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

Research, Monitoring and Evaluation (RM&E)
Habitat Information Resources
for
Snake River Spring-Summer Chinook

Presented for

The FCRPS 2015 Tributary Habitat
Expert Panel Review Process

By

Bonneville Power Administration

&

United States Bureau of Reclamation

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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 bring 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.

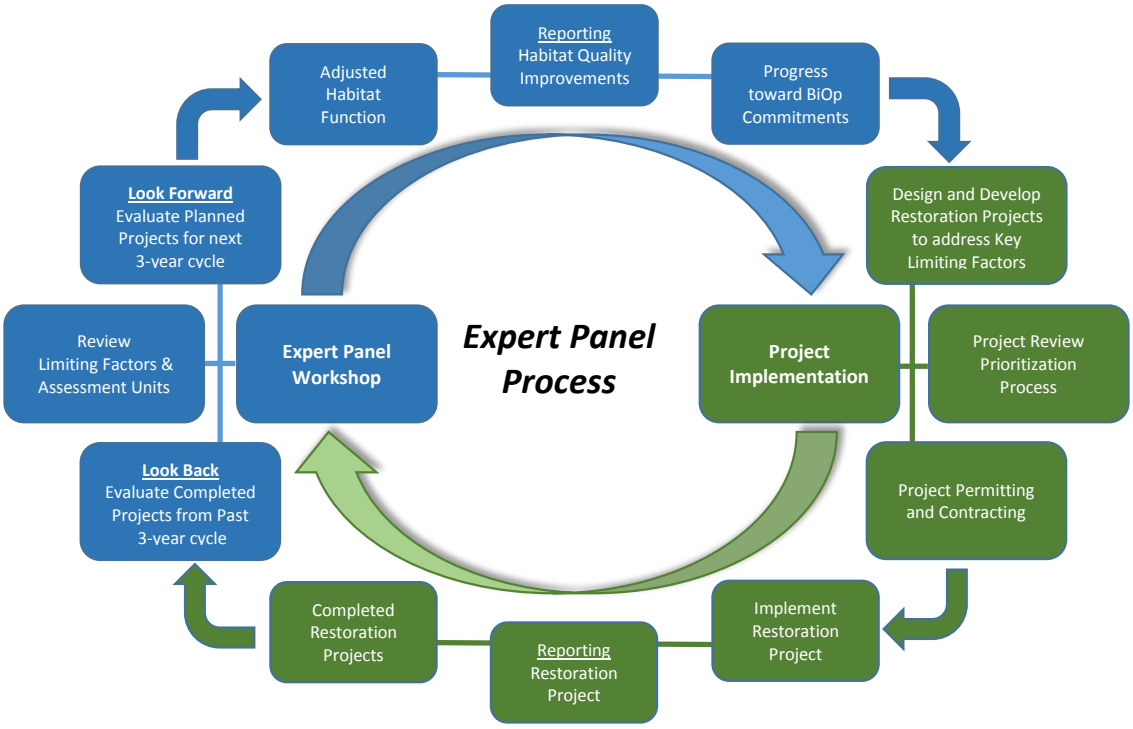

Figure 1. Diagram of the expert panel process used to implement and evaluate habitat improvement actions necessary to fulfill FCRPS BiOp Commitments.

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 are weighted accordingly. Again, AU weights are based on the percentage use of the AU relative to other AUs in the area 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.. 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 indicate their importance relative to other limiting factors in the AU. The number of limiting factors 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 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 spring-summer Chinook (CE Section 2, Table 35, pg. 150).

Table 1. Percent HQIs from actions benefitting spring-summer Chinook in the Snake River ESU. 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 Spring-Summer Chinook	Grande Ronde/Imnaha	Catherine Creek	22%	65%
		Lostine-Wallowa River	150%	350%
		Grande Ronde River Upper Mainstem	17%	100%
		Imnaha River	100%	100%
	Lower Snake	Tucannon River	12%	171%
	S. Fk. Salmon R.	Secesh River	500%	600%
		S. Fk. Salmon R. Mainstem	200%	500%
	M. Fk. Salmon R.	Big Creek	40%	400%

ESU/DPS	MPG	Population	Percentage at or above 2018 Table 5 Habitat Quality Improvement (HQI)	
	Upper Salmon	E. Fk. Salmon River	200%	600%
		Lemhi River	400%	457%
		Pahsimeroi River	151%	171%
		Salmon River lower mainstem below Redfish Lake	300%	300%
		Salmon River upper Mainstem above Redfish Lake	36%	100%
		Valley Creek	1300%	1900%
		Yankee Fork	0%	143%

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 on fish, initial results 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 identified the life stages for spring-summer Chinook (e.g., parr-to-smolt) that benefit from these actions. In general, results in the literature demonstrate that survival is higher in watersheds with less disturbance and that have been treated (Paulsen and Fisher 2005). 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.

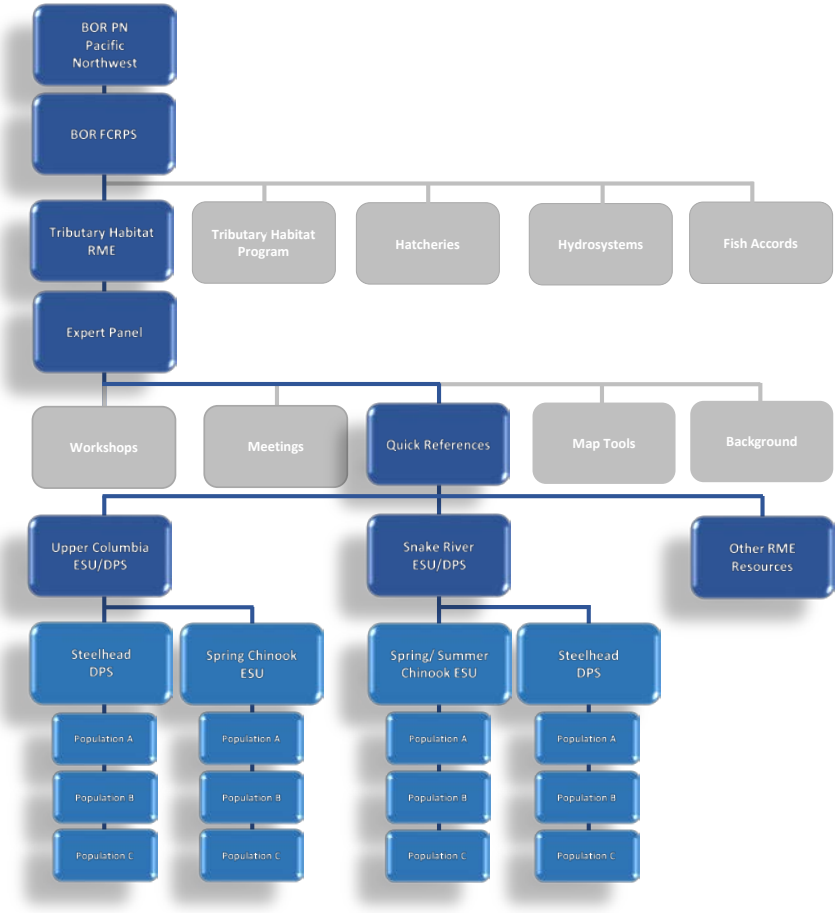

Figure 2. Flow diagram of Bureau of Reclamation website to RM&E information organized down to the population level.

