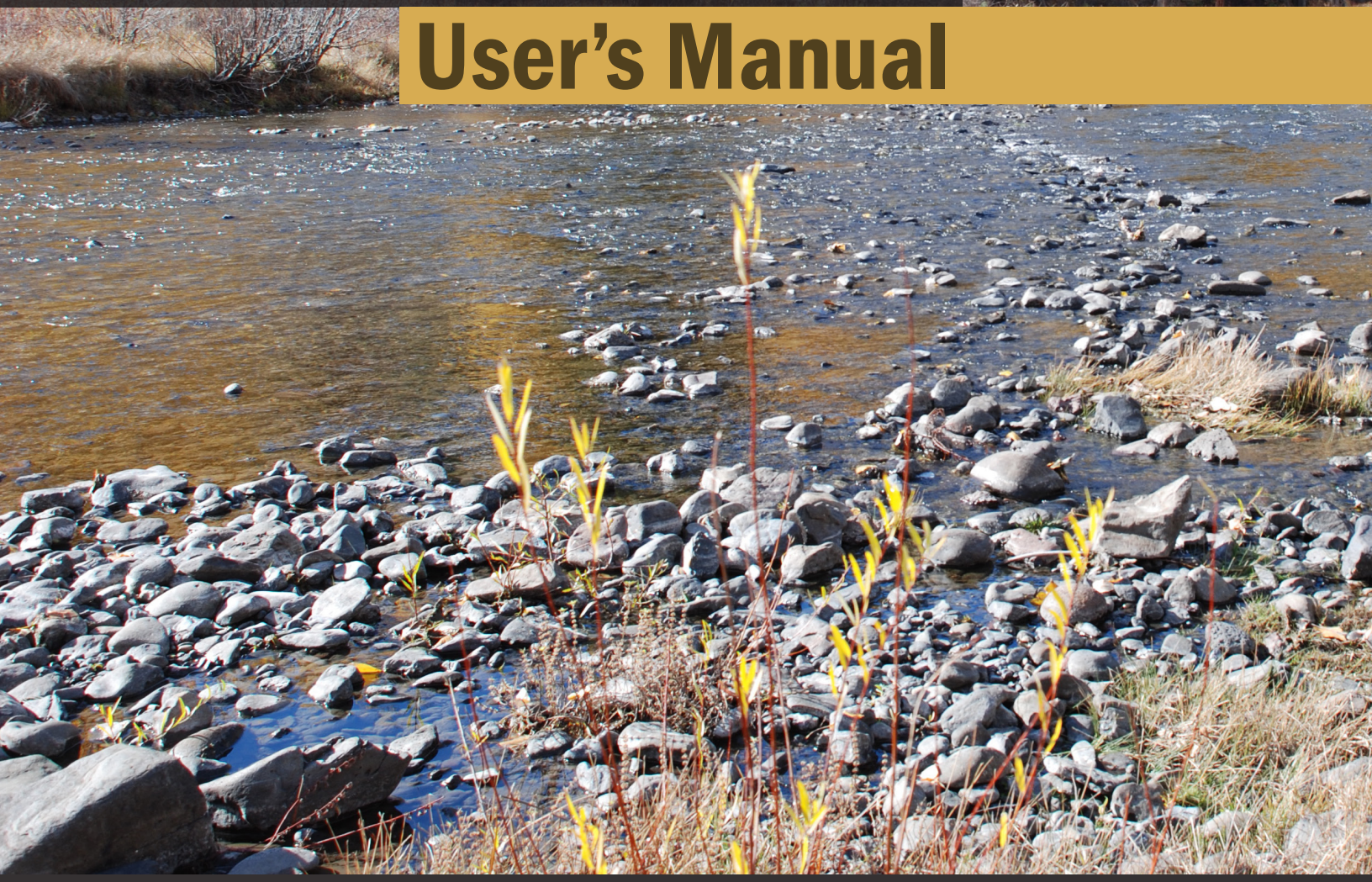
Bonneville
POWER ADMINISTRATION

Catherine Creek and Upper Grande Ronde River Atlas Restoration Prioritization Framework:

User's Manual



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TETRA TECH

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User's Manual

Prepared for:

Bonneville Power Administration
905 NE 11th Avenue
Portland, OR 97232

and

Atlas Partners

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Prepared by:

Tetra Tech, Inc.
19803 North Creek Parkway
Bothell, WA 98011

Atlas Partners

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GLOSSARY

Alluvial – a deposit of unconsolidated sediments left by flowing streams in a river channel, delta, estuary, or floodplain.

Biologically Significant Reaches (BSRs) – stream reaches with similar fish use and limiting factor characteristics used to aid in determining priority restoration work areas.

Channel Stability – a general term that refers to the resistance of bed and bank erosion in a river in response to changes in flow or sediment transport. Natural stream channels have varying degrees of stability. A naturally stable channel has the ability to transport water and sediment over time without an overall net increase in aggradation or incision. Under this definition, streams may migrate laterally if they maintain their natural dimensions (width, depth), pattern (sinuosity), and profile (gradient and bed features).

Channel Substrate – the composition of the river channel bed materials within the active channel.

Clean Water Act (CWA) – the primary federal law in the United States governing water pollution.

Confinement – a general term used to describe the degree to which a stream is laterally contained. Confinement boundaries may include natural high terraces and hillslopes, or artificial features such as levees.

Diversion Screen – devices installed at surface water diversions to physically preclude passage of fish into the intake to prevent injury and entrainment.

Ecological Node – a smaller geographic area within a lower ranked (Tier 2 or Tier 3) biologically significant reach that may have significant fish use based on close proximity to known spawning habitat, refuge habitat (thermal refugia, hiding cover, or available floodplain), or important tributary junctions. Restoration work in these areas may not provide immediate benefits for focal fish species, but may provide an opportunity for experimental techniques that may provide refuge habitat until root causes of low fish survival are determined.

Embeddedness – the extent to which larger cobbles or gravel are surrounded by or covered by fine sediment.

Endangered Species Act (ESA) – a 1973 Act of Congress that mandated that endangered and threatened species of fish, wildlife, and plants be protected and restored.

Enhancement –actions designed to increase, or further improve the quality, value, or extent of particular habitat features that are already present.

Entrenchment – the degree to which a stream is vertically confined from its floodplain. Usually expressed as the ratio of the width of the flood-prone area to the bankfull width, in which higher entrenchment ratios indicate higher floodplain connectivity. May be impacted by both human and natural causes.

Expert Panel – scientific panels formed by Bonneville Power Administration and the Bureau of Reclamation to assist prioritizing limiting factors, establishing habitat baselines, and habitat improvement goals directed toward meeting the objectives of the FCRPS BiOP implementation strategy.

FCRPS BiOP – Federal Columbia River Power System Biological Opinion.

FLIR – forward looking infrared sensing to determine stream temperature distribution along a stream corridor at a single point in time.

Flood Refugia – areas of lower water velocity during higher discharges. Also referred to as high-flow refugia.

Floodplain – the areas of land adjacent to a river extending out to the enclosing valley walls that are inundated with water during flood events. Soils within the floodplain are largely made up of alluvium from river deposits.

Floodplain Connectivity – a general description of the degree of interaction river flows have with the floodplain at a range of flows.

Focal Fish Species – fish species that are identified as at risk based on ESA criteria, and toward which restoration and enhancement actions are directed. For the Atlas, they include Snake River spring Chinook salmon, Snake River summer steelhead, and Columbia River bull trout.

Geomorphic Potential – a ranking value assigned by assessing existing data layers and evaluating the degree to which channel process and form in a reach are functioning or could be improved to support in-channel, off-channel, and floodplain habitats.

Geomorphology – the study of the physical features of the surface of the earth and their relation to its geological structures.

Incised River – a river that cuts its channel through the bed of the valley floor, as opposed to one flowing on a floodplain. Formed by the process of degradation and sometimes expressed as the ratio of the stream's low bank height to bankfull height.

Limiting Factors – physical, biological, or chemical features experienced by fish that result in reductions in viable salmonid population parameters (abundance, productivity, spatial structure, and diversity).

Meander Belt Width – the width between points of inflection defining the lateral extents of opposing meanders over which the stream naturally moves over time. This width does not necessarily correspond with the width of the valley.

Off-Channel Habitat – habitat that is not part of the active channel, but has a direct connection to it.

Point of Diversion – the location at which surface water is diverted from a source as specified in a legal water right.

P-score – a cumulative score assigned within a biologically significant reach based on the number of life stages present for each of the three focal fish species as identified in the periodicity (thus "P" – score) tables.

Pool Frequency – a measure of the pool-to-pool spacing in a river channel.

Rearing – refers to the period of time and/or locations (rearing habitat) that juvenile fish spend feeding in nursery areas of rivers, lakes, streams and estuaries before migration.

Restoration – renewing or repairing of a natural system so that its functions and qualities are comparable to its original, unaltered state.

Riparian Zone – a riparian zone (or riparian area) is the interface between upland lands and a river or stream.

River Miles – number of miles from the mouth of a river to a specific destination.

Streambank – the terrain alongside the bed of a river that comprises the sides of the channel.

Subbasin – a structural geologic feature where a basin forms within a larger basin. Described by the USGS as a 4th level, 8-digit hydrologic unit code

Total Maximum Daily Load (TMDL) – a calculation of the maximum amount of a pollutant that a waterbody can receive and still meet water quality standards, and an allocation of that load among the various sources of that pollutant.

Turbidity – a measure of water clarity or how much the material suspended in water decreases the passage of light through the water.

U-score – a cumulative score assigned within a biologically significant reach based on fish life stage utilization (thus "U" – score) rankings.

Watershed – an area or ridge of land that separates waters flowing to different rivers or larger subbasins. Described by the USGS as a 5th level, 10-digit hydrologic unit code.

ACRONYMS AND ABBREVIATIONS

Atlas	Catherine Creek and Upper Grande Ronde River Atlas Restoration Prioritization Framework
BPA	Bonneville Power Administration
BSR	biologically significant reach
CHaMP	Columbia River Habitat Monitoring Program
CRITFC	Columbia River Inter-tribal Fish Commission
EP	Expert Panel
ESA	Endangered Species Act
FLIR	forward-looking infrared
GIS	Geographic Information System
GRMW	Grande Ronde Model Watershed
ISRP	Independent Scientific Review Panel
NOAA	National Oceanic and Atmospheric Administration
ODFW	Oregon Department of Fish and Wildlife
P	Fish Periodicity
TAC	Technical Advisory Committee
TMDL	Total Maximum Daily Load
U	Fish Use

Section I INTRODUCTION

During recent Independent Scientific Review Panel (ISRP) evaluations of habitat projects funded by the Bonneville Power Administration (BPA), considerable emphasis has been placed on developing a strategic framework to ensure that funding entities direct efforts toward the most important restoration priorities; restoration projects should be conducted in the right locations and in the right order based on a process-based, landscape approach (ISRP 2013). Restoration practitioners have often not considered, or did not have adequate information available to make determinations of, how and where priority work should occur, particularly at the watershed level or finer geographic scales. More recently, however, research, monitoring, and evaluation practitioners have gathered new data that are more closely linked to habitat requirements of focal fish species and are able to draw conclusions from those data, and new planning documents have been published in many subbasins throughout the Columbia River Basin. There have also been considerable gains in knowledge and experience of stream restoration techniques and the ability to apply correct treatments to address limiting factors.

Within the Upper Grande Ronde River subbasin, BPA, in cooperation with subbasin partners, coordinated efforts to leverage existing and new biological and physical information for the development of a strategic, prioritized restoration implementation framework: the Catherine Creek and Upper Grande Ronde River Atlas Restoration Prioritization Framework (Atlas). The process began in November of 2012, and the upper and lower Catherine Creek watersheds were selected as the initial pilot focus area among the larger Grande Ronde/Imnaha subbasin major population groups because of an estimated potential 23 percent improvement in habitat quality for Snake River spring Chinook salmon (NOAA 2008). Following completion of the Catherine Creek focus area in late 2014, the watersheds making up the Upper Grande Ronde River, beginning at the headwaters and continuing down to Lookingglass Creek, were then incorporated into the Atlas.

The intent of the Atlas is not to replicate previous planning efforts that include the Grande Ronde Subbasin Plan (NPCC 2004), Catherine Creek Reach Assessment (USBR 2012), Upper Grande Ronde River Tributary Assessment (USBR 2014), and other recovery plans (NMFS 2013; USFWS 2014), but rather to synthesize critical information (e.g., limiting factors, life history, habitat conditions, Ecosystem Diagnosis and Treatment [EDT], restoration action categories) from these previous planning efforts, while incorporating new data to strategically identify and prioritize locations and restoration actions required to enhance aquatic habitats and survival for Endangered Species Act (ESA) listed spring/summer Chinook salmon, summer steelhead, and bull trout. The products of the Atlas are intended to assist restoration practitioners in:

- Integrating past and best available current empirical data to assist in prioritizing the appropriate types of restoration actions in strategically defined locations to address key limiting factors;
- Transitioning from the past model of opportunistic restoration and enhancement to a more accountable approach of focused restoration within key reaches containing habitat for ESA listed species; and

- Facilitating implementation of collaborative, focused, and biologically beneficial restoration projects.

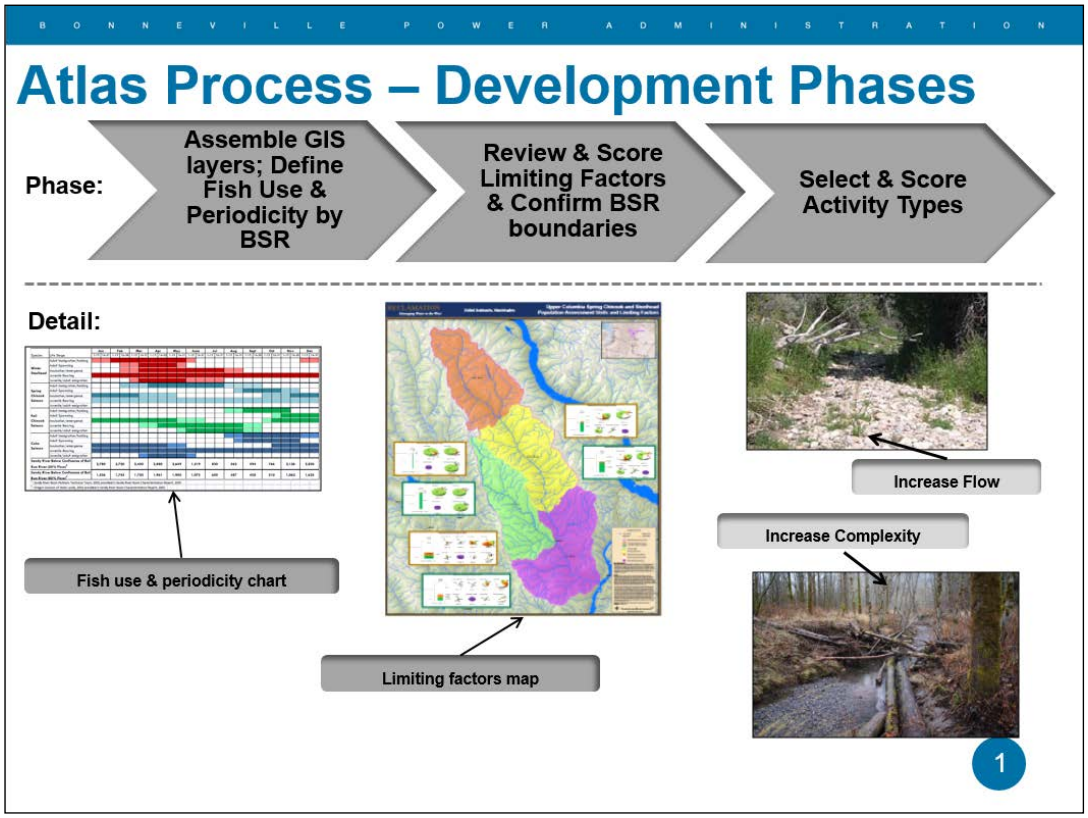
Products of the Atlas include a centralized data and map repository with information related to focal fish species limiting factors, life history requirements, biologically significant reaches (BSRs), habitat restoration opportunities, and conceptual habitat restoration opportunity maps consistent with local geomorphology. The Atlas includes a scoring and ranking matrix of project opportunities and associated site maps that were collectively developed and evaluated by local and regional experts who participated on committees throughout its development. The Atlas development and implementation process assures implementation of high priority, strategic habitat restoration projects that produce measurable results; maintenance of a collaborative prioritization framework that demonstrates objectivity, transparency, and accountability; and adaptive management of the prioritization framework and associated project implementation to ensure maximum biological benefit now and into the future.

