3.2	3.3	4.1	4.2	5.1	5.2	5.3	5.4	6.1	6.2	7.1	7.2	8.1	8.2	8.3	8.4	8.5	8.6	8.7	9.1	9.2	9.3	10.1	10.2	10.3	10.4
LGS5	Lower GR River Mainstem (Wenaha R to Wallowa R)																																		
LGS6	Courtney, Mud, Grossman, & Wildcat Cr.	1																			2														
LGS7	Upper tribs of the Lower Grande Ronde River																																		
JCS1	Joseph Cr. Mainstem																					1													
JCS2	Cottonwood Creek																				1														
JCS3	Joseph Creek Small Tributaries																																		
JCS4	Swamp & Davis Creeks																																		
JCS5	Elk & Crow Creeks																																		
JCS6	Lower Chesnimnus Creek and Prairie Tributaries																																		
JCS7	Upper Chesnimnus Creek and Forest Tributaries																				2														
WRS1	Lower Wallowa River																																		
WRS2	Lower Wallowa Tribs - Howard, Wise & Fisher Cr																																		
WRS3	Wallowa R Canyon - Minam R to Dry Cr & tribs	1																																	
WRS4	Lower Minam R. & tribs (down from Cougar Cr.)																																		
WRS5	Upper Minam R & Tribs (up from Cougar Cr.,)																																		

Assessment Unit		Habitat Quantity			Injury and Mortality				Food			Riparian Condition		Peripheral and Transitional Habitats				Channel Structure and Form		Sediment Conditions		Water Quality							Water Quantity			Population Level Effects			
		Anthropogenic Barriers	Natural Barriers	HQ-Competition	Predation	Pathogens	Mechanical Injury	Contaminated Food	Altered Primary Productivity	Food-Competition	Altered Prey Sp. Comp. & Div.	Riparian Condition	LWD Recruitment	S. Channel and Wetland Cond.	Floodplain Condition	Estuary Conditions	Nearshore Conditions	Bed and Channel Form	Instream Structural Complexity	Decreased Sediment Quantity	Increased Sediment Quantity	Temperature	Oxygen	Gas Saturation	Turbidity	pH	Salinity	Toxic Contaminants	Increased Water Quantity	Decreased Water Quantity	Altered Flow Timing	Reduced Genetic Adaptiveness	Small Population Effects	Demographic Changes	Life History Changes
Code	**Name**	**1.1**	**1.2**	**1.3**	**2.1**	**2.2**	**2.3**	**2.4**	**3.1**	**3.2**	**3.3**	**4.1**	**4.2**	**5.1**	**5.2**	**5.3**	**5.4**	**6.1**	**6.2**	**7.1**	**7.2**	**8.1**	**8.2**	**8.3**	**8.4**	**8.5**	**8.6**	**8.7**	**9.1**	**9.2**	**9.3**	**10.1**	**10.2**	**10.3**	**10.4**
WRS6	Mid-Wallowa River (Dry Cr to Lostine River)																																		
WRS7	Dry Creek and Tributaries																																		
WRS8	Bear Creek and Tributaries	1																																	
WRS9	Whisky Creek	2																																	
WRS10	Lostine River	1																	1											2					
WRS11	Hurricane Creek																		1																
WRS12	Prairie Creek																																		
WRS13	Up. Wallowa R & small tribs (up from Lostine R.)	2																	1											1					
All AU Totals		**19**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**3**	**0**	**11**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**5**	**0**	**0**	**0**	**0**	**0**

Clearwater River

The Clearwater River lower mainstem, Lolo Creek, Lochsa River, Selway River, and South Fork Clearwater River steelhead populations have been grouped together because they represent a single expert panel workshop. There are 36 AUs covering this geographic area with 229 planned habitat improvement actions within 27 of the AUs (Table 8; Figure 6). These planned habitat improvement actions have been or will be completed by end of 2018. Habitat improvement actions are well distributed although there is some concentration of effort in Clearwater River lower mainstem, Lochsa River and South Fork Clearwater River AUs. Limiting factors/ecological concerns identified for these AUs are presented in Table 9.

Table 8. Assessment unit names, codes and weight (in percent) along with the number of planned habitat improvement actions for the Clearwater River lower mainstem, Lolo Creek, Lochsa River, Selway River, and South Fork Clearwater populations.

AU Code	Assessment Unit	Assessment Unit Weight (%)	2013-2018 Planned Restoration Actions
LCS1	Big Canyon Creek	12.0%	0
LCS2	Camas Prairie tributaries	13.0%	0
LCS3	Clearwater Mountain tributaries	18.0%	0
LCS4	Lapwai Creek Basin	11.0%	37
LCS5	Potlatch River Basin	28.0%	21
LCS6A	Weippe Prairie	7.0%	0
LCS6B	Lower canyon tributaries	7.0%	0
LCS7	Lower Clearwater mainstem	4.0%	0
	Total	**100.0%**	**58**
LOS1	Eldorado Creek	1.0%	2
LOS2	Jim Brown Creek	7.0%	2
LOS3	Lolo Creek	57.0%	6
LOS4	Musselshell Creek	25.0%	7
LOS5	Yoosa Creek	10.0%	6
	Total	**100.0%**	**23**
LAS1A	Upper Lochsa Tributaries – Post office to Parachute Creeks	9.0%	12
LAS2A	Lower Colt Killed Creek	12.0%	7
LAS2B	Big Sand Creek	11.0%	0
LAS3A	Crooked Fork	11.0%	18
LAS3B	Upper Crooked Fork/Boulder Creek	10.0%	0
LAS6	Lochsa Mainstem	11.0%	4
LAS7	Lower Lochsa (Deadman Creek to Pete King Creek)	8.0%	11
LAS8	Middle Lochsa North Face tributaries - Weir to Tick Creeks	11.0%	5
LAS9	Middle Lochsa South Face tributaries - Lottie to Robin Creeks	17.0%	12
	Total	**100.0%**	**57**
SRS1	Lower Selway River	6.0%	4
SRS2	Meadow Creek	11.0%	2
SRS3	O'Hara Creek	7.0%	2
SRS4	Wilderness Area (Moose Creek, Upper Selway River, etc.)	76.0%	0
	Total	**100.0%**	**8**
SCS1	American River	12.0%	9
SCS2	Crooked River	13.0%	21
SCS3	John's Creek	13.0%	2
SCS4	Meadow Creek	8.0%	6
SCS5	Mill Creek	7.0%	10

SCS6	Misc Clearwater Tribs	2.0%	7
SCS7	Newsome Creek	13.0%	10
SCS8	Red River	16.0%	13
SCS9	South Fork Clearwater Mainstem	5.0%	3
SCS10	Ten Mile Creek	11.0%	2
	Total	**100.0%**	**83**

The most common limiting factors/ecological concerns noted for these populations are channel structure and form, riparian and sediment conditions, water quality, and habitat quantity for steelhead (Table 9). Limiting factors/ecological concerns like increased sediment conditions were identified in 33 (92%) AUs while barriers, stream temperature and poor riparian conditions were noted in at least 24 (67%) AUs. Channel structure and form, identified as a lack of instream structural complexity, occurs in 16 (44%) of the AUs. Less common were limiting factors/ecological concerns noted for LWD recruitment, water quantity, bed and channel form, and condition of side channels, wetlands and floodplain. Although not as common, limiting factors/ecological concerns such as toxic contaminants, low dissolved oxygen and natural barriers are affecting steelhead locally within three steelhead populations (Table 9).

There are 229 habitat improvement actions planned for the 2013-2018 period covering seven major limiting factors/ecological concerns for steelhead in the Clearwater River Basin (Table 10). Most of the habitat improvement actions are focused on resolving barriers to migration, poor sediment and temperature conditions as well as riparian and stream channel conditions. RM&E resource information that will assist expert panel process depends largely on the location and type of habitat improvement actions and limiting factors/ecological concerns that will be assessed in the next workshops.