Request for RM&E

In an effort to provide as comprehensive a RM&E reference to the panels, the AAs requested that watershed group members, agencies, tribes and participants share available data and information. The objective being 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 Spring-Summer Chinook

The Snake River Spring-Summer Chinook ESU contains five major population groups (MPGs) with 28 extant populations excluding three functionally extirpated populations (Asotin, Big Sheep, and Panther creeks). There are 72 assessments units (AUs) that have been identified for this ESU by the expert panels (Figure 3). The Snake River spring-summer Chinook salmon ESU includes all naturally spawned

populations of spring-summer Chinook salmon in the mainstem Snake River and the Tucannon River, Grande Ronde River, Imnaha River, and Salmon River subbasins (NMFS 2011a). Fifteen artificial propagation programs are also considered to be part of the ESU: the Tucannon River conventional Hatchery, Tucannon River Captive Broodstock Program, Lostine River, Catherine Creek, Lookingglass Hatchery Reintroduction Program (Catherine Creek stock), Upper Grande Ronde, Imnaha River, Big Sheep Creek, McCall Hatchery, Johnson Creek Artificial Propagation Enhancement, Lemhi River Captive Rearing Experiment, Pahsimeroi Hatchery, East Fork Captive Rearing Experiment, West Fork Yankee Fork Captive Rearing Experiment, and the Sawtooth Hatchery spring/summer-run Chinook hatchery programs (NMFS 2011a).

The initial expert panel for the Snake River Spring-Summer Chinook ESU identified 21 limiting factors/ecological concerns (ecological concern subcategories) and their current habitat function for spring-summer Chinook. Based on these limiting factors/ecological concerns a suite of habitat actions (that are evaluated by the expert panels) have been implemented. Every three years, the expert panels evaluate the implemented actions and assess additional actions for their benefits to fish. The evaluation of actions that have been implemented happens during the "look back." The evaluation of additional projects proposed for implementation is called the "look forward." Combined, 792 habitat improvement actions have been completed or are planned in 45 of the 72 AUs in the Snake River ESU. In the sections that follow, we discuss the limiting factors/ecological concerns and planned habitat improvement actions in the Lower Snake, Grande Ronde/Imnaha, South Fork Salmon, Middle Fork Salmon and Upper Salmon MPGs for spring-summer Chinook salmon. Assembling existing RM&E resources for the Snake River expert panels will follow the intersection of completed and planned actions within an AU and the limiting factors/ecological concerns that are addressed.

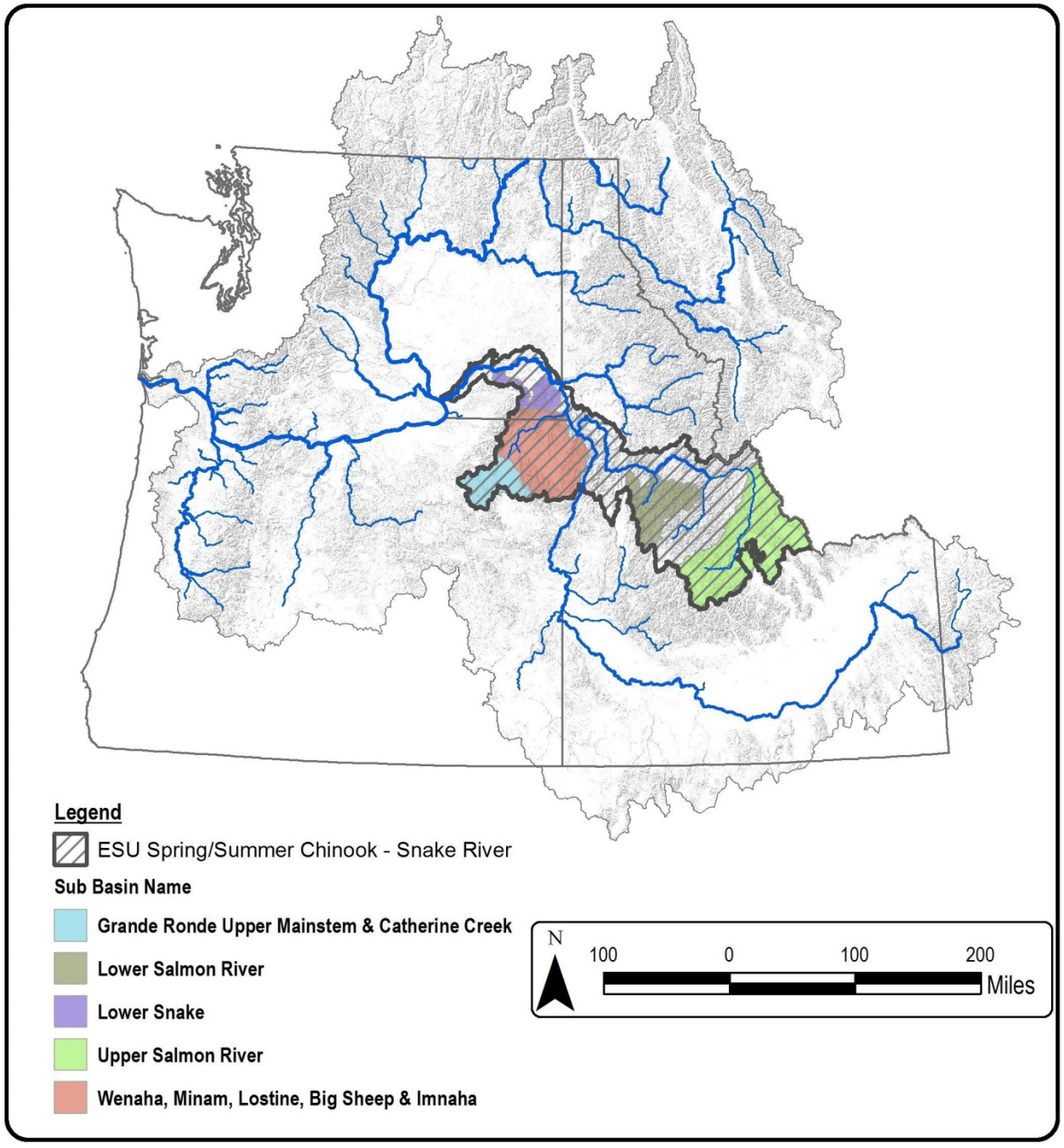

Figure 3. Display of the Snake River spring-summer Chinook ESU and populations involved in the expert panel process.

Grande Ronde/Imnaha

Grande Ronde Upper Mainstem & Catherine Creek Populations

These two populations were grouped together because they represent a separate expert panel workshop apart from the other populations of the Grande Ronde/ Imnaha MPG. The Grande Ronde upper mainstem and Catherine Creek populations contain 19 AUs with 262 planned habitat improvement actions within 16 AUs (Table 1; 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 lower and middle Catherine Creek and middle Grande Ronde mainstem AUs. Limiting factors/ecological concerns identified for the Grande Ronde and Catherine Creek populations are presented in Table 2.

Table 2. Assessment unit names, codes and weight (in percent) along with the number of planned habitat improvement actions for the Grande Ronde upper mainstem and Catherine Creek populations of the Snake River spring-summer Chinook ESU.

AU Code	Assessment Unit Names	Assessment Unit Weight (%)	2013-2018 Planned Restoration Actions
CCC1	Indian Creek	5.0%	2
CCC2A	Lower Catherine Creek (Mouth of Indian Ck. to State Ditch Div.)	5.0%	22
CCC2B	Lower Catherine Creek (State Ditch Div. to old GR River conf.)	10.0%	20
CCC2C	Lower Catherine Creek (old Grande Ronde River conf. to Pyles Cr)	15.0%	44
CCC3A	Middle Catherine Creek (Pyles Cr. To Swackhammer Diversion)	20.0%	42
CCC3B	Middle Catherine Creek (Swackhammer Diversion to N. & S Forks)	25.0%	30
CCC4	Lower & Middle Catherine Cr. Tributaries	5.0%	0
CCC5	N. & S. Forks Catherine Cr.	15.0%	9
	Total	**100.0%**	**169**
UGC1A	Middle GR Mainstem (Five-Points Cr)	5.0%	0
UGC1B	Middle GR Mainstem (Mouth of St. Ditch to Five-Pts. Cr.)- excl. 5-Pts. Cr.	3.0%	20
UGC2	Middle GR Mainstem (Five-Points Cr. To Meadow Cr.)	7.0%	39
UGC3A	Beaver Creek	5.0%	5
UGC3B	Fly Creek	7.0%	0
UGC4	Meadow Cr. and Tributaries	10.0%	9
UGC5	UGR Mainstream (Meadow Cr. To Sheep Cr.)	19.0%	7
UGC6	UGR Mainstem (Sheep Cr. To Meadowbrook Cr.)	20.0%	3
UGC7	UGR & Tribs. (Meadowbrook Cr. To E. Fk.; Clear Cr. & E. Fk.)	12.0%	1
UGC8	Sheep Cr. & Chicken Cr.	7.0%	5
UGC9	Limber Jim & Tribs. & Meadowbrook Cr.	5.0%	4
	Total	**100.0%**	**93**