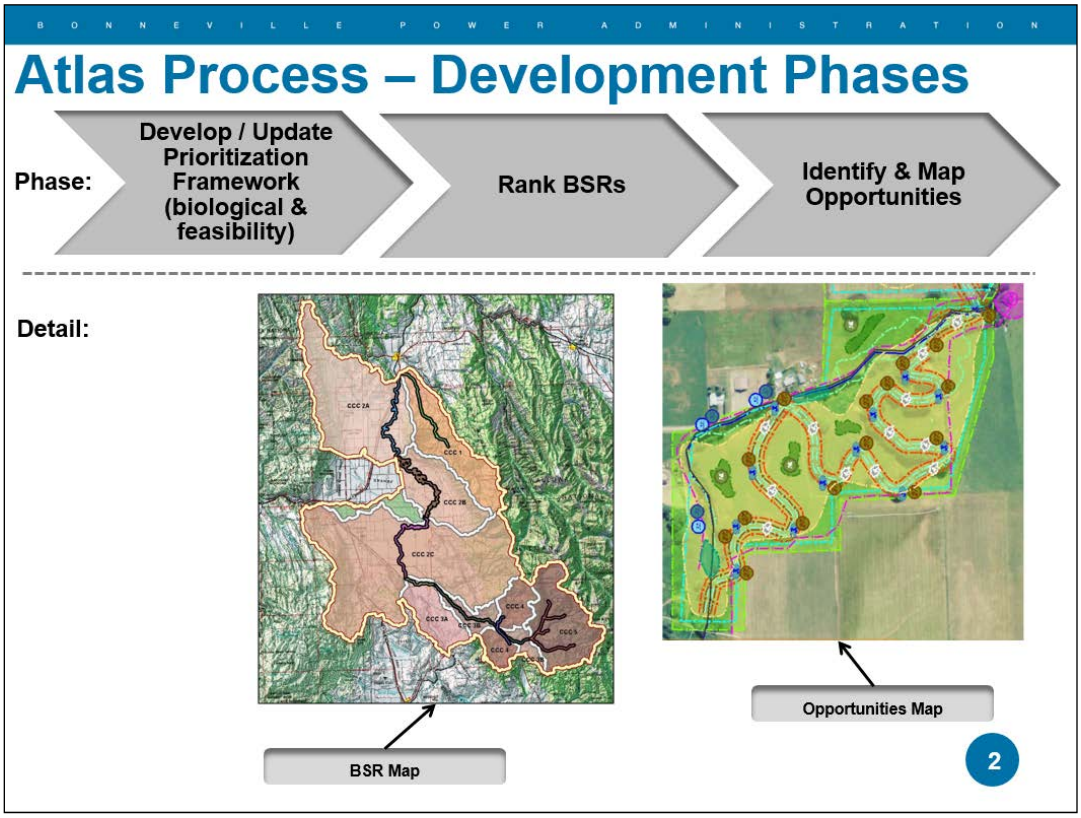
The focus of this Atlas user's manual is to document the technical aspects of how project areas and restoration actions were identified and evaluated. Figure 1 summarizes the Atlas development phases; existing and new information were gathered and synthesized into a user-friendly Geographic Information System (GIS) format; fish use and periodicity were identified; BSRs were determined based on focal species utilization and timing; limiting factors were determined and their relative importance within each BSR were determined; restoration actions were defined, selected, and scored based on physical and biological needs; and project restoration opportunities were identified, mapped (i.e., a "roadmap" of restoration opportunities or "Atlas"), and scored based on biological criteria. Methods for addressing how project feasibility is considered in the overall ranking strategy are also described.

The Science Technical Advisory Committee (TAC) who participated in the Atlas throughout its development acknowledges the limitations of the Atlas products; project opportunity rankings should be considered as a tool for decision making, and restoration practitioners should recognize that project opportunities do not always translate into final project actions.

The Atlas framework contains an iterative and adaptive set of procedures that can be adjusted as new empirical data and published research evidence become available, as projects are implemented over time, and as local knowledge evolves. The *Atlas Implementation Guidelines - Catherine Creek and Upper Grande Ronde River* (BPA 2015) provides additional documentation on the background and history of the Atlas development and implementation phases, and the roles and responsibilities of the Atlas Science TAC, Atlas Implementation Team, and other partners within the subbasin, and provides details on how project opportunities are funded and implemented through the Grande Ronde Model Watershed (GRMW) implementation process. The following sections describe the development of Atlas tools, the use of project prioritization and project opportunity matrices, followed by a summary of how Atlas is intended to be used now and into the future.

Figure 1. Atlas Development Phase





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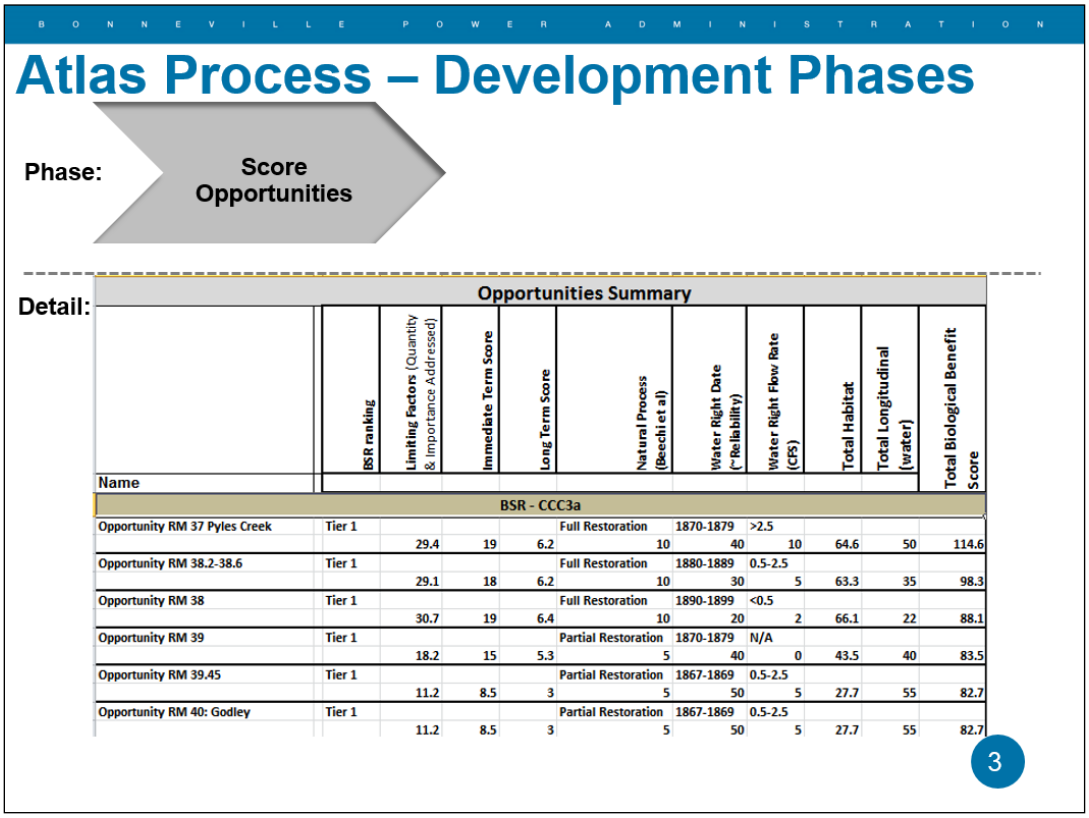


Opportunities Summary

Name	BSR ranking	Limiting Factors (Quantity & Importance Addressed)	Immediate Term Score	Long Term Score	Natural Process (Beechi et al)	Water Right Date (~Reliability)	Water Right Flow Rate (CFS)	Total Habitat	Total Longitudinal (water)	Total Biological Benefit Score
BSR - CCC3a										
Opportunity RM 37 Pyles Creek	Tier 1				Full Restoration	1870-1879	>2.5			
		29.4	19	6.2	10	40	10	64.6	50	114.6
Opportunity RM 38.2-38.6	Tier 1				Full Restoration	1880-1889	0.5-2.5			
		29.1	18	6.2	10	30	5	63.3	35	98.3
Opportunity RM 38	Tier 1				Full Restoration	1890-1899	<0.5			
		30.7	19	6.4	10	20	2	66.1	22	88.1
Opportunity RM 39	Tier 1				Partial Restoration	1870-1879	N/A			
		18.2	15	5.3	5	40	0	43.5	40	83.5
Opportunity RM 39.45	Tier 1				Partial Restoration	1867-1869	0.5-2.5			
		11.2	8.5	3	5	50	5	27.7	55	82.7
Opportunity RM 40: Godley	Tier 1				Partial Restoration	1867-1869	0.5-2.5			
		11.2	8.5	3	5	50	5	27.7	55	82.7

Section II ATLAS TOOL DEVELOPMENT

Atlas tools were developed by a Science TAC and smaller subgroups comprising local biologists and outside the basin experts with knowledge and familiarity of focal species' life history, production, abundance, and distribution and habitat conditions within the subbasin. The Science TAC included fish research and implementation biologists, engineers, geomorphologists, and hydrologists. The Science TAC performed the initial evaluation of the most current empirical data in spatial format to interpret how fish are using specific river reaches, identified the primary limiting factors by reach, and recommended restoration actions that have the greatest ability to address those key limiting factors. Products from the Science TAC efforts in developing the tools needed for prioritization of restoration work areas, actions, and rankings are summarized below.

II.1 INFORMATION USED

The first step in the Atlas development process was to assemble all current data into a transparent and user friendly format to determine, based on life history stage, where, when, and how focal species are using different stream reaches of Catherine Creek and the Upper Grande Ronde River and its major tributaries. Existing planning documents, results of research and monitoring, peer reviewed, published scientific literature, and new or unpublished data provided by researchers were used to identify specific criteria for the preferred biological and physical habitat of focal species. Data and information were consolidated in a spatial GIS context to evaluate fish life stage utilization of habitat areas, timing (periodicity), and limiting factors affecting each focal species to delineate stream reach subdivisions (i.e., defining BSRs).

In addition to general planning and cadastral layers, such as public land survey system, tax lots, county boundaries, aerial background imagery, topography, roads, and other administrative boundaries, GIS data gathering focused on biological, ecological and physical data pertinent to habitat prioritization, such as:

- **Hydrography-Hydrology –** flood inundation zones, bathymetry data, surface waters framework, and stream layers.
- **Water Quality and Quantity –** Total Maximum Daily Load (TMDL) 303d listings, point sources of pollutants, existing stream temperature data (thermographs and forward-looking infrared sensing [FLIR]) and predicted temperature data based on modeling, gage stations, and water right points of diversion, seniority, and quantity.
- **Fisheries and Fish Habitat –** Oregon Department of Fish and Wildlife (ODFW) aquatic habitat inventories, and fish life history (smolt outmigrants, radio telemetry, and redd count data), EDT reaches, fish barriers, hatchery facilities, StreamNet layers for focal species utilization for spawning, rearing and migration areas, Columbia River Habitat Monitoring Program (CHaMP) data, and Columbia River Inter-tribal Fish Commission (CRITFC) data.

Presenting geospatial fisheries information to the Science TAC allowed for a transparent and accountable decision making framework. During analysis of the GIS data, various delineations of reach breaks and agency assigned assessment units were reviewed. The Science TAC displayed and analyzed available data in a spatial context to assess fish utilization at various scales as identified in

the following section. During these procedures, the Science TAC also identified where important data gaps existed. For example, ODFW researchers identified high mortality of juvenile Chinook salmon fall migrants in the lower valleys of Catherine Creek, but the sources of mortality were unknown, and therefore were identified as an important data gap.

II.2 Fish Periodicity and Life Stage Use

Geospatial data, information from local restoration practitioners and researchers, such as ODFW's radio telemetry and CHaMP programs, and best professional judgement were used by the Science TAC to refine periodicity and fish life stage use for designated stream reaches. Fish use and periodicity were determined for each of the focal species (Chinook salmon, steelhead, and bull trout), at six life stages, including adult migration; adult spawning; incubation/emergence; juvenile summer rearing; juvenile winter rearing; and juvenile emigration. For the Upper Grande Ronde River, the Science TAC separated adult migration into two life stages, adult immigration and adult holding, to separate areas where adults may only reside briefly during migration versus pre-spawn holding areas where they may reside for weeks, resulting in seven life stages. Fish periodicity tables were developed in a Restoration Activity Prioritization Worksheet, which also contained summary information on fish utilization, limiting factors, and restoration actions, and was organized using separate worksheets for each stream reach. An example of a fish periodicity table for Catherine Creek is shown in Figure 2, with darker shades of colors representing high use, and lighter shades of colors indicating limited use. A question mark indicates suspected use, but data were lacking to support it.

Figure 2. Example Fish Periodicity Table developed for the Catherine Creek and Upper Grande Ronde Atlas. Darker shades of color represent high use, lighter shades indicate limited use, and question marks indicate suspected use, but data lacking.

Catherine Creek Periods of Occurrence in Assessment Unit: CC3B1 (Swackhammer diversion to reach break at river mile 47.2)

Species	Life Stage	Jan		Feb		Mar		Apr		May		June		Jul		Aug		Sept		Oct		Nov		Dec	
		1-15	16-31	1-15	16-28	1-15	16-31	1-15	16-30	1-15	16-31	1-15	16-31	1-15	16-31	1-15	16-31	1-15	16-30	1-15	16-31	1-15	16-30	1-15	16-31
Chinook Salmon	Adult migration																								
	Adult Spawning																								
	Incubation/emergence																								
	Juvenile summer rearing																								
	Juvenile winter rearing																								
	Juvenile emigration																								
Steelhead	Adult migration																								
	Adult Spawning																								
	Incubation/emergence																								
	Juvenile summer rearing																								
	Juvenile winter rearing																								
	Juvenile emigration																								
	Adult emigration					?	?	?	?	?	?														
Bull trout	Adult migration																								
	Adult Spawning																								
	Incubation/emergence																								
	Juvenile summer rearing																								
	Juvenile winter rearing																								
	Juvenile migration																								

Lighter shades indicate limited use.

Within the same Restoration Activity Prioritization Worksheet, fish use and life stage utilization were then summarized for each stream reach and assigned scores of High, Medium, or Low based on *current fish use* as follows (Figure 3):

- High (H) – Critical life stage use in need of *immediate* action for salmonid population performance (abundance, productivity, and sustainability).
- Medium (M) – Life stage use that is important to the *long-term* salmonid population performance.
- Low (L) – Life stage use that is minimally affected by existing conditions.
- N/A – Life stage is not present.

For the Catherine Creek Atlas, fish use scores were evaluated and assigned based on Chinook salmon because this species is the most imperiled of the three ESA-listed species. Furthermore, any restoration work directed for Chinook salmon is likely to have positive impacts on steelhead and bull trout.

Figure 3. Example Fish Life Stage Utilization Summary for Catherine Creek Chinook Salmon as part of the Catherine Creek and Upper Grande Ronde Atlas

Fish Use & Life Stage Utilization		
Fish Utilization	**Score**	**Comments**
Adult Migration	H	No complete barriers, flow likely not affecting migration. However, there are three partial barriers (push up dams) that will be addressed in 2014. Revisit ranking once addressed. (Moved holding comment into Holding/Spawning/Incubation/Emergence row)
Juvenile Outmigration	H	No complete barriers, but juvenile outmigration being affected due to unknown causes. Potential flow, hydrology, fitness affects.
Holding/Spawning / Incubation / Emergence	M	Spawning occurring, but not the critical need due to density dependence needing to be addressed 1st. Limited holding habitat.
Summer Rearing	H	Critical summer rearing to help address density dependence
Winter Rearing	M	Winter/Summer rearing overlap.

For the Upper Grande Ronde River Atlas, the Science TAC wanted to consider and separately document data for Chinook salmon, steelhead, and bull trout; therefore, all three species were evaluated and scored, as illustrated in Figure 4. Comments were recorded in the spreadsheets to provide supportive documentation and also noted if scores needed to be revisited in the future because data were weak or absent. The number of fish life stages present and fish use scores factor into ranking of BSRs as described in Section II.7. Periodicity tables were then used to guide discussions of appropriate biological reach breaks and refinement of limiting factors identified as described in the following section.

Figure 4. Example Fish Life Stage Utilization Summary for focal species in the Upper Grande Ronde River Multi-Species

Fish Use & Life Stage Utilization				
Fish Utilization	**Scores**			**Comments**
	Chinook	**Steelhead**	**Bull Trout**	
Adult Immigration	H	H	L	BUT present but mostly residents high in the watershed (L rating for immigration). Indian Creek has lots of barriers.
Adult Holding	H	M	L	BUT periodicity chart needs to be double checked with USFWS
Spawning / Incubation / Emergence	H	M	L	Historic CHS population, but currently is being supplemented.
Juvenile Emigration	M	M	L	
Summer Rearing	H	M	M	Lower Indian Creek has high summer temps and very degraded habitat. Lots of O. *mykiss* use.
Winter Rearing	H	M	M	Chinook ratings specific to Indian Creek and limited use in Clark Creek.

II.3 BIOLOGICALLY SIGNIFICANT REACH DELINEATION

Using the fish periodicity and fish life stage utilization tables and GIS-referenced biological data, the existing reach breaks from previous planning documents were refined into BSRs that were defined as stream reaches with similar fish use and limiting factors. These reaches represent the "fish's view of the river." For example, a section of river that is used for spawning and incubation requires specific functional physical and biological conditions (e.g., flow, temperature, and substrate size and type). If these conditions are not present, fish species presence or survival will be limited. Another reach of the river system may be identified as primarily juvenile summer rearing habitat, resulting in a different set of conditions necessary for survival and use. Therefore, depending on location, geomorphology, and species use, each BSR may have a different suite of appropriate restoration actions.

For Catherine Creek, initial BSR geographic area determinations were based on the five Expert Panel (EP) Chinook salmon assessment unit designations beginning at the confluence with Indian Creek (CCC1), and proceeding upstream to include the North and South Fork Catherine Creek headwaters (CCC5). Based on further evaluation of fish use and timing, the Science TAC made the following revisions:

- Assessment unit CCC2 was subdivided into CCC2a (lower), CCC2b (middle), and CCC2c (upper).
- Assessment unit CCC3b was subdivided into CCC3b1 (lower reach) and CCC3b2 (upper reach) at the U.S. Bureau of Reclamation reach break at river mile 47.2.
- Tributaries were grouped separately from mainstem Catherine Creek in BSRs CCC2a-2c due to significant differences in fish use.