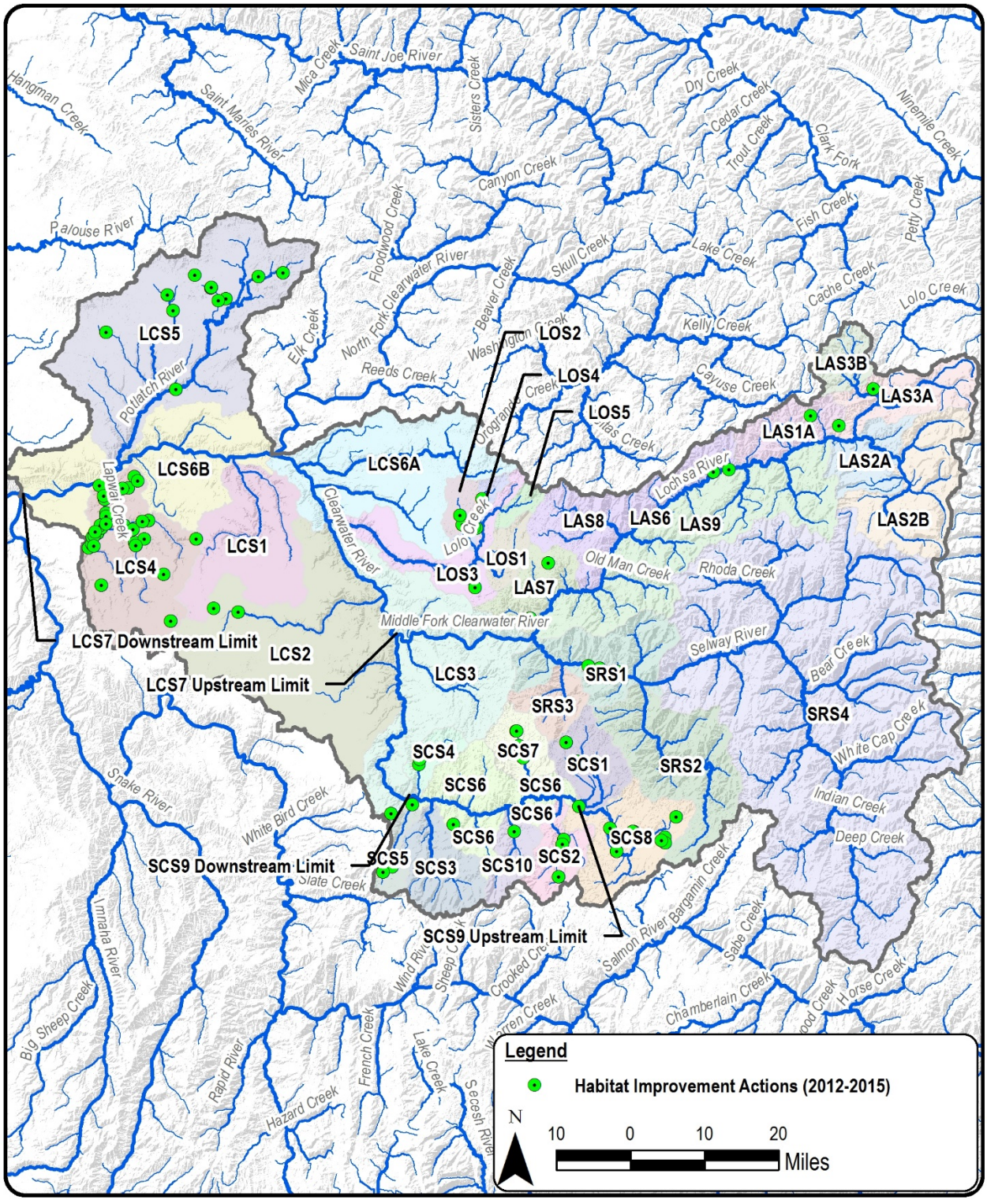

Figure 6. Clearwater River steelhead populations, AU level boundaries and locations of habitat improvement actions.

Table 9. Limiting factors/ecological concerns identified by an "X" for ecological sub-categories in AUs of the Clearwater River steelhead populations. Assessment units in gray have no planned restoration action for the 2013-2018 expert panel cycle.

Assessment Units		Habitat Quantity			Injury and Mortality				Food			Riparian Condition		Peripheral and Transitional Habitats				Channel Structure and Form		Sediment Conditions		Water Quality							Water Quantity			Population Level Effects			
		Anthropogenic Barriers	Natural Barriers	HQ-Competition	Predation	Pathogens	Mechanical Injury	Contaminated Food	Altered Primary Productivity	Food-Competition	Altered Prey Sp. Comp. & Div.	Riparian Condition	LWD Recruitment	S. Channel and Wetland Cond.	Floodplain Condition	Estuary Conditions	Nearshore Conditions	Bed and Channel Form	Instream Structural Complexity	Decreased Sediment Quantity	Increased Sediment Quantity	Temperature	Oxygen	Gas Saturation	Turbidity	pH	Salinity	Toxic Contaminants	Increased Water Quantity	Decreased Water Quantity	Altered Flow Timing	Reduced Genetic Adaptiveness	Small Population Effects	Demographic Changes	Life History Changes
Code	**Name**	**1.1**	**1.2**	**1.3**	**2.1**	**2.2**	**2.3**	**2.4**	**3.1**	**3.2**	**3.3**	**4.1**	**4.2**	**5.1**	**5.2**	**5.3**	**5.4**	**6.1**	**6.2**	**7.1**	**7.2**	**8.1**	**8.2**	**8.3**	**8.4**	**8.5**	**8.6**	**8.7**	**9.1**	**9.2**	**9.3**	**10.1**	**10.2**	**10.3**	**10.4**
LCS1	Big Canyon Creek											X						X	X		X	X						X	X	X				
LCS2	Camas Prairie tributaries											X						X	X		X	X							X	X				
LCS3	Clearwater Mountain tributaries	X										X						X	X		X	X							X	X				
LCS4	Lapwai Creek Basin	X										X						X	X		X	X						X	X	X				
LCS5	Potlatch River Basin	X										X						X	X		X	X								X				
LCS6A	Weippe Prairie											X						X	X		X	X							X	X				
LCS6B	Lower canyon tributaries	X										X						X	X		X	X							X	X				
LCS7	Lower Clearwater mainstem																																		
LAS1A	Upper Lochsa Tributaries - Postoffice to Parachute Creeks	X											X						X		X	X													
LAS2A	Lower Colt Killed Creek	X																			X	X													
LAS2B	Big Sand Creek																					X													
LAS3A	Crooked Fork	X											X						X		X	X													
LAS3B	Upper Crooked Fork/Boulder Creek	X																			X														

Assessment Units		Habitat Quantity			Injury and Mortality				Food			Riparian Condition		Peripheral and Transitional Habitats				Channel Structure and Form		Sediment Conditions		Water Quality							Water Quantity			Population Level Effects			
		Anthropogenic Barriers	Natural Barriers	HQ-Competition	Predation	Pathogens	Mechanical Injury	Contaminated Food	Altered Primary Productivity	Food-Competition	Altered Prey Sp. Comp. & Div.	Riparian Condition	LWD Recruitment	S. Channel and Wetland Cond.	Floodplain Condition	Estuary Conditions	Nearshore Conditions	Bed and Channel Form	Instream Structural Complexity	Decreased Sediment Quantity	Increased Sediment Quantity	Temperature	Oxygen	Gas Saturation	Turbidity	pH	Salinity	Toxic Contaminants	Increased Water Quantity	Decreased Water Quantity	Altered Flow Timing	Reduced Genetic Adaptiveness	Small Population Effects	Demographic Changes	Life History Changes
Code	Name	1.1	1.2	1.3	2.1	2.2	2.3	2.4	3.1	3.2	3.3	4.1	4.2	5.1	5.2	5.3	5.4	6.1	6.2	7.1	7.2	8.1	8.2	8.3	8.4	8.5	8.6	8.7	9.1	9.2	9.3	10.1	10.2	10.3	10.4
LAS6	Lochsa Mainstem											X									X	X													
LAS7	Lower Lochsa (Deadman Creek to Pete King Creek)	X										X							X		X	X													
LAS8	Middle Lochsa North Face tributaries - Weir to Tick Creeks	X										X									X	X													
LAS9	Middle Lochsa South Face tributaries - Lottie to Robin Creeks																					X													
LOS1	Eldorado Creek		X									X									X														
LOS2	Jim Brown Creek	X										X									X	X	X												
LOS3	Lolo Creek	X										X							X		X														
LOS4	Musselshell Creek	X										X									X	X													
LOS5	Yoosa Creek	X										X									X														
SRS1	Lower Selway River	X																			X	X													
SRS2	Meadow Creek																				X														
SRS3	O'Hara Creek											X									X	X													
SRS4	Wilderness Area (Moose Creek, Upper Selway River, etc.)																				X														
SCS1	American River	X										X	X	X	X				X		X	X													

Assessment Units		Habitat Quantity			Injury and Mortality				Food			Riparian Condition		Peripheral and Transitional Habitats				Channel Structure and Form		Sediment Conditions		Water Quality							Water Quantity			Population Level Effects			
		Anthropogenic Barriers	Natural Barriers	HQ-Competition	Predation	Pathogens	Mechanical Injury	Contaminated Food	Altered Primary Productivity	Food-Competition	Altered Prey Sp. Comp. & Div.	Riparian Condition	LWD Recruitment	S. Channel and Wetland Cond.	Floodplain Condition	Estuary Conditions	Nearshore Conditions	Bed and Channel Form	Instream Structural Complexity	Decreased Sediment Quantity	Increased Sediment Quantity	Temperature	Oxygen	Gas Saturation	Turbidity	pH	Salinity	Toxic Contaminants	Increased Water Quantity	Decreased Water Quantity	Altered Flow Timing	Reduced Genetic Adaptiveness	Small Population Effects	Demographic Changes	Life History Changes
Code	**Name**	**1.1**	**1.2**	**1.3**	**2.1**	**2.2**	**2.3**	**2.4**	**3.1**	**3.2**	**3.3**	**4.1**	**4.2**	**5.1**	**5.2**	**5.3**	**5.4**	**6.1**	**6.2**	**7.1**	**7.2**	**8.1**	**8.2**	**8.3**	**8.4**	**8.5**	**8.6**	**8.7**	**9.1**	**9.2**	**9.3**	**10.1**	**10.2**	**10.3**	**10.4**
SCS2	Crooked River	X										X	X	X	X				X		X	X													
SCS3	John's Creek	X										X									X														
SCS4	Meadow Creek	X										X	X								X	X													
SCS5	Mill Creek	X										X	X								X	X													
SCS6	Misc Clearwater Tribs	X										X									X	X													
SCS7	Newsome Creek	X										X	X		X				X		X	X													
SCS8	Red River	X										X	X		X				X		X	X													
SCS9	South Fork Clearwater Mainstem																		X		X	X													
SCS10	Ten Mile Creek	X																			X														
All AU Totals		**24**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**24**	**8**	**2**	**4**	**0**	**0**	**7**	**16**	**0**	**33**	**27**	**1**	**0**	**0**	**0**	**0**	**2**	**6**	**7**	**0**	**0**	**0**	**0**	**0**

Table 10. Number of planned habitat improvement actions in AUs of the Big Sheep, Wenaha, Minam, Lostine and Imnaha populations for the period of 2013-2018 organized by the limiting factors/ecological concerns that are being addressed.