The most widespread and numerous limiting factors/ecological concerns noted for these two populations are channel structure and form, riparian condition, habitat quantity, water quantity and water quality (Table 2). Channel structure and form, or more specifically, instream structural complexity is a limiting factor/ecological concern that occurs in all AUs while poor bed and channel form conditions occur in ten AUs. Large woody debris (LWD) recruitment also occurs in all AUs while poor riparian conditions occur in all except one. Similarly, increased sediment quantity occurs in all AUs while increased stream temperatures occur in all AUs but one. Limiting factors/ecological concerns like migration barriers and decreased water quantity are nearly as widespread occurring in 13 and 14 AUs, respectively. The remaining limiting factors/ecological concerns appear to be more localized.

There are 262 habitat improvement actions planned between 2013 and 2018 covering seven major limiting factors/ecological concerns in the Grande Ronde and Catherine Creek populations (Table 3). The priority for assembling existing RM&E resources for the expert panel follows the intersection of currently planned actions with limiting factors/ecological concerns that will be addressed in those sixteen AUs.

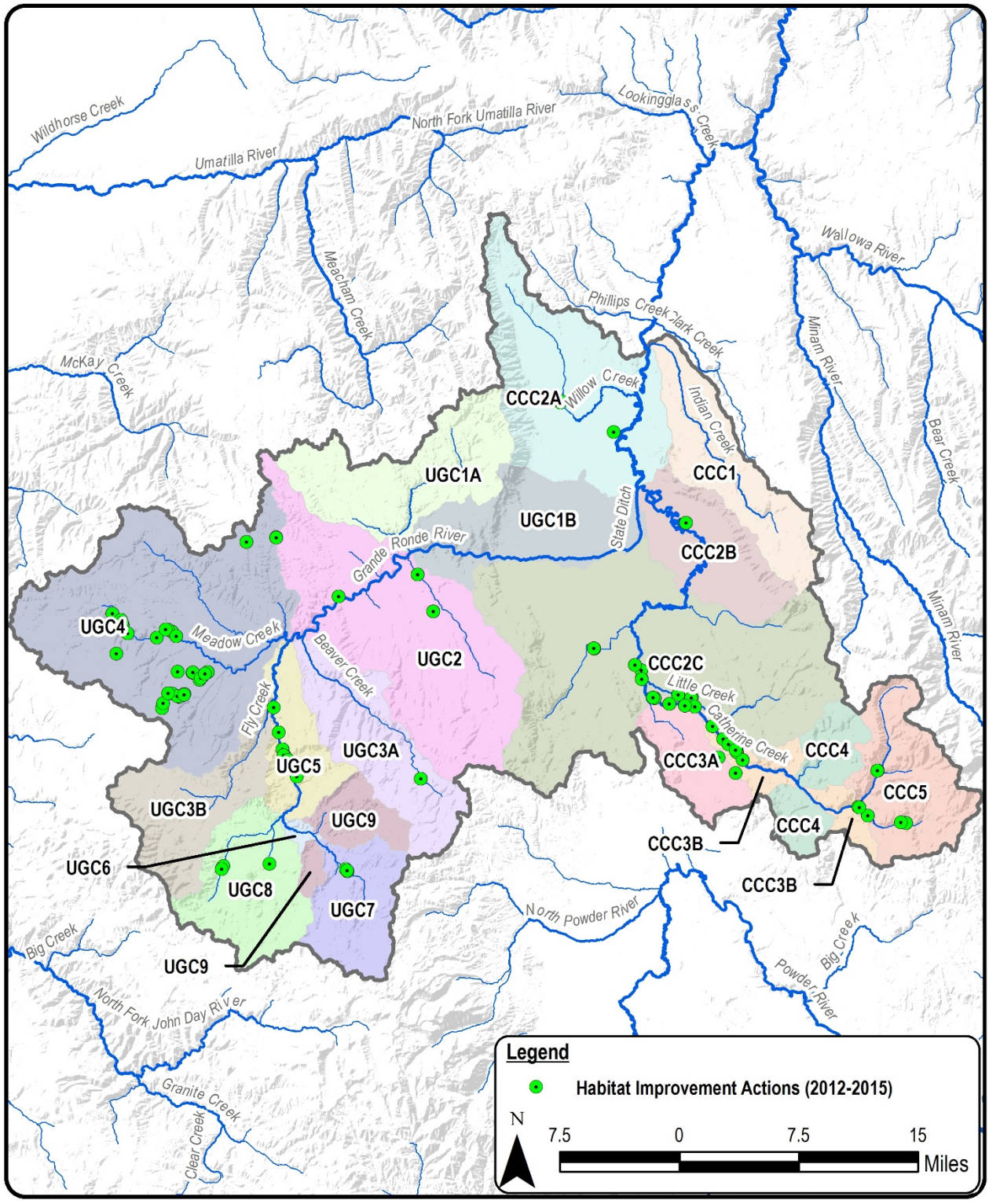

Figure 4. Grande Ronde upper mainstem and Catherine Creek populations displaying AU level boundaries and locations of habitat improvement actions.

Table 3. Limiting factors/ecological concerns identified by an "X" for ecological sub-categories in AUs of the Grande Ronde upper mainstem and Catherine Creek 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**
CCC1	Indian Creek	X										X	X					X	X		X	X								X					
CCC2A	Lower Catherine Creek (Indian Cr to St. Ditch Div.)	X			X						X	X	X	X	X			X	X		X	X	X							X					
CCC2B	Lower Catherine Creek (St. Ditch Div. to old GR Riv. conf.)	X			X						X	X	X	X	X			X	X		X	X	X							X					
CCC2C	Lower Catherine Creek (old GR River conf. to Pyles Cr)	X			X					X		X	X	X	X			X	X		X	X	X							X					
CCC3A	Middle Catherine Creek (Pyles Cr. To Swackhammer Div.)	X										X	X	X	X			X	X		X	X	X		X					X					
CCC3B	Middle Catherine Creek (Swackhammer Div. to N & S Fks.)	X										X	X	X	X			X	X		X	X								X					
CCC4	Lower & Middle Catherine Cr. Tributaries											X	X						X		X	X								X					
CCC5	North & South Forks Catherine Creek	X										X	X						X		X	X								X					
UGC1A	Middle GR Mainstem (Five-Points Cr)	X										X	X					X	X		X	X								X					
UGC1B	Middle GR Mainstem (Mouth of St. Ditch to 5-Pts. Cr.)	X										X	X					X	X		X	X								X					
UGC2	Middle GR Mainstem (Five-Points Cr. To Meadow Cr.)	X										X	X					X	X		X	X								X					
UGC3A	Beaver Creek	X									X	X	X						X		X	X													
UGC3B	Fly Creek											X	X						X		X	X													
UGC4	Meadow Creek and Tribs	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**
UGC5	UGR Mainstream (Meadow Cr. - Sheep Cr.)	X										X	X						X		X	X								X					
UGC6	UGR Mainstem (Sheep Cr. - Meadowbrook Cr.)												X						X		X	X								X					
UGC7	UGR & Tribs. (Meadowbrook Cr. - E. Fk. Clear Cr. & E. Fk.)											X	X						X		X														
UGC8	Sheep Cr. & Chicken Cr.											X	X						X		X	X													
UGC9	Limber Jim & Tribs. & Meadowbrook Cr.											X	X						X		X	X													
All AU Totals		**13**	**0**	**0**	**3**	**0**	**0**	**0**	**0**	**1**	**3**	**18**	**19**	**5**	**5**	**0**	**0**	**10**	**19**	**0**	**19**	**18**	**4**	**0**	**1**	**0**	**0**	**0**	**0**	**14**	**0**	**0**	**0**	**0**	**0**