The final Catherine Creek BSR delineations used throughout the development of the Atlas are illustrated in Figure 5.

For the Upper Grande Ronde River, initial BSR geographic area determinations were based on the nine EP Chinook salmon assessment unit designations for the upper mainstem portion of the river. However, the overall area was expanded to include four of the Lower Grande Ronde Chinook assessment units down to Lookingglass Creek, and steelhead assessment units for areas in between. In order to accommodate evaluation of both Chinook salmon and steelhead, and to further distinguish fish utilization, many of the larger assessment units were divided into smaller areas, resulting in 20 BSRs (Figure 6).

It was important to correctly designate BSRs because they represent the first level of hierarchy in the overall rating and ranking system to determine the broader geographic areas where restoration work should be sequenced over time. Ranking BSRs relative to one another occurred at a later development phase (see Section II.7), after refining and scoring limiting factors, and after identifying restoration actions as described in the next two sections.

Figure 5. Final BSR Delineations for Catherine Creek

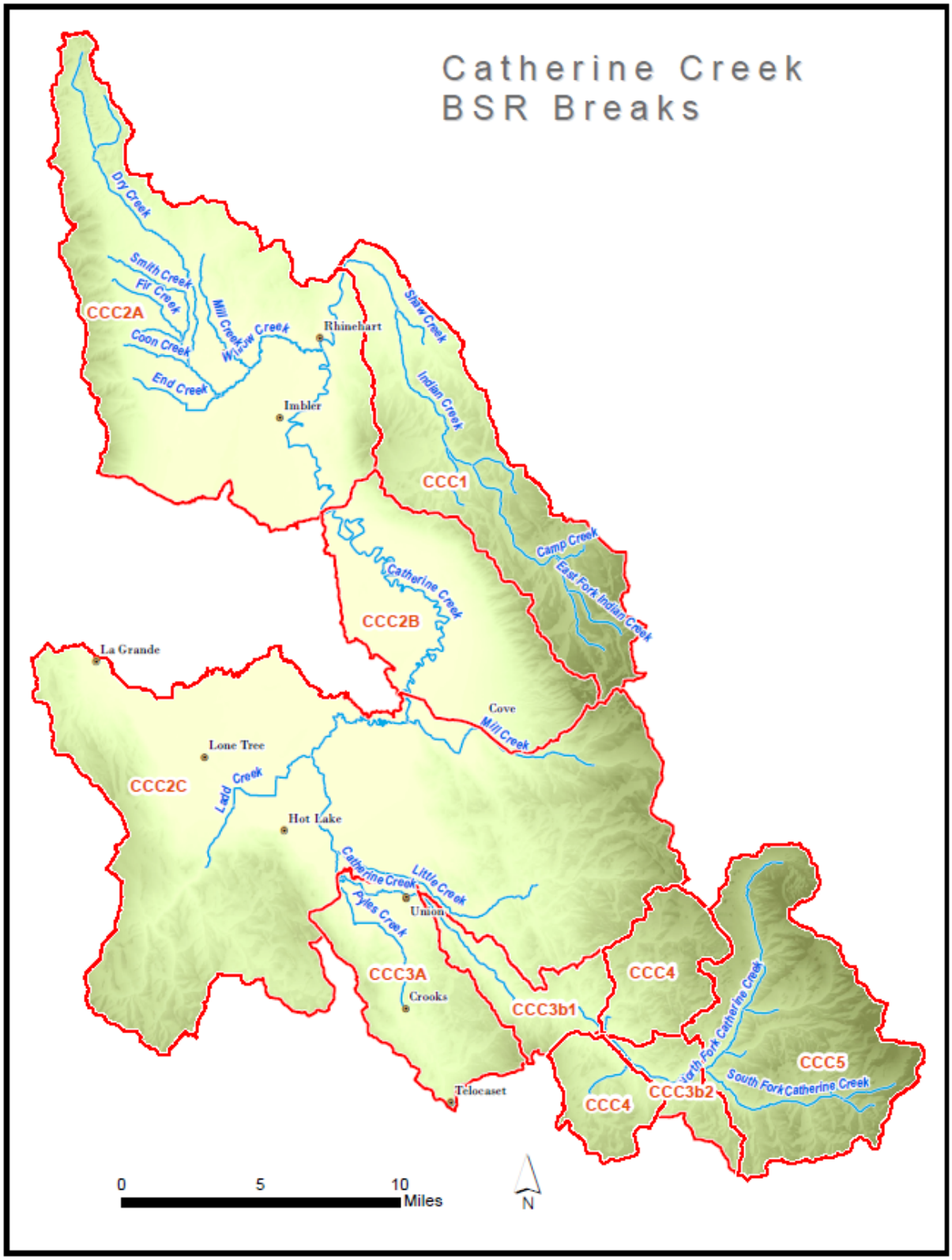
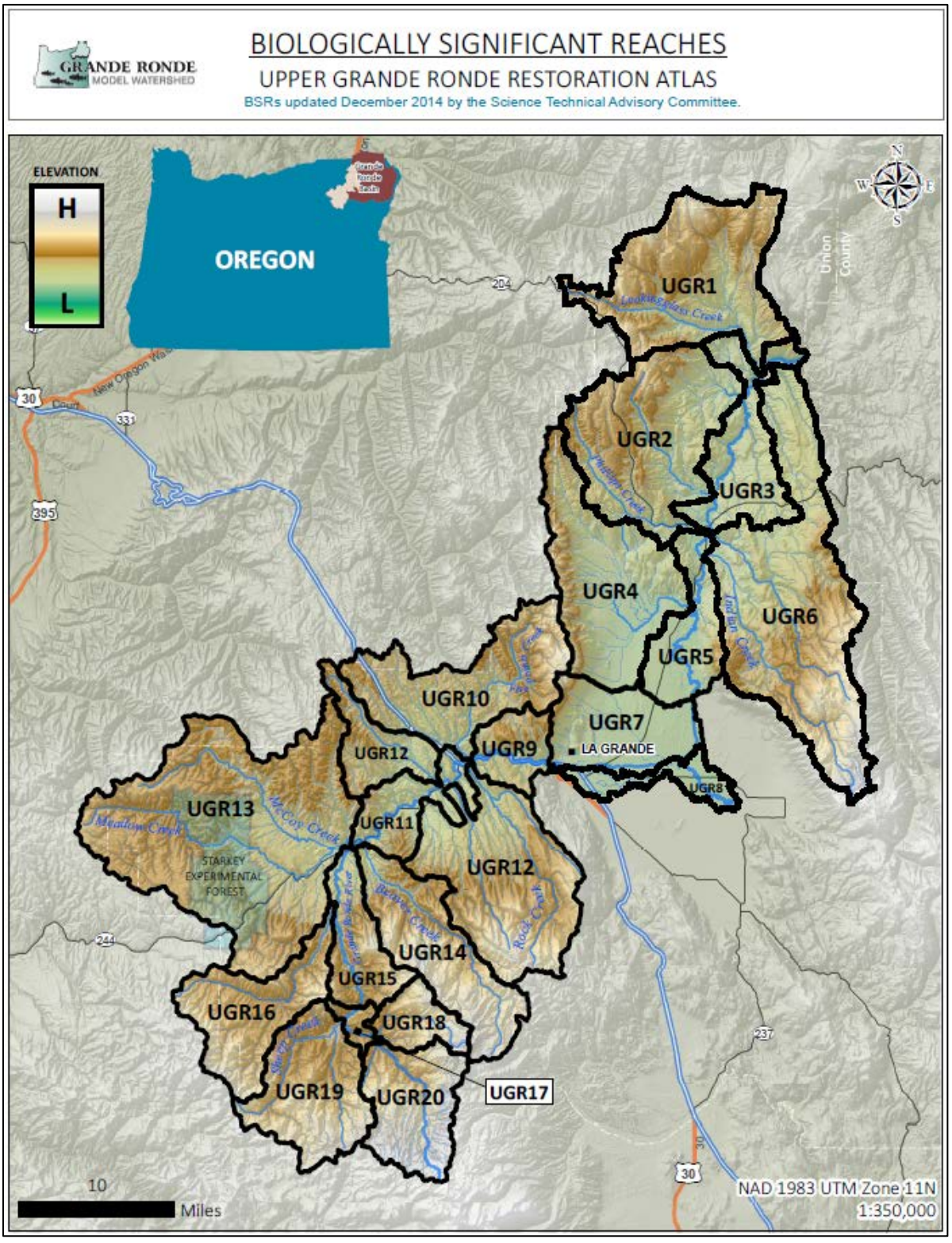


Figure 6. Final BSR Delineations for the Upper Grande Ronde River



II.4 REFINE AND SCORE LIMITING FACTORS

Once the BSRs were identified and mapped, additional biological data were used to refine limiting factors that had been previously identified within higher level planning documents (such as subbasin plans, recovery plans, and EP workshops). Temperature, flow, habitat surveys, and other data sets were analyzed as GIS layers relative to existing BSR breaks to update or confirm previously determined limiting factors at a finer resolution. For both Catherine Creek and the Upper Grande Ronde River, the National Marine Fisheries Service (NMFS 2012) standardized limiting factors, as identified and weighted during the EP workshops, were used as the basis of comparison but with some differences as noted below.

Catherine Creek. The original EP weights and limiting factor descriptions for Chinook salmon were listed without revision for Catherine Creek and used as a reference for finer resolution within the BSRs. Scores of High, Medium, or Low were assigned to each limiting factor based on current fish use from empirical data, published research evidence, or local knowledge, and were defined as follows:

- High (H) – Factors that are critical to address to improve salmonid population performance (abundance, productivity, and sustainability).
- Medium (M) – Factors that are important (not critical) to be addressed to improve salmonid population performance.
- Low (L) – Beneficial to address, but not critical to improve salmonid population performance.

Comments specific to the BSR were added to the Restoration Activity Prioritization Worksheet data to document differences between EP weights and Science TAC scores, or record other notes, as illustrated in Figure 7 below.

Figure 7. Example Limiting Factors Weightings and Scores for Catherine Creek

Limiting Factors: CCC3B1			
EP Weight	**Description**	**Score**	**Comments**
2%	1.1: Habitat Quantity: Anthropogenic Barriers	H	Limited barriers, however addressing would increase summer rearing habitat.
7%	4.1: Riparian Condition: Riparian Condition	H	Beneficial to address, but restoration benefit will be realized into future, combine with other LF to be most effective.
7%	4.2: Riparian Condition: LWD Recruitment	H	Beneficial to address, but restoration benefit will be realized into future, combine with other LF to be most effective
15%	5.1: Peripheral and Transitional Habitats: Side Channel and Wetland Condition	H	Important for summer rearing during spring run off period.
10%	5.2: Peripheral and Transitional Habitats: Floodplain Condition	H	Important for rearing during spring run off period. Erosion reduction, healthy floodplain contributes to ground water recharge, delayed release of cool
10%	6.1: Channel Structure and Form: Bed and Channel Form	H	Improved channel form needed to benefit summer rearing and density dependence.
15%	6.2: Channel Structure and Form: Instream Structural Complexity	H	Improved complexity needed to benefit summer rearing and density dependence.
5%	7.2: Sediment Conditions: Increased Sediment Quantity	L	Limited sediment input.
10%	8.1: Water Quality: Temperature	H	High temps affect summer rearing.
20%	9.2: Water Quantity: Decreased Water Quantity	H	Flow affecting summer rearing habitat.
Source (above data): Expert Panel [X] Sub-Basin [ ] Recovery Plan [ ]			

Upper Grande Ronde River. A multi-species approach was used to refine and score limiting factors in the Upper Grande Ronde River. The Science TAC compared EP limiting factor weights for Chinook salmon and steelhead, and in many cases added limiting factors to the lists when they thought important categories had been omitted. Although bull trout limiting factors were not previously identified and weighted by the EP, they too were included and rated. Scores of High (H), Medium (M), or Low (L) were assigned to each limiting factor based on current fish use from empirical data, published research evidence, or local knowledge. Those scores were defined in the same way as for Catherine Creek above and as illustrated in Figure 8 below.

Figure 8. Example Limiting Factors Weightings and Scores for the Upper Grande Ronde River

Limiting Factors: UGR 19				
Description	Score			Comments
	Chinook	Steelhead	Bull Trout	
4.1 Riparian Condition: Riparian Condition (CHS, STS)	H	H	L	
4.2 Riparian Condition: LWD Recruitment (CHS, STS)	H	H	L	Upper watershed riparian in good condition
6.2 Channel Structure and Form: Instream Structural Complexity (CHS, STS)	H	H	M	
7.2 Sediment Condition: Increased Sediment Quantity (CHS, STS)	H	H	L	
8.1 Water Quality: Temperature (CHS, STS)	H	H	H	CHaMP sites show some summer temperatures at 18-19 C
5.1 Peripheral and Transitional Habitats: Side Channel and Wetland Conditions	H	H	H	Possibly spawning in upper Chicken, but unsure
5.2 Peripheral and Transitional Habitats: Floodplain Condition	H	H	H	Added and scored 5.1 & 5.2 on 4/8/15 by
1.1 Habitat Quantity: Anthropogenic Barrier (CHS, STS)	M	M	H	Add 1.1 - at least one culvert on Sheep Creek and one on W. Chicken that need replaced. Culvert at Indiana Creek under 51 road needs replaced for BUT
Source (above data): Expert Panel [X] Sub-Basin [ ] Recovery Plan [ ] Science TAC [X]				

The comments column was again used to document important notes, such as additions of new limiting factors. The limiting factor scores affect ranking of project opportunities as described in Section II.8. The results of these exercises were also recorded and documented in the same Restoration Activity Prioritization Worksheet where fish periodicity and fish life stage utilization data were stored, and the combined results were used to inform restoration action decisions as described in the following section.

II.5 Restoration Activity Worksheets

The purpose of the restoration action worksheets was to ensure that proposed restoration actions align with current fish use and critical limiting factors based on the best available and most current data; therefore, restoration actions were assigned while reviewing the fish life stage utilization scores (see Section II.2 and Figures 3 and 4 above), in combination with the limiting factor scores (Section II.4 and Figures 7 and 8 above). Restoration actions were grouped into 10 broader categories (e.g., channel modification, floodplain reconnection), and a total of 36 individual actions were assigned activity numbers (1-36) within those categories. The restoration actions are intended to provide a comprehensive list of all potential activities that might be implemented; they include a full suite of passive to active restoration and protection approaches, and include actions that are very site-specific, to those covering larger, watershed-scale actions. An example of a completed restoration action worksheet is illustrated in Figure 7. Restoration actions were scored for immediate or long-term benefits as follows:

Immediate Term Based On Current Fish Use:

- High (H) – Actions that have the ability to provide immediate benefits to key life stage use (and were assigned a High fish use score as defined in Section II.2).
- Medium (M) – Actions that will provide benefit into the future or should be implemented in concert with other restoration actions to improve salmonid population performance (and were assigned a High fish use score as defined in Section II.2).
- N/A – Actions that would not provide immediate or future benefits.

Long Term Based on Future Fish Use:

- High (H) – Most important actions to implement to benefit species and life stage use in the future (and were assigned a Medium fish use score as defined in Section II.2).
- Medium (M) – Actions that should be implemented in concert with other restoration actions (and were assigned a Medium fish use score as defined in Section II.2).
- N/A – Actions that would not provide immediate or future benefits.

Comments specific to the BSR were added to the spreadsheet data to document the rationale behind the scores, as illustrated in Figure 9 below. The immediate- and long-term restoration action scores factor into the ranking of potential projects as described in Section II.8. Explanations of some of the restoration actions that may not be readily transparent are provided in Appendix A. The restoration action worksheets were used to perform initial mapping of project opportunities, as described in the following section.