Assessment Units		Habitat Quantity			Injury and Mortality				Food			Riparian Condition		Peripheral and Transitional Habitats				Channel Structure and Form		Sediment Conditions		Water Quality							Water Quantity			Population Level Effects			
		Anthropogenic Barriers	Natural Barriers	HQ-Competition	Predation	Pathogens	Mechanical Injury	Contaminated Food	Altered Primary Productivity	Food-Competition	Altered Prey Sp. Comp. & Div.	Riparian Condition	LWD Recruitment	S. Channel and Wetland Cond.	Floodplain Condition	Estuary Conditions	Nearshore Conditions	Bed and Channel Form	Instream Structural Complexity	Decreased Sediment Quantity	Increased Sediment Quantity	Temperature	Oxygen	Gas Saturation	Turbidity	pH	Salinity	Toxic Contaminants	Increased Water Quantity	Decreased Water Quantity	Altered Flow Timing	Reduced Genetic Adaptiveness	Small Population Effects	Demographic Changes	Life History Changes
Code	Name	1.1	1.2	1.3	2.1	2.2	2.3	2.4	3.1	3.2	3.3	4.1	4.2	5.1	5.2	5.3	5.4	6.1	6.2	7.1	7.2	8.1	8.2	8.3	8.4	8.5	8.6	8.7	9.1	9.2	9.3	10.1	10.2	10.3	10.4
LCS1	Big Canyon Creek																																		
LCS2	Camas Prairie tributaries																																		
LCS3	Clearwater Mountain tributaries																																		
LCS4	Lapwai Creek Basin																	7	1			29													
LCS5	Potlatch River Basin	6																9	1			2								3					
LCS6A	Weippe Prairie																																		
LCS6B	Lower canyon tributaries																																		
LCS7	Lower Clearwater mainstem																																		
LAS1A	Upper Lochsa Tributaries – Post office to Parachute Creeks	3											2								7														
LAS2A	Lower Colt Killed Creek	1																			6														
LAS2B	Big Sand Creek																																		
LAS3A	Crooked Fork	3																			14	1													
LAS3B	Upper Crooked Fork/Boulder Creek																																		

Assessment Units		Habitat Quantity			Injury and Mortality				Food			Riparian Condition		Peripheral and Transitional Habitats				Channel Structure and Form		Sediment Conditions		Water Quality							Water Quantity			Population Level Effects			
		Anthropogenic Barriers	Natural Barriers	HQ-Competition	Predation	Pathogens	Mechanical Injury	Contaminated Food	Altered Primary Productivity	Food-Competition	Altered Prey Sp. Comp. & Div.	Riparian Condition	LWD Recruitment	S. Channel and Wetland Cond.	Floodplain Condition	Estuary Conditions	Nearshore Conditions	Bed and Channel Form	Instream Structural Complexity	Decreased Sediment Quantity	Increased Sediment Quantity	Temperature	Oxygen	Gas Saturation	Turbidity	pH	Salinity	Toxic Contaminants	Increased Water Quantity	Decreased Water Quantity	Altered Flow Timing	Reduced Genetic Adaptiveness	Small Population Effects	Demographic Changes	Life History Changes
Code	Name	1.1	1.2	1.3	2.1	2.2	2.3	2.4	3.1	3.2	3.3	4.1	4.2	5.1	5.2	5.3	5.4	6.1	6.2	7.1	7.2	8.1	8.2	8.3	8.4	8.5	8.6	8.7	9.1	9.2	9.3	10.1	10.2	10.3	10.4
LAS6	Lochsa Mainstem											3									1														
LAS7	Lower Lochsa (Deadman Creek to Pete King Creek)	1																			10														
LAS8	Middle Lochsa North Face tributaries - Weir to Tick Creeks	1										1									3														
LAS9	Middle Lochsa South Face tributaries - Lottie to Robin Creeks																																		
LOS1	Eldorado Creek																				2														
LOS2	Jim Brown Creek	1										1																							
LOS3	Lolo Creek	1																			5														
LOS4	Musselshell Creek	2										2									3														
LOS5	Yoosa Creek	1																			5														
SRS1	Lower Selway River	2																			2														
SRS2	Meadow Creek																				2														
SRS3	O'Hara Creek											1									1														
SRS4	Wilderness Area (Moose Creek, Upper Selway River, etc.)																																		
SCS1	American River	5										2									2														

Assessment Units		Habitat Quantity			Injury and Mortality				Food			Riparian Condition		Peripheral and Transitional Habitats				Channel Structure and Form		Sediment Conditions		Water Quality							Water Quantity			Population Level Effects			
		Anthropogenic Barriers	Natural Barriers	HQ-Competition	Predation	Pathogens	Mechanical Injury	Contaminated Food	Altered Primary Productivity	Food-Competition	Altered Prey Sp. Comp. & Div.	Riparian Condition	LWD Recruitment	S. Channel and Wetland Cond.	Floodplain Condition	Estuary Conditions	Nearshore Conditions	Bed and Channel Form	Instream Structural Complexity	Decreased Sediment Quantity	Increased Sediment Quantity	Temperature	Oxygen	Gas Saturation	Turbidity	pH	Salinity	Toxic Contaminants	Increased Water Quantity	Decreased Water Quantity	Altered Flow Timing	Reduced Genetic Adaptiveness	Small Population Effects	Demographic Changes	Life History Changes
Code	**Name**	**1.1**	**1.2**	**1.3**	**2.1**	**2.2**	**2.3**	**2.4**	**3.1**	**3.2**	**3.3**	**4.1**	**4.2**	**5.1**	**5.2**	**5.3**	**5.4**	**6.1**	**6.2**	**7.1**	**7.2**	**8.1**	**8.2**	**8.3**	**8.4**	**8.5**	**8.6**	**8.7**	**9.1**	**9.2**	**9.3**	**10.1**	**10.2**	**10.3**	**10.4**
SCS2	Crooked River	2										5		4					8		2														
SCS3	John's Creek	1																			1														
SCS4	Meadow Creek											2	1								2	1													
SCS5	Mill Creek	2										2	1								4	1													
SCS6	Misc Clearwater Tribs	2																			5														
SCS7	Newsome Creek											1	1		1				4		2	1													
SCS8	Red River	2										1	1		1				3		4	1													
SCS9	South Fork Clearwater Mainstem																		1		1	1													
SCS10	Ten Mile Creek	1																			1														
All AU Totals		**37**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**21**	**6**	**4**	**2**	**0**	**0**	**16**	**18**	**0**	**85**	**37**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**3**	**0**	**0**	**0**	**0**	**0**

Lower Snake

The Lower Snake MPG includes the Tucannon and Asotin steelhead populations and contains six AUs with 74 planned habitat improvement actions within five of the AUs (Table 11; Figure 7). Most of the planned habitat improvement actions occur within the upper Tucannon AU (Table 11). Limiting factors/ecological concerns identified for these AUs are presented in Table 12.

Table 11. Assessment unit names, codes and weight in percent along with the number of planned habitat improvement actions for the Lower Snake MPG of the Snake River steelhead DPS.

AU Code	Assessment Units	Assessment Unit Weight (%)	2013-2018 Restoration Actions
ACS1	Alpowa	19.0%	0
ACS2	Asotin Creek	52.5%	5
ACS3	George Creek	28.5%	2
	Total	**100.0%**	**7**
TUS1A	Upper Tucannon - Pataha up to Panjab	85.0%	55
TUS1B	Lower Tucannon - Mouth to Pataha	5.0%	5
TUS1C	Pataha	10.0%	7
	Total	**100.0%**	**67**

There are several limiting factors/ecological concerns that were identified in all AUs of the Lower Snake MPG. Those concerns are channel structure and form, riparian condition, peripheral and transitional habitat, poor sediment conditions, habitat and water quantity and water quality for steelhead (Table 12). Mechanical injury to salmon and changes in life history pattern only occurred in the Tucannon AUs.

There are 74 habitat improvement actions planned for the 2013-2018 period covering six major limiting factors/ecological concerns in the Lower Snake steelhead MPG (Table 13). Efforts to improve floodplain condition and instream complexity were the majority of the habitat improvement actions for steelhead. RM&E resource information that will assist expert panel process depends largely on the location and type of habitat improvement actions and limiting factors/ecological concerns that will be assessed in the next workshops.

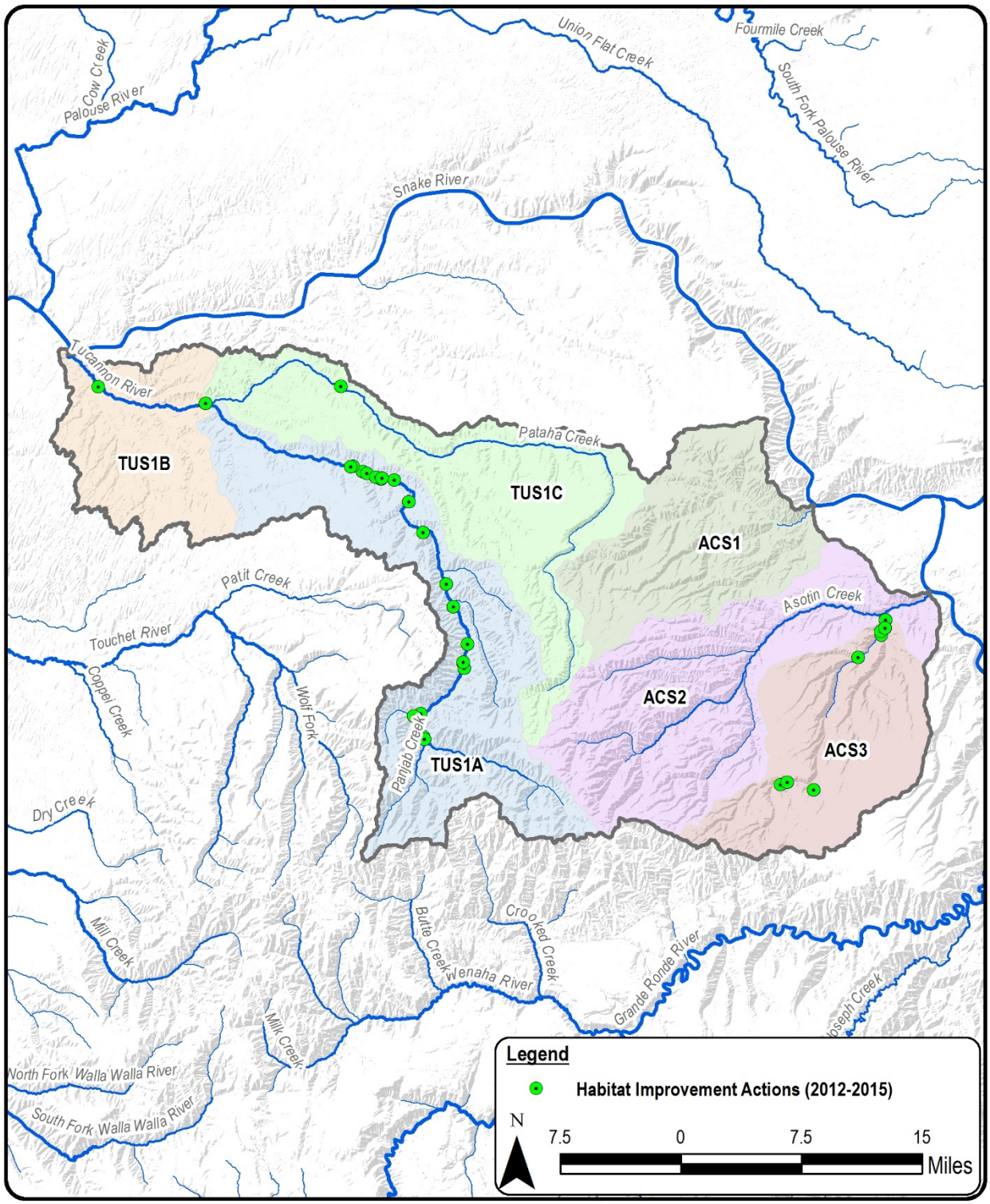

Figure 7. Lower Snake Asotin and Tucannon steelhead populations, AU level boundaries and locations of habitat improvement actions.