Table 4. Number of planned habitat improvement actions in the Upper Grande Ronde and Catherine Creek 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
CCC1	Indian Creek											2																							
CCC2A	Lower Catherine Creek (Indian Cr. to St. Ditch Div.)	1										5	1	3	1			1	2		2	4								2					
CCC2B	Lower Catherine Creek (St. Ditch Div. to old GR River conf.)	1										4	4	3	1			1	1			3								2					
CCC2C	Lower Catherine Creek (old GR River conf. to Pyles Cr)	9										5	5	4	1			4	6		3	5								2					
CCC3A	Middle Catherine Creek (Pyles Cr. To Swackhammer Div.)	1										7		6	4			5	5		5	7								2					
CCC3B	Middle Catherine Creek (Swackhammer Div. to N. & S Forks)	2										3	3	3	3			3	3		3	4								3					
CCC4	Lower & Middle Catherine Cr. Tributaries																																		
CCC5	N. & S. Forks Catherine Cr.	1										3									4									1					
UGC1A	Middle GR Mainstem (Five-Points Cr)																																		
UGC1B	Middle GR Mainstem (Mouth of State Ditch to Five-Points Cr)- excludes Five-Points Cr.	1										3	3					3	3		4	1								2					
UGC2	Middle GR Mainstem (Five-Points Cr. To Meadow Cr.)	2										7	5					5	7		6	5								2					
UGC3A	Beaver Creek	1										1							1		1	1													
UGC3B	Fly Creek																																		

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**
UGC4	Meadow Creek and Tribs	1																	3		5														
UGC5	UGR Mainstream (Meadow Cr. To Sheep Cr.)											1							1		3	1								1					
UGC6	UGR Mainstem (Sheep Cr. To Meadowbrook Cr.)											1										1								1					
UGC7	UGR & Tribs. (Meadowbrook Cr. To E. Fk.; Clear Cr. & E. Fk.)																				1														
UGC8	Sheep Cr. & Chicken Cr.											2	1						1		1														
UGC9	Limber Jim & Tribs. & Meadowbrook Creek											1	1						1		1														
All AU Totals		**20**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**45**	**23**	**19**	**10**	**0**	**0**	**22**	**34**	**0**	**39**	**32**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**18**	**0**	**0**	**0**	**0**	**0**

Wenaha, Minam, Lostine, Big Sheep & Imnaha Populations

The Wenaha, Minam, Wallowa-Lostine and Imnaha populations have been grouped together because they represent a separate expert panel workshop apart from the Grande Ronde and Catherine Creek populations. Big Sheep Creek and Lookingglass Creek are functionally extirpated populations; however, they are maintained within the list because habitat improvement actions are credited in the 2008 BiOp. The mainstem Lower Grande Ronde and its tributaries (MCC1 and MCC2) are not classified as populations per se but are recognized here as part of the migration corridor for the Grande Ronde River system. There are 25 AUs covering this geographic area with 22 planned habitat improvement actions within 8 of the AUs (Table 4; Figure 5). These planned habitat improvement actions have been or will be completed by the end of 2018. Most of the habitat improvement actions are concentrated within the Lostine and Big Sheep Creek AUs. Limiting factors/ecological concerns identified for these AUs are presented in Table 5.

Table 5. Assessment unit names, codes and weight (in percent) along with the number of planned habitat improvement actions for the Big Sheep, Lookingglass, Imnaha, Wenaha, Minam, and Lostine populations.

AU Code	Assessment Unit	Assessment Unit Weight (%)	2013-2018 Planned Restoration Actions
WRC1	Lower Wenaha River	42.1%	0
WRC2	Lower Wenaha River Tributaries	23.2%	0
WRC3	Wenaha River Forks	34.7%	0
	Total	**100.0%**	**0**
MRC1	Lower Minam River (mouth to Cougar Creek)	18.3%	0
MRC2	Lower Minam River (Cougar Creek to Little Minam River)	19.1%	0
MRC3	Lower Minam River (Little Minam River to headwaters)	53.0%	0
MRC4	Little Minam River (mouth to headwaters)	9.6%	0
	Total	**100.0%**	**0**
WLC1	Lower Wallowa River (Minam River & Howard Creek)	9.9%	0
WLC2	Middle Wallowa River (Minam R. to Dry Cr. & Deer Cr.)	10.2%	0
WLC3	Upper Wallowa River (Dry Creek to Wallowa Lake)	30.0%	6
WLC4	Hurricane Creek	3.8%	1
WLC5	Prairie Creek	7.7%	0
WLC6	Bear Creek	14.8%	1
WLC7	Lower Lostine River (Mouth to Silver Creek)	12.6%	4
WLC8	Upper Lostine River (Silver Creek To Headwaters)	11.2%	0
	Total	**100.0%**	**12**
IRC1	Lower Imnaha Mainstem	35.5%	0
IRC2	Cow, Lightening & Horse Creeks	22.7%	0
IRC3	Upper Imnaha River Mainstem	37.7%	0
IRC4	Upper Imnaha River Tributaries	4.2%	3
	Total	**100.0%**	**3**
BSC1	Lower Big Sheep and Little Sheep Creeks	44.2%	3
BSC2	Upper Big Sheep Creek	34.1%	0
BSC3	Big Sheep Creek Tributaries	21.7%	3
	Total	**100.0%**	**6**
LGC1	Lookingglass Creek	100.0%	0
	Total	**100.0%**	**0**
MCC1	Mainstem Lower Grande Ronde River	84.3%	0
MCC2	Lower Grande Ronde Tributaries	15.7%	1
	Total	**100.0%**	**1**

The most common major limiting factors/ecological concerns noted for these populations are channel structure and form, sediment conditions and water quality for spring-summer Chinook (Table 5). Channel structure and form identified as a lack of instream structural complexity occurs in all but five AUs while poor sediment and temperature conditions occur in all but seven of the twenty-five AUs. Less common were limiting factors/ecological concerns noted for water quantity, habitat quantity, riparian condition, and peripheral and transitional habitats. Although not as common, limiting factors/ecological concerns like migration barriers, decreased water quantity, and low dissolved oxygen (DO) were present in nearly half of the AUs occurring most in the Wallow-Lostine, Imnaha and Big Sheep Creek populations. Limiting factors/ecological concerns such as riparian and floodplain condition, bed and channel form as well as increased water quantity were less common (Table 5).

There are 22 habitat improvement actions planned for implementation between 2013and 2018 covering four major limiting factors/ecological concerns for spring-summer Chinook (Table 6). Most of the habitat improvement actions are focused on barrier removal in the Wallowa-Lostine, Imnaha and Big Sheep Creek while efforts to increase instream complexity and augment water quantity are the focus in the Wallowa-Lostine and Big Sheep Creek. Controlling sediment inputs is limited to tributaries of Big Sheep Creek. 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.