Figure 9. Example Restoration Action Worksheet

Restoration Activities				
	Description by Group & Action	Immediate Term Score	Long Term Score	Comments
Dedicating Land and Water to the Preservation and Restoration of Stream Habitat				
1	Protect Land and Water (Easement, Acquisition)	H	H	Key area for both summer & winter rearing, future spawning, protect large parcels when available.
Channel Modification				
2	Channel Reconstruction/construction	H	H	High priority work for rearing and future spawning and current habitat is degraded
3	Pool Development	H	H	High priority work for rearing, holding and future spawning and current habitat is degraded
4	Riffle Construction	M	M	Riffle habitat currently available, increasing complexity around pool tailouts and addition of higher quality riffle habitat has value.
5	Meander (Oxbow) Re-connect - Reconstruction	H	H	High priority work for rearing and future spawning and current habitat is degraded
6	Spawning Gravel Cleaning and Placement	L	L	Material available. Address with complexity activities
Floodplain Reconnection				
7	Levee Modification: Removal, Setback, Breach	M	M	High priority work for rearing and future spawning and current habitat is degraded.
8	Remove - Relocate Floodplain Infrastructure	H	H	High priority work for rearing and future spawning and current habitat is degraded
9	Restoration of Floodplain Topography and Vegetation	H	H	High priority work for rearing and future spawning and current habitat is degraded
10	Floodplain Construction	H	H	High priority work for rearing and future spawning and current habitat is degraded
Side Channel / Off-Channel Habitat Restoration				
11	Perennial Side Channel	H	H	High priority work for rearing and future spawning and current habitat is degraded
12	Secondary (non-perennial) Channel	H	H	High priority work for rearing and future spawning and current habitat is degraded
13	Floodplain Pond - Wetland	H	H	High priority work for rearing and future spawning and current habitat is degraded
14	Alcove	H	H	High priority work for rearing and future spawning and current habitat is degraded
15	Hyporheic Off-Channel Habitat (Groundwater)	H	H	High priority work for rearing and future spawning and current habitat is degraded
16	Beaver Restoration Management	H	H	High priority work for rearing and future spawning and current habitat is degraded
Riparian Restoration and Management				
17	Riparian Fencing	H	H	High priority work for rearing and future spawning and current habitat is degraded
18	Riparian Buffer Strip, Planting	H	H	High priority work for rearing and future spawning and current habitat is degraded
19	Thinning or removal of understory	L	L	
20	Remove non-native plants	M	M	Non-natives are near impossible to remove in this section.
Fish Passage Restoration				
21	Dam removal or breaching	N/A	N/A	None known. If discovered and affecting access to rearing habitat then activity becomes more important. Look for opportunities to address sediment transport above and below large structures
22	Barrier or culvert replacement/removal	N/A	N/A	None known. If discovered and affecting access to rearing habitat then activity becomes more important.
23	Structural Passage (Diversions)	H	H	Three known Juvenile passage issues, one barrier has too much velocity and too high of jump. (Diversions - Prescott, Adult Weir, State Ditch, Kinsley/Richards, S. Cross, Smith). Operations & Maintenance of existing screen diversions
Nutrient Supplementation				
24	Addition of organic and inorganic nutrients	M	N/A	nutrients beneficial for rearing
Instream Structures, Large Wood and Logjams				
25	Rock Weirs	N/A	N/A	Moving away from their use, unless grade control needed
26	Boulder Placement	M	M	Need pool forming structures, prefer wood w/in this BSR.
27	LWD Placement	H	H	Pools lacking in this BSR. LWD as pool forming structures for rearing, good for spawning at tailout as well.
Bank Restoration, Modification, and Removal				
28	Modification or Removal of Bank Armoring	H	M	Riprap and car bodies
29	Restore banklines with LWD - Bioengineering	H	M	High priority work for rearing, beneficial to future spawning (but not primary action for spawning). Current habitat is degraded
Water Quality - Quantity Impacts				
30	Acquire Instream Flow (Lease- Purchase)	H	H	Low flow affecting summer rearing and adult holding
31	Improve Thermal Refugia (spring reconnect, other)	H	H	Springs
32	Irrigation System Upgrades -Water Management	H	H	High priority work for rearing and future spawning and current habitat is degraded
33	Reduce - Mitigate Point Source Impacts	H	H	Feedlot needs to be removed away from stream
34	Upland Vegetation Treatment - Management	M	M	Protect springs from grazing
35	Road Decommissioning or abandonment	H	N/A	Potential opportunity to insert a bridge to CC can move away from the road. RE-ROUTE 1 APPOX 1 MILE SEGMENT OF HWY 203 TO EAST TO INCREASE SUMMER REARING AND WINTER CAPACITY. POTENTIAL SPAWNING AS WELL
36	Road Grading - Drainage Improvements	N/A	N/A	not directly affecting habitat condition

II.6 HIGH-LEVEL MAPPING OF RESTORATION OPPORTUNITIES

Once the biological needs of fish were determined and potential restoration actions were identified based on those needs, an initial phase of restoration opportunity mapping began. This mapping phase used stream geomorphic and various other data available in GIS layers to identify restoration and protection opportunities for implementation. This mapping phase was described as "high level" because the stream reaches were generally larger than what might typically occur at the project implementation stage, and actions were identified by simple polygons and basic line work, but without construction-level details.

Restoration actions were identified by the action numbers from the restoration action worksheets for the entire BSR (see Figure 9 above), but actual locations were fine-tuned down to the reach level.

For example, in reaches where floodplain reconnection was identified as a need, GIS terrain layers could be used to determine opportunities for levee setback (Action 7) or locate where old meander scrolls are still present and could be reactivated (Action 5). If flow or temperature was a priority, water right points of diversion were identified to locate areas where increased flow might be achieved (Action 30), or FLIR data used to identify cool water spring locations that might be reconnected (Action 31). Opportunity mapping was completed using Civil 3D software and converted to 11 x 17-inch PDF files that could be reviewed by the Science TAC. Once reviewed, the resulting set of maps (or "Atlas") of project opportunities was distributed to the Science TAC and the Atlas Implementation Team.

An example opportunity map is illustrated in Figure 10 below, with restoration actions listed to the right.

Figure 10. Example High-Level Opportunity Map

BSR: CCC3A Site: CC38

CC38:
1,2,3,17,18,20,30,32,7,9,11,13,14,27,29,4,16

#	CCC3a RESTORATION ACTIVITIES BY SCIENCE TAC PRIORITY	Immediate Term Score	Long Term Score
1	Protect Land and Water (Easement, Acquisition)	H	H
2	Channel Reconstruction	H	H
3	Pool Development	H	H
17	Riparian Fencing	H	H
18	Riparian Buffer Strip, Planting	H	H
20	Remove non-native plants	H	H
30	Aquire Instream Flow (Lease- Purchase)	H	H
31	Improve Thermal Refugia (spring reconnect, other)	H	H
32	Irrigation System Upgrades -Water Management	H	H
33	Reduce - Mitigate Point Source Impacts	H	H
5	Meander (Oxbow) Re-connect - Reconstruction	H	M
7	Levee Modification: Removal, Setback, Breach	H	M
8	Remove - Relocate Floodplain Infrastructure	H	M
9	Restoration of Floodplain Topography and Vegetation	H	M
11	Perennial Side Channel	H	M
12	Secondary (non-perrenial) Channel	H	M
13	Floodplain Pond - Wetland	H	M
14	Alcove	H	M
15	Hyporheic Off-Channel Habitat (Groundwater)	H	M
26	Boulder Placement	H	M
27	LWD Placement	H	M
28	Modification or Removal of Bank Armoring	H	M
29	Restore banklines with LWD - Bioengineering	H	M
22	Barrier or culvert replacement/removal	H	N/A
4	Riffle Construction	M	M
10	Floodplain Construction	M	M
16	Beaver Restoration Management	M	M
23	Structural Passage (Diversions)	M	M
24	Addition of organic and inorganic nutrients	M	M
36	Road Grading - Drainage Improvments	M	M

It is important to note that, during this process, opportunities and actions that were identified were based on Science TAC opinion of all the work that could be accomplished to achieve full site potential, without taking into consideration landowner willingness or other related feasibility constraints. Feasibility of implementing identified actions was evaluated separately in the process (see Section III.2.5). Geologic or geomorphic conditions such as channel confinement were taken into consideration. For example, restoring floodplain connectivity within a confined reach would not be possible and not be identified as an action.

II.7 BSR PRIORITIZATION MATRIX

The BSR prioritization matrix was developed to rank geographic areas where restoration work most beneficial to salmonid population performance should occur. It consisted of a separate Prioritization Calculator spreadsheet used to rank the nine Catherine Creek BSRs relative to each other, and the 20 Upper Grande Ronde BSRs relative to each other. No attempt was made to compare BSRs in Catherine Creek to BSRs in the Upper Grande Ronde River. The purpose of ranking BSRs was to ensure that work efforts are sequenced over time. Tier I areas are the highest priority, followed by Tier II and Tier III.

The framework for prioritizing BSRs was based on recent and relevant literature related to fisheries restoration priorities (Beechie et al. 2008; Roni et al. 2002), and based on the following principles:

1. Build from existing production areas.
2. Target areas with critical species and life stages present.
3. Target areas where there is geomorphic potential to affect change (available floodplain to implement a broader range of restoration actions).
4. Target areas where the current habitat condition allows the ability to affect change (i.e., habitat condition is somewhere between completely degraded, requiring great effort for little change, and pristine conditions in which there is little room for improvement).

II.7.1 BSR Scoring Categories

Scoring systems were developed to evaluate BSRs based on the four principles mentioned above. Scoring categories were classified as either providing inputs on impacts to species or inputs for the ability to affect change. The BSR prioritization matrix used information from earlier Science TAC efforts identifying fish periodicity, life stages, and critical limiting factors (see Section II.2, Fish Periodicity and Life Stage Use) to evaluate the first two principles. Two separate scores (P-score and U-score) were developed as described below. To evaluate the third and fourth principles related to the ability to affect change (geomorphic potential and current habitat condition), the Science TAC evaluated additional data layers that were made available in a GIS-based map format. The scoring categories and rationale for use are summarized as follows:

Periodicity (P)-score: Targets areas based on the raw count of the number of life stages of each focal fish species present, as determined from the periodicity tables. The length of time that a life stage is present was not factored in as an indication of importance (i.e., spawning may only occur over a few weeks, but is equally important as summer or winter rearing which occurs over months).

BSRs that have multiple species and more life stages present receive the highest scores, which are based on the combined total count of those species and life stages present. The number of life stages present was multiplied by a calibration factor to ensure that the P-score accounted for up to 25 points of the total possible score of 100.

Use (U)-score: Targets areas based on the number of critical/imperiled life stages present and their rankings (High, Medium, Low) as determined from the fish utilization scores. BSRs with the most life stages present and that received rankings of High (critical life stage use in need of *immediate* action for salmonid population performance) received the highest scores. Generally, the qualitative scores of High, Medium, and Low were converted to numerical values (5, 3, and 1, respectively) and multiplied by a calibration factor to ensure that the U-score accounted for up to 25 points of the total possible score of 100; however, some differences between how this score was derived in Catherine Creek (which ranked life stages based on the most imperiled species, Chinook salmon) versus a modified approach in the Upper Grande Ronde River (which used all three focal species) are discussed in Section III.

Geomorphic Potential Score: Targets areas with the ability to affect change in terms of geomorphic potential and is based on the assumption that moderately confined or unconfined reaches present more physical opportunities to implement restoration actions that can increase both habitat quantity and quality. The primary data layers used by the Science TAC to evaluate geomorphic potential were:

- National Oceanic and Atmospheric Administration (NOAA) Science Center: Chinook intrinsic potential data layer (incorporates stream width, valley width, gradient, with a sediment filter), and Beechie/Imaki classification data (confined, island-braided, meandering, straight)
- CRITFC: Valley setting data layer (confined, partly confined, unconfined)

The qualitative scores of High, Medium, or Low reflected the amount of floodplain available for restoration actions, and were converted to numeric values (25, 15, and 5, respectively) to account for up to 25 points of the total possible score of 100.

Current Habitat Condition Score: Targets areas with the ability to effect change by enhancing habitat conditions. Scores reflect the expected improvements, and are based on the assumption that areas with fair to good habitat provide the most opportunity for improvement, while areas with poor habitat would require larger investments for minimal improvement, and areas with excellent habitat provide little opportunity for improvement beyond their current condition. The primary data layers used by the Science TAC to evaluate current habitat condition were:

- ODFW: HabRate model, redd way point data, fish utilization data layers
- Qualitative scores of Excellent, Good, Fair, and Poor were converted to numeric values (5, 25, 25, and 5, respectively) to account for up to 25 points of the total possible score of 100.

Current Temperature Score: Included as a sub-score within the Current Habitat Condition Score, and acts primarily as a filter for the ability to affect change. This category had a smaller impact on the Current Habitat Condition Score and overall BSR rankings, but was listed as a separate item. If

stream temperatures were poor or lethal, then existing or newly created habitat cannot be fully utilized. The primary data layers used by the Science TAC to score stream temperatures were:

- CRITFC: Temperature model, Chinook extents data layer
- U.S. Bureau of Reclamation: FLIR data

Qualitative scores of OK or Lethal in Catherine Creek were converted to numeric values (0 and -5, respectively). In the Upper Grande Ronde River, a slightly modified approach was used to achieve finer resolution, and qualitative scores of Excellent, Good, Fair, and Poor were converted to numeric values (5, 3, 0, and -5, respectively).

II.7.2 BSR Output

The P- and U-scores were entered into the BSR matrix (Figure 11). The Science TAC reviewed available data and the appropriate GIS data layers, and entered the qualitative scores for Geomorphic Potential, Current Habitat Condition, and Current Temperature into the BSR matrix. All qualitative scores were automatically converted to numeric values based on the conversion values noted above, and resulting cumulative scores were calculated for each BSR. As illustrated in Figure 11, the BSR matrix for Catherine Creek provided a drop-down menu for the P-score approach, allowing a choice between two methods: a multi-species with equal weighting, or a multi-species with Chinook emphasis approach. For Catherine Creek, the multi-species with equal weighting option was chosen, while for the Upper Grande Ronde River, Chinook salmon were given more weight (see Section III.1 for additional explanation).

The total scores were used by the Science TAC to rank BSRs into three major categories as defined below:

- **Tier I –** High priority areas for restoration; actions within these BSRs should be considered for early implementation.
- **Tier II –** Medium priority areas; actions within these BSRs should be considered for strategic implementation.
- **Tier III –** Low priority areas; actions should be implemented within these BSRs when Tier 1 or Tier 2 actions are either complete or not available due to feasibility constraints.

The BSR ranking into Tiers I, II, or III represented the first hierarchy in ranking project opportunities as described in the following section. Additional details on the BSR matrix refinements, use, and results are described in Section III.1.

Figure 11. BSR Matrix Scoring Methods for the Catherine Creek and Upper Grande Ronde Atlas

Step 1 – Enter number of life stages present, and quantity of highs, mediums and lows from the fish use scores.

Step 2 – Review existing classification, pdf data maps and adjust as needed by clicking on the cell you want to change and selecting an option from the drop down menu.

Step 3 – Ranked BSRs by Tier I, II, III

Catherine Creek Biologically Significant Reach (BSR) - Ranking

	Inputs					Species Impact		Ability to Affect Change		Outputs	
BSR	P-score (Number life stages present)	U-Score (Qty of Highs, Mediums & Lows)	Geomorphic Potential Classification	Current Habitat Condition Classification	Current Temperature	U-Score (Critical use / bottleneck)	P-Score (Presence Absence- Current Production Area)	Geomorphic Score (lateral confinement ratio)	Current Condition Score	Cummalative Score	Ranking (Tier I,II,III)
CCC1											
CCC2a	8	2H, 1M	Medium	Poor	Lethal	13	10.56	15	0	39	3
CCC2b	8	2H, 1M	Medium	Poor	Lethal	13	10.56	15	0	39	3
CCC2c	8	2H, 1M	High	Poor	Ok	13	10.56	25	5	54	2
CCC3a	15	3H, 1M, 1L	High	Fair	Ok	19	19.8	25	25	89	1
CCC3b1	15	3H, 2M	High	Good	Ok	21	19.8	25	25	91	1
CCC3b2	15	1H, 2M, 2L	Medium	Good	Ok	13	19.8	15	25	73	2
CCC4	15	1H, 2M, 2L	Low	Excellent	Ok	13	19.8	5	5	43	3
CCC5	19	1H, 2M, 2L	Low	Excellent	Ok	13	25.08	5	5	48	3

Sources:

- Periodicity chart from the activity sheet of the respective BSR
- Fish use & life stage utilization table from the activity sheet of the respective BSR
- Assessment utilizing Interactive map CRITFC Valley Setting, IP, & Beechi/Imaki Class data
- Assessment utilizing Interactive map HabRate, Use Type, Temperature, Redd data
- Based on CRITFC & USBR temperature data

Self-populates – P-Score varies based on drop down selection of multi-species with equal weighting or multi-species with Chinook emphasis.

P-Score Approach
(Equal Species or CHS Weighted)
Multi-Species Equal

II.8 OPPORTUNITY PRIORITIZATION MATRIX

Opportunity prioritization matrices were included as separate worksheets within the BSR Prioritization Matrix spreadsheet and were used to list and rank project opportunities within each BSR. It is important to acknowledge that opportunity matrix scores are relative and should *not* be considered absolute scores for sequential project implementation, but should guide project implementers in determining which parcels of land should be pursued first. Each score is described below.