Table 12. Limiting factors/ecological concerns identified by an "X" for ecological sub-categories in AUs of the Lower Snake steelhead MPG. AUs in gray have no planned restoration action for the 2013-2018 expert panel cycle.

Assessment Unit		Habitat Quantity			Injury and Mortality				Food			Riparian Condition		Peripheral and Transitional Habitats				Channel Structure and Form		Sediment Conditions		Water Quality							Water Quantity			Population Level Effects			
		Anthropogenic Barriers	Natural Barriers	HQ-Competition	Predation	Pathogens	Mechanical Injury	Contaminated Food	Altered Primary Productivity	Food-Competition	Altered Prey Sp. Comp. & Div.	Riparian Condition	LWD Recruitment	S. Channel and Wetland Cond.	Floodplain Condition	Estuary Conditions	Nearshore Conditions	Bed and Channel Form	Instream Structural Complexity	Decreased Sediment Quantity	Increased Sediment Quantity	Temperature	Oxygen	Gas Saturation	Turbidity	pH	Salinity	Toxic Contaminants	Increased Water Quantity	Decreased Water Quantity	Altered Flow Timing	Reduced Genetic Adaptiveness	Small Population Effects	Demographic Changes	Life History Changes
Code	**Name**	**1.1**	**1.2**	**1.3**	**2.1**	**2.2**	**2.3**	**2.4**	**3.1**	**3.2**	**3.3**	**4.1**	**4.2**	**5.1**	**5.2**	**5.3**	**5.4**	**6.1**	**6.2**	**7.1**	**7.2**	**8.1**	**8.2**	**8.3**	**8.4**	**8.5**	**8.6**	**8.7**	**9.1**	**9.2**	**9.3**	**10.1**	**10.2**	**10.3**	**10.4**
ACS1	Alpowa	X										X			X			X	X		X	X			X					X				
ACS2	Asotin Creek	X										X			X			X	X		X	X			X					X				
ACS3	George Creek	X										X			X			X	X		X	X			X					X				
TUS1A	Upper Tucannon - Pataha up to Panjab	X					X					X			X			X	X		X	X			X					X				X
TUS1B	Lower Tucannon - Mouth to Pataha	X					X					X			X			X	X		X	X			X					X				X
TUS1C	Pataha	X					X					X			X			X	X		X	X			X					X				X
All AU Totals		**6**	**0**	**0**	**0**	**0**	**3**	**0**	**0**	**0**	**0**	**6**	**0**	**0**	**6**	**0**	**0**	**6**	**6**	**0**	**6**	**6**	**0**	**0**	**6**	**0**	**0**	**0**	**0**	**6**	**0**	**0**	**0**	**0**	**3**

Table 13. Number of planned habitat improvement actions in the Lower Snake steelhead MPG for the period of 2013-2018 organized by the limiting factors/ecological concerns and that have been identified.

Assessment Unit		Habitat Quantity			Injury and Mortality				Food			Riparian Condition		Peripheral and Transitional Habitats				Channel Structure and Form		Sediment Conditions		Water Quality							Water Quantity			Population Level Effects			
		Anthropogenic Barriers	Natural Barriers	HQ-Competition	Predation	Pathogens	Mechanical Injury	Contaminated Food	Altered Primary Productivity	Food-Competition	Altered Prey Sp. Comp. & Div.	Riparian Condition	LWD Recruitment	S. Channel and Wetland Cond.	Floodplain Condition	Estuary Conditions	Nearshore Conditions	Bed and Channel Form	Instream Structural Complexity	Decreased Sediment Quantity	Increased Sediment Quantity	Temperature	Oxygen	Gas Saturation	Turbidity	pH	Salinity	Toxic Contaminants	Increased Water Quantity	Decreased Water Quantity	Altered Flow Timing	Reduced Genetic Adaptiveness	Small Population Effects	Demographic Changes	Life History Changes
Code	**Name**	**1.1**	**1.2**	**1.3**	**2.1**	**2.2**	**2.3**	**2.4**	**3.1**	**3.2**	**3.3**	**4.1**	**4.2**	**5.1**	**5.2**	**5.3**	**5.4**	**6.1**	**6.2**	**7.1**	**7.2**	**8.1**	**8.2**	**8.3**	**8.4**	**8.5**	**8.6**	**8.7**	**9.1**	**9.2**	**9.3**	**10.1**	**10.2**	**10.3**	**10.4**
ACS1	Alpowa																																		
ACS2	Asotin Creek	1										1			1				2																
ACS3	George Creek											1							1																
TUS1A	Upper Tucannon - Pataha up to Panjab											2			21				26			1			2					3				
TUS1B	Lower Tucannon - Mouth to Pataha														1				2			1								1				
TUS1C	Pataha	1													1							1			4									
All AU Totals		**2**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**4**	**0**	**0**	**24**	**0**	**0**	**0**	**31**	**0**	**0**	**3**	**0**	**0**	**6**	**0**	**0**	**0**	**0**	**4**	**0**	**0**	**0**	**0**	**0**

Lower Salmon River

Steelhead populations of the Secesh, South Fork Salmon and Big Creek portion of the Big, Camas, and Loon creek population are combined here and referred to as the Lower Salmon River because they represent a separate expert panel workshop distinct from the rest of the Salmon River MPG. There are eight AUs that make up the lower Salmon populations evaluated in the expert panel process. Those AUs have 23 planned habitat improvement actions within five of the AUs (Table 14; Figure 8).

Table 14. Assessment unit names, codes and weight in percent along with the number of planned habitat improvement actions for the Lower Salmon River steelhead populations.

AU Code	Assessment Units	Assessment Unit Weight (%)	2013-2018 Restoration Actions
MLS1A	Lower Big Creek	45.0%	0
MLS1B	Upper Big Creek	55.0%	6
	Total	**100%**	**6**
SES1	Secesh River	100.0%	4
SSS1A	EFSF Salmon and Tribs	19.2%	0
SSS1B	Johnson Creek	25.8%	5
SSS2	Upper SF Salmon Tribs above EFSF Salmon (High Idaho Batholith Tribs - from the headwaters to the mouth of EFSF Salmon)	1.5%	6
SSS3	Lower SF Salmon Tribs below EFSF Salmon (Hot Dry Canyon Tribs - from mouth of EFSF Salmon to mouth of SF Salmon)	15.9%	2
SSS4	Mainstem SF Salmon	37.6%	0
	Total	**100%**	**17**

The most common limiting factors/ecological concerns noted for steelhead in the lower Salmon are sediment conditions and barriers (Table 15). Increased sediment conditions occur in all assessments while migration barriers occur in all but three of the AUs. Stream temperature and toxic contaminants were identified in two AUs each.

There are 23 habitat improvement actions planned for the 2013-2018 period covering three major limiting factors/ecological concerns in the lower Salmon population (Table 16). The majority of habitat improvement actions are focused on eliminating migration barriers and improving poor sediment conditions. RM&E resource information that will assist expert panel process depends largely on the location and type of habitat improvement actions and limiting factors/ecological concerns that will be assessed in the next workshops.