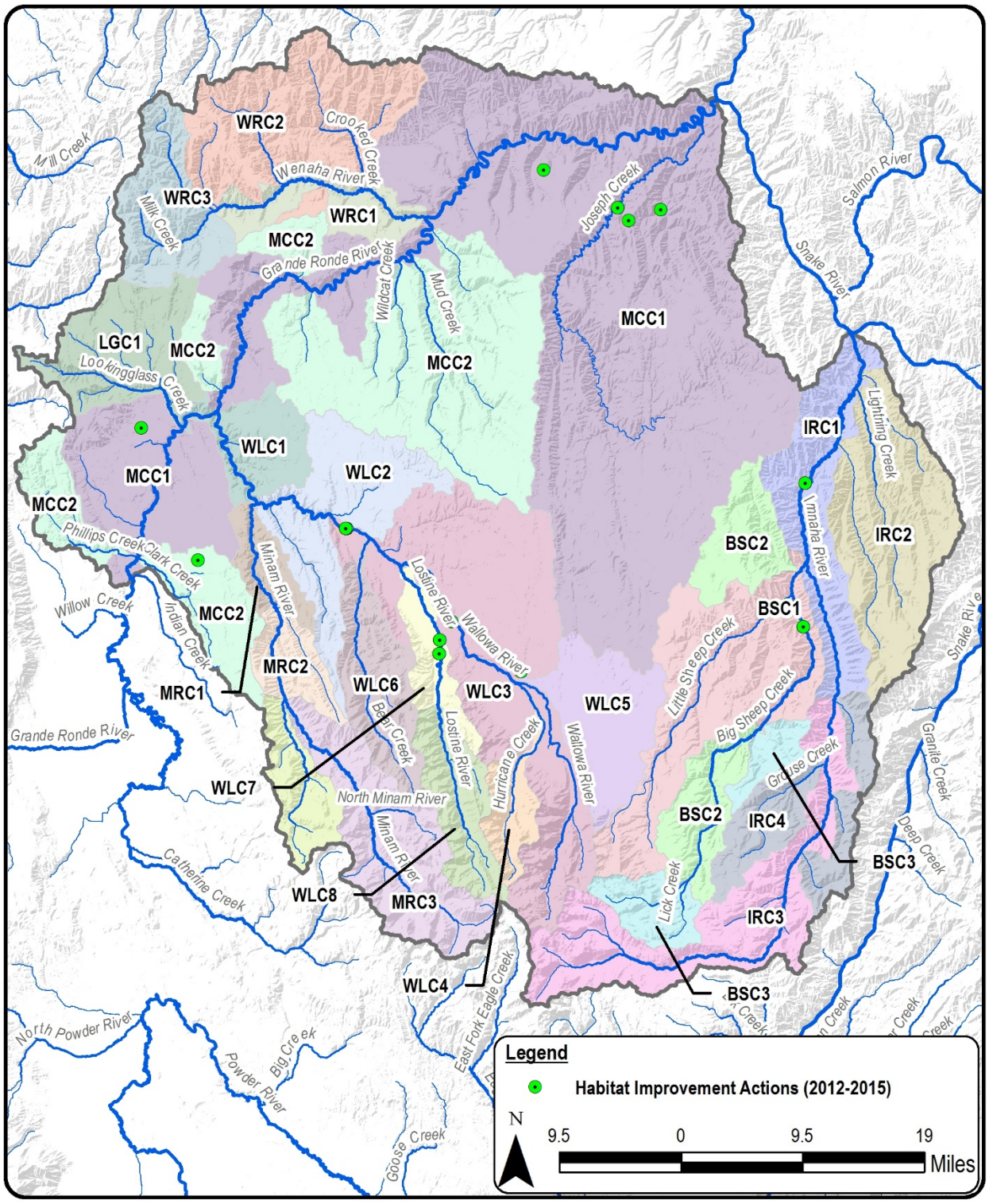

Figure 5. Wenaha, Minam, Lostine, Big Sheep and Imnaha populations displaying AU level boundaries and locations of habitat improvement actions.

Table 6. Limiting factors/ecological concerns identified by an "X" for ecological sub-categories in AUs of the Big Sheep, Wenaha, Minam, Lostine and Imnaha 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
WRC1	Lower Wenaha River																		X			X													
WRC2	Lower Wenaha River Tributaries																					X													
WRC3	Wenaha River Forks																																		
MRC1	Lower Minam River (mouth to Cougar Creek)																		X		X														
MRC2	Lower Minam River (Cougar Cr. to Little Minam River)																		X																
MRC3	Lower Minam River (Little Minam River to headwaters)																		X																
MRC4	Little Minam River (mouth to headwaters)																		X																
WLC1	Lower Wallowa River (Mouth to Minam R. & Howard Cr.)																		X		X	X								X					
WLC2	Middle Wallowa River (Minam R. to Dry Cr. And Deer Cr.)																		X		X	X													
WLC3	Upper Wallowa River (Dry Cr. To Wallowa Lake)	X										X						X	X		X	X	X							X					
WLC4	Hurricane Creek	X										X			X				X		X	X	X							X					
WLC5	Prairie Creek	X										X									X	X	X						X	X					
WLC6	Bear Creek	X																	X		X	X	X							X					
WLC7	Lower Lostine River (Mouth to Silver Cr.)	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**
WLC8	Upper Lostine River (Silver Cr. To Headwaters)																				X	X	X												
IRC1	Lower Imnaha Mainstem																				X	X	X							X					
IRC2	Cow, Lightening & Horse Cr.																	X	X		X	X													
IRC3	Upper Imnaha River Mainstem	X																	X		X	X	X												
IRC4	Upper Imnaha River Tribs.	X										X						X	X		X	X	X						X	X					
BSC1	Lower Big Sheep and Little Sheep Creeks																		X		X	X	X							X					
BSC2	Upper Big Sheep Creek	X																	X		X	X	X							X					
BSC3	Big Sheep Creek Tributaries	X													X			X	X		X		X												
LGC1	Lookingglass Creek	X																	X																
MCC1	Mainstem Lower Grande Ronde River											X							X		X	X								X					
MCC2	Lower Grande Ronde Tributaries	X										X							X		X	X								X					
All AU Totals		**11**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**6**	**0**	**0**	**2**	**0**	**0**	**4**	**20**	**0**	**18**	**18**	**12**	**0**	**0**	**0**	**0**	**0**	**2**	**12**	**0**	**0**	**0**	**0**	**0**

Table 7. 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
WRC1	Lower Wenaha River																																		
WRC2	Lower Wenaha River Tributaries																																		
WRC3	Wenaha River Forks																																		
MRC1	Lower Minam River (mouth to Couger Creek)																																		
MRC2	Lower Minam River (Couger Cr. to Little Minam River)																																		
MRC3	Lower Minam River (Little Minam River to headwaters)																																		
MRC4	Little Minam River (mouth to headwaters)																																		
WLC1	Lower Wallowa River (Mouth to Minam R. & Howard Cr.)																																		
WLC2	Middle Wallowa River (Minam R. to Dry Cr. And Deer Cr.)																																		
WLC3	Upper Wallowa River (Dry Cr. to Wallowa Lake)	4																	1											1					
WLC4	Hurricane Creek																		1																
WLC5	Prairie Creek																																		
WLC6	Bear Creek	1																																	
WLC7	Lower Lostine River (Mouth to Silver Cr.)	1																	1											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**
WLC8	Upper Lostine River (Silver Cr. to Headwaters)																																		
IRC1	Lower Imnaha Mainstem																																		
IRC2	Cow, Lightening & Horse Cr.																																		
IRC3	Upper Imnaha River Mainstem																																		
IRC4	Upper Imnaha River Tribs.	3																																	
BSC1	Lower Big Sheep and Little Sheep Creeks	2																												1					
BSC2	Upper Big Sheep Creek																																		
BSC3	Big Sheep Creek Tributaries	2																			1														
LGC1	Lookingglass Creek																																		
MCC1	Mainstem Lower Grande Ronde River																																		
MCC2	Lower Grande Ronde Tributaries	1																																	
All AU Totals		**14**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**3**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**4**	**0**	**0**	**0**	**0**	**0**

Lower Snake

The Lower Snake spring-summer Chinook MPG contains three AUs with 55 planned habitat improvement actions within two of the AUs (Table 7; Figure 6). Asotin Creek has been identified as extirpated (NOAA Fisheries 2011a). Most of the planned habitat improvement actions occur within the upper Tucannon AU (Table 7). Limiting factors/ecological concerns identified for these AUs are presented in Table 8.