II.8.1 Opportunity Scoring Categories

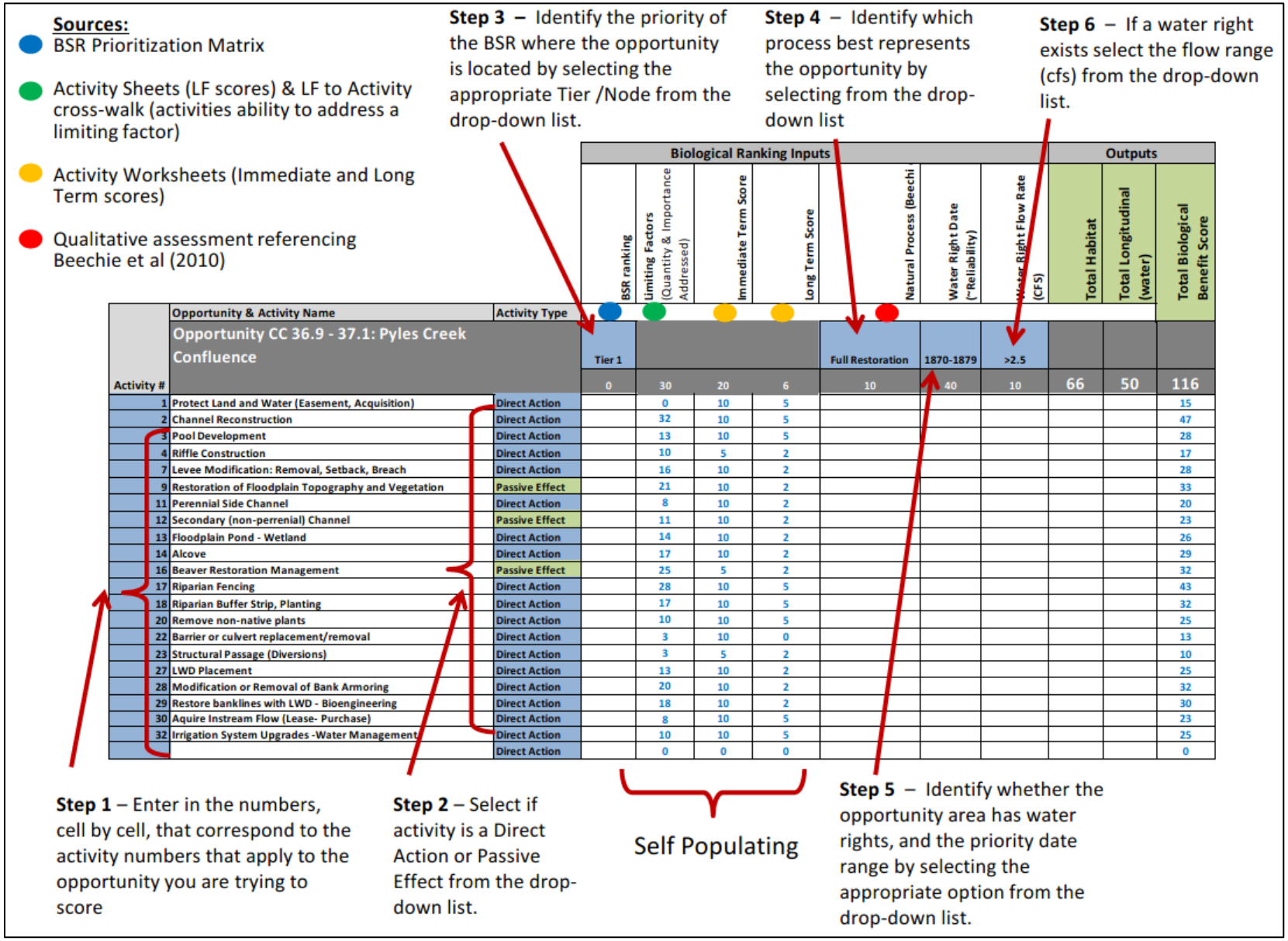
Restoration opportunities within each BSR are prioritized based on the following:

1. Ranking of the BSR they are located within (Tier I, II, or III);
2. Ability to address the most important and the greatest number of limiting factors;
3. Ability to address immediate and long-term habitat needs;
4. Determination of whether the opportunity meets full restoration, partial restoration, or simply short-term habitat restoration based on Beechie et al. (2010); and
5. Presence of water rights and the potential to carry longitudinal benefits (flow) into downstream reaches (Note: this category was not used in the Upper Grande Ronde River due to the absence of irrigation diversions).

Within each BSR, project opportunities were described and named based on river mile (RM) locations (e.g., Opportunity CC 38.4 would be the short name for an opportunity on Catherine Creek at RM 38.4). Project opportunities might occur at a spot location if the restoration actions are site specific, such as eliminating a point source of contamination, or acquiring a water right.

Opportunities also could also be much larger if, for example, a 3-mile reach was owned by a single landowner or consisted of very similar geomorphic characteristics. Within those opportunity areas, restoration actions that could occur in that reach were identified and the action number entered into column A of the worksheet. The action names associated with the action numbers were then automatically generated in column B, along with some of the other score categories. Figure 12 below shows an example of this first step, and an overview of the additional steps necessary to complete an opportunity.

Figure 12. Example Completed Opportunity Scoring Worksheet with Explanations for the Catherine Creek and Upper Grande Ronde Atlas



The process of completing the opportunity scoring within the Prioritization Calculator spreadsheet continued as follows:

BSR Ranking: Establishes the initial hierarchy for ranking project opportunities relative to each other based on the assumption that project opportunities within higher ranked (Tier I) BSRs should be pursued first. Precedence for this strategy is found in *Setting River Restoration Priorities: A Review of Approaches and a General Protocol for Identifying and Prioritizing Actions* (Beechie et al. 2008), and the I*ntegrated Species Restoration Prioritization Tucannon River* (Anchor QEA 2012). Within the BSR Matrix worksheet, each BSR was identified as Tier 1, Tier II, or Tier III. The corresponding BSR ranking for each opportunity was selected from the drop-down menu in the project opportunity matrix. Under this system, it is possible for a project opportunity in a Tier III BSR to have a higher opportunity score than an opportunity in a Tier I BSR, but that high score does not trump the initial hierarchy.

Limiting Factor Score: This category was scored based on the ability of project restoration actions to address the limiting factors that had been previously identified and ranked as High, Medium, or Low (see Section II.4). The scores in this category accounted for both direct and indirect impacts that a restoration action would have on limiting factors. For example, a levee removal project can directly affect Peripheral and Transitional Habitats: Floodplain Condition (NOAA limiting factor 5.2), but indirectly affect other limiting factors, such as Riparian Condition (NOAA limiting factor 4.1) and Channel Structure & Form (NOAA limiting factors 6.1 and 6.2). To account for the greater benefit anticipated with direct impacts, the limiting factors' rating (High, Medium, Low) and impact type was scored as shown in Table 1.

Table 1. Limiting Factors Ratings, Impact Type, and Scores

Limit Factor Rating	Impact Type	Score
High	Direct	5
High	Indirect	3
Medium	Direct	3
Medium	Indirect	2
Low	Direct	2
Low	Indirect	1

Using this scoring system, each restoration action was then automatically scored based on the number and severity of limiting factors that it addressed, and whether it was primarily a direct or indirect impact. In this fashion, the greater the number of restoration actions that are identified within an opportunity, combined with limiting factors having direct impacts, could result in a very large cumulative score. Therefore, the cumulative score of all limiting factors was divided by 10 to align with the ranges of the other variable scores.

Immediate-Term Score: Uses the immediate-term scores from the ranking of restoration action benefits to key life stage uses (see Section II.5 and Figure 8). The High, Medium, or N/A scores were automatically converted to numerical values of 10, 5, or 0, respectively (Table 2). Under this scoring system, the more restoration actions within an opportunity that were identified, combined with High ratings, could result in a very large cumulative score; therefore, the cumulative score of all immediate term scores was divided by 10 to align with the ranges of the other variable scores.

Long-Term Score: Uses the long-term scores from the ranking of restoration actions benefits to key life stage uses (see Section II.5 and Figure 8). The High, Medium, or N/A scores were automatically converted to numerical values of 5, 2, or 0, respectively (Table 2). Under this scoring system, the greater the number of restoration actions that are identified within an opportunity, combined with High ratings, could result in a very large cumulative score. Therefore, the cumulative score of all long-term action scores was divided by 10 to align with the ranges of the other variable scores. Long-term scores generally were weighted at one-half the values of the immediate-term score (Table 2).

Table 2. Immediate- and Long-Term Restoration Activity Benefits Scores used in the Catherine Creek and Upper Grande Ronde Atlas

Benefit Type	Rating	Score
Immediate Term	High	10
	Medium	5
	N/A	0
Long Term	High	5
	Medium	2
	N/A	0

Natural Processes Score: This score considers the opportunity as a whole and is based on the assumption that restoration of natural processes (full restoration) is more beneficial than partial restoration or habitat creation. Restoration opportunities that have the ability to restore processes that create and maintain habitats and biota are more beneficial than those that can only improve the quality of habitat by treating specific symptoms through the creation of locally appropriate habitat types. Precedence for this approach is found in Process-based Principles for Restoring River Ecosystems (Beechie et al. 2010). Within the Opportunity Matrix worksheet, the Natural Processes Score is selected from a drop-down menu. The action class, definition, and resulting scores used in this category are shown in Table 3.

Table 3. Natural Processes Action Classes, Definitions, and Scores used in the Catherine Creek and Upper Grande Ronde Atlas

Action Class	Definition	Score
Full Restoration	Restore processes that create and maintain habitats and biota, thereby returning a river ecosystem to its normative state.	10
Partial Restoration	Restore or improve selected ecosystem processes, thereby partially restoring a riverine ecosystem.	5
Habitat Creation	Improve quality of habitat by treating specific symptoms through creation of locally appropriate habitat types; used where causes of degradation cannot be addressed.	2.5

Water Rights Date Score: As part of the evaluation of water quantity and any potential longitudinal (downstream) fisheries benefits, water rights, if present in an opportunity area, were scored based on seniority of the water right. This scoring category primarily applied in Catherine Creek, and was not used in the Upper Grande Ronde River where irrigation diversions were not present. If no water rights were present, then no score would be credited. If a water right was present, then the reliability of that right to carry benefits downstream was scored based on the water right priority date. The scoring criteria and scores based on water right priority date and reliability are shown in Table 4.

Within the Opportunity Matrix worksheets, the water rights dates are selected from a drop-down menu. Since low flow (NOAA limiting factor 9.2) was frequently listed and considered to be highly limiting in many reaches, this category provided up to 50 points of the total opportunity score.

Table 4. Water Rights Priority Dates, Reliability, and Volume with Matrix Scores

Priority Date Range	Reliability	Priority Date Score	Water Right Volume (cfs)	Volume Score
N/A	N/A	0	N/A	0
1900-1909	65%	10	<0.5	2
1890-1899	70%	20	0.5-2.5	5
1880-1889	80%	30	>2.5	10
1870-1879	90%	40		
1867-1869	100%	50		

Water Right Flow Score: A second part of the evaluation of water quantity was the volume, in cubic feet per second (cfs), of any water rights that could potentially return to the river. Within the Opportunity Matrix worksheets, the water flow rate is selected from a drop-down menu. The scoring criteria ranges and resulting values are shown in Table 4 above.

After entering all of the required information, the resulting subtotal scores for Habitat and Longitudinal (flow) benefits were added to determine the total Biological Benefit Score for that opportunity (Figure 12). Scoring for Habitat and Longitudinal Benefit were listed separately to provide implementers with the ability to evaluate an opportunity's value in moving forward to project development if one subcategory or the other (habitat or flow) could not be addressed due to feasibility constraints. The entire sequence was repeated for additional opportunities within each BSR, until the entire stream corridor was completed for each area of the watershed.

Section III REFINEMENTS AND USE OF MATRIX TOOLS

This section discusses some of the refinements that were made to the matrix tools and some of the decisions made during their development regarding their use. BSR matrix refinements are presented first, followed by descriptions of Opportunity matrix refinements.

III.1 BSR MATRIX REFINEMENTS

Several strategies were considered in the scoring of various matrix categories in Catherine Creek versus the Upper Grande Ronde River based on differences in watershed characteristics, species utilization, and different interpretations of available data by the Science TAC. Refinements to the BSR matrices based on discussions of varying approaches are discussed below.

III.1.1 Weighting Percentages of BSR Scoring Categories

As described earlier in Section II.7, input values into the ranking of BSRs consisted of the P-score, U-score, Geomorphic Potential Score, and Current Habitat Condition Score, with Temperature as a lower weighted subscore within the Current Habitat Condition Score. During beta testing of the Catherine Creek BSR matrix, the four main scoring categories initially were equally weighted (25 percent each). Optionally, Science TAC members were allowed to vary those percentages if they thought that some categories contributed significantly more or less to a BSR's total value. After several trial runs using different weightings of each scoring category, the results indicated that the overall ranking order of the BSRs did not change (i.e., a BSR that was ranked number 3 did not change to number 2 or 4 in the overall order). That, combined with the fact that there were no strong opinions among the Science TAC, it was decided to retain the original equal weighting of the scoring categories at 25 percent each. This was also carried over into the Upper Grande Ronde River Atlas.

III.1.2 Multi-species Approaches

There was considerable discussion about whether or not the P-score values should be weighted equally between the three focal species (multi-species with equal emphasis), or alternatively, since Chinook salmon were more imperiled, weight Chinook values more heavily (multi-species with Chinook emphasis). During development of the Catherine Creek BSR matrix, Science TAC members were provided the opportunity during beta testing to rank BSRs using either approach. The multi-species with equal emphasis approach assigned equal weighting to all three species, and overall produced lower BSR scores. The multi-species with Chinook emphasis approach was originally labeled as the single species approach, but the term "single species" was a misnomer and created some confusion; therefore, it was renamed as noted. The multi-species with Chinook emphasis approach still factored in steelhead and bull trout, but weighted Chinook salmon by a factor of 3. That approach resulted in overall higher values for each BSR, but did not cause any BSR to change its overall position in the rankings. The Science TAC chose to use the multi-species with equal emphasis (i.e., each life stage of each species was weighted equally) approach for the final results in the Catherine Creek Atlas. This decision was influenced by the fact that further weighting

for the most imperiled species and life stages was evaluated under the U-score (fish life stage utilization) scoring element that was based only on Chinook salmon (see Section III.I.3 below).

This discussion continued during the onset of the Upper Grande Ronde River Atlas; during beta testing, the Science TAC experimented with putting in various Chinook multipliers, again based on the premise that Chinook were more imperiled. Based on input from a representative sample of team members, the Science TAC used a multiplier for the Chinook U-scores, with the initial value set at 2.38. This multiplier was calculated based on the current Chinook population abundance of natural origin or hatchery produced fish versus what was needed to achieve an abundance of 1.5 times the minimum abundance threshold goal. Other multiplier values ranging from 1 to 10 were also compared, and while this lowered or raised the total BSR scores, similar to what was observed in Catherine Creek, it did not appear to significantly change a BSR's overall positon in the rankings. The Science TAC chose to use the multi-species with Chinook emphasis (i.e., most imperiled species) approach, with the Chinook weighting factor of 2.38 for the final results in the Upper Grande Ronde River Atlas.

III.1.3 U-Scores and Limiting Factors Scores

In the Catherine Creek Atlas, fish use and limiting factor scoring was considered solely for Chinook salmon. The rationale was based on the premise that Chinook salmon were the most imperiled of the three ESA-listed species present in the Catherine Creek watershed, as well as acknowledgement that any restoration implemented for the benefit of Chinook salmon would also likely benefit steelhead and bull trout as previously noted in Section II.2.

For the Upper Grande Ronde River Atlas, a different method was used based on the fact that the geographic area was considerably larger, and:

- It contained a higher percentage of primarily steelhead tributaries;
- It included some BSRs not occupied by Chinook salmon or bull trout; and
- In some cases, the Chinook salmon that were present were not natural origin stocks.

For those reasons, the Science TAC chose to rank both the U-scores and Limiting Factor scores for all three species (Chinook salmon, steelhead, bull trout). For Chinook salmon U-scores, the weighting factor of 2.38 noted in the previous section was applied.

III.2 Opportunity Prioritization Matrix Refinements

The Opportunity Prioritization Matrix was used to identify and prioritize project opportunities within each BSR. The goal was to utilize a strategic approach that facilitates the allocation of funds to the most biologically beneficial actions in a prioritized restoration framework. Refinements to the opportunity prioritization matrix based on discussions of varying approaches are described below.

III.2.1 Action Type

While the majority of action types were direct actions, the Science TAC thought it would be useful to identify whether a restoration action type had a passive effect, therefore this category was added into the Opportunity Prioritization Matrix as a drop-down item (see Figure 12, Step 2). The selection of

an action as a passive effect helps address situations where only a few limited physical actions might be implemented (such as a project opportunity which only requires an easement, or beaver restoration management), but selecting some actions as having a passive effect represents greater benefit for larger scale restoration opportunities. For example, if removing a levee (Action 7) also contributes to the restoration of floodplain connectivity, then Action 9 (Restoration of Floodplain Topography and Vegetation), Action 11 (Perennial Side Channel), and Action 12 (Secondary [non-perennial] Channel) could also be selected as a passive effect, and thus give credit to those actions. While most restoration actions were direct actions, this category helped highlight more passive actions such as the Protect Land and Water, Riparian Fencing, and Beaver Restoration Management.

III.2.2 Ecological Nodes

Initial determinations for the lower Catherine Creek watershed (BSRs CCC2a, CCC2b, and CCC2c) indicated that these areas would rank as a lower priority given their distance from current production areas and their highly degraded habitat. Restoration work in these BSRs would require huge investment for minimal change, and without knowing if that investment would be realized due to the unknown root cause of the juvenile fish mortality. However, given the high percentage of fall migrants and the high over-winter mortality of Chinook salmon outmigrants through the lower watershed, the Science TAC did not want to completely rule out these BSRs from any consideration, and decided that investing in some targeted, strategic restoration actions could be beneficial. In order to place some sideboards on when or where this type of work might occur, the Science TAC designated potential smaller targeted areas as an Ecological Node, defined as:

> *A smaller geographic area within a lower ranked (Tier 2 or Tier 3) biologically significant reach (BSR) that may have significant fish use based on close proximity to known spawning habitat, refuge habitat (thermal refugia, hiding cover, or available floodplain), or important tributary junctions. Restoration work in these areas may not provide immediate benefits for focal fish species, but may provide an opportunity for experimental techniques that may provide refuge habitat until root causes of low fish survival are determined.*

The Opportunity Prioritization Matrix for Catherine Creek was thus modified based on these determinations, and the Ecological Node (Node) category was added to the BSR Ranking drop-down menu in the Prioritization Matrix (Figure 12, Step 3). With the addition of this category, actions identified within an ecological node could be considered a higher priority for implementation. This BSR ranking category was also retained in the Upper Grande Ronde Prioritization Matrix.

III.2.3 Project Scale

Earlier in the Atlas development process it was mentioned that the size of a project should be a separate scoring component of the Opportunity Prioritization Matrix and weigh heavily into its overall opportunity score. However, there were also concerns that this matrix was becoming too complex. The Science TAC decided that project scale issues could be resolved later during the project funding approval phases by simply recognizing that if two projects had closely matching opportunity scores, then the larger project would be viewed as more beneficial. Therefore, to simplify the Opportunity Prioritization Matrix as much as possible, the scale of a project was dropped as a scoring component.