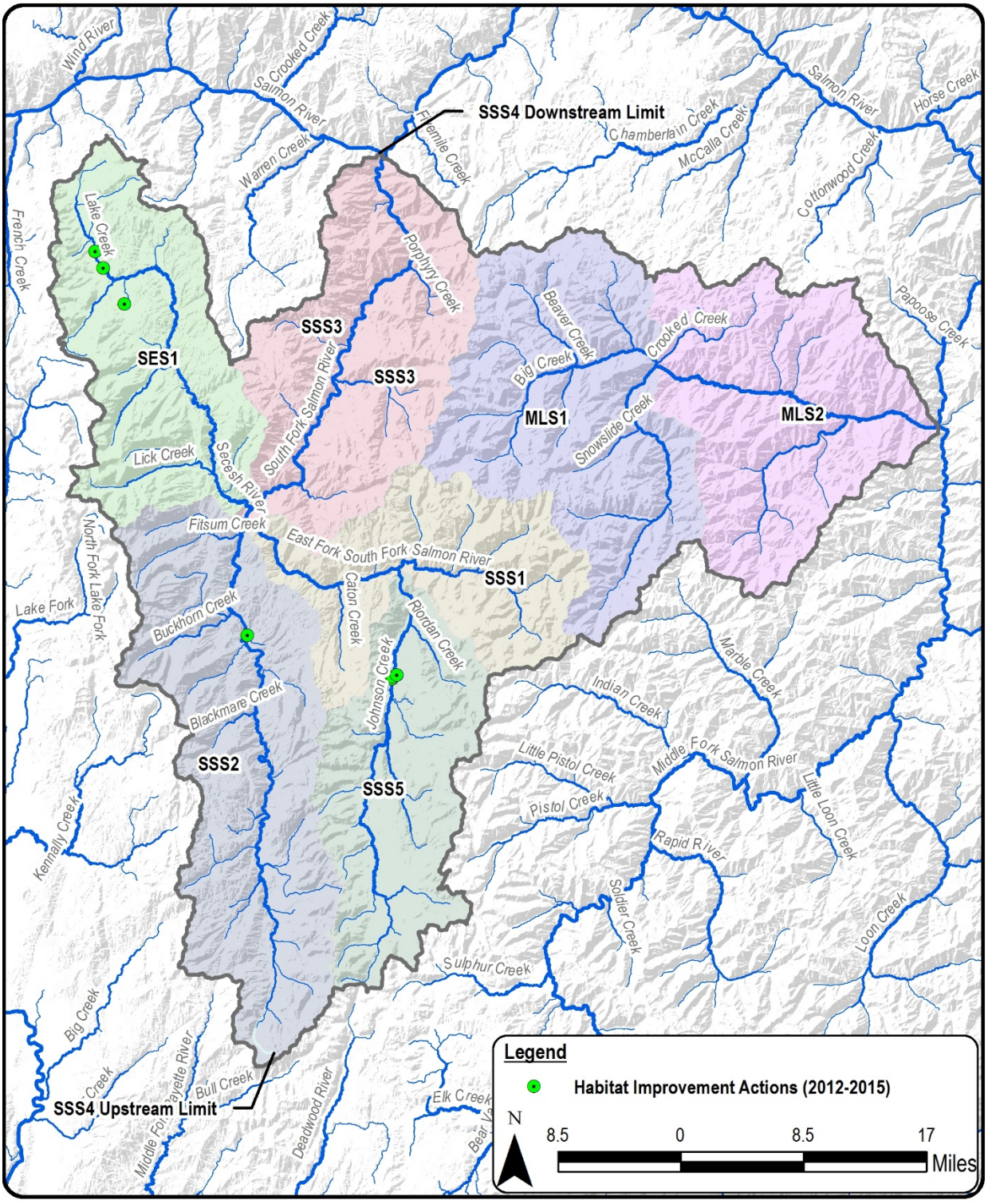

Figure 8. Lower Salmon River steelhead populations, AU boundaries and locations of habitat improvement actions.

Table 15. Limiting factors/ecological concerns identified by an "X" for ecological sub-categories in AUs of the Lower Salmon River steelhead populations. AUs in gray have no planned restoration action for the 2013-2018 expert panel cycle.

Assessment Unit		Habitat Quantity			Injury and Mortality				Food			Riparian Condition		Peripheral and Transitional Habitats				Channel Structure and Form		Sediment Conditions		Water Quality							Water Quantity			Population Level Effects			
		Anthropogenic Barriers	Natural Barriers	HQ-Competition	Predation	Pathogens	Mechanical Injury	Contaminated Food	Altered Primary Productivity	Food-Competition	Altered Prey Sp. Comp. & Div.	Riparian Condition	LWD Recruitment	S. Channel and Wetland Cond.	Floodplain Condition	Estuary Conditions	Nearshore Conditions	Bed and Channel Form	Instream Structural Complexity	Decreased Sediment Quantity	Increased Sediment Quantity	Temperature	Oxygen	Gas Saturation	Turbidity	pH	Salinity	Toxic Contaminants	Increased Water Quantity	Decreased Water Quantity	Altered Flow Timing	Reduced Genetic Adaptiveness	Small Population Effects	Demographic Changes	Life History Changes
Code	**Name**	**1.1**	**1.2**	**1.3**	**2.1**	**2.2**	**2.3**	**2.4**	**3.1**	**3.2**	**3.3**	**4.1**	**4.2**	**5.1**	**5.2**	**5.3**	**5.4**	**6.1**	**6.2**	**7.1**	**7.2**	**8.1**	**8.2**	**8.3**	**8.4**	**8.5**	**8.6**	**8.7**	**9.1**	**9.2**	**9.3**	**10.1**	**10.2**	**10.3**	**10.4**
MLS1A	Lower Big Creek																				X														
MLS1B	Upper Big Creek	X																			X							X						
SES1	Secesh River	X																			X													
SSS1A	EFSF Salmon and Tribs	X																			X	X						X							
SSS1B	Johnson Creek	X																			X	X													
SSS2	Upper SF Salmon Tribs above EFSF Salmon	X																			X													
SSS3	Lower SF Salmon Tribs below EFSF Salmon																				X													
SSS4	Mainstem SF Salmon																				X													
All AU Totals		**5**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**8**	**2**	**0**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

Table 16. Number of planned habitat improvement actions in the South Fork and Middle Fork Salmon River MPGs for the period of 2013-2018 organized by limiting factors/ecological concerns that have been identified.

Assessment Unit		Habitat Quantity			Injury and Mortality				Food			Riparian Condition		Peripheral and Transitional Habitats				Channel Structure and Form		Sediment Conditions		Water Quality							Water Quantity			Population Level Effects			
		Anthropogenic Barriers	Natural Barriers	HQ-Competition	Predation	Pathogens	Mechanical Injury	Contaminated Food	Altered Primary Productivity	Food-Competition	Altered Prey Sp. Comp. & Div.	Riparian Condition	LWD Recruitment	S. Channel and Wetland Cond.	Floodplain Condition	Estuary Conditions	Nearshore Conditions	Bed and Channel Form	Instream Structural Complexity	Decreased Sediment Quantity	Increased Sediment Quantity	Temperature	Oxygen	Gas Saturation	Turbidity	pH	Salinity	Toxic Contaminants	Increased Water Quantity	Decreased Water Quantity	Altered Flow Timing	Reduced Genetic Adaptiveness	Small Population Effects	Demographic Changes	Life History Changes
Code	**Name**	**1.1**	**1.2**	**1.3**	**2.1**	**2.2**	**2.3**	**2.4**	**3.1**	**3.2**	**3.3**	**4.1**	**4.2**	**5.1**	**5.2**	**5.3**	**5.4**	**6.1**	**6.2**	**7.1**	**7.2**	**8.1**	**8.2**	**8.3**	**8.4**	**8.5**	**8.6**	**8.7**	**9.1**	**9.2**	**9.3**	**10.1**	**10.2**	**10.3**	**10.4**
MLS1A	Lower Big Creek																																		
MLS1B	Upper Big Creek	3																			3														
SES1	Secesh River	2																			2														
SSS1A	EFSF Salmon and Tribs																																		
SSS1B	Johnson Creek	3																			1	1													
SSS2	Upper SF Salmon Tribs above EFSF Salmon	2																			4														
SSS3	Lower SF Salmon Tribs below EFSF Salmon																				2														
SSS4	Mainstem SF Salmon																																		
All AU Totals		**10**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**12**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

Upper Salmon River

Steelhead populations from the Lemhi, Pahsimeroi, East Fork Salmon River and Salmon River Upper Mainstem are combined here and referred to as the upper Salmon River portion of the Salmon River MPG. This grouping is a separate expert panel workshop from the lower Salmon River. There are 19 AUs with 380 planned habitat improvement actions within 16 of the AUs (Table 17; Figure 9). Most of the planned habitat improvement actions occur within the Lemhi, Pahsimeroi and Yankee Fork AUs. Limiting factors/ecological concerns identified for AUs of the Upper Salmon River are presented in Table 18.

Table 17. Assessment unit names, codes and weight in percent along with the number of planned habitat improvement actions for steelhead in the Upper Salmon River.

AU Code	Assessment Unit	Assessment Unit Weight (%)	2013-2018 Restoration Actions
LRS1	Carmen, Bohannon, Wimpey, and Kenney Creeks	7.6%	28
LRS2	Mainstem Salmon and Lemhi Rivers and Hayden Creek	44.6%	81
LRS3	Other Salmon and Lemhi River seasonally and disconnected tributaries	47.8%	92
	Total	**100%**	**201**
PRS1	Pahsimeroi Downstream Of Big Ck	20.0%	50
PRS2	Salmon River and Tributaries	40.0%	2
PRS3	Pahsimeroi Upstream Of Big Ck	40.0%	20
	Total	**100%**	**72**
EFS1	Bayhorse Creek	1.0%	1
EFS2	Challis Creek	6.0%	3
EFS3	EF Salmon River	14.0%	5
EFS4	EF Salmon Tributaries	34.0%	2
EFS5	Garden Creek	4.0%	2
EFS6	Herd Creek	3.0%	2
EFS7	Mainstem Salmon River	30.0%	0
EFS8	Morgan Creek	5.0%	0
EFS9	Salmon River Tributaries	3.0%	0
	Total	**100%**	**15**
UMS2	Mainstem Upper Salmon River	62.0%	1
UMS3	Upper Salmon River Tributaries	21.0%	28
UMS4	West Fork Yankee Fork	5.0%	3
UMS5	Yankee Fork	12.0%	60
	Total	**100%**	**92**

The most common limiting factors/ecological concerns noted in the Upper Salmon River are riparian condition, habitat quantity, sediment conditions, decreased water quantity, water quality and injury and mortality to salmonids (Table 18). Limiting factors/ecological concerns were also noted for channel structure and form as well as peripheral and transitional habitats. Limiting factors/ecological concerns such as riparian condition, barriers, decreased water quantity, increased sediment and temperature and mechanical injury are widespread and occur in at least 12 of the 19 AUs of the Upper Salmon River.

Restoration efforts planned for the 2013-2018 period are diverse covering eight major limiting factors/ecological concerns encompassing 16 AUs (84%) of the Upper Salmon River (Table 19). RM&E resource information that will assist the expert panel process depends largely on the location and type of habitat improvement actions and limiting factors/ecological concerns that will be assessed in the next workshops.