Table 8. 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 Spring-Summer Chinook ESU.

AU Code	Assessment Units	Assessment Unit Weight (%)	2013-2018 Restoration Actions
ACC1	Asotin Creek	100.0%	1
	Total	**100.0%**	**1**
TUC1A	Upper Tucannon - Pataha up to Panjab	80.0%	54
TUC1B	Lower Tucannon - Mouth to Pataha	20.0%	0
	Total	**100.0%**	**54**

There are several widespread limiting factors/ecological concerns identified for 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 spring-summer Chinook (Table 8). Additional impacts to salmon from mechanical injury and changes in life history patterns have also been noted in the Tucannon.

There are 55 habitat improvement actions planned for implementation between 2013 and 2018 covering six major limiting factors/ecological concerns in the Lower Snake spring-summer Chinook MPG (Table 9). 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.

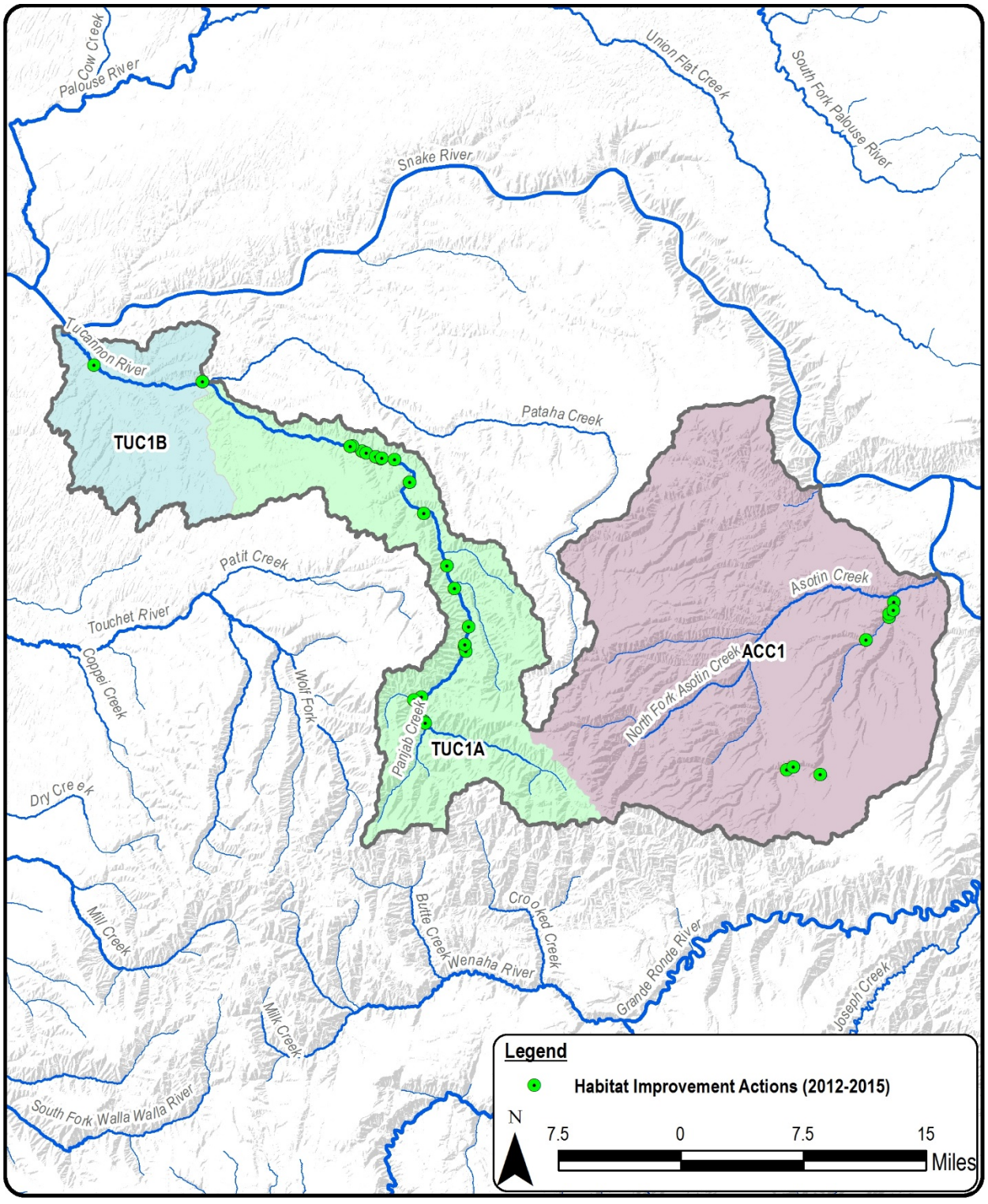

Figure 6. Asotin and Tucannon spring-summer Chinook populations displaying AU level boundaries and locations of habitat improvement actions.

Table 9. Limiting factors/ecological concerns identified by an "X" for ecological sub-categories in AUs of the Lower Snake spring-summer Chinook 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**
ACC1	Asotin Creek	X										X			X			X	X		X	X			X					X					
TUC1A	Upper Tucannon (Pataha up to Panjab)	X					X					X			X			X	X		X	X			X					X					X
TUC1B	Lower Tucannon (Mouth to Pataha)	X					X					X			X			X	X		X	X			X					X					X
All AU Totals		**3**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**3**	**0**	**0**	**3**	**0**	**0**	**3**	**3**	**0**	**3**	**3**	**0**	**0**	**3**	**0**	**0**	**0**	**0**	**3**	**0**	**0**	**0**	**0**	**2**

Table 10. Number of planned habitat improvement actions in the Lower Snake spring-summer Chinook MPG for the period of 2013-2018 organized by the 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**
ACC1	Asotin Creek	1																																	
TUC1A	Upper Tucannon (Pataha up to Panjab)											2			21				27			1			2					1					
TUC1B	Lower Tucannon (Mouth to Pataha)																																		
All AU Totals		**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**21**	**0**	**0**	**0**	**27**	**0**	**0**	**1**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**

Lower Salmon River

The South Fork and Middle Fork Salmon River MPGs are combined and are referred to as the Lower Salmon River because they represent a separate expert panel workshop distinct from the Upper Salmon River MPG. The Secesh, East Fork of the South Fork Salmon, South Fork Mainstem and Big Creek are four of the 13 populations contained in these two MPGs represented in the expert panel process. With the exception of the Little Salmon River, the remaining populations are largely contained within the wilderness area of the Middle Fork Salmon River. The four lower Salmon populations evaluated in the expert panel process contain eight AUs with 22 planned habitat improvement actions within six of the AUs (Table 10; Figure 7).

Table 11. Assessment unit names, codes and weight in percent along with the number of planned habitat improvement actions for the South Fork and Middle Fork Salmon MPGs of the Snake River Spring-Summer Chinook ESU.

AU Code	Assessment Units	Assessment Unit Weight (%)	2013-2018 Restoration Actions
SEC1	Secesh River	100.0%	4
	Total	**100.0%**	**4**
SSC1A	EFSF Salmon and Tribs	14.1%	0
SSC1B	Johnson Creek	38.1%	5
SSC2	Upper SF Salmon Tribs above EFSF Salmon (High Idaho Batholith Tribs - from the headwaters to the mouth of EFSF Salmon)	1.2%	5
SSC3	Lower SF Salmon Tribs below EFSF Salmon (Hot Dry Canyon Tribs - from mouth of EFSF Salmon to mouth of SF Salmon)	8.3%	1
SSC4	Mainstem SF Salmon	38.3%	1
	Total	**100.0%**	**12**
BCC1A	Lower Big Creek	42.0%	0
BCC1B	Upper Big Creek	58.0%	6
	Total	**100.0%**	**6**

The most common limiting factors/ecological concerns noted are increased sediment and migration barriers (Table 11). Increased sediment occurs in all AUs while migration barriers occur in all but three of the AUs. Stream temperature and toxic contaminants were identified in two AUs each. (Table 11).