III.2.4 Longitudinal Benefit and Flow

The Science TAC agreed that streamflow was one of the most important limiting factors, particularly in Catherine Creek, and that restoring flow could provide considerable downstream benefits. Early versions of the Opportunity Prioritization Matrix accounted for longitudinal benefit/flow using a very simple "off" or "on" variable, in which the selection of "off", or no water savings, resulted in no effect on total score, and selecting "on" resulted in an additional 10 points in the total score. It quickly became evident that water rights were much more complex, and that return of water to a stream did not necessarily mean that this water remained in the stream unless the source of water was from a very early water right.

After consultation with water right experts, the water right scoring as shown in Table 4 was developed to more accurately reflect the chance that water returned to the river would remain there for any length of time. The scores for this category were intentionally set very high (up to 50 points total) to reflect the importance of water. The rationale was that if a project opportunity consisted of no other restoration actions except returning water to the stream, it would still rank relatively high because that act alone could significantly improve salmonid population performance in flow-limited reaches. The companion water right volume score provided up to 10 additional points based on the volume of water returned to the stream. While this scoring system is still an oversimplification of a very complex topic, the Science TAC decided that other details that are associated with water rights could be further evaluated as an opportunity progresses into the project proposal stages. Details that would require more evaluation as an opportunity moves into the project stage include:

- Longitudinal position in the watershed (an upstream water right that carries benefits downstream should rank higher);
- Length of stream benefitted (i.e., does the water flow downstream for an extended length, or does it quickly get consumed at the next point of diversion?); and
- Location of the water right in relation to key spawning and rearing strongholds (points of diversion in close proximity to where multiple life stages occur are more valuable than those located where fish utilization is limited).

III.2.5 Project Feasibility

Up to this point, project opportunities were rated and ranked based solely on biological benefit. Implementation of restoration actions, especially on private land, is often constrained by other factors. Therefore, a feasibility scoring system was developed and kept as a separate but important component that must be considered before advancing a project opportunity to the project proposal, funding, and implementation stages. Within the Opportunity Prioritization Matrix spreadsheet, Feasibility Criteria and an associated rating system that included several variables was incorporated adjacent to the Biological Benefit Score to more accurately evaluate the implementation potential of a project opportunity. While the nine variables chosen by the Implementation Team represent a comprehensive list (as illustrated in Figure 13 below), it was generally agreed that the most important among these was Landowner Willingness. If a high ranking opportunity from a biological perspective cannot be pursued because of a landowner's unwillingness to participate, then the remaining categories have little meaning. For that reason, along with challenges with respect to the

objective assignment of a quantitative score for each criterion, the Feasibility Scores were left as qualitative rankings (High, Medium, Low, and TBD).

Figure 13. Example Feasibility Criteria and Rankings

Catherine Creek Opportunities Summary													
Basic Information				Feasibility Criteria									
Opportunity Name	BSR	BSR ranking	Total Biological Benefit Score	Landowner Willingness	Design Effort	Construction Effort	Site Access Effort	Site Management - Dewatering and Erosion Control Effort	Risk & Uncertainty (Goals and Objectives)	Risk & Uncertainty (Public Safety)	Regulatory Requirements Permitting Effort	Value	Comments
BSR - CCC1													
No opportunties currently identified													
BSR - CCC2a													
Opportunity GR 115.4 - 117.5	CCC2a	Tier 3	121	Yes	High	High	Medium	Low	High	High	Medium	Low	
Opportunity GR 114.45 - 115.4	CCC2a	Tier 3	82	No	TBD	Low	Low	TBD	TBD	TBD	Low	TBD	unwilling owner
Opportunity GR 113.9 - 114.2	CCC2a	Tier 3	82	Yes	Low	Low	TBD	High	Medium	Medium	TBD	Medium	
Opportunity GR 108.8 - 105.05	CCC2a	Tier 3	78	No	High	High	High	TBD	TBD	Low	High	TBD	difficult access
Opportunity GR 111.4 - 112.1	CCC2a	Tier 3	77	TBD	TBD	TBD	TBD	Medium	Low	TBD	TBD	Low	
Opportunity GR 104.85 - 105.55	CCC2a	Tier 3	69	Yes	Medium	TBD	Low	Low	TBD	Low	Medium	High	
Opportunity GR 108.45 - 108.65	CCC2a	Tier 3	68	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	
Opportunity GR 106.55 - 107: Willow C	CCC2a	Tier 3	56	No	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	

Feasibility Scores were not evaluated for each and every opportunity; instead, the Atlas Implementation Team decided it would be better to complete those once an opportunity moved further along toward implementation. Opportunities that were not evaluated for feasibility were scored using the default category of TBD (to be determined). For those opportunities that were scored for feasibility, the comments area allowed for documentation of specific reasons why a project may rank low for any particular feasibility variable. This provides project implementers the rationale behind decisions not to pursue or to defer opportunities, and this justification can be presented to funding agencies and reviewers (i.e., BPA and the ISRP) to answer the potential question "Why was the most highly ranked opportunity not pursued?" It is important to note that the Feasibility Score does not have any impact on the Biological Benefit Score (i.e., it does not move any project lower or higher on the list).

III.3 Use of Matrix Tools

The primary products of the Atlas include prioritized BSRs, ranked lists of opportunities within those BSRs, and high-level maps of restoration opportunities. These products should be viewed not as static or fixed but rather as useful tools to assist habitat restoration practitioners in ensuring the correct restoration actions are implemented in the areas that can address the most limiting factors, and produce the highest potential benefits for salmonid population performance. This is done with the understanding that conditions can change over time based on new information, including empirical data, published research evidence, and local knowledge, as it becomes available.

The Atlas provides a useful, evidenced-based framework for restoration planners, practitioners, and funders. It is important to remember that a ranked conceptual project opportunity does not

represent a "project" until it has been reviewed and approved by the landowner and the funding entities. The Atlas provides a long-term, strategic action plan to pursue restoration opportunities transparently and objectively within the highest priority areas of a watershed. Once an opportunity has received landowner approval and becomes a project, it is intended to be evaluated by the Atlas Implementation Team and proceed through the existing GRMW project funding and implementation process.

Section IV RESULTS AND NEXT STEPS

This section describes the final rankings of BSRs and summarizes project opportunity scoring in Catherine Creek and the Upper Grande Ronde River analysis areas based on previously described physical and biological scoring criteria, followed by concluding remarks and next steps.

IV.1 BSR RANKINGS AND PROJECT OPPORTUNITY SCORES

The final rankings for the eight BSRs in Catherine Creek showed that two BSRs (CCC3a and CCC3b1) were ranked as Tier I areas, two adjoining BSRs (CCC2c and CCC3b2) were ranked as Tier 2, and the remaining BSRs were classified as Tier III areas (Table 5).

The final rankings for the 20 BSRs in the Upper Grande Ronde River show 3 BSRs (UGR-15, UGR-17, and UGR-19) along the mainstem Upper Grande Ronde River within core Chinook salmon spawning areas ranked as Tier I areas. Tier II rankings were assigned to 5 adjacent BSRs, and the remaining 12 BSRs were assigned Tier III rankings (Table 6).

Table 5. Catherine Creek BSR Scores and Final Rankings

BSR Number	Qualitative Inputs for Ability to Affect Change			Species Impact Scores		Ability to Affect Change Scores		Results	
	Geomorphic Potential Rating	Current Habitat Condition Rating	Current Temperature Rating	U-Score (Critical fish use)	P-Score (Fish life stages present)	Geomorphic Potential Score	Current Habitat Condition Score	Cumulative Score	Ranking (Tier I, II, III)
CCC1[1/]									
CCC2a	Medium	Poor	Lethal	13	10.6	15	0	39	3
CCC2b	Medium	Poor	Lethal	13	10.6	15	0	39	3
CCC2c	High	Poor	Ok	13	10.6	25	5	54	2
CCC3a	High	Fair	Ok	19	19.8	25	25	89	1
CCC3b1	High	Good	Ok	21	19.8	25	25	91	1
CCC3b2	Medium	Good	Ok	13	19.8	15	25	73	2
CCC4	Low	Excellent	Ok	13	19.8	5	5	43	3
CCC5	Low	Excellent	Ok	13	25.1	5	5	48	3

[1/] Not ranked during Catherine Creek Atlas development. See Upper Grande Ronde River, UGR-6.

Table 6. Upper Grande Ronde River BSR Scores and Final Rankings

BSR Number	Qualitative Inputs for Ability to Affect Change			Species Impact Scores		Ability to Affect Change Scores		Results	
	Geomorphic Potential Rating	Current Habitat Condition Rating	Current Temperature Rating	U-Score (Critical fish use)	P-Score (Fish life stages present)	Geomorphic Potential Score	Current Habitat Condition Score	Cumulative Score	Ranking (Tier I, II, III)
UGR-1	Medium	Good	Excellent	5	8	15	30	58	3
UGR-2	Medium	Good	Good	7	8	15	28	58	3
UGR-3	Low	Fair	Poor	12	14	5	20	51	3
UGR-4	High	Fair	Fair	8	9	25	25	67	3
UGR-5	High	Fair	Poor	13	14	25	20	71	3
UGR-6	Medium	Fair	Fair	9	17	15	25	66	3
UGR-7	Low	Poor	Poor	12	14	5	0	31	3
UGR-8	High	TBD	TBD	0	0	25	0	25	3
UGR-9	Low	Poor	Poor	13	15	5	0	32	3
UGR-10	Medium	Good	Fair	6	8	15	25	54	3
UGR-11	High	Fair	Poor	23	18	25	20	86	2
UGR-12	Medium	Fair	Fair	6	10	15	25	56	3
UGR-13	High	Fair	Fair	9	17	25	25	76	2
UGR-14	Medium	Fair	Good	18	22	15	28	83	2
UGR-15	High	Fair	Fair	24	22	25	25	96	1
UGR-16	Medium	Fair	Fair	11	10	15	25	61	3
UGR-17	High	Fair	Good	24	22	25	28	99	1
UGR-18	Medium	Good	Excellent	13	25	15	30	83	2
UGR-19	High	Fair	Fair	25	23	25	25	98	1
UGR-20	Medium	Good	Excellent	15	25	15	30	86	2

A total of 73 project opportunities for Catherine Creek were ranked in May of 2015, and each was assigned a status of "Not Started," "Active," "On Hold," or "Closed" from a drop-down menu. There were 28 project opportunities within Tier 1 BSRs, 24 project opportunities within Tier 2, and 22 within Tier 3. Project opportunities ranged in size from less than a tenth of a mile to several miles along the stream. Project opportunity scores ranged from 7 to 127, and eight Tier 1 project opportunities scored 100 or more. The results are presented in Appendix B.

The Upper Grande Ronde River project opportunity rankings were completed in October of 2016. A total of 184 project opportunities were identified, with 25, 47, and 184 listed as Tier 1, Tier 2, and Tier 3, respectively. All of these project opportunities were listed as 'Not Started" using the drop-down menu in the status column. Project opportunities ranged in size from a single point up to several miles long. Project opportunity scores ranged from 6 to 85, and the eight highest ranked Tier 1 project opportunities scored between 54 and 65. The results are included in Appendix C. Note

that scores between Catherine Creek and the Upper Grande Ronde River should not be compared because a different ranking system was used in each analysis area.

It is expected that these project opportunity lists will be dynamic in nature and adaptively managed over time. Landowners may not fully approve all proposed restoration actions on their land which would require those opportunities to be re-scored. Opportunity lists would also be modified as overall opportunity status changes (projects are completed and/or new opportunities are added over time). Other Atlas products, including GIS data and high level and detailed concept maps of project opportunities, will be housed by the GRMW, with some information made available on the GRMW website.

IV.2 Summary and Next Steps

The products of the Atlas reflect the widely recognized need for a strategic approach that facilitates the allocation of funds to the most biologically beneficial restoration actions. These actions have been identified within the highest priority areas of the Catherine Creek and Upper Grande Ronde River analysis areas. Atlas products include maps of restoration opportunities along with a biologically based scoring and ranking system, vetted through an open and transparent evaluation of best available data by a large and well-represented multi-agency Science TAC.

The Atlas provides a scientifically defensible ranking and selection framework for restoration projects, and sets the baseline for future adaptive management. It also provides objective scoring rationale that can be used in communication with landowners who may choose to participate in habitat restoration. It should be noted, however, that a highly ranked project opportunity should be distinguished from an actual project, which requires additional review by the Atlas Implementation Team, landowner approval, and approval through the GRMW funding and implementation process. The *Atlas Implementation Guidelines - Catherine Creek and Upper Grande Ronde River* (BPA 2015) provides additional information on the procedures to be used for taking a project from the opportunity stage to project proposal and implementation stages, public outreach, and engagement of regulatory partners that should occur in conjunction with Atlas implementation, along with details on how and when the Atlas will be adaptively managed and updated in out years.

Atlas tools will remain flexible and adaptable. Updates will be made as limiting factors or river conditions change, new empirical data and research evidence become available, or as projects are implemented (i.e., removed from the rankings list), thus contributing to the adaptive management of habitat restoration programs into the future. Regularly scheduled reviews, with potential updates, through the annual State of the Science meeting will ensure that the Atlas serves as a "living" document now and well into the future. Because of the widespread acceptance of the Atlas by the stakeholders conducting research and implementing projects within the Catherine Creek and the Upper Grande Ronde River analysis areas, the Atlas will also be developed and implemented in the eastern area of the Grande Ronde Subbasin (Wallowa, Lostine, Joseph, Imnaha, Minam, and Lower Grande Ronde watersheds), with the expectation that each new version of Atlas will be based on lessons learned from previous development and implementation efforts.

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APPENDIX A – RESTORATION ACTION EXPLANATIONS

Restoration Action Group	Action No.	Action	Explanations
Dedicating Land & Water to the Preservation & Restoration of Stream Habitat	1	Protect Land and Water (Easement, Acquisition)	Includes various types of easements, leases, or land acquisitions. May also include land management plans if they are protective and long term.
Channel Modification	2	Channel Reconstruction	Activities in this category generally involve active construction with heavy equipment. Pool development includes pool construction, or actions to deepen pools but should not be confused with # 27 - LWD Placement. Meander (Oxbow) Re-connect may include less aggressive approaches such as excavating the inlet of remnant channels.
	3	Pool Development	
	4	Riffle Construction	
	5	Meander (Oxbow) Re-connect - Reconstruction	
	6	Spawning Gravel Cleaning and Placement	
Floodplain Reconnection	7	Levee Modification: Removal, Setback, Breach	Actions 7 and 8 are self-explanatory. Confusion surrounding Action 9 centered on excavation versus activation of the floodplain by other means, and what role vegetation played. The key point is that this action increases flood inundation which likely leads to more riparian vegetation. Action 10 refers to excavation of floodplain benches either in existing or new channels.
	8	Remove - Relocate Floodplain Infrastructure	
	9	Restoration of Floodplain Topography and Vegetation	
	10	Floodplain Construction	
Side Channel / Off-Channel Habitat Restoration	11	Perennial Side Channel	Actions 11 and 12 may include constructing, restoring connectivity or enhancing existing channels. Action 13 includes both ponds *and* wetlands, with ponds usually being constructed while wetlands may either be enhanced or constructed. Action 15 refers to hyporheic (sub-surface) water/flow but specific activities to achieve it were lacking; it can be a result of the other activities listed
	12	Secondary (non-perennial) Channel	
	13	Floodplain Pond - Wetland	
	14	Alcove	
	15	Hyporheic Off-Channel Habitat (Groundwater)	
	16	Beaver Restoration Management	
Riparian Restoration & Management	17	Riparian Fencing	Riparian Fencing usually is interpreted to mean fencing to exclude livestock, not riparian pastures. Action 19 was not a recommended activity in any BSR.
	18	Riparian Buffer Strip, Planting	
	19	Thinning or removal of understory	
	20	Remove non-native plants	
Fish Passage Restoration	21	Dam removal or breaching	Structural Passage (Diversions) may include the addition of fish screens to unscreened irrigation diversions, measures to ensure that all life stages of fish can pass channel spanning irrigation diversions, or removal of diversions altogether.
	22	Barrier or culvert replacement/removal	
	23	Structural Passage (Diversions)	
Nutrient Supplementation	24	Addition of organic and inorganic nutrients	This was always used with regard to additions of organic nutrients via fish carcasses.
Instream Structures, LWD/Logjams	25	Rock Weirs	The use of Rock Weirs was generally considered as an "old school" technique, but remains as an action since they can still be a tool to restore gradient where avulsions or down cutting occur. LWD includes all types and may be soft placed or engineered, with multiple objectives (enhance or create pools, bank stability, etc.)
	26	Boulder Placement	
	27	LWD Placement	
Bank Restoration, Modification, Removal	28	Modification or Removal of Bank Armoring	All of these actions are self-explanatory.
	29	Restore banklines with LWD - Bioengineering	
Water Quality – Quantity Impacts	30	Acquire Instream Flow (Lease- Purchase)	Most of these actions were self-explanatory. Action 31 could include coldwater seeps (without a surface water connection). Action 34 might include juniper/conifer thinning, fire management activities, reseeding. For Action 35 road decommissioning may involve regrading to natural contours. Action 36 refers to activities primarily related to sediment reduction and return flow in channels.
	31	Improve Thermal Refugia (spring reconnect, other)	
	32	Irrigation System Upgrades -Water Management	
	33	Reduce - Mitigate Point Source Impacts	
	34	Upland Vegetation Treatment - Management	
	35	Road Decommissioning or abandonment	
	36	Road Grading - Drainage Improvements	