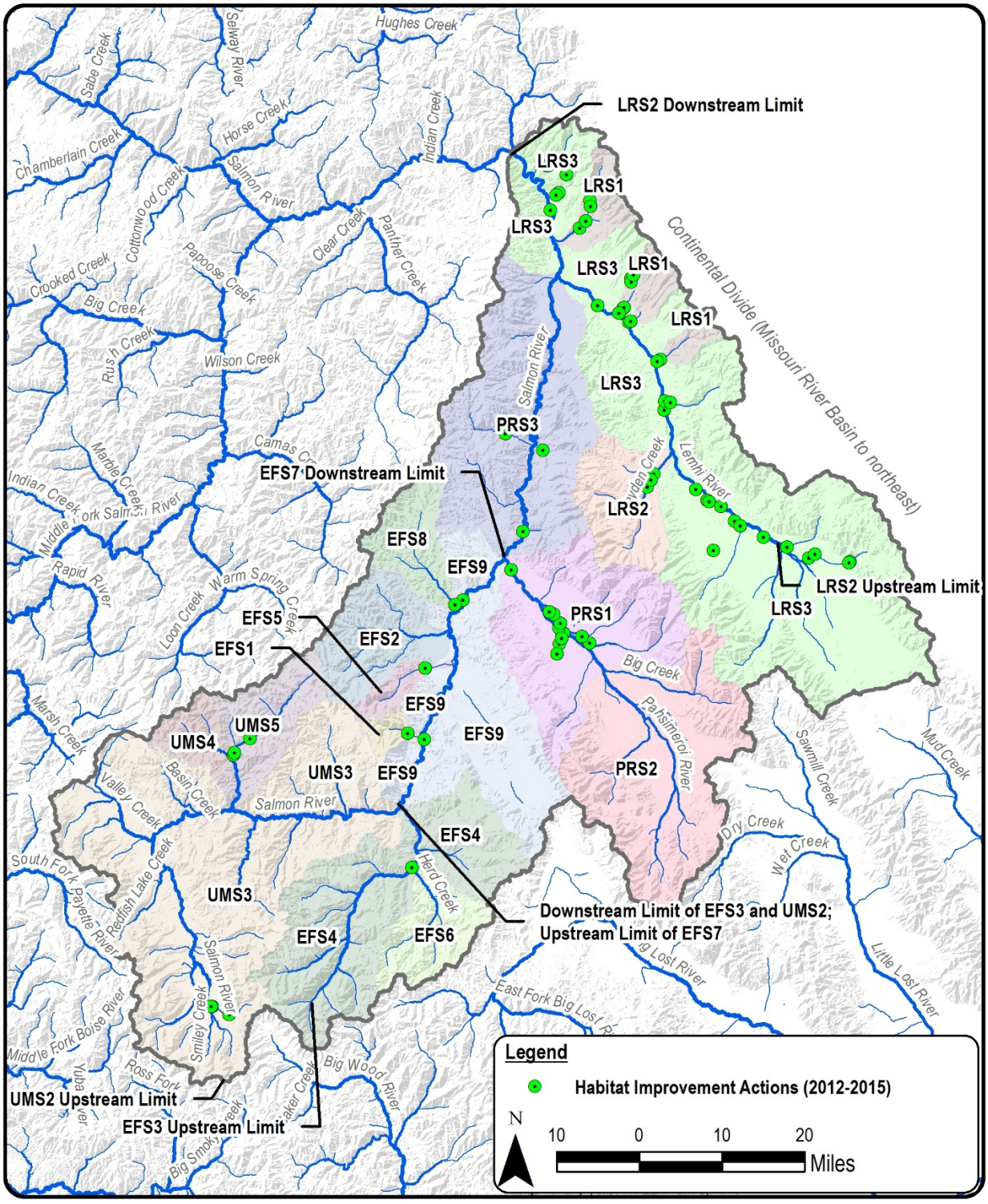

Figure 9. Upper Salmon River steelhead populations, AU boundaries, and locations of habitat improvement actions.

Table 18. Limiting factors/ecological concerns identified by an "X" for ecological sub-categories in AUs of the Upper Salmon River steelhead. AUs in gray have no planned restoration action for the 2013-2018 expert panel cycle.

Assessment Unit		Habitat Quantity			Injury and Mortality				Food			Riparian Condition		Peripheral and Transitional Habitats				Channel Structure and Form		Sediment Conditions		Water Quality							Water Quantity			Population Level Effects			
		Anthropogenic Barriers	Natural Barriers	HQ-Competition	Predation	Pathogens	Mechanical Injury	Contaminated Food	Altered Primary Productivity	Food-Competition	Altered Prey Sp. Comp. & Div.	Riparian Condition	LWD Recruitment	S. Channel and Wetland Cond.	Floodplain Condition	Estuary Conditions	Nearshore Conditions	Bed and Channel Form	Instream Structural Complexity	Decreased Sediment Quantity	Increased Sediment Quantity	Temperature	Oxygen	Gas Saturation	Turbidity	pH	Salinity	Toxic Contaminants	Increased Water Quantity	Decreased Water Quantity	Altered Flow Timing	Reduced Genetic Adaptiveness	Small Population Effects	Demographic Changes	Life History Changes
Code	Name	1.1	1.2	1.3	2.1	2.2	2.3	2.4	3.1	3.2	3.3	4.1	4.2	5.1	5.2	5.3	5.4	6.1	6.2	7.1	7.2	8.1	8.2	8.3	8.4	8.5	8.6	8.7	9.1	9.2	9.3	10.1	10.2	10.3	10.4
EFS1	Bayhorse Creek	X					X					X									X									X					
EFS2	Challis Creek	X										X									X	X								X					
EFS3	EF Salmon River	X					X					X						X			X									X					
EFS4	EF Salmon Tributaries	X					X																							X					
EFS5	Garden Creek	X					X					X									X									X					
EFS6	Herd Creek	X										X									X									X					
EFS7	Mainstem Salmon River											X			X			X			X	X													
EFS8	Morgan Creek						X					X									X	X								X					
EFS9	Salmon River Tributaries																													X					
LRS1	Carmen, Bohannon, Wimpey, and Kenney Creeks	X					X					X						X			X	X								X					
LRS2	Mainstem Salmon and Lemhi Rivers and Hayden Creek	X					X					X			X			X			X	X								X					
LRS3	Other Salmon and Lemhi River seasonally and disconnected tributaries	X					X					X			X			X	X		X	X								X					
PRS1	Pahsimeroi Downstream Of Big Ck	X					X					X						X		X	X	X								X					
PRS2	Salmon River and Tributaries	X					X					X										X								X					

Assessment Unit		Habitat Quantity			Injury and Mortality				Food			Riparian Condition		Peripheral and Transitional Habitats				Channel Structure and Form		Sediment Conditions		Water Quality							Water Quantity			Population Level Effects			
		Anthropogenic Barriers	Natural Barriers	HQ-Competition	Predation	Pathogens	Mechanical Injury	Contaminated Food	Altered Primary Productivity	Food-Competition	Altered Prey Sp. Comp. & Div.	Riparian Condition	LWD Recruitment	S. Channel and Wetland Cond.	Floodplain Condition	Estuary Conditions	Nearshore Conditions	Bed and Channel Form	Instream Structural Complexity	Decreased Sediment Quantity	Increased Sediment Quantity	Temperature	Oxygen	Gas Saturation	Turbidity	pH	Salinity	Toxic Contaminants	Increased Water Quantity	Decreased Water Quantity	Altered Flow Timing	Reduced Genetic Adaptiveness	Small Population Effects	Demographic Changes	Life History Changes
Code	**Name**	**1.1**	**1.2**	**1.3**	**2.1**	**2.2**	**2.3**	**2.4**	**3.1**	**3.2**	**3.3**	**4.1**	**4.2**	**5.1**	**5.2**	**5.3**	**5.4**	**6.1**	**6.2**	**7.1**	**7.2**	**8.1**	**8.2**	**8.3**	**8.4**	**8.5**	**8.6**	**8.7**	**9.1**	**9.2**	**9.3**	**10.1**	**10.2**	**10.3**	**10.4**
PRS3	Pahsimeroi Upstream Of Big Ck.	X					X					X									X									X					
UMS2	Mainstem Upper Salmon River											X									X	X								X					
UMS3	Upper Salmon River Tributaries	X					X					X									X	X								X					
UMS4	West Fork Yankee Fork														X			X	X																
UMS5	Yankee Fork	X											X		X			X	X	X															
AU Total		**19**	**0**	**0**	**0**	**0**	**12**	**0**	**0**	**0**	**0**	**15**	**1**	**0**	**5**	**0**	**0**	**8**	**3**	**2**	**22**	**12**	**0**	**0**	**0**	**0**	**0**	**2**	**0**	**16**	**0**	**0**	**0**	**0**	**0**

Table 19. Number of planned habitat improvement actions in the Upper Salmon River for the period of 2013-2018 organized by limiting factors/ecological concerns that have been identified.

Assessment Unit		Habitat Quantity			Injury and Mortality				Food			Riparian Condition		Peripheral and Transitional Habitats				Channel Structure and Form		Sediment Conditions		Water Quality							Water Quantity			Population Level Effects			
		Anthropogenic Barriers	Natural Barriers	HQ-Competition	Predation	Pathogens	Mechanical Injury	Contaminated Food	Altered Primary Productivity	Food-Competition	Altered Prey Sp. Comp. & Div.	Riparian Condition	LWD Recruitment	S. Channel and Wetland Cond.	Floodplain Condition	Estuary Conditions	Nearshore Conditions	Bed and Channel Form	Instream Structural Complexity	Decreased Sediment Quantity	Increased Sediment Quantity	Temperature	Oxygen	Gas Saturation	Turbidity	pH	Salinity	Toxic Contaminants	Increased Water Quantity	Decreased Water Quantity	Altered Flow Timing	Reduced Genetic Adaptiveness	Small Population Effects	Demographic Changes	Life History Changes
Code	Name	1.1	1.2	1.3	2.1	2.2	2.3	2.4	3.1	3.2	3.3	4.1	4.2	5.1	5.2	5.3	5.4	6.1	6.2	7.1	7.2	8.1	8.2	8.3	8.4	8.5	8.6	8.7	9.1	9.2	9.3	10.1	10.2	10.3	10.4
EFS1	Bayhorse Creek	1																																	
EFS2	Challis Creek	2																												1					
EFS3	EF Salmon River	1					1											2												1					
EFS4	EF Salmon Tributaries						2																												
EFS5	Garden Creek	1																												1					
EFS6	Herd Creek	1																												1					
EFS7	Mainstem Salmon River																																		
EFS8	Morgan Creek																																		
EFS9	Salmon River Tributaries																																		
LRS1	Carmen, Bohannon, Wimpey, and Kenney Creeks	5					6					3						3			3	3								5					
LRS2	Mainstem Salmon and Lemhi Rivers and Hayden Creek	4					4					9			6			19			18	18								3					
LRS3	Other Salmon and Lemhi River seasonally and disconnected tributaries	21					9					3			9			9	9		10	16								6					
PRS1	Pahsimeroi Downstream Of Big Ck	9					2					9									9	15								6					
PRS2	Salmon River and	1					1																												