There are 22 habitat improvement actions planned for implementation between 2013 and2018 covering three major limiting factors/ecological concerns in the South Fork and Middle Fork Salmon River spring-summer Chinook MPGs (Table 12). 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.

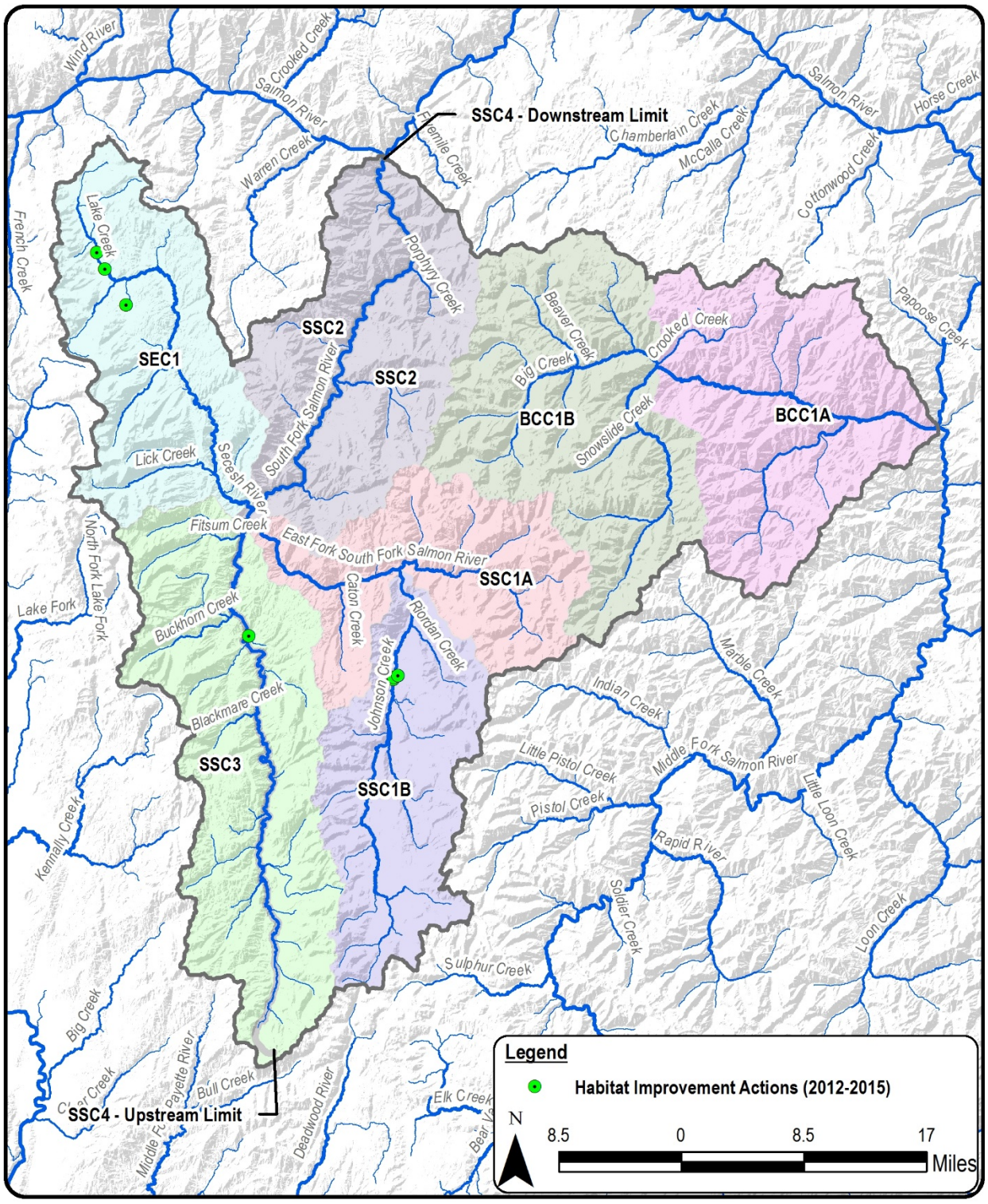

Figure 7. Display of the Lower Salmon River AU level boundaries and locations of habitat improvement actions.

Table 12. Limiting factors/ecological concerns identified by an "X" for ecological sub-categories in AUs of the South Fork and Middle Fork Salmon Snake River spring-summer Chinook MPGs. 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**
SEC1	Secesh River	X																			X														
SSC1A	EFSF Salmon and Tribs	X																			X	X						X							
SSC1B	Johnson Creek	X																			X	X													
SSC2	Upper SF Salmon Tribs above EFSF Salmon	X																			X														
SSC3	Lower SF Salmon Tribs below EFSF Salmon																				X														
SSC4	Mainstem SF Salmon																				X														
BCC1A	Lower Big Creek																				X														
BCC1B	Upper Big Creek	X																			X							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 13. 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**
SEC1	Secesh River	2																			2														
SSC1A	EFSF Salmon and Tribs																																		
SSC1B	Johnson Creek	3																			1	1													
SSC2	Upper SF Salmon Tribs above EFSF Salmon	1																			4														
SSC3	Lower SF Salmon Tribs below EFSF Salmon																				1														
SSC4	Mainstem SF Salmon																				1														
BCC1A	Lower Big Creek																																		
BCC1B	Upper Big Creek	3																			3														
All AU Totals		**9**	**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

The Upper Salmon River MPG contains 16 AUs with 496 planned habitat improvement actions within 13 of the AUs (Table 13; Figure 8). 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 MPG are presented in Table 14.

Table 14. Assessment unit names, codes and weight in percent along with the number of planned habitat improvement actions for the Upper Salmon River MPG of the Snake River Spring-Summer Chinook ESU.

AU Code	Assessment Unit	Assessment Unit Weight (%)	2013-2018 Restoration Actions
EFC1	East Fork Salmon River	100.0%	20
	Total	**100.0%**	**20**
LMC1	Challis Creek	6.0%	5
LMC2	Iron Creek	2.0%	0
LMC3	Mainstem Salmon River (including Basin Creek)	78.0%	0
LMC4	Morgan Creek	5.0%	1
LMC5	Squaw Creek	4.0%	0
LMC6	Remaining Lower Salmon Tributaries Bayhorse, Mill, Hat, Thompson, Slate, Gordon, Warm Springs Creek	5.0%	17
	Total	**100.0%**	**23**
LRC1	Lemhi tributaries and Carmen Creek	32.0%	154
LRC2	Lemhi, Hayden Creek, Big Springs Creek	68.0%	78
	Total	**100.0%**	**232**
PRC1	Pahsimeroi River and tributaries downstream from the mouth of Big Creek	54.0%	65
PRC2	Pahsimeroi River and tributaries upstream from the mouth of Big Ck. Including the Big Ck. Drainage	46.0%	13
	Total	**100.0%**	**143**
UMC1	Mainstem Upper Salmon River, Alturas Lake Creek, and Tributaries upstream from Alturas Lake Creek	89.9%	11
UMC2	Upper Salmon Tributaries with Significant water withdrawals (Fourth of July, Champion, Cleveland, Fisher, Warm, and Williams Creek	10.1%	4
	Total	**100.0%**	**15**
VCC1	Valley Creek	100.0%	5
	Total	**100.0%**	**5**
YFC2	West Fork Yankee Fork	27.4%	3
YFC3	Yankee Fork	72.6%	55
	Total	**100.0%**	**58**

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 14). 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 nineof the 16 AUs of the Upper Salmon River.

Habitat improvement actions proposed for implementation between 2013 and 2018 address eight major limiting factors/ecological concerns in the Upper Salmon River spring-summer Chinook MPG (Table 15). 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.