APPENDIX B – CATHERINE CREEK PROJECT OPPORTUNITY RESULTS

Catherine Creek Project Opportunities Summary (May-2015)

Basic Information				Biological Criteria								
Opportunity Name	Status	BSR	BSR ranking	Limiting Factors (Quantity & Importance Addressed)	Immediate Term Score	Long Term Score	Natural Process (Beechi et al 2010)	Water Right Date (~Reliability)	Water Right Flow Rate (CFS)	Total Habitat	Total Longitudinal (water)	Total Biological Benefit Score
BSR - CCC1												
No opportunties currently identified												
BSR - CCC2a												
Opportunity GR 115.4 - 117.5	**Not started**	CCC2a	Tier 3	25	17	8	10	50	10	61	60	121
Opportunity GR 114.45 - 115.4	**Not started**	CCC2a	Tier 3	27	17	8	10	10	10	62	20	82
Opportunity GR 113.9 - 114.2	**Not started**	CCC2a	Tier 3	27	17	8	10	10	10	62	20	82
Opportunity GR 108.8 - 105.05	**Not started**	CCC2a	Tier 3	27	17	9	10	10	5	63	15	78
Opportunity GR 111.4 - 112.1	**Not started**	CCC2a	Tier 3	27	17	8	10	10	5	62	15	77
Opportunity GR 104.85 - 105.55	**Not started**	CCC2a	Tier 3	23	14	7	10	10	5	54	15	69
Opportunity GR 108.45 - 108.65	**Not started**	CCC2a	Tier 3	20	12	6	10	10	10	48	20	68
Opportunity GR 106.55 - 107: Willow Creek	**Not started**	CCC2a	Tier 3	17	11	6	10	10	2	44	12	56
BSR - CCC2b												
Opportunity CC 17.7 - 20.8: Warm Creek, Murphy Creek	**Not started**	CCC2b	Tier 3	29	18	10	10	50	10	67	60	127
Opportunity CC 0.0 - 24.5: Historic GR Re-Connect	**Not started**	CCC2b	Tier 3	28	17	9	10	50	10	65	60	125
Opportunity CC 11.4 - 13.8: Elmer Dam	**Not started**	CCC2b	Tier 3	27	17	9	10	10	10	63	20	83
Opportunity CC 15.3 - 17.7: Eckesley Creek, Boswell Creek	**Not started**	CCC2b	Tier 3	30	19	10	10	10	5	68	15	83
Opportunity CC 13.8 - 15.3: Unnamed Tributaries	**Not started**	CCC2b	Tier 3	26	16	9	10	10	10	61	20	81
Opportunity CC 0.0 - 8.7	**Not started**	CCC2b	Tier 3	27	17	9	10	10	5	62	15	77
Opportunity CC 8.7 - 11.4	**Not started**	CCC2b	Tier 3	27	17	9	10	10	5	62	15	77
BSR - CCC2c												
Opportunity CC 35.8 - 36.0: Little Creek	**Not started**	CCC2c	Tier 2	29	17	9	10	50	5	65	55	120
Opportunity CC 34.31 - 34.42: Ladd Creek/Tule Lake Connection	**Not started**	CCC2c	Tier 2	25	16	8	10	40	10	59	50	109
OpportunityCC 23.7 - 26.6: Mill Creek, Phys Slough	**Not started**	CCC2c	Tier 2	28	18	9	10	30	10	66	40	106

Catherine Creek Project Opportunities Summary (May-2015)

Basic Information				Biological Criteria								
Opportunity Name	Status	BSR	BSR ranking	Limiting Factors (Quantity & Importance Addressed)	Immediate Term Score	Long Term Score	Natural Process (Beechi et al 2010)	Water Right Date (~Reliability)	Water Right Flow Rate (CFS)	Total Habitat	Total Longitudinal (water)	Total Biological Benefit Score
Opportunity CC 31.3 - 31.9: Ladd Creek Confluence, Gekeler Slough	**Not started**	CCC2c	Tier 2	27	16	9	10	30	10	62	40	102
Opportunity CC 26.6 - 30	**Not started**	CCC2c	Tier 2	25	16	8	10	30	10	59	40	99
Opportunity CC 31.9 - 33.5	**Not started**	CCC2c	Tier 2	25	15	8	10	30	10	58	40	98
Opportunity CC 34.5 - 35.3	**Not started**	CCC2c	Tier 2	19	12	6	10	40	10	46	50	96
Opportunity CC 30.0 - 31.3	**Not started**	CCC2c	Tier 2	23	15	8	10	30	10	56	40	96
Opportunity CC 33.5 - 34.3	**Not started**	CCC2c	Tier 2	18	12	6	10	40	10	45	50	95
Opportunity CC 21.3 - 23.7: Old Grande Ronde Confluence, Duncan C	**Not started**	CCC2c	Tier 2	24	16	8	10	10	2	58	12	70
Opportunity CC CC 35.3 - 35.75	**Not started**	CCC2c	Tier 2	20	12	6	10	10	10	48	20	68
Opportunity CC 36.5 - 36.9	**Not started**	CCC2c	Tier 2	19	11	5	10	0	0	45	0	45
Opportunity CC 36.0 - 36.5	**Not started**	CCC2c	Tier 2	14	9	4	10	0	0	37	0	37
BSR - CCC3a												
Opportunity CC 36.9 - 37.1: Pyles Creek Confluence	**Active**	**CCC3a**	Tier 1	30	20	6	10	40	10	66	50	116
Opportunity CC 38.2 - 38.9	**Not started**	**CCC3a**	Tier 1	30	19	6	10	40	10	66	50	116
Opportunity CC 37.1 -37.6	**Not started**	**CCC3a**	Tier 1	29	17	5	10	50	2	61	52	113
Opportunity CC 37.6 - 38.2	**Active**	**CCC3a**	Tier 1	32	20	7	10	30	5	69	35	104
Opportunity CC 38.9 -39.1	**Not started**	**CCC3a**	Tier 1	18	15	5	10	50	5	48	55	103
Opportunity CC 40.56 - 40.63: Swackhammer	**Not started**	**CCC3a**	Tier 1	10	8	3	5	50	10	26	60	86
Opportunity CC 39.15 - 39.21	**Not started**	**CCC3a**	Tier 1	13	9	3	5	50	5	30	55	85
Opportunity CC 39.98 - 40.02: Godley	**Not started**	**CCC3a**	Tier 1	11	9	3	3	50	5	25	55	80
Opportunity CC 39.43 - 39.48	**Not started**	**CCC3a**	Tier 1	11	9	3	3	50	5	25	55	80
Opportunity CC 39.2 - CC40.5: City of Union (Multiple Projects)	**Not started**	**CCC3a**	Tier 1	10	8	3	3	50	5	23	55	78
Opportunity CC 39.6 - 39.65: Hempe-Hutchison	**Not started**	**CCC3a**	Tier 1	11	9	3	3	50	2	25	52	77
Opportunity CC 39.86 - 39.94: Townley Dobbin	**Not started**	**CCC3a**	Tier 1	11	9	3	3	50	2	25	52	77
Opportunity CC 40.51 - 40.55	**Not started**	**CCC3a**	Tier 1	11	9	3	3	10	2	25	12	37

Catherine Creek Project Opportunities Summary (May-2015)

Basic Information				Biological Criteria								
Opportunity Name	Status	BSR	BSR ranking	Limiting Factors (Quantity & Importance Addressed)	Immediate Term Score	Long Term Score	Natural Process (Beechi et al 2010)	Water Right Date (~Reliability)	Water Right Flow Rate (CFS)	Total Habitat	Total Longitudinal (water)	Total Biological Benefit Score
Opportunity CC 38.4	**Not started**	**CCC3a**	Tier 1	1	2	1	3	0	0	7	0	7
BSR - CCC3b1												
Opportunity CC 40.88 - 41.65 (Alt 1): Robinson	**Active**	CCC3b1	Tier 1	29	19	9	10	50	10	66	60	126
Opportunity CC 47.52 - 48.45: 7 Diamonds	**Active**	CCC3b1	Tier 1	22	18	8	10	50	2	58	52	110
Opportunity CC 41.65 - 42.4: Ricker	**Active**	CCC3b1	Tier 1	16.9	12	6	10	50	5	45	55	100
Opportunity CC 40.64 - 40.69	**Not started**	CCC3b1	Tier 1	14	11	5	5	50	2	34	52	86
Opportunity CC 40.80 - 40.88	**Not started**	CCC3b1	Tier 1	11	9	4	5	40	10	28	50	78
Opportunity CC 47.05 - 47.34	**Not started**	CCC3b1	Tier 1	22	18	8	10	10	5	58	15	73
Opportunity CC 48.6 - 49.05	**Not started**	CCC3b1	Tier 1	14	13	6	10	20	5	43	25	68
Opportunity CC 42.45 - 45.55: Adult Collection Facility	**Active**	CCC3b1	Tier 1	10	8	4	5	20	5	26	25	51
Opportunity CC CC 49.35 - 49.45	**Not started**	CCC3b1	Tier 1	7	7	3	5	10	5	22	15	37
Opportunity CC 40.88 - 41.65 (Alt 2)	**Not started**	CCC3b1	Tier 1	9	6	2	5	0	0	21	0	21
BSR - CCC3b2												
Opportunity CC 50.1 - 52.2: Hall Ranch	**Active**	CCC3b2	Tier 2	16	10	4	10	10	10	40	20	60
Opportunity CC 52.77 - 53.13	**Not started**	CCC3b2	Tier 2	11	8	3	10	0	0	32	0	32
Opportunity CC 54.05 - 54.13	**Not started**	CCC3b2	Tier 2	11	8	3	10	0	0	31	0	31
Opportunity CC 53.9 - 54.0	**Not started**	CCC3b2	Tier 2	8	6	3	10	0	0	27	0	27
Opportunity CC 54.67 - 54.82	**Not started**	CCC3b2	Tier 2	8	6	3	10	0	0	27	0	27
Opportunity CC 52.22 - 52.55	**Not started**	CCC3b2	Tier 2	4	2	1	5	0	0	11	0	11
Opportunity CC 52.56 - 52.75	**Not started**	CCC3b2	Tier 2	2	2	1	3	0	0	7	0	7
Opportunity CC 53.26 - 53.48	**Not started**	CCC3b2	Tier 2	2	2	1	3	0	0	7	0	7
Opportunity CC 53.60 - 53.80	**Not started**	CCC3b2	Tier 2	2	2	1	3	0	0	7	0	7
Opportunity CC 54.25 - 54.5	**Not started**	CCC3b2	Tier 2	2	2	1	3	0	0	7	0	7
BSR - CCC4												

Catherine Creek Project Opportunities Summary (May-2015)

Basic Information				Biological Criteria								
Opportunity Name	**Status**	**BSR**	**BSR ranking**	**Limiting Factors** (Quantity & Importance Addressed)	**Immediate Term Score**	**Long Term Score**	**Natural Process (Beechi et al 2010)**	**Water Right Date (~Reliability)**	**Water Right Flow Rate (CFS)**	**Total Habitat**	**Total Longitudinal (water)**	**Total Biological Benefit Score**
No opportunties currently identified												
BSR - CCC5												
Opportunity Catherine Creek Meadows	**Not started**	CCC5	Tier 2	4	2	1	10	0	0	16	0	16
Opportunity USFS N. Fork CG #1	**Not started**	CCC5	Tier 3	2	3	2	5	0	0	11	0	11
Opportunity -USFS N. Fork CG #2	**Not started**	CCC5	Tier 3	2	3	2	5	0	0	11	0	11
Opportunity USFS S Fork 6.05	**Not started**	CCC5	Tier 3	1	1	1	5	0	0	8	0	8
Opportunity USFS N Fork Access	**Not started**	CCC5	Tier 3	1	2	1	5	0	0	9	0	9
Opportunity USFS S Fork Access 2	**Not started**	CCC5	Tier 3	1	2	1	5	0	0	9	0	9
Opportunity USFS Buck Creek Access	**Not started**	CCC5	Tier 3	1	2	1	5	0	0	9	0	9
Opportunity USFS S Fork Access 1	**Not started**	CCC5	Tier 3	1	1	0	5	0	0	7	0	7
Completed or Closed												
Opportunity CC 41.87 - 42.1	**Closed**	CCC3b1	Tier 1	10	8	4	5	10	10	26	20	46
Opportunity CC 42.08 - 42.15	**Closed**	CCC3b1	Tier 1	10	8	4	5	10	5	26	15	41
Opportunity CC 42.16 - 42.28: State Ditch	**Closed**	CCC3b1	Tier 1	10	8	4	5	50	5	26	55	81
Opportunity CC 42.32 - 42.42	**Closed**	CCC3b1	Tier 1	13	10	5	10	50	5	38	55	93

APPENDIX C – UPPER GRANDE RONDE PROJECT OPPORTUNITY RESULTS

Upper Grande Ronde Opportunities Summary (October 2016)

Basic Information				Biological Criteria				
Opportunity Name	Status	BSR	BSR ranking	Limiting Factors (Quantity & Importance Addressed)	Immediate Term Score	Long Term Score	Natural Process (Beechi et al)	Total Biological Benefit Score
BSR - UGR-15								
Opportunity - GRR_163.2-163.7	Not started	UGR-15	Tier 1	23	18	9	10	59
Opportunity - GRR_160.9-161.4	Not started	UGR-15	Tier 1	23	18	9	10	59
Opportunity -GRR_157.1-157.9	Not started	UGR-15	Tier 1	20	16	8	10	54
Opportunity - GRR_156.1-157	Not started	UGR-15	Tier 1	20	17	8	10	55
Opportunity -GRR_155.3-156	Not started	UGR-15	Tier 1	20	16	8	10	54
Opportunity - GRR_153.3-155.1	Not started	UGR-15	Tier 1	26	20	9	10	65
Opportunity -GRR_152.2-153.2	Not started	UGR-15	Tier 1	26	20	9	10	65
Opportunity - GRR_152.1	Not started	UGR-15	Tier 1	2	2	1	5	10
BSR - UGR-17								
Opportunity - GRR_164.7-169.7	Not started	UGR-17	Tier 1	25	14	7	10	56
BSR - UGR-19								
Opportunity - E_Sheep_5.7-6.2	Not started	UGR-19	Tier 1	8	3	1	5	17
Opportunity - E_Sheep_2.8-5.7	Not started	UGR-19	Tier 1	5	3	1	5	13
Opportunity - E_Sheep_0-2.8	Not started	UGR-19	Tier 1	5	3	1	5	13
Opportunity - Sheep_10.3-11	Not started	UGR-19	Tier 1	8	4	2	5	18
Opportunity - Sheep_8.7-10.3	Not started	UGR-19	Tier 1	3	3	1	5	12
Opportunity - Sheep_8.55-8.65	Not started	UGR-19	Tier 1	5	3	1	5	14
Opportunity - Sheep_7.85-8.5	Not started	UGR-19	Tier 1	1	2	0	5	8
Opportunity - Sheep_5.41-7.85	Not started	UGR-19	Tier 1	17	10	5	5	36
Opportunity - Sheep_3.18-5.41	Not started	UGR-19	Tier 1	17	10	5	5	36
Opportunity - Sheep_0-3.18	Not started	UGR-19	Tier 1	17	10	5	5	37
Opportunity - Chicken_7.35-7.4	Not started	UGR-19	Tier 1	1	1	0	5	6
Opportunity - Chicken_5.25-6.85	Not started	UGR-19	Tier 1	4	2	1	5	11
Opportunity - Chicken_5-5.25	Not started	UGR-19	Tier 1	1	1	0	5	6
Opportunity - Chicken_2.01-3.09	Not started	UGR-19	Tier 1	19	12	5	5	40
Opportunity - Indiana_0.45-0.55	Not started	UGR-19	Tier 1	1	1	0	5	6
Opportunity - W_Chick_1.48-5.18	Not started	UGR-19	Tier 1	6	4	1	5	16
BSR - UGR-11								
Opportunity: GRR 137.1-139.8	Not started	UGR-11	Tier 2	35	21	10	10	76
Opportunity: GRR 139.9-141	Not started	UGR-11	Tier 2	9	6	3	5	22
Opportunity: GRR 140.9-141.9	Not started	UGR-11	Tier 2	32	17	8	5	61
Opportunity: GRR 142-146.1	Not started	UGR-11	Tier 2	42	22	11	10	85
Opportunity: GRR 146.2-151.9	Not started	UGR-11	Tier 2	42	22	11	10	84
BSR - UGR-13								
Opportunity: Dark Canyon 0-1.9	Not started	UGR-13	Tier 2	12	11	6	5	34
Opportunity: Dark Canyon 1.9-3.2	Not started	UGR-13	Tier 2	12	11	6	5	33
Opportunity: McCoy 0-1.7	Not started	UGR-13	Tier 2	6	4	2	5	16
Opportunity: McCoy 1.9-4.2	Not started	UGR-13	Tier 2	12	11	6	5	34
Opportunity: McCoy 4.3-5.3	Not started	UGR-13	Tier 2	14	12	6	5	38
Opportunity: McCoy 5.3-6.2	Not started	UGR-13	Tier 2	14	13	7	5	38
Opportunity: McCoy 6.2-7.2	Not started	UGR-13	Tier 2	17	14	7	5	43
Opportunity: McCoy 7.2-7.6	Not started	UGR-13	Tier 2	16	14	7	5	42
Opportunity: McCoy 8-8.2	Not started	UGR-13	Tier 2	16	14	7	5	42
Opportunity: McCoy 8.5-9.1	Not started	UGR-13	Tier 2	9	7	4	5	25
Opportunity: McCoy 9.1-11.3	Not started	UGR-13	Tier 2	12	11	6	5	33
Opportunity: McCoy 11.8-12.3	Not started	UGR-13	Tier 2	12	11	6	5	33
Opportunity: McCoy 12.3-12.9	Not started	UGR-13	Tier 2	12	10	6	5	32
Opportunity: Meadow 0-3.49	Not started	UGR-13	Tier 2	20	17	9	10	55
Opportunity: Meadow 3.49-5.43	Not started	UGR-13	Tier 2	16	13	7	5	41