Assessment Unit		Habitat Quantity			Injury and Mortality				Food			Riparian Condition		Peripheral and Transitional Habitats				Channel Structure and Form		Sediment Conditions		Water Quality							Water Quantity			Population Level Effects			
		Anthropogenic Barriers	Natural Barriers	HQ-Competition	Predation	Pathogens	Mechanical Injury	Contaminated Food	Altered Primary Productivity	Food-Competition	Altered Prey Sp. Comp. & Div.	Riparian Condition	LWD Recruitment	S. Channel and Wetland Cond.	Floodplain Condition	Estuary Conditions	Nearshore Conditions	Bed and Channel Form	Instream Structural Complexity	Decreased Sediment Quantity	Increased Sediment Quantity	Temperature	Oxygen	Gas Saturation	Turbidity	pH	Salinity	Toxic Contaminants	Increased Water Quantity	Decreased Water Quantity	Altered Flow Timing	Reduced Genetic Adaptiveness	Small Population Effects	Demographic Changes	Life History Changes
Code	**Name**	**1.1**	**1.2**	**1.3**	**2.1**	**2.2**	**2.3**	**2.4**	**3.1**	**3.2**	**3.3**	**4.1**	**4.2**	**5.1**	**5.2**	**5.3**	**5.4**	**6.1**	**6.2**	**7.1**	**7.2**	**8.1**	**8.2**	**8.3**	**8.4**	**8.5**	**8.6**	**8.7**	**9.1**	**9.2**	**9.3**	**10.1**	**10.2**	**10.3**	**10.4**
	Tributaries																																		
PRS3	Pahsimeroi Upstream Of Big Ck	9					1					4									3									3						
UMS2	Mainstem Upper Salmon River											1																							
UMS3	Upper Salmon River Tributaries	9										4									4	7								4						
UMS4	West Fork Yankee Fork														1			1	1																	
UMS5	Yankee Fork	5											13		13			13	13	3																
	AU Total	**69**	**0**	**0**	**0**	**0**	**26**	**0**	**0**	**0**	**0**	**33**	**13**	**0**	**29**	**0**	**0**	**47**	**23**	**3**	**47**	**59**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**31**	**0**	**0**	**0**	**0**	**0**

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Appendices

Appendix 1.Limiting Factors/Ecological Concerns used to designate limiting factors for steelhead in the Snake River DPS. Limiting factors were identified by the ID code and ecological sub-category for each AU.

ID	Ecological Concern	Definition	Included Categories	ID	Ecological Concern-Sub Category	Definition	Included Categories	VSP parameter effects	Primary Life Stages Affected	Metric Assessment Guidelines
1	**Habitat Quantity**	Insufficient quantity of total habitat or habitat diversity due to the elimination of access	Connectivity, Access, Structure, Simplification, Availability	**1.1**	**Anthropogenic Barriers**	Loss of access to habitat and/or habitat sub-types due to anthropogenic activity. Includes partial or ephemeral barriers.	Access, Barriers, Flap Gates, Tidal Gates, Culverts, Obstacles, Obstructions, Passage Issues, Blocked	Compensation/Carrying Capacity/Spatial Structure and Diversity	1,4,5,8	stream miles of access
				1.2	**Natural Barriers**	Lasting natural barriers to stream or estuary access, including waterfalls, sand bars, log jams, sufficiently steep gradients or insufficient water. May represent the end of good quality habitat	Water Falls, Sand Bar, Bar Breach, Log Jams, Steep Gradient, Thermal Barriers, Low Water	Compensation/Carrying Capacity	1,4,5,8	stream miles of access
				1.3	**HQ-Competition**	Limited physical space and the protection from predators or physical forces it provides, due to the addition of competing salmonid stocks, species or hatchery produced fish.	Refugia, Hatchery Fish, Predation, Stocking, Swamping	Compensation/Carrying Capacity/Spatial Structure and Diversity	4,5,6	Increased mortality from interactions
2	**Injury and Mortality**	Lethal and sub-lethal effects due to other organisms, including human activities	Death, Injury, Predation	**2.1**	**Predation**	Introduced salmon predators or changes to the habitat that increase native predator numbers or increase predator success.	Invasive/Exotic Fish or Invertebrate Predators, Native Fish, Native Bird, Native Pinnipeds, Fishing	Density Dependent-Positive and Negative- at Low Abundance/High Abundance Effects	1,2,3,4,5,6,7,8	Increased mortality
				2.2	**Pathogens**	Increased mortality due to disease causing organisms or parasites.	Disease, Sea Lice, Introduced Diseases, Native Diseases, Whirling Disease, Myxobolus Cerebralis, Gyrodactylus, Sea Lice, Ulcerative dermal necrosis (UDN), IHNV, VHSV, Kudoa, Henneguya, White Spot, Ich, Gill Amoeba	Negative Density Dependence- High Abundance Effects	1,2,4,5,6,7,8	Increased mortality
				2.3	**Mechanical Injury**	Mortality or injury due to anthropogenic structures or as the result of mechanical forces due to anthropogenic structures	Inadequate screening, Barging, Snagging, Stranding, Entrainment	Compensation/Carrying Capacity	4,5,6,8	Increased mortality
				2.4	**Contaminated Food**	Toxics substances found in prey that negatively affect salmon. Includes persistent toxic substances that are concentrated as they are consumed and move to the next trophic level.	Bioaccumulation Toxicity, PBDEs, PCBs, Oil, Organochlorides, Pesticides	Density Independent	4,5,6,7	Increased mortality

ID	Ecological Concern	Definition	Included Categories	ID	Ecological Concern-Sub Category	Definition	Included Categories	VSP parameter effects	Primary Life Stages Affected	Metric Assessment Guidelines
3	Food	Insufficient or inadequate food for salmonids.	Competition, Prey Availability, Species Interactions	3.1	Altered Primary Productivity	Alteration of ecological dynamics affecting the quantity, quality and/or species composition of phytoplankton or detritus resulting in insufficient food available for salmonids or prey species.	Micro and Macro-Detrital Inputs, Loss of Marine Derived Nutrients, Carcasses, Down-welling, Ocean Conditions, Detritus, Phytoplankton	Compensation/Carrying Capacity	4,5,6,7	Increased mortality
				3.2	Food-Competition	Insufficient food due to the addition of competing salmonid stocks, species or hatchery produced fish.	Hatchery Fish, Increased Natural Competitors, Invasive Species	Compensation/Carrying Capacity	4,5,6,7	Increased mortality
				3.3	Altered Prey Species Composition and Diversity	Alteration of ecological dynamics affecting the species composition, distribution or nutritional quality of zooplankton, macroinvertebrates, forage-fish or other prey resulting in insufficient food for salmonids.	Species Diversity, Prey Species Abundance, Invasive Species, Altered Food Web Dynamics	Compensation/Carrying Capacity	4,5,6,7	Increased mortality
4	Riparian Condition	Degradation of the habitat adjacent to streams, rivers, lakes and nearshore environments. Impairment of the near-bank environment to support plants including large trees that help stabilize stream banks, provide shade, add primary production to the aquatic ecosystem and includes the supply of mature trees into streams as LWD.	Impaired Riparian Function/Condition, microclimate, lack of shade	4.1	Riparian Condition	Disturbance to streamside ecological relationships, including but not limited to, loss of flora, erosion and increased light and temperatures	Bank degradation, Cover, Canopy, Inability to supply organic matter and filter sediments, Insufficient buffers, Light, Loss of natural shade	Compensation/Carrying Capacity/High Abundance Effects	1,2,3,4,5,6,8	stream miles and/or acres of riparian buffer
				4.2	LWD Recruitment	Loss of mature streamside trees that may become instream structures and associated decline in habitat complexity	LWD supply, Mature riparian, Mature trees	Compensation/Carrying Capacity	1,2,3,4,5,6,8	miles of improved stream complexity and/or # of LWD's added per mile

ID	Ecological Concern	Definition	Included Categories	ID	Ecological Concern-Sub Category	Definition	Included Categories	VSP parameter effects	Primary Life Stages Affected	Metric Assessment Guidelines
5	**Peripheral and Transitional Habitats**	Loss and/or degradation of the peripheral habitat of streams and rivers, including standing water, connected channels and areas that are periodically inundated during high flows.	High quality over-winter rearing habitat, Summer rearing habitat, Peripheral Habitat, Habitat Diversity, (Key) Habitat Quantity/Quality, Refugia Habitat	**5.1**	**Side Channel and Wetland Conditions**	Degradation, elimination and loss of access to peripheral freshwater habitat, including side-channels and freshwater wetlands.	Side Channels, Loss of peripheral habitat, Freshwater Wetlands, Swamp, Oxbows, Ponds, Alcoves	Compensation/Spatial Structure and Diversity	4,5,6	miles of side channel
				5.2	**Floodplain Condition**	Degradation, elimination and loss of access to the over or beyond bank habitat, of streams and rivers that is periodically inundated during high flows.	Floodplain, Bank condition, Overbank area, Diking	Compensation/Spatial Structure and Diversity	4,5,6	acres of floodplain accessed and/or stream miles
				5.3	**Estuary Conditions**	Loss and degradation of saltwater transition zone	Estuary, Salt-water transition zone, Lagoon, Estuary plume, Delta, Slough, Pocket estuary	Compensation/Carrying Capacity	6,8	N/A
				5.4	**Nearshore Conditions**	Loss and degradation of shallow water nearshore habitat	Beaches, Tidal flats, Eelgrass beds, Eelgrass meadows, Kelp forest, Baitfish spawning grounds	Compensation/Carrying Capacity	7,8	N/A
6	**Channel Structure and Form**	Changes to river, stream, lake, estuarine tributary and distributary channel form, including instream structural complexity, width to depth ratios, sinuosity and bedload movement such as the loss (scour) or fill (aggradation) of the channel.	Channel Conditions, Channel Form, Channel morphology, Channel Instability, Channel Stability, Loss of Spawning Substrate due to high flow, Bedload Movement	**6.1**	**Bed and Channel Form**	Changes to river, stream, lake, estuarine tributary and distributary channel form, including width to depth ratios, sinuosity and bedload movement such as the loss (scour) or fill (aggradation) of the channel.	Loss of sinuosity, Bank hardening, Channel incision, Channelized, Aggradation, Bed substrate stability, Armoring, Bridge crossings, Confinement, Nearshore sediment loss, Beach erosion	Compensation/Carrying Capacity	1,2,3,4,5,6,8	stream miles and/or miles restored to a percentage of functioning condition
				6.2	**Instream Structural Complexity**	Decline of the instream habitat quality. Based on the degree of habitat complexity and variety, includes the quantity and variability of stream depth and pools of varying size and depth.	LWD, Pools, Boulders, Bank overhang, Cover, Habitat structure, Instream habitat, Habitat, Stream complexity, Habitat diversity, (Key) Habitat quantity/quality, Refugia habitat, Channel conditions, Instream roughness, Poor gravel/sediment sorting, Rugosity	Compensation/Carrying Capacity	1,2,3,4,5,6,8	stream miles and/or increased complexity component

ID	Ecological Concern	Definition	Included Categories	ID	Ecological Concern-Sub Category	Definition	Included Categories	VSP parameter effects	Primary Life Stages Affected	Metric Assessment Guidelines
7	**Sediment Conditions**	Reduction of the quantity or quality of spawning habitat due to changes to the background (natural) quantity, rate, and size of sediment inputs to the stream system.	Sediment, Stream Spawning Habitat, Spawning Gravel, Beach Spawning Habitat (lake), Substrate, Benthic Habitat	**7.1**	**Decreased Sediment Quantity**	Decreased input of sediment to the stream system or some part of the stream system.	Substrate Quantity, Scour, Entrenchment, Loss of Spawning Habitat, Lack of spawning Gravel, Sediment transport	Compensation/Carrying Capacity	1,2,3,4,5,6	stream miles with improved substrate conditions
				7.2	**Increased Sediment Quantity**	Increased input of sediment to the stream system.	Bank Erosion, Excessive sedimentation, Aggradation, Sediment Load, Excess Fines, Embeddedness, Sediment Size Ratio	Compensation/Carrying Capacity/positive density dependence-high abundance effects	1,2,3,4,5,6	stream miles with improved substrate conditions and/or tons of sediment reduced
8	**Water Quality**	Degraded chemical, physical, and biological characteristics of water with respect to its suitability for a salmon, excluding toxins and pathogens.		**8.1**	**Temperature**	Water temperature deviations, either in intensity or duration, sufficient to have adverse effects on listed salmonids	High temperature	Density Independent	1,2,3,4,5,6,8	7 day average max stream temp decrease riparian shading potential increased stream flow riparian improvement
				8.2	**Oxygen**	Oxygen concentration deviations sufficient to induce adverse effects in listed salmonids.	Eutrophication, Excess nutrients, Oxygen depleted bottom water	Density Independent	1,2,3,4,5,6,8	miles restored to sustainable O2 limits
				8.3	**Gas Saturation**	Pathological condition due to saturated gases leaving solution into an animal's tissue.	Gas bubble disease (GBD), Dissolved gasses, Nitrogen	Density Independent	1,2,3,4,5,6,8	N/A
				8.4	**Turbidity**	Increased concentrations of suspended fine particulate matter sufficient to have adverse effects in listed salmonids, including reduction of their foraging ability and/or degradation of ecosystem function.	Suspended sediments, Plume Effects,	Density Independent	1,2,3,4,5,6,8	miles where turbidity lessened to acceptable levels
				8.5	**pH**	Acidity/alkalinity deviations sufficient to adversely affect salmonids or the species on which they feed.	Alkalinity, Ocean acidification, CO2	Density Independent	1,2,3,4,5,6,8	miles restored to acceptable range
				8.6	**Salinity**	Salinity at concentrations harmful to salmon	Refuge from salinity regimes	Density Independent	6	N/A
				8.7	**Toxic Contaminants**	Direct exposure to toxic substance in the water column.	Short-term Toxicity, Storm water Discharge, Outfalls, Wastewater, Non-point Source Pollution, Spills, Marine Debris, Point Source Pollution, Copper, Mercury	Density Independent	1,2,3,4,5,6,8	miles of stream of reduced toxic conditions

ID	Ecological Concern	Definition	Included Categories	ID	Ecological Concern-Sub Category	Definition	Included Categories	VSP parameter effects	Primary Life Stages Affected	Metric Assessment Guidelines
9	**Water Quantity**	Detrimental effects of deviations to the background (natural) amount and timing of water quantity instream, including lowered water quality and barriers to access.	Changes in Flow Regime, Spring Freshets, Piped Outfalls of Surface and Ground Water, Withdrawals, Flow-Related Plume Changes	**9.1**	**Increased Water Quantity**	Habitat disturbance associated with abnormally (compared to background) high water flow and increased "flashiness", including loss of channel substrate and the flushing of young fish downstream.	High flow, High volume, Flooding, Increased velocity, Increased peak flows, Decreased flood lag time, Redd scouring, Flashiness, Increased runoff, Water storage capability, Road density	Density Independent	1,2,3,4,5,6	flows at optimal levels to maximize survival, CFS
				9.2	**Decreased Water Quantity**	Habitat disturbances associated with abnormally (compared to background) low water flow, including but not limited to, increased temperature, loss of sediment, nutrients and barriers to passage and redd dewatering.	Low Volume, Plume Changes, Redd Dewatering, Water Withdrawals, Surface Impoundments, Diversions, Lake Level	Carrying Capacity/Spatial Structure and Diversity/Density Independent	1,2,3,4,5,6,8	flows at optimal levels to maximize survival, CFS
				9.3	**Altered Flow Timing**	Habitat changes associated with alterations to the background (natural) timing of water quantity instream.	Water Releases, Impervious Surfaces, Urbanization, Low Flows, Dewatering	Spatial Structure and Diversity/Density Independent	1,2,3,4,5,6,8	Flow timing at optimal range to maximize survival
10	**Population Level Effects**			**10.1**	**Reduced Genetic Adaptiveness**	Genetic changes that result in the loss of adaptedness to the habitat or set of habitats a population experiences.	Domestication Selection, Harvest selection, Outbreeding depression, Loss of life history types	Spatial Structure and Diversity/Density Dependent	1	N/A
				10.2	**Small Population Effects**	Reductions in reproductive rate, loss of genetic resilience or loss of genetic adaptedness in a population due to reductions in abundance that result in further losses of abundance.	Depensation, Loss of genetic diversity, Inbreeding, Genetic Drift, Increased predator effectiveness	Spatial Structure and Diversity/Density Dependent	1,2,3,4,5,6,7,8	N/A
				10.3	**Demographic Changes**	Changes to the age, size or developmental makeup of a population that result in a reduction to abundance, fecundity or reproductive rate.	Smaller size at return/maturity, greater age at return/maturity, reduced egg quality	Spatial Structure and Diversity/Carrying Capacity	7,8	N/A
				10.4	**Life History Changes**	Changes to the behavior of individuals that result in a population wide loss of adaptedness, including changes in the composition of life-history types or the timing of migration and reproduction.	Changes to migration timing, loss of reproductive strategies, loss of life-history types (timing of release), increased residual/precocial males/females, run timing, increased jacks/jills	Spatial Structure and Diversity/Density Dependent	4,5,6,8,1	N/A

Appendix 2

Bonneville Power Administration

US Bureau of Reclamation

July 15, 2015

From: FCRPS Action Agencies
Rosy Mazaika, Bonneville Power Administration
Jude Trapani, US Bureau of Reclamation

To: Expert Panel Watershed Coordinators

Re: Request for RM&E resource information

The FCRPS Action Agencies are requesting RM&E information from the different expert panel groups. This request is part of a larger effort to gather and organize RM&E information that will be useful to the expert panel process. The goal of this effort is to maintain this information so that panel members can distribute and access information at a common website to help stay informed on research at the population level. Because there is an overwhelming amount of information available on salmon habitat and ecology, the request is specific to the fish, habitat and limiting factors/ecological concerns identified for each population. However, we encourage researchers to also consider information on general topics such as; habitat improvement, fish-habitat relationships, status and trend, action effectiveness, and other materials related to salmonid habitat and limiting factors/ecological concerns. These types of resources will be placed under a general category in which researchers, implementers and managers can access to inform their decision making process.

There are a multitude of information resources available from peer reviewed journals to websites and databases for research. For journal articles, reports and documents, we request that you provide a reference to the document and an electronic copy if it is not copy right protected or the website hyperlink where the document can be obtained. We want to acknowledge the entities that produced the information.

The Bureau of Reclamation will host the website and provide a point of contact for people to send information for inclusion of RM&E information. We thank the expert panels and their members for their contributions.

Sincerely,

Appendix 3. FCRPS AAs focus populations and limiting factors/ecological concerns for developing CHaMP habitat metrics for the expert panel process.

Species	ESU	Population	Limiting Factor / Ecological Concern-Sub Categories							
			4.1 Riparian Condition	4.2 LWD Recruitment	5.1 Side Channel and Wetland Conditions	5.2 Floodplain Conditions	6.1 Bed and Channel Form	6.2 Instream Structural Complexity	7.2 Increased Sediment Quantity	8.1 Temperature
Chinook	Upper Columbia	Entiat	X			X	X	X	X	
	Snake River	Tucannon	X			X	X	X	X	X
		Upper GR	X	X			X	X	X	X
		Catherine Cr	X	X	X	X	X	X	X	X
		Yankee Fork		X		X	X	X		
		Upper Salmon above Redfish	X						X	X
Steelhead	Snake River	Clearwater Lower	X				X	X	X	X
		Lolo Cr					X		X	X
		SF Clearwater	X	X	X	X	X	X	X	X
		Lochsa	X	X				X	X	X
Base Metric Guideline			stream length and/or area of riparian buffer	Stream length of improved complexity and/or # LWD added/mile	stream side-channel length	stream length and/or areas	stream length restored to functioning condition	Stream length and/or increased complexity	Stream length with improved substrate conditions and/or tons of sediment input reduced	Stream length/flow/ temperature improvement