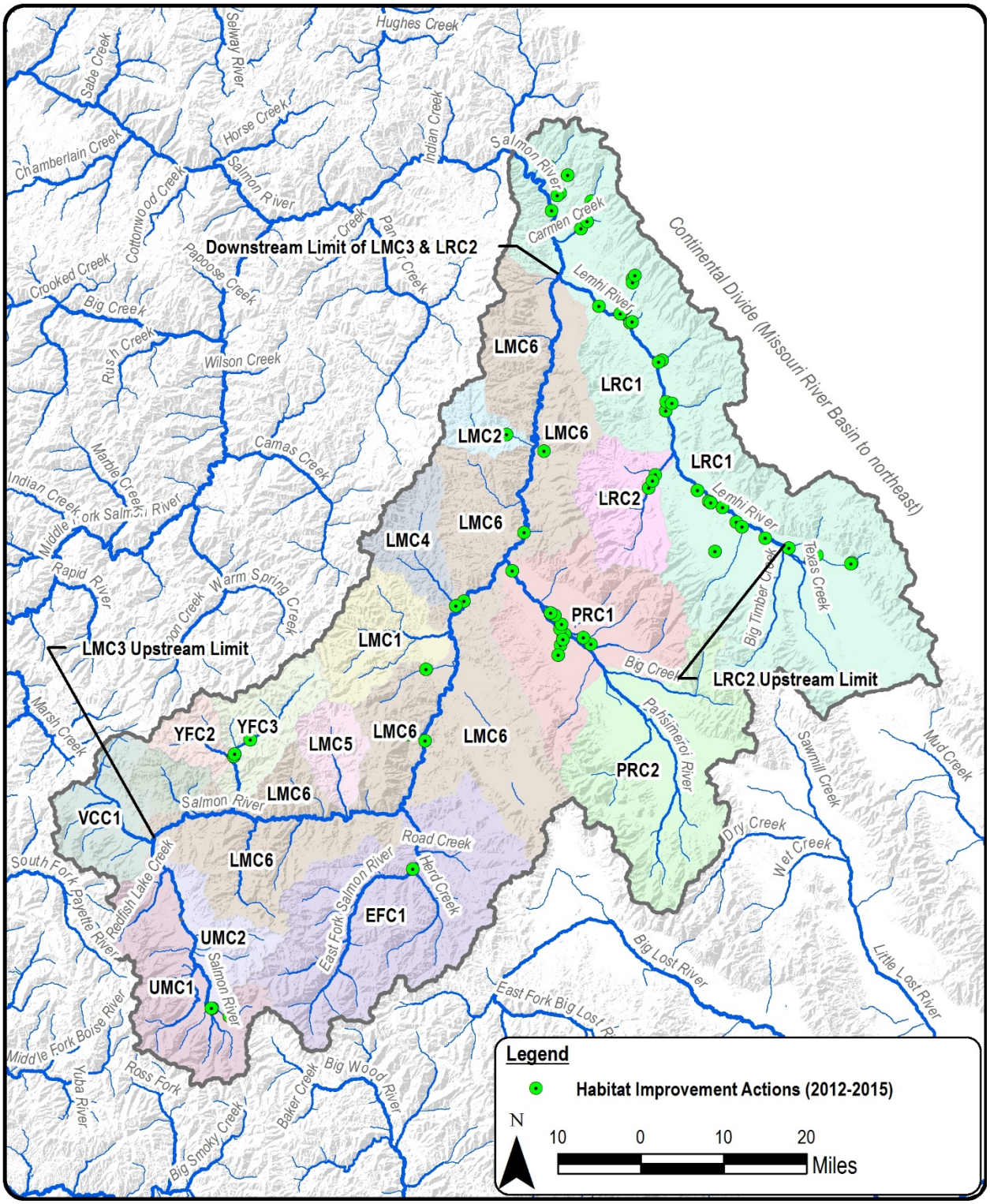

Figure 8. Display of the Upper Salmon River AU level boundaries and locations of habitat improvement actions.

Table 15. Limiting factors/ecological concerns identified by an "X" for ecological sub-categories in AUs of the Upper Salmon River spring-summer Chinook 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**
EFC1	EF Salmon River	X					X					X						X			X									X					
LRC1	Lemhi tribs & Carmen Ck.	X					X					X			X			X	X		X	X								X					
LRC2	Lemhi, Hayden Ck., Big Springs Ck.	X		X			X					X			X			X			X	X								X					
PRC1	Pahsimeroi R. & Tribs (Downstream from Big Ck.)	X		X			X					X						X			X	X								X					
PRC2	Pahsimeroi R. & Tribs (upstream from & including Big Ck.)	X					X					X									X									X					
LMC1	Challis Creek	X					X					X									X	X								X					
LMC2	Iron Creek											X																		X					
LMC3	Mainstem Salmon River (including Basin Creek)											X			X						X	X													
LMC4	Morgan Creek	X					X					X									X	X								X					
LMC5	Squaw Creek											X									X	X								X					
LMC6	Remaining L. Salmon Tribs. (Bayhorse, Mill, Hat, Thompson, Slate, Gordon, Warm Springs Ck.)	X					X					X									X									X					
UMC1	Mainstem Up.Salmon River (Alturas Lake Ck., and Tribs upstream from Alturas Lake Ck.)	X		X								X									X	X								X					
UMC2	Upper Salmon Tribs. (w/ sig. water withdrawals; Fourth of July, Champion, Cleveland, Fisher, Warm, and Williams Creek	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**
VCC1	Valley Creek	X		X			X					X							X		X	X								X					
YFC2	West Fork Yankee Fork														X			X	X																
YFC3	Yankee Fork												X		X			X	X	X															
		11	**0**	**5**	**0**	**0**	**10**	**0**	**0**	**0**	**0**	**14**	**1**	**0**	**5**	**0**	**0**	**6**	**4**	**1**	**13**	**9**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**13**	**0**	**0**	**0**	**0**	**0**

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**
EFC1	EF Salmon River	7					6											5												2					
LRC1	Lemhi tribs & Carmen Ck.	26					10					16			17			17	21		18	17								12					
LRC2	Lemhi, Hayden Ck., Big Springs Ck.	4					4					8			14			14			14	17								3					
PRC1	Pahsimeroi R. & Tribs (Downstream from Big Ck.)	9					2					9						15			9	15								6					
PRC2	Pahsimeroi R. & Tribs (upstream from & including Big Ck.)	8					1					1									1									2					
LMC1	Challis Creek	2										1										1								1					
LMC2	Iron Creek																																		
LMC3	Mainstem Salmon River (including Basin Creek)																																		
LMC4	Morgan Creek	1																																	
LMC5	Squaw Creek																																		
LMC6	Remaining L. Salmon Tribs. (Bayhorse, Mill, Hat, Thompson, Slate, Gordon, Warm Springs Ck.)	10					3					2									1									1					
UMC1	Mainstem Up.Salmon River (Alturas Lake Ck., and Tribs upstream from Alturas Lake Ck.)	5										4										1								1					
UMC2	Upper Salmon Tribs. (w/ sig. water withdrawals; Fourth of July, Champion, Cleveland, Fisher, Warm, and Williams Creek	2					1																							1					
VCC1	Valley Creek	1					1					1									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**
YFC1	Lightning Creek																																		
YFC2	West Fork Yankee Fork														1			1	1																
YFC3	Yankee Fork												13		13			13	13	3															
		75	**0**	**0**	**0**	**0**	**28**	**0**	**0**	**0**	**0**	**42**	**13**	**0**	**45**	**0**	**0**	**65**	**35**	**3**	**44**	**51**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**30**	**0**	**0**	**0**	**0**	**0**

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Appendices

Appendix 1. Ecological Concerns used to designate limiting factors/ecological concerns for Snake River spring-summer Chinook in the Grande Ronde/Imnaha, Lower Snake, South Fork Salmon, Middle Fork Salmon and Upper Salmon MPGs. Limiting factors/ecological concerns 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. Please contact Jude Trapani at jtrapani@usbr.gov and 208-940-0229.

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 / 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