Upper Grande Ronde Opportunities Summary (October 2016)

Basic Information				Biological Criteria				
Opportunity Name	Status	BSR	BSR ranking	Limiting Factors (Quantity & Importance Addressed)	Immediate Term Score	Long Term Score	Natural Process (Beechi et al)	Total Biological Benefit Score
Opportunity: Meadow 5.43-6.37	Not started	UGR-13	Tier 2	5	7	3	5	20
Opportunity: Meadow 6.37-10.16	Not started	UGR-13	Tier 2	18	15	8	5	45
Opportunity: Meadow 12.84-14.07	Not started	UGR-13	Tier 2	11	9	5	5	30
Opportunity: Meadow 15.87-17.93	Not started	UGR-13	Tier 2	11	9	5	5	30
Opportunity: Meadow 17.93-19.01	Not started	UGR-13	Tier 2	12	10	5	5	32
Opportunity: Meadow 19.69-20.53	Not started	UGR-13	Tier 2	18	16	8	5	47
BSR - UGR-14								
Opportunity: Beaver 0-0.5	Not started	UGR-14	Tier 2	18	14	7	5	44
Opportunity: Beaver 0.7-2.8	Not started	UGR-14	Tier 2	24	17	8	10	59
Opportunity: Beaver 2.8-5.8	Not started	UGR-14	Tier 2	16	13	6	5	40
Opportunity: Beaver 5.8-10.3	Not started	UGR-14	Tier 2	5	3	2	5	14
Opportunity: Beaver 10.3-11.5	Not started	UGR-14	Tier 2	19	14	7	5	44
Opportunity: Beaver 12-12.3	Not started	UGR-14	Tier 2	18	13	6	5	41
Opportunity: Beaver 13.3-14.8	Not started	UGR-14	Tier 2	11	9	4	5	30
BSR - UGR-18								
Opportunity: LimberJim 0-0.5	Not started	UGR-18	Tier 2	19	0	6	10	35
Opportunity: LimberJim 0.5-1.6	Not started	UGR-18	Tier 2	19	0	6	10	35
BSR - UGR-20								
Opportunity: Clear 0-3.2	Not started	UGR-20	Tier 2	7	0	2	5	14
Opportunity: GRR 170.3-170.6	Not started	UGR-20	Tier 2	6	0	2	5	13
Opportunity: GRR 170.7-174.8	Not started	UGR-20	Tier 2	6	0	2	5	13
Opportunity: MeadowB 2-3.5	Not started	UGR-20	Tier 2	4	0	1	5	11
Opportunity: MeadowB 0-0.25	Not started	UGR-20	Tier 2	4	0	1	5	11
Opportunity: MeadowB 0.25-0.6	Not started	UGR-20	Tier 2	4	0	1	5	11
Opportunity: MeadowB 0.6-0.9	Not started	UGR-20	Tier 2	4	0	1	5	11
Opportunity: MeadowB 0.9-1.4	Not started	UGR-20	Tier 2	4	0	1	5	11
Opportunity: MeadowB 1.4-2	Not started	UGR-20	Tier 2	4	0	1	5	11
Opportunity: Muir 0-0.1	Not started	UGR-20	Tier 2	6	0	2	5	13
Opportunity: UGR20Trib 0-0.44	Not started	UGR-20	Tier 2	6	0	1	5	13
Opportunity: UGR20Trib 0.9-1.2	Not started	UGR-20	Tier 2	3	0	1	5	9
BSR - UGR-1								
Opportunity: Jarboe 2.5-5.2	Not started	UGR-1	Tier 3	1	0	0	5	6
Opportunity: Jarboe 5.2-7.4	Not started	UGR-1	Tier 3	5	0	1	5	11
Opportunity: Little Looking 0-1.8	Not started	UGR-1	Tier 3	5	1	2	5	13
Opportunity: Little Looking 1.8-2.7	Not started	UGR-1	Tier 3	2	0	1	5	8
Opportunity: Little Looking 3.4-5.5	Not started	UGR-1	Tier 3	1	0	1	5	7
Opportunity: Lookingglass 0-3.9	Not started	UGR-1	Tier 3	2	0	2	5	8
Opportunity: Lookingglass 4.3-6.6	Not started	UGR-1	Tier 3	13	1	5	10	28
Opportunity: Lookingglass 7-12	Not started	UGR-1	Tier 3	7	1	3	5	16
Opportunity: Mottet 0-1.0	Not started	UGR-1	Tier 3	11	1	4	5	21
Opportunity: Mottet 1.3-3.7	Not started	UGR-1	Tier 3	4	0	2	5	11
BSR - UGR-2								
Opportunity: Gordon 0-1.0	Not started	UGR-2	Tier 3	10	16	7	10	43
Opportunity: Gordon 1.0-1.6	Not started	UGR-2	Tier 3	9	15	7	10	40
Opportunity: Gordon 1.6	Not started	UGR-2	Tier 3	0	1	1	5	7
Opportunity: Gordon 2.3-3.3	Not started	UGR-2	Tier 3	8	12	6	5	31
Opportunity: Gordon 3.3-3.8	Not started	UGR-2	Tier 3	8	12	6	5	31
Opportunity: Gordon 3.8-4.1	Not started	UGR-2	Tier 3	8	13	6	5	31
Opportunity: Gordon 4.1-5.1	Not started	UGR-2	Tier 3	6	12	6	5	29
Opportunity: Gordon 5.1-7.2	Not started	UGR-2	Tier 3	5	8	4	5	22

Upper Grande Ronde Opportunities Summary (October 2016)

Basic Information				Biological Criteria				
Opportunity Name	Status	BSR	BSR ranking	Limiting Factors (Quantity & Importance Addressed)	Immediate Term Score	Long Term Score	Natural Process (Beechi et al)	Total Biological Benefit Score
Opportunity: Little Phillips 0-0.8	**Not started**	UGR-2	Tier 3	1	4	2	5	12
Opportunity: Phillips 0-2.6	**Not started**	UGR-2	Tier 3	7	12	6	5	30
Opportunity: Phillips 2.6-4.3	**Not started**	UGR-2	Tier 3	1	3	1	5	11
Opportunity: Phillips 6.3-7	**Not started**	UGR-2	Tier 3	3	4	2	5	13
Opportunity: Phillips 7-10.3	**Not started**	UGR-2	Tier 3	3	5	2	5	16
Opportunity: SF Cabin 0.5	**Not started**	UGR-2	Tier 3	6	10	5	5	26
Opportunity: SF Cabin 1.0-1.5	**Not started**	UGR-2	Tier 3	2	5	3	5	15
BSR - UGR-3								
Opportunity: GRR 95.3-99.4	**Not started**	UGR-3	Tier 3	18	0	9	10	37
BSR - UGR-4								
Opportunity: Dry 0.5-2.5	**Not started**	UGR-4	Tier 3	19	18	9	10	56
Opportunity: Dry 2.7-3	**Not started**	UGR-4	Tier 3	18	17	8	10	54
Opportunity: Dry 3-3.3	**Not started**	UGR-4	Tier 3	18	17	8	10	54
Opportunity: Dry 3.4-3.8	**Not started**	UGR-4	Tier 3	18	16	8	10	52
Opportunity: Dry 3.8-4	**Not started**	UGR-4	Tier 3	18	16	8	5	47
Opportunity: Dry 4-4.2	**Not started**	UGR-4	Tier 3	18	16	8	5	47
Opportunity: Dry 4.2-5.5	**Not started**	UGR-4	Tier 3	4	3	2	5	13
Opportunity: Dry 5.5-6.3	**Not started**	UGR-4	Tier 3	15	15	7	5	42
Opportunity: Dry 6.3-9.7	**Not started**	UGR-4	Tier 3	5	6	3	5	19
Opportunity:Dry 2.5-2.6	**Not started**	UGR-4	Tier 3	0	1	1	5	7
Opportunity: Lanman 0.5-2	**Not started**	UGR-4	Tier 3	23	25	12	10	69
Opportunity: Mill 1.0-6.0	**Not started**	UGR-4	Tier 3	6	9	4	5	24
Opportunity: Willow 1.7-3.5	**Not started**	UGR-4	Tier 3	22	23	11	10	66
Opportunity: Willow 3.5-3.8	**Not started**	UGR-4	Tier 3	21	22	11	10	64
Opportunity: Willow 3.8-4.6	**Not started**	UGR-4	Tier 3	22	22	11	10	64
Opportunity: Willow 5-5.2	**Not started**	UGR-4	Tier 3	20	20	10	10	60
Opportunity: Willow 5.2-6.0	**Not started**	UGR-4	Tier 3	20	20	10	10	60
Opportunity: Willow 6.0-6.8	**Not started**	UGR-4	Tier 3	20	18	9	5	52
Opportunity: Willow 6.8-7.6	**Not started**	UGR-4	Tier 3	20	18	9	5	52
Opportunity: Willow 7.6-10.1	**Not started**	UGR-4	Tier 3	21	22	11	10	64
BSR - UGR-5								
Opportunity: GRR 99.6-102.1	**Not started**	UGR-5	Tier 3	24	0	10	10	45
Opportunity: GRR 102.3-102.7	**Not started**	UGR-5	Tier 3	27	0	11	10	48
Opportunity: GRR 104.8-105.5	**Not started**	UGR-5	Tier 3	18	0	7	5	29
Opportunity: GRR 106.6-107	**Not started**	UGR-5	Tier 3	14	0	5	5	25
Opportunity: GRR 108.6-108.7	**Not started**	UGR-5	Tier 3	17	0	6	5	29
Opportunity: 108.8-110.0	**Not started**	UGR-5	Tier 3	21	0	8	10	39
Opportunity: GRR 111.4-112.1	**Not started**	UGR-5	Tier 3	21	0	8	10	39
Opportunity: GRR 113.9-114.2	**Not started**	UGR-5	Tier 3	21	0	8	10	39
Opportunity: GRR 114.5-115.4	**Not started**	UGR-5	Tier 3	21	0	8	10	39
Opportunity: GRR 115.4-117.5	**Not started**	UGR-5	Tier 3	21	0	8	10	39
BSR - UGR-6								
Opportunity: Camp 0-3.5	**Not started**	UGR-6	Tier 3	4	5	3	5	16
Opportunity: Clark 0.3-0.6	**Not started**	UGR-6	Tier 3	21	22	11	10	63
Opportunity: Clark 1.2-3	**Not started**	UGR-6	Tier 3	16	18	9	5	48
Opportunity: Clark 2.4-3.3	**Not started**	UGR-6	Tier 3	21	23	11	10	65
Opportunity: Clark 3.3-4.9	**Not started**	UGR-6	Tier 3	11	12	6	5	34
Opportunity: Clark 4.9-6	**Not started**	UGR-6	Tier 3	14	15	8	5	41
Opportunity: Clark 6.0-10.5	**Not started**	UGR-6	Tier 3	5	6	3	5	19
Opportunity: Indian 1.2-2.3	**Not started**	UGR-6	Tier 3	23	24	12	10	68

Upper Grande Ronde Opportunities Summary (October 2016)

Basic Information				Biological Criteria				
Opportunity Name	Status	BSR	BSR ranking	Limiting Factors (Quantity & Importance Addressed)	Immediate Term Score	Long Term Score	Natural Process (Beechi et al)	Total Biological Benefit Score
Opportunity: Indian 2.3-2.9	**Not started**	UGR-6	Tier 3	23	24	12	10	68
Opportunity: Indian 2.9-3.5	**Not started**	UGR-6	Tier 3	22	22	11	10	64
Opportunity: Indian 3.5-4.6	**Not started**	UGR-6	Tier 3	5	5	3	5	18
Opportunity: Indian 4.6-4.8	**Not started**	UGR-6	Tier 3	19	19	9	5	53
Opportunity: Indian 4.8-5.2	**Not started**	UGR-6	Tier 3	16	18	9	5	48
Opportunity: Indian 5.2-6.8	**Not started**	UGR-6	Tier 3	9	12	6	5	31
Opportunity: Indian 6.8-7.7	**Not started**	UGR-6	Tier 3	11	14	7	5	37
Opportunity: Indian 9.2-10.1	**Not started**	UGR-6	Tier 3	9	11	6	5	31
Opportunity: Indian 10.5-17.5	**Not started**	UGR-6	Tier 3	5	6	3	5	19
Opportunity: NF Clark 2.2-4.0	**Not started**	UGR-6	Tier 3	10	10	5	5	30
Opportunity: NF Clark 4.7-5	**Not started**	UGR-6	Tier 3	13	15	7	5	40
Opportunity: RhysdamCan 0-2	**Not started**	UGR-6	Tier 3	5	5	3	5	17
BSR - UGR-7								
Opportunity: GRR 117.6-122.1	**Not started**	UGR-7	Tier 3	5	0	2	5	12
Opportunity: GRR 122.1-125.8	**Not started**	UGR-7	Tier 3	30	0	13	10	52
Opportunity: GRR 125.8-127.4	**Not started**	UGR-7	Tier 3	27	0	12	10	48
Opportunity: GRR 127.4-129.7	**Not started**	UGR-7	Tier 3	26	0	11	10	47
Opportunity: GRR 129.7-130.3	**Not started**	UGR-7	Tier 3	25	0	11	10	46
BSR - UGR-8								
none	**Not started**	UGR-8	Tier 3					
BSR - UGR-9								
Opportunity: GRR 131.1-137.7	**Not started**	UGR-9	Tier 3	8	0	5	5	18
Opportunity: GRR 131.7-131.9	**Not started**	UGR-9	Tier 3	14	0	6	5	25
Opportunity: GRR 133.4-133.8	**Not started**	UGR-9	Tier 3	17	0	8	5	30
Opportunity: GRR 131.3	**Not started**	UGR-9	Tier 3	2	0	1	5	8
Opportunity: GRR 133.7-133.9	**Not started**	UGR-9	Tier 3	28	0	10	10	47
BSR - UGR-10								
Opportunity: Dry 0.5-2	**Not started**	UGR-10	Tier 3	6	10	5	5	25
Opportunity: Five Points 0-0.9	**Not started**	UGR-10	Tier 3	4	8	4	5	21
Opportunity: Five Points 1-1.5	**Not started**	UGR-10	Tier 3	7	13	6	5	31
Opportunity: Five Points 2-6.7	**Not started**	UGR-10	Tier 3	6	12	6	5	28
Opportunity: Five Points 6.7-11.5	**Not started**	UGR-10	Tier 3	5	10	5	5	24
Opportunity: Pelican 0-1.5	**Not started**	UGR-10	Tier 3	4	8	3	5	20
BSR - UGR-12								
Opportunity: Jordan 0-2	**Not started**	UGR-12	Tier 3	11	13	6	5	36
Opportunity: Jordan 2-4	**Not started**	UGR-12	Tier 3	7	8	3	5	23
Opportunity: Rock 0-0.5	**Not started**	UGR-12	Tier 3	17	17	8	10	52
Opportunity: Rock 5.5-10	**Not started**	UGR-12	Tier 3	10	11	5	5	31
Opportunity: Rock 10-13	**Not started**	UGR-12	Tier 3	10	13	6	5	34
Opportunity: Spring 0-2.7	**Not started**	UGR-12	Tier 3	15	16	7	5	42
BSR - UGR-16								
Opportunity: Fly 4.25-6.8	**Not started**	UGR-16	Tier 3	4	3	1	5	13
Opportunity: Fly 6.9-7.6	**Not started**	UGR-16	Tier 3	11	10	4	5	30
Opportunity: Fly 7.6-10.7	**Not started**	UGR-16	Tier 3	12	11	4	5	31
Opportunity: Fly 10.7-14.4	**Not started**	UGR-16	Tier 3	12	10	4	5	31
Opportunity: Fly 14.5-14.55	**Not started**	UGR-16	Tier 3	0	1	0	5	6
Opportunity: Little Fly 0.45-1.4	**Not started**	UGR-16	Tier 3	12	10	4	5	31
Opportunity: Little Fly 1.4-2.35	**Not started**	UGR-16	Tier 3	12	11	4	5	32
Opportunity: Little Fly 2.35-4.35	**Not started**	UGR-16	Tier 3	12	11	4	5	32

Upper Grande Ronde Opportunities Summary (October 2016)

Basic Information				Biological Criteria				
Opportunity Name	Status	BSR	BSR ranking	Limiting Factors (Quantity & Importance Addressed)	Immediate Term Score	Long Term Score	Natural Process (Beechi et al)	Total Biological Benefit Score
Opportunity: Little Fly 4.6-4.75	**Not started**	UGR-16	Tier 3	8	6	3	5	22
Opportunity: Lookout 2.15-2.94	**Not started**	UGR-16	Tier 3	9	7	3	5	23
Opportunity: Lookout 2.94-3.28	**Not started**	UGR-16	Tier 3	12	10	4	5	31
Opportunity: Lookout 3.28-3.69	**Not started**	UGR-16	Tier 3	12	10	4	5	31
Opportunity: Lookout 3.69-4.28	**Not started**	UGR-16	Tier 3	12	10	4	5	31

Bonneville
POWER ADMINISTRATION